Guidelines for the Selection of Biological SSSIs

Part 2: Detailed Guidelines for Habitats and Species Groups

Chapter 1b Marine Intertidal and Shallow Subtidal Habitats

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Cover note

This chapter updates and replaces the previous Intertidal SSSI Selection Guidelines (Joint Nature Conservation Committee 1996). It contains guidelines for the selection of marine (intertidal and subtidal) habitats, including their associated biological communities and species, as Sites of Special Scientific Interest (SSSIs). This chapter (1b) of Part 2 of the SSSI selection guidelines should be used in conjunction with Part 1 of the guidelines (Bainbridge *et al.* 2013), and other relevant habitat and species chapters in Part 2. Part 1 of the guidelines describes the overarching rationale, operational approach and criteria for selection of SSSIs (Bainbridge *et al.* 2013). This chapter, along with Coastland Habitats (1a; Rees, *et al*. 2019)) and Saline Lagoons (1c; Brazier *et al.* in prep.) makes up the marine chapter. This chapter has been prepared by Paul Brazier (NRW), Nikki Hiorns (NE), Emily Kirkham (NE), Christine Singfield (NE), Margaret Street (NE), Laura Steel (SNH) and Flora Kent (SNH), in association with Hugh Edwards (DAERA) and provides detailed guidance for use in selecting marine sites throughout Great Britain for notification as SSSIs.

The main changes from the previous version of the chapter are:

- a clearer definition of landscape scale features that encompass, where appropriate, complete functioning units such as whole estuaries and bays and their associated habitats and species;
- amendment of the selection criteria to reflect changes to Part 1, including the incorporation of ecological coherence, ecosystem services concepts and future climate change scenarios;
- opportunities from the Marine and Coastal Access Act 2009 (England and Wales) to extend site boundaries to below mean low water and seaward of estuarial waters;
- expansion of Habitats and species annexes to reflect changes to date and incorporation of subtidal features; and
- update of the selection units and biotopes, to reflect the latest revision of the marine biotope classification (UK and European).

This chapter has been subjected to appropriate levels of evidence quality assurance. It is compliant with the JNCC Evidence Quality Assurance Policy 2019, and has been subjected to external peer review by Keith Hiscock (https://jncc.gov.uk/about-jncc/corporate-information/evidence-quality-assurance/).

1 Introduction

1.1 The purpose and overall rationale for Sites of Special Scientific Interest (SSSIs) designation are described in Part 1 of the 'Guidelines for Selection of Biological SSSIs' (Bainbridge *et al.* 2013). SSSIs are an important component, in a network of conservation sites, for the protection of important and/or threatened habitats and species and as part of a wider landscape-scale ecosystem approach to the sustainable management of our environment (Bainbridge *et al*. 2013). Marine Intertidal and Shallow Subtidal Habitats SSSIs are taken account of by local planning authorities and devolved government marine management authorities: in Scotland, Marine Scotland; in England, the Marine Management Organisation (MMO) and Inshore Fisheries and Conservation Authorities (IFCAs); and in Wales, the Welsh Government. The essence of the exemplary site principle procedure is that all examples of habitats and species assemblages within an Area of Search (AoS) are compared, to identify the best, and it is only those which are selected. This guidance is used to identify those marine features that are of sufficient quality to be notified as a SSSI, and to meet the needs of a wider series of protected sites. It uses a selection unit-based approach, using the principles in Bainbridge *et al.* 2013.

1.2 Potential marine features include broad marine geomorphological features[1], such as:

- estuaries;
- marine archipelagos; and
- Inlets and bays;

as well as eight different whole-shore type selection units:

- wave-exposed rock;
- moderately wave-exposed rock;
- wave-sheltered rock;
- mixed substrata (boulders, cobbles, pebbles with small amount of interstitial sediment);
- sand and coarse sediment;
- sand and muddy sand;
- mud; and
- mixed sediment (mud, sand and gravel).

1.3 The above potential marine features are referred to as selection units, all sites in each selection unit are arranged in order of merit to identify the 'best'. While minimum standards of quality have still to be observed, the main point is that not all sites above this standard must be selected, within a selection unit. The suite of selection units consists of geomorphological features and of major shore types within which reasonable inter-site comparisons can be made, eliminating the variability of the main influences between each whole shore type (substratum and wave exposure). The named geomorphological features and the eight different whole shore types should each be represented, if present, through selecting the best examples, based on the criteria below. The selection units are described in Section 4.4, with further details in Annex 3. To identify potential site features within a predetermined geographically based AoS (see Section 4), examples of each Selection Unit are compared and measured against the selection criteria. Selection units differ from the hierarchy of the marine habitat classifications (JNCC 2015a; European Nature Information System (EUNIS): Davies *et al.* 2004), because the upper level structure of these classifications results in biotopes which exist proximally being widely separate in the hierarchy. The two main discrepancies (although others exist) between the classification hierarchy and the selection units are:

1 The term 'geomorphological' has been used throughout this document, to include physiographic and other landscape scale features.

- subtidal and intertidal biotopes are in different parts of the classifications; these must be considered together at the sites where they are present; and
- tide-swept (high energy in the classification) communities can be present in 'low energy' (wave-sheltered) sites.

1.4 The biotopes[2] and their descriptions in JNCC (2015a) and Davies *et al.* (2004) are used as the building blocks to describe the different selection units described above and in Sections 4.7 and 4.8. In this context, a marine feature is a geomorphological feature, habitat or multiple habitats or species that are within the scope of the Wildlife and Countryside Act 1981 (as amended), Marine and Coastal Access Act 2009 (England and Wales) and Marine (Scotland) Act 2010, including the intertidal zone and under certain circumstances, areas of subtidal benthic habitats (according to the relevant Act being applied in the particular country).

1.5 JNCC and the country agencies determine that a SSSI with a marine biological component can be defined by the presence of one or more marine features that represent a habitat (Annex 1 or Annex 2), or a mammal (JNCC in prep[3]), freshwater fish (Bean *et al*. 2018) and estuarine fish (in prep.), invertebrate or plant listed in Annex 4. Other components are described in Rees *et al*. 2019.; Brazier *et al*. in prep., that may show transitions with marine features. Saltmarsh, whilst within the tidal prism (i.e. below mean high-water spring tides), is included in the coastlands habitats chapter (Rees *et al*. 2019), due to the vegetation communities being characterised by vascular plants that form a transition into terrestrial habitats. These marine guidelines cover seagrass communities located outside of saltmarsh (Rodwell 2000). Other fringing and coastal communities dominated by vascular plants (e.g. sand dunes, vegetated shingle) are covered in the coastlands habitats chapter (Rees *et al*. 2019).

1.6 The following annexes provide important supporting information to these Guidelines:

Annex 1 - Biotopes considered nationally or internationally important, or of special interest;
Annex 2 - List of habitats of interest in Great Britain;
Annex 3 - Biotopes that are typical of each of the shore types that should be represented in the SSSI series;
Annex 4 - Overview of legislation and policy relevant to species within the scope of this chapter; and
Annex 5 - Examples where inclusion of subtidal areas within SSSI boundaries is appropriate (England and Wales only).

1.7 Marine habitats[2] listed in the annexes are in most instances equivalent to, characteristic of, or may include features on, existing conservation listings such as Annex I of the EC Habitats Directive (Council of the European Communities 1992), or as Section 41 Habitats of Principal Importance of the Natural Environment and Rural Communities Act 2006 (England), Section 7 Habitats of Principal Importance of the Environment (Wales) Act 2016 and the Priority Habitats list for the Wildlife and Natural Environment Act (Northern Ireland) 2011. A prioritised list of species and habitats of conservation importance in Scotland, the Priority Marine Features (PMF) list, has been produced. This supports a wider seas approach to conservation, for example, through Scotland's National Marine Plan.

1.8 The UK government made a commitment under the Marine Strategy Framework Directive, OSPAR Convention (OSPAR 2006) and Biodiversity 2020 to create an ecologically coherent

[2] The term 'biotope' refers specifically to the units of classification in JNCC (2015a), describing a repeatable combination of substratum and biological community. The term 'habitat', in this context, is used loosely to describe one or more biotopes of similar nature or a predetermined, listed habitat (e.g. as predefined in an Act).
[3] The updated marine mammal guidance is not ready. Until it is updated, users are asked to consult the guidance for marine mammals here http://jncc.defra.gov.uk/pdf/SSSIs_Chapter13(a)(b).pdf.

network of Marine Protected Areas (MPAs) (Gubbay 2014) by 2016; this 'network' includes marine components of SSSIs (Section 3.7). A major amendment to the scope of the original version of this chapter is the inclusion of subtidal features alongside intertidal features to incorporate recognised amendments to legislation in England and Wales and to enable support for the extension of selection of SSSIs beyond the intertidal and estuarial waters; to date this does not apply to Scotland. In Northern Ireland, the Department of Agriculture, Environment and Rural Affairs (DAERA) is responsible for the declaration of Areas of Special Scientific Interest (ASSI). DAERA considers that the ASSI guidelines published in 1999 (intended as an addendum to the JNCC 1996 SSSI guidelines) remain fit for purpose, and have been involved in and supportive of both the 2011 and the current SSSI guideline revisions.

2 International importance

2.1 A habitat or species which is of international importance is of particular interest in its national occurrence even where the feature may be locally numerous (Section 6 in Bainbridge *et al*. 2013). On this larger geographic scale, rarity is the most important criterion, identifying those habitats and species that are rare or highly localised internationally.

2.2 The very extensive and varied nature of the marine resource in Great Britain compared with that of other countries in the north-east Atlantic has led to some of our marine features being of international importance. International importance is established by the presence of habitats, communities, or populations of species that are one of the best examples, the most extensive examples or the only examples in the north-east Atlantic. Examples include chalk shores of south-east England, sea lochs of Scotland and offshore islands of west coasts of Britain. Geographically restricted species are often associated with these habitats.

2.3 Some marine features are included in international conservation directives and conventions. For features protected under these measures, it may be necessary to select more than the minimum number of exemplary areas, based on the relevant international standard required. Where the features are rare, or Great Britain holds a major proportion of the resource, this should be considered when evaluating a site for SSSI notification (Section 3.7 on Ecological coherence). Other international conservation mechanisms may also have to be considered, to identify the most appropriate option (Section 1). See also Annexes 1 and 2.

3 Assessment Criteria

The same principles and criteria are used for the selection of marine features as are identified in Part 1 of the Guidelines (Bainbridge *et al.* 2013). A notable difference is that, in the marine environment, animals as well as vegetation characterise the biotopes (finer level of the classification including the habitat and associated biological community) and are therefore important in the assessment of marine habitats. The UK and Ireland classification of biotopes (JNCC 2015a) matches the European Nature Information System (EUNIS) classification (Davies *et al.* 2004). Specific details relevant to assessing marine features are described here for the 10 assessment criteria (Sections 3.1 – 3.9).

3.1. Typicalness

Typicalness may be used in a more general way than other criteria, ensuring that not only unusual or exceptional examples are identified, but also those examples of selection units that may be under-represented through the assessment of other criteria (Bainbridge *et al*. 2013 Section 5.4). Examples of habitats and species that are not only typical (characteristic) of that ecosystem in the AoS, but are also highly rated in other criteria have a stronger case for being included as a feature of a SSSI. This criterion can be applied at a habitat level, and at the whole shore or site level, providing full representation of the wide spectrum of marine habitats. For marine habitats, this should be evaluated using the Marine Habitat Classification (JNCC 2015a) as a reference framework, to level 4 and preferably level 5 to reasonably reflect the variation in the biological character of habitats. For marine habitats this criterion is applied alongside other criteria (diversity, size and rarity) and with OSPAR MPA network representativity criteria (OSPAR 2006, 2012, 2013; Jackson *et al.* 2008). Representation of the range of marine habitats and ecological process is required to achieve an ecologically coherent marine network with all biogeographic regions and major habitats represented.

3.2. Fragility

Essentially, this criterion is used synonymously with ‘sensitivity’ of habitats and species to natural change or human impact. The greater the fragility, and the lower the recoverability or capacity to be recreated, accords greater importance for selection. Communities and species are likely to be sensitive if they, or their substratum, are:

- fragile/delicate (brittle);
- long-lived with poor or no recruitment (and therefore would be slow to recover or would not recover if damaged);
- susceptible to pollution or other anthropogenic pressures;
- unable to move away from adverse pressure; or
- requiring a specific site/habitat for a part of their life cycle (e.g. reproduction, nursery area, feeding).

A high degree of natural stress, e.g. physical stress from wave and tidal action, results in most intertidal habitats being robust and not especially fragile. However, very sheltered shores, seagrass beds and some biogenic reefs can be particularly fragile. Features that are either fragile or robust in terms of their resilience to natural pressures can be stressed by non-natural pressures, with fragile features likely to have a lower tolerance in the outset. Fragile features are generally more vulnerable and therefore require greater or more urgent management measures.

3.3. Size (extent)

Size or extent is important as larger sites tend to contain more features, support greater diversity, have more viable populations and, importantly in the marine environment, provide greater opportunity and capacity for natural processes and change. This makes larger sites more resilient to natural or anthropogenic effects. Consideration of size of intertidal features needs to take account of both the length of coastline and the width of the shore.

For sediment shores, area (hectares or square metres) is a valid measure of size. In this context, many of the concepts and principles outlined in Bainbridge *et al.* (2013) are valid, e.g. consideration given to extent and continuity of features, edge effects (including proximity to harmful or change-creating activities) and environmental context of the site.

In contrast, for rocky shores, where shore inclination varies from near horizontal platforms to vertical cliffs, the length (kilometres or metres) of coast is the usual measure of size, although for horizontal expanses of rocky shore, area may also be used. Marine habitats can be extensive, and the site size should reflect that. Intertidal sites would be expected to be sufficiently extensive to encapsulate the functioning of the marine features for which it is notified. Some habitats will have a minimum viable size, which should be considered on a site basis, as well as the minimum practicable size for effective maintenance and management of the features/site (refer to Bainbridge *et al*. 2013, Section 8). It is possible that within the site, the quality may not be uniform or the habitat continuous. The length of coast included may also be influenced by the extent of other coastal and terrestrial habitats adjacent to the intertidal/subtidal area that also qualify for SSSI notification and where it would be appropriate to match the location of boundaries.

Areas that contain marine biotopes or species of at least national importance (see Annex 1; Section 3.6) are cases where this criterion may be adjusted to ensure adequate representation of highly-rated smaller areas within the AoS. Size should also take into consideration the coastal system and sediment processes and allow for future changes (up to 50 years, Section 5.1) where possible and take account of coastal management policies set out in Shoreline Management Plans (SMPs) (Hansom *et al.* 1999; Scottish Natural Heritage 2000; SMP2 2009; SMP 2010).

3.4. Diversity

The term “diversity” refers to both habitat diversity and species richness, and is derived through comparison among selection units. Some shore types are intrinsically richer in species than other types, e.g. moderately exposed rocky shores are typically more habitat and species rich than extremely exposed shores. Comparison of species richness should therefore only be within shore types. Within each marine shore type, some examples will have a greater range of biotopes than others; this is usually due to the 'architecture' of the shore, with rich examples having special niches such as overhangs, underboulder habitats and pools (see Annex 1, ‘biotopes of special interest’) in addition to open rock surfaces (Section 4). Due consideration should be made as to whether or not a biotope is natural, permanent (i.e. not ephemeral) and contains non-native species. Rarely are there adequate data to make comparisons based on empirical data and statistical indices and, therefore, alternative means of estimating diversity (e.g. taxon number, frequency of occurrence) are likely to be used.

In addition to identifying the diversity of habitats and species within a marine feature, transitions along gradients of salinity, wave action, tide height and substratum increase the diversity of a site. This is particularly apparent where zonation in habitats and species occurs vertically on rocky or sediment habitats. There is intrinsic value in having the complete zonation of habitats and species e.g. upper to lower shore or river to sea. Geomorphological marine features such as estuaries, bays, inlets, headlands, and archipelagos have interdependent mosaics of subtidal and intertidal habitats, plus associated terrestrial habitats; due to their range of conditions (salinity, waves, tides and substratum types), these are highly diverse environments.

3.5. Naturalness

Truly natural examples, unmodified by humans are highly valued, but rare. Many areas of the marine environment have been modified to some extent by humans (e.g. structures, disturbance, pollution, introduction of non-native species) and impacts are often difficult to detect due to the inaccessible nature of the marine environment. However, there are marine areas in the UK (e.g. offshore islands) that are considered relatively undisturbed, compared to terrestrial habitats. SSSIs will usually not extend into areas that are substantially modified for example, by coastal or marine structures, aquaculture, recreational use, pollution, or other anthropogenic pressures, unless there are clear opportunities for restoration (Section 3.8). The defining of realistic boundaries may however include modified habitats (Section 5). The naturalness of the supporting physical processes should also be considered; these can be an essential element of the special interest of a marine feature. The dynamic, successional and transitional nature of communities and strong influence of natural processes on the intertidal and shallow marine environment should be considered during site selection.

3.6. Rarity

Rare habitats are given higher priority because the options and opportunities for conserving them, and their associated species and processes, are more limited. The scarcer the feature, the greater the percentage that needs protection, and the stronger the case for the selection of degraded or smaller areas as SSSIs. For biotopes of at least national importance[4], it would be expected that **all** highly rated examples in an AoS would be included in SSSIs (JNCC 1996, Annex 1). Biotopes of national and international importance (Annex 1) include those that are limited in distribution (rare or scarce) as well as threatened biotopes.

Nationally rare species should also be considered for inclusion as a high priority, whilst nationally scarce species should be considered if they meet at least some of the other criteria. In Sanderson (1996), nationally rare marine species are those that are found in fewer than eight 10km squares and nationally scarce marine species are those found in from nine to fifty-five 10km squares. Currently, the majority of marine phyla are not covered by red data lists. Some marine species are included in the Red Data Book of British Invertebrates (Bratton 1991), and there is a provisional list for marine algae (Brodie *et al.* 2014). In the absence of a comprehensive red data list, a list compiled by JNCC (Sanderson 1996, revised unpublished 2000) is used and is presented in Annex 4. Annex 4, as well as the rare species, also includes non-avian marine species listed in Schedules 5 and 8 of the Wildlife and Countryside Act 1981 (as amended), and other species of interest.

Assigning rarity scores to the nationally rare and scarce marine species listed in Annex 4 is not recommended at present because of the inadequate knowledge of distribution and because assessment criteria for 'rarity' need revision (Hiscock 2014). In any assessment based on the presence of rare or scarce species, further enquiries should be made as to the adequacy of distribution records and the identification expertise required for a species (Sanderson 1996). Should new information become available on rare and scarce species and habitats, then a case should be made to include such species or habitats as features of a SSSI.

The Annexes are considered as the minimum list, since information on the Great Britain marine resource continues to grow, so additional habitats and species may be added to these lists in future. Species that are rare in Great Britain but more abundant elsewhere in Europe are nevertheless of interest in a British context, although the importance will depend on the geographic distribution, risks and threats, for example, species at the edge of their range. Similarly, certain species that are abundant in Britain but considered less common elsewhere in Europe should also be considered for notification as part of supporting wider MPA network obligations.

Marine habitats and intertidal areas (including when covered by water) should be considered of special interest for mobile species scheduled for protection under the Wildlife and Countryside Act 1981[5] when they are used on a regular basis for breeding, feeding and other key stages in the lifecycle (see relevant chapters).

3.7. Ecological Coherence

The position of a site in an ecological/geographical unit is given greater importance than originally by Ratcliffe (1977). Sites ideally contribute towards the establishment of an ecologically coherent national network of protected areas, through consideration of the functional importance of the site within the wider environment (Section 5.11 in Bainbridge *et al*. 2013). During selection, consideration should be given to:

- the functioning and resilience of the ecosystem (site, biological community and habitat);
- if there are functional linkages of the site with other sites in the wider MPA network;
- if the site is important as a source of larvae or propagules of rare, scarce or valued species and may provide recruitment to the wider marine environment; and
- the dispersal capability of key species associated with the site.

[4] Evaluation of biotopes of national and international importance has not been revised since the original Guidelines (JNCC 1996) and does not include exclusively subtidal habitats.
[5] Note that cetaceans are no longer on the Wildlife and Countryside Act 1981 (amended) schedule 5 in Scotland, but would only likely be considered for subtidal areas.

Detailed connectivity issues should be considered only for those species where a specific path between identified places is known (e.g. critical areas of a life cycle). Further information on assessing ecological coherence can be drawn from the Ecological Network Guidance (Ardron 2008), Hiscock (2014) and work carried out by the JNCC in estimating sufficiency of European Marine Sites (JNCC 2009; Natural England & JNCC, 2010; Rondinini 2010; SNH & JNCC 2012; Gubbay 2014).

For sessile or limited-mobility marine species, connectivity during planktonic life stage is critical to ensure recruitment and settlement of juveniles. The distance travelled and the direction of travel of such species is very different from one species to another and in different years. However, the sea is a good connectivity ‘medium’ and SSSIs have the potential to ‘seed’ the wider marine environment with the propagules of rare or threatened species that may be protected within SSSIs. With regard to highly mobile and migratory species, protection for spawning sites, nursery grounds and migration routes subject to the sites being adequately connected to the wider environment is valuable.

For species that disperse over short distances, the population is likely to be sustained easily within sites, but not across sites. Those species that disperse over longer distances may require sites to be established as part of a series of ‘stepping stones’ so that there is recruitment along the coast via currents. This, however, may also be achieved through mechanisms other than SSSI notification (e.g., protection through the MCAA Act 2009 and Marine (Scotland) Act 2010), all of which should be considered to identify the most suitable conservation option.

3.8. Potential Value

Sites can develop greater conservation value through appropriate management and/or natural change over time. This is particularly relevant to marine features, where there are strong natural forces of tide and wave action that result in dynamic habitats and long-term changes in distribution and extent of features. This criterion could apply where:

- habitats have recently deteriorated, e.g. coastal squeeze of intertidal flats, excessive recreational pressure at the coast;
- habitat succession can be encouraged, reversed or amended by management, e.g. amendment of fisheries activities, improvement in water quality;
- there is a need to reinstate ecological processes or support ecological resilience, e.g. changes in coastal flood risk management, active managed realignment of the coast; and
- evolution of the coast as a result of natural processes, leading to development of interests in areas currently devoid, e.g. via inundation by tidal waters or evolution of sedimentary systems.

This criterion also enables the selection of sites to support the persistence and resilience of habitats and species to climate change and associated pressures (Birchenough *et al.* 2013; Horsburgh & Lowe 2013; Masselink & Russell 2013; Mieszkowska, *et al.* 2013).

3.9. Recorded History

A site that has good ecological data records or history may be more valuable than one with none. A site with a long history can be valuable to ecological research, habitat, and species datasets. A good historical dataset also allows for evaluation of the condition of a new site, compared to other sites. There is a series of long-term marine and coastal datasets around the UK, and the long-term continuity of such ecological information should be considered when considering site selection (e.g. Frost *et al.* 2006). See Section 4.1 for further information on existing data sources.

4 Selection Requirements

The essence of the exemplary site principle procedure is that all examples of habitats and species assemblages within a selection unit and within an AoS are compared, to identify the best, and it is only these which are selected. If all sites within a selection unit can be arranged in order of merit, selection of the 'best' can vary from one to whatever number of examples is judged appropriate by the responsible SNCB. While minimum standards of quality have still to be observed, the main point is that not all sites above this standard must be selected.

Normally one good quality example of each selection unit, meeting one or more of the selection criteria, should be designated within an AoS. However, several sites may be needed to adequately represent the full range of communities encountered for different marine features, in addition to those sites designated for nationally or internationally important habitats or species.

4.1. Survey Requirements

The evaluation of marine SSSI features requires data across a wide range of marine habitats and species. It is recognised that these data are often difficult to collect and are rarely complete, but features of special interest may be identified through a variety of data sources. Typically, these sources include previous studies (including the Marine Nature Conservation Review (MNCR) and country agency wide-scale survey) and reports, expert opinion or work connected with the identification of broader areas for international initiatives, e.g. international site designation requirements. All existing data on features at a site level need collating to develop surveys to update existing data for SSSI selection.

Phase 2 surveys (e.g. MNCR) provide the level of detail required to understand species distribution and presence on a site, especially in association with the important habitats. Phase 1 surveys, including mapping of sites to be considered for notification, are desirable to assess extent of biotopes, to determine the appropriate site boundaries and to describe site features.

The MNCR site assessment protocol (Hiscock 1996) based its selection process on an expansion of the criteria defined in Ratcliffe (1977). Selection of MNCR sites considered biogeographic variation and the restricted geographical nature of the specific habitat types. In Wales, a complete mapping survey (Brazier *et al.* 2007) was finished in 2006, providing a seamless dataset against which the SSSI selection guidelines were tested. The technique was based on the ground-truthing of information from aerial photographs to produce habitat maps which could then be incorporated into a Geographical Information System (GIS). In this case, the information gathered was specifically in line with the needs of site selection - biotope naturalness, rarity, distribution and extent, and species richness and rarity (Wyn *et al.* 2006).

Data gathering and collation in relation to the Conservation of Habitat and Species Regulations 2017, as well as ongoing monitoring programs provide further information. Various data sources are available from across Britain, from numerous web-based data portals, including Marine Recorder, archives at the Marine Environmental Data and Information Network (MEDIN) and the National Oceanography Centre. Querying spatial data at various scales with GIS, can add to the value of the information gathered.

Once an area has been identified, further information is usually needed to confirm the current presence and status of a feature, and to describe the features and locate boundaries adequately.

Specialists in country agencies can advise on sources of evidence and analytical techniques should this be required. The JNCC website hosts the Guidelines (https://jncc.gov.uk/our-work/guidelines-for-selection-of-sssis/) and the current biotope classification for Britain and Ireland (JNCC 2015a; https://mhc.jncc.gov.uk). Links are available to the EUNIS classification (Davies *et al.* 2004), Wildlife and Countryside Act 1981, Marine and Coastal Access Act 2009, Marine

(Scotland) Act 2010, the Conservation of Habitat and Species Regulations 2017, as well as information on reviews of the Schedule 5 and 8 species and species and habitat sensitivity.

4.2. Supporting Information

A site should be surveyed to the standard of at least the biotope level to enable a full identification of the habitats present. The biotope classification (JNCC 2015a, Davies *et al.* 2004) is a national framework based on biological samples across Great Britain and Ireland and does not necessarily describe the full range in biological variation of different biotopes. In addition, many of the biotopes occur over a wide geographical range, though species may have their own individual ranges. Atypical or poor fit to the biotope classification does not mean that a community has a lower intrinsic conservation value. Such examples represent the full range of variation in biotopes and may indicate local and important peculiarities. It is, nevertheless, important that the site is surveyed for the presence of special features including rare and scarce species so enabling the required 'Assessment to identify the best examples of sites to represent habitats and species'.

4.3. Areas of Search

As set out in Part 1 (Bainbridge *et al.* 2013), Areas of Search (AoS) for marine/intertidal SSSIs are based on the major 'coastal cell' boundaries (Figure 1) established as the areas within which localised coastal sediment processes are considered to be largely restricted (Motyka & Brampton 1993; HR Wallingford 1997). The AoS also break at boundaries between Scotland, England and Wales. Many of the break-points between AoS correspond to or are near to boundaries for coastal sediment processes including those for coastal sectors of the MNCR, which are also relevant to biodiversity. For selection purposes, sites that cross a cell boundary will be assigned to the AoS with the greatest proportion of the site's scientific interest for selection purposes. Outlying islands may not be included in cells but should be assigned to the nearest adjacent cell for selection purposes.

Within an AoS it is possible that SSSIs with marine features covered in this chapter have already been notified for several different reasons (species, habitats or geological features), which may include or be complementary to marine features. The addition of further sites that have similar marine habitats, associated communities and species to existing sites within that AoS, should only be undertaken if the quality is clearly and significantly higher in the new site. Comparisons with existing marine SSSIs should be recorded as part of the process. Distinct variants of a particular selection unit may be worth selecting as additional SSSIs to provide adequate coverage of variation within the AoS. By reviewing SSSIs with marine features described in this chapter within each AoS, any shortfalls in representation of features will be identified. This assessment will support extension of existing SSSIs, addition of marine features and selection of new sites to secure an effective site series.

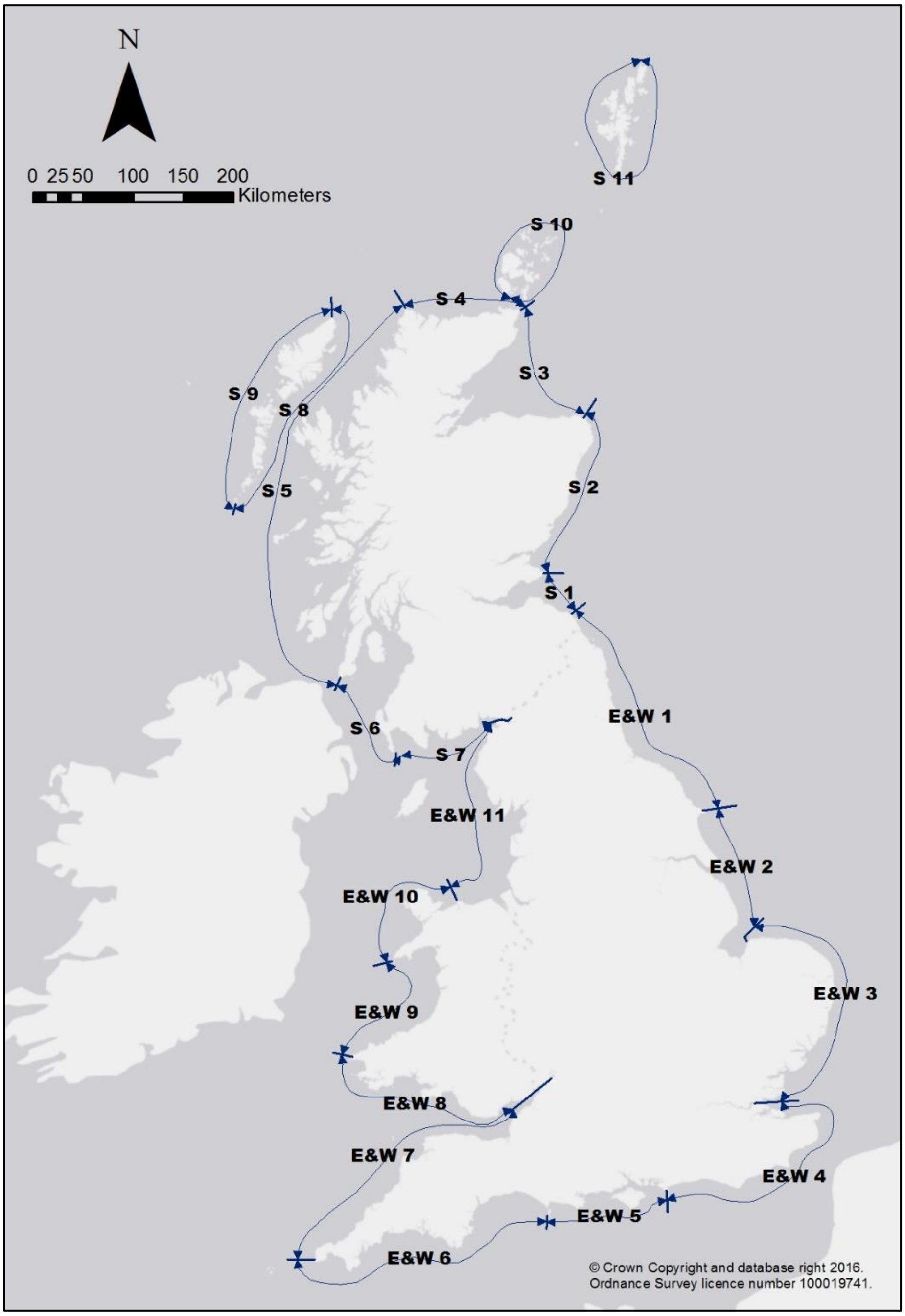

Figure 1. Areas of Search for selection of SSSI with marine features, based on the major coastal cell boundaries for inshore areas of England and Wales (Motyka & Brampton 1993) and for Scotland (HR Wallingford 1997; Ramsay & Brampton 2000).

The boundaries of AoS for marine feature selection may not align with the AoS used for selection of SSSIs for coastal or terrestrial features: coastal features generally cover shorter lengths of coastline. Where a marine feature selected using these guidelines is continuous with semi-natural habitat landwards, a further evaluation of adjoining coastal or terrestrial features, especially saltmarsh, using the relevant chapter would be required. This step will need to take account of continuity between marine and other habitats.

4.4. Site Selection Principles

Selection units (the three geomorphological features and eight whole shore types) should meet the requirements for multiple assessment criteria (Section 3). The seven guiding principles below provide a framework to evaluate and combine the outcomes of each assessment criterion. They have been taken directly from the former intertidal guidelines (JNCC 1996) and provide some consistency of approach. The assessment criteria in Bainbridge *et al.* (2013) that are further described in Section 3 are used to identify qualifying selection units using seven site selection principles. Sites to be selected for designation must satisfy **some** or **all** of the following principles:

4.4.1. The site includes the best example of a particular habitat type with its associated communities within that AoS.
The site must contain the best-known example of a particular marine feature (see Section 4.5) within the AoS. The best example can be defined as having the best associated biotopes, defined by their richness, naturalness, typicalness and extent.

4.4.2. The site contains a variety of high quality marine features (Section 4.5) which represent the range and variation within that AoS.
The site must contain an assortment of high quality marine features that are typical and represent the full geographic range and biological variation within the AoS. This can be defined in terms of the full biotope richness and rarity, naturalness and extent of the whole proposed site. This principle emphasises the value of having a wide variety of communities and features of good quality, but not necessarily the best examples of individual features.

4.4.3. The site contains good quality examples of specialised habitats such as rockpools, overhangs, caves and gullies or unusual features in addition to 1 and 2 above.
The site must contain good examples of habitats that enhance the range of niches and the diversity of species present. Individual biotopes are identified for their value as SSSI features. The quality of the biotopes, realistically the smallest feature possible, can be defined by the species richness, naturalness and extent.

4.4.4. The site contains habitat or community features of a restricted nature on a national or international (north-east Atlantic) basis (see Annex 1 for habitat and biotope list).
The site must contain geographically restricted biotopes or suites of biotopes on a national or international scale. Individual biotopes are identified for their value as SSSI features, based on their rarity. Extent and naturalness may be used to identify the best of these, where all examples are not to be selected.

4.4.5. The site has a complete zonation down the shore or from fresh to saline environment including, where relevant, mature community types.
The site contains good examples of zonation of biotopes, from the top of the shore to the bottom, or along a gradient of salinity or wave exposure. This is more visual in rocky habitats, but should also be applied to sediment habitats. For each particular marine feature, the typical biotopes can be identified, and their inclusion in an environmental gradient can be confirmed. Biotope typicalness and naturalness are important assessment criteria.

4.4.6. The site contains one or more marine species currently considered nationally rare or scarce including those listed in schedules 5 and 8 of the Wildlife & Countryside Act 1981 (as amended).
The site contains one or more marine species, or be used during part of that species' life-cycle, including for feeding, where that species is either scheduled for protection under the Wildlife and Countryside Act 1981 (as amended) or is listed as being nationally rare or scarce (Sanderson 1996). This principle relies on good species distribution data. See Section 3.6 for further consideration of species rarity.

4.4.7. The site is a large area or length, either continuous or in several discrete units depending on the degree of natural and man-made interruptions.
The site must be extensive either in area or length, and can be continuous or in a series of discrete blocks. These parameters can be defined by the full extent of the marine feature

and its degree of naturalness. This principle only applies to those sites already identified under one of the other principles – a site should not qualify based on its size alone.

Where the guiding principle recommends the 'best example', single examples are expected to be selected within an AoS. 'High quality' or 'good quality' marine features are ranked, to identify those of greatest conservation value, recognising that the underlying assessment criteria for which they are selected may be different.

4.5. Marine Features

Marine features are notified at a wide variety of scales, from the geomorphological scales, to whole shores and to individual habitats (benthic biotopes).

In addition, consideration should be made of habitats that support mobile species such as fish (e.g. nursery, migration, estuarine), mammals (marine, coastal and riparian) and seabirds (Drewitt *et al.* 2015) and habitats that complement features identified in the coastlands habitats and saline lagoons (Brazier *et al*. in prep; Rees *et al*. 2019) and the GCR (Ellis *et al.* 1996). Normally one good quality example of each selection unit, meeting one or more of the site selection principles (Section 4.4) should be selected in each AoS, although several sites may be needed to adequately represent the full range of communities encountered on each type of shore (Section 4.10 in Bainbridge *et al.* 2013).

There are three geomorphological selection units: 'Estuaries', 'Inlets and bays' and 'Marine archipelagos'. These reflect the importance of including whole systems that contain interdependent habitats, in addition to stretches of coast of similar character. Marine landscapes or geomorphological features comprise suites of habitats that consistently occur together, but which are often derived from different parts of the habitat classification hierarchy (e.g. estuary, embayment). The Guidelines highlight the importance of considering an ecosystem approach and emphasise the incorporation, safeguarding and promotion of underlying ecological processes in the definition of the site interests and boundaries (Bainbridge *et al.* 2013). As with riverine and coastal systems, the ecosystem approach is of especial relevance to marine habitats and species and the geomorphological features they are associated with e.g. estuaries, bays, inlets and archipelagos.

Whole shore selection units consist of intertidal and subtidal benthic habitats and are divided into rock (hard) and sediment (soft) substrata types. These are further divided into shore types, according to other physical parameters - wave exposure, substratum type and salinity. The shore types (selection units) of the former Guidelines (JNCC 1996) were based closely on the 1996/7 biotope classification. The structure of this earlier classification reflected the spatial proximity of biotopes that are found in similar locations. The same shore types are used here, since they are most suitable for site selection and notification. The 2015 version of the UK and Ireland habitat classification (JNCC 2015a) is used; this matches the EUNIS classification (Davies *et al.* 2004).

The eight 'whole shore' selection units are:
- wave-exposed rock;
- moderately wave-exposed rock;
- wave-sheltered rock;
- mixed substrata (boulders, cobbles, pebbles with small amount of interstitial sediment);
- sand and coarse sediment;
- sand and muddy sand;
- mud; and
- mixed sediment (mud, sand and gravel).

The descriptions here are brief and as non-technical as possible, but the full technical descriptions of each biotope are provided in JNCC (2015a). The marine habitat classification is a convenient framework for grouping biotopes of similar substratum or species, but it is important to acknowledge that this framework represents a complex multi-dimensional array of substrata and biological communities. Biotopes that are found in each of the shore types described here do not necessarily sit together in the classification and, therefore, they do not necessarily correlate with the higher levels of the classification.

The different communities are, where possible, described in the order they are likely to be encountered from the top of the shore down to low water level and into the subtidal zone. Extra consideration should be given to the communities found on the extreme lower shore; these communities are frequently the most species-rich areas of the shore (being much less exposed to desiccation than upper shore communities).

Ephemeral communities may be present at many sites but may be of lower conservation value and are not listed in the following descriptions of shore types. The taxonomic nomenclature in the biotope descriptions follows Howson and Picton (1997), but is updated, where necessary, to the current scientific names in the World Register of Marine Species database (WoRMS 2015: http://www.marinespecies.org).

4.6. Geomorphological features (marine systems and associated habitat complexes)

Most of the coastline is likely to be 'open coast'. In this section, specific geomorphological features are considered. They encompass habitat complexes, which comprise an interdependent mosaic of subtidal and intertidal habitats, closely associated with surrounding coastal and terrestrial habitats. As stated in Bainbridge *et al.* (2013), the key is selecting those sites that retain the highest or best complement of species and communities naturally associated with that habitat (or system), including the complexities of habitat mosaics. There are several types of geomorphological features that should be considered for marine and coastal SSSIs ('estuaries', 'inlets and bays' and 'marine archipelagos'). Sites notified for geomorphological selection units under these Guidelines should also be considered in respect of the Geological Conservation Review principles and the selection of SSSIs for their earth heritage interest (JNCC 1977).

The selection of these geomorphological features should reflect the physical and geological variation found in Great Britain and incorporate the wide variety of habitats, communities and species they support from land to sea. They may also support important mobile species interests of national and international importance, including birds (Drewitt *et al.* 2015) and fish (Bean *et al.* 2018, estuarine fish in prep).

These systems can be subject to change and features will not necessarily be fixed over time. For example, the evolution of these systems may result in realignment of the high-water mark, leading to inundation of low lying land and development of marine interests over time. The dynamic nature and evolution of these systems should be considered and site boundaries should aim to incorporate the likely predicted changes over 50 years (Section 5.1).

Geomorphology should be considered as an overarching feature that supports multiple habitat and species. The combinations of habitats and species (including mobile species) within or supported by these geomorphological features can also be of international importance. In England and Wales, the overarching geomorphological features may extend into the subtidal according to the W&CA as amended by MCAA; this does not apply to designation in Scotland (Annex 5).

4.6.1. Estuaries

Estuaries are habitat complexes comprising an interdependent mosaic of subtidal and intertidal habitats, which are closely associated with surrounding coastal and terrestrial habitats. They are defined as the downstream part of a river valley, subject to the tide and extending to the limit of brackish water. There is a gradient of salinity from freshwater in the river to saline marine conditions towards the open sea. Estuarine conditions are considered likely to have a significant effect on the occurrence of marine species at salinities of less than 30. The input of sediment from the river, the shelter of the estuary from wave action, and the often low current flows typically lead to the presence of extensive intertidal sediment flats, sediment-filled channels and usually a limited extent of rocky habitat. A review of the effects of climate change on estuaries has been completed by Robins *et al.* (2016) and describes the likely trajectory of habitats and species in estuaries in the future.

The structure of estuaries is largely determined by geomorphological and hydrographic factors. There are four main sub-types:

- *Coastal plain estuaries*. These estuaries have formed where pre-existing valleys were flooded at the end of the last glaciation. They are usually less than 30 m deep, with a large width-to-depth ratio. This is the main type of estuary, by area, in UK;
- *Bar-built estuaries*. These characteristically have a sediment bar across their mouths and are partially drowned river valleys that have subsequently been inundated. Bar-built estuaries tend to be small but are widespread around the UK coast;
- *Complex estuaries*. These have been formed by a variety of physical influences, which include glaciation, river erosion, sea-level change and geological constraints from hard rock outcrops. There are few examples of this type of estuary in UK; and
- *Ria estuaries*. Rias are drowned river valleys, characteristically found in south-west Britain. The estuarine part of these systems is usually restricted to the upper reaches. The outer parts of these systems are little diluted by freshwater and can be described as a bay/inlet.

The intertidal and subtidal sediments of estuaries support biological communities that vary according to sediment types and salinity within the estuary, plus geographic location and tidal currents. Some of these elements support habitats or species that qualify for selection in their own right (e.g. saltmarshes, Rees *et al*. 2019). The parts of estuaries furthest from the open sea are usually characterised by soft sediments, lower salinity and riverine freshwater input. Transitions with other important lowland habitats at the upper tidal limit of an estuary, such as freshwater marsh and coastal grazing marsh (Mainstone *et al.* 2018; Taylor *et al*. in prep.) should be considered. Towards the mouth of the estuary, the system becomes more saline and the substratum tends to become coarser. The sheltered upper reaches of estuaries often support saltmarsh, and often near the estuary mouth there may be supralittoral spits supporting sand dunes or shingle systems (Rees *et al*. 2019). In the outer estuary, close to the open sea, the seabed is often sandy sediment, and supports more marine communities. Narrow channels in the estuary can lead to some localised high energy communities where they are tide-swept.

Estuaries can include rock habitats consisting of natural reefs and constructions, as well as broken-down constructions, that support distinctive communities of species including some estuarine specialists.

In addition to the benthic communities, the water column of estuaries is important for a range of species including fish and the juvenile and planktonic stages of species. Estuaries are important conduits for migratory species between the marine and freshwater environments and as nursery grounds (Bean *et al.* 2018). Estuaries can also support large bird populations, which may also qualify for selection (Drewitt *et al*. 2015).

4.6.2. Inlets and Bays

Inlets and bays are habitat complexes that comprise an interdependent mosaic of subtidal and intertidal marine habitats and associated coastal and terrestrial habitats. They are generally large indentations of the coast, more sheltered from wave action than the open coast. They are relatively shallow and, in contrast to estuaries, have low freshwater influence. The subtidal elements of these features are excluded from designation in Scotland due to the Nature Conservation (Scotland) Act 2004 not containing the provision for designating SSSIs below low water spring tide mark.

There are three main sub-types:

- Embayment: a marine inlet where the line of the coast typically follows a concave sweep between rocky headlands, sometimes with only a narrow entrance to the embayment;
- Fjardic sea loch: a series of shallow basins connected to the sea via shallow, sometimes intertidal, sills. Fjards are found in areas of low-lying ground which have been subject to glacial scouring. They have a highly irregular outline, no main channel and lack the high relief and U-shaped cross-section of fjordic sea lochs; and
- Ria: rias are long narrow inlets of the sea that were once river valleys and that are a feature of south-west Britain. The sides are often steep and rocky. Voes and firths (in Shetland and Orkney) are similarly long narrow inlets that most likely started as small river valleys but that were further deepened by glaciers and eventually flooded after the last glaciation.

Inlets and bays vary widely in habitat and species diversity according to their geographic location, size, shape, form and geology. There is considerable variation between hard (rock) and soft (sediment) coasts. The degree of exposure to wave action and tidal current strengths are critical factors in determining the habitats and species present, affecting communities both on the shore and in the sublittoral zone. The range of plants and animals associated with this habitat type is therefore very wide. The issue of site size is also important, as larger sites tend to encompass the greatest variety of constituent habitats and have the greatest potential for maintenance of ecosystem integrity.

4.6.3. Marine archipelagos, headlands and sea stacks

Marine archipelagos (island groups) together with headlands, sea stacks and rocks are habitat complexes which comprise an interdependent mosaic of intertidal and subtidal marine habitats and associated coastal and terrestrial habitats. The associated coastal and terrestrial habitats above high tide but with a strong maritime influence, particularly cliff habitats, may qualify for selection in their own right (Rees *et al*. 2019). Marine archipelagos, headlands and stacks vary widely in habitat and species diversity according to their geographic location, size, shape, form and geology; the range of communities associated with this feature is broad. The degree of wave and tidal exposure is a critical factor in determining habitat and species diversity, affecting communities both on the shore and in the subtidal zone.

The following examples of marine features demonstrate the type and range of these geomorphological selection units (without prejudging the SSSI selection procedure:

- Headlands - The Lizard, St David's Head;
- Skerries/rocks - Wembury Point and Great Mew Stone, Hats and Barrels;
- Sea stacks - Old Man of Hoy, Stacks of Duncansby Head, Old Harry's Rocks, The Needles;
- Islands - Staffa, Bass Rock, Ailsa Craig, Caldey and St Margaret's Islands; and
- Island groups - Farne Isles, Monach Isles and St Kilda, Treshnish Isles, Small Isles.

Existing SSSIs are often not continuous, e.g. excluding the subtidal habitats and water column between features (e.g. headland and sea stack), are separate SSSIs (e.g. headland and island), or exclude offshore rocks and sea stacks from the notification. This can be improved through incorporation of overarching archipelago features within SSSIs and associated habitat complexes. This will allow for notification of important and diverse shallow subtidal habitats and communities, inclusion of offshore features and of supporting habitats for mobile species, e.g. seabirds associated with offshore stacks and rocks in England and Wales. This will not apply in Scotland, where subtidal elements are excluded from designation.

Islands often have a combined terrestrial and marine biological interest which makes them extremely important. Most small coastal islands exhibit good examples of terrestrial habitats that are selected using other guideline chapters, e.g. Chapter 4 Lowland Heathland. Many are bounded by sea cliffs, at least in part, but others are fringed by lower rocky platforms. They can be important breeding and resting places for species such as grey and common seals. The number of such islands along the coasts of England, Wales and southern Scotland is low, and many of them qualify for selection on ornithological grounds alone. In the western and northern Highlands and Islands, however, they are numerous and selection is likely to require more assessment effort.

4.7. Marine rock habitats (descriptions from Hiscock 1996)

Rocky shores are dominated by species of plant and animal that are adapted to the rigours of a life of alternating immersion in seawater and exposure to the air. The composition of these communities is determined mainly by the ability of these species to survive the desiccating effects of exposure to air and the various degrees of wave action, ranging from the almost constant pounding of Atlantic waves on western headlands, for example, to the stillness of enclosed backwaters where even a Force 10 gale may only ripple the surface. The 'architecture' of rocky shores is also very important with the creation of platforms, cliffs, overhangs, caves, pools, boulder fields and other features that encourage higher species diversity compared with uniform rocky slopes. Tidal rise and fall is a major factor determining one of the most striking features of rocky shores - the horizontal zonation of species brought about by the direct physical effects of alternate immersion in water and drying in air and by biological interactions, especially competition for space, predation and grazing. The lowest part of the shore is a narrow transition between the habitat that is exposed by every tide and the continuously submerged area beyond the lowest tides.

The desiccating effects found on the open shore are ameliorated in rockpools, under overhangs, in caves, under boulders and below dense algae where relatively rich communities can develop. Under small boulders, there may be as many as 50 conspicuous animal species (although highly characteristic underboulder communities may include many fewer). Rock type is also important, particularly if it retains water or is too soft for holdfasts of algae to remain attached. Rocks that are soft enough to allow animals to bore into them provide security from predators and, when the inhabitant dies, a habitat for nestling species. Other rock types are creviced and a distinctive fauna can develop within the crevices. Such conditions add to the diversity of a shore and can be additional reasons for considering an area as of conservation importance.

Where rocky substrata occur in the low or variable salinity zones of estuaries, they are generally characterised by a low number of species that also occur in full salinity. However, some species are characteristic of rocky substrata in reduced salinities and specific communities develop where they are dominant. These species include a range of highly characteristic green and other filamentous algae, the brown alga *Fucus ceranoides*, the hydrozoans *Hartlaubella gelatinosa and Cordylophora caspia* (non-native hydroid), the barnacle *Balanus improvisus*, a variety of encrusting bryozoans and sphaeromid isopods.

Rocky shores comprise about 35% of the coastline of Great Britain but are mainly a feature of the open coast and sea lochs and are rarely encountered in estuaries. Natural rocky shores are rare in the east basin of the Irish Sea between Colwyn Bay and Morecambe Bay and on the east coast of England between Flamborough Head and the Thames, although less diverse rocky shore communities can develop on structures such as breakwaters and piers. These are unlikely to qualify as SSSI features, due to the unnatural nature of the feature.

4.7.1. Marine rock - special features

Sites that represent the extremes of exposure or shelter are of limited extent on a national basis and are, therefore, of particular interest. Rocky shores are typically not extensive in estuaries. Such hard substrata within mid- and upper- estuaries subject to variable or low salinity may therefore also be important. A rocky peninsula or an extensive, very broken, rocky shore may include communities that are characteristic of exposed and sheltered conditions within a small area, thus producing a site with a very wide variety of representative communities and species, which would be particularly favoured as a candidate site.

Some features are important in providing additional value through increasing habitat and species diversity or supporting rarely encountered species. At all sites, surge gullies, rockpools, overhangs, caves and underboulder habitats typically add to the interest and are of especial interest when they are well developed. These specialist habitats show variability across the different wave exposure levels and selection should be considered to represent the full range of variation of rockpools, overhangs, caves and underboulder communities.

Shores may be species-rich or include species rarely encountered in the intertidal zone for a variety of reasons. For instance, north-facing shores in coastal areas with high turbidity may hold species from the circalittoral zone (subtidal zone dominated by sessile animals), due to the turbidity reducing light penetration and they can survive on the shore because of protection from desiccation. Such shores are unusual and of increased conservation interest. Shores where the low spring tides occur in the early morning and evening may have richer lower shore communities than where midday low spring tides result in greater desiccation and bleaching.

Annex 1 and Annex 2 tabulate those habitats of particular nature conservation importance.

4.7.2. Wave-exposed rock - description

These shores are present where the coast faces prevailing winds and swell and is not sheltered by coastal and offshore features. They occur particularly on northern and western coasts and on headlands. Given the extreme conditions and the limited range of species that can tolerate these conditions, the shores support fewer communities and species than rocky shores in less wave-exposed conditions.

Below a very broad grey and yellow lichen band in the splash zone, a distinct band of black lichens is present and the alga *Porphyra linearis* may be found. The black lichens may also be associated with sparsely distributed barnacles (the species differ in the north and east compared to the west and south coasts of Britain). The eulittoral zone is usually dominated by mussels and/or barnacles with a dense red algal turf occurring towards the lower shore margin. In some instances, pink coralline algal crust dominates, with a short turf of *Corallina* spp. At the sublittoral fringe, the kelp *Alaria esculenta* typically occurs. This species is very characteristic of highly wave-exposed conditions and is often accompanied by a dense band of small mussels. In only slightly less exposed conditions, the kelp *Laminaria digitata* may occur mixed with *A. esculenta*. The presence of good quality rockpools and surge gullies adds interest to these shores. These high-energy shores are typically steep and shelve steeply into the sublittoral. These kelp forest sublittoral biotopes may be included within the boundary of the SSSI in such cases as offshore island groups, provided they add value to the intertidal features.

Biotopes that characterise the wave-exposed rock shore type are listed and indicated in Annex 3.

Additional considerations: The *Fucus distichus* subsp*. anceps* and *Fucus spiralis* f. *nana* community is restricted to the far north and west of Great Britain and sites may be considered for SSSI selection to provide representation of this geographically restricted shore type within the series. This is an unusual community that will not necessarily occur on most good quality (representative) extremely or very exposed rocky shore sites.

4.7.3. Moderately wave-exposed rock - description

Moderately wave-exposed shores are more common than the previous category and generally support a greater variety of communities and species, although this depends markedly on shore topography.

Below a band of yellow and grey lichens, the upper shore is characterised by the black lichen *Verrucaria maura*. The mid-shore typically supports one or more of a range of communities such as barnacle/limpet mosaics, fucoid algae/barnacle mosaics or mussel beds with red algae and fucoid algae, the latter typically found in silted areas. On the upper shore, the predominant fucoid algae are the channelled wrack *Pelvetia canaliculata* and the spiral wrack *Fucus spiralis*, in the mid-shore it is bladder wrack *Fucus vesiculosus* and on the lower shore it is either serrated wrack *Fucus serratus* or thongweed *Himanthalia elongata* (or both). Around the sublittoral fringe, dense forests of the kelp *Laminaria digitata* occur. Shallow sublittoral habitats are dominated by kelp *Laminaria hyperborea* forest and, deeper still, kelp park, with increasing domination by red and other brown algae. Some kelp beds can extend well offshore, and perform a valuable wave attenuation function. This, and the vast quantities of particulate organic matter and beach-cast material, can cause fundamental ecological changes on adjacent beaches. Where SSSI boundaries extend between headlands, islands or rocky outcrops, these biotopes may be included if they add value to the other features.

On rocky shores near sandy beaches, sand scour may cause part or all of the mid-shore to become dominated by ephemeral algae such as the red alga *Porphyra purpurea* and the green algae *Ulva* spp., which grow rapidly over scoured rock during calm periods. Further down the shore, the sand may be bound to the rock by the red alga *Rhodothamniella floridula*. Of note on sand-influenced beaches are the reefs of the honeycomb worm *Sabellaria alveolata*. These are particularly important when well developed into honeycomb reefs, a feature restricted to parts of the west and south coast of Great Britain as far north as the Solway Firth.

Communities that occur on chalk shores are of considerable marine conservation interest. Chalk is a restricted coastal feature in Great Britain, only found in significant amounts in east and south-east England. England has the greatest extent of chalk shore in Europe. The soft, alkaline nature of chalk means that certain species which do not occur elsewhere, flourish. British chalk is the type locality for a range of microscopic algae (Fowler and Tittley 1993). They occur in caves and on rock surfaces around the high-water mark. Other soft types of solid substratum (e.g. soft limestone, clay and peat) are of interest in that they have a highly restricted distribution and certain species are restricted to these substrata.

Biotopes that characterise the moderately wave-exposed rock shore type are listed and indicated in Annex 3.

Additional considerations: The communities present on steep rocky shores compared to extensive rocky platforms are typically very different in character and examples of each may be considered for notification.

Sufficient sites should be considered for notification to provide adequate representation within the SSSI series of the geographically restricted communities on chalk, soft rock and *Sabellaria alveolata* types. These are unusual communities that will not occur on most good quality (representative) sites of this selection unit type.

4.7.4. Wave-sheltered rock - description
This is a widely distributed selection unit which occurs frequently around the coasts of Great Britain. On shores predominantly of bedrock and boulders, there are zones of yellow and grey lichens and of black lichens at the top of the shore, although these are typically much narrower than on more exposed shores. The upper shore is usually marked by a zone of the channelled wrack *Pelvetia canaliculata*. The mid- to low shore supports a range of different communities distinguished by the dominant fucoid algae *Fucus spiralis*, *Fucus vesiculosus* or *Fucus serratus*. In more sheltered conditions, the *Fucus vesiculosus* on the mid-shore is replaced by the egg wrack *Ascophyllum nodosum*. With increasing shelter, the horizontal extent and density of the *Ascophyllum* zone increases until, in the most sheltered situations, the whole mid-shore may be covered in a dense canopy of this species. Typically, the dense canopy of fucoid algae provides shelter from desiccation, for many other algae and animals, the levels of richness depending on shore topography and geology. The sublittoral fringe in very sheltered conditions may be dominated by the kelp *Laminaria saccharina* on its own or with *Laminaria digitata*. An interesting variant is where the sublittoral fringe is dominated by the kelp *Saccorhiza polyschides*, an opportunistic annual species on shores in the west and south-west.

In tide-swept areas, particularly associated with tidal rapids in sea lochs and narrow channels or inlets, *Ascophyllum nodosum*, *Fucus serratus* and *Laminaria digitata* zones may also have well developed populations of sponges, ascidians and other species which significantly increase the species richness of these sheltered rocky shores.

Biotopes that characterise the sheltered rock shore type are listed and indicated in Annex 3.

Additional considerations: At all sites, rockpools, overhangs and underboulder habitats typically add to the interest, especially where they are well developed. Sufficient sites should be considered for selection within the SSSI series to provide adequate representation of the geographically restricted sheltered tide-swept communities. These are unusual communities that will not normally occur on most good quality (representative) sites of this selection unit type.

4.7.5. Mixed substrata (boulders, cobbles, pebbles with interstitial sediment) - description
Shores of mixed substrata are often characterised by communities of fucoid algae similar to those on bedrock and boulders. Where the substratum is unstable, or scoured by the interstitial sediments, then these habitats support fewer species than bedrock or stable boulders. Where these shores are not backed by high ground, freshwater streams reduce the salinity, which reduces the species richness. Fucoid algae grow on the stable rocks, but where substrata are less stable barnacle communities and clumps of large mussels *Mytilus edulis* prevail; the latter may be present as extensive mussel beds.

Mixed substrata shores subject to strong tidal streams may support rich communities of sponges, ascidians and red algae.

Under conditions of variable or lowered salinity, rocky shore species are reduced to a limited number that can tolerate these conditions. Within areas of variable salinity, *Fucus ceranoides* is the characteristic brown alga, especially in locations where freshwater runs across the intertidal area. In summer, the eulittoral zone may be dominated by dense ephemeral red and green algae, the same community that can develop in areas subject to siltation. In areas where the salinity is constantly low, brown fucoid algae may be lacking altogether and shores may be dominated by green algae *Enteromorpha* spp.

In extremely sheltered areas, beds of the internationally important free-living *mackayi* form of *Ascophyllum nodosum* may develop. The form is an 'ecad' produced in response to habitat physical factors, the characteristic adaptations not being heritable. Often exploited by man in the past and occurring in areas subject to human disturbance, extensive beds of this alga are rare. Sites should be selected within an AoS where they support good examples of *Ascophyllum nodosum* ecad *mackayi* beds which cover a significant proportion of the shore.

Biotopes that characterise the mixed substrata shore type are listed and indicated in Annex 3.

Additional considerations: Sufficient sites should be considered for selection to provide adequate representation of the geographically restricted, rich, sheltered tide-swept types and the *Ascophyllum nodosum* ecad *mackayi* beds within the SSSI series. These are unusual communities that will not occur on most good quality (representative) sites of this selection unit type.

4.8. Marine sediment habitats

Sediment shores comprise about 52% of the coastline of Great Britain, representing a total area of over 235,000ha. The greatest extent is in semi-enclosed or enclosed areas such as bays and estuaries but with some extensive areas of sand on the open coast, especially along the North Sea and Irish Sea margins. Extensive areas of intertidal sediment also occur on offshore drying banks.

Sediment shores range from being almost devoid of life, as in mobile gravel/shingle and sand on surf beaches, to being relatively rich in species such as on sheltered muddy gravel shores. Some characteristically intertidal species occur on sediment shores but the richest communities are the lower shore margins of much more extensive shallow subtidal communities. Macro-infaunal species that typically colonise sediments include polychaete worms, amphipod crustaceans, bivalve molluscs and (at extreme low water level) burrowing sea urchins. The sediment particle size, mixture of sediment grades, organic content and the stability of the sediment have the greatest importance in determining the types and number of species that colonise the sediment habitat. Different sediment types, ranging from clean sand to coarse muddy gravel to fine mud, have very different and distinctive assemblages of species. Different communities occur at different heights on the shore, according to the varying degrees of water retention during low tide, which in turn is affected by sediment grade; finer sediments retaining water to a greater degree than coarse well-draining sediments. However, the zonation is less apparent where fine-grained water-retentive sediment flats, as found in estuarine situations, show less variation in faunistic composition with height than do coarser well-drained beaches.

In estuaries, between headlands and groups of islands or rocks, habitats exhibit transitions between degrees of wave exposure, tidal stream, sediment type and salinity, depending on the local topography. This increases heterogeneity of the habitats, which can be important in terms of species richness at a landscape scale. Tide-swept sediment habitats provide greater supplies of food than areas of low tidal flow, and are dominated by the sand mason worm *Lanice conchilega* and infaunal bivalve molluscs. Stable, undisturbed sediments can be important for long-lived bivalve mollusc species such as *Mya* spp. and *Arctica islandica* that are found naturally in low abundance.

Sandy shores on the open coast may be highly dynamic with impoverished communities. However, with increasing shelter, they support increasingly diverse communities which may include some long-lived species. Such communities are more sensitive to physical disturbance than those of more dynamic shores.

4.8.1. Marine sediment - special features

The presence of coarse material such as gravel within otherwise muddy sediment shores often contribute to increased species richness. For example, these mixed sediments often include the richest communities of burrowing species of any of the shore types. This seems to reflect their longer-term stability which allows for the recruitment and survival of a variety of long-lived and often slower-growing species. Many mixed sediments have coarse substrata at the surface so that both burrowing species (infauna) and species of algae and animals attached to the surface (epifauna) occur in the same habitat, resulting in a high overall species richness. This is especially the case in areas of shore subject to the influence of moderate tidal flow. Lower shore and shallow subtidal sediments are typically richer in species, due to the greater stability of water levels and temperature. The full height of the shore should be considered at a site, since not all species are at their optimum at the lower shore and subtidal heights.

Many muddy shores are highly productive and this is often signalled by their importance for populations of wading birds. Drewitt *et al.* (2015) identifies SSSIs based mainly on population size of individual bird species or a suite of bird species. In terms of marine benthic habitats and species, high species richness is likely to be more important than high productivity. Productivity might only affect the importance, in the context of the current guidelines, with respect to supporting populations of marine predators such as fish and crustaceans. Likewise, seagrasses on the shore are often highly valued as a source of food for some birds but consideration should also be given to the quality of the habitat in its own right, including its local extent, species richness and rarity. Muddy shores subject to fully saline conditions are a feature of the rias of south-west Britain and the fjardic sea lochs in Scotland. In sea lochs, muddy habitats are generally rare and are of regional, or higher, conservation importance because of that rarity.

Although the most species-rich muddy shores are likely to be in full salinity situations, those with characteristic species in low or variable salinity are also important and should be included in a representative series. Some of the richest 'muddy' shores have mixed sediments, including coarse material below the surface.

Whole shore types for sediment habitats are based on different energy levels, which typically define the sediment type, along with further consideration of the salinity. It is important to recognise, however, that sediment type and the associated communities have long transitions from one to another, usually without clear boundaries. The sediment type usually does not change rapidly over time, but when assessing the communities present, the temporal variability in species abundance must be considered.

Annex 1 and Annex 2 tabulates those habitats of nature conservation importance.

4.8.2. Sand and coarse sediment - description

This selection unit generally occurs on wave-exposed open coasts. These shores include only a few communities due to the high mobility and free-draining nature of the sediment. On the most exposed sandy or shingle beaches a search for infauna may reveal no species except for animals associated with drift weed on the strandline. Older strandlines provide locations that trap sand to form embryonic dune habitats and also support coastal invertebrate populations, covered in Rees *et al.* (2019) and Curson *et al.* (2019.) respectively. On less exposed beaches, the community is likely to be dominated by burrowing amphipods (mainly the genera *Bathyporeia*, *Pontocrates* and *Haustorius*), the isopod *Eurydice pulchra* and a few species of small polychaete worms. Typical polychaetes found on such exposed sandy shores include *Scolelepis squamata*, *Paraonis fulgens* and *Nephtys cirrosa*. Bivalve molluscs are usually absent on such exposed sandy shores although the occasional specimen of *Tellina tenuis* may be found. From time to time, a particularly successful recruitment of *Arenicola marina* may result in colonisation of the mid-shore; this is a temporary phenomenon and not of conservation interest. Oligochaete worms may be found associated with freshwater run-off on the upper shore.

Exposed shores of shingle or coarse sand with no apparent macrofauna occur in this selection unit but have little marine biological interest, although they can be important in terms of coastal protection.

Subtidal banks of shingle and sand may often be formed and maintained in a dynamic equilibrium at the entrances to estuaries and adjacent to headlands. Subtidal coarse sediment habitats are not exposed to the extremes of wave action in the same way as intertidal habitats, which permit a greater diversity of species including anemones, *Moerella* spp., interstitial polychaetes and venerid bivalve species. Biotopes that characterise the sand and coarse sediment shore type are listed and indicated in Annex 3.

Additional considerations: The amphipod *Pectenogammarus planicrurus* is found almost exclusively in mobile gravel and shingle in high energy environments and can be the only infauna present. This species is considered nationally scarce (formerly rare) according to the criteria in Sanderson (1996) and the *Pectenogammarus* biotope represents most of the records for this species.

4.8.3. Sand and muddy sand - description

Moderately-exposed sandy shores are generally found on open coasts that are not exposed to strong wave action. They may also occur near the mouths of marine inlets. The sediments are usually of fine sand but may be slightly muddy at the more sheltered end of the range. Moderately exposed sandy shores generally support communities with greater species richness than exposed sandy shores. The major difference is the presence of certain species of bivalve and many more species of polychaete. In fine, clean sand the typical bivalves are *Tellina tenuis*, *Tellina (Fabulina) fabula* and *Donax vittatus,* whereas the cockle *Cerastoderma edule* and Baltic tellin *Macoma balthica* are generally found in slightly more muddy sand. On the extreme lower shore, the razor shell *Ensis siliqua* may be found, often in conjunction with the burrowing heart urchin *Echinocardium cordatum*. Beds of eelgrass *Zostera marina* may be exposed on low spring tides. Typical polychaetes include the lugworm *Arenicola marina*, often in high numbers, as well as *Nephtys cirrosa*, *Nephtys hombergii*, *Pygospio elegans*, *Spio filicornis* and *Scoloplos armiger*. Oligochaete worms may be found associated with freshwater run-off on the upper shore. Where the shore is tide-swept, there may be beds of the sand mason worm *Lanice conchilega* on the low shore. Burrowing crustaceans, principally *Bathyporeia spp.*, are often found in high numbers (although generally less numerous than on more exposed sandy beaches). Cumaceans and the polychaete *Ophelia rathkei* may be present.

Moderate energy subtidal habitats are subject to less wave action, and are likely to have more fine sand and mud associated with them. A similar suite of species is present, as described for the intertidal zone, but there is likely to be a greater diversity of bivalves and polychaetes at a single location. The black lug species *Arenicola defodiens* can replace *A. marina* at the extreme low shore and subtidally. At deeper sites, more echinoderms, including infaunal brittlestars (*Ophiura* spp. and *Amphiura* spp.) will be present, as well as the bivalves *Abra* spp. and *Nucula nitidosa*. Examples of moderate energy sediments in variable and low salinity environments are limited to the mid and upper reaches of estuaries and are characterised by robust amphipods, polychaetes and mysid shrimps such as *Nephtys* spp., *Capitella capitata* and *Gammarus* spp. None of the species in these environments are unique to that habitat and many are likely to be transient.

Sandy-mud shores, within marine inlets, in full salinity are likely to be rich in species and of marine conservation interest.

Biotopes that characterise the sand and muddy sand shore type are listed and indicated in Annex 3.

Additional considerations: None identified.

4.8.4. Mud – description
These shores are almost invariably found in the shelter of marine inlets. The exception to this is where shallow water extends a long way out to sea on the open coast and the wave energy is dissipated before reaching the near shore and shore. Muddy sediments occur along gradients of shelter and salinity and are often characterised by the absence or limited abundance of certain species that are more readily found in sandier habitats. Sediment particle size and salinity are often well correlated, with muddy shores often found under estuarine, less saline conditions. However, fully marine muds occur in the rias of south-west Britain and some sea lochs. Muds typically support a greater biomass than other sediments, the abundance of bivalve and polychaete species being particularly high. In the intertidal zone, the burrowing amphipods of the genus *Bathyporeia* are often absent in very muddy substrata but the mud shrimp *Corophium volutator* may be present in high numbers. The cockle *Cerastoderma edule* is often abundant in fully marine sandy muds with *M. balthica* being typical of finer muds. In reduced salinity muds, there is additionally the peppery furrow shell *Scrobicularia plana*, particularly on the mid- and upper shore. The polychaete *Hediste diversicolor* is widespread in muddy substrata and is often particularly abundant in reduced salinity conditions. Other polychaetes found in muddy shores include *Nephtys hombergii*, *Streblospio shrubsolii*, *Aphelochaeta marioni* and *Manayunkia aestuarina*. In very low salinities, very few species occur other than oligochaete worms. The prosobranch *Peringia ulvae* is typically common on the surface of the mud and the eelgrass *Zostera noltii* may also be found. Filamentous green algae frequently cover the surface of the mud but these are of low conservation interest because of their ephemeral and widespread nature.

Subtidal mud habitats are limited to sheltered inlets. Such habitats can have a very high biomass of polychaetes, bivalves and echinoderms, with a similar complement to the slightly muddy sands of moderate energy sediments. In addition, rarely, sea pens *Virgularia mirabilis* and holothurians *Ocnus planci* can live alongside sedentary tube dwelling polychaetes such as *Polydora* spp. Diversity and biomass can be limited in low or variable salinity environments.

Biotopes that characterise the muddy sediment shore type are listed and indicated in Annex 3.

Additional considerations: Preference may be given to examples which support rare or scarce species. The seagrass *Zostera* communities are of marine conservation interest, according to their frequency of occurrence in the AoS.

4.8.5. Mixed sediment (mud, sand and gravel) - description
Intertidal mixed sediments, including muddy gravels, are not widespread but may be found in sea lochs and some other marine inlets. Muddy gravels may support a wide variety of syllid polychaetes, bivalves *Venerupis senegalensis*, *Mya truncata* or *M. arenaria* but often the most abundant species in this substratum, particularly under conditions of reduced salinity, is *Hediste diversicolor*. These habitats are a great deal

richer further down the shore and into the subtidal zone. In the shallow subtidal, the bivalve species include venerid species and *Ostrea edulis*, with increased variety and abundance of hydroids and anemones such as *Cerianthus lloydii* and *Sagartiogeton undatus*. Often, the pebbles and gravel that lie at the surface of this habitat will also be colonised by an epibiota of small filamentous algae and encrusting invertebrates such as barnacles and keel worms *Spirobranchus* spp.

Biotopes that characterise the mixed sediment shore type are listed and indicated in Annex 3.

Additional considerations: Preference may be given to examples that support nationally important communities of rare or scarce species. Of special interest are muddy gravels that have populations of the burrowing bivalves *Mya arenaria*, *M. truncata* and *Venerupis senegalensis*, sipunculans and burrowing holothurians. Sites with such species may be considered for additional selection within an AoS, particularly if the infaunal community is rich and the habitat extensive.

5 Boundary Definition

5.1. Principles of defining boundaries for marine features

The approach for marine habitats should be based on the selection of complete systems as a geomorphological feature or as whole shores, i.e. from the top of the shore to low water (or beyond where justified (in England and Wales)), which will typically consist of a series of zoned communities. This is compatible with the terrestrial use of broad habitats rather than separate communities for selection; it is also pragmatic and creates readily defined areas for selection and management.

Overarching boundary principles are detailed in Bainbridge *et al.* (2013).

- The boundary should encompass all the features that are the ‘reasons for notification’, e.g. for mobile species this may include their supporting habitats (or a selection of these). In England and Wales, it is reasonable to extend the boundary into the subtidal to include the entire feature(s) or other features on which the qualifying feature depends. This does not apply to Scotland, where the lower limit remains at Mean Low Water of Spring Tides.
- The boundary should include critical physical or ecological processes which support notified features; e.g. immediate sediment supply for marine habitats, tidal channels that are essential components of the structure and function of the marine feature.
- The boundary should include the area necessary to provide space for change. For coastal and marine sites, the boundary should be sufficiently large to encompass the likely extent and locations of the notified features for at least 50 years. This will likely require further work (potentially including modelling) to confirm the trajectory of the features.

The coastal processes of erosion and accretion are key factors that influence and maintain the range of marine and coastal habitats present. Coastal processes drive change and there is an identified need to restore functionality to the coast, to ensure the longer-term dynamism of intertidal and coastal habitats. This guidance should be read in conjunction with that for coastlands habitats (Rees *et al*. 2019.), where features form a continuous transition within a system with common physical drivers. A review of the local rates of erosion or accretion over a relevant period will provide a useful understanding of the degree of geophysical change over time. Certain geomorphological features, (where not already fixed by coastal defences) are particularly vulnerable to increased erosion from climate change driven sea level rise, e.g. mouths of estuaries (Lush & Ashmead 2010) and their future extent and location should be considered when setting boundaries. Robins *et al.* (2016) have provided a review of the influences of changes in climate in estuarine systems.

Boundaries should be established to include all the features which contribute to selection of the site as a SSSI. Additional areas should be included within the boundary, where they occur within a mosaic of qualifying features and where, to exclude them would result in fragmentation and reduced viability of the site.

Boundaries must also be clearly identifiable in practice; this may mean that boundaries are drawn between conspicuous features on the coast (e.g. between headlands) or that they are a continuous extension of the boundaries of landward habitat features that are also being included as part of the site (e.g. fence line). In all cases, convenience must not compromise the setting of boundaries that relate to the extent of the special interest. The 'special interest' of biodiversity features is not necessarily fixed in time. Some species or habitats may become more widespread and numerous and thus less threatened, whilst others may decline or additional rare and scarce species be discovered, so the remaining populations and areas will assume increased value and may require greater protection and/or better management.

Establishing boundaries for intertidal areas may be problematic given the extent of the features, which sometimes cover large or lengthy, continuous areas; it may be desirable to select parts of the total area, but the definition of such boundaries may be difficult. The guiding principle here is that the diversity, which is characteristic of the particular ecosystem in a given AoS, must be fully represented in the selected site. Further guidance on the approach is provided in Bainbridge *et al*. (2013).

In other situations, where highly rated features are scattered across a shore with no other particular interest, the whole general shore area could be considered for notification through its ecological relationship with those highly rated features, encompassing all or most of the scattered features of particular interest.

5.2. Clarification of seaward limits of SSSI and SSSI contribution to Marine Protected Areas network.

Under the Marine and Coastal Access Act 2009 (Clause 123(4b)), the Marine (Scotland) Act 2010 (Clause 79(4c)) and the Marine Act (Northern Ireland) 2013 (Clause 20(c)), where SSSI protect marine features, the features form part of the marine protected area (MPA) network (JNCC 2015b).

In England and Wales, section 28(1A) of Wildlife and Countryside Act 1981 (as amended) clarifies the normal seaward extent of SSSI as being the Mean Low Water Mark (MLWM) or the seaward limits of estuarial waters[6]. Sections 28(1B) and (1C) set out the circumstances in which SSSIs may extend beyond those limits into the subtidal zone[7].

The conditions are that (text adapted from section 28(1C)):
- features span above and below MLWM or extend beyond the seaward limits of estuarial waters;
- features are wholly or in part dependent on anything which takes place in or is present within the subtidal area; or
- the identification of the boundary of the SSSI is impossible or impracticable without the inclusion of a subtidal component.

In all these circumstances, boundaries should only extend into the subtidal area as far as is necessary to incorporate the features or supporting processes. If extending the boundaries results in more subtidal than intertidal or terrestrial area being within the SSSI this may not be appropriate

[6] The definition of estuarial waters in the Marine and Coastal Access Act 2009 is 'any waters within the limits of Transitional Waters', within the meaning of the Water Framework Directive (Directive 2000/06/EC): "bodies of surface water in the vicinity of river mouths which are partly saline in character as a result of their proximity to coastal waters but are substantially influenced by freshwater flows".
[7] Sections 28B(2A-2C) and 28C(2A-2C) of the Wildlife and Countryside Act 1981 (as amended) set out the equivalent provisions where an existing SSSI (in England or Wales) is to be extended or enlarged.

and further advice should be sought on other options to be considered for all or parts of the subtidal area. This is particularly relevant when considering extending boundaries to incorporate geological and or geomorphological features and supporting processes, where potentially very large subtidal areas could be linked to notified intertidal features. Examples to illustrate where it may be appropriate to extend boundaries into the subtidal are found in Annex 5, along with guidance on defining subtidal boundaries and useful data sources.

In Scotland, areas selected as SSSI are generally **above** MLWS. However, areas below MLWS but within local planning authority jurisdiction in an estuary or firth, for example, have been included in some SSSIs for practical boundary setting reasons.

ASSIs in Northern Ireland are designated under article 28 of the Environment (Northern Ireland) Order 2002 by reference to land, which under the Interpretation Act (Northern Ireland) 1954 includes land covered by water. Terrestrial planning, by convention, extends to the MLWM and ASSIs can also extend to this seaward boundary. Highest Astronomical Tide (HAT) depicts the landward limit of marine submergence, although marine influence continues above this level, due to wave splash; HAT has not been extensively mapped throughout the UK and so defining marine components of SSSIs using geographical extent may under-represent some features found above Mean High Water Mark (MHWM) or Mean High Water Springs (MHWS) such as saltmarshes that are influenced, at least in part, by seawater. Note that this upper limit of the marine environment and associated habitats is covered in Rees *et al.* (2019) including habitats such as saltmarsh, sea cliffs, vegetated shingle and associated vegetation communities (Rodwell 2000). Transitions into freshwater systems should be considered alongside the Freshwater Habitats (Mainstone *et al.* 2018) and Saline Lagoons (Brazier *et al.* in prep) guidelines.

5.3. Coastal and marine geomorphological processes

Geomorphological processes (weathering, erosion, deposition, sediment flow, *etc*.) are the main influences on coastal, intertidal and shallow marine habitat types (May & Hansom 2003). The combination of geology and maritime processes varies at each site, offering up a wide variety of combinations. There is a requirement to understand the rates and types of change at the coast when setting boundaries. Habitats should be expected to change because of accretion and erosion, as well as wave or wind processes. Long-term migration of features landward or seaward as the coast evolves needs to be considered and the identification of suitable space for the feature over a maximum of the next 50 years, as covered in the coastlands chapter (Rees *et al*. 21019).

If there is a strong likelihood of change, geomorphological assessments will be needed to determine where the landward boundary should be set to ensure ecological coherence within sites. Expert knowledge of marine and coastal processes, the geology of the coastline (historical data including maps, aerial images, fixed-point monitoring, records of erosion rates and significant change events) will need to be combined with evidence about the ability of marine habitats and species to colonise after changes. If a wider boundary is proposed, it must be supported by evidence that the features can colonise into it over time

Sediment supply needs to be considered, with the inclusion of sediment ‘feeder’ areas at some distance from the interest features. For example, within an estuary all the intertidal flats and saltmarsh should be included within the boundary. Exclusion of even small areas may have consequences for sediment processes. Existing artificial structures and features may be suitable for exclusion, although where there is underlying geological interest these may still need to be included in the boundary. The most suitable approach is to include the whole coastal/marine system and its underlying sediments within the SSSI rather than exclude small pockets.

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Annex 1 Biotopes considered nationally or internationally important, or of special interest.

All highly rated examples of **nationally and internationally important biotopes** should be notified features in SSSI.

Status	UK Biotope Type	UK Biotope Code	UK Biotope Name
Nationally and Internationally important biotopes	**Chalk biotopes (or on other soft rock)**	LR.FLR.Lic.Bli	*Blidingia* spp. on vertical littoral fringe soft rock
		LR.FLR.Lic.UloUro	*Ulothrix flacca* and *Urospora* spp. on freshwater-influenced vertical littoral fringe soft rock
		LR.FLR.CvOv.ChrHap	Chrysophyceae and Haptophyceae on vertical upper littoral fringe soft rock
		LR.FLR.CvOv.AudCla	*Audouinella purpurea* and Cladophora rupestris on upper to mid-shore cave walls
	Soft, piddock bored biotopes	LR.HLR.FR.RPid	*Ceramium* spp. and piddocks on eulittoral fossilised peat
		LR.MLR.BF.Fser.Pid	*Fucus serratus* and piddocks on lower eulittoral soft rock
		LR.MLR.MusF.MytPid	*Mytilus edulis* and piddocks on eulittoral firm clay
		IR.MIR.KR.Ldig.Pid	*Laminaria digitata* and piddocks on sublittoral fringe soft rock
	Extremely exposed fucoid biotopes	LR.HLR.FR.Fdis	*Fucus distichus* and *Fucus spiralis* f. *nana* on extremely exposed upper shore rock
	Tide-swept algal biotopes	LR.HLR.FT.AscT	*Ascophyllum nodosum*, sponges and ascidians on tide-swept mid eulittoral rock
		LR.HLR.FT.FserT	*Fucus serratus*, sponges and ascidians on tide-swept lower eulittoral rock
		LR.HLR.FT.FserTX	*Fucus serratus* with sponges, ascidians and red seaweeds on tide-swept lower eulittoral mixed substrata
		IR.MIR.KT.LdigT	*Laminaria digitata*, ascidians and bryozoans on tide-swept sublittoral fringe rock
		IR.MIR.KT.LsacT	*Laminaria saccharina* with foliose red seaweeds and ascidians on sheltered tide-swept infralittoral rock
		IR.LIR.IFaVS.MytRS	*Mytilus edulis* beds on reduced salinity tide-swept infralittoral rock
	Sand-influenced rock biotopes	LS.LBR.Sab.Salv	*Sabellaria alveolata* reefs on sand-abraded eulittoral rock
	Extreme shelter biotopes	LR.LLR.FVS.Ascmac	*Ascophyllum nodosum* on full salinity mid eulittoral mixed substrata
	Muddy gravel biotopes	LS.LMx	Littoral mixed sediment
		LS.LMx.Mx.CirCer	Cirratulids and *Cerastoderma edule* in littoral mixed sediment
		LS.LSa.St.MytFab	*Mytilus edulis* and *Fabricia stellaris* in littoral mixed sediment
		SS.SMx.CMx.ClloMx	*Cerianthus lloydii* and other burrowing anemones in circalittoral muddy mixed sediment
		SS.SMx.IMx.Lim	*Limaria hians* beds in tide-swept sublittoral muddy mixed sediment
		SS.SMx.IMx.Ost	*Ostrea edulis* beds on shallow sublittoral muddy mixed sediment
		SS.SMx.IMx.VsenAsquAps	Venerupis senegalensis, Amphipholis squamata and Apseudopsis latreilli in infralittoral mixed sediment

Good examples of **biotopes of special interest** are expected to be represented across the SSSI series. For details on biotopes of special interest, see references to *additional considerations* in Sections 4.7 and 4.8.

Status	UK Biotope Type	UK Biotope Code	UK Biotope Name
Biotopes of special interest	**Rockpool biotopes**	LR.FLR.Rkp.Cor	Coralline crust-dominated shallow eulittoral rockpools
		LR.FLR.Rkp.Cor.Bif	*Bifurcaria bifurcata* in shallow eulittoral rockpools
		LR.FLR.Rkp.Cor.Cys	*Cystoseira* spp. in eulittoral rockpools
		LR.FLR.Rkp.FK	Fucoids and kelp in deep eulittoral rockpools
		LR.FLR.Rkp.H	Hydroids, ephemeral seaweeds and *Littorina littorea* in shallow eulittoral mixed substrata pools
		LR.FLR.Rkp.SwSed	Seaweeds in sediment-floored eulittoral rockpools
	Under-boulder biotopes	LR.MLR.BF.Fser.Bo	*Fucus serratus* and under-boulder fauna on exposed to moderately exposed lower eulittoral boulders
		IR.MIR.KR.Ldig.Bo	*Laminaria digitata* and under-boulder fauna on sublittoral fringe boulders
	Cave and overhang biotopes	LR.FLR.CvOv	Littoral caves and overhangs
		LR.FLR.CvOv.FaCr	Faunal crusts on wave-surged littoral cave walls
		LR.FLR.CvOv.SpByAs	Sponges, bryozoans and ascidians on deeply overhanging lower shore bedrock or caves
		LR.FLR.CvOv.SpR	Sponges and shade-tolerant red seaweeds on overhanging lower eulittoral bedrock and in cave entrances
		LR.FLR.CvOv.SpR.Den	Sponges, shade-tolerant red seaweeds and *Dendrodoa grossularia* on wave-surged overhanging lower eulittoral bedrock and caves
		LR.FLR.CvOv.VmucHil	*Verrucaria mucosa* and/or *Hildenbrandia rubra* on upper to mid shore cave walls
		IR.FIR.SG.CrSpAsDenB	Crustose sponges and colonial ascidians with *Dendrodoa grossularia* or barnacles on wave-surged infralittoral rock
		LR.FLR.CvOv.AudCla	*Audouinella purpurea* and *Cladophora rupestris* on upper to mid-shore cave walls
	Sublittoral fringe surge gully biotopes	IR.FIR.SG	Features of infralittoral rock
		IR.FIR.SG.CrSp	Crustose sponges on extremely wave-surged infralittoral cave or gully walls
		IR.FIR.SG.CrSpAsAn	Anemones, including *Corynactis viridis*, crustose sponges and colonial ascidians on very exposed or wave surged vertical infralittoral rock
		IR.FIR.SG.DenCcor	*Dendrodoa grossularia* and *Clathrina coriacea* on wave-surged vertical infralittoral rock
		IR.FIR.SG.FoSwCC	Foliose seaweeds and coralline crusts in surge gully entrances
		IR.FIR.SG.CrSpAsDenB	Crustose sponges and colonial ascidians with *Dendrodoa grossularia* or barnacles on wave-surged infralittoral rock
	Seagrass biotopes	LS.LMp.LSgr.Znol	*Zostera noltii* beds in littoral muddy sand
		SS.SMp.SSgr.Zmar	*Zostera marina/angustifolia* beds on lower shore or infralittoral clean or muddy sand
		SS.SMp.SSgr.Rup	*Ruppia maritima* in reduced salinity infralittoral muddy sand

UK biotopes match those of the EUNIS classification, although the coding system differs (Davies *et al.* 2004) - http://jncc.defra.gov.uk/page-6767.

Annex 2 List of habitats of interest in Great Britain

The table below includes priority habitats as required under Section 41 (England) of the NERC Act 2006, Section 7 of the Environment (Wales) Act 2016 and specified Priority Marine Features (PMF) in Scotland. The PMF list supports a wider seas approach to conservation, for example, through Scotland's National Marine Plan. OSPAR (The Convention for the Protection of the Marine Environment of the North-East Atlantic) habitats are those that are threatened and/or declining in the NE Atlantic. Up to date lists of habitats and the precise definition of each, in each country, should be acquired from the following links:
PMF - http://www.snh.gov.uk/docs/A1327320.pdf,
OSPAR - http://www.ospar.org/work-areas/bdc/species-habitats/list-of-threatened-declining-species-habitats
England S41 - http://webarchive.nationalarchives.gov.uk/20140712055944/http://www.naturalengland.org.uk/ourwork/conservation/biodiversity/protectandmanage/habsandspeciesimportance.aspx
Wales S7 - http://www.biodiversitywales.org.uk/Environment-Wales-Bill
The Habitats of Conservation Importance (HOCI) has also been derived from these lists - http://jncc.defra.gov.uk/page-4527

Listed Habitat	**OSPAR habitat**	**Pertinent to**		
		Wales	**England**	**Scotland**
Blue mussel beds	Intertidal *Mytilus edulis* Beds on Mixed & Sandy Sediments	x	x	x
Estuarine rocky habitats		x	x	
Intertidal boulder communities		x	x	
Intertidal chalk	Littoral Chalk Communities		x	
Sea loch egg wrack beds				x
Peat and clay exposures		x	x	
Sabellaria alveolata reefs		x	x	
Seagrass beds	Zostera Beds	x	x	x
Sheltered muddy gravels		x	x	
Intertidal mudflats	Intertidal Mudflats	x	x	x
Tide-swept channels / algal communities		x	x	x
Ostrea edulis beds	Ostrea edulis Beds			x
Saline lagoons		See Brazier *et al*. in prep.		
Coastal saltmarsh		See Rees *et al*. (2019)		
Coastal sand dunes		See Rees *et al*. (2019)		
Coastal vegetated shingle		See Rees *et al*. (2019)		
Maritime cliff and slopes		See Rees *et al*. (2019)		

Annex 3 Biotopes that are typical of each of the whole shore types that should be represented in the SSSI series

Saltmarsh habitats are not included, since these are dealt with in the coastlands habitats chapter (Rees *et al*. 2019). Biotopes are reflected in the EUNIS classification (Davies *et al.* 2004).
Excludes those feature biotopes that are found across all shore types and exclusively subtidal biotopes (where all level 5 biotopes are in the same selection unit, only level 4 is shown).

Biotope 2004	Biotope Name	Wave exposed rock	Moderately wave exposed rock	Wave sheltered rock	Mixed substrata	Sand and coarse sediment	Sand and muddy sand	Mud	Mixed sediment
Rock biotopes									
LR.FLR.Lic.Ver.B	*Verrucaria maura* and sparse barnacles on exposed littoral fringe rock	●							
LR.FLR.Lic.Pra	*Prasiola stipitata* on nitrate-enriched supralittoral or littoral fringe rock	●	●						
LR.HLR.FR.Fdis	*Fucus distichus* and *Fucus spiralis* f. *nana* on extremely exposed upper shore rock	●							
LR.HLR.FR.Coff	*Corallina officinalis* on exposed to moderately exposed lower eulittoral rock	●	●						
LR.HLR.FR.Coff.Coff	*Corallina officinalis* on exposed to moderately exposed lower eulittoral rock	●	●						
LR.HLR.FR.Coff.Puly	Corallina officinalis, Himanthalia elongata and Patella ulyssiponensis on very exposed lower eulittoral rock	●							
LR.HLR.FR.Him	*Himanthalia elongata* and red seaweeds on exposed to moderately exposed lower eulittoral rock	●	●						
LR.HLR.FR.Mas	*Mastocarpus stellatus* and *Chondrus crispus* on very exposed to moderately exposed lower eulittoral rock	●	●						
LR.HLR.FR.Pal	*Palmaria palmata* on very exposed to moderately exposed lower eulittoral rock	●	●						
LR.HLR.MusB.	Mussel and/or barnacle communities	●	●						
LR.HLR.MusB.Cht	*Chthamalus* spp. on exposed eulittoral rock	●	●						
LR.HLR.MusB.Cht.Cht	*Chthamalus* spp. on exposed upper eulittoral rock	●	●						
LR.HLR.MusB.Sem	*Semibalanus balanoides* on exposed to moderately exposed or vertical sheltered eulittoral rock	●	●						
LR.HLR.MusB.Cht.Lpyg	*Chthamalus* spp. and *Lichina pygmaea* on steep exposed upper eulittoral rock	●							
LR.HLR.MusB.MytB	*Mytilus edulis* and barnacles on very exposed eulittoral rock	●							
IR.HIR.KFaR.Ala.	*Alaria esculenta* on exposed sublittoral fringe bedrock	●							
IR.HIR.KFaR.AlaAnCrSp	*Alaria esculenta* forest with dense anemones and crustose sponges on extremely exposed infralittoral bedrock	●							

Biotope 2004	**Biotope Name**	**Wave exposed rock**	**Moderately wave exposed rock**	**Wave sheltered rock**	**Mixed substrata**	**Sand and coarse sediment**	**Sand and muddy sand**	**Mud**	**Mixed sediment**
IR.HIR.KFaR.LhypFa	*Laminaria hyperborea* forest with a faunal cushion (sponges and polyclinids) and foliose red seaweeds on very exposed upper infralittoral rock	●							
IR.HIR.KFaR.LhypR.	*Laminaria hyperborea* with dense foliose red seaweeds on exposed upper infralittoral rock	●							
IR.HIR.KSed.all level 4	Sediment-affected or disturbed kelp and seaweed communities	●	●		●				
LR.HLR.FR.Osm	*Osmundea pinnatifida* on moderately exposed mid eulittoral rock		●						
LR.HLR.FR.RPid	*Ceramium* sp. and piddocks on eulittoral fossilised peat		●						
LR.MLR.BF.PelB	*Pelvetia canaliculata* and barnacles on moderately exposed littoral fringe rock		●						
LR.MLR.BF.FspiB	*Fucus spiralis* on full salinity exposed to moderately exposed upper eulittoral rock		●						
LR.MLR.BF.FvesB	*Fucus vesiculosus* and barnacle mosaics on moderately exposed mid eulittoral rock		●						
LR.MLR.BF.Fser.R	*Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock		●						
LR.MLR.BF.Fser.Bo	*Fucus serratus* and under-boulder fauna on exposed to moderately exposed lower eulittoral boulders		●	●					
LR.MLR.BF.Fser.Pid	*Fucus serratus* and piddocks on lower eulittoral soft rock		●	●					
LR.MLR.BF.Rho	*Rhodothamniella floridula* on sand-scoured lower eulittoral rock		●	●					
LR.MLR.MusF.	*Mytilus edulis*, and fucoids on moderately exposed lower eulittoral rock		●						
LS.LBR.Sab.Salv	*Sabellaria alveolata* reefs on sand-abraded eulittoral rock		●		●				
SS.SBR.PoR.SalvMx	*Sabellaria alveolata* on variable salinity sublittoral mixed sediment		●		●				
IR.MIR.KR.Ldig.	*Laminaria digitata* on moderately exposed sublittoral fringe rock		●	●					
IR.MIR.KT.LdigT	*Laminaria digitata*, ascidians and bryozoans on tide-swept sublittoral fringe rock		●	●					
IR.MIR.KR.Lhyp.	*Laminaria hyperborea* and foliose red seaweeds on moderately exposed upper infralittoral rock		●						
IR.MIR.KR.XFoR	Dense foliose red seaweeds on silty moderately exposed infralittoral rock		●						
IR.LIR.K.LhypLoch	Mixed *Laminaria hyperborea* and *Laminaria ochroleuca* forest on moderately exposed or sheltered infralittoral rock		●	●					
LR.LLR.F.Pel	*Pelvetia canaliculata* on sheltered littoral fringe rock			●					
LR.LLR.F.Fspi	*Fucus spiralis* on moderately exposed to very sheltered upper eulittoral rock		●	●					
LR.LLR.F.Fspi.FS	*Fucus spiralis* on full salinity moderately exposed to very sheltered upper eulittoral rock		●	●					
LR.LLR.F.Fves	*Fucus vesiculosus* on moderately exposed to sheltered mid eulittoral rock		●	●					
LR.LLR.F.Fves.FS	*Fucus vesiculosus* on full salinity moderately exposed to sheltered mid eulittoral rock		●	●					
LR.LLR.F.Asc.FS	*Ascophyllum nodosum* on full salinity mid eulittoral rock			●					
LR.LLR.F.Fserr	*Fucus serratus* on sheltered lower eulittoral rock			●					

Biotope 2004	Biotope Name	Wave exposed rock	Moderately wave exposed rock	Wave sheltered rock	Mixed substrata	Sand and coarse sediment	Sand and muddy sand	Mud	Mixed sediment
LR.LLR.F.Fserr.FS	Dense *Fucus serratus* on moderately exposed to very sheltered full salinity lower eulittoral rock			●					
LR.LLR.FVS.PelVS	*Pelvetia canaliculata* on sheltered, variable salinity littoral fringe rock			●	●				
LR.LLR.FVS.FspiVS	*Fucus spiralis* on sheltered variable salinity upper eulittoral rock			●	●				
LR.LLR.FVS.FvesVS	*Fucus vesiculosus* on variable salinity mid eulittoral boulders and stable mixed substrata			●	●				
LR.LLR.FVS.AscVS	*Ascophyllum nodosum* and *Fucus vesiculosus* on variable salinity mid eulittoral rock			●	●				
LR.LLR.FVS.FserVS	*Fucus serratus* and large *Mytilus edulis* on variable salinity lower eulittoral rock			●	●				
LR.LLR.FVS.Fcer	*Fucus ceranoides* on reduced salinity eulittoral rock			●	●				
LR.HLR.FT.AscT	*Ascophyllum nodosum*, sponges and ascidians on tide-swept mid eulittoral rock			●					
LR.HLR.FT.FserT	*Fucus serratus*, sponges and ascidians on tide-swept lower eulittoral rock			●					
IR.MIR.KR.LhypT.	*Laminaria hyperborea*, foliose red seaweeds and a diverse fauna on tide-swept upper infralittoral rock			●					
IR.MIR.KT.LsacT	*Laminaria saccharina* with foliose red seaweeds and ascidians on sheltered tide-swept infralittoral rock			●					
IR.MIR.KT.XKT	Mixed kelp with foliose red seaweeds, sponges and ascidians on sheltered tide-swept infralittoral rock			●					
IR.MIR.KT.FilRVS	Filamentous red seaweeds, sponges and *Balanus crenatus* on tide-swept variable salinity infralittoral rock *Balanus crenatus*			●	●				
IR.LIR.K.LhypLsac.	Mixed *Laminaria hyperborea* and *Laminaria saccharina* on sheltered infralittoral rock			●					
IR.LIR.K.Lsac.	*Laminaria saccharina* on very sheltered infralittoral rock			●					
IR.LIR.K.LhypCape	Silted cape-form *Laminaria hyperborea* on very sheltered infralittoral rock			●	●				
IR.LIR.KVS.Cod	*Codium* spp. with red seaweeds and sparse *Laminaria saccharina* on shallow, heavily-silted, very sheltered infralittoral rock			●	●				
IR.LIR.KVS.LsacPsaVS	*Laminaria saccharina* and *Psammechinus miliaris* on variable salinity grazed infralittoral rock			●					
IR.LIR.KVS.LsacPhyVS	*Laminaria saccharina* with *Phyllophora* spp. and filamentous green seaweeds on variable or reduced salinity infralittoral rock			●	●				
IR.LIR.IFaVS.MytRS	*Mytilus edulis* beds on reduced salinity tide-swept infralittoral rock			●	●				
IR.LIR.IFaVS.CcasEle	*Cordylophora caspia* and *Electra crustulenta* on reduced salinity infralittoral rock			●	●				
IR.LIR.IFaVS.HarCon	*Hartlaubella gelatinosa* and *Conopeum reticulum* on low salinity infralittoral mixed substrata				●				
LR.HLR.FT.FserTX	*Fucus serratus* with sponges, ascidians and red seaweeds on tide-swept lower eulittoral mixed substrata				●				

Biotope 2004	**Biotope Name**	**Wave exposed rock**	**Moderately wave exposed rock**	**Wave sheltered rock**	**Mixed substrata**	**Sand and coarse sediment**	**Sand and muddy sand**	**Mud**	**Mixed sediment**
LR.LLR.F.Fspi.X	*Fucus spiralis* on full salinity upper eulittoral mixed substrata				●				
LR.LLR.F.Asc.X	*Ascophyllum nodosum* on full salinity mid eulittoral mixed substrata				●				
LR.LLR.F.Fserr.X	*Fucus serratus* on full salinity lower eulittoral mixed substrata				●				
LR.LLR.F.Fves.X	*Fucus vesiculosus* on mid eulittoral mixed substrata				●				
LR.LLR.FVS.Ascmac	*Ascophyllum nodosum* ecad *mackaii* beds on extremely sheltered mid eulittoral mixed substrata				●				
LS.LBR.LMus.Myt.Mx	*Mytilus edulis* beds on littoral mixed substrata				●				
IR.MIR.KR.LhypTX.	*Laminaria hyperborea* on tide-swept infralittoral mixed substrata				●				
IR.MIR.KT.XKTX	Mixed kelp and red seaweeds on infralittoral boulders, cobbles and gravel in tidal rapids				●				
Sediment Biotopes									
LS.LCS.Sh.BarSh	Barren littoral shingle					●			
LS.LSa.MoSa.BarSa	Barren littoral coarse sand					●			
LS.LSa.MoSa.Ol.	Oligochaetes in littoral mobile sand					●			
LS.LSa.MoSa.AmSco.	Amphipods and *Scolelepis* spp in littoral medium-fine sand					●			
SS.SCS.ICS.	Infralittoral coarse sediment					●			
LS.LSa.FiSa.Po.	Polychaetes in littoral fine sand					●	●		
SS.SSa.IFiSa.NcirBat	*Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand					●	●		
LS.LSa.MuSa.MacAre	Macoma balthica and Arenicola marina in littoral muddy sand						●		
LS.LSa.MuSa.CerPo	*Cerastoderma edule* and polychaetes in littoral muddy sand						●		
LS.LSa.MuSa.HedMacEte	Hediste diversicolor, Macoma balthica and Eteone longa in littoral muddy sand						●	●	
LS.LSa.MuSa.BatCare	Bathyporeia pilosa and Corophium arenarium in littoral muddy sand						●		
LS.LSa.MuSa.Lan	*Lanice conchilega* in littoral sand						●		
SS.SMp.SSgr.Zmar	*Zostera marina/angustifolia* beds on lower shore or infralittoral clean or muddy sand						●		
SS.SSa.IFiSa.	Infralittoral fine sand						●		
SS.SSa.IMuSa.	Infralittoral muddy sand						●	●	
SS.SSa.IMuSa.EcorEns	*Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand						●	●	
LS.LMp.LSgr.Znol	*Zostera noltii* beds in littoral muddy sand						●	●	
SS.SMp.SSgr.Rup	*Ruppia maritima* in reduced salinity infralittoral muddy sand							●	

Biotope 2004	**Biotope Name**	**Wave exposed rock**	**Moderately wave exposed rock**	**Wave sheltered rock**	**Mixed substrata**	**Sand and coarse sediment**	**Sand and muddy sand**	**Mud**	**Mixed sediment**
LS.LMu.MEst.HedMac	Hediste diversicolor and Macoma balthica in littoral sandy mud							●	
LS.LMu.MEst.HedMacScr	Hediste diversicolor, Macoma balthica and Scrobicularia plana in littoral sandy mud shores							●	
LS.LMu.MEst.NhomMacStr	Nephtys hombergii, Macoma balthica and Streblospio shrubsolii in littoral sandy mud							●	
LS.LMu.UEst.Hed.	Hediste diversicolor in littoral mud							●	
LS.LMu.UEst.NhomStr	Nephtys hombergii and Streblospio shrubsolii in littoral mud							●	
SS.SMu.SMuVS.	Sublittoral mud in variable salinity							●	
SS.SMu.ISaMu.	Infralittoral sandy mud							●	
SS.SMu.IFiMu	Infralittoral fine mud							●	
LS.LMx	Littoral mixed sediment								●
LS.LMx.GvMu.HedMx.	*Hediste diversicolor* in littoral gravelly muddy sand and gravelly sandy mud								●
LS.LMx.Mx.CirCer	Cirratulids and *Cerastoderma edule* in littoral mixed sediment								●
LS.LSa.St.MytFab	*Mytilus edulis* and *Fabricia sabella* in littoral mixed sediment								●
SS.SMx.SMxVS.	Sublittoral mixed sediment in variable salinity								●
SS.SMx.IMx.Lim	*Limaria hians* beds in tide-swept sublittoral muddy mixed sediment								●
SS.SMx.IMx.SpavSpAn	*Sabella pavonina* with sponges and anemones on infralittoral mixed sediment								●
SS.SMx.IMx.VsenAsquAps	Venerupis corrugata, Amphipholis squamata and Apseudopsis latreilli in infralittoral mixed sediment								●
SS.SMx.CMx.ClloMx	*Cerianthus lloydii* and other burrowing anemones in circalittoral muddy mixed sediment								●
SS.SBR.SMus.MytSS	Mytilus edulis beds on sublittoral sediment				●				●
SS.SMp.KSwSS.	Kelp and seaweed communities on sublittoral sediment				●				●
SS.SMx.IMx.Ost	Ostrea edulis beds on shallow sublittoral muddy mixed sediment				●				●

Annex 4 Species relevant to current legislation and policy within the scope of the marine SSSI Selection Guidance.

- This Annex includes those species that have formerly been identified as rare or scarce (Sanderson 1996) and should include, in the future, any species that meet the criteria in Sanderson (1996). In addition, species identified as important in subsequent legislation are included.
- Wholly subtidal species are not included, except where the species may occur within an estuary, inlet or lagoon, or where it may be biologically, physically, or hydrodynamically associated with a feature that could be notified. All saltmarsh species, including *Salicornia* sp. and *Spartina* sp., are covered in the Coastlands chapter (Rees *et al*. 2019) and not repeated here. N = not listed.
- Cetaceans (whales, dolphins and porpoises), elasmobranchs (sharks) and turtles protected under Schedule 5 of the Wildlife and Countryside Act 1981, or are in the 'Species of Principal Importance' (England) and Section 7 of the Environment (Wales) Act have not been listed here, unless considered likely to be a SSSI feature.
- The 'Listed Species' is an aggregated list of species from various initiatives or legislation (environment Acts and Directives), including the Priority Marine Features (PMF) of Scotland, and lists from the NERC Act (Species of Principal Importance in England and Section 42 in Wales). The PMF list in Scotland is a prioritised list of species and habitats of conservation importance that supports a wider seas approach to conservation, for example, through Scotland's National Marine Plan. The OSPAR list is the list of threatened and/or declining species. A maintained, up to date list is available on the JNCC website (http://jncc.defra.gov.uk/page-3408). The Species of Conservation Importance (SOCI) list for the review of features of conservation importance (Marine and Coastal Access Act) to inform Marine Conservation Zone designation, is based on the same original lists, and is therefore comparable to this list (SOCI - http://jncc.defra.gov.uk/page-4527).
- Those species listed below as 'Nationally rare marine species' and 'Nationally scarce marine species' are based on Sanderson (1996) and carried across from JNCC (1996). Species that are newly identified as qualifying, and including species new to science and new records (range extensions of NE Atlantic species) to Britain should be included as potential SSSI features, during selection unit assessment. Nationally rare or scarce plants are from vascular plant red data list (Cheffings *et al*. 2005).

IUCN codes: DD, Data Deficient; LC, Least Concern; NT, Near Threatened; VU, Vulnerable; EN, Endangered, CR, Critically Endangered.

Species	Common Name	Wildlife and Countryside Act 1981 – Schedules 5 and 8	Habitats Directive – Annex 2, 4 or 5.	Listed species (E = England, W = Wales, S = Scotland)	IUCN Red List (Based on 2001 guidelines, unless otherwise stated)	Nationally Rare Marine Species incl Bratton (1991)	Nationally Scarce Marine Species	OSPAR species	Nationally Rare (Ra) or Scarce (Sc) Plant
Hartlaubella gelatinosa	Hydroid	N	N	N		N	Y	N	N
Laomedea angulata	Seagrass sea fir	N	N	N		N	Y	N	N
Obelia bidentata	Hydroid	N	N	N		Y	N	N	N

Species	Common Name	Wildlife and Countryside Act 1981 – Schedules 5 and 8	Habitats Directive – Annex 2, 4 or 5.	Listed species (E = England, W = Wales, S = Scotland)	IUCN Red List (Based on 2001 guidelines, unless otherwise stated)	Nationally Rare Marine Species incl Bratton (1991)	Nationally Scarce Marine Species	OSPAR species	Nationally Rare (Ra) or Scarce (Sc) Plant
Pachycordyle navis	Hydroid	Y	N	E		N	N	N	N
Balanophyllia regia	Gold and scarlet star coral	Y	N	N		N	Y	N	N
Hoplangia durotrix	Weymouth carpet coral	N	N	N		Y	N	N	N
Aiptasia mutabilis	Trumpet anemone	N	N	N		N	Y	N	N
Edwardsia ivelli @	Ivell's Sea Anemone	Y	N	E	EN - Pre 1994	Y	N	N	N
Edwardsia timida	Timid burrowing anemone	N	N	E, W		N	Y	N	N
Nematostella vectensis @@	Starlet sea anemone	Y	N	E	VU - Post 1994	N	N	N	N
Scolanthus callimorphus	Worm anemone	N	N	N		Y	N	N	N
Haliclystus spp.	Stalked jellyfish	N	N	E, W		N	N	N	N
Calvadosia campanulata	Stalked jellyfish	N	N	E, W		N	N	N	N
Calvadosia cruxmelitensis	Stalked jellyfish	N	N	E		N	N	N	N
Alkmaria romijni	Tentacled lagoon worm	Y	N	N		N	Y	N	N
Armandia cirrhosa	Lagoon sandworm	Y	N	E, W		Y	N	N	N
Ophelia bicornis	Polychaete worm	Y	N	N		Y*	N	N	N
Sternaspis scutata	Polychaete worm	N	N	N		Y	N	N	N
Apocorophium lacustre	Amphipod	N	N	N	R - Pre 1994	Y	N	N	N
Gammarus chevreuxi	Sand shrimp	N	N	N		N	Y	N	N
Gammarus insensibilis	Lagoon sand shrimp	Y	N	E	R - Pre 1994	N	Y	N	N
Echinogammarus incertae sedis planicruru	Amphipod (Pectenogammarus)	N	N	N		Y*	N	N	N
Pereionotus testudo	Amphipod	N	N	N		Y	N	N	N
Stenosoma lancifer	Sea slater	N	N	N		N	Y	N	N
Pollicipes pollicipes	Gooseneck barnacle	N	N	E		N	N	N	N

Species	Common Name	Wildlife and Countryside Act 1981 – Schedules 5 and 8	Habitats Directive – Annex 2, 4 or 5.	Listed species (E = England, W = Wales, S = Scotland)	IUCN Red List (Based on 2001 guidelines, unless otherwise stated)	Nationally Rare Marine Species incl Bratton (1991)	Nationally Scarce Marine Species	OSPAR species	Nationally Rare (Ra) or Scarce (Sc) Plant
Caecum armoricum	De Ffolin's lagoon snail	Y	N	N		Y	N	N	N
Mercuria similis	Swollen spire snail	N	N	N	EN	N	N	N	N
Paludinella globularis	Lagoon snail	Y	N	N	LC	N	Y*	N	N
Truncatella subcylindrica	Looping snail	N	N	N	R - Pre 1994	Y*	N	N	N
Leptochiton scabridus	Chiton	N	N	N		N	Y	N	N
Atrina fragilis	Fan mussel	Y	N	E, W		N	Y	N	N
Cerastoderma glaucum	Brackish water cockle	N	N	(NI)		N	N	N	N
Ostrea edulis	Native oyster	N	N	E, W, S		N	N	Y	N
Thyasira gouldi	Northern hatchet-shell	Y	N	N		Y*	N	N	N
Aeolidiella sanguinea	Sea slug	N	N	N		Y	N	N	N
Tenellia adspersa	Lagoon sea-slug	Y	N	E W		Y*	N	N	N
Paracentrotus lividus	Purple sea urchin	N	N	N		N	Y	N	N
Crisularia purpurotincta	Bryozoan	N	N	N		Y*	N	N	N
Plesiothoa gigerium	Bryozoan	N	N	N		Y	N	N	N
Porella alba	Bryozoan	N	N	N		Y	N	N	N
Turbicellepora magnicostata	Orange peel bryozoan	N	N	N		Y	N	N	N
Victorella pavida	Trembling sea-mat	Y	N	E		Y	N	N	N
Watersipora complanata	Bryozoan	N	N	N		Y	N	N	N
Molgula oculata	Solitary seasquirt	N	N	N		N	Y	N	N
Phallusia mammillata	Solitary seasquirt	N	N	N		N	Y	N	N
Paracymus aeneus	Bembridge beetle	Y	N	N		N	N	N	N
Acipenser sturio	European sturgeon	Y	Y	E, W	CR	Y	N	Y	N
Alosa fallax	Twaite shad	Y	Y	E, W	LC	N	N	Y	N
Alosa alosa	Allis shad	Y	Y	E, W	LC	N	N	Y	N

Species	Common Name	Wildlife and Countryside Act 1981 – Schedules 5 and 8	Habitats Directive – Annex 2, 4 or 5.	Listed species (E = England, W = Wales, S = Scotland)	IUCN Red List (Based on 2001 guidelines, unless otherwise stated)	Nationally Rare Marine Species incl Bratton (1991)	Nationally Scarce Marine Species	OSPAR species	Nationally Rare (Ra) or Scarce (Sc) Plant
Ammodytes marinus	Lesser sandeel	N	N	E, W		N	N	N	N
Anguilla anguilla	European eel	N	N	E W	CR	N	N	Y	N
Coregonus autumnalis	Pollan	N	Y	N	EN	N	N	N	N
Dicentrarchus labrax	Sea bass	N	N	N	LC	N	N	N	N
Gobius cobitis	Giant goby	Y	N	N		N	N	N	N
Gobius couchi	Couch's goby	Y	N	N	LC	N	N	N	N
Hippocampus guttulatus	Long snouted seahorse	Y#	N	E, W	DD	Y	N	Y	N
Hippocampus hippocampus	Short snouted seahorse	Y#	N	E	DD	Y	N	Y	N
Lampetra fluviatilis	River lamprey	N	Y	N	LC	N	N	N	N
Osmerus eperlanus	European smelt/Sparling	N	N	E, W	LC	N	N	N	N
Petromyzon marinus	Sea lamprey	N	Y	N	LC	N	N	Y	N
Pleuronectes platessa	Plaice	N	N	E, W	LC	N	N	N	N
Salmo salar	Atlantic salmon	N	Y	E, W	LC	N	N	Y	N
Salmo trutta	Brown sea trout	N	N	N	LC	N	N	N	N
Solea solea	Sole	N	N	E, W	LC	N	N	N	N
Halichoerus grypus	Grey seal	N	Y	S	LC	N	N	N	N
Lutra lutra	Common otter	Y	Y	E, S	NT	N	N	N	N
Phoca vitulina	Common seal	N	Y	E, W, S	LC	N	N	N	N
Phocoena phocoena ***	Harbour porpoise	Y	Y	E, W	LC	N	N	Y	N
Tursiops truncatus ***	Bottlenose dolphin	Y	Y	E, W	LC	N	N	N	N
Cladophora battersii	Green branched weed	N	N	N		Y	N	N	N
Derbesia tenuissima	Silky thread weed (green)	N	N	N		Y	N	N	N
Ascophyllum nodosum ecad mackayi	Sea loch egg wrack	Y****	Y+	S+		N	N	N	N

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Asperococcus ensiformis	Sausage weed - brown alga	N	N	N		N	Y	N	N
Asperococcus scaber	Sausage weed - brown alga	N	N	N		Y	N	N	N
Fucus distichus	Two-headed wrack	N	N	S		N	Y	N	N
Halothrix lumbricalis	Brown alga	N	N	N		Y	N	N	N
Leblondiella densa	Brown alga	N	N	N		Y	N	N	N
Padina pavonica	Peacock's tail alga	N	N	E, W		N	Y	N	N
Anotrichium barbatum	Bearded red seaweed	N	N	E, W		Y	N	N	N
Bornetia secundiflora	Bornet's coral weed	N	N	N		Y*	N	N	N
Cruoria cruoriiformis	Crustose red alga	N	N	E, W		N	Y	N	N
Dermocorynus montagnei	Crustose red alga	N	N	E, W		Y	N	N	N
Euthora cristata	Red alga	N	N	N		N	Y	N	N
Gelidium corneum	Straggle weed (red)	N	N	N		Y*	N	N	N
Gigartina pistillata	Pestle weed (red)	N	N	N		N	Y	N	N
Gracilaria bursa-pastoris	Shepherd's purse wart weed	N	N	N		N	Y	N	N
Gracilaria multipartita	Cleaved wart weed	N	N	N		N	Y	N	N
Lithothamnion corallioides	Coral Maërl +	N	Y+	E, W, S+		N	Y	N	N
Lophosiphonia reptabunda	Red alga	N	N	N		Y	N	N	N
Phymatolithon calcareum	Common Maërl +	N	Y+	E, W, S+		N	N	N	N
Polysiphonia ceramiiformis	Banded siphon weed (red)	N	N	N		Y	N	N	N
Xiphosiphonia pennata	Winged weed (red)	N	N	N		N	Y	N	N
Pseudolithoderma roscoffense	Red alga	N	N	N		N	Y	N	N
Lamprothamnium papulosum	Foxtail stonewort	Y****	N	E, S	NT	N	N	N	N
Tolypella nidifica	Bird's nest stonewort	N	N	S	EN	Y	N	N	Ra
Ruppia cirrhosa	Spiral tasselweed	N	N	N	NT	N	N	N	Sc

Species	Common Name	Wildlife and Countryside Act 1981 – Schedules 5 and 8	Habitats Directive – Annex 2, 4 or 5.	Listed species (E = England, W = Wales, S = Scotland)	IUCN Red List (Based on 2001 guidelines, unless otherwise stated)	Nationally Rare Marine Species incl Bratton (1991)	Nationally Scarce Marine Species	OSPAR species	Nationally Rare (Ra) or Scarce (Sc) Plant
Ruppia maritima	Beaked tasselweed	N	N	N	LC	N	N	N	N
Zostera (Zostera) marina **	Eelgrass	N	N	N	LC	N	N	N	N
Zostera (Zosterella) noltei **	Dwarf eelgrass	N	N	N	VU	N	N	N	Sc

@ *Edwardsia ivelli* may be extinct in Great Britain
@@ *Nematostella vectensis* considered a non-native species, since being listed on Schedule 5 (Sheader *et al.* 1997). It has been left in this list, since it is a useful indicator of prime lagoonal conditions.
* Improved data on species distribution is likely to adjust the rarity.
** If the *Zostera* species are to be designated as species (rather than priority marine habitat), then they must meet the criteria laid out in Chapter 11 Vascular Plants.
***Listed as ‘Dolphins’, ‘Porpoises’ and ‘Whales (all species)’ under Schedule 5 of the Wildlife and Countryside Act 1981, except in Scotland.
**** Schedule 8 of the Wildlife and Countryside Act 1981
+ *Lithothamnion glaciale*, another maërl species is proposed to be added to Annex V of the EC Habitats Directive.
# spiny and short snouted seahorses are excluded in Scotland.

+ as a habitat only

Annex 5 Examples where inclusion of subtidal areas in SSSI boundaries may be appropriate (England and Wales only)

The following illustrate where it may be appropriate to extend the boundary into the subtidal area (in all cases, at least one of the three conditions set out in section 5.2 of this chapter must apply):

- **To protect the entire extent of the intertidal habitat and dependent communities**
  Intertidal communities will extend below the MLWM down to Lowest Astronomical Tide (LAT). Rocky shores can be a good example of diversity and abundance increasing down the shore as conditions stabilise as a result of increasing submersion time and decreasing energy exposure. Extending the boundary below the MLWM down to LAT will enable the SSSI to protect the full extent of the intertidal feature and potentially include areas of maximum biological diversity and interest. The extent beyond LAT can only be quantified by specific consideration of the habitat or species under consideration as a feature.

- **To protect lower shore intertidal communities**
  A number of intertidal habitats may only currently occur below the MLWM, for example some eelgrass beds will only exist in the lower intertidal zone. If a feature starts just below the MLWM it may still be appropriate to extend the boundaries to include it.
  For example, an eelgrass bed that exists below the MLWM may act as a food resource for notified wildfowl when the tide has sufficiently receded (meeting condition two).
  Alternatively, it may be appropriate to extend the boundary to include a feature below the MLWM if doing so allows for a more coherent and easily managed boundary (meeting condition three).

- **To protect subtidal features**
  It would not normally be considered appropriate to notify purely subtidal habitats (except within estuarial waters), however, some habitats will extend from the intertidal into the subtidal zone, where they are never exposed at low tide. Examples include chalk platforms, eelgrass (*Zostera* spp.) beds, blue mussel (*Mytilus edulis*) beds and honeycomb worm reefs (*Sabellaria alveolata*). Where these features are known to extend from the intertidal into the subtidal zone it would be appropriate to extend the SSSI boundary to encompass the full extent of the feature.

- **To reduce disturbance to loafing, feeding and breeding sites**
  Species such as seals and waterbirds may be protected within SSSIs. If they use subtidal areas or offshore sediment banks and islands, for loafing, feeding, roosting or breeding it may be appropriate to incorporate these areas within the SSSI boundary. For example, seals will often use sea areas adjacent to their haul-out and pupping grounds for feeding. Incorporating these adjacent subtidal areas within the SSSI can protect areas important for the viability of the colony and help with management of activities that may disturb them (JNCC in prep[8]). Similarly, birds may forage on subtidal sediments, through diving or use subtidal areas close to their roosting and nesting sites; encompassing these areas in to the SSSI can offer improved protection (Drewitt *et al.* 2015)). It should however be remembered that SSSI boundaries should not normally extend to cover large areas of subtidal in relation to the intertidal and terrestrial portion of the site.

- **To protect the full extent of geological and/or geomorphological features**
  Some SSSIs are notified for their geological and/or geomorphological interest. In some cases, these features may extend into the subtidal area and it may be appropriate to extend the boundaries to incorporate the full extent. Some features, such as chalk cliffs and reefs,

[8] The updated marine mammal guidance is not ready. Until it is updated, users are asked to consult the guidance for marine mammals here http://jncc.defra.gov.uk/pdf/SSSIs_Chapter13(a)(b).pdf.

may be exposed on the upper shore, become covered by sediments on the lower shore but are re-exposed in the subtidal area. It would be appropriate in these circumstances to consider extending boundaries to ensure the subtidal exposures are incorporated.

- **To account for the physical, ecological, and hydrodynamic complexities and inter-dependencies between habitats and species that exists on and near the coast.**
  Many intertidal habitats and communities are intrinsically linked through ecological, physical and / or hydrodynamic processes to features in the near shore subtidal area and rely on the maintenance of these processes. For example, seaweeds in the shallow subtidal can support intertidal invertebrate grazing communities, either whilst still alive or when deposited on the shore along the strandline. These invertebrates can in turn support wading birds.
  Sediment transport is another key process, intertidal habitats and saltmarsh communities, may receive sediments from subtidal banks just offshore, and as such require the natural sediment dynamics of the system to be maintained to ensure sustainability of these features. In these cases, it may be appropriate to extend the SSSI boundary to encompass the near shore subtidal habitats and communities as important supporting features for the intertidal. However, it is unlikely to be appropriate to notify SSSIs at the kind of scale likely to be required to incorporate the full physical and ecological processes, particularly on the open coast.

- **To account for habitat mobility, mosaics and feature patchiness**
  Features may be naturally mobile, cyclical in nature, patchy in distribution, shift with tides, currents, or storm events. Extending the boundary beyond feature limits at the time of notification to ensure that features do not migrate outside of the SSSI will help ensure long-term protection and reduce the need for future boundary adjustments. In order to do this, evidence should be sought to predict the likely extent of changes over a 50 year period and ensure the boundaries are not extended more than is necessary.

- **To avoid convoluted boundaries**
  Some marine features, such as sand and mud banks and seagrass beds, may have convoluted boundaries. Extending the SSSI boundary seaward of these habitats, rather than drawing it tightly around the feature edges, may allow for simplified boundaries to be drawn that are easier to define, communicate and manage.

- **To avoid having to create very small or narrow MCZs as an adjunct area to an existing SSSI to protect subtidal habitats.**
  SSSIs and MCZs can both be designated for intertidal and subtidal features. If the features of interest only occur in the coastal and near shore environment, extending SSSI boundaries into the subtidal area could ensure the adequate coverage of features within the Marine Protected Area network, without the need to designate an abutting MCZ.

Subtidal boundary extents and demarcation

There are no definitive guidelines as to how far into the subtidal area SSSI boundaries should extend. The general principle that boundaries should only be extended as far as necessary to incorporate and ensure the long-term sustainability of the features of special interest should be followed.

To demarcate the seaward extent consider using charted features, such as LAT, or depth contours such as the 2m or 5m below Chart Datum (CD) contour. In areas that shelve off steeply deeper contours may be appropriate as they will be close to shore, but in gently shelving areas even the 2m below CD contour could extend the boundaries significantly out to sea. Alternatively, it may be feasible to use geographical landmarks, such as setting the boundary across a bay in line with two headlands.

It may be possible to use navigational features, such as channel markers, these may often be easy to identify and understand by stakeholders, however, bear in mind that sometimes buoys, posts and other markers are moved. If using navigational markers, it is always advisable to also give the corresponding coordinates in case the markers are moved.
When setting boundaries, especially at sea where there may be few obvious reference points, it is important to bear in mind that sites that comprise of few and straight boundaries are the easiest to communicate and manage.

Some intertidal and subtidal features may occur across significant lengths of coast and it may not be practical to incorporate the entire feature within the SSSI. The Part 1 guidelines provide advice on selecting parts of the total area but in summary, the best examples that can be clearly demarcated by geographical features such as headlands, abrupt and obvious changes of habitat, seawalls or other artificial but relatively permanent features may be the best candidate areas for notification.

As outlined elsewhere in the guidance for a number of habitats, when determining boundaries, consideration should be given to including buffer areas to avoid damage to the edge of features through physical damage or changes to the ecological processes that support the feature. These buffers should only be as wide as necessary and should not incorporate large sea areas. Setting of boundaries should take account of the potential site integrity and functionality. In the fluid medium of marine areas, establishing the area important for functionality or integrity is very difficult. Enclosed coast areas come closest to the concepts of functional units.

Data sources to support inclusion of areas below MLW

In order to include subtidal areas, data and evidence will be required for the features or processes that occur to demonstrate the linkages to intertidal features. Data sources and the use of survey evidence to support boundary definition are discussed elsewhere in this document and suggestions such as the NBN and Local Records Centres are equally relevant for marine habitats and species. Listed below are some additional sources of data and evidence to assist decision making:

- European Marine Site (EMS) monitoring reports – many EMSs overlap SSSI with coastal and marine features. Consulting the EMS monitoring reports may provide additional evidence to support SSSI features.
- Marine Recorder database.
- Country agency marine specialists
- Existing habitat maps available from JNCC, MAGIC.
- Marine charts and existing available bathymetry data sets
- Inshore Fisheries and Conservation Authorities (IFCAs) – Many IFCAs are now involved in habitat mapping and monitoring and may hold relevant data.
- Environment Agency (EA) – The EA gathers substantial amounts of data in the intertidal and shallow subtidal areas, especially associated with estuaries and harbours.
- Peer reviewed and other publications from the research community and/or stakeholders.