

**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:

H1170 - Reefs

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	1170 - Reefs

2. Maps

2.1 Year or period	1996-2017
2.3 Distribution map	Yes
2.3 Distribution map Method used	Complete survey or a statistically robust estimate
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	<p>AWFA reports. 2017. Multiple on-line reports. https://naturalresources.wales/about-us/our-projects/marine-projects/assessing-welsh-fishing-activities/?lang=en.</p> <p>Bergmann M, Gutow L, Klages M. 2015. Marine Anthropogenic Litter. https://link.springer.com/content/pdf/10.1007%2F978-3-319-16510-3.pdf</p> <p>Bohn K. 2014. The distribution and potential northwards spread of the invasive slipper limpet <i>Crepidula fornicata</i> in Wales, UK. NRW Evidence Report No: 40, 43pp, Natural Resources Wales, Bangor.</p> <p>Brazier DP. in prep. Pembroke power Station - limpet size profiles. NRW data.</p> <p>Brazier DP, Robinson K. In prep. Article 17 GIS processing notes for Reefs. Draft internal report, NRW.</p> <p>Bunker FStPD. 2015. Intertidal Monitoring of rocky reefs, Pembrokeshire Marine SAC. Population trends for selected species 2005 to 2014. NRW Evidence Report No: 59, 66pp, Natural Resources Wales, Bangor</p> <p>Bunker FStPD, Brazier DP. 2013. Monitoring of intertidal rocky reefs in Pembrokeshire Marine SAC, 2007 to 2010. CCW Marine Monitoring Report No: 101, 93pp + x, Countryside Council for Wales, Bangor.</p> <p>Bush LE, Balestrini SJ, Robins PE, Davies AJ. 2015. NRW Evidence Report No 049 - The reproduction and connectivity of <i>Sabellaria alveolata</i> reefs in Wales - MAR4REF Bangor University. NRW Evidence Report No: 49. 119pp. Bangor University, Bangor UK.</p> <p>Cook R, Farinas-Franco JM, Gell FR, Holt RHF, Holt T, Lindenbaum C, Porter JS, Seed R, Skates LR, Stringell TB, Sanderson WG. 2013. The Substantial First Impact of Bottom Fishing on Rare Biodiversity Hotspots: A Dilemma for Evidence-Based Conservation. PLoS ONE, 8(8), e69904.</p> <p>Duigan CA, Rimington NA, Howe, MA. (Eds). 2014. Coastal storms December 2013 & January 2014 - an assessment of environmental change. Natural Resources Wales Evidence Report No: 33, 122pp, Natural Resources Wales, Bangor.</p> <p>Egerton J, Morris L, Goudge H, Brazier P. 2010. Intertidal Phase 1 mapping from Pen-ychain to Criccieth, Pen Llyn a'r Sarnau SAC CCW Science Report No 953. 30pp, Countryside Council for Wales, Bangor.</p> <p>Edwards P. 2014. Nutrient concentrations in the Milford Haven catchment area. Tech. memo: TMW14-09 Natural Resources Wales. NRW.</p>

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4. Range

4.1 Surface area (in km ²)	3430.56
4.2 Short-term trend Period	2010-2018
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	Based mainly on extrapolation from a limited amount of data
4.6 Long-term trend Period	1996-2018
4.7 Long-term trend Direction	Stable (0)
4.8 Long-term trend Magnitude	a) Minimum b) Maximum
4.9 Long-term trend Method used	Based mainly on extrapolation from a limited amount of data
4.10 Favourable reference range	a) Area (km ²) b) Operator c) Unknown No d) Method
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	2010-2018
5.2 Surface area (in km ²)	a) Minimum 3430.56 b) Maximum 3430.56 c) Best single value 3430.56
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	Decreasing (-)
5.7 Short-term trend Magnitude	a) Minimum b) Maximum c) Confidence interval

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5.8 Short-term trend Method used	Based mainly on extrapolation from a limited amount of data		
5.9 Long-term trend Period	1994-2018		
5.10 Long-term trend Direction	Uncertain (u)		
5.11 Long-term trend Magnitude	a) Minimum	b) Maximum	c) Confidence interval
5.12 Long-term trend Method used	Based mainly on extrapolation from a limited amount of data		
5.13 Favourable reference area	a) Area (km ²) b) Operator c) Unknown No d) Method		
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 (km ²) Minimum 537.7 Maximum 537.7 b) Area in not-good condition (km ²) Minimum 932.33 Maximum 932.33 c) Area where condition is not known (km ²) Minimum 1960.53 Maximum 1960.53
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	2010-2018
6.4 Short-term trend of habitat area in good condition Direction	Unknown (x)
6.5 Short-term trend of habitat area in good condition Method used	Based mainly on extrapolation from a limited amount of 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)	H
Marine fish and shellfish harvesting (professional, recreational) causing reduction of species/prey populations and disturbance of species (G01)	M
Marine fish and shellfish harvesting (professional, recreational) activities causing physical loss and disturbance of seafloor habitats (G03)	M

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Residential or recreational activities and structures generating marine pollution (excl. marine macro- and micro-particular pollution) (F20)	M
Modification of coastline, estuary and coastal conditions for development, use and protection of residential, commercial, industrial and recreational infrastructure and areas (including sea defences or coastal protection works and infrastructures) (F08)	M
Change of species distribution (natural newcomers) due to climate change (N08)	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
Other invasive alien species (other than species of Union concern) (I02)	M
Industrial or commercial activities and structures generating marine pollution (excluding marine macro- and micro-particular pollution) (F21)	M
Threat	Ranking
Other invasive alien species (other than species of Union concern) (I02)	H
Change of species distribution (natural newcomers) due to climate change (N08)	H
Marine fish and shellfish harvesting (professional, recreational) causing reduction of species/prey populations and disturbance of species (G01)	M
Residential or recreational activities and structures generating marine pollution (excl. marine macro- and micro-particular pollution) (F20)	M
Marine fish and shellfish harvesting (professional, recreational) activities causing physical loss and disturbance of seafloor habitats (G03)	M
Mixed source marine water pollution (marine and coastal) (J02)	M
Modification of coastline, estuary and coastal conditions for development, use and protection of residential, commercial, industrial and recreational infrastructure and areas (including sea defences or coastal protection works and infrastructures) (F08)	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

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Wind, wave and tidal power, including infrastructure (D01) 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

Restore the habitat of the species (related to '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

Manage changes in hydrological and coastal systems and regimes for construction and development (CF10)

Reduce/eliminate marine pollution from industrial, commercial, residential and recreational areas and activities (CF07)

Other measures related to residential, commercial, industrial and recreational infrastructures, operations and activities (CF12)

Management of professional/commercial fishing (including shellfish and seaweed harvesting) (CG01)

Habitat restoration of areas impacted by residential, commercial, industrial and recreational infrastructure, operations and activities (CF02)

Adapt/manage renewable energy installation, facilities and operation (CC03)

Reduce/eliminate marine pollution from agricultural activities (CA13)

Reduce bycatch and incidental killing of non-target species (CG05)

Reduce impact of other specific human actions (CH03)

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

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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 2397

b) Maximum 2397

c) Best single value 2397

11.2 Type of estimate

Best estimate

11.3 Surface area of the habitat type inside the network Method used

Complete survey or a statistically robust estimate

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

12. Complementary information

12.1 Justification of % thresholds for trends

12.2 Other relevant information

Distribution Map

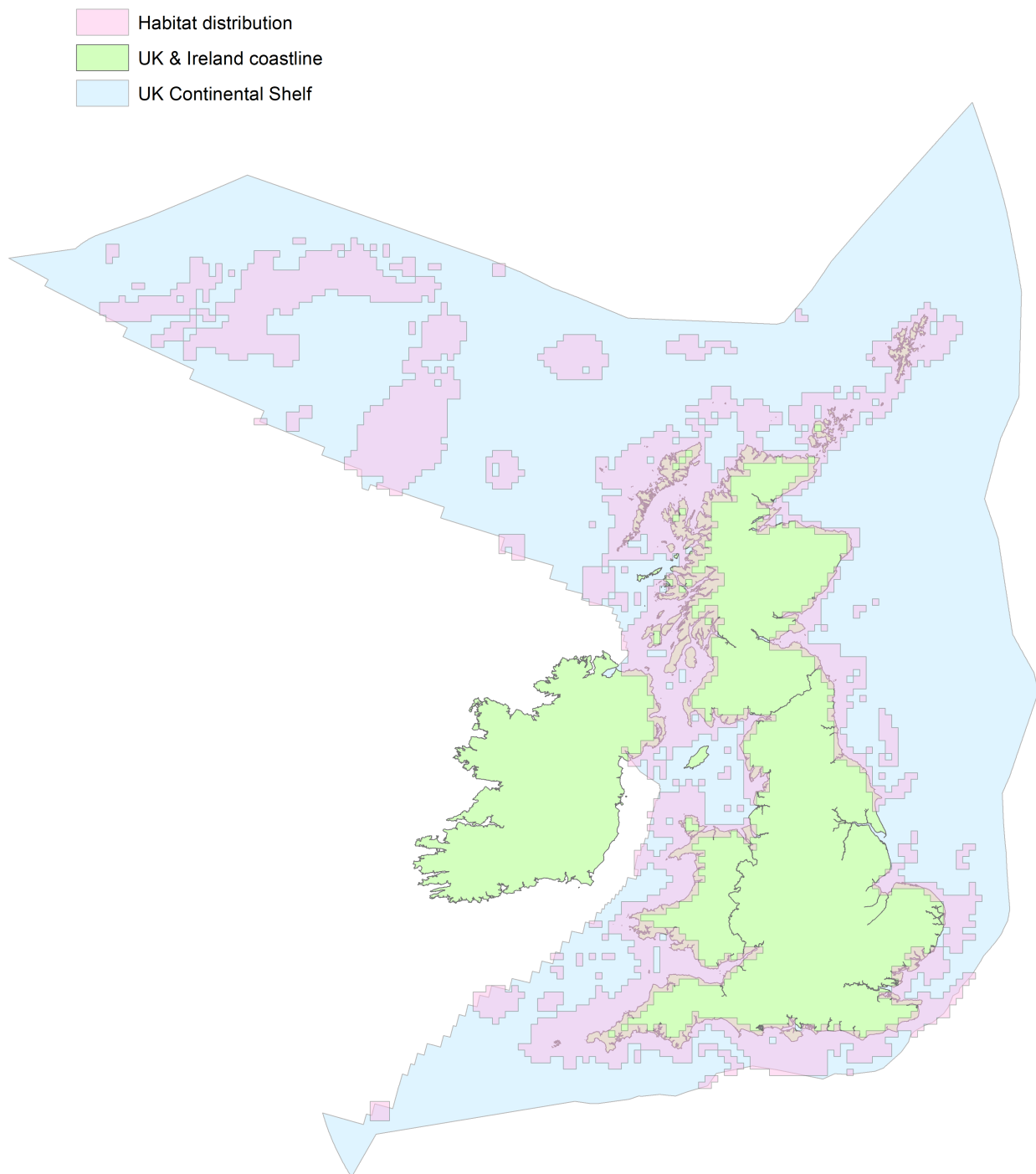


Figure 1: UK distribution map for H1170 - Reefs.

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

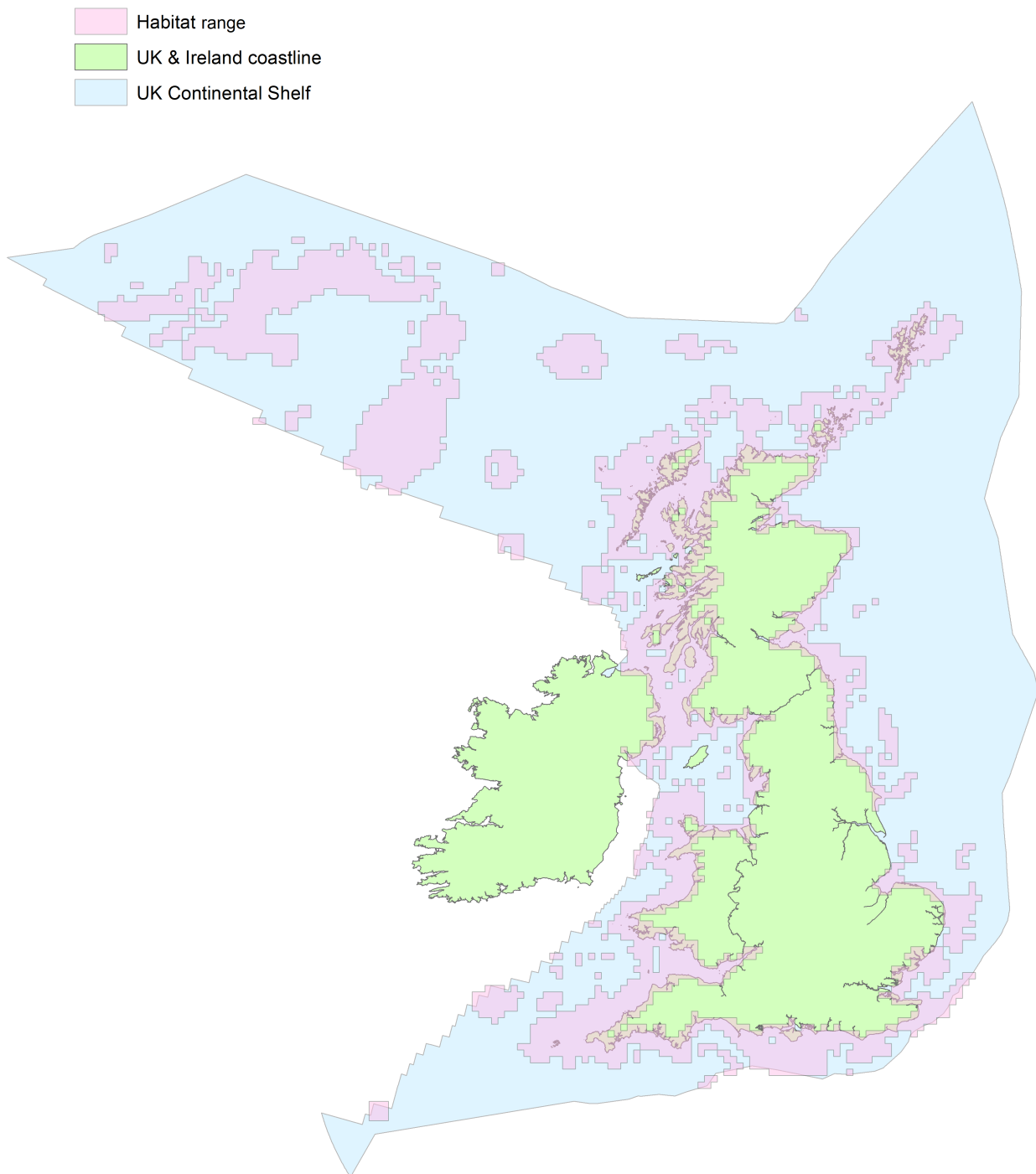


Figure 2: UK range map for H1170 - Reefs.

The UK range map was developed from the UK surface area map, but additionally included an area of iceberg ploughmarks off North-West Scotland in offshore waters, where cobble reefs had been recorded (JNCC, 2018a).

Explanatory Notes

Habitat code: 1170

Field label	Note
2.1 Year or period	Development of two map layers, one intertidal and one subtidal, used a variety of data sources and followed a complex process. In summary: Intertidal reef was identified primarily by identifying reef biotopes from CCW's Phase I intertidal mapping survey Wyn et al. (2006) and an update in 2010 for a section of coast in Tremadoc Bay (Egerton et al. 2010); Subtidal reef areas were identified from a variety of sources, including JNCC, BGS and NRW mapping work (Lough et al.2017). Full details are given in Brazier & Robinson (in prep).

Habitat code: 1170 Region code: MATL

Field label	Note
4.1 Surface area	Awaiting value from JNCC Development of two map layers, one intertidal and one subtidal, used a variety of data sources and followed a complex process. In summary: Intertidal reef was identified primarily by identifying reef biotopes from CCW's Phase I intertidal mapping survey Wyn et al. (2006) and an update in 2010 for a section of coast in Tremadoc Bay (Egerton et al. 2010); Subtidal reef areas were identified from a variety of sources, including JNCC, BGS and NRW mapping work (Lough et al., 2017). Full details are given in Brazier & Robinson (in prep). There have been some on-going small losses of reef, typically small intertidal losses due to development and coastal protection. We currently have no evidence of loss outside of monitored sites. Due to the lack of evidence it has not been possible to calculate areas of loss in these areas.
4.4 Short term trend; Magnitude	Assessment of trends has included consideration of any recorded anthropogenic changes in habitat extent and range from casework (e.g. new land claim or losses through dredging). There have been some known reductions in extent. Knowledge of these is primarily limited to the SAC suite. Whilst these may be significant at a local scale, they do not affect the overall range of the habitat across Wales.
4.8 Long term trend; Magnitude	Assessment of trends has included consideration of any recorded anthropogenic changes in habitat extent and range from casework (e.g. new land claim). There have been some known reductions in extent. Knowledge of these is primarily limited to the SAC suite. Whilst these may be significant at a local scale, they do not affect the overall range of the habitat across Wales.

5.2 Surface area

Best: 2997.47 Km² Full extent of the feature as derived from JNCC version of feature maps. (NRW Area measure = 2997.43 Km²) Development of two map layers, one intertidal and one subtidal, used a variety of data sources and followed a complex process. In summary: Intertidal reef was identified primarily by identifying reef biotopes from CCW's Phase I intertidal mapping survey Wyn et al. (2006) and an update in 2010 for a section of coast in Tremadoc Bay (Egerton et al., 2010); Subtidal reef areas were identified from a variety of sources, including JNCC, BGS and NRW mapping work (Lough et al., 2017). Full details are given in Brazier & Robinson (in prep). There have been some on-going small losses of reef, typically small intertidal losses due to development and coastal protection. We currently have no evidence of loss outside of monitored sites. Due to the lack of evidence it has not been possible to calculate all areas of loss in these areas. Differences in extent area covers any gains and losses that are referred to elsewhere in this document. The value includes definite and probable Reef, but does not account for where sediment levels have fluctuated and therefore changed the extent of rock exposure. Casework records have been considered, in order to understand changes in area covered by Reefs. Casework records are within the last 6 years, or ongoing, that have influenced the cover in the last 6 years. Losses resulted from: developments outside of N2K sites, and not requiring a HRA. construction of sea defences illegal placement of structures in the intertidal

5.14 Change and reason for change in surface area

The long-term trend covers the last 24 years. In this time there have been some real losses from intertidal coastal defence work within (illegal) and outside of SACs. These are small and localised occurrences. A considerable change in surface area is derived from further survey work in Cardigan Bay and Pembrokeshire, as a result of evidence collecting to inform SAC management and applications for renewable power installations (incl. Lough et al., 2017). Other sources of evidence are listed in the evidence section.

6.1 Condition of habitat

Good 537.70 Km² (Intertidal - 19.64 Km², Subtidal - 518.06 Km²) Not good 932.33 Km² (Intertidal - 45.02 Km², Subtidal - 887.31 Km²) Not known 1527.44 Km² (Intertidal - 13.14 Km², Subtidal - 1514.30 Km²) The area in good/not good/unknown condition of structure and function is assessed using collated available evidence. Evidence used includes data from intersecting WFD waterbody classification. Where an intersecting waterbody status, for either ecology or chemistry, is less than 'good' the structure and function of this feature was assessed as 'Unfavourable' e.g. WFD waterbodies that fail for TBT, BDPE and other pollutants (water sampling) are unfavourable, since a fail for a determinand under WFD is deemed to be of ecological significance. Manuel Nicolaus & Barry (2015) completed a survey in 2014, including Tenby, which showed imposex to be below the OSPAR Ecotoxicological Assessment Criterion (EAC) (The level of imposex in the more sensitive gastropod species (223c30-223c100 % of the females have imposex) indicates exposure to TBT) concentrations below the EAC derived by OSPAR for TBT, e.g. adverse effects in the more sensitive taxa of the ecosystem caused by long-term exposure to TBT are predicted to be unlikely to occur.) A caution: Waterbody boundaries do not reflect coastal processes or hydrography. For this reason, the WFD results from a sampling location may not be appropriate for the feature in 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. Low confidence should be associated with applying WFD results to feature condition. Some locations such as the Milford Haven have a moderate DIN under WFD, deemed detrimental to this feature. Reef is deemed to be not 'Good' where:- the overlapping WFD waterbody is less than 'Good';- There are coastal developments/structures that have the potential to cause habitat loss through coastal squeeze, and/or cause a change in the physical environment;- damage or disruption through other human activities. Levels of litter have not been used in the assessment condition, since there is currently no evidence to suggest that it is affecting the condition of the reef feature. Where monitoring surveys collected multivariate data, analysis employed multivariate statistics in conjunction with consideration of natural and anthropogenic influences that may explain observed changes. Examples include analysis of intertidal and subtidal reef benthic community records (e.g. quadrats with species or morphology counts) as well as reef fish communities. Where appropriate, consideration of univariate measures are also assessed (e.g. single species abundance changes). Analysis of trends was conducted where possible, though few datasets have been fully collated and analysed to allow for this. Exceptions include intertidal quadrat monitoring (Bunker & Brazier, 2013; Bunker, 2015) and the long-term monitoring data from Skomer Marine Conservation Zone. The spatial extent of NRW's in-field reef monitoring is limited and unless it happens to be in an area of localised impact it tends to provide an indication of changes due to wider environmental variables acting at the estuary, bay or wider sea level. Some example projects from across Wales and which are referred to in the evidence sources section include: - Intertidal biogenic reef monitoring of *Sabellaria alveolata* and *Mytilus edulis*, - Subtidal biogenic reef monitoring using drop down video and side-scan of *Modiolus modiolus* - Single species monitoring of Mediterranean-Atlantic species e.g. *Parazoanthus axinellae*, *Eunicella verrucosa*, *Caryophyllia smithii* cup corals. - Reef fish- fish community monitoring, - BROADSCALE habitat monitoring (biotopes) - Monitoring of algal and faunal communities of intertidal and subtidal reef (quadrats, multivariate) - Monitoring of algal and faunal communities of specialist reef habitats incl. rockpools, overhangs and gullies, - Surveillance of physical parameters e.g. temperature - Surveillance of marine activities e.g. commercial potting and recreational diver activity. Some gradual recovery (back to the previously recorded algal dominated state) has been seen after the severe event when algal communities at Sarn Badrig were smothered by *Mytilus edulis* mussel

settlement. Initial assessment of data from monitoring reef communities and species, suggests that most changes are likely to be due to natural fluctuations rather than anthropogenic influence. No major variations in overall reef trends since 2004 for intertidal rocky shore on Skomer, while sponge assemblages, from data in 2016, appear to be stable. Side scan sonar is used to monitor the extent of the two separate horse mussel *Modiolus modiolus* reefs off the north Llyn Peninsula coast (Cook et al., 2013). Detailed analysis of side scan data has revealed damaging scallop dredge tracks through the protected *Modiolus* reef in the Pen Llyn a'r Sarnau SAC. Dredge marks from the 2012 side-scan survey are still evident in a 2017 side-scan survey, showing that the impact from prior dredging activity persists. Since 2012, new legislation has been introduced by the Welsh Government to extend protection from mobile fishing gear to both areas containing horse mussel reefs (HM Government, 2012b; SI 2012 2571) and requiring all vessels using scallop dredges to have a functioning vessel tracking system (iVMS) installed (HM Government, 2012a: SI 2012 2729). New tracks have been identified from the 2017 side-scan survey of the biogenic reef have been identified as from scallop dredging, demonstrating that there has been activity within the area protected by SI 2571 (HM Government, 2012b) sometime between 2012 and 2017. Preliminary analysis of sponge morphology using data from NRW surveys from 2005 to 2016, do not show any trends of change or concern. Analyses include surveys at Moelfre, Anglesey, although these data had numerous gaps due to the challenging survey conditions there. At Moelfre, when all quadrat data were merged, there was a continual trend of change from 2005 to 2016, particularly after 2013, but there is no clear driver for this and it requires further analysis to elucidate whether the change is detrimental. A preliminary look at the data suggests that 'encrusting' sponges may be increasing and 'massive' sponges declining in frequency of records. In Milford Haven, NRW's encrusting and erect sponges transect data have been analysed (sponge depth, height and circumference). The presence and crust thickness data from several species showed a non-significant gradual decline, but with low confidence, when the annual fluctuating pattern is considered. Preliminary analysis of NRW's territorial fish data from the methane derived authigenic carbonate (MDAC) reef (Holden's Reef) in Pen Llyn a'r Sarnau shows no clear trend in species richness or numbers. Preliminary analysis of intertidal bedrock, rockpools and biogenic *Sabellaria alveolata* reef show no major changes in condition, based on quadrat surveys of species and physical parameters. Changes in sand levels near to Afon Dwyfor have caused fragmentation of the reef. The drop in sand level may be due to coastal defences further along the coast (Bunker & Brazier, 2013; Bunker 2015; Mercer, 2011; 2013; 2016a; 2016b; Moore & Brazier, 2013). In 2016, an unusually high number of sea fan losses were recorded at Skomer MCZ, especially at the Bull Hole site. The losses are most likely due to mechanical damage (breakages), as remains of colony stalks were located. Activities that could lead to mechanical damage include potting, angling, recreational diving and anchoring (NRW 2018e). Newman et al. (2017) states 'These losses include nearly a third of all the sea fans at one site alone and means that sea fans are disappearing from our monitoring sites about twice as fast as new ones are growing. No specific cause is evident for the disappearances, but what remains of the sea fans show signs of having been knocked or broken off.' The decline in the sea fan population is not enough to fail the whole typical species component (of the Pembrokeshire Marine SAC reef feature). Information on sea fans in the reef feature outside of the MCZ is not available (NRW, 2018e). Potting carries the same risks on the MDAC, due to the friable nature of this reef. Recording of rugosity (measure of the vertical variability of the seafloor across the reef) on two separate occasions (2007 and 2017?) have not shown significant change, but this is a very limited data set to make any firm conclusions.

6.4 Short term trend of
habitat area in good
condition; Direction

(2013 values: Good = 29.41 Km², Not Good = 3006.24 km²) The decrease in value for total area of Reef, compared to 2013 is attributed to changes in mapping methods. Higher resolution surveys have resulted in removal of some low confidence Reef feature from the 2013 extent. Improved mapping is from multibeam surveys west of St. David's Head (Ramsey area) and St. Brides Bay. There are also minor adjustments to the Modiolus reef extent and further cleaning of the dataset. No meaningful comparison is possible, of the extent of the Reef in good condition, between 2013 and present.

7.1 Characterisation of pressures/ threats

J02 Mixed source marine water pollution (marine and coastal) Pressure: high; Threat: medium There is an assortment of sources of pollution to the marine environment that are difficult to quantify and apportion. Open coast areas are relatively unpolluted, but many of the estuarine reefs have raised levels of nutrients and contaminants. This pressure relates to pollution with no known origin, but also included below are pressures accounting for pollution derived from residential/domestic sources (F20) and from industrial sources (F21). 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 estuaries and bays, particularly Milford Haven Waterway (NRW, 2014; Haines & Edwards, 2016), Carmarthen Bay and Y Foryd) (NRW, 2013). In Milford Haven Waterway this is resulting in raised levels of suspended silt, silt deposition and increased plant growth. Raised turbidity and silt deposition is likely to be affecting algae and dense intertidal green macroalgae (increased nutrients) generates eutrophication impacts when it is washed up on estuary reefs G01 Marine fish and shellfish harvesting (professional, recreational) causing reduction of species/prey populations and disturbance of species Pressure: medium; Threat: medium Many typical fish species of reefs, fin fish, molluscs and crustacea, are caught in commercial fisheries, either targeted or as bycatch. The full range of fin fish that are associated with Reef feature have not been defined here. The small nature of the inshore fleet suggests that the pressure and future threat are moderate. Whelk fishing is not currently considered to operate within sustainable limits. Llewellyn (2017) stated that 'The current management measure of a pan EU MCRS of 45 mm is not protecting the spawning stock in Wales and as such the stock is in danger of recruitment overfishing. Additionally, there is no protection for whelks throughout their reproductive season which will exemplify the effect of recruitment overfishing.' There is currently a consultation on the best way forward for managing the fishery. The Welsh Government's draft Welsh National Marine Plan identifies potential opportunities for development of shellfisheries across Wales. This is accompanied by appropriate safeguards within Protected Sites (HRA, statutory Instruments), to protect the features, and the draft plan also contains a series of environmental policies that apply throughout Welsh seas that should ensure that all development is sustainable. Where Regulating and Several Orders are applied for, this also provides some safeguards to protect Annex I habitats outside of SACs, although these orders are not compulsory, leaving features under these circumstances under potential threat. Commercial shell fisheries are active in some areas and include winkle picking (with associated boulder turning and ecosystem effects). G03 Marine fish and shellfish harvesting (professional, recreational) activities causing physical loss and disturbance of seafloor habitats. Pressure: medium; Threat: medium Whilst there have been some significant recent improvements in management (HM Government, 2010a, 2012a,b - Welsh statutory instruments (SI 269, SI 2571 & SI 2729); see Conservation Measures), important sensitive reefs appear to be impacted from illegal fishery activity, e.g. Modiolus reefs off north Wales (Cook et al., 2013; Lindenbaum, in prep a). Bait collection (boulder turning) is present, often in sensitive sheltered and tide-swept habitats. Commercial shell fisheries are active in some areas and include winkle picking (with associated boulder turning and ecosystem effects). Methane Derived Authigenic Carbonate (MDAC) reef, as found at Holden's Reef, Pen Llyn a'r Sarnau SAC, are partly sensitive to abrasion and highly sensitive to changes in habitat structure and physical change (Tyler-Walters, 2018). Potting in particular, can result in outcrops being lifting or damage to the fragile structures, which threatens the integrity of the MDAC reef. Intertidal boulder surveys in the Menai Strait suggest a continued disturbance and damage to the flora and fauna (Moore & Brazier, 2013). F20 Residential or recreational activities and structures generating marine pollution (excl. marine macro- and micro-particular pollution. Pressure: medium; Threat: medium F21 Industrial or commercial

activities and structures generating marine pollution (excluding marine macro- and micro-particulate pollution). Pressure: medium; Threat: low Discharges associated with urban areas (sewage) as well as industrial areas. Available nutrient levels, contaminants in sediments and poor water quality is present in several areas, particularly estuaries (e.g. Milford Haven Waterway, Carmarthen Bay, Swansea Bay, north Llyn Peninsula). Below 'Good' WFD waterbody assessments tend to reflect this. Contaminant input from diffuse (urban and industrial run off) as well as point source industrial discharges. Contaminant levels are greatest where industry is associated with the estuary e.g. Milford Haven. There is pressure from chronic input of hydrocarbons in port and recreational harbour areas, especially Milford Haven, though indications are that hydrocarbon contaminant loads there are decreasing (Little, 2009). Bioaccumulation of contaminants indicates some levels high enough to cause adverse effects to biota (Langston et al., 2012). Pressure from occasional spills (e.g. Sea Empress) and continued presence and reworking of historic oil. 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: medium; Threat: medium Several recorded small losses of habitat are associated with the creation and maintenance of roads, paths and railways along the coast. Creation of private slipways and hard standing on shoreline reef, and maintenance or establishment of shore defences is increasing in areas where housing has water frontage (e.g. Milford Haven). In many cases, these activities are illegal and remediation is being carried out to resolve the inappropriate development. Outside of SACs, there is no requirement for a HRA, such that these activities are not effectively regulated. Dumping of waste rubble onto shores. N08 Change of species distribution (natural newcomers) due to climate change Pressure: medium; Threat: high The Modiolus reefs in Wales are the most southern known on the west coast of the UK and they are considered to be at great threat from climate change. The resilience of the Modiolus reef is already compromised in places, increasing the risk of fragmentation of this biogenic reef. The effects of southern species, moving northwards is still unclear, but there are suggestions that the increase in grazers could reduce algal cover in the future, changing the character of intertidal and shallow subtidal habitats (Hawkins et al., 2009). F22 & F23: 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/angling gear and other anthropogenically derived debris) is often found entangled in sessile reef biota. There is a small increasing trend in marine litter on UK beaches (Nelms, 2017). In general, the key physical impact of litter is likely to be linked to ingestion of plastic. Several invertebrate and fish species have been shown to ingest plastic in field and laboratory experiments. 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 function on 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. The level of dumped construction materials on some shores is significantly changing the nature of the shore. This includes material lost from failed coastal defences (e.g. gabion baskets). Lost fishing gear (including angling line, hooks and weights and lobster pots) has been found amongst and around subtidal reefs (NARC, 2015; 2016). I02 Other invasive alien species (other than species of Union concern) Pressure: medium; Threat: high Presence of invasive non-native species on reefs including *Crepidula fornicata* (Bohn, 2014),

Magallana (Crassostrea) gigas, Didemnum vexillum and Sargassum muticum. Modification of habitat and associated community is observable in areas of high density. Milford Haven is a hot spot, with a high UK diversity of non-natives being present (Mieszkowska, 2011). The future threat from highly damaging species such as Didemnum vexillum is high. D01 Wind, wave and tidal power, including infrastructure Pressure: none Threat: medium Development of tidal lagoons, marine wind and tidal turbines all require a degree of anchoring, and infrastructure that are likely to have a footprint on the Reef feature. Within MPAs, these will require a HRA assessment, with appropriate mitigation if necessary. Recent plans for a tidal lagoon at Swansea have currently stalled, such that this is now a threat only. Plans for tidal turbines with associated cables to Aberdaron in Bardsey Sound are at the planning stage. Habitats Regulations Assessment should avoid any impacts to this feature.

8.5 List of main conservation measures

CF10 Manage changes in hydrological and coastal systems and regimes for construction and development Within the NRW Actions database 185 actions were listed relating to coastal squeeze, 49 of these were under control and 61 complete. The Pen Llyn a'r Sarnau SAC has an objective to restore the 'Estuaries' feature where the structure and functions of the estuaries that have been damaged/degraded by the constraints of artificial structures such as flood banks. Reef in estuarine conditions is a small part of the reef feature, but it is under greater threat than other Reef areas. A reduction in the artificial constraints (such as flood banks) on the tidal limits within the estuaries would provide the potential to increase and re-establish estuary communities that have been reduced or lost to past interventions in the estuaries including sheltered intertidal reef and the full range of zones which this feature encompasses. However, there are many barriers to achieving restoration on such as scale. 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. CF07 Reduce/eliminate marine pollution from industrial, commercial, residential and recreational areas and activities CA13 Reduce/eliminate marine pollution from agricultural activities 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 measures planned aim to deal with issues causing WFD coastal and estuarine waterbody failures for ecological and chemical elements. 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, Bathing Waters Directive and Eel Regulations. Shared multi-agency pollution response plans to deal with major incidences are in place and are regularly updated. Diffuse Water Pollution TAP (Thematic Action Plan) (see below) CF12 Other measures related to residential, commercial, industrial and recreational infrastructures, operations and activities This measure covers the HRAs that have been completed for construction projects, to ensure no significant effect on site integrity within marine Natura 2000 sites. CG01 Management of professional/commercial fishing (including shellfish and seaweed harvesting) Key measures which are in place to mitigate fisheries related pressure and threats identified in this assessment (G01 & G03) are driven by national and European legislation and cover the wider sea area. The Common Fisheries Policy measures and the Scallop Orders (Wales) (2010, 2012) are the key measures which will protect habitats and improve fish stock levels. The Scallop Orders and compulsory Vessel Management System (VMS) have gone a long way to protect the reef, but unfortunately there are still occasional unconsented commercial activities. The Welsh Government's draft Welsh National Marine Plan identifies potential opportunities for development of shellfisheries across Wales. This is accompanied by appropriate safeguards within Protected Sites (HRA, statutory Instruments), to protect the features, and the draft plan also contains a series of environmental policies that apply throughout Welsh seas that should ensure that all development is sustainable. Where Regulating and Several Orders are applied for, this also provides some safeguards to protect Annex I habitats outside of SACs, although these orders are not compulsory, leaving features under these circumstances under potential threat. The Common Fisheries Policy (CFP) manages common resources and seeks to ensure that fishing and aquaculture are environmentally, economically and socially sustainable. Reform of this policy came into effect from 2014 including

measures to protect endangered stocks, and the ending of discards. Measures (mainly effort controls and technical measures based on scientific advice) implemented over time should (and have in some cases) improve poor stock levels. A pilot project, the 'Sustainable Shellfish Pilot Initiative', sponsored by numerous organisations, strives to resolve some of the issues of persistent ghost fishing from lost gear (see Pembrokeshire Marine SAC (2018)). The Marine Strategy Framework Directive (MSFD) 2009 aims to achieve Good Environmental Status (GES) of the EU's marine waters by 2020. The MSFD has 11 descriptors, one of which is Commercial fisheries (D3) (target = Populations of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock), other descriptors also have relevance for marine fisheries including Biodiversity (D1), Food webs (D4) and Seafloor integrity (D6). The aim of the Marine and Coastal Access Act (MaCAA) 2009 is to improve management and protection of the UK marine and coastal environment. It has eight key elements, including fisheries management and marine enforcement. The legislation allowed Welsh Government (WG) to rationalise the management of marine fisheries in Wales by transferring functions of the two Sea Fisheries Committees and the Marine Fisheries Agency (MFA) to the Welsh Government. It also expanded the remit of marine fisheries management organisations to conserve marine ecosystems. The HM Government (2010a - Statutory Instruments 269) restricts fishing effort (e.g. closed season, engine capacity, amount of dredges, number of boats permitted to fish), fishing location (predominantly not within MPAs or close to shore) and species size restrictions (size of scallop). The WG has a clear and evidence led process for assessing the impacts from fisheries, including HRAs (where appropriate) and the Assessing Wales Fishing Activities (AWFA) project. Fishing activities that require a permit e.g. scalloping, mussel dredging are subject to the HRA process which looks at the impact pathways from the activity on the feature and the AWFA is delivering evidenced based assessments on the impacts from fishing activities on protected features. Outside of protected areas, and for fisheries that are not licensed, typically further offshore, the habitats present and the intensity of fishing is less well understood. Investigatory actions identified in thematic action plans should improve understanding and aid better management in the future (one example of this is assessing welsh fisheries project currently underway by NRW). In combination, the legislation, management and investigations aim to improve and maintain fish stocks and reduce impact of fishing to marine species and habitats. Since 2012, new legislation has been introduced by the Welsh Government to extend protection from mobile fishing gear to both areas containing horse mussel reefs (HM Government, 2012b: SI 2012 2571) and requiring all vessels using scallop dredges to have a functioning vessel tracking system (iVMS) installed (HM Government, 2012a: SI 2012 2729). The legislation provides the governance for additional protection in two exclusion boxes for fishing with mobile fishing gear. NRW staff liaise with fisheries groups and individuals who are represented on the MCZ Advisory Committee, with a view to establishing a means to avoid fishing in areas where higher densities of seafans are known to occur. A voluntary code of practice established with commercial fishermen to prevent the use of monofilament tangle nets within 50 m of the coast of Skomer Island. Combined this legislation, management and investigation aims to improve and maintain fish stocks and reduce impact of fishing to marine species and habitats. Measures is ranked as High as related pressure and threat G01/G03 ranked medium and low respectively and is relevant to a wide area (offshore and inshore). Marine Fisheries TAP (see below) CF02 Habitat restoration of areas impacted by residential, commercial, industrial and recreational infrastructures, operations and activities The National Habitat Creation Program (NHCP) has been put in place by the Welsh Government to identify and progress opportunities for managed retreat of the coastline, in order to compensate for predicted losses of intertidal habitats as a result of coastal squeeze. Coastal squeeze occurs where habitats are caught between rising sea-level and man-made structures and are reduced in extent over time. The NHCP provides compensatory habitat for

schemes which maintain or upgrade Local Authority or Natural Resources Wales' assets in line with 'Hold The Line' policies within the Shoreline Management Plans. The NHCP does not provide compensatory habitat for coastal squeeze losses in relation to third party assets, and these are considered on a case by case basis (ref: Welsh Government, March 2018. Welsh Government clarification note on the current relationship between the Habitats Directive, the Shoreline Management Plans and the National Habitat Creation Programme.

<https://gov.wales/topics/environmentcountryside/epg/flooding/coastal-risk/?lang=en>)

This is particularly relevant to the 43% of Wales' 'reef' which is an Annex I feature protected by Welsh SACs. General regulatory framework for assessment of environmental impacts prior to development, plans and projects. Local authority byelaws restricting use of vehicles on the shore. Marine Litter TAP (see below) Invasive Species and Pathogens TAP (see below) Flood and Coastal Erosion Risk Management TAP (see below) CC03 Adapt/manage renewable energy installation, facilities and operation Consents are required to develop a tidal lagoon and associated cable lines. Over the past reporting period, for 1-100MW capacity projects developers were required to gain approval from Marine Management Organisation (Section 36 Electricity Act). For larger projects (>100MW) developers are required to gain approval from the UK government (nationally significant infrastructure projects - Planning Act 2008). For all projects such as these a marine licence is required (under Part 4 of the Marine and Coastal Access Act, 2009). The licence application is determined by NRW. Each application may require an Environmental Impact Assessment and Habitats Regulation Assessment (where within or adjacent to a Natura 2000 site). Based on evidence produced mitigation is agreed and implemented as appropriate. This generally reduces the impact of developments to an acceptable level. This measure relates to D01 and was ranked as medium because a moderate area may be effected (Swansea Bay) but potentially this process prevents development at a wider-scale at other bays. From April 2019, the consenting requirements for marine energy generation in Wales will change, as requirements of the Wales Act are implemented. CG05 Reduce bycatch and incidental killing of non-target species A voluntary code of practice established with commercial fishermen to prevent the use of monofilament tangle nets within 50 m of the coast of Skomer Island. Legislation, management and investigation aims to improve and maintain fish stocks and reduce impact of fishing to marine species and habitats. This measure is ranked as Medium - the related pressure and threats G01/G03/G12 are ranked medium and low and the measure is relevant to a wide area (offshore and inshore). CH03 Reduce impact of other specific human actions Conservation measures for protecting seafans (and other MCZ seabed features at Skomer Island) include a voluntary no anchoring code of conduct throughout the MCZ (other than two permitted areas in North and South Havens) and a conservation byelaw that states (among other things) no person shall 'kill, take, destroy, molest or disturb any animal or plant' in the MNR (under the MaCAA transitional arrangements, the byelaws still apply to the Skomer MCZ until a designating order is created). The byelaw does not interfere with 'any right of fishery', so does not affect operations undertaken for commercial fisheries. To address the latter NRW staff liaise with fisheries groups and individuals who are represented on the MCZ Advisory Committee, with a view to establishing a means to avoid fishing in areas where higher densities of seafans are known to occur. A voluntary code of practice established with commercial fishermen to prevent the use of monofilament tangle nets within 50 m of the coast of Skomer Island. A further and very important measure are weekend boat patrols, to encourage compliance and ensure that visitors are aware of the codes and byelaws. 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. 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 for Invasive Species and Pathogens - Thematic Action Plan: Marine Litter - Thematic Action Plan: Marine Fisheries Thematic action plans were developed under the LIFE N2K Project, highlighting the priority actions needed to improve evidence collection and understanding as associated with the issue on N2K sites in Wales. Details can be found in the plan on the NRW website (<http://naturalresources.wales/about-us/our-projects/nature-projects/life-n2k-wales/life-n2k-thematic-action-plans/?lang=en>).

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: Invasive Species and Pathogens - Improve awareness of, and compliance with, good biosecurity practices and training amongst NRW staff and contractors e.g. cleaning of boots/tools/vehicles at entry points to N2K sites. Ensure all NRW staff use bilingual biosecurity e-learning resource. Gather evidence on the presence and distribution of invasive non-natives species within sites, and the activities associated with the vectors of spread. There would also be a need to investigate pathways to and from each site, including from high risk areas adjacent to the site. Marine INNS Pathway Management in Wales will help deliver the above. 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 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. Thematic Action Plan: Marine Fisheries - Investigation is the most frequently identified mechanism relating to marine fisheries issues / risks. This mechanism is identified for use where a better understanding and evidence base of the direct and indirect effects on habitats and species is required, to enable the development of management actions where appropriate. The AWFA project is currently improving understanding of the effects of boat-based fishing activities on benthic habitats and species. Direct management is cited as a mechanism to address marine fisheries issues/risks, indicating where action is required by the competent authority, the Welsh Government or NRW. Targeted education, awareness raising and liaison as a mechanism can be used to develop projects to educate or inform people about the impacts that activities can have on features and to encourage more sustainable behaviours. Marine Litter TAP (see below) Invasive Species and Pathogens TAP (see below) Flood and Coastal Erosion Risk Management TAP (see below) CC03

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9.1 Future prospects of parameters	Non-strategic and illegal coastal defences continue to cause constraints in intertidal reef areas, mostly in areas of sediment influence such as Sabellaria alveolata, where sediment supply is compromised.
11.1 Surface area of the habitat type inside the pSCIs, SCIs and SACs network	1282.62 Km2 (intertidal - 51.84 Km2, subtidal - 1230.78 Km2)
11.4 Short term trend of habitat area in good condition within the network; Direction	Feature that is in Protected Sites and in Good condition amounts to 348.04 km2. Differences in approach make a comparison with the 2013 data not possible. Differences that exist are most likely relate to the changes in waterbody status between reporting periods.