European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC)

Fourth Report by the United Kingdom under Article 17

on the implementation of the Directive
from January 2013 to December 2018

Supporting documentation for the
conservation status assessment for the habitat:

H8330 - Submerged or partially submerged sea caves

WALES

IMPORTANT NOTE - PLEASE READ

- The information in this document is a country-level contribution to the UK Report on the conservation status of this habitat, submitted to the European Commission as part of the 2019 UK Reporting under Article 17 of the EU Habitats Directive.
- The 2019 Article 17 UK Approach document provides details on how this supporting information was used to produce the UK Report.
- The UK Report on the conservation status of this habitat is provided in a separate document.
- The reporting fields and options used are aligned to those set out in the European Commission guidance.
- Explanatory notes (where provided) by the country are included at the end. These provide an audit trail of relevant supporting information.
- Some of the reporting fields have been left blank because either: (i) there was insufficient information to complete the field; (ii) completion of the field was not obligatory; and/or (iii) the field was only relevant at UK-level (sections 10 Future prospects and 11 Conclusions).
- For technical reasons, the country-level future trends for Range, Area covered by habitat and Structure and functions are only available in a separate spreadsheet that contains all the country-level supporting information.
- The country-level reporting information for all habitats and species is also available in spreadsheet format.

Visit the JNCC website, https://jncc.gov.uk/article17, for further information on UK Article 17 reporting.

Report on the main results of the surveillance under Article 17 for Annex I habitat types (Annex D)

NATIONAL LEVEL

1. General information

1.1 Member State	**UK (Wales information only)**
1.2 Habitat code	**8330 - Submerged or partially submerged sea caves**

2. Maps

2.1 Year or period	1975-2015
2.3 Distribution map	Yes
2.3 Distribution map Method used	Based mainly on extrapolation from a limited amount of data
2.4 Additional maps	No

BIOGEOGRAPHICAL LEVEL

3. Biogeographical and marine regions

3.1 Biogeographical or marine region where the habitat occurs	**Marine Atlantic (MATL)**
3.2 Sources of information	Bergmann M, Gutow L, Klages M. 2015. Marine Anthropogenic Litter. https://link.springer.com/content/pdf/10.1007%2F978-3-319-16510-3.pdf Brazier P. 2017. Sea caves Friog comparison 2004 2015 DPB. Unpublished NRW survey note on repeat survey of sea caves at Friog in 2015. Natural Resources Wales document. Bull JC, Borger L, Franconi N, Banga R, Lock KM, Morris CW, Newman PB, Stringell TB. 2017. Temporal trends and phenology in grey seal (Halichoerus grypus) pup counts at Skomer, Wales. NRW Evidence Report No: 217, 23pp, Natural Resources Wales, Bangor Bunker FStPD, Holt RHF. 2003. Survey of Sea Caves in Welsh Special Areas of Conservation 2000 to 2002. A report to the Countryside Council for Wales by MarineSeen, Pembrokeshire. CCW Marine Monitoring Report No: 6, 184pp. Burdon D, Boyes S. 2009. Intertidal monitoring of sea caves in Pen Llyn a'r Sarnau SAC, 2004. CCW Marine Monitoring Report No 54. Burton M, Lock K, Newman P, Jones J. 2014. Skomer Marine Nature Reserve Project Status Report 2013 Burton M, Lock K, Newman P, Jones J. 2016. Skomer Marine Conservation Zone Project Status Report 2015. NRW Evidence Report No. 148. Countryside Council for Wales. 2013. Article 17 reporting GIS processing notes sea caves. Unpublished document, now held as Natural Resources Wales document. Edwards P. 2014. Nutrient concentrations in the Milford Haven catchment area. Tech. memo: TMW14-09 Natural Resources Wales. NRW. Environmental Protection (Microbeads) (Wales) Regulations 2018 was voted on and passed by the Welsh Assembly in June 2018 (http://www.assembly.wales/laid documents/sub-ld11558-em/sub-ld11558-em-e.pdf) - Explanatory Memorandum prepared by the Department for Economy, Skills and Natural Resources and laid before the National Assembly for Wales on the 18th May 2018. European Commission (2000) The EU Water Framework Directive http://ec.europa.eu/environment/water/water-framework/index_en.html European Commission (1992) The Habitats Directive (1992) http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm

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HM Government (1981) Wildlife and Countryside Act 1981 https://www.legislation.gov.uk/ukpga/1981/69/section/14
HM Government (1989) Electricity Act 1989 (Section 36) https://www.legislation.gov.uk/ukpga/1989/29/section/36
HM Government (2008) Planning Act 2008 https://www.legislation.gov.uk/ukpga/2008/29/part/3/crossheading/energy
HM Government (2009) Marine and Coastal Access Act 2009 https://www.legislation.gov.uk/ukpga/2009/23/contents
HM Government (2010) The Single Use Carrier Bags Charge (Wales) Regulations 2010 http://www.legislation.gov.uk/wsi/2010/2880/contents/made
HM Government (2017) The Conservation of Habitats and Species Regulations 2017 http://www.legislation.gov.uk/uksi/2017/1012/contents/made
HM Government (2017) Wales Act 2017 http://www.legislation.gov.uk/ukpga/2017/4/section/39/enacted
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NRW. 2018b. Cardigan Bay / Bae Ceredigion Special Area of Conservation: Indicative site level feature condition assessments 2018. NRW Evidence Report Series, Report No: 226, 39pp, NRW, Bangor.
NRW. 2018c. Y Fenai a Bae Conwy / Menai Strait and Conwy Bay Special Area of Conservation: Indicative site level feature condition assessments 2018. NRW Evidence Report Series, Report No: 232, 33pp, NRW, Bangor.
NRW. 2018d. Pen Llyn a`r Sarnau / Lleyn Peninsula and the Sarnau Special Area of Conservation: Indicative site level feature condition assessments 2018. NRW Evidence Report Series, Report No: 234, 58pp, NRW, Bangor.
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4. Range

4.1 Surface area (in km²)	
4.2 Short-term trend Period	
4.3 Short-term trend Direction	Stable (0)
4.4 Short-term trend Magnitude	a) Minimum b) Maximum
4.5 Short-term trend Method used	
4.6 Long-term trend Period	

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4.7 Long-term trend Direction 4.8 Long-term trend Magnitude	a) Minimum	b) Maximum
4.9 Long-term trend Method used		
4.10 Favourable reference range	a) Area (km²) b) Operator c) Unknown d) Method	No
4.11 Change and reason for change in surface area of range	No change The change is mainly due to:	
4.12 Additional information		

5. Area covered by habitat

5.1 Year or period	1975-2015		
5.2 Surface area (in km²)	a) Minimum	b) Maximum	c) Best single value
5.3 Type of estimate	Best estimate		
5.4 Surface area Method used	Based mainly on extrapolation from a limited amount of data		
5.5 Short-term trend Period	2007-2018		
5.6 Short-term trend Direction	Stable (0)		
5.7 Short-term trend Magnitude	a) Minimum	b) Maximum	c) Confidence interval
5.8 Short-term trend Method used	Based mainly on expert opinion with very limited data		
5.9 Long-term trend Period	1994-2018		
5.10 Long-term trend Direction	Decreasing (-)		
5.11 Long-term trend Magnitude	a) Minimum	b) Maximum	c) Confidence interval
5.12 Long-term trend Method used	Based mainly on expert opinion with very limited data		
5.13 Favourable reference area	a) Area (km²) b) Operator c) Unknown d) Method	No	
5.14 Change and reason for change in surface area of range	No change The change is mainly due to:		
5.15 Additional information			

6. Structure and functions

6.1 Condition of habitat	a) Area in good condition (km²)	Minimum 0.0507	Maximum 0.0507
	b) Area in not-good condition (km²)	Minimum 0.0362	Maximum 0.0362
	c) Area where condition is not known (km²)	Minimum	Maximum
6.2 Condition of habitat Method used	Based mainly on extrapolation from a limited amount of data		
6.3 Short-term trend of habitat area in good condition Period	2007-2018		

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6.4 Short-term trend of habitat area in good condition Direction	Uncertain (u)	
6.5 Short-term trend of habitat area in good condition Method used	Based mainly on expert opinion with very limited data	
6.6 Typical species	Has the list of typical species changed in comparison to the previous reporting period?	No
6.7 Typical species Method used		
6.8 Additional information		

7. Main pressures and threats

7.1 Characterisation of pressures/threats

Pressure	Ranking
Mixed source marine water pollution (marine and coastal) (J02)	M
Residential or recreational activities and structures generating marine macro- and micro- particulate pollution (e.g. plastic bags, Styrofoam) (F22)	M
Industrial or commercial activities and structures generating marine macro- and micro- particulate pollution (e.g. plastic bags, Styrofoam) (F23)	M

Threat	Ranking
Mixed source marine water pollution (marine and coastal) (J02)	M
Residential or recreational activities and structures generating marine macro- and micro- particulate pollution (e.g. plastic bags, Styrofoam) (F22)	M
Industrial or commercial activities and structures generating marine macro- and micro- particulate pollution (e.g. plastic bags, Styrofoam) (F23)	M
Roads, paths, railroads and related infrastructure (e.g. bridges, viaducts, tunnels) (E01)	M

7.2 Sources of information

7.3 Additional information

8. Conservation measures

8.1 Status of measures	a) Are measures needed?	Yes
	b) Indicate the status of measures	Measures identified and taken
8.2 Main purpose of the measures taken	Maintain the current range, population and/or habitat for the species	
8.3 Location of the measures taken	Both inside and outside Natura 2000	
8.4 Response to the measures	Medium-term results (within the next two reporting periods, 2019-2030)	
8.5 List of main conservation measures		

Reduce impact of mixed source pollution (CJ01)

Reduce/eliminate marine contamination with litter (CF08)

Reduce impact of transport operation and infrastructure (CE01)

8.6 Additional information	

9. Future prospects

9.1 Future prospects of parameters	a) Range b) Area c) Structure and functions
9.2 Additional information	

10. Conclusions

10.1. Range	
10.2. Area	
10.3. Specific structure and functions (incl. typical species)	
10.4. Future prospects	
10.5 Overall assessment of Conservation Status	
10.6 Overall trend in Conservation Status	
10.7 Change and reasons for change in conservation status and conservation status trend	a) Overall assessment of conservation status No change The change is mainly due to: b) Overall trend in conservation status No change The change is mainly due to:
10.8 Additional information	

11. Natura 2000 (pSCIs, SCIs, SACs) coverage for Annex I habitat types

11.1 Surface area of the habitat type inside the pSCIs, SCIs and SACs network (in km² in biogeographical/ marine region)	a) Minimum b) Maximum c) Best single value
11.2 Type of estimate	Best estimate
11.3 Surface area of the habitat type inside the network Method used	Based mainly on extrapolation from a limited amount of data
11.4 Short-term trend of habitat area in good condition within the network Direction	Uncertain (u)
11.5 Short-term trend of habitat area in good condition within network Method used	Based mainly on expert opinion with very limited data
11.6 Additional information	

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12. Complementary information

12.1 Justification of % thresholds for trends

12.2 Other relevant information

Distribution Map

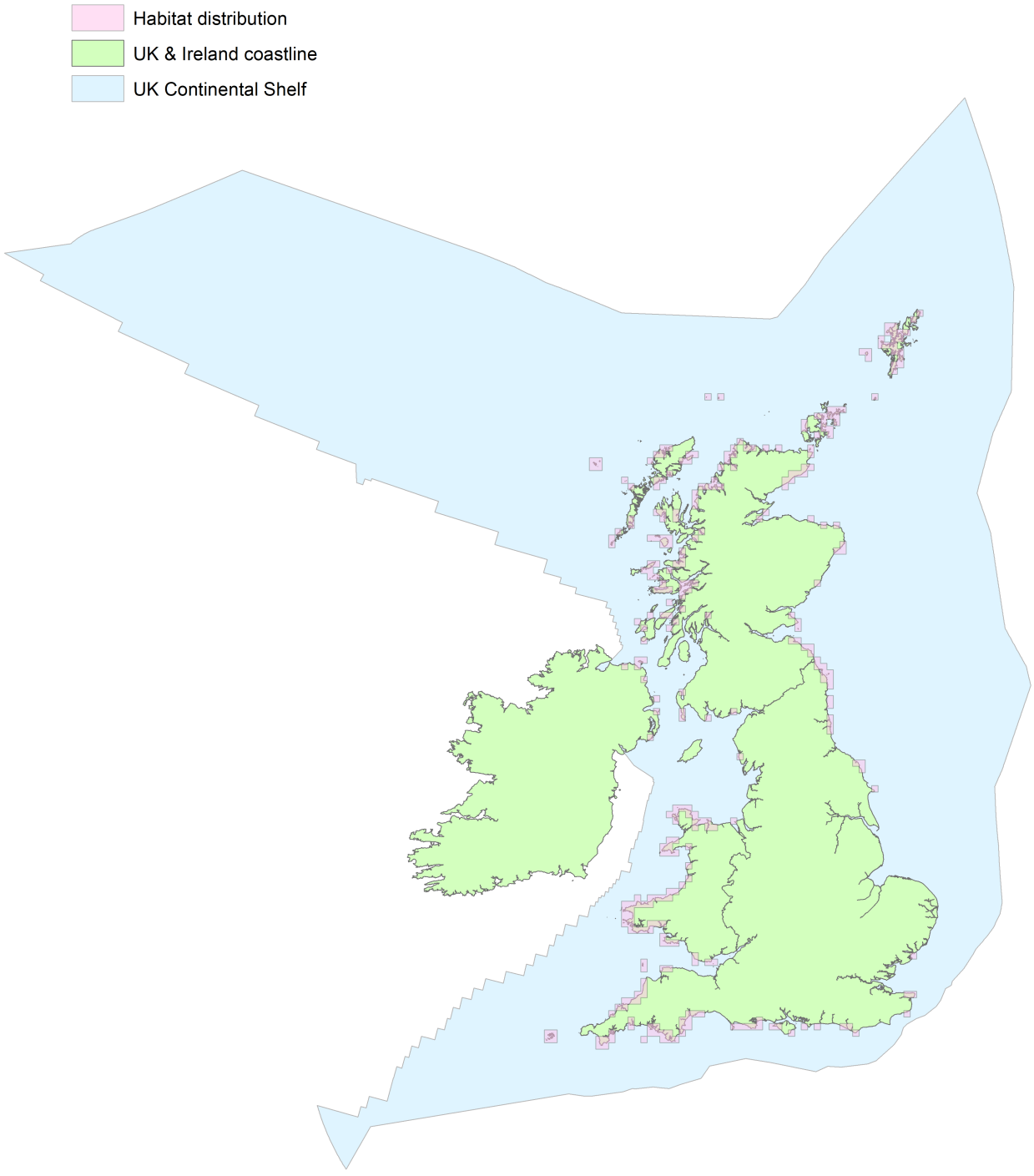

Figure 1: UK distribution map for H8330 - Submerged or partially submerged sea caves.

The 10km grid square distribution map is based on available habitat records which are considered to be representative of the distribution within the current reporting period. For further details see the 2019 Article17 UK Approach document.

Range Map

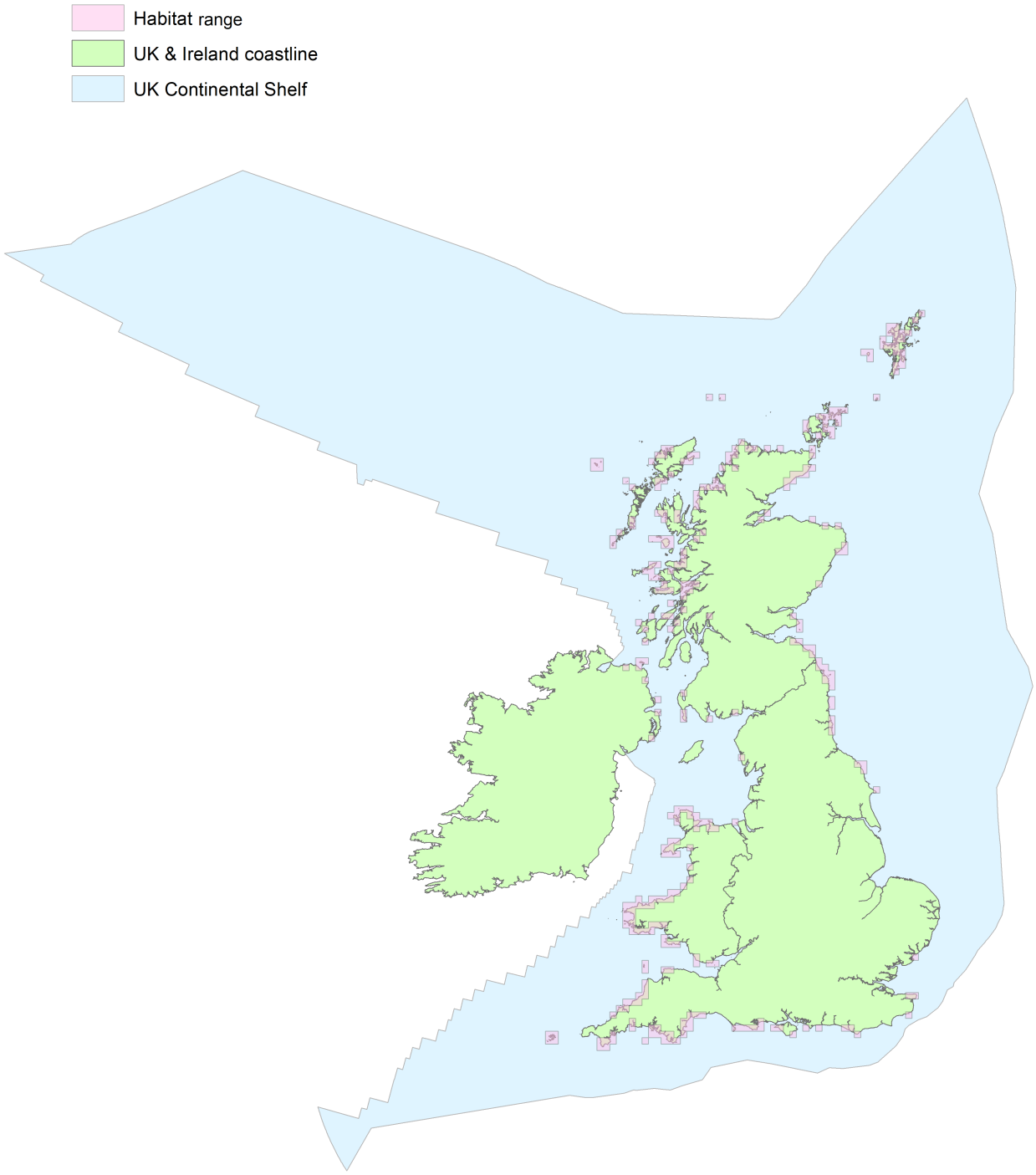

Figure 2: UK range map for H8330 - Submerged or partially submerged sea caves.

Sea caves are physiographic features and so their range is determined primarily by geomorphological and hydrographic processes occurring over long time-scales and is not related to biological communities or processes supported by communities. Therefore, the range was considered equivalent to the distribution and was calculated from the distribution map, but additionally included areas that had the potential for the habitat to occur based on an understanding of seabed geology.

Explanatory Notes

Habitat code: 8330

Field label	Note
2.1 Year or period	No exhaustive survey of sea caves has ever been undertaken in Wales, and of those that have been identified, very few have been studied in detail. Sections of rocky cliffy coast, where individual caves have been identified, have been assumed to support caves along their entire length. Phase 1 intertidal surveys (Wyn et al., 2006) supplied positions for some caves and some sections of cliffy coastline have been assumed to support sea caves where the high-water mark reaches above the base of the cliff. Neither the point data (mostly Phase 1) nor line data is exhaustive (NRW, 2013b). Some sections of coast that may contain sea caves remain un-surveyed for presence of caves. As natural change in cave distribution is considered unlikely to occur rapidly, all known records for caves have been included (back to at least 1975). However, consideration has been given to the potential for loss of caves through anthropogenic intervention (e.g. closed off during coastal defence works).

Habitat code: 8330 Region code: MATL

Field label	Note
4.3 Short term trend; Direction	There were insufficient data to have a directly measured trend. However, checks with regional staff dealing with coastal development and other casework revealed no evidence of cave losses during the stated period. Short term trend in Cave range is therefore assumed to be stable.
4.11 Change and reason for change in surface area of range	There has been no change to the welsh 10 km2 distribution reported here from that submitted in support of the 2013 article 17 report. During the current reporting period (2013-2018), there have not been any reported cases of reduction in cave habitat range.
5.1 Year or period	As natural change in cave extent and distribution is considered unlikely to occur rapidly, all known records for caves have been included (back to at least 1975). However, consideration has been given to the potential for loss of caves through anthropogenic intervention (e.g. closed off as a result of coastal defence works and infrastructure protection).

5.3 Type of estimate	We have no true value for the plan area of sea caves, nor is it likely that we ever will. No exhaustive survey of sea caves has ever been undertaken in Wales, and of those that have been identified and georeferenced, very few caves have been studied in any detail. The main reasons for this lack of study is that caves are usually remote and often almost inaccessible, therefore costs in terms of survey time and resources are high. For example, Bunker & Holt (2003) describe intertidal and subtidal sea cave surveys that took place between 2000 and 2002 within Welsh Special Areas of Conservation (SACs). These surveys involved 11 people, took 16 days and surveyed a total of 24 sea caves. These surveys included mapping and photographing caves, a detailed inventory of species and biotopes present and the installation of permanent monitoring equipment within the caves (Bunker & Holt, 2003). Therefore, the figure in section 5.2 should be treated with caution and is of very low confidence. It is likely only a small proportion of sea caves present in Wales have ever been recorded. Using the same method as in the 2013 sea cave report (NRW, 2013a, NRW, 2013b), the figure shown in section 5.2 was calculated by giving each known cave a standard area value of 100m2, which approximates to an 'average cave' of 10 meters depth and circular cross-section of 3 meters (diameter). The total number of recorded caves (869), although likely a gross under estimation of the total, was then multiplied by the average cave area to give an overall surface area value presented in section 5.2. Caves tend to occur along or above the highwater mark of rocky cliff areas. Many marine GIS layers, such as SAC boundaries, use the mean highwater mark as the shoreward edge of the designation. This creates a problem when mapping vertical features such as caves as they often fall outside the boundary layer within the GIS and therefore it is not always clear from the GIS whether a cave is even situated within a SAC.
5.5 Short term trend; Period	default used
5.6 Short term trend; Direction	There was insufficient data to directly measure trend. However, during the most recent Special Area of Conservation (SAC) feature indicative condition assessments, cave features within SACs were considered 'favourable' in terms of distribution and extent, and no activities were identified that directly impacted the sea cave feature condition (NRW, 2018a-g). Checks with regional staff dealing with coastal development and related casework, revealed no evidence of recent cave losses during the current short-term period. Although historic cave losses were noted prior to 2004 in the Pen Llyn a`r Sarnau / Lleyn Peninsula and the Sarnau SAC (Burdon & Boyes, 2009), a partial resurvey of the area in 2015 concluded no further losses had occurred (Brazier, 2017). Based on this evidence, the short-term trend in cave extent is assumed to be stable, and confidence is moderate to high.
5.9 Long term trend; Period	default used

5.10 Long term trend; Direction	Although the short-term trend direction was considered stable (section 5.6), Burdon & Boyes (2009) reported significant localised occurrences of historical cave infilling or modification relating to coastal defences and protection of railway infrastructure. They estimated as of 2004 (the year of the survey), 66% of caves were lost or modified within the 4 km coastal stretch between Friog and Llwyngwril in Gwynedd, north Wales. Although no specific dates were reported, it was estimated the losses had occurred in the few decades prior to 2004 (Burdon & Boyes, 2009). Following a second partial survey of this area in 2015, and subsequent comparison to 2004 data, Brazier (2017) concluded that no further losses to the cave feature had occurred since the 2004 survey, although some existing defences had been maintained. However, Brazier (2017) indicated a potential for further cave losses in this area due to the likely need of future coastal defences along the same stretch of coastline. Based on this evidence and expert opinion the long-term trend in cave extent was assessed as decreasing. The magnitude of the decrease is likely to be small as there are lots of caves and comparatively few are known to have been filled in. The confidence of this assessment is low based on the lack of cave extent data and the uncertainty of dates of historic cave losses.
6.1 Condition of habitat	We have no true value for the surface area of sea caves, whether good or bad habitat, nor is it likely that we ever will. No exhaustive survey of sea caves has ever been undertaken in Wales, and of those that have been identified and georeferenced, very few caves have been studied in any detail. The main reasons for this lack of study is that caves are usually remote and often almost inaccessible, therefore costs in terms of survey time and resources are high. For example, Bunker & Holt (2003) describe intertidal and subtidal sea cave surveys that took place between 2000 and 2002 within Welsh Special Areas of conservation (SACs). These surveys involved 11 people, took 16 days and surveyed a total of 24 sea caves. These surveys including mapping and photographing caves, a detailed inventory of species and biotopes present and the installation of permanent monitoring equipment within the caves (Bunker & Holt, 2003). Therefore, the figures above should be treated with caution and are of very low confidence. During the most recent Special Areas of Conservation (SAC) indicative condition assessment, all sea cave features were classed as favourable in terms of distribution and extent, unknown in terms of structure and function, unknown in terms of typical species and given an overall assessment of unknown (NRW, 2018a-g). Additionally, no widespread surveys of sea caves have been completed since 2002 (NRW, 2018a-g) and therefore it is difficult to assess the condition of this habitat in terms of structure and function. The only addition information available to assess sea caves that are not in 'good' condition is the outcome of WFD water quality assessments. These have been used, using the GIS, to draw conclusion about those sea caves that may be compromised by low water quality. The proportions of caves have then been adjusted to an area value using the same method as described in section 5.3 (NRW, 2013a, NRW, 2013b). All known caves were assigned an average surface area of 100 m2 (see section 5.3 for further details). The 507 caves (58%) located in WFD waterbodies classed as High and Good was multiplied by 100 m2 to provide an area in square metres of 'Good' habitat, this value was divided by a million to convert to km2. The same calculation was applied to the 362 (42%) caves located in Moderate or Poor waterbodies, providing the value for habitat classed as 'Not Good'. These figures should be treated with caution and are of very low confidence. Only a small proportion of sea caves present have ever been recorded accurately. Addittionally, WFD results from a sampling location may not be appropriate for cave features throughout the rest of the waterbody. There has not been the opportunity to verify that a WFD sampling location is appropriate to use for the feature across the spatial extent of the waterbody. For example, extensive tracts of north Cardigan Bay are 'not good' due to mercury levels, but no evaluation has been done to the appropriateness of this outcome, since the sampling location is likely to be a long way from some parts of the feature.

6.3 Short term trend of habitat area in good condition; Period	default period used
6.8 Additional information	Of the 869 caves identified and georeferenced throughout Wales (NRW, 2013a & NRW, 2013b), 12 caves were in WFD waterbodies classed overall in 2018 as 'High', 495 caves in waterbodies classed overall as 'Good', 361 in 'Moderate' and 1 cave in a waterbody classed overall as 'Poor'. In the absence of any cave monitoring or survey data, and assuming it is reasonable and correct to use WFD waterbody classifications to assess the habitat condition of seas caves, the above values equate to 58% of caves being classed as 'good' habitat (as defined in section 6.1) and 42% of caves as 'not good'. The Limestone Coast of South West Wales SAC contains significant hibernation sites for Rhinolophus ferrumequinum greater horseshoe bats at sites such as Castle Martin and Bacon Hole. The significance specifically of the sea caves for this species is unclear, due to the inaccessible nature of the caves (NRW, 2018f).

7.1 Characterisation of pressures/ threats	Pressures & Threats: J02: Mixed source marine water pollution (marine and coastal). Pressure: medium; Threat: medium There are multiple sources of pollution to the marine environment that are difficult to quantify and apportion. Open coast areas are relatively unpolluted, but many coastal areas have raised levels of nutrients and contaminants. Diffuse pollution is derived primarily from agricultural activities, with abandoned mines being the second likely cause of failure of a WFD waterbody (Edwards, 2014). The former is due to raised levels of nutrient (nitrogen and phosphorus) and sediment run off, whilst the latter is due to metal contamination. Waterbody failures due to diffuse nutrients from agriculture affect some areas, particularly Carmarthen Bay (NRW, 2013a). Low confidence on the levels of pressure and threat, due to the uncertainty of the significance of coastal pollution of the biological communities of sea caves. F22: Residential or recreational activities and structures generating marine macro- and micro- particulate pollution (e.g. plastic bags, Styrofoam). Pressure: medium; Threat: medium F23: Industrial or commercial activities and structures generating marine macro- and micro- particulate pollution (e.g. plastic bags, Styrofoam). Pressure: medium; Threat: medium Marine macro-pollution (e.g. plastic bags, lost fishing gear and other anthropogenically derived debris) tends to accumulate within sea caves, particularly those with an internal beach. There is a small increasing trend in marine litter on UK beaches (Nelms, 2017). Grey seals in Wales largely pup within caves and the pups and adults must negotiate this debris and may ingest, entangle or injure themselves in the process. Negative (and some negligible) impacts of ingestion of plastic have been observed on marine species but the research on the impacts of litter in the marine environment is in its infancy and impacts are poorly understood (Bergmann et al., 2015; Gall & Thompson, 2015; Galloway & Lewis, 2016). Further assessment of the impacts is required to aid understanding of the extent and the likely impact of litter on the functioning of animal communities, and recommendations of any appropriate management action. Monitoring, reporting and method development under MSFD and OSPAR will help increase knowledge and confidence in the future. E01: Roads, paths railroads and related infrastructure (e.g. bridges, viaducts, tunnels). Pressure: low; Threat: medium Historically, sea cave losses or modifications (i.e. caves closed off or filled in) appear to have been as a result of maintenance or creation of road and rail infrastructure (particularly railways), specifically to prevent or reduce erosion that may adversely affect such infrastructure. Casework, involving Network Rail, has aimed to avoid further cave infilling, such as that which has occurred along the coastal stretch between Friog and Llwyngwril in Gwynedd, north Wales (Brazier, 2017, Burdon & Boyes, 2009). With future sea level rise and continual erosion, it is anticipated that further caves will be in-filled to secure major infrastructure (Railway and roads), resulting in a medium threat. E03: Shipping lanes, ferry lanes and anchorage infrastructure (e.g. canalisation, dredging). Pressure: low; Threat: low Sea caves have been, or could potentially be, closed off or filled in to prevent or reduce erosion that may adversely affect port and harbour infrastructure. F08: Modification of coastline, estuary and coastal conditions for development, use and protection of residential, commercial, industrial and recreational infrastructure and areas (including sea defence or coast protection works and infrastructures). Pressure: low; Threat: low Sea caves have been, or could potentially be, closed off or filled in to prevent or reduce erosion that may adversely affect residential, commercial, industrial and recreational infrastructure, or caves near to urban areas that are considered to pose a health and safety risk. This is considered a low threat, due to the distribution of sea caves largely being away from residential, commercial, industrial or recreational infrastructure. F07: Sport, tourism and leisure activities outside the urban and recreational zones (e.g. outdoor sports, leisure aircrafts, drones, human trampling, wildlife watching). Pressure: low; Threat: low Recreational use of intertidal caves resulting in trampling and scouring of cave floor and sides. Although no evidence of direct impacts, concern has been raised due to increases in activities such as coasteering and climbing in Pembrokeshire and Pen Llyn a`r Sarnau. Although limited in

extent, increased recreational use of intertidal caves has the potential to disturb seals during the pupping season and disturb bats at all times of the year. The Limestone Coast of South West Wales SAC contains significant hibernation sites for Rhinolophus ferrumequinum greater horseshoe bats at sites such as Castle Martin and Bacon Hole. The significance specifically of the sea caves for this species is unclear, due to the inaccessible nature of the caves (NRW, 2018f). N04: Sea-level and wave exposure changes due to climate change. Pressure: low; Threat: low Climate-change related changes in sea-level and wave exposure have the potential to impact and affect the physical structure and biological communities of sea caves. Increased erosion from rising sea level and wave exposure can provide the opportunity for additional formation of caves, whilst destroying others. It is therefore anticipated that the extent of caves should be in dynamic equilibrium, provided there are no impediments to natural processes. Other changes such as temperature, acidity, and precipitation (runoff from land may also influence cave communities, but probably not until beyond the time scales of this assessment.

8.5 List of main conservation measures	CJ01: Reduce impact of mixed source pollution. Key measures which are in place to mitigate water quality related pressure and threats identified in this assessment are driven by European legislation and cover the wider sea area: The Water Framework Directive (WFD) aims to maintain the 'high and good status' of waters where it exists, prevent any deterioration in the existing status of waters and to restore at least 'good status' in relation to all waters. The mechanism by which this is to be achieved under the WFD is through the adoption and implementation of River Basin Management Plans and Programmes of Measures for each of the identified River Basin Districts. The Programme of Measures will be incorporated into the delivery plan for updated river basin management plans. Many planned measures aim to deal with issues causing WFD coastal and estuarine waterbody failures for ecological and chemical elements. Management of the wider countryside including the implementation of the River Basin Management Plans by NRW and EA (cross border catchments) is also contributing to improvements (NRW, 2015). The Programme of Measures delivers many of the statutory requirements for other directives and associated legislations e.g. Marine Strategy Framework Directive, Urban Waste Water Directive and Bathing Waters Directive. Implementation and enforcement of water quality regulation (both marine and freshwater) is ongoing work and is making gains in improving water quality. Shared multi-agency pollution response plans to deal with major incidences are in place and are regularly updated. Remediation work continues for capturing mine water and removing heavy metal contaminants (Jarvis et al., 2014). Diffuse Water Pollution TAP (Thematic Action Plan) (NRW, 2015) has more details and is at the end of this section. CF08: Reduce/eliminate marine contamination with litter. European policies aim to reduce the effect of marine litter, which has recently been well publicised as an issue. The Marine Strategy Framework Directive (MSFD) requires EU Member States to ensure that, by 2020, properties and quantities of marine litter do not cause harm to the coastal and marine environment. Pollution of the seas from plastics and microplastics is one of the three major areas of the Strategy for Plastics, adopted by the European Commission on 16th January 2018; most of the proposed Actions are directly or indirectly related to marine litter, including its international dimension. Initiatives against plastic pollution of the oceans, flowing from the Strategy are: - consideration of measures against Single Use Plastics and fishing gear - assessment of the need to restrict microplastics intentionally used in products - consideration of measures against microplastics generated during the life cycle of products The 7th Environment Action Programme calls for the development of an EU-wide quantitative reduction headline target for marine litter, supported by source-based measures and considering marine strategies established by Member States. The Circular Economy Package sets a target for reducing by 30% beach litter and lost fishing gear until 2020. Some steps have been made towards controlling the use of single use plastics. The Single Use Carrier Bags Charge (Wales) Regulations 2010 (http://www.legislation.gov.uk/wsi/2010/2880/contents/made) came into force on the 1 October 2011 and brought into effect a charge of 5p for all single use plastic bags. Environmental Protection (Microbeads) (Wales) Regulations 2018 was voted on and passed by the Welsh Assembly in June 2018 (http://www.assembly.wales/laid documents/sub-ld11558-em/sub-ld11558-em-e.pdf) - the actual legislation is not yet published, but the Explanatory Memorandum was prepared by the Department for Economy, Skills and Natural Resources and laid before the National Assembly for Wales on the 18th May 2018. Future legislation: the EU is looking to create a Directive on single use plastics: http://ec.europa.eu/environment/circular-economy/pdf/single-use_plastics_proposal.pdf. The European Commission (EC) has proposed a full ban on some of the most commonly used and littered disposable plastic products in Europe. The draft 'Single-Use Plastics Directive', announced on Monday (28 May), proposes measures covering a range of items which constitute the most common sources of marine litter in Europe, including 10 single-use plastic products. Marine Litter TAP (NRW, 2015) has more details and is at the end of this section. Actions Identified by the

actions database (site level) include: Investigation actions principally relate to improving the evidence base to underpin better management and reduce both sources of marine litter and impacts on features. This includes investigations to develop better understanding of local sources of marine litter and its disposal, and identification of high risk areas for marine litter. Targeted education, awareness raising, and liaison actions include, for example, developing opportunities to reduce litter at source (locally), including site level awareness. CE01: Reduce impact of transport operation and infrastructure. General regulatory framework for assessment of environmental impacts prior to development, plans and projects. The Shoreline Management Plans (SMP) which identify the most sustainable approach to managing the flood and coastal erosion risks to the coastline in the short, medium and long term have been produced for the whole of the Welsh coast, however, these plans have yet to be fully implemented. The National Habitat Creation Program has been put in place by the Welsh Government to identify and progress opportunities for managed retreat of the coastal line, to mitigate losses of intertidal habitats as a result of man-made constraints where Hold-The-Line policies of the Shoreline Management Plan have been maintained. Flood and Coastal Erosion Risk Management TAP (NRW, 2015) has more details and is at the end of this section. Other sources: Evidence from the NRW Actions Database, the Prioritised Improvement Plans (PIPs) and Site Management Reports has been used. There are few active measures that can be applied, but there are a considerable number of investigations proposed, to improve understanding of the pressures and threats on a site (NRW, 2015). The Natura 2000 LIFE project also brought together Thematic Action Plans to resolve some of the pressures and threats as follows: - Thematic Action Plan for Flood and Coastal Erosion Risk Management - Thematic Action Plan for Diffuse Water Pollution - Thematic Action Plan: Marine Litter Thematic Action Plan: Flood and Coastal Erosion Risk Management - Implementation of appropriate coastal management - >(pounds)44 million across the N2K. Mitigation for the coastal squeeze losses through the National Habitat Creation Project (NHCP). This is in response to the Welsh Government's statutory obligation for compensatory measures under Article 6(4) of the Habitats Directive, relating to offsetting the impacts of coastal squeeze on Natura 2000 sites. Thematic Action Plan: Diffuse Water Pollution - Investigation, Direct Management and Management Agreements (incl Glastir) are the main mechanisms to manage diffuse water pollution: Raise the profile of breaches in cross-compliance affecting N2K habitats and features (terrestrial, freshwater and marine) and target compliance monitoring. Risk assessments to be carried out on catchments of N2K sites which have high priority diffuse pollution issues/risks, and which are failing under the WFD. Examples of new or improved mechanisms may include: - Small-scale standalone capital grant scheme to address diffuse pollution issues. - Development of nutrient management initiatives. - Training for farmers/landowners regarding reducing diffuse pollution, waste management and farm nutrient budgeting. - Catchment Level Rural Sustainable Drainage Systems pilot projects. Thematic Action Plan: Marine Litter - Direct management is the most frequently identified mechanism for addressing marine litter impacts. This mechanism predominantly refers to action required by Local Authorities (LA) to support and help implement measures to remove litter from beaches (e.g. third-party collections and LA beach cleaning), ensuring that approaches are sensitive to features. Investigation actions principally relate to improving the evidence base to underpin better management and reduce both sources of marine litter and impacts on features. This includes investigations to develop better understanding of local sources of marine litter and its disposal, and identification or high-risk areas for marine litter. Targeted education, awareness raising, and liaison actions include, for example, developing opportunities to reduce litter at source (locally), including site level awareness

11.1 Surface area of the habitat type inside the pSCIs, SCIs and SACs network	We have no true value for the surface area of sea caves, nor is it likely that we ever will. No exhaustive survey of sea caves has ever been undertaken in Wales, and of those that have been identified and georeferenced, very few caves have been studied in any detail. The main reasons for this lack of study is that caves are usually remote and often almost inaccessible, therefore costs in terms of survey time and resources are high. For example, Bunker & Holt (2003) describe intertidal and subtidal sea cave surveys that took place between 2000 and 2002 within Welsh Special Areas of conservation (SACs). These surveys involved 11 people, took 16 days and surveyed a total of 24 sea caves. These surveys included mapping and photographing caves, a detailed inventory of species and biotopes present and the installation of permanent monitoring equipment (Bunker & Holt, 2003). Therefore, the figures in this section should be treated with caution and are of very low confidence. It is likely only a small proportion of sea caves present in Wales have ever been recorded. Using the same method as in the 2013 sea cave report (NRW, 2013a, NRW, 2013b), the figure shown above was calculated by giving each known cave a standard area value of 100 m2, which approximates to an 'average cave' of 10 m depth and circular cross-section of 3 meters (diameter). The total number of recorded caves within marine Special Areas of Conservation (SAC) (total of 410), although likely a gross under estimation of the total, was then multiplied by the average cave area to give the overall surface area value presented above. This value represents 47% of the estimated cave resource (total of 869) in Wales (NRW, 2013b). Caves tend to occur along or above the highwater mark of rocky cliff areas. Many marine GIS layers, such as SAC boundaries, use the mean highwater mark as the shoreward edge of the designation. This creates a problem when mapping vertical features such as caves as they often fall outside the boundary layer within the GIS and therefore it is not always clear from the GIS whether a cave is even situated within a SAC.