Ardal Cadwraeth Arbennig Bae Ceredigion/ Cardigan Bay Special Area of Conservation

Advice provided by Natural Resources Wales in fulfilment of Regulation 37(3) of the Conservation of Habitats and Species Regulations 2017.

June 2025

Bottlenose dolphin *Tursiops truncatus* in Cardigan Bay © Peter Evans.

Contents

List of Figures

List of Tables

Crynodeb Gweithredol

Mae'r ddogfen hon yn cynnwys cyngor Cyfoeth Naturiol Cymru ar gyfer ardal cadwraeth arbennig (ACA) Bae Ceredigion a gyhoeddwyd o dan Reoliad 37(3) o Reoliadau Cadwraeth 2017. Sef amcanion cadwraeth a chyngor ar weithrediadau.

Mae Adran 1 yn cyflwyno'r safle, pwrpas y cyngor a strwythur yr amcanion cadwraeth. Mae Adran 2 yn cynnwys esboniad o'r rolau a'r cyfrifoldebau, ac mae Adran 3 yn amlinellu amcanion cadwraeth pob nodwedd a gwybodaeth ategol. Mae cyngor ar weithrediadau mewn perthynas â'r safle hwn i'w gael yn Adran 4. Mae rhagor o wybodaeth am yr ACA wedi'i chynnwys yn Atodiad 1.

Isod mae rhestr o nodweddion dynodedig yr ACA hon a dolen uniongyrchol i'r amcanion cadwraeth, ond mae'n bwysig darllen pob adran yn llawn.

Tabl 1. Crynodeb o nodweddion yr ACA a'r ddolen i'r amcanion cadwraeth.

Enw'r ACA	Modweddion Dynodedig	Cysylltiad â'r Amcanlon Cadwraeth
Bae Ceredigion	• Dolffin trwyn potel *Tursiops truncatus* • Riffiau • Cilfachau a baeau mawr bas • Ponciau tywod sydd fymryn dan ddŵr y môr drwy'r amser • Morlo llwyd *Halichoerus grypus* • Lamprai neu lysywen bendoll yr afon *Lampetra fluviatilis* • Lamprai neu lysywen bendoll y môr *Petromyzon marinus*	Amcanion cadwraeth

Executive Summary

This document contains NRW's advice for Cardigan Bay special area of conservation (SAC) issued under Regulation 37(3) of the Conservation Regulations 2017.

Section 1 introduces the site, the purpose of the advice and the structure of the conservation objectives. Section 2 includes an explanation of the roles and responsibilities before Section 3 outlines each feature's conservation objectives and supporting information. Advice on operations in relation to this site is found in Section 4 which information on climate change and coastal squeeze in section 5. Additional information on the site is captured in Appendix 1.

Table 1 lists the designated features of this site and provides a direct link to the conservation objectives, but it is important that all sections are read in full.

Table 1. Summary of site features and link to conservation objectives.

SAC Name	Designated Features	Link to Conservation Objectives
Cardigan Bay	• Bottlenose dolphin *Tursiops truncatus* • Reefs • Submerged or partially submerged sea caves • Sandbanks which are slightly covered by seawater all the time • Grey seal *Halichoerus grypus* • River lamprey *Lampetra fluviatilis* • Sea lamprey *Petromyzon marinus*	Conservation objectives

1. Introduction

The ardal cadwraeth arbennig Bae Ceredigion/ Cardigan Bay special area of conservation (SAC) is located on the west coast of Wales. Cardigan Bay is one of the largest bays in the British Isles. It measures over 100km (60 miles) across its westernmost extent from the Llŷn Peninsula to St. David's Head. Cardigan Bay is one of the very few areas around the UK where significant numbers of coastal bottlenose dolphins are known to occur regularly and is the primary reason the area was first selected as a SAC.

The site was designated in 2004 under Article 4.2 of the conservation of natural habitats and of wild fauna and flora directive (92/42/EEC) for three habitat features under Annex I and four species under Annex II. It is one of the best areas in the UK for the feature,

- Bottlenose dolphin *Tursiops truncatus*

And supports a significant presence of,

- Reefs
- Submerged or partially submerged sea caves
- Sandbanks which are slightly covered by seawater all the time
- Grey seal *Halichoerus grypus*
- River lamprey *Lampetra fluviatilis*
- Sea lamprey *Petromyzon marinus*

Cardigan Bay SAC wholly overlaps with one other SAC, the West Wales Marine SAC for harbour porpoise. It also partly overlaps with the Afon Teifi SAC and two Sites of Special Scientific interest (SSSIs). A list of overlapping sites can be seen in Appendix 2 and the conservation objectives for these protected sites can be found on the NRW website.

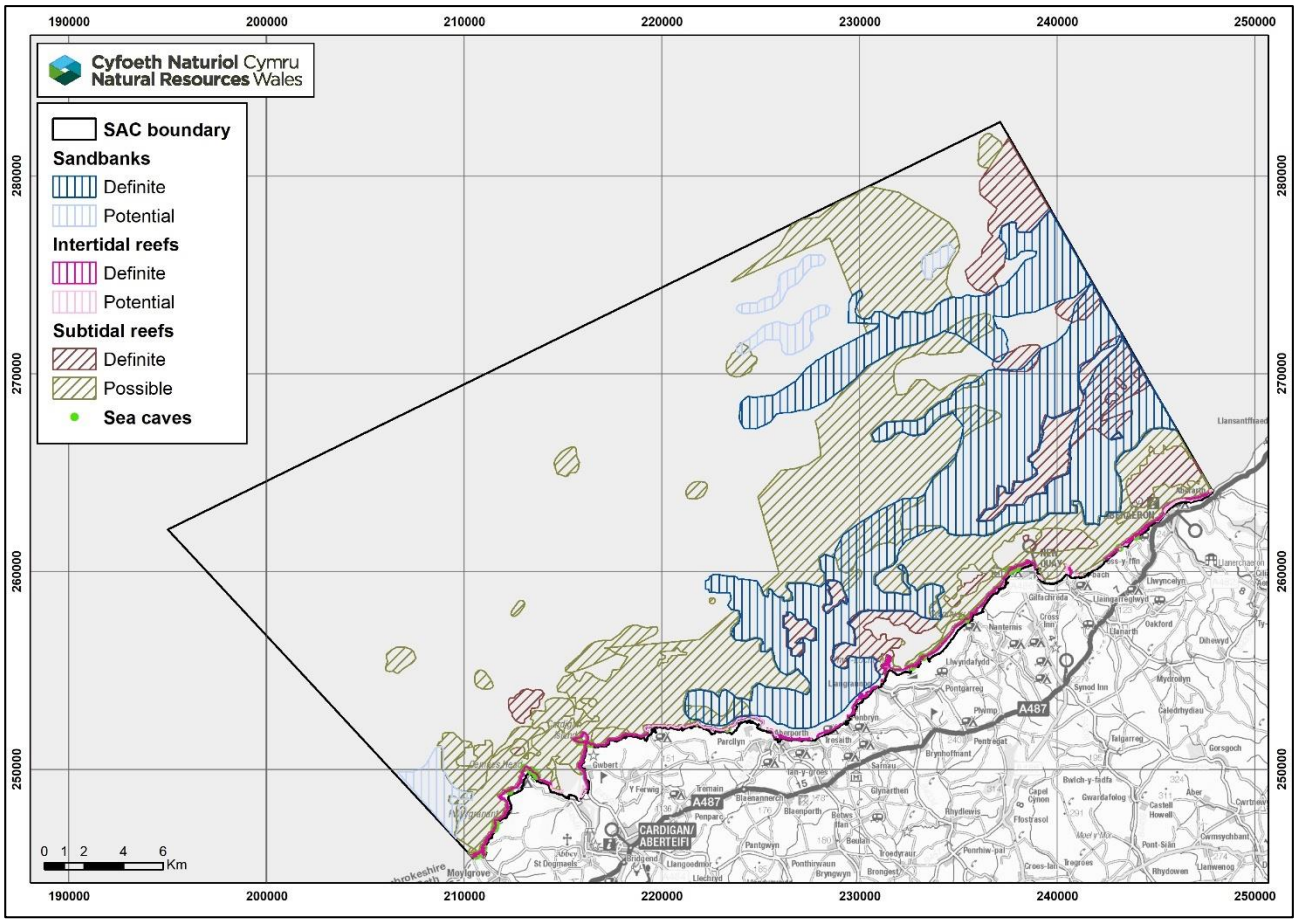
The boundaries and geographical extents of these sites can be seen on the Joint Nature Conservation Committee (JNCC) MPA mapper. Several habitats and species within the SAC are also listed in Section 7 of the Environment Act (Wales) which lists habitats and species of principal importance in Wales. There are also OSPAR threatened and declining species and habitats within the SAC. For these additional conservation interests see Appendix 2.

1.1. SAC feature map

The feature locations in maps are indicative and represent the best available evidence at the time of publication. No single habitat feature occupies the entire SAC and features overlap in some locations (See Figure 1). The extent of most habitat features is not known precisely because accurate mapping is very difficult, expensive and resource intensive. This is further complicated due to the dynamic and mobile nature of some habitats. Work is ongoing to improve our knowledge of where designated habitat features occur in our SACs and maps are updated periodically. When new areas of Annex I habitat are discovered within the boundary of a SAC they automatically become part of the SAC feature where it is already a designated feature of the site.

A map of each habitat feature within the SAC is shown before its conservation objectives. All maps in this document are for illustrative purposes only. Detailed maps for the features in Wales can be found on Data Map Wales.

Figure 1. Map showing the SAC boundary and designated habitat features of Cardigan Bay SAC.



1.2. The purpose of conservation advice

Conservation advice provides a framework for assessing developments and activities with the potential to affect the features for which a European marine site (EMS) is designated. An EMS is a SAC or SPA which consists of marine areas. Conservation advice presents site specific information, in addition to highlighting activities that are potentially capable of having an impact on the site and its designated species (known as a feature).

This SAC is an EMS subject to protection under the Conservation of Habitats and Species Regulations 2017, as amended (referred to in this document as the 'Habitats Regulations'). Under the Habitats Regulations, relevant and competent authorities with functions in relation to an EMS must exercise those functions to comply with the requirements of the 1992 European Commission (EC) Habitats and Species Directive and the 2009 EC Wild Birds Directive. The key requirements of these Directives include the conservation of the features (habitat types or species) for which SACs or SPAs are

designated. This requires taking appropriate steps to avoid deterioration or disturbance of SAC or SPA features and carrying out appropriate assessment of any plan or project likely to have a significant effect on a SAC or SPA.

This document contains the conservation advice for the Menai Strait and Conwy Bay SAC. It is prepared by Natural Resources Wales (NRW) and given under our duty in Regulation 37(3) of the Habitats Regulations (see Section 2.1).

This advice is based on the best available evidence and information at the time of writing. In some cases, evidence can be limited. It will be kept under review by NRW and updated as and when appropriate.

1.3. Conservation objective structure

The conservation objectives for the designated features in this site are underpinned by conservation objective attributes. These attributes describe the ecological characteristics (e.g. population), and the ecological requirements that allow the conservation objectives for each feature to be met.

Conservation objective attributes have a target which is either quantified or qualified depending on the available evidence. The target identifies, as far as possible, the desired state to be achieved for the attribute. In many cases, the attribute targets show if the current objective is to either 'maintain' or 'restore' the attribute and are based on the latest condition assessment for the feature. Some aspects of feature condition may be assessed as unknown. In these cases, a maintain target will be set as necessary. For attributes that have been assigned 'unknown' in the condition assessment, further information on feature condition and/or activities impacting the feature will be required to inform further advice. Each attribute target will need to be assessed on a case-by-case basis using the most current information available.

The conservation objective attributes that underpin the conservation objectives are used to measure if the objective is being met. This in turn can be used to see if site integrity is being maintained. Failure to meet any attribute means that the conservation objective is not being met and thus site integrity is not being maintained. Below is an example of a conservation objective and associated conservation objective attributes and targets.

Example Objective 1: The overall distribution and extent of the mudflats and sandflats feature within the SAC and each of its main component habitats are stable or increasing, subject to natural change.

Example Objective attribute	**Example Site specific target**
Feature extent and distribution	Maintain/restore the extent and distribution of mudflats and sandflats
Component habitat extent and distribution	Maintain/restore the extent and distribution of mudflat and sandflat component habitats.

The conservation objectives for Cardigan Bay SAC are set out in Section 3. As noted in Section 1.2, NRW may refine these in the future as further information becomes available and increases our understanding of the feature.

The feature's conservation objective section provides:

1. A clear statement of each conservation objective for the feature.

2. A table summarising the attributes, and the targets for those attributes.

3. Supporting information that underpins the selection of the attributes and targets.

2. Roles and responsibilities

2.1. NRW's role

Under Regulation 5 of the Habitats Regulations, NRW is a Nature Conservation Body and, in relation to Wales, is the Appropriate Nature Conservation Body (ANCB).

In its role as the ANCB, NRW has a duty under Regulation 37(3) of the Habitats Regulations to advise relevant authorities in respect of a EMS as to:

(a) the conservation objectives for that site

(b) any operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species, for which that site has been designated (see Section 1.2).

Advice on operations which may cause deterioration, together with the conservation objectives, is designed to assist relevant authorities and other decision-makers in complying with their statutory duties under the Habitats Regulations. The advice on operations which may cause deterioration given in this document is without prejudice to other advice given. This includes the conservation objectives themselves, and other advice which may be given by NRW from time to time in relation to any specific operations.

"Operations" is taken to cover all types of human activity, irrespective of whether they are under any form of regulation or management. Thus, the advice contains reference to operations which may not be the responsibility of any of the relevant authorities.

NRW will provide additional advice for the site to relevant authorities and competent authorities to allow them to fulfil their duties under the Habitats Regulations. For example, by providing advice to a competent authority assessing the implications of plans or projects on the features of the EMS. Each plan or project will be judged on its own merits, and this will determine the nature of any additional advice required.

2.2. The role of competent and relevant authorities

The expressions used in this advice of "relevant authority" and "competent authority" are as defined in Regulation 3 of the Habitats Regulations. Relevant authorities are specified in Regulation 6 of the Habitats Regulations. Competent Authorities are specified in Regulation 7 of the Habitats Regulations.

Under Part 6 of the Habitats Regulations, all competent authorities must undertake a formal assessment of the implications that any new plans or projects may have on the designated features of a protected site. The implications must be assessed in the context of other plans and projects affecting the same site. Activities outside the site may also affect the features of the site, therefore, plans and projects located outside of a designated site may still need to be assessed.

In respect of the assessment provisions in Part 6 (assessment of plans or projects) of the Habitats Regulations, NRW is also the ANCB in relation to Wales.

The assessment provisions comprise several distinct stages which are collectively described as a Habitats Regulations Assessment (HRA), for which guidance is available. Before deciding to undertake, or give any consent, permission or other authorisation for, a plan or project which is likely to have a significant effect on a European site or a European offshore marine site (either alone or in combination with other plans or projects), and is not directly connected with or necessary to the management of that site, the competent authority must make an appropriate assessment of the implications of the plan or project for that site in view of that site's conservation objectives.

In light of the conclusions of the HRA and subject to derogation under Regulation 64, the competent authority may agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the EMS. In considering whether a plan or project will adversely affect the integrity of the site, the competent authority must have regard to the manner in which it is proposed to be carried out or to any conditions or restrictions subject to which it proposes that the consent, permission or other authorisation should be given.

Carrying out the HRA process is the responsibility of the decision maker as the competent authority. However, it is the responsibility of the applicant to provide the competent authority with the information that they require for this purpose.

The competent authority has a duty to consult the ANCB for the purposes of the assessment. Under Regulation 63(3) of the Habitats Regulations the competent authority must have regard to any representations made by the ANCB when reaching its decision.

Under Regulation 38(1) of the Habitats Regulations it states that, "*the relevant authorities, or any of them, may establish for a European marine site a management scheme under which their functions (including any power to make byelaws) are to be exercised so as to secure compliance with the requirements of the Directives in relation to that site".*

In other words, a group of relevant authorities, or any individual relevant authority, may create a management plan for an EMS. Management plans should be used to help relevant authorities carry out their duties to secure compliance with the Habitats Regulations. Only one management scheme may be made for each EMS. A management scheme may be amended. An authority which has established a management scheme must as soon as practicable thereafter send a copy of it to the ANCB. Any management plans created on this site should be guided by the advice in this package.

Within their areas of jurisdiction relevant authorities must have regard to both direct and indirect effects of an activity on the designated features of the site. This may include consideration of issues outside the boundary of the site. Nothing within a Regulation 37(3) package will require relevant authorities to undertake any actions to maintain or improve the condition of designated features if it is shown that the changes result wholly from natural causes.

NRW will continue to review any new evidence or information about this site and will provide further advice as appropriate. This does not stop relevant authorities from taking any appropriate conservation measures to prevent deterioration to the designated features. Such actions should be undertaken when required.

2.3. The purpose of conservation objectives

The purpose of the conservation objectives for an EMS is to help meet the obligations of the Habitats Regulations in relation to that site. They do this by supporting:

- **Communication**. The conservation objectives help convey to stakeholders what is needed to maintain or restore a feature in/to favourable condition.
- **Site planning and management**. The conservation objectives guide the development of management measures for sites. Achievement of conservation objectives may require management action to be taken inside or outside the site boundary.
- **Assessment of plans and projects**. The Habitats Regulations require the assessment of plans and projects in view of a site's conservation objectives. Subject to certain exceptions, plans or projects may not proceed unless it is established that they will not adversely affect the integrity of a site. Conservation objectives can help develop suitable compensatory measures.
- **Monitoring and reporting**. Conservation objectives provide the basis for defining the evidence that will be used for assessing the condition of a feature.

This document includes both a statement of the conservation objectives and explanatory text on their intent and interpretation specific to the site (supporting information).

2.4. The purpose of advice on operations

NRW must provide advice to relevant authorities about operations that may cause,

- Deterioration of designated natural habitats
- Deterioration of the habitats of designated species
- The disturbance of designated species

This is statutory advice required by Regulation 37(3)(b) of the Habitats Regulations when considering operations which may cause impacts to designated features. These are operations which could take place within or outside the boundary of the SAC.

NRW can provide specific advice on existing activities and management, advising on the extent to which activities are consistent with the conservation objectives. This advice, together with the list of activities in Section 4 and the latest condition assessments should direct required management measures within a site.

2.5. When to use this advice

This advice should be used together with case-specific advice issued by NRW when developing, proposing or assessing an activity, plan or project that may affect the features of the site. Any proposal or operation that has the potential to affect a site must not prevent the achievement of the feature's conservation objectives. Any such prevention would amount to an adverse effect on the integrity of the site.

The advice given here is without prejudice to any advice which may be provided by NRW in relation to the consideration of individual plans or projects in the carrying out of the assessment provisions as defined in Part 6 of the Habitat Regulations.

2.6. Feature condition

NRW has a dedicated condition assessment process to assess feature condition. Each feature designated in Welsh EMS have their own set of performance indicators. These indicators have targets which are assessed with the most up to date evidence available. When all required indicator targets are met a feature is in favourable condition.

The condition assessment of a feature helps to determine if its conservation objectives are being achieved. Results determine if maintain or restore conservation objectives are needed. Appropriate management must be in place to enable conservation objectives to continue being met and for feature condition to be maintained or restored as required. The conservation objectives cannot be achieved if a feature is in unfavourable condition.

Feature condition is recorded in condition assessment documents. These are available on the NRW website. NRW will update this advice package when new condition assessment information is available.

2.6.1. Favourable conservation status and National Site Network

If features are in favourable condition, it is likely they are making an appropriate contribution to Favourable Conservation Status (FCS) of the feature at the UK level. A feature cannot make an appropriate contribution to FCS without meeting its conservation objectives. More information on FCS can be found in the joint statement from the UK Statutory Nature Conservation Bodies.

Regulation 16A of the Habitats Regulations creates the National Site Network on land and at sea, including both the inshore and offshore marine areas in the UK, and sets out the powers and duties of the appropriate authority (Welsh Government).

Information on how features in a site are meeting their conservation objectives will feed into the assessment of the National Site Network management objectives. The management objectives for the National Site Network are to maintain or restore designated SAC and SPA features to favourable conservation status across their natural range. More information on the UK National Site Network and its management objectives can be found on the gov.uk website.

2.7 Climate change and coastal squeeze

2.7.1 Vulnerability of Annex I habitats to climate change pressures

The oceans play a vital role in the global carbon cycle, and the importance of the oceans in mitigating against climate change is now widely recognised. Understanding the impacts of climate change on the features of our MPAs is Wales is important as we consider future potential management action.

Oaten et al. (2021) determined the vulnerability of Welsh Annex I marine features to a range of climate change pressures. The method involved developing a Geographical Information System (GIS) model using the best available climate projections and spatial data on marine habitats in Wales at that time. This was undertaken for a number of emissions scenarios and management timeframes.

A literature review on the sensitivities of Annex I habitats to physical and chemical pressures as a result of climate change was carried out which also informed the assessment. The biological resolution of Annex I habitats was considered too broad to undertake a meaningful vulnerability assessment, as individual biotopes that comprise the Annex I habitats have differing sensitivities to climate change pressures. Thus, the initial assessment was based on the vulnerabilities of component biotopes of Annex I marine habitats in Wales.

The biotopes were then re-assigned to the respective features within each MPA. While it was not possible to achieve full spatial coverage of biotopes that comprise the Annex I features (due to spatial gaps in data in some of the features), the resulting data was considered to sufficiently represent the types of communities that would be found (Gihwala et al., 2024).

The climate change pressure that were assessed included:

- Air temperature
- Deoxygenation
- Ocean acidification
- Salinity
- Sea level rise
- Sea temperature
- Wave exposure

There are other pressures that have not been assessed such as those arising from the terrestrial environment for example increased river and sediment run off due to predicted higher rainfall levels.

The vulnerability categories used in the analysis were ‘Not relevant’, ‘Not sensitive’, ‘Low’, ‘Medium’ and ‘High’. The overall vulnerability score for each climate change pressure was based on the vulnerability category with the greatest spatial coverage for the respective feature (based on the underpinning biotopes). It should be noted that climate change vulnerabilities assigned to each respective feature at the site level were only based on biotope sensitivities and did not consider any local circumstances (e.g. specific management policies or existing coastal structures) and were based on one specific emission scenario (RCP 8.5) and to one time period (up to 2049) (for more information see Gihwala et al., 2024). RCP 8.5 was developed as a baseline scenario for climate modelling and was intended to represent the 90th percentile of no-policy baseline scenarios at the time. It is now considered a high-emissions future for global warming.

In section 5.1 a summary of the climate change vulnerabilities for each assessed feature on this site can be found, the full report including the impact on Blue Carbon and maps of the different climate change pressures can be found here (in line link).

Climate change is likely to cause changes across a site and across the network of sites in Wales. There are likely to be differences in impacts across features with some features being more impacted by certain climate change pressures than others. There may also be perceived conflicts between features where potential management measures may impact one feature to the detriment of another e.g. the protection of a coastal lagoon may affect adjacent mudflats and sandflats. These challenges are difficult to address through conservation advice and a lot more thinking needs to be done on this issue. In the meantime they will need to be considered on a site-by-site basis, as and when they arise.

2.7.2. Vulnerability of coastal features to coastal squeeze

Besides the general work on climate change vulnerabilities above more specific detailed work has been carried out on the impacts of sea-level rise on our MPA network (Oaten et al., 2024). This work regards the extent to which sea-level rise may cause coastal squeeze and natural squeeze, an issue which affects intertidal habitats.

Coastal Squeeze is “The loss of natural habitats or deterioration of their quality arising from anthropogenic structures, or actions, preventing the landward transgression of those habitats that would otherwise naturally occur in response to sea level rise in conjunction with other coastal processes. Coastal Squeeze affects habitat on the seaward side of existing structures.”

Natural squeeze is defined as the loss of habitat against any natural frontage that restricts the rollback of intertidal habitats. Two types of natural frontage are considered within the assessment of natural squeeze:

- Natural Ridge – e.g., a shingle / dune ridge or a natural bank that has an area of low-lying land behind that could be inundated by the tide if the ridge is breached; and
- High ground – naturally high ground that limits any inundation of the tide into the hinterland.

Seven broad intertidal habitat groups were identified as being subjected to coastal squeeze. The following are of relevance for our marine Annex I habitats in our Welsh MPA network and included, where relevant in section 5.2:

- Saltmarsh,
- Mudflats and sandflats,
- Intertidal reef, and
- Vegetated shingle.

The affected habitat for this SAC is reefs. Further information on the specific feature impacts is provided in Section 5.2. The different timeframes, climate change scenarios and management scenarios can be found in the full assessment of coastal squeeze report.

3. Conservation objectives for Cardigan Bay SAC

The conservation objectives for each designated feature are outlined in the sections below. Each objective is accompanied by objective attributes and targets (see Section 1.3) and supporting information specific to each objective. General site information can be found in Appendix 1. General feature descriptions and ecological characteristics can be found on the JNCC habitats and species lists.

The following terms are used in the conservation objectives.

Anthropogenic: In this document anthropogenic specifically relates to environmental changes caused or influenced by people, either directly or indirectly. NRW consider anthropogenic influences to include climate change.

Component habitat: Habitats that constitute the named features. E.g. Muddy gravels in mudflats and sandflats not covered by seawater at low tide.

Maintain: Where existing evidence from the most recent condition assessment suggests the feature to be in favourable condition, the conservation objective is for the feature to remain in favourable condition.

Natural change: This is defined as species or habitat changes which are not a result of anthropogenic influences. NRW consider anthropogenic influences to include climate change.

Natural variability: This is defined as species or habitat variability, which are not a result of anthropogenic influences. NRW consider anthropogenic influences to include climate change.

Restore: Where existing evidence from the most recent condition assessment suggests the feature, or part of the feature, to be in unfavourable condition the conservation objective is to return the feature to favourable condition. As the feature is being returned to favourable condition, further decline in the aspects of condition that are causing it to be unfavourable should be prevented. The ability to achieve favourable condition should not be inhibited.

Structure and function: Structure encompasses both the physical structure of a habitat feature (e.g. geology and morphology), together with the biological structure, including habitat forming species (both plant and animal) and species composition. Function encompasses the ecological processes influencing the habitat feature at different temporal and spatial scales.

Unknown: Where there is not enough suitable evidence to complete a condition assessment the feature is assigned an unknown condition.

3.1. Feature 1: Bottlenose dolphin *Tursiops truncatus*

The bottlenose dolphin *Tursiops truncatus* feature within Cardigan Bay SAC is currently in **favourable** condition (medium confidence). NRW published the latest condition assessment in June 2025. NRW will review these conservation objectives when new condition assessment information is available.

Below are the attributes and targets for each conservation objective alongside supporting information.

Objective 1: The bottlenose dolphin population that use the SAC is maintained in favourable condition and stable or increasing over the medium and long term.

Objective attribute	**Site specific target(s)**
1a. Population using the SAC	Maintain a stable or increasing population of bottlenose dolphins that use the SAC over the, medium and long term. Population demographics, such as reproductive success and survival rates, at levels needed for the population to be maintained in favourable condition.
1b. SAC residency	Maintain bottlenose dolphin residency in the SAC over the medium and long term.

Supporting information

1a. Population using the SAC

For the purposes of this objective, medium and long term have been defined as 10 and 20 years respectively.

Bottlenose dolphins are common and found throughout the UK and North East Atlantic waters, especially offshore. However, populations of coastal bottlenose dolphins are much rarer in the UK. Cardigan Bay is one of the very few areas around the UK where significant numbers of coastal bottlenose dolphin are known to occur regularly. The population of bottlenose that live here have been studied intensively since the late 1990s.

While the dolphins of Cardigan Bay SAC are thought to be semi-resident here, they do range widely within the Irish Sea (a Management Unit for the species (see IAMMWG, 2023). Their full distribution is not known precisely but individuals recorded regularly within the SAC have also been seen further afield around the Welsh coast, North West English waters and the Isle of Man. Bottlenose dolphin distribution varies from year to year, which is likely to be a consequence of natural environmental changes, such as fluctuations in prey distribution.

A combination of boat-based line transect surveys (distance sampling) and photo identification (capture-mark-recapture (CMR)) have been carried out in the SAC since 2001 and in the wider Cardigan Bay region since 2005. These monitoring techniques have been used to produce coastal bottlenose dolphin population abundance estimates (Lohrengel et al., 2018; Lohrengel et al., in draft).

From 2001 to 2024 the number of dolphins using the SAC and the wider Cardigan Bay (monitored since 2005) are variable, but the population is considered to be broadly stable over that time frame. More information on bottlenose dolphin numbers and monitoring methods used for their assessment can be found in the condition assessment for this feature (Cuthbertson et al., 2025).

Bottlenose dolphin is a long-lived species that may survive in the wild for 40-50 years or more. The reproductive rate of bottlenose dolphins is low: Females produce a single calf every 3.4 years on average once they mature at around 7-8 years old. The gestation period is about one year, and the pregnancy rate does not appear to decrease with age.

Newborn and very young calves have been observed in Cardigan Bay from April to September, suggesting a seasonal pattern to calving. The continued presence of mother and calf pairs confirm that this region serves as an important nursery area for bottlenose dolphin. Analysis of crude birth rates in Cardigan Bay SAC show signs of decreasing in recent years (Lorenghel et al., in draft). The reason why is not clear. The calf survival was deemed to reach the required levels in the latest condition assessment (Cuthbertson et al., 2025a). The decline in birth rate seen is concerning and needs to be monitored.

The population using the SAC attribute has been met, allowing maintain targets to be set for objective 1a. For more information see the latest condition assessment (Cuthbertson et al., 2025a).

1b. SAC residency

The coastal bottlenose dolphin population in Cardigan Bay SAC is one of two major semi-resident coastal populations in UK; the other resides in Moray Firth, Scotland for which the Moray Firth SAC was designated. Smaller coastal populations can also be found in South West England and West Scotland (see IAMMWG, 2023).

Detecting residency in a mobile species is difficult and requires long term intensive monitoring with photo identification of individuals. A bottlenose dolphin is considered to be a resident if it is seen for a minimum of seven years and on at least 12 separate occasions.

Analysis of the latest values found the percentage of residency to be stable in the long term (Lohrengel et al., in draft). The SAC residency attribute has been met, allowing a maintain target to be set for objective 1b. For more information see the latest condition assessment (Cuthbertson et al., 2025a).

Objective 2: The bottlenose dolphin population that use the SAC continue to have access to, and be able to utilise habitats necessary to maintain the population in favourable condition.

Objective attribute	Site specific target
2a. Accessibility to habitat used by bottlenose dolphin	Bottlenose dolphins that use the SAC should not be significantly constrained from accessing necessary habitats within or outside of the site.
2b. Anthropogenic disturbance	Bottlenose dolphins that use the SAC should not be subject to significant anthropogenic disturbance within or outside of the site.

Supporting information

2a. Accessibility to habitat used by bottlenose dolphin

The mobile nature of bottlenose dolphins means that they utilise a wide area for their functional needs (e.g. feeding, breeding etc). However, there is a lack of understanding on what constitutes suitable habitat for the species, but repeated presence of bottlenose dolphin at a particular location is likely to indicate reliance on the habitat associated with that location. It is vital that bottlenose dolphin continue to have unimpeded access to habitats within and outside of the SAC that are necessary to maintain the population that use the SAC in favourable condition. It is not only physical barriers or constraints that could reduce access to their habitat, noise and visual stimuli could also prevent dolphins from accessing an area.

The degree of concern about habitat accessibility will differ depending on the life stage of the individuals and the severity of the constraint. For example, there may be more concern around access constraints that impact mother and calf pairs, large areas, or that persists for a long time.

We know bottlenose dolphins forage and breed outside of the SAC boundaries. Therefore, we need to ensure functionally linked (i.e. necessary) habitats are available to them and their use of them is not constrained in such a way that the population that uses the SAC is adversely affected. Whether an activity is causing significant constraint will be judged on a case by case basis.

There is currently no evidence bottlenose dolphins that use the SAC are significantly constrained from accessing necessary habitats. For more information see the latest condition assessment (Cuthbertson et al., 2025a).

2b. Anthropogenic disturbance

Like all cetaceans, bottlenose dolphins are sensitive to disturbance, particularly from underwater noise, as they rely heavily on sound to sense their surroundings, detect prey

and to communicate (Evans, 1996). One of the main anthropogenic sources of underwater noise in Cardigan Bay is from vessel traffic. Boat noise has been shown to mask cues, affect the behaviour of bottlenose dolphins and their prey and cause stress (Pirotta et al., 2015).

The degree of concern about anthropogenic disturbance will differ depending on the life stage of the individuals and the severity of the disturbance. For example, there may be more concern around disturbance that impacts mother and calf pairs, large areas, or that persists for a long time.

We know bottlenose dolphins forage and breed outside of the SAC boundaries. Therefore, we need to ensure that bottlenose dolphin that use the SAC are not disturbed in such a way that the population that is adversely affected. Whether an activity is causing significant disturbance will be judged on a case by case basis.

Disturbance is currently not at levels significantly affecting the bottlenose dolphin population the use the SAC. See the latest condition assessment for further information (Cuthbertson et al., 2025a).

Objective 3: The bottlenose dolphin population that use the SAC have high quality habitat and sufficient food supply to support and maintain the population in favourable condition.

Objective attribute	**Site specific target**
3a. Habitat quality and function	Maintain the quality and functionality of habitat to support the bottlenose dolphin population that use the SAC in favourable condition.
3b. Prey availability	Maintain the quality, abundance and diversity of prey needed for the bottlenose dolphin population that use the SAC to remain in favourable condition.
3c. Water, sediment and prey contaminants	Contaminants are at levels not detrimental to the bottlenose dolphin population that use the SAC.

Objective 3 supporting information

3a. Habitat quality and function

There are two ecotypes of bottlenose dolphin, those that live in the offshore and those that live mainly inshore (Louis et al., 2014). Each has different habitat and dietary preferences (Hernadez-Milian et al., 2015). In coastal waters, bottlenose dolphins appear to favour habitat with uneven topography and/or strong tidal currents. The precise habitat requirements of coastal bottlenose dolphins are poorly understood, but includes habitat that is of sufficient quality for feeding and calving, as well as resting and travelling. Cardigan Bay SAC is primarily designated for the population of coastal bottlenose dolphin that reside here.

Coastal bottlenose dolphins use different areas throughout the Irish Sea Management Unit, Cardigan Bay, and the SAC. However, Cardigan Bay SAC represents a core area of habitat used by the population. The high frequency of persistent sightings along the coast from Aberaeron to Cardigan and around Fishguard suggests these areas may be of particular importance (Feingold and Evans, 2014; Lohrengel et al., 2018).

The habitat quality and function attribute is being met, allowing a maintain target to be set for objective 3a. See the latest condition assessment for more information (Cuthbertson et al., 2025a).

3b. Prey availability

Bottlenose dolphins are generalist and opportunistic feeders eating a wide range of pelagic and benthic (demersal) fish, crustaceans and molluscs both within and outside of the SAC.

From visual observations of the surface behaviour of bottlenose dolphins in Cardigan Bay and prey capture, it is known that they catch pelagic fish (such as sea trout and bass), bottom dwelling fish (e.g. flatfish) and invertebrates (e.g. squid) (unpublished data, Seawatch Foundation). Hernadez-Milian et al (2015) analysed stomach content of bottlenose dolphins stranded on the west coast of Ireland and indicated a wide variety of both benthic and pelagic prey was consumed. However, this study may better represent the offshore ecotype rather than coastal bottlenose dolphin associated with the Irish Sea and Cardigan Bay.

As bottlenose dolphins forage widely within and outside of the SAC, a decline in a single prey species in one area may not immediately impact the population. However, prey availability is likely to be a key factor in determining the abundance and distribution of dolphins in the Irish Sea, Cardigan Bay and the SAC.

The prey availability attribute has been met, allowing a maintain target to be set for objective 3b. See the latest condition assessment for more information (Cuthbertson et al., 2025a).

3c. Water, sediment and prey contaminants

As top predators, marine mammals are vulnerable to contaminants, particularly those which biomagnify and/or bioaccumulate, such as persistent organic pollutants (POPs). These include, but are not limited to, pesticides, polychlorinated biphenyls (PCBs) historically used in manufacturing, and polybrominated diphenyl ethers (PBDEs) typically used as flame retardants in a variety of products. While many POPs have been banned in Europe since the 1970s and 80s, they take a very long time to degrade (i.e. are persistent). Despite this, these contaminants continue to enter the marine environment via use and disposal of products made before bans were introduced. This is evidenced by the high levels of PCBs found in dolphins and cetaceans in European shallow coastal waters (Jepson and Law, 2016; Williams et al., 2023; Zanuttini et al., 2019).

POPs pose a risk to bottlenose dolphin as these harmful contaminants are lipophilic in nature and are stored in their fat (e.g. blubber) and bioaccumulate over their long life spans (Williams et al. 2023, and references therein).

POPs are known to cause a variety of negative health impacts in individual marine mammals such as immune system suppression, reproductive impairment and developmental abnormalities (Aguilar and Borrell, 1994; Jepson et al., 2005; Tanabe et al.,

1994; Schwacke et al., 2002; 2012; Vos et al., 2003;). The impacts these chemicals have at a population level, however, is not well understood.

Contaminant levels are not thought to be having a detrimental impact on the bottlenose dolphin population of the SAC at the time of writing, but are considered to pose a threat. For more information see the latest condition assessment (Cuthbertson et al., 2025a).

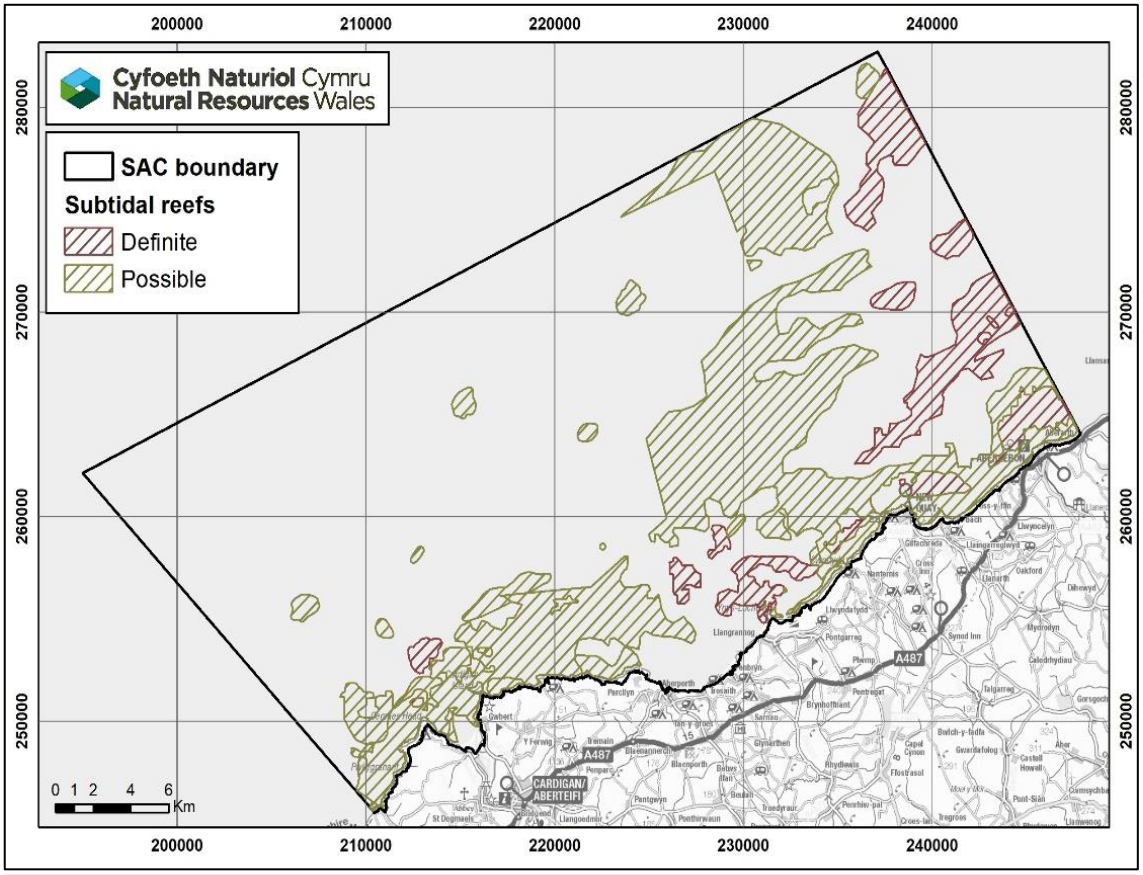
3.2. Feature 2: Reefs

The reefs feature within Cardigan Bay SAC is currently in **unfavourable** condition (low confidence). NRW published the latest condition assessment in June 2025. NRW will review these conservation objectives when new condition information is available.

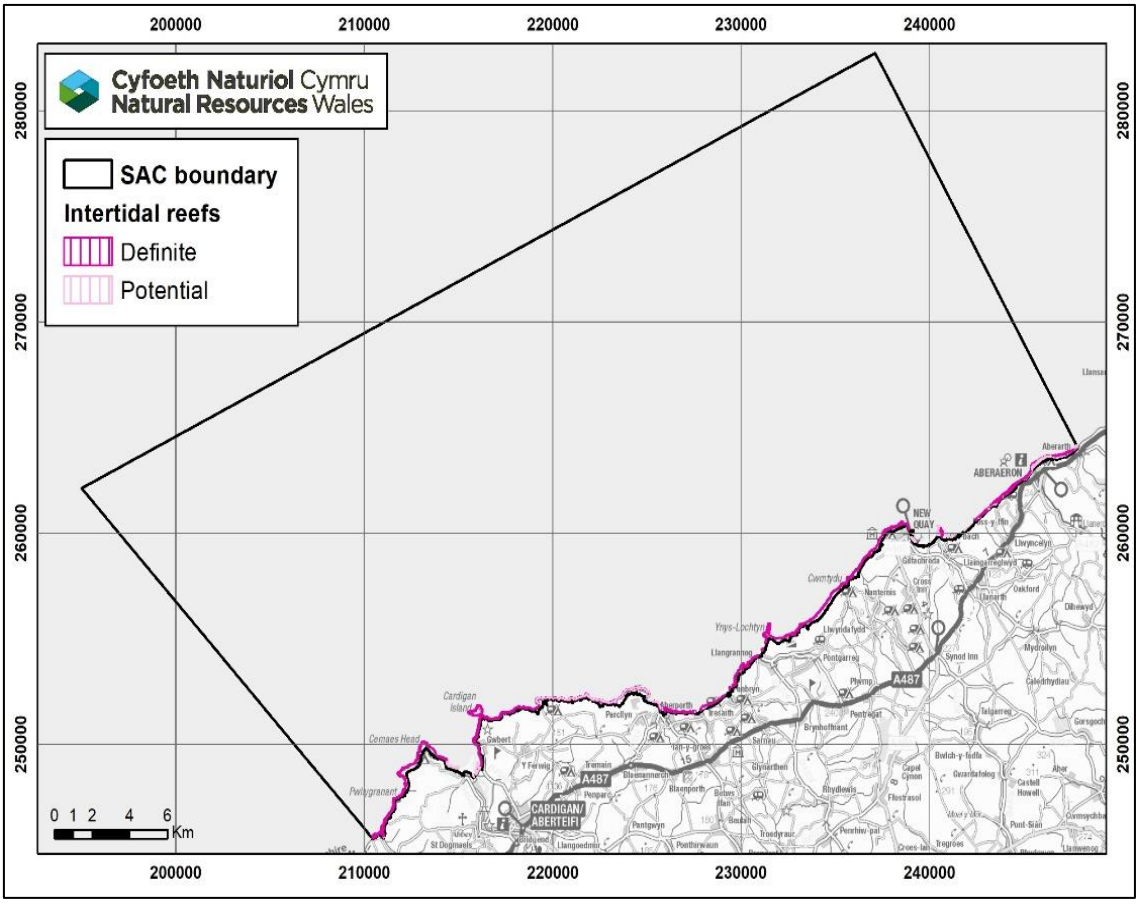
Figure 2 is a map of the location of the reefs feature within Cardigan Bay SAC. The map is for indicative purposes only. Detailed maps for this feature in Wales can be found on Data Map Wales. The attributes and targets for each conservation objective alongside supporting information follow figure 2.

Figure 2. Map of the reefs feature within Cardigan Bay SAC. a) subtidal and b) intertidal.

a)



b)



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Objective 1: The overall distribution and extent of the reefs feature within the SAC and each of its main component habitats are stable or increasing, subject to natural change.

Objective attribute	Site specific target
1a. Feature extent and distribution	Maintain the extent and distribution of the reefs feature and reef types, subject to natural change.
1b. Component habitat extent and distribution	Maintain the extent and distribution of the component habitats and communities necessary for the structure and function of the reefs feature.

Supporting information

1a. Feature extent and distribution

The extent describes the presence and area of the habitat across the whole site, even where it is patchy. The distribution describes the more detailed locations and pattern of different habitats that comprise the feature across the SAC. The reefs feature occurs intermittently throughout the SAC in intertidal and subtidal areas.

Cardigan Bay SAC supports bedrock, stony and biogenic reef types. The seabed of Cardigan Bay appears to be very patchy, forming a mosaic of seabed types, some of which seem to run parallel to the shore. This range of reef is greatest in the east and near shore, becoming less dense offshore in the west.

Subtidal reef is widespread within the SAC and is predominantly a mosaic of boulder, cobble and pebble with sand and gravel. At the southern end of the site, along the coast and nearshore areas, bedrock is dominant. In the north-eastern end of the site the shore is predominantly boulder and cobble mosaics with sediment.

Biogenic reefs of the honeycomb worm *Sabellaria alveolata* are common in the intertidal and shallow subtidal environment. Records of *Sabellaria spinulosa* are found in the subtidal area, but these are currently not considered to be reef. Further investigation would be required to determine if these meet the definition of *Sabellaria spinulosa* reef.

Due to the mosaic nature of reef in Cardigan Bay the distribution and extent of subtidal reef within the SAC is difficult to map. Furthermore, due to the mobile nature of sediment in the site, subtidal reef can sometimes overlap with the sandbanks feature.

The extent of the reefs feature is judged to be favourable allowing a maintain target to be set for objective 1a. See the latest condition assessment for more information (Jackson-Bue et al., 2025a).

1b. Component habitat extent and distribution

Cardigan Bay’s reefs fall into three main geomorphological categories:

- Raised areas of hard ground consisting of pebbles, cobbles and boulders. Present both subtidally and intertidally. They cover wide areas and appear to form a patchwork with more mobile patches of sediment.
- Biogenic reefs of the polychaete worm *Sabellaria alveolata*. Present predominantly in the intertidal, but extending into the subtidal. They grow on bedrock and hard ground where sufficient wave action provides a supply of sediment particles required by the worm to create its tubes.
- Hard bedrock reef. Present subtidally and intertidally. These reefs contain many fissures and crevices. The rocky shores of the south and west are typical of moderately exposed bedrock shores, with a good range of specialised habitats such as gullies, overhangs and pools. These reefs typically consist of bedrock ridges on the shore and into the subtidal, becoming broken bedrock that merges into boulders on sediments before eventually petering out into subtidal sediment plains. At the southern end of the site around Cemaes Head and Cardigan Island these reefs can extend over a kilometre offshore, but these reefs diminish as you travel up the coast, so that bedrock reefs quickly become limited to the intertidal and immediately adjacent subtidal. Most of the site's sea-caves are also found here.

The extent and distribution of reef type, component habitats and biological communities of the reefs feature is judged to be favourable, allowing a maintain target to be set for objective 1b. See the latest condition assessment for more information (Jackson-Bue et al., 2025a).

Objective 2: The hydro-morphological and chemical elements necessary for the structure and function of the reefs feature are stable or improving, subject to natural change.

Objective attribute	Site specific target(s)
2a. Water and sediment quality	Contaminants are at levels not detrimental to the structure and function of the reefs feature. Nutrients are at levels not detrimental to the structure and function of the reefs feature. Physicochemical characteristics are at levels not detrimental to the structure and function of the reefs feature.
2b. Hydro-morphology	The characteristic hydrodynamics, sediment transport and morphology necessary for the structure and function of the reefs feature are sustained.
2c. Sediment supply	The sediment type, size distribution and budget necessary for the structure and function of the reefs feature is sustained.

Supporting information

2a. Water and sediment Quality

Various contaminants are known to affect species living within the water column and in or on the surface of sediments. The biological effect of a contaminant will vary depending on its nature. Contaminants include, but are not limited to, heavy metals (e.g. mercury and zinc), polybrominated diphenol ethers (PBDEs), poly-aromatic hydrocarbons (PAHs), poly-chlorinated biphenyls (PCBs) and organotin and pesticides such as hexachlorobenzene. These chemicals (e.g. heavy metals) can degrade community structure and bioaccumulate within organisms, entering the marine food chain (e.g. PCBs) (OSPAR Commission, 2012).

High concentrations of nutrients (nitrogen and phosphorus) in the water column can cause phytoplankton and opportunistic macroalgae blooms. These blooms can lead to reduced dissolved oxygen availability especially in warmer months. This can have lethal and sub-lethal impacts on sensitive fish, epifauna and infauna communities (Best et al., 2007). Overgrowth of opportunistic macroalgae species due to increased nutrient input on intertidal reef can reduce biodiversity. However, the effect of grazers and wave action can help limit the impacts (Bokn et al., 2003; Worm and Lotze, 2006). High nutrient loads may be more of an issue on sheltered intertidal reef with low grazing pressure (Bokn et al., 2003).

Physicochemical characteristics include salinity, pH, temperature, dissolved oxygen and turbidity. They affect habitats in terms of the abundance, distribution and composition of communities present. Changes in any of these properties, because of anthropogenic activities, may impact habitats and the communities they support.

Water quality issues have been identified for this feature. For information on water quality see the latest condition assessment report (Jackson-Bué et al., 2025a).

2b. Hydro-morphology

Hydro-morphology refers to patterns of water movement (caused by waves, wind and tides), coastal processes (e.g. erosion and deposition), and the physical characteristics of the environment. Waves and currents move sediment, which can change the morphology of the seabed, which in turn changes waves and currents; in other words there is two-way feedback between the hydrodynamics and the morphology. Water movement transports nutrients, sediment and other particles, strongly influencing the species and communities present.

Wave exposure is similar throughout the SAC for the deeper water reefs: short period wind waves dominate, with prevailing winds from a west or south westerly aspect being most common. Large swell waves are less common due to the sheltering effect of Pembrokeshire and Ireland, however long period swell from the Atlantic is more frequent during the winter months. Wave exposure at intertidal reefs is much more variable because local wave conditions are affected by coastline orientation and the modulation of waves by nearshore bathymetry. Tidal flows are relatively low in general, with mean spring peak currents being under 1 m/s, however it is likely that this may be stronger in places, particularly near headlands.

Many anthropogenic activities can change the hydrodynamic and sediment transport process. For example, changes to depth or the introduction of barriers (including energy extraction) can change the speed of currents and the degree of wave exposure. While dredging and construction can have large, though short lived, increases in the volume of sediment deposited on a habitat.

Morphology of hard substrata reefs is unlikely to change without direct anthropogenic action (e.g. construction or demolition). Cobble and boulder reef morphology can also be altered by large wave events. Biogenic reef morphology can be affected by changes to the nutrient, food or sediment supply required for their maintenance, as well as storm events or anthropogenic activity.

No hydro-morphology issues have been identified for this feature. See the latest condition assessment for information (Jackson-Bué et al., 2025a). Information on the hydro-morphology of the SAC can be found in Appendix 1.

2c. Sediment supply

Sediment type, distribution and supply are important in determining the species and communities present in a habitat. The rate at which sediment is deposited is known to influence reef habitats and their associated communities. Sedimentation influences community composition, alters species growth rates, inhibits feeding or photosynthesis and potentially affects reproductive success by reducing larval recruitment. High levels of sediment deposition could lead to smothering or burying of sessile benthic species.

Sediment supply is important for reef forming *Sabellaria* species, as tube growth is dependent on the presence of suspended particles. A reduction in sediment transport may reduce the amount of sediment available for tube construction. Conversely an increase in sediment may facilitate tube building but clog up feeding apparatus. Sediment budgets and transport are often on a regional scale, and therefore projects outside the SAC can still alter the sediment supply to features within the site.

No sediment supply issues have been identified for this feature. See the latest condition assessment for information (Jackson-Bué et al., 2025a). Information on the sedimentology of the SAC can be found in Appendix 1.

Objective 3: The abundance, distribution and diversity of species within communities and component habitats necessary for the structure and function of the reefs feature are stable or improving, subject to natural variability.

Objective attribute	Site specific target
3a. Habitats and communities	Maintain the abundance, distribution and diversity of species within component habitats and communities necessary for the structure and function of the reefs feature.
3b. Invasive and non-native species	Introduction or spread of new non-native species to the SAC by anthropogenic activities should not have a detrimental impact on the structure and function of the reefs feature.

Supporting information

3a. Habitats and communities

All the habitats and communities within the reefs contribute to the overall condition of the feature. Changes to the spatial distribution of communities across the feature could highlight changes to the overall feature. The limited information on Cardigan Bay reefs suggests that species richness is high, though variable between and within reef habitats and over time. The range of substrate type, topography, depth, wave and tidal current exposures and light contribute to the high species variety.

The rocky shore reefs of different geology and topography are exposed to strong gradients of wave exposure, tidal streams, salinity, water clarity and other functional processes and as a result are colonised by a diversity of algae, sponges, polychaetes, crustaceans, molluscs and ascidians.

The principle types of reef within this site are:

- Intertidal bedrock reef
- Subtidal bedrock reef
- Subtidal stony reef
- Intertidal boulder and cobble reefs
- Biogenic reef: honeycomb worm reef and blue mussel beds

More information on each of these habitats and their communities and reef communities in general can be found in Appendix 1.

The habitats and communities attribute is being met, allowing a maintain target to be set for objective 3a. See the latest condition assessment for more information (Jackson-Bué et al., 2025a).

3b. Invasive and non-native species

Non-native species (NNS) may become invasive non-native species (INNS) and displace native species by predating them or out-competing them for food, space or both. This can lead to the loss of indigenous species from certain areas or changes to community structure (JNCC, 2004; Levin et al., 2002), as well as changes to biotope and habitat type. The introduction of INNS to the SAC, or spread of INNS within the SAC, can occur through various regulated and unregulated pathways. Further information on introduction pathways can be found on the GB non-native species secretariat website.

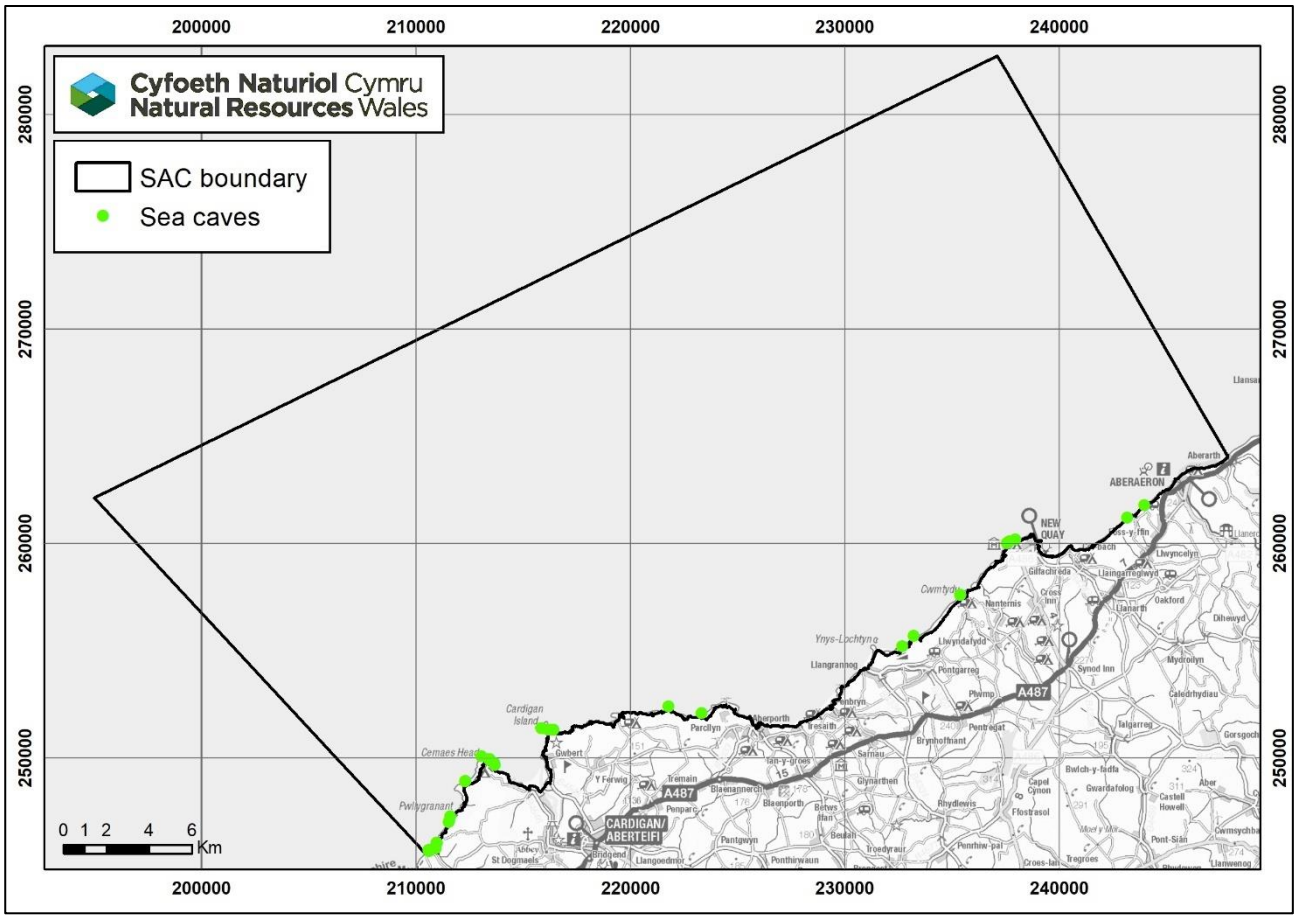
INNS are not currently impacting the reefs feature in Cardigan Bay. For more information see the latest condition assessment (Jackson-Bué et al., 2025a). Information on INNS in the SAC as a whole can be seen in Appendix 1.

3.3. Feature 3: Submerged or partially submerged sea caves

The submerged or partially submerged sea caves (sea caves) feature within Cardigan Bay SAC is currently in **unknown** condition. NRW published latest condition assessment in June 2025. NRW will review these conservation objectives when new condition assessment information is available.

Figure 3 is a map of the location of the sea caves feature within Cardigan Bay SAC. The map is for indicative purposes only. Detailed maps for this feature in Wales can be found on Data Map Wales.

Figure 3. Location map of the sea caves feature within Cardigan Bay SAC.



Below are the attributes and targets for each conservation objective alongside supporting information.

Objective 1: The overall distribution and extent of the sea caves feature within the SAC and each of its main component habitats are stable or increasing, subject to natural change.

Objective attribute	Site specific target
1a. Feature extent and distribution	Maintain the extent and distribution of sea caves habitat, subject to natural change.

Supporting information

1a. Feature extent and distribution

The extent describes the presence and area of the feature across the whole site, even where it's patchy. The distribution describes the more detailed locations and patterns of different habitats that comprise the feature across the site.

Intertidal sea-caves are distributed widely throughout the site and are common wherever there are suitable geological exposures. The general distribution is well known but is poorly documented or mapped. The majority of caves are found towards the south-western end of the site but are present almost anywhere where there are sea cliffs of relatively hard rock. Submerged and partially submerged sea caves are distributed throughout the southwestern part of the site. The distribution of partially submerged sea caves is reasonably well known, though that of submerged sea caves within the SAC is not.

The total number of sea caves is unknown, and their extent is poorly known (especially for submerged sea caves). Individual sea caves range in size from little more than deep enclosed overhangs to more than 100m long. A few sea caves within the SAC have been specifically surveyed and based on this the area and volume of sublittoral caves is estimated as small.

The extent and distribution attribute is being met, allowing a maintain target to be set for objective 1a. See the latest condition assessment for more information (Hatton-Ellis et al., 2025).

Objective 2: The hydro-morphological and chemical elements necessary for the structure and function of the feature are stable or improving, subject to natural change.

Objective attribute	Site specific target(s)
2a. Water and sediment quality	Contaminants are at levels not detrimental to the structure and function of the sea caves feature. Nutrients are at levels not detrimental to the structure and function of the sea caves feature. Physicochemical characteristics are at levels not detrimental to the structure and function of the sea caves feature.
2b. Hydro-morphology	The characteristic hydrodynamics, sediment transport and morphology necessary for the structure and function of the sea caves feature are sustained.
2c. Sediment supply	The sediment type, size distribution and budget necessary for the structure and function of the sea caves feature is sustained.

Supporting information

2a. Water and sediment quality

Various contaminants are known to affect species living within the water column and in or on the surface of sediments. The biological effect of a contaminant will vary depending on its nature. Contaminants include, but are not limited to, heavy metals (e.g. mercury and zinc), Polybrominated diphenol ethers (PBDEs), poly-aromatic hydrocarbons (PAHs), poly-chlorinated biphenyls (PCBs) and organotin and pesticides such as hexachlorobenzene. These chemicals (e.g. heavy metals) can degrade community structure and bioaccumulate within organisms, entering the marine food chain (e.g. PCBs) (OSPAR Commission, 2012).

High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced dissolved oxygen availability. This can impact sensitive fish, epifauna and infauna communities. Overgrowth of opportunistic macroalgae species that occurs because of increased nutrient input on intertidal reef can reduce biodiversity, though the effect of grazers and wave action can help limit the impacts (Bokn et al., 2003; Worm and Lotze, 2006). High nutrient loads may be more of an issue on sheltered intertidal reef with low grazing pressure (Bokn et al., 2003). This is likely to be true for sheltered intertidal sea caves.

Physicochemical characteristics include salinity, pH, temperature, dissolved oxygen and turbidity. They affect habitats in terms of the abundance, distribution and composition of

communities present. Changes in any of these properties, because of anthropogenic activities, may impact habitats and the communities they support.

For the latest information on water quality see the latest condition assessment report (Hatton-Ellis et al., 2025).

2b. Hydro-morphology

Hydro-morphology refers to patterns of water movement (caused by waves, wind, tides and fluvial input), coastal processes (e.g. erosion and deposition), and the physical characteristics of the environment. Waves and currents can move sediment, which can change the shape of the seabed, which in turn changes waves and currents; in other words there is two-way feedback between the hydrodynamics and the morphology. Hydro-morphology plays an important role in determining the species and communities present.

The most important structure and function characteristics for the sea caves feature are the geology and geomorphology, including topography (surface features), together with hydrodynamic processes (wave action and tidal currents) and water quality and clarity (turbidity). Sea cave morphology and topography is varied and determined by the underlying geology. Microtopography is a further important dimension to habitat variation. Cave surfaces range from smooth, unbroken rock walls to fractured, fissured and perforated surfaces.

Many of the cave mouths in Cardigan Bay face west where wave action has eroded out the strata of naturally weaker shales and slates leaving the harder sandstones. Caves with boulder floors at and just below sea level are typically heavily scoured, with walls polished smooth by boulders thrown around by heavy wave action. The seabed, which slopes very gradually away from the coast in much of the area, is predominantly sand and is easily churned up to add to the scouring action and heavy siltation which is characteristic of this area, particularly in the vicinity of the mouth of the Afon Teifi (Bunker and Holt, 2002).

Tidal streams in the vicinity of sea caves vary but the inside of the majority of sea caves themselves are inherently current sheltered. There is no information on hydro-morphology in sea caves in this SAC. Information on the hydro-morphology of the site can be found in Appendix 1.

2c. Sediment supply

Sediment type, distribution and supply are important in determining the species and communities present in a habitat. The rate at which sediment is deposited is known to influence sea cave habitats and their associated communities. Sedimentation influences community composition, alters species growth rates, inhibits feeding or photosynthesis and potentially affects reproductive success by reducing larval recruitment. High levels of sediment deposition could lead to smothering or burying of sessile benthic species.

The mobilisation and deposition of sediment as a result of water movement is regular and widespread and can lead to rapid fluctuations in sediment height. The floors of many sea caves are areas of sediment or mixtures of sediment and pebbles, cobbles and boulders, with sheltered locations in caves tending to accumulate silt or shell fragments. The sediments contribute to the habitat and species diversity and composition and have a strong influence on the amount of scouring of cave walls. Suspended particulate concentrations are generally significantly higher in sea caves subject to water movement

with sediment floors or with a nearby sediment source, than levels in the adjacent external water column.

Silty, turbid and scoured conditions are typical of the area around Cardigan and the Teifi Estuary (Bunker and Holt, 2002). The combined effects of scour from suspended particulates and sediment and food particle supply are particularly important to the development, survival and diversity of cave species populations, especially in caves adjacent to sediment or with sediment floors. The species populations in different sea caves reflect the differing balance between these effects. There is no information on sediment supply in sea caves in this SAC. Information on sediment transport in the SAC can be found in Appendix 1.

Objective 3: The abundance, distribution and diversity of species within component habitats and communities necessary for the structure and function of the sea caves feature are stable or improving, subject to natural variability.

Objective attribute	**Site specific target**
3a. Habitats and communities	Maintain the abundance, distribution and diversity of species within component habitats and communities necessary for the structure and function of the sea caves feature.
3b. Invasive and non-native species	Introduction or spread of new non-native species to the SAC by anthropogenic activities should not have a detrimental impact on the structure and function of the sea caves feature

Supporting information

3a. Habitats and communities

All the sea cave communities within the SAC contribute to contribute to the overall condition of the feature. Changes to the spatial distribution of communities across the feature could highlight changes to the overall feature.

The wide range of rock type, cave morphology, topography, depth and exposures to water movement, scour and light contribute to the high species diversity in sea caves within the SAC. Sea caves also typically support species that seem out of place, because caves provide environmental conditions which differ from those immediately outside the cave, for example sponges typical of deep-water are sometimes found in intertidal caves and mud dwelling anemones in sediments on the floor of caves in exposed rocky areas. The number of marine algal and invertebrate species associated with sea-caves can be high, though highly variable between and within sea-caves.

More information on each of these habitats and their communities and sea cave communities in general can be found in Appendix 1. As the state of habitat and

communities in the sea caves of the SAC are unknown there is a default maintain target for objective 1a.

3b. Invasive and non-native species

Non-native species (NNS) may become invasive non-native species (INNS) and displace native species by predating them or out-competing them for food, space or both. This can lead to the loss of indigenous species from certain areas or changes to community structure (JNCC, 2004; Levin et al., 2002), as well as changes to biotope and habitat type. The introduction of INNS to the SAC, or spread of INNS within the SAC, can occur through various regulated and unregulated pathways. Further information on introduction pathways can be found on the GB non-native species secretariat website.

There is currently no information on whether INNS are impacting the sea cave feature in Cardigan Bay. Information on INNS in the SAC as a whole can be seen in Appendix 1.

3.4. Feature 4: Grey seal *Halichoerus grypus*

The grey seal *Halichoerus grypus* feature within Cardigan Bay SAC is currently in **favourable** condition (low confidence). NRW published latest condition assessment in June 2025. NRW will review these conservation objectives when new condition assessment information is available.

Below are the attributes and targets for each conservation objective alongside supporting information.

Objective 1: The grey seal population that use the SAC is maintained in favourable condition and stable or increasing over the medium and long term.

Objective attribute	**Site specific target**
1a. Population using the SAC	Maintain the grey seal population that use the SAC in favourable condition, and stable or increasing in the medium and long term.
1b. SAC pup production	Maintain a stable or increasing grey seal pup production within the SAC in the medium and long term, including at important pupping sites.

Supporting information

1a. Population using the SAC

Based on pup production estimates, the Welsh 'population' forms around 3-4% of the UK population (SCOS, 2022). The Pembrokeshire coast contains the main colonies in Wales and is the most southerly in Europe of any significant size (Baines et al., 1995). Grey seals within Cardigan Bay SAC are considered part of the wider regional population, which is not isolated, but extends from the west coast of Scotland to France (SCOS, 2013. Carter et al., 2022; Langley et al., 2020; Pomeroy, et al., 2014; Russell et al., 2017; Sayer et al., 2019).

An estimated 2,250 pups are born per year in Wales (Russell and Morris, 2020), though there is some uncertainty around this value (Thompson, in prep). Pup production at regularly monitored sites in Wales has increased markedly since monitoring began (Bull et al., 2017; Morgan et al., 2018; Robinson et al., 2023). This reflects similar regional and UK wide increases (SCOS, 2022). Summer haul out census data obtained via aerial survey in 2023 estimated the grey seal population in Wales to be 5,284 individuals, + or – 4,571-6,195 (Thompson, in prep). This is thought to be an increase in the population (Thompson, in prep).

The population relevant to, and using, the SAC is judged to be favourable and assumed stable resulting in a maintain target for objective 1a. Further detail on the wider population can be found in the latest condition assessment (Cuthbertson et al., 2025b).

1b. SAC pup production

There is currently no monitoring of pup production in Cardigan Bay SAC. However, there are data available for pup production directly to the north and south in neighbouring SACs. These data are used as a proxy to assess the SAC pup production in Cardigan Bay. The monitored colonies in Pembrokeshire Marine and Pen Llŷn a'r Sarnau SACs have continued to do well since 2005 and have seen a continued upward trend in pup production (Büche and Bond, 2023; Bull et al., 2021; Robinson et al., 2023). There has also been an increase in the grey seal populations in most regions of the UK since the 1960s, though this increase is now slowing (1.4% per year over the last survey interval) (SCOS, 2022). The seal pup production in Cardigan Bay is assumed to be at least stable, allowing a maintain target to be set for objective 1b. For more information see the latest condition assessment (Cuthbertson et al., 2025b).

Objective 2: The grey seal population that use the SAC continue to have access to, and be able to utilise habitats necessary to maintain the population in favourable condition.

Objective attribute	**Site specific target**
2a. Distribution of grey seal pupping sites within the SAC	Maintain a stable or increasing grey seal pupping distribution across the SAC. Allowing for natural change and variation.
2b. Accessibility to habitat used by seals	Grey seal that use the SAC should not be significantly constrained from accessing necessary habitats within or outside of the site.
2c. Anthropogenic disturbance	Grey seal that use the SAC should not be subject to significant anthropogenic disturbance within or outside of the site.

Supporting information

2a. Distribution of grey seal pupping sites within the SAC

It is likely that pupping takes place throughout the site on the coast where there is suitable habitat i.e. physically inaccessible to humans, remote and/ or undisturbed rocky coast beaches, coves and caves. The distribution of breeding across the SAC can reflect influencing factors impacting on seals, both positive and negative. Monitoring seal pupping distribution can identify areas that are important to breeding seals and enable sites to be managed for impacts where needed (JNCC, 2005). Impacts are most likely to be managed

when they are anthropogenic rather than natural. Physical processes may alter the availability of some sites (e.g. rock falls caused by storms), but are considered to be part of the natural variation.

Any changes in the distribution of breeding seals across the SAC could be indicative of a reduction in habitat quality caused, for example, by disturbance. Reduction in use of available pupping sites may put pressure on the remaining sites and potentially limit seal pupping productivity due to lack of available space to pup. While there is no monitoring of seals in the SAC it is known pupping occurs at a limited number of favourable sites (towards the southern end of the SAC) (Baines et al., 1995). Anecdotal information and data from the neighbouring SACs is used to assess the distribution of seals in Cardigan Bay.

The latest condition assessment suggests the number of pupping sites has increased across Pembrokeshire Marine SAC, reflecting a successful increasing population. However, in some existing pupping sites pup production is stabilising, implying they are potentially reaching carrying capacity (Büche and Bond, 2023). The North Wales region, which includes the Pen Llŷn a'r Sarnau SAC, has seen an increase of 145% in pupping sites between 2004 to 2017, though some of this increase may be attributed to increased survey effort (Robinson et al., 2023). It is assumed that Cardigan Bay is following the same pattern as neighbouring SACs allowing a maintain target to be set for objective 2a. For more information see the latest condition assessment (Cuthbertson et al., 2025b).

2b. Accessibility to habitat used by seals

Grey seal coastal habitat serves to support the species during all of its life phases and needs. From breeding, pupping, moulting and resting whilst on land, to foraging on the seabed and in the water column and travelling whilst at sea. Grey seals are a highly mobile species, and individuals that breed within the SAC may spend other times of the year in areas far from the site, dispersing widely within the Irish and Celtic Seas (Carter et al., 2022; Sayer et al., 2019). It is vital that grey seal continue to have unimpeded access to habitats within and outside of the SAC that are necessary to maintain the population that use the SAC in favourable condition. It is not only physical barriers or constraints that could reduce access to their habitat, noise and visual stimuli could also prevent grey seals from accessing an area.

For example, West Hoyle sandbank in Liverpool Bay is a major, if not the biggest, grey seal haul out in the Irish and Celtic seas, and has demonstrated connectivity to the SAC (e.g. Carter et al., 2022; Langley et al., 2020) and is considered to have functional linkage (i.e. necessary). If access to this sandbank was impeded, for example, it may impact the seals that use Cardigan Bay SAC. Whether an activity is causing significant constraint will be judged on a case by case basis.

There is currently no evidence grey seals that use the SAC are significantly constrained from accessing necessary habitats. For more information see the latest condition assessment (Cuthbertson et al., 2025b).

2c. Anthropogenic disturbance

Seal disturbance on land mainly comes in the form of recreational disturbance (e.g. dog walkers, wildlife watching boats, etc), and from airborne noise such as from construction, military exercises and recreation (e.g. fireworks). Disturbance to seals while at sea is largely through underwater noise associated with construction of industrial developments.

Changes in the distribution of breeding seals could be indicative of disturbance (see objective attribute 2a).

Disturbance can lead to seals abandoning haul outs as they flush into the water to avoid the perceived threat. This can stress seals and can also be a danger to new pups due to physical harm, as adults rush to the water, or through starvation due to temporary or permanent abandonment (SCOS, 2013).

We know grey seals forage and breed outside of the SAC boundaries. Therefore, we need to ensure that grey seals that use the SAC are not disturbed in such a way that the population that is adversely affected. Whether an activity is causing significant disturbance will be judged on a case by case basis.

The latest condition assessment found current disturbance is not significant enough to adversely affect the seal population. For more information see the latest condition assessment (Cuthbertson et al., 2025b).

Objective 3: The grey seal population that use the SAC have high quality habitat and sufficient food supply to support and maintain the population in favourable condition.

Objective attribute	**Site specific target**
3a. Habitat quality and function	Maintain the quality and functionality of habitat to support the grey seal population that use the SAC in favourable condition.
3b. Prey availability	Maintain the quality, abundance and diversity of prey needed for the grey seal population that use the SAC to remain in favourable condition.
3c. Water, sediment and prey contaminants	Contaminants are at levels not detrimental to the grey seal population using the SAC.

Supporting information

2a. Distribution of grey seal pupping sites within the SAC

The exact habitat requirements of grey seals are not known (seemingly suitable habitat is often not occupied), but must include suitable pupping, moulting and resting haul-out areas on land as well as access to suitable foraging and passage areas at sea. Adults and weaned pups are assumed to feed at sea throughout the site, and some are known to make long foraging trips offshore to deeper waters off the Pembrokeshire coast (Thompson, 2011).

Many grey seals in Wales tend to use secluded coves and caves for pupping instead of forming large congregations of pupping females on open beach sites, differing from seals elsewhere in Britain (Baines et al., 1995; Stringell et al., 2013). Other preferred breeding

sites tend to be secluded and sheltered from heavy wave action. Moulting and resting haul-out sites are distributed throughout the site, though only a small number of sites are regularly used as haul-outs by large numbers of seals (Baines et al., 1995; Thompson, in prep). Known winter moulting haul-outs and non-moulting / resting haul-outs are limited to offshore islands and remote, undisturbed and inaccessible rocky shores and beaches.

Pupping occurs at a limited number of favourable sites (towards the southern end of the SAC) with some use of less optimal sites to the north of the SAC (Baines et al., 1995). Suitable habitat for moulting and resting haul-out is thought to be available throughout the SAC, although few seals were observed to have been hauled out during the latest summer aerial survey (Thompson, in prep).

The habitat quality and function attribute is being met, allowing a maintain target to be set for objective 3a. See the latest condition assessment for more information (Cuthbertson et al., 2025b).

3b. Prey availability

Grey seals are generalist feeders, taking whatever food source is locally abundant (Brown et al., 2012; Thompson et al., 1991). They forage primarily on the seabed, taking a wide variety of prey including sandeels, gadoids (cod, whiting, haddock, ling), and flatfish (plaice, sole, flounder, dab (SCOS, 2013). A study of grey seal diets from scats collected in Pembrokeshire, found that gadoids (mainly whiting) and flatfish (mainly sole) dominated the diet (70% by weight) (Strong et al., 1996). Similar results were seen from a more recent comprehensive study of grey seal diet in Wexford Harbour, Southeast Ireland (Gosch et al., 2019) and in small seal diet study on Skomer Island (Lofthouse, 2017).

While stocks of some key prey species are depleted in the Irish/Celtic sea region, there is no reason to believe that prey is limited or has reduced diversity in the areas that grey seal are using to forage. The grey seal population in Wales has been expanding and pupping has an increasing trend in the SAC, suggesting prey is abundant enough to support a growing population.

The prey availability attribute has been met, allowing a maintain target to be set for objective 3b. See the latest condition assessment for more information (Cuthbertson et al., 2025b).

3c. Water, sediment and prey contaminants

Grey seals, like many marine mammals, are exposed to a variety of anthropogenic contaminants. The main route of exposure is through ingestion of prey. As grey seals are top predators, they are at risk from contaminant biomagnification through the food chain (Hammond et al., 2005). This is particularly the case for persistent organic pollutants (POPs) like polychlorinated biphenyls (PCBs), which are lipid soluble, and heavy metals, like mercury. The toxic effects of these contaminants are well studied with impacts such as reduced reproduction and high susceptibility to disease (Hammond et al., 2005).

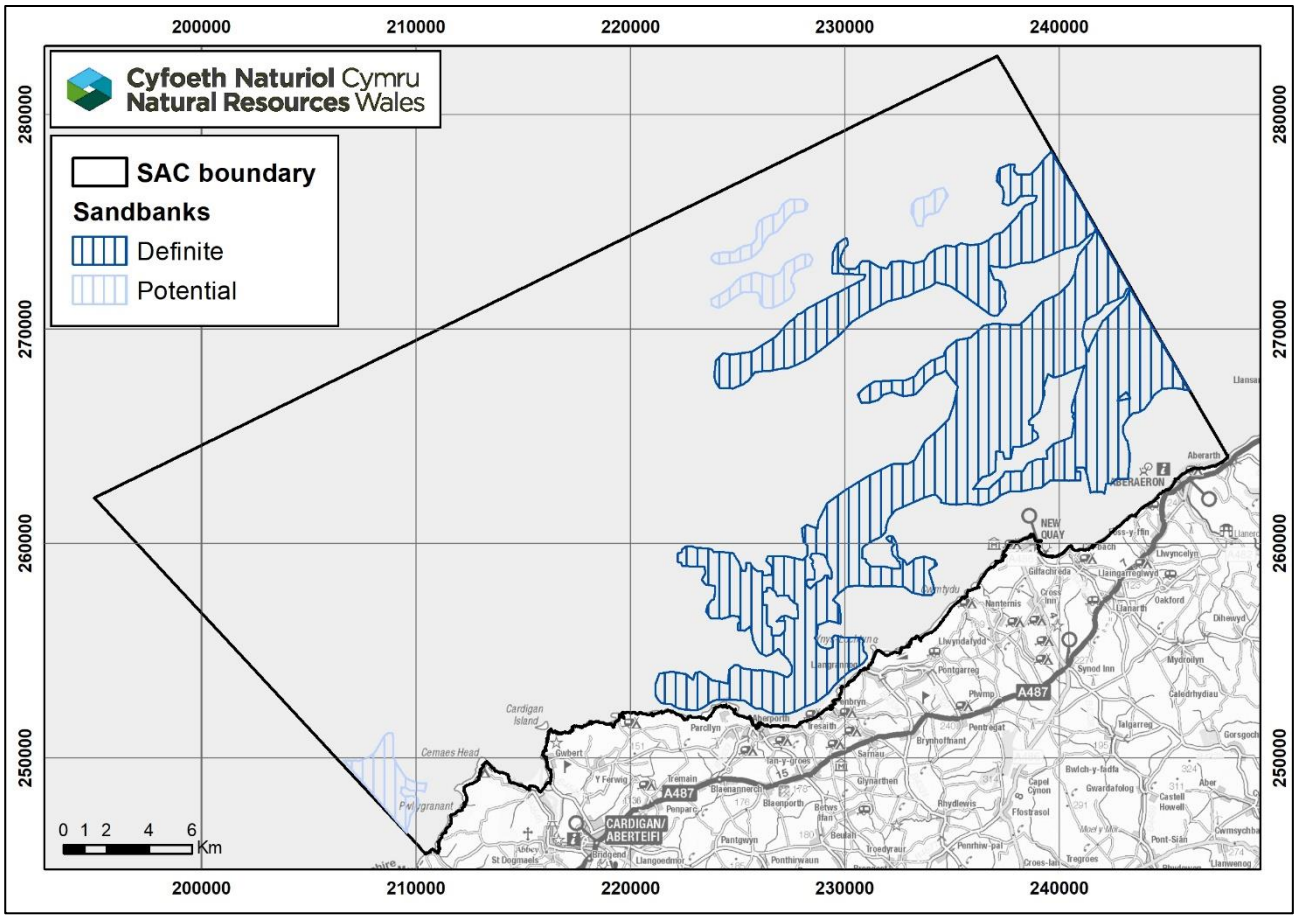
Contaminant levels are not thought to be having a detrimental impact on the grey seal population of the SAC at the time of writing, but are considered to pose a threat. For more information see the latest condition assessment (Cuthbertson et al., 2025b).

3.5. Feature 5: Sandbanks covered by seawater all the time

The sandbanks covered by seawater all the time (sandbanks) feature within Cardigan Bay SAC is currently in **favourable** condition (medium confidence). NRW published the latest condition assessment in June 2025. NRW will review these conservation objectives when new condition assessment information is available.

Figure 4 is a map of the location of the sandbank feature within Cardigan Bay SAC. The map is for indicative purposes only. Detailed maps for this feature in Wales can be found on Data Map Wales.

Figure 4. Map of the sandbanks feature within Cardigan Bay SAC.



Below are the attributes and targets for each conservation objective alongside supporting information.

Objective 1: The overall distribution and extent of the sandbanks feature within the SAC is stable or increasing, subject to natural change.

Objective attribute	Site specific target
1a. Feature extent and distribution	Maintain the extent and distribution of each of the sandbanks that form the sandbanks feature.

Supporting information

1a. Feature extent and distribution

The extent describes the presence and area of the habitat across the whole site, even where it is patchy. The distribution describes the more detailed locations and pattern of different habitats that comprise the feature across the site.

The sandbanks of the Cardigan Bay SAC are of sub-type gravelly and clean sands. The parameters used to define Annex I sandbanks have changed since the SAC was designated. Annex I sandbanks are now only present in the north-eastern end of the site, to the north and west of New Quay. There have been a few general studies in the bay that have sampled the sand bank areas and only one dedicated survey of sandbank habitat. Reefs and sandbanks may occasionally overlap in this site. This is due to the mobile nature of the seabed meaning that sediment may move from time to time (e.g. seasonally or after storm events) to either cover or expose rocky areas beneath. The precise extent of sandbank features within the SAC is unknown; however the general location of known subtidal sandbanks is shown in the feature map.

The extent and distribution attribute of the sandbanks feature is being met, allowing a maintain target to be set for objective 1a. See the latest condition assessment for more information (Jackson-Bue et al., 2025b).

Objective 2: The hydro-morphological and chemical elements necessary for the structure and function of the sandbanks feature are stable or improving, subject to natural change.

Objective attribute	Site specific target(s)
2a. Water and sediment quality	Contaminants are at levels not detrimental to the structure and function of the sandbanks feature. Nutrients are at levels not detrimental to the structure and function of the sandbanks feature. Physicochemical characteristics are at levels not detrimental to the structure and function of the sandbanks feature.
2b. Hydro-morphology	The characteristic hydrodynamics, sediment transport and morphology necessary for the structure and function of the sandbanks feature are sustained.
2c. Sediment supply	The sediment type, size distribution and budget necessary for the structure and function of the sandbanks feature is sustained.

Supporting information

2a. Water and sediment Quality

Various contaminants are known to affect species living within the water column and in or on the surface of sediments. The biological effect of a contaminant will vary depending on its nature. Contaminants include, but are not limited to, heavy metals (e.g. mercury and zinc), polybrominated diphenol ethers (PBDEs), poly-aromatic hydrocarbons (PAHs), poly-chlorinated biphenyls (PCBs) and organotin and pesticides such as hexachlorobenzene. These chemicals (e.g. heavy metals) can degrade community structure and bioaccumulate within organisms, entering the marine food chain (e.g. PCBs) (OSPAR Commission, 2012).

Much of the sandbank feature lies outside of the one nautical mile sampling regime. Dilution effects of chemicals are likely. While it is not known how contaminants accumulate in sandbank sediment, it is likely to be minimal due to the coarse and mobile nature of the sand.

High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms. These blooms can lead to reduced dissolved oxygen availability especially in warmer months. This can have lethal and sub-lethal impacts on sensitive fish, epifauna and infauna communities (Best et al., 2007). Sandbanks are at

lower risk from issues caused by excess nutrients due to their subtidal nature and being further away from the shore where inputs are diluted.

Physicochemical characteristics include salinity, pH, temperature, dissolved oxygen and turbidity. They affect habitats in terms of the abundance, distribution and composition of communities present. Changes in any of these properties, because of anthropogenic activities, may impact habitats and the communities they support.

Some water quality issues have been identified for this feature. For the information on water and sediment quality see the latest condition assessment report (Jackson-Bué et al., 2025b).

2b. Hydro-morphology

Hydro-morphology refers to patterns of water movement (caused by waves, wind, tides and fluvial input) coastal processes (e.g. erosion and deposition), and the physical characteristics of the environment. Waves and currents move sediment, which can change the shape of the seabed, which in turn changes waves and currents; in other words there is two-way feedback between the hydrodynamics and the morphology. Hydro-morphology plays an important role in determining the species and communities present.

The subtidal sandbanks of Cardigan Bay SAC vary considerably throughout the SAC according to sedimentology, seabed structure, bathymetry and hydrodynamics. The sandbank feature illustrates the variation between exposed (as these sandbanks are) and less exposed (to prevailing winds and weather) sandbanks. Their orientation is primarily dictated by the direction of the dominant tidal streams.

Sandbanks often have smaller rhythmic morphological features (described as ripples, mega-ripples or sand waves depending on length scales) superimposed on the bank morphology. These smaller features are important to water flow and sediment transport around or over the sandbanks.

No hydro-morphology issues have been identified for this feature. See the latest condition assessment for information (Jackson-Bué et al., 2025b). Information on the hydro-morphology of the SAC can be found in Appendix 1.

2c. Sediment supply

The size, shape, aspect and orientation, as well as the macro- and micro-topography and sediment characteristics of sandbanks are largely determined by the sediment supply and the influence of the hydrodynamic processes affecting each bank. They change shape over time and while some are ephemeral, most large banks are relatively stable and long-established. Mobile sediments that form temporary sandbanks are associated sediments that should be retained in the system, although their location may change.

Very limited data are available on the sedimentology of this feature in this site. The micro-distribution of sediments within the larger banks appears likely to be highly dynamic, while the gross distribution of the main banks themselves appears quite stable and stability is likely to increase with depth. The sandbanks are generally more sorted towards their crest with more mixed sediments towards their base. Sediments sampled in detail include banks in the New Quay area where they range from coarser-fine sand through to sandy gravel in the western part. The seaward side has a more mixed muddy sandy gravel substratum.

The dune, wave and ripple microtopography of sandbanks are important sandbank micro-niches that contribute to habitat and species diversity.

Sediment budgets and transport are often on a regional scale, and therefore projects outside the SAC can still alter the sediment supply to features within the site. No sediment supply issues have been identified for this feature. See the latest condition assessment for information (Jackson-Bué et al., 2025b). Information on the sediment transport in the SAC can be found in Appendix 1.

Objective 3: The abundance, distribution and diversity of species within component habitats and communities necessary for the structure and function of the sandbanks feature are stable or improving, subject to natural variability.

Objective attribute	**Site specific target**
3a. Habitats and communities	Maintain the abundance, distribution and diversity of species within habitats and communities necessary for the structure and function of the sandbanks feature.
3b. Non-native species	Introduction or spread of new non-native species to the SAC by anthropogenic activities should not have a detrimental impact on the structure and function of the sea caves feature

Supporting information

3a. Habitats and communities

Biological processes and interactions such as competition and predation play an important structural and functional role in influencing the assemblages of marine species associated with the subtidal sandbanks feature throughout the SAC.

Species richness is higher in deeper, more heterogeneous sediments toward the lowest extremities of the banks and where there is less exposure to waves and currents. It is lowest in the dynamic well-sorted sands on the crest of the banks. Species colonising sandbanks provide a rich food source for birds and fish. Infauna of surveyed banks is dominated by polychaete worms, crustaceans, molluscs, bristleworms and nemerteans. Sandeels are also present, which burrow in the sandbanks diurnally and during their winter hibernation. They form an important part of the infaunal and epifaunal community of the sandbanks feature. Other benthic fish species such as gobies, some flatfish, skates and rays and weevers inhabit sandbanks and form an important part of the epifauna and food web of the sandbanks feature of the site.

The prevalent sandy community type along the Cardigan Bay coast is a ‘shallow *Venus* community’ or an ‘offshore sand association’. Due to the varied sediments the communities correspond with a variety of biotopes, including affinities with the shallow sand faunal communities. The west New Quay bank has a very rich and diverse range of

taxa, mainly due to the coarse sands at the seaward side of the bank (Darbyshire et al., 2002). More information on the communities in the Cardigan Bay sandbanks can be found in Appendix 1.

The habitats and communities attribute of the sandbanks feature is being met, allowing a maintain target to be set for objective 3a. See the latest condition assessment for more information (Jackson-Bué et al., 2025b).

3b. Non-native species

Non-native species (NNS) may become invasive non-native species (INNS) and displace native species by predating them or out-competing them for food, space or both. This can lead to the loss of indigenous species from certain areas or changes to community structure (JNCC, 2004; Levin et al., 2002), as well as changes to biotope and habitat type. The introduction of INNS to the SAC, or spread of INNS within the SAC, can occur through various regulated and unregulated pathways. Further information on introduction pathways can be found on the GB non-native species secretariat website.

INNS are not currently impacting the sandbanks feature in Cardigan Bay. For more information see the latest condition assessment (Jackson-Bué et al., 2025b). Information on INNS in the SAC as a whole can be seen in Appendix 1.

3.6. Features 6 and 7: River lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus*

The river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* features within Cardigan Bay SAC are currently in **favourable** condition (medium confidence). NRW published the latest condition assessment in June 2025. NRW will review these conservation objectives when new condition assessment information is available.

Below are the attributes and targets for each conservation objective alongside supporting information.

Objective 1: The river and sea lamprey populations that use the SAC are maintained in favourable condition and are stable or increasing in the long-term.

Objective attribute	**Site specific target**
1a. Population	Maintain the river and sea lamprey populations relevant to the SAC to favourable condition.
1b. Anthropogenic mortality	Anthropogenic mortality is not having a detrimental impact on the river and sea lamprey populations that use the SAC.

Supporting information

1a. Population

The population of river and sea lamprey in the Cardigan Bay SAC will be made up predominantly of fish from the Teifi and Aeron rivers. River lampreys from other rivers nearby to the Cardigan Bay SAC (such as the Ystwyth, Rheidol, Goodwick Brook and Nevern) may also provide a limited contribution to the river lamprey population of the SAC given their relatively small home range during their marine residency phase.

Sea lampreys from other rivers around Cardigan Bay (as listed above) and potentially farther afield are also likely to be present in the Cardigan Bay SAC given their wider home range during their marine residency and feeding phase, and so are likely to provide a greater contribution to the SAC population than for river lamprey. However, the Teifi and Aeron rivers still provide the largest contributing rivers to the SAC population of sea lamprey.

River and sea lampreys are difficult to sample in the marine environment. Inferences about the status of the river and sea lamprey populations in the Cardigan Bay SAC are based on condition monitoring of the Afon Teifi SAC, which assesses the extent and density of juvenile lampreys, augmented by other data if available. Both river and sea lamprey are considered to be present in good numbers in the Teifi SAC. While there is no monitoring of

either species within Cardigan Bay SAC itself the populations are considered to be favourable and stable (Wynter et al., 2025). Therefore the population attribute is being met, allowing a maintain target to be set for objective 1a. for more information see the latest condition assessment (Wynter et al., 2025).

1b. Anthropogenic mortality

Anthropogenic mortality may include but is not limited to,

- Entrapment - fish entering water intake systems of water abstractions or dredgers and either being trapped on screens (impingement) or passing through screens and the works and re-entering the environment in water discharge outfalls (entrainment);
- Targeted exploitation – fisheries catching specific species intentionally, and using specific methods, fishing areas and times to do so;
- By-catch – fisheries catching specific species unintentionally, through use of methods, fishing areas and times which aim to catch other species but for which there remains a risk of catching the specific species.

Anthropogenic mortality affecting the population may include, but is not limited to, changes in numbers of fish or mortality rates in the population, changes in recruitment, productivity, spawning success or migration success across the population, and changes in age structures or size structures of the population.

There is no targeted exploitation of river or sea lamprey known to be taking place within the Cardigan Bay SAC, or in the river populations which contribute to the Cardigan Bay SAC population. Bycatch of river and sea lamprey within the Cardigan Bay SAC is understood to be low. However, there is limited data on bycatch, especially for unregulated fishing.

In Wales, all licenced abstractions have been assessed through Habitats Regulations Review of Consents process, the Eel Regulations, or Salmon and Freshwater Fisheries Act 1975 to ensure that all permitted abstractions are screened to minimise entrainment of fish. There are no major operations within the Cardigan Bay SAC known to be causing entrapment of river or sea lamprey (Wynter et al., 2025).

Objective 2: The river and sea lamprey that use the SAC continue to have unimpeded access to the habitats necessary to complete their life cycle.

Objective attribute	Site specific target
2a. Habitat connectivity	Maintain the connectivity and continuity of migration routes throughout the SAC and connected spawning locations for river and sea lamprey, allowing for natural change and variation.
2b. Anthropogenic disturbance	River and sea lamprey that use the SAC are not subject to significant anthropogenic disturbance.

Supporting information

2a. Habitat connectivity

Adult river and sea lampreys migrate through the Cardigan Bay SAC on their spawning migration to reach the Afon Teifi SAC and River Aeron. It is important that there are sufficient freshwater flows in rivers, and in to estuaries, to provide freshwater flow cues for migration, as migrating lampreys are understood to be attracted to the pheromones from other lampreys in freshwater, and to allow upstream migration to spawning grounds.

Juvenile river lampreys generally migrate into estuaries and inshore coastal waters after a period of growth as ammocoetes in freshwater. River lampreys from other rivers nearby to the Cardigan Bay SAC (such as the Ystwyth, Rheidol, Goodwick Brook and Nevern) may also provide a limited contribution to the river lamprey population of the SAC. Since river lampreys feed and grow in estuaries and inshore waters, it should be assumed that juveniles are present in the SAC throughout the year.

Juvenile sea lampreys migrate downstream after a period of growth as ammocoetes in freshwater and spend some time feeding in the estuary and inshore waters, with some moving offshore in search of larger prey. Sea lampreys from other rivers around Cardigan Bay and potentially farther afield may also provide a limited contribution to the sea lamprey population of the SAC (see objective 1a). Accordingly, various stages of sea lamprey should be assumed to be present all year round.

Some barriers have been identified within the River Teifi SAC, however they are not known to be significant obstacles to migration of river or sea lamprey as both species has been recorded up to the natural barrier at Cenarth waterfall. Therefore, the habitat connectivity attribute is being met, allowing maintain target to be set for objective 2a. for more information see the latest condition assessment (Wynter et al., 2025).

2b. Anthropogenic disturbance

Significant anthropogenic disturbance in this context is defined as activities which change the behaviours of lampreys in the short-term or long-term, at a level which could cause changes in numbers of fish or mortality rates in the population, changes in recruitment,

productivity, spawning success or migration success across the population, and changes in age structures or size structures of the population. Disturbance could come from, for example, noise and vibration, water quality changes, structures and/or electromagnetic fields.

There are no known sources of significant anthropogenic disturbance to river or sea lamprey in the Cardigan Bay SAC (Wynter et al., 2025).

Objective 3: There is sufficient habitat and food supply to support the river and sea lamprey population using the site in the long term.

Objective attribute	**Site specific target(s)**
3a. Water quality	Contaminants are at levels not detrimental to the condition of river and sea lamprey populations that use the SAC. Dissolved oxygen levels are at levels not detrimental to the condition of river and sea lamprey populations that use the SAC. Physicochemical characteristics are at levels not detrimental to river and sea lamprey populations that use the SAC.
3b. Prey availability	Maintain the quality, abundance and diversity of prey needed for the river and sea lamprey populations that use the SAC to be in favourable condition.
3c. Invasive non-native species	Invasive non-native species are not detrimental to the condition of river and sea lamprey populations that use the SAC.

Objective 3 supporting information

3a. Water quality

Various contaminants are known to affect species living within the water column and in or on the surface of sediments. The biological effect of a contaminant will vary depending on its nature but can lead to reductions in fitness or changes in olfactory senses. Contaminants include, but are not limited to, heavy metals (e.g. mercury and zinc), polybrominated dipheynol ethers (PBDEs), poly-aromatic hydrocarbons (PAHs), poly-chlorinated biphenyls (PCBs) and organotin and pesticides such as hexachlorobenzene (OSPAR Commission, 2012).

For the latest information on water quality see the latest condition assessment report (Wynter et al., 2025).

3b. Prey availability

During their marine phase, river lampreys are predominantly an estuarine and inshore coastal species, feeding parasitically. They feed on small fish such as herrings and sprats.

Sea lampreys are much larger and more oceanic, feeding in the same way as river lamprey, initially on similar species before switching to larger prey, including sharks and cetaceans (Silva et al., 2014). Juvenile sea lampreys have been suggested to prefer migratory species as prey in freshwater and estuarine environments, perhaps due to their larger size, and prey selection is positively correlated with lamprey size (Silva et al., 2014). At sea they appear not to be very selective and have been recorded feeding on at least 54 different species. They are not thought to be restricted to any specific habitat and are likely to follow prey; however, a preference for demersal species and sheltered locations has been suggested.

The status of preferred prey species within the SAC, and any potential contamination load of prey species, is unknown. Therefore a default maintain target has been set for objective 3b. For more information see the latest condition assessment (Wynter et al., 2025).

3c. Invasive non-native species

Non-native species (NNS) may become invasive non-native species (INNS) and displace native species by predating them or out-competing them for food, space or both. This can lead to the loss of indigenous species from certain areas or changes to community structure (JNCC, 2004; Levin et al., 2002), as well as changes to biotope and habitat type. The introduction or spread of NNS within the SAC can occur through various regulated and unregulated pathways. Further information on introduction pathways can be found on the GB non-native species secretariat website.

There are currently no INNS present in Cardigan Bay SAC that are a cause for concern for sea or river lamprey (Wynter et al., 2025). Information on INNS in the SAC as a whole can be seen in Appendix 1.

4. Advice on operations

NRW must provide advice to relevant authorities about operations that may cause,

- deterioration of designated natural habitats
- deterioration of the habitats of designated species
- the disturbance of designated species

This is statutory advice required by regulation 37(3b) of the Habitats Regulations.

This advice is to help relevant authorities direct and prioritise their management of activities that are of greatest threat to the features of the site. The advice given here is without prejudice to any advice provided in relation to the consideration of plans or projects within the meaning of Part 6 of the Habitat Regulations.

Activities operating at distance from the site may cause pressures that travel into the site. These external pressures may affect features within the SAC.

4.1. Operations which may cause deterioration or disturbance to the features of the site

Table 2 lists activities that have the potential to deteriorate or disturb the designated features of Cardigan Bay/ Bae Ceredigion SAC and if they are known to occur within the SAC.

This list of operations is not exhaustive. If an operation or activity is not listed in Table 2 it may still have the potential to deteriorate the features of the site. Activities occurring outside if the site may still have the potential to impact the features within the SAC. The occurrence information was correct at time of publication, but activities may have ceased or started since. Advice on individual operations should be sought on a case-by-case basis.

Additional information can be found on the Natural England's designated sites website and Marine Scotland's Feature Activity Sensitivity Tool (FEAST). It is important to note that NRW has not agreed sensitivity thresholds with either Natural England or Nature Scot and the information should be used as a general guide. Specific advice on operations should be sought from NRW on a case-by-case basis.

Table 2. Advice on operations for Cardigan Bay SAC.

Operation/ Activity	Occurrence in SAC
Dredging: Construction and maintenance, including disposal.	Dredging at Aberaeron in relation to flood protection and mechanical dredging and disposal at New Quay.
Shipping: Vessel traffic and maintenance (including antifouling).	Not occurring.
Shipping: Mooring and anchoring (commercial).	May occur rarely.
Shipping: Conventional and accidental discharges. (Including ballast water discharge, refuse, sewage, operational, petrochemical, cargo losses and salvage).	Possible in emergency.
Land claim (e.g. flood defence).	Some localised private sea defences.
Coast protection: both hard and soft defences (including sea walls, breakwaters, railways and foreshore deposit of rock, rubble, groynes, beach replenishment etc).	Ongoing flood defence works at Aberaeron. See relevant shoreline management plan.
Coast protection: Barrages (including storm surge, tidal and amenity).	Not currently present in the SAC.
Artificial reef.	Not currently present in the SAC.
Hard-engineered freshwater watercourses.	Not currently present in the SAC.
Power station.	Not currently present in the SAC.
Pipelines.	Not currently present in the SAC.
Power / communication cables	Not currently present in the SAC.

Operation/ Activity	Occurrence in SAC
Effluent disposal by vessels at sea: disposal of sewage, chemical, thermal and sludge dumping. Not CSOs.	NRW and DCWW datasets available on locations and inputs.
Miscellaneous wastes and debris (including refuse and litter).	Litter present in the sea from various sources.
Run-off: Agricultural, urban and industrial run-off.	Probably widespread and common around coastal populations and industry. Concentrated around estuaries.
Fishing: All trawling (Including beam, otter, toothed and any trawled gear).	Light otter trawling from vessels under 12m occurs in the SAC. Byelaws limit larger vessels from fishing within SAC.
Fishing: All dredging (including toothed, bladed, mechanical, hydraulic and any other great not listed).	Dredging for oyster is not known to occur. Scallop dredging is banned in the SAC with the exception of in the outer part of the site known as the Kaiser and Lambert box.
Fishing: All netting (including gill, tangle, trammel, seine, fyke and any other fishing with netted gear).	Multiple types of netting except demersal seine netting occurs throughout site, but location and effort information is unknown.
Fishing: All potting (including lobster, crab, prawn, whelk and any other fishing with potted gear).	Multiple types of potting occurs within the SAC, but location and effort information is unknown.
Fishing: All line fishing (including long-line and handline).	Line fishing occurs within the SAC, but location and effort information is unknown.
Fishing: All methods of hand gathering (including cockles, mussels, mussel seed, razor clam, bivalves, winkles, crustaceans, shellfish, algae and plants for human consumption and chemical extraction and biomass (excluding access issues).	Small amount of hand collection of species (Shellfish and seaweed) occurs within the SAC but extent of locations and intensity information is unknown.

Operation/ Activity	Occurrence in SAC
Fishing: Bait collection commercial and recreational (including digging, pump, boulder turning etc).	Digging occurs within the SAC but location and effort information is unknown.
Aquaculture: All forms of aquaculture (including algae, sea cages, impoundments, ranching, shellfish ropes and trestles and enclosed recirculation).	Possibility of future mussel and seaweed rope growing activity.
Water abstraction.	Not occurring
Aggregate extraction (including mineral and biogenic sands and gravels).	Not occurring
Oil and gas exploration: All oil and gas exploration activity (including seismic survey, drilling and discharges both operational and accidental).	Not currently present in the SAC.
Renewable energy generation: All forms of renewable energy (including tidal barrage and impoundments, tidal and wave energy, offshore wind both fixed and floating).	Not currently present in the SAC. Potential to occur in the future.
Oil spill response: All activities of responding to oil spills at sea and on shore (including chemical, physical and access).	Reactive only. No recent activity.
Recreation: Fishing (e.g. angling and spearfishing).	Occurs within the SAC but extent of locations and intensity information is unknown.
Recreation: Boating (e.g. power craft, sailing, canoeing, surfing, kite surfing, paddle boarding, etc).	Occurs within the SAC but extent of locations and intensity information is unknown.

Operation/ Activity	Occurrence in SAC
Recreation: Coastal activities (e.g. Scuba diving, snorkelling, dog walking, coasteering etc).	Occurs within the SAC but extent of locations and intensity information is unknown.
Recreation: Coastal access.	Occasional on areas of foreshore within SAC have vehicles on the foreshore in relation to launching of boats.
Recreation: Light aircraft.	Air traffic from various small airfields cross the SAC.
Recreation: Marine wildlife watching / eco-tourism.	Occurs in SAC. Dolphin watching boat trips operate out of New Quay.
Military activity: All forms of military activity (including ordnance ranges, marine exercises, aircraft etc).	Military range in Aberporth. Occasional military exercises in Irish sea RAF Valley airbase on Anglesey. Occasional aircraft (tornados) transit over SAC.
Marine archaeology and salvage.	Not known to be occurring at present.
Science and outreach: Education.	Occurs within the SAC but extent of locations and intensity information is unknown.
Science and outreach: Animal welfare operations and sanctuaries.	Occurs within the SAC but extent of locations and intensity information is unknown.
Science and outreach: Science research.	Occurs within the SAC but extent of locations and intensity information is unknown.

5. Climate change and Coastal Squeeze

5.1 Climate change vulnerability

Marine intertidal habitats are most at risk from climate change. Marine ecosystems will be impacted by climate change through both direct and indirect effects on the distribution and abundance of biotopes and species. Climate change pressures include, rising sea surface temperatures, sea level rise, ocean acidification, air temperature increases, deoxygenation, changes in salinity and increasing wave exposure. There are other pressures that have not been assessed such as those arising from the terrestrial environment for example increased river and land run off due to higher rainfall levels.

Climate induced changes could include irreversible impacts to ecosystems from loss of species, degradation of carbon sequestrating habitats (blue carbon habitats) leading to carbon being released and exacerbating the problem.

Below is a climate change profile for each Annex I habitat in the SAC. The profile summarises the climate change pressures each habitat is vulnerable to in this site, excluding sea caves although sea caves are likely to have similar vulnerabilities to both intertidal and subtidal reefs. The summary of impacts for all features can be seen in Table 3.

Table 3. Climate change summary indicating the climate change vulnerabilities for the features of the Cardigan Bay SAC. ASM = Atlantic Salt Meadows, LSIB = Large shallow Inlets and Bays. H = High vulnerability, M = Medium vulnerability, L = Low vulnerability, N/V = Not vulnerable.

Climate change pressure	Intertidal reefs	Subtidal reefs	Sandbanks
Air temperature	L	N/V	N/V
Deoxygenation	L	L	L
Ocean acidification	L	M	L
Salinity	L	L	L
Sea level rise	L	L	N/V
Sea temperature	L	L	M
Wave exposure	H	N/V	N/V

5.2 Coastal squeeze

Extensive work has been carried out (Oaten et al., 2024) regarding the extent to which sea-level rise may cause coastal squeeze and natural squeeze, an issue which affects intertidal habitats. Overall, this SAC is projected to lose 65% of its intertidal habitats (reef) by 2155 under an RCP 8.5 95th percentile sea-level rise scenario. In this SAC, the majority of the losses are due to natural squeeze rather than coastal squeeze because a significant proportion of the coast is natural rather than defended and land often rises quite steeply from the coast causing a natural constraint.

Intertidal Reefs

The predicted change in the extent of this habitat due to both coastal squeeze and natural squeeze is a loss of 18% (4 ha) by 2055, and a loss of 65% (16 ha) by 2155 under an RCP 8.5 95th percentile scenario, assuming that defences are managed in line with shoreline management plan policies (Oaten *et al.*, 2024).

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Appendix 1: Additional supporting information

Site Description

The Cardigan Bay SAC is sited off the south Ceredigion and north Pembrokeshire coast, in the southern part of Cardigan Bay. The landward boundary runs along the coast from Aberarth to Ceibwr just south of the Teifi Estuary, typically following the back of the shore or the first hedge line beyond the top of the cliff or coastal slope. The boundary of the site was determined to encompass the features for which the site was selected, primarily what was regarded as the main area of importance for the bottlenose dolphins; it is not a representation of the precise extent of any one feature. The site extends approximately twelve miles offshore and occupies approximately 960 km^2.

Geology

The geology of Cardigan Bay consists of an almost complete arc of Pre-Cambrian and Lower Palaeozoic rocks cradling a post-Palaeozoic sedimentary basin. It is oriented south-west to north-east extending from St. George's Channel to the coastline of Tremadoc Bay. The area was subject to periods of intense erosion during glaciations, at which time sediments were deposited, particularly in the Celtic Trough. Quaternary sediments almost completely cover Cardigan Bay, including the SAC.

Exposed boulders and bedrock mainly occur in regions dominated by strong tidal currents or wave action, such as headlands. The distribution and extent of the main intertidal rock types is well known, though the distribution and extent of subtidal rock types is incompletely known and largely inferred.

Within the SAC itself, steep cliffs and eroding banks of alternating layers of Ordovician slates, shale and sandstones, characterise the coastline. This geology along with prevailing hydrodynamics has a dominating effect on cave geomorphology. Rock structure, faulting and folding determine cave structure and axis of orientation. Combined with exposure, these determine erosion which modifies cave structure and function.

Sedimentology

Cardigan Bay SAC supports an extremely wide range of sediments, from well sorted, highly homogenous sands to well mixed muddy gravels, pebbles and cobble. The stable seabed in the western part of the SAC is largely sandy and gravely with occasional areas of mega ripples. The eastern and inshore areas are more variable, constituting mixed ground with areas of sand, mud, muddy gravels, pebble, cobble and boulder. The coastal areas are generally dominated by sands, but with some intrusions of gravel such as the area adjacent to New Quay.

Geomorphology

Cardigan Bay is a relatively shallow and gently sloping embayment of the Irish Sea, generally reaching 50 m only in the outer parts of the bay towards St. George's Channel. Most of the SAC is less than 30 m deep, with deeper areas off Aberporth and in the south

western part of the site. Due to the general shallowness, wind and wave action dominate the physical processes. The seabed is relatively level with gentle banks and troughs but there are areas of greater topographical interest, particularly closer to shore and in the vicinity of headlands.

The coast is dominated by rugged headlands, interspersed by bays and the Teifi inlet. Shores tend to become more rugged and rocky towards the southern end of the site, typically with sandy bays. Towards the north the headlands consist of softer rocks and the shores tend to be dominated by cobble, pebble and boulders. The geomorphology of this area is described in more detail within the West of Wales Shoreline Management Plan.

Hydrography and meteorology

The Irish Sea is a relatively enclosed body of water with moderate tidal ranges. In the southern part of Cardigan Bay, for example, mean spring tidal ranges are approximately 4-5 m. Tides in this area are predominantly semi-diurnal, with high and low water times getting progressively later further north. The tide enters the bay via St. George's Channel with a weak average flow northwards of both surface and bottom currents, running north during flood tides and south during the ebb.

Tidal currents are generally low within the bay (max 0.9 m/s) but locally variable, and little is known about water transport patterns. Currents are slightly stronger near headlands and estuaries with some of the strongest currents along the SAC coast run between Cardigan Island and the mainland.

The bay has a mainly open coastline, exposed to the prevailing south-westerly and westerly winds however as the Irish Sea is relatively sheltered, the majority of waves reaching the Cardigan Bay coast are locally generated, of fairly short period and therefore steep. A substantial swell develops during prolonged periods of high winds. During the winter when gales are common, the wave height exceeds 1 m for about half the time, compared to about a quarter of the time during the summer months. Depending on the wind direction, small embayments within the SAC may provide some shelter during stormy conditions in the areas of New Quay, Ynys Lochtyn, Aberporth, Mwnt and the Teifi estuary. The water masses are partly of coastal origin (Bristol Channel and southern Irish Sea circulation) with an oceanic input through the Celtic Sea. The general pattern of near-surface water movement in the Irish and Celtic Seas and south-western approaches indicates the possibility of a certain amount of water recirculation; this is of significance for larvae and spore dispersal. Water circulation is seasonally modified as a result of summer heating and stratification (density layering) in the Celtic and Irish Seas.

Parts of the Irish Sea have a marked seasonal variation in turbidity and this is particularly true in Cardigan Bay. During the summer suspended sediments settle out in the relatively calm bay whereas during the winter when winds increase, bottom sediments are mixed throughout the water column and produce turbid surface waters, particularly close to the coast. Turbidity of inshore waters is also strongly affected by outflow from the rivers such as the Aeron and Teifi, as well as smaller outflows. Sediments from the Gwaun and Nevern Rivers adjacent to the southern boundary of the site are also carried into the SAC by tidal currents, and together these turbid waters often form darker coloured bands that spread out from the estuaries and follow the line of the coast. Seasonal phytoplankton blooms temporarily increase particulate concentrations and decrease water clarity.

Water and sediment chemistry

Salinity within Cardigan Bay is influenced not only by incoming Atlantic water, but also by freshwater input from rainfall, run-off from rivers and estuaries within the bay as well as the Severn, and the effects of evaporation, currents and mixing. Surface salinities within the Bay in summer are generally less than 34 ppt, decreasing towards the shore. During the summer months when the inshore waters of Cardigan Bay are stratified, salinity also varies with depth with fresher water overlying more saline water, particularly near the mouths of rivers and estuaries. Rainfall into the Irish Sea contributes a volume of water equal to about one third of the riverine input. Cardigan Bay receives an average freshwater flow from rivers of 113 m^3s^{-1} with rivers adjacent to the SAC including the Aeron, Ina and Teifi, contributing the greatest input of freshwater into the SAC. Smaller streams and freshwater from the rivers Nevern at Newport and the Gwaun at Fishguard also affect salinity, particularly in the southern inshore waters of the SAC. River discharges are highly variable and the largest inputs to Cardigan Bay occur between December and February and the smallest in July.

The limited marine monitoring undertaken in Cardigan Bay has found the water quality to be in general good however sediment analysis has found significant levels of contaminants at several locations in the bay. The status of the water bodies within the SAC including levels of nutrients and chemicals is available on Water Watch Wales.

Sediment processes

Detailed sediment processes in the Irish Sea through St George's Channel are poorly known but inferred to be dominated by tidal current action on mainly coarse, relict or locally derived strong currents have prevented the accumulation of fine sediment. Long period wave action also has a major local modifying effect. There is a net westward transport of sediments from the Bristol Channel across and into southern Irish Sea. The sand fraction is transported near-bed and the muddier fractions in suspension, possibly resulting in different transport paths. Shoreline and near shore sediment process have been studied in more detail and are described within the West of Wales Shoreline Management Plan.

Species

Species interactions within the SAC are complex and inter-related. Bottlenose dolphin and grey seal, for example, are top predators and therefore are likely to be affected by changes at lower trophic levels in the food chain. These food chains extend beyond the confines of Cardigan Bay SAC, as both the dolphins and seals rely heavily on prey that spend much of their time outside the site and which, in turn, may interact with species populations some distance away. Impacts on biological interactions taking place some distance from the site may can therefore have a significant effect on these predators.

The abundance and range of bottlenose dolphins has declined over the past few centuries as a consequence of human activities. Current human activities have the potential to impact the bottlenose dolphins using the site. Activities include, disturbance (recreational), pollution (particularly organohalides), prey depletion (fisheries) and fisheries activities. These can directly or indirectly cause deaths, affect survivorship or reduce reproductive potential. The degree to which these damaging influences are currently significant in terms of site population maintenance is not known.

Invasive non-native species

Based on NRW records, there are very few noteworthy INNS (those listed as High or Medium on the Marine Invasive Non-native Species Priority Monitoring and Surveillance List) in this SAC. Those of concern for this SAC include the High risk species American slipper limpet *Crepidula fornicata*, where there is a record of a live specimen at a depth of approximately 20m close to the north of the SAC boundary. Another *Crepidula fornicata* record is also noted close the inshore SAC boundary at New Quay.

The medium risk species *Sargassum muticum* is the other species found at many locations along the intertidal and shallow subtidal area of the SAC, especially in rocky areas around New Quay and Aberaeron. Occurrence records can be found on the Wales INNS portal.

High impact INNS that pose a risk to the site, but are not currently recorded, are the carpet sea squirt *Didemnum vexillum* and American jack knife clam *Ensis leei* (Tillin and Pegg, in draft). The rapa whelk *Rapana venosa* has not been recorded in the UK to date, but is noted as a potential predator of shellfish, especially mussels, which has the potential to impact this site (Tillin et al., 2020).

Additional information for features of the site

General feature descriptions and ecological characteristics can be found on the JNCC habitats list and species list. Habitat definitions can be found in the European Union Interpretation Manual of Annex I habitats.

Reefs

Rocky reefs are extremely variable, both in structure and in the communities they support. They range from vertical rock walls to horizontal ledges, sloping or flat bedrock, broken rock, boulder fields, and aggregations of cobbles. Reefs are characterised by communities of attached algae and invertebrates, usually with a range of associated mobile animals. Algae tend to dominate the more illuminated shallow water and intertidal areas and animals the darker deeper areas. The specific communities vary according to a variety of factors such as, rock type, wave exposure, slope, aspect, and tidal streams.

There is less variation in biogenic reefs, but the associated communities can vary according to local conditions of water movement, salinity, depth and turbidity. In Cardigan Bay SAC the only biogenic reefs present are formed by the honeycomb worm *Sabellaria alveolata* and blue mussels *Mytilus edulis*. Records of *Sabellaria spinulosa* are present within the SAC, but it is unclear whether these form reefs. Biogenic reefs are often highly productive and may be important ecologically as feeding, settlement and breeding areas for many other species.

The majority of reef within Cardigan Bay SAC is moderately exposed, tideswept and often scoured mixed ground. The aggregations of consolidated and unconsolidated hard substrata (such as pebbles, cobbles and boulders) are intermixed with silts, sands and gravels. Although generally being sufficiently stable to support sessile organisms, the mobility of the reef structure and the scouring and smothering effects of the shifting sands and gravels have a strong influence on the habitat's community composition.

Large areas of reef surfaces are subject to intermittent or regular, long or short-term sediment cover depending on depth, topography, exposure to water movement and proximity to sediment sources. Overlying sediments vary from very fine deposits in wave and / or current sheltered locations to extremely coarse sands and fine shell gravel in current exposed offshore locations.

Communities

The diversity and type of wildlife communities found on reefs varies according to the nature and type of rock habitat present and is strongly influenced by a number of physical characteristics, in particular how exposed or sheltered a site is to wave action and tidal currents. Extremely exposed areas are dominated by a robust turf of animals such as sponges and anemones and, in shallower water, foliose red seaweed, while reefs in the most sheltered locations such as sea lochs and rias support delicate or silt-tolerant seaweed, fan-worms, sea squirts and brachiopods. Stronger tidal streams often increase species diversity, although some communities require very still conditions. Other physical, chemical and biological factors are also an important influence on reef communities, such as depth, clarity of the water, salinity, whether there is a lot of sediment nearby or held in suspension in the water and has a scouring effect and availability of food supply.

The spatial range of most species characteristic of reef habitat is extensive, though the habitat range of many, particularly highly specialised species, is restricted in distribution and / or extent. Because of the hydrodynamic regime and the continuous throughput of water masses of distant and varied origins, species are inferred to be likely to be both capable of recruiting from and contributing to recruitment from both nearby and distant populations. Many invertebrate species on reefs have planktonic juvenile stages and are likely to be at least partly dependant on recruitment from outside the site. The true ranges of apparently rare or scarce species are unknown.

Submerged or partially submerged sea caves

Caves in UK waters can vary in size, from only a few metres to more extensive systems, which may extend hundreds of metres into the rock. There may be tunnels or caverns with one or more entrances, in which vertical and overhanging rock faces provide the principal marine habitat. The UK has the most varied and extensive sea-caves on the Atlantic coast of Europe.

Cave morphology and topography and microtopography is strongly determined by the underlying geology and erosion processes and has an important influence on species present. Wave exposure also plays a large role in determining the species and communities present within a cave. Most caves are sheltered from currents inside while tidal streams outside can vary considerably. In the shallow sublittoral zone caves with boulder floors at and just below sea level are typically heavily scoured, with walls polished smooth by boulders thrown around by heavy wave action. However, microtopography can create niche diversity within caves by providing protection from scour allowing sessile organisms to colonise.

Within Cardigan Bay the seabed slopes gradually away from the coast in much of the area, and is comprised of mixed sediment, predominantly sand, and is easily churned up to add to the scouring action and heavy siltation which is characteristic of this area. There are a greater number of caves to the west of Ynys Lochtyn where the rock is more suitable

for cave formation and Cardigan Bay caves, particularly those at the western end of the site, can extend 100m into the cliff face due to the frequent vertical orientation of the rock layers

As physical conditions, such as inclination, wave surge, scour and shade, change rapidly from the cave entrance to the inner parts of a cave and this often leads to a marked zonation in the communities present. The combined effects of scour from suspended particulates and sediment and food particle supply is particularly important to the development, survival and diversity of cave species populations, especially in caves adjacent to sediment or with sediment floors.

Some of the Welsh sea-caves are used as pupping sites and resting by grey seals *Halichoerus grypus*. Particularly tall sea caves with dry ceilings are used as bat hibernation sites. All the sea caves in Welsh SACs are considered to be of significant conservation value.

Communities

Many sea caves provide highly favourable environmental conditions for key ecological structuring species (e.g. grazing molluscs, scavenging crustaceans). Sea caves also typically support species that seem out of place, because caves provide environmental conditions which differ from those immediately outside, for example sponges typical of deep-water in intertidal caves and mud dwelling anemones in sediments on the floor of caves in exposed rocky areas.

Stable boulders and bedrock on the lower shore portions of the cave floors in the Cardigan Bay area are colonised by *Sabellaria alveolata*. Although not often found as the large hummocks of honeycomb like tubes found on the open coast, the fresh growth of tubes in several of the caves reflect the turbid and sand-scoured conditions not found in caves in the other SACs in Wales.

Spirorbid worms *Verruca stroemia* and barnacles *Semibalanus crenatus* with patchy thin crusts of sponge including *Halichondria panicea*, *Myxilla incrustans* and other yellow encrusting sponge species and sparse anemones *Actinia equina*, cover the less scoured intertidal parts of the cave walls towards the backs of the caves. Barnacles, anemones and limpets are more common towards the cave entrance eventually merging with biotopes normally encountered on open wave-exposed rock all along this stretch of coast.

Above high water mark, deep inside the caves, the walls support little other than biotic films grazed by small molluscs such as the limpet *Patella vulgata*. Where scour from cave floor sediments is high there is generally a largely barren zone of bedrock just above the mobile boulder floor. On the roofs of the caves, if out of reach from main surge, spiders *Meta menardi* are found with thin crusts of bluegreen algae, green algae, red velvety patches of *Audouinella* sp. and lichens where small amounts of light reach the rocky surfaces.

Where cave walls have a lower shore and shallow subtidal section, for example on the south-west side of Cardigan Island and the east side of Cemaes Head, the sea squirt *Dendrodoa grossularia* is occasionally found at high densities, mixed with smaller patches of the white lace sponge *Clathrina coriacea*. These species are highly characteristic of wave-surge conditions. The most species-rich sections occur just below chart datum, 10-30 m into caves. Patches of bright yellow sponge *Aplysilla sulfurea* and red *A. rosea* and

Ophlitaspongia papilla are found on the walls, interspersed with colonial ascidians *Botrylloides leachii* and encrusting bryozoans such as *Flustrellidra hispida.*

Detailed information on communities recorded in sea caves in Cardigan Bay SAC can be found in a monitoring report from 2003 (Bunker and Holt, 2003).

The range of few cave-dwelling species is constrained by habitat requirements with most species living in sea caves being part of wider populations in nearby suitable habitats. Their distribution is mostly determined by recruitment from populations with widespread distributions both within and outside caves. A few cave specialists have a restricted distribution and are only known from few locations but it is unclear whether this is a function of survey effort or represents truly limited distribution. Species populations with genuinely restricted distribution are more vulnerable than those that may recruit from large, widespread populations.

Sandbanks which are slightly covered by sea water all the time

Subtidal sandbanks are dynamic features with their size, shape, aspect and orientation, as well as the macro- and micro-topography and sediment characteristics largely determined by the sediment supply and the influence of the hydrodynamic processes affecting each bank. They change shape over time and while some are ephemeral others may be relatively stable and long established. Mobile sediments that form temporary sandbanks are considered to be sediments that should be retained in the system but their location may change. The sandbanks of the Cardigan Bay SAC are of sub-type gravelly and clean sands.

Suspended particulate concentrations and water transparency are geographically and seasonally variable. Highest turbidity occurs during and following strong wave action, spring tides and heavy rainfall, typically in the winter months. There are also prolonged periods of low turbidity especially during spring and summer and in areas of weak tidal current streams. Whilst the exposed nature of the sites open coast sandbanks tends to minimise the presence of photosynthesising organisms such as *Zostera* spp, suspended fine particulates are relevant in terms of faunal feeding and respiration.

Sandbanks are important, not just for the range and variation of community types and species present, but for their influence on the wider structural integrity of the surrounding habitats.

Communities

The medium-fine sands of the sandbanks are often dominated by the polychaete worms *Mediomastus fragilis* and *Ampharete finmarchica (*previously *lindstroemi)*, and the crustacean *Bodotria arenosa*. The coarser, more mixed sediments show a different collection of species and greater species diversity. Two stations in coarser sediment on the west margin of a New Quay sandbank had 184 and 224 different taxa recorded in 0.2 m^2 (Darbyshire et al., 2002). Species found in large densities include the amphipod *Phtisica marina*, the tubeworm *Spirobranchus lamarcki,* and the Ross worm *Sabellaria spinulosa*. Species found in lesser numbers include the mollusc *Corbula gibba*, the rosy feather star echinoderm *Antedon bifida*, the polychaete worms *Nereis elittoralis* and *Caulleriella alata*, and the amphipod *Ampelisca tenuicornis*, along with many other species

and taxa that are often only found in mixed sediment environments. Uncommon polychaete worm species such as *Armandia polyophthalma* and the rare mantis shrimp *Rissoides desmaresti* have also been recorded here.

Appendix 2: Additional conservation interest

Sites of Special Scientific Interest (SSSIs)

- Aberarth
- Carreg Wylan
- Afon Teifi

Special Conservation Areas (SACs)

- Gorllewin Cymru Forol / West Wales Marine
- Afon Teifi / River Teifi

Section 7 and OSPAR threatened and declining habitats and species

that occur within this habitat. These are:

- Estuarine rocky habitats
- Intertidal Underboulder Communities
- Mussel beds
- *Sabellaria alveolata* reef
- Blue mussel bed
- Fragile sponge and anthozoan communities on subtidal rocky habitats
- Subtidal mixed muddy sediments
- *Arctica islandica*
- *Ostrea edulis*
- *Pleuronectes platessa*
- *Raja clavata*
- *Raja montagui*
- *Solea solea*