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Data from: A Marine Natural Capital Asset and Risk Register Towards securing the benefits from marine systems and linked ecosystem services.

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Supplementary Materials 1 – Input data products

The following input data products underpinning the North Devon Marine Pioneer (NDMP) Asset and Risk Register are derived from existing data sources and methodologies described in the sections below with references provided.

Contents

1 List of abbreviations

CBD Convention on Biological Diversity

CL Conservation Limit

CPUE Catch per Unit Effort

DEFRA Department for Environment, Food & Rural Affairs

ES Ecosystem Service

EUNIS European Nature Information System

GES Good Environmental Status

ICES International Council for the Exploration of the Sea

IFCA Inshore Fisheries and Conservation Authority

JNCC Joint Nature Conservation Committee

LRC Likely Relative Condition

MarESA Marine Evidenced Based Sensitivity Assessment

MCZ Marine Conservation Zone

MESH Marine European Seabed Habitats

MPA Marine Protected Area

MSFD Marine Strategy Framework Directive

MSY Maximum Sustainable Yield

NASCO North Atlantic Salmon Conservation Organization

NDMP North Devon Marine Pioneer

TAC Total Allowable Catch

VMS Vessel Monitoring System

WFD Water Framework Directive

2 Composite Habitat Map

Method

The environmental features, and habitats present within the NDMP, up to mean high water, were derived from best available habitat map data available for the region (Table 1). A composite habitat map was generated that combined spatial data sets. Data were accessed through two sources 1) A Natural England internal habitats dataset, compiled from best available survey maps 2) Modelled data from EMODnet/EUSeaMap.

A confidence map layer was also produced, confidence was based on Marine European Seabed Habitats (MESH) confidence scores (MESH, 2008). The MESH Confidence Assessment Scheme is a systematic approach using a multi-criteria questionnaire to score habitat maps derived from survey data according to three key aspects: remote sensing methods, ground-truth data collection and data interpretation (JNCC 2008). The MESH scoring framework assigns each habitat map with a score between 0 and 100 (100 = highest confidence). The broad-scale modelled habitat data from EUSeaMap, used in areas where habitat maps from surveys were not available, has associated confidence measures, but these were developed more to illustrate some of the uncertainties around the modelling process (Cameron, Askew & 2011;EUSeaMap 2017). These result in a qualitative score (Low, Moderate or High) derived from confidence in the underlying continuous physical variables (e.g. depth, light at the seabed) and the confidence in the classification of habitat descriptors (i.e. the thresholds applied to the physical variables).

Table 1 Source habitat data available to build a composite map for the NDMP.

Dataset	Dataset Name	Source	Type	MESH Confidence Score
GB100217	2013 Natural England MCZ Verification Survey - Bideford to Foreland Point	NE/JNCC	Survey	97
GB100281	2013-2014 Ecospan NE Taw Torridge Estuary rMCZ Intertidal Verification Survey	NE	Survey	97
GB100220	2013 Natural England MCZ Verification Survey - Hartland Point to Tintagel	NE/JNCC	Survey	96
GB100218	2013 Natural England MCZ Verification Survey - Bideford to Foreland Point	NE/JNCC	Survey	96
GB100221	2013 Natural England MCZ Verification Survey - Hartland Point to Tintagel	NE/JNCC	Survey	94
NE_1600	EA Saltmarsh Zonation - December 2016 update	NE	Survey	90
GB001494	2013 CEFAS Hartland Point to Tintagel Subtidal Verification Survey - HRPT_20150821_BSH	NE	Survey	87
GB100267	Coastal Observatories South West Regional Coastal Monitoring Programme Habitat Mapping	PCO	Survey	86
GB001494	2013 CEFAS Hartland Point to Tintagel Subtidal Verification Survey - HRPT_20150821_BSH	NE	Survey	83
GB001548	2014 Cefas Morte Platform rMCZ Subtidal Verification Survey	NE	Survey	82
GB100239	2007 Marine Benthic Biotope Mapping of Sedimentary Environments, Lundy Marine Protected Area	NE	Survey	78
GB000227	Broad scale biological mapping of Lundy Marine Nature Reserve with particular reference to reefs	EMODnet MSM	Survey	77
D_00001	2011 Atlantic Array Benthic Ecology Characterisation Report - (D_00001) - JER4290_AA_Benthic_CombinedBiotopes_RPS_110721_A	NE	Survey	59
GB100335	2014 ERCCIS North Cornwall Biotope Mapping Cornwall Wildlife Trusts - Intertidal Discovery Project	NE	Survey	49
GB000579	The distribution of sublittoral macrofauna communities in the Bristol Channel in relation to substrate	NE	Survey	47
GB000284	MNCR Area Summaries - Inlets in the Bristol Channel and approaches	EMODnet MSM	Survey	42

GB001072	Intertidal mudflats layer for England	EMODnet FSM	Survey	36
GB001070	Futurecoast	EMODnet FSM	Survey	NA
EUSM16aa	EUSeaMap 2016	EMODnet	Modelled	NA
EUSM2012	EUSeaMap 2012	EMODnet	Modelled	NA

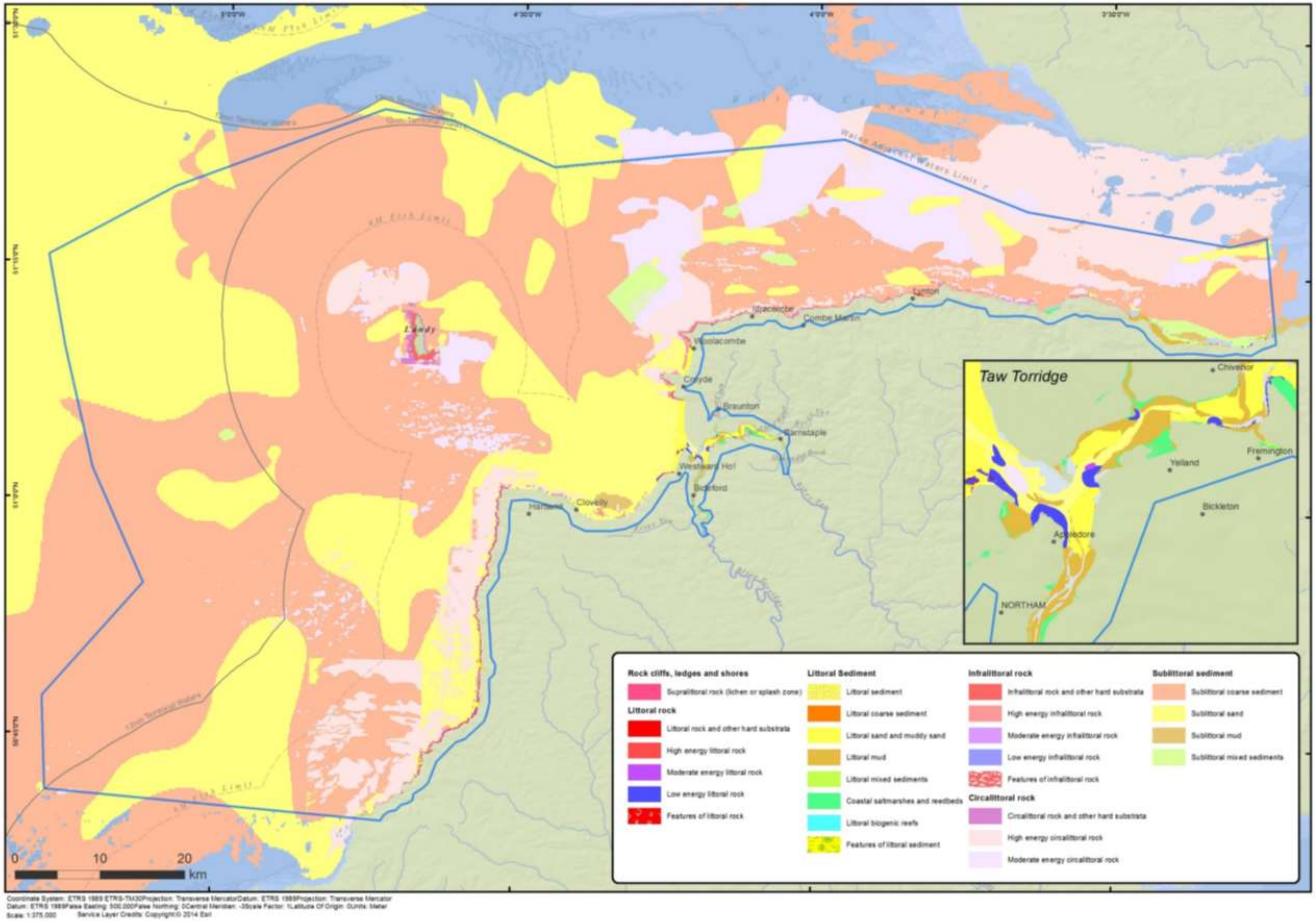
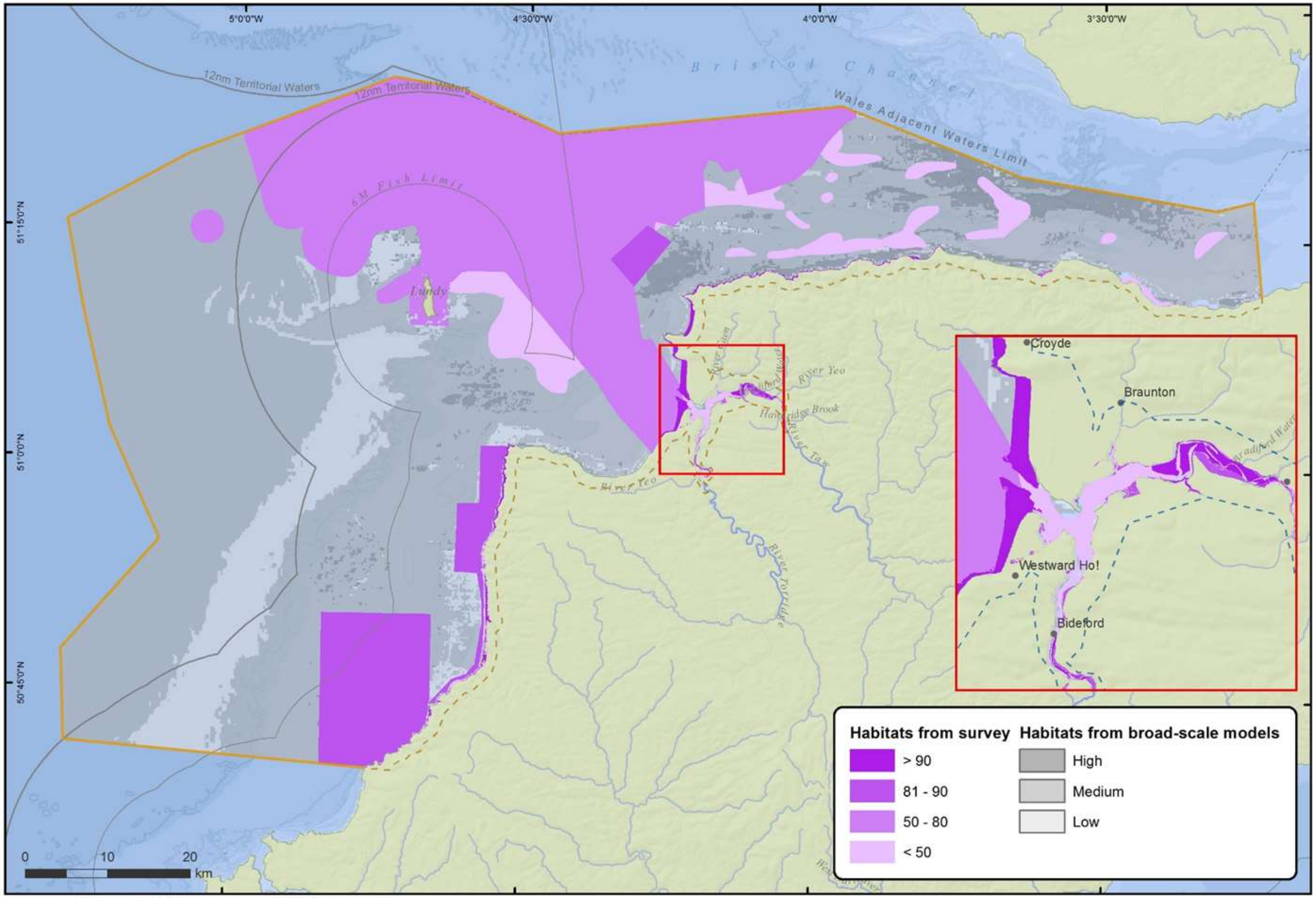


Figure 1 Mapped extent of habitat (Eunis L2/3 or greater) within NDMP



Coordinate System: ETRS 1989 ETRS-TM30Projection: Transverse MercatorDatum: ETRS 1989Projection: Transverse Mercator
Datum: ETRS 1989False Easting: 500,000False Northing: 0Central Meridian: -3Scale Factor: 1Latitude Of Origin: 0Units: Meter
Scale:1:550,000

Figure 2 Data confidence in relation to MESH confidence scores (habitats from surveys) and low-high assessment (habitats from broad scale models)

3 The Asset-Benefit matrix

Method

This data input layer for the North Devon Marine Pioneer (Figure 3) used established matrices to define ecosystem services from UK marine habitats (Saunders et al. 2015; Potts et al. 2014; Fletcher et al. 2012). We supplemented this with additional literature (list below).

The extent (km^2) of each habitat occurring within North Devon Marine Pioneer (NDMP), within designated Marine Protected Areas (MPAs), and the extent (km^2) of each habitat with a management measure associated with it (i.e. habitat extent in an MPA with a byelaw, such as bottom towed fishing gear restrictions) were calculated from the composite habitat map, in ARC GIS. The calculation only takes into account measures designed to reduce adverse effects on habitats in MPAs and thus, only includes fishery byelaws. Seasonal closures and voluntary agreements to reduce fishing pressure on commercial species were not included, as condition assessments and monitoring have not been undertaken to for these sites.

Figure 3 Matrix of EUNIS habitats to ecosystem service for the North Devon Marine Pionner.

Natural Capital Asset: Habitats in North Devon Marine Pioneer	Area (km²)	Area in MPAs (km²)	Area in management measure (km²)	Intermediate services											Goods / Benefits													
				Supporting services							Regulating services				from Provisioning services					from Regulating services					from Cultural services			
				Primary production	Larval / Gamete supply	Nutrient cycling	Water cycling	Formation of species habitat	Formation of physical barriers	Formation of seascape	Biological control	Natural hazard regulation	Regulation of water and sediment quality	Carbon sequestration	Food	Fish feed	Fertiliser (and biofuels)	Ornaments (incl. Aquaria)	Medicines and blue biotechnology	Healthy climate	Prevention of coastal erosion	Sea defence	Clean water and sediments	Imobilisation of pollutants	Tourism/nature watching	Spiritual / cultural wellbeing	Aesthetic benefits	Education
Sand dune	6.72			2		2	2	2	3	2		3		2	2					2	3	3	2		2	1	2	1
Sand dune with shrubs	0.39			2		2	2	2	3	2		3		3	2					3	3	3	2		2	1	2	1
Shingle	0.17			1			2	2		2		2		2	2					2	2	2	2		2	1	2	1
A2.5 Saltmarsh	2.80	2.10	0.62	2	3	3		3	3	3		3	3	3	3		3			3	3	3	3	3	3	1	3	1
Water estuary	2.45																											
B3.1: Supralittoral rock (lichen or splash zone)	0.85	0.58	0.00																									
A1: Littoral rock and other hard substrata	11.31	10.45	1.02																									
A1.1: High energy littoral rock	5.73	5.21	0.00	3	2	3		2	1	1		1		2	3					2	1	1			1	1	1	1
A1.2: Moderate energy littoral rock	2.98	2.83	0.03	3	2	3		2	1			1		2	3					2	1	1			1	1	1	1
A1.3: Low energy littoral rock	1.69	1.55	0.98	3	2	3		2	1			1		2	3					2	1	1			1	1	1	1
A1.4: Features of littoral rock	0.38	0.37	0.01																									
A2: Littoral sediment	29.31	22.84	9.22																									
A2.1: Littoral coarse sediment	0.76	0.61	-	1	3	1		3	1	1		3			1						3	3			1	1	1	1
A2.2: Littoral sand and muddy sand	14.99	14.74	4.21	3	3	3			1	3		3		2	1					2	3	3			1	1	3	1
A2.3: Littoral mud	9.98	4.81	4.36	3	3	3		1		1		3	3	3	3					3	3	3	3	3	1	1	1	1
A2.4: Littoral mixed sediments	0.45	0.34	0.03	3	3	3			1	1		3		2	1					2	3	3			1	1	1	1
A2.5: Coastal saltmarshes and saline reedbeds	2.80	2.10	0.62	2	3	3		3	3	3		3	3	3	3		3			3	3	3	3	3	3	1	3	1
A2.7: Littoral biogenic reefs	0.01	0.01	-	1	1	2		3		1		2	1	1	2					1	2	2	2	2	1	1		1
A2.8: Features of littoral sediment	0.03	0.03	-																									
A3: Infralittoral rock and other hard substrata	17.27	12.51	4.91																									
A3.1: Atlantic and Mediterranean high energy infralittoral rock	11.19	7.43	0.23	2	2			2	1			1		2	3					2	1	1			1	1		1
rock	2.12	1.21	0.79	2	2			2	1			1		2	3					2	1	1			1	1		1
A3.3: Atlantic and Mediterranean low energy infralittoral rock	0.07	-	-	2	2			2	1			1		2						2	1	1			1	1		1
A3.7: Features of infralittoral rock	0.00	0.00	-																									
A4: Circalittoral rock and other hard substrata	875.90	183.87	9.17																									
A4.1: Atlantic and Mediterranean high energy circalittoral rock	476.58	173.89	1.81	2	2			2	1			1			1						1	1			1	1		1
rock	393.68	4.37	1.73	2	2			2	1			1			1						1	1			1	1		1
A5.1: Sublittoral coarse sediment	2,845.22	345.70	8.56	3	3	3		3				3	1		2	3				2	3	3	3	1		1		1
A5.2: Sublittoral sand	1,690.03	52.81	4.50	3	3	3		3				3	1		2	3				2	3	3	3	1		1		1
A5.3: Sublittoral mud	10.85	0.21	-	3	3	3		3				3	1		2	3				2	3	3	3	3		1		1
A5.4: Sublittoral mixed sediments	48.56	24.38	-	3	3	3		3				3	1		2	3				2	3	3	3	3		1		1
A7.4, 7.7: Salinity fronts	TBD	TBD	TBD	1	1	1		1	1		1	1	1	1	1		1	1	1	1	1	1	1	2	1	1		1
EUNIS >Level 3																												
Intertidal underboulder communities [A1.2142, A3.2112]	0.03	0.03	-	1	1			2				1			2						1	1			1	1	1	1
Littoral chalk communities [B3.114, B3.115, A1.441, A1.2143]	0.00	0.00	-	1	1			3																	1	1		1
A5.612]	0.00	0.00	-		1	1		3	1		1	2	1	1	1					1	1	1	1	1	1	1		1
Tide-swept algal communities (L.hyperborea) [A3.126, A3.213,]	0.68	0.67	0.68	1	1	1		1	1	1	1	1	1	1	1		1		1	1	1	1	1	1	1	1	1	1
habitats [A4.12, A4.121, A4.131, A4.1311, A4.1312, A4.133, A4.211, A4.2111,	-	-	-		1			3			1				3									1	3	1		1
Kelp and seaweed communities on sublittoral sediment [A5.52]	-	-	-	1	1	1		1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1
N/A Areas of high planktonic primary productivity	TBD	TBD	TBD	3	1	3		1	1		1	1		2	2	3				2	1	1	1	1	1	1		1

Scale of ecosystem service contribution relative to other features	
#	Significant contribution
#	Moderate
#	Low
#	No or neglibible
[Blank]	Not assessed

Confidence in evidence available to assign ES provision	
3	UK-related, peer-reviewed literature
2	Grey or overseas literature
1	Expert opinion
[Blank]	Not assessed

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4 The Condition of Habitats and Species within Designated MPAs

Using a literature review of conservation advice packages on Natural England's designated sites online resource, the conservation objectives for designated features within all MPAs within the NDMP were collated (Natural England 2017) (Table 2).

Key reference

Natural England (2017) *Designated Sites View: Natural England Conservation Advice for Marine Protected Areas: Advice on Operations, Supplementary Advice on Conservation Objectives*. Natural England. https://designatedsites.naturalengland.org.uk/

Table 2 Summary table of the conservation objectives for designated features within all MPAs within the NDMP

MPA	Feature	Subfeature	EUNIS	Condition	Management
Lundy SAC	Reefs	Intertidal rock	A1	Maintain	D&S IFCA byelaws 2018: Prohibition of the removal of *Palinurus elephas* (Spiny lobster). Mobile Fishing Permit Byelaw 2018 (no access to vessels using demersal gear, except if access is authorised within the permit to an area to the north west of Lundy (iVMS introduction to monitor fishing location) for demersal trawl gear and demersal scallop gear). Potting and Mobile fishing bylaw IFCA 2015. Netting Permit Byelaw 2018.. No take zone since 2003, small area off the east coast of Lundy (2003)
	Reefs	Infralittoral rock	A3	Maintain	
	Reefs	Circalittoral rock	A4	Maintain	
	Sandbanks which are slightly covered by sea water all the time	Subtidal coarse sediment	A5.1	Maintain	
	Sandbanks which are slightly covered by sea water all the time	Subtidal sand	A5.2	Maintain	
	Submerged or partially submerged sea caves	See Annex I relations	A4.71	Maintain	
	Communities of littoral caves and overhangs		A1.44	Maintain	
	Grey seal (Halichoerus grypus)			Maintain	
Lundy MCZ	Spiny lobster (Palinurus elephas)			**Recover**	Management for Lundy SAC overlaps with Lundy MCZ, specific to Lundy MCZ is also the Diving Permit Byelaw 2018, which limits removal of edible crab, lobster, scallop, spider crab and spiny lobster.
Hartland Point to Tintagel MCZ	Coastal saltmarshes and saline reed beds		A2.5	Maintain	Impact assessments (Habitats Regulation Assessment) have been undertaken by Cornwall IFCA, to identify impact of each fishing activity on MCZ features and inform byelaws.
	Fragile sponge and anthozoan communities on subtidal rocky habitats		A4.12	**Recover (previous bottom towed fishing gear activity)**	
	High energy circalittoral rock		A4.1	**Recover**	
	High energy infralittoral rock		A3.1	Maintain	
	High energy intertidal rock		A1.1	Maintain	
	Honeycomb worm (Sabellaria alveolata) reef		A2.71	Maintain	
	Intertidal coarse sediment		A2.1	Maintain	
	Intertidal sand and muddy sand		A2.2	Maintain	
	Low energy intertidal rock		A1.3	Maintain	
	Moderate energy circalittoral rock		A4.2	**Recover (see high energy)**	
	Moderate energy infralittoral rock		A3.2	Maintain	
	Moderate energy intertidal rock		A1.2	Maintain	
	Pink sea-fan (Eunicella verrucosa)		SOCI 8	**Recover**	
	Subtidal coarse sediment		A5.1	**Recover (see high energy rock)**	
	Subtidal sand		A5.2	**Recover (see high energy rock)**	
Bideford to Foreland Point MCZ	Low energy intertidal rock		A1.3	Maintain	Interacts with D&S IFCA fishing restriction byelaws (prohibition on removal of spiny lobster across the site, Potting Permit Byelaw 2018 and restrictions within the Netting Permit Byelaw 2018)
	Moderate energy intertidal rock		A1.2	Maintain	
	High energy intertidal rock		A1.1	Maintain	
	Intertidal coarse sediment		A2.1	Maintain	
	Intertidal mixed sediment		A2.4	Maintain	
	Intertidal sand and muddy sand		A2.2	Maintain	
	Intertidal underboulder communities		A1.21	Maintain	
	Littoral chalk communities		A1.441	Maintain	
	Low energy infralittoral rock		A3.3	Maintain	
	Moderate energy infralittoral rock		A3.2	Maintain	
	High energy infralittoral rock		A3.1	Maintain	
	Moderate energy circalittoral rock		A4.2	Maintain	
	High energy circalittoral rock		A4.1	Maintain	
	Subtidal coarse sediment		A5.1	Maintain	
	Subtidal mixed sediment		A5.4	Maintain	
	Subtidal sand		A5.2	**Recover**	
	Fragile sponge and anthozoan communities on subtidal rocky habitats		A4.12	Maintain	
	Honeycomb worm (Sabellaria alveolata) reef		A2.71	Maintain	
	Pink sea-fan (Eunicella verrucosa)		SOCI 8	Maintain	
	Spiny lobster (Palinurus elephas)		SOCI 24	**Recover**	
Taw Torridge Estuary SSSI	Saltmarsh		A2.5	Favourable	Interacts with D&S IFCA fishing restriction byelaws (Netting Permit Byelaw 2018, Potting permit byelaw 2018)
	Sheltered muddy shores		A2.3	Favourable	
Lundy SSSI (marine and intertidal features only listed)	Seabirds (5)			Populations of all seabirds expanding, with the exception of kittiwake.	Interacts with D&S IFCA fishing restriction byelaws (see Lundy SAC and MCZ)
	Grey seal			Seal population is stable; ample evidence of continued successful breeding.	
	Littoral sediment		A2	Favourable	

5 The Condition of Seabed Habitats (proxy approach)

As described above, MPA assessments of benthic habitats are both limited spatially to the extent of designated sites only, to the designation features of interest within them, and with limitations on the level of activity information and update frequency available. To obtain a spatially explicit indication of condition applicable across the NDMP a proxy approach was applied, using existing tools and data layers to determine habitat sensitivity to pressures, and activity data that may contribute to those pressures.

Method

Sensitivity information by EUNIS habitat was extracted from the Marine Evidence-based Sensitivity Assessment (MarESA) database (Tyler-Walters *et al.* 2018). MarESA compiles sensitivity information through a detailed literature review process of available evidence on the effects of pressures arising from human activities on marine habitats. The assessments assign scores for habitat sensitivity as a combination of resistance and resilience to particular pressures. The scores allocated are: Not Sensitive (NS), Low (L), Medium (M), High (H) and Not relevant (NR) (Tillin & Tyler-Walters 2014)

The assessments also include semi-quantitative assessments of the quality of evidence, applicability of evidence and the degree of agreement between evidence sources. These were coded numerically and linked to the North Devon habitat data layer through a series of iterative joins, linking sensitivity information based on the most detailed habitat class information available (EUNIS levels 5 and 6), up to EUNIS level 3. At the higher EUNIS levels (3 and 4), MarESA assessments were aggregated, taking advantage of EUNIS' hierarchical structure and following a precautionary approach to assign the most sensitive score of all 'children' classes from existing MarESA assessments to their 'parent' class.

This habitat-ES-sensitivity data layer was then intersected with data on fishing intensity. The fishing data used was an amalgamated product combining spatial information on smaller fishing vessels, obtained through the participatory mapping exercise FisherMap (des Clers *et al.* 2008), with aggregated VMS data for vessels over 15m (Enever *et al.* 2017). Enever *et al.* (2017) classified their dataset into low, medium or high exposure according to relative levels of fishing effort throughout English waters, based on quartiles of vessel counts per square nautical mile. These exposure levels were coded and combined spatially with the sensitivity information. Combinations of sensitivity and exposure levels (Table 3) were then used to indicate the likely impacts to benthic habitats, and their likely relative condition as a result (LRC).

Table 3 *Combination matrix for Impacts due to habitats sensitivity and pressure exposure, and inferred Likely Relative Condition (LRC) due to impacts.*

Sensitivity	Exposure			
	None	Low	Moderate	High
NS	None	None	None	None
L	None	Low	Low	Moderate
M	None	Low	Moderate	High
H	None	Moderate	High	Very High

⇒

Sensitivity	Exposure			
	None	Low	Moderate	High
NS	Good	Good	Good	Good
L	Good			↓
M	Good			↓
H	Good	→	→	

Figure 4 demonstrates is the spatial representation of LRC across the North Devon Marine Pioneer. Table 4 provides the calculations for the area of the LRC of each habitat as hectares and as a percentage proportion of the NDMP area.

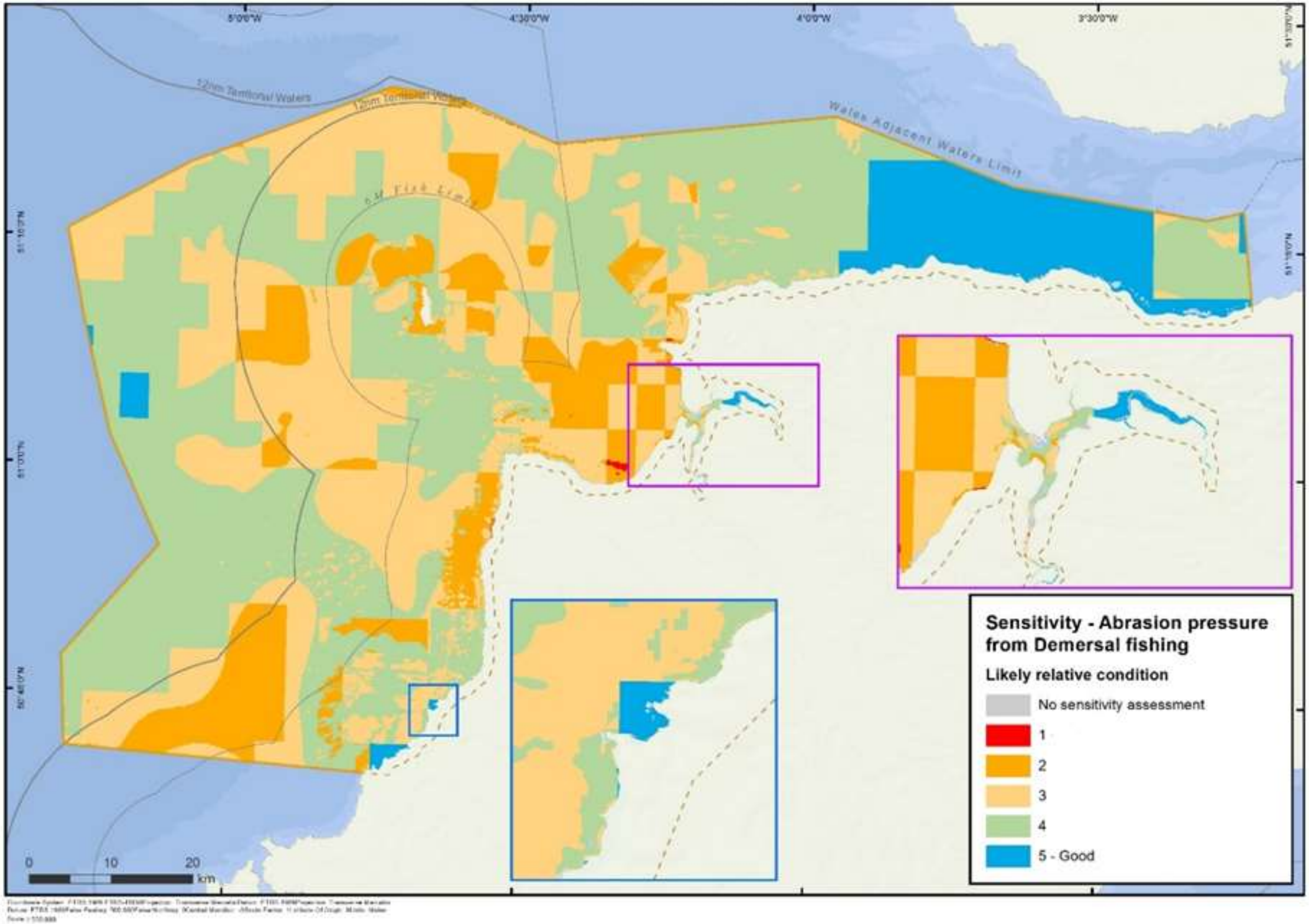

Figure 4 Likely Relative Condition (LRC) due to impacts from abrasion, as inferred from the sensitivity-pressure approach.

Table 4 Summary table of habitats and LRC (areas are presented in hectares (ha) to convert to km² divide the value by 100)

Natural Capital Asset: Habitats in North Devon Marine Pioneer (EUNIS level >3)	Area (ha)	Area (% of Pioneer)	Likely Relative Condition (LRC) inferred by sensitivity/pressure information - Full Pioneer				
			LRC 1 area, ha (% of Pioneer)	LRC 2 area, ha (% of Pioneer)	LRC 3 area, ha (% of Pioneer)	LRC 4 area, ha (% of Pioneer)	LRC 5 'Good' area, ha (% of Pioneer)
Saltmarsh	279.67	0.05					
B3.1: Supralittoral rock (lichen or splash zone)	85.09	0.02	0.44 (0.00008%)	3.65 (0.00066%)	11.46 (0.00207%)	14.24 (0.00258%)	5.67 (0.00102%)
A1: Littoral rock and other hard substrata	52.23	0.01					
A1.1: High energy littoral rock	573.43	0.10	47.42 (0.00858%)	122.43 (0.02214%)	151.15 (0.02734%)	79.03 (0.01429%)	92.05 (0.01665%)
A1.2: Moderate energy littoral rock	297.91	0.05		17.89 (0.00324%)	111.63 (0.02019%)	127.64 (0.02308%)	23.07 (0.00417%)
A1.3: Low energy littoral rock	168.73	0.03	4.11 (0.00074%)	104.13 (0.01883%)	9.54 (0.00173%)	6.62 (0.0012%)	33.43 (0.00605%)
A1.4: Features of littoral rock	38.46	0.01		2.72 (0.00049%)	8.38 (0.00152%)	20.02 (0.00362%)	4.39 (0.00079%)
A2: Littoral sediment	30.05	0.01					
A2.1: Littoral coarse sediment	75.57	0.01			1.9 (0.00034%)	17.49 (0.00316%)	27.13 (0.00491%)
A2.2: Littoral sand and muddy sand	1,498.82	0.27		230.19 (0.04163%)	731.77 (0.13234%)	178.14 (0.03222%)	276.26 (0.04996%)
A2.3: Littoral mud	997.99	0.18			31.83 (0.00576%)	289.44 (0.05235%)	601.43 (0.10877%)
A2.4: Littoral mixed sediments	44.77	0.01			5.34 (0.00097%)	33.99 (0.00615%)	3.44 (0.00062%)
A2.5: Coastal saltmarshes and saline reedbeds	279.67	0.05					
A2.7: Littoral biogenic reefs	0.60	0.00		0.19 (0.00004%)	0.41 (0.00007%)		
A2.8: Features of littoral sediment	3.03	0.00				2.54 (0.00046%)	0.48 (0.00009%)

Natural Capital Asset: Habitats in North Devon Marine Pioneer (EUNIS level >3)	Area (ha)	Area (% of Pioneer)	Likely Relative Condition (LRC) inferred by sensitivity/pressure information - Full Pioneer				
			LRC 1 area, ha (% of Pioneer)	LRC 2 area, ha (% of Pioneer)	LRC 3 area, ha (% of Pioneer)	LRC 4 area, ha (% of Pioneer)	LRC 5 'Good' area, ha (% of Pioneer)
A3: Infralittoral rock and other hard substrata	389.12	0.07					
A3.1: Atlantic and Mediterranean high energy infralittoral rock	1,119.22	0.20		82.29 (0.01488%)	419.04 (0.07578%)	279.67 (0.05058%)	310.03 (0.05607%)
A3.2: Atlantic and Mediterranean moderate energy infralittoral rock	143.98	0.03		1.04 (0.00019%)	22.88 (0.00414%)	30.99 (0.00561%)	87.02 (0.01574%)
A3.3: Atlantic and Mediterranean low energy infralittoral rock	6.77	0.00		6.77 (0.00122%)			
A3.7: Features of infralittoral rock	0.03	0.00				0.01 (0%)	0.01 (0%)
A4: Circalittoral rock and other hard substrata	564.82	0.10		564.14 (0.10203%)	0.48 (0.00009%)		
A4.1: Atlantic and Mediterranean high energy circalittoral rock	47,658.02	8.62	38.77 (0.00701%)	16604.04 (3.00291%)	15041.35 (2.72029%)		15973.49 (2.88888%)
A4.2: Atlantic and Mediterranean moderate energy circalittoral rock	39,367.51	7.12		1012.29 (0.18308%)	8569.03 (1.54975%)	21477.47 (3.8843%)	8308.72 (1.50267%)
A5.1: Sublittoral coarse sediment	284,521.56	51.46			74212.1 (13.42158%)	195513.21 (35.35942%)	14689.32 (2.65663%)
A5.2: Sublittoral sand	169,003.27	30.56		48602.01 (8.78989%)	81902.68 (14.81246%)	34715.5 (6.27845%)	3715.01 (0.67188%)
A5.3: Sublittoral mud	1,085.29	0.20	202.96 (0.03671%)	280.74 (0.05077%)	223.92 (0.0405%)	20.26 (0.00366%)	356.7 (0.06451%)
A5.4: Sublittoral mixed sediments	4,856.38	0.88		2015.49 (0.36451%)	1547.39 (0.27985%)	20.36 (0.00368%)	1227.63 (0.22202%)

Natural Capital Asset: Habitats in North Devon Marine Pioneer (EUNIS level >3)	Area (ha)	Area (% of Pioneer)	Likely Relative Condition (LRC) inferred by sensitivity/pressure information - Full Pioneer				
			LRC 1 area, ha (% of Pioneer)	LRC 2 area, ha (% of Pioneer)	LRC 3 area, ha (% of Pioneer)	LRC 4 area, ha (% of Pioneer)	LRC 5 'Good' area, ha (% of Pioneer)
A1.2142, A3.2112 Intertidal underboulder communities	2.09	0.00				2.07 (0%)	0.02 (0%)
A1.2142, A3.2112 Intertidal underboulder communities	0.77	0.00				0.77 (0%)	
A2.71: Honeycomb worm, *Sabellaria alveolata* reef	0.38	0.00			0.02 (0%)	0.36 (0.00007%)	
A3.126, A3.213: Tide-swept algal communities (L.hyperborea)	67.51	0.01			64.54 (0.01167%)		

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6 Species Assets

The UK Government Centre for Environment, Fisheries and Aquaculture Science (Cefas) collect data that can act as indicators of the extent and condition of commercial species. The Environment Agency (EA) collect data on migratory species Atlantic salmon *Salmo salar* and sea trout *Salmo trutta.* The following data were accessed from published and publically accessible sources of UK government data.

Trend analysis

Where data were available for multiple years, the trends (positive, negative or no change) between the earliest year's data and the baseline year (2017) were assessed. Values such as fisheries landings for a species may rise and fall between years and do not necessarily provide a linear trend over time (increase or decrease concurrently and at a constant rate). Therefore, to identify if a trend over time occurred, annual data (e.g. 2010-2017) were first plotted against time to visualise inter-year changes. To statistically test for the presence of a trend, Kendall's tau-b statistical tests were calculated in SPSS to test for presence of a monotonic relationship between indicator data and time (2010-2017). The test provides a non-parametric form of monotonic trend regression analysis (Meals et al. 2011). Monotonic trends occur when the variables (indicator over time) tend to move in the same relative direction, but not necessarily at a constant rate. A significant positive or negative trend was assessed at the 95% confidence limit.

Three-year moving averages were also compared where possible, to identify a change in average values between the most recent 3 year period and the three year period previous to it (e.g. was there an increase, decrease or no change in the moving between 2012-2014, and 2015-2017). This provided a summary of changes in the most recent years' data, and provided consideration for inter-annual variation, which is common in data such as fisheries landings or tourism statistics.

The following tables collate the data available from the EA and Cefas for input into the asset and risk register.

Table 4 CPUE (number per km²) from UK Irish Sea and Bristol Channel Beam Trawl Survey samples. Species include main quota species (by landings weight) for fisheries from NDMP ports.

Natural Capital Assets	Indicator		Unit	Baseline year 2017	Baseline Trend 2010-2017	Correlation coefficient (Kendall's tau-b)	Significance
Species stocks (for each fish and shellfish stock used for food: Quota Species)	Extent: Abundance, CPUE n per km² (average per sample site from ICES rectangles intersecting NDMP: 31E4, 31E5, 31E6, 30E4, 30E5	Cod: CPUE	n per km² (per sample site in ICES rectangles intersecting NDMP)	0	↓	**-0.79**	**0.006**
		Plaice: CPUE	n per km² (per sample site in ICES rectangles intersecting NDMP)	2697.82	↓	-0.214	0.458
		Sole: CPUE	n per km² (per sample site in ICES rectangles intersecting NDMP)	4436.94	↓(↔)	-0.071	0.805
		Herring: CPUE	n per km² (per sample site in ICES rectangles intersecting NDMP)	0	↑	0.357	0.275
		Thornback ray: CPUE	n per km² (per sample site in ICES rectangles intersecting NDMP)	444.33	↑	0.286	0.322
		Small eyed ray: CPUE	n per km² (per sample site in ICES rectangles intersecting NDMP)	67.47	↓	-0.429	0.138
		Blonde ray: CPUE	n per km² (per sample site in ICES rectangles intersecting NDMP)	199.63	↔	0	1
		Bass: CPUE	n per km² (per sample site in ICES rectangles intersecting NDMP)	21.69	↓	-0.286	0.322
		Squid: CPUE	n per km² (per sample site in ICES rectangles intersecting NDMP)	468.79	↑	**0.571**	**0.048**

Table 5 Advised TAC for ICES area VII f, based on scientific advice for key NDMP commercial species by weight landed (herring is included as a traditional fishery)

Natural Capital Assets	**Indicator**		**Unit**	**Baseline year 2017**	**Baseline Trend 2010-2017**	**Correlation coefficient (Kendall's tau-b)**	**Significance**
Species stocks (for fish and shellfish stock used for food: Quota Species)	Condition	Cod: Advised TAC for area VIIf	(t)	1447	↓	-0.286	0.322
		Plaice: Advised TAC for area VIIf	(t)	405	(↔)	-0.074	0.802
		Sole: Advised TAC for area VIIf	(t)	806	↓	-0.327	0.262
		Herring: Advised TAC for area VIIg	(t)	16145	(↔)	0.048	0.881
		Thornback ray: Advised TAC for area VIIf	(t)	1235	↓	-0.206	0.503
		Small eyed ray: Advised TAC for area VIIf	(t)	154	**↓**	**-0.926**	**0.002**
		Blond ray: Advised TAC for area VIIf	(t)	895	**↓**	**-0.926**	**0.002**

Table 6 Crab and lobster (non quota species) stock assessment, from Cefas stock reports for south west UK

Natural Capital Assets	Indicator	Species	Unit	Baseline year (2017)	Trend 2010-2017
Species stocks (for each fish and shellfish stock used for food: Non- Quota Species)	Condition (Cefas stock status report)	Crab (*Cancer pagurus*)	classification (exploitation level)	Moderate, likely to be sustainable, between minimum reference point and MSY.	↔
		Lobster (*Homarus gammarus*)	classification (exploitation level)	Moderate, above critical levels but not yet at the MSY.	↔

Table 7 Salmon and Sea trout CPUE from net fisheries on NDMP estuaries

Natural Capital Assets	Indicator	Species	Unit	Baseline year 2017	Baseline Trend 2010-2017	Correlation coefficient (Kendall's tau-b)	Significance
Species stocks (for fish and shellfish stock used for food: migratory species)	Env. Agency and Cefas salmon sea trout monitoring (annual catch nets)	Salmon	*n* per license day	0.75	↓(↔)	-0.4	0.327
		Sea trout	*n* per license day	0.95	↑(↔)	0.6	0.142

Table 8 % of conservation limit (egg deposition levels) attained in salmon rivers in NDMP

Natural Capital Assets	Indicator		Unit	2010	2011	2012	2013	2014	2015	2016	Baseline year (2017)
Compliance of salmon and sea trout rivers with conservation limits, as reported in annual ICES reports	Condition % of the percentage of the CL attained (annual)	Taw	% of conser-vation limit attained	134	287	199	52	109	253	139	244
		Torridge	% of conser-vation limit attained	80	68	131	58	49	91	83	101
		Lyn	% of conser-vation limit attained	227	291	166	85	103	95	60	257

Table 9 Compliance of salmon rivers in NDMP with management objectives

Natural Capital Assets	Indicator		Unit	Baseline year (2017)	Trend 2010-2017
Compliance of salmon rivers with management objectives, as reported in annual ICES reports	Condition (Classification: At Risk, Probably at risk, Probably not at risk)	Taw	classification	Probably at risk	↔
		Torridge	classification	Probably at risk	↔
		Lyn	classification	Probably at risk	↑(↔)

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7 Water Column

In line with UK commitments under the Marine Strategy Framework Directive (MSFD) and the Water Framework Directive (WFD), data are collected by government agencies that can be applied in the natural capital context as indicators of the condition of water body assets. Each water body status, in reference to WFD targets, was assessed in the case study area. Data on status was accessed from HM Government online resources. The data are collated below for input into the Asset and Risk Register. Trend analysis follows the same analysis as species assets.

Table 10 Water body status for WFD estuarine and Coastal water bodies within NDMP.

WFD Estuarine and Coastal Water Body	**2015 status, based on data collected 2009-2014**				
	Overall water body status	**Ecological status**	**Chemical status**	**Target water body status**	**Hydromorpholoy status**
Cornwall North	High	High	Good	High	High
Lundy	Good	Good	Good	Good	High
Taw / Torridge	Moderate	Moderate	Good	Moderate	Supports Good
Barnstaple Bay	Good	Good	Good	Good	High
Bristol Channel Outer South	Good	Good	Good	Good	Supports Good
Bristol Channel Inner South	Moderate	Moderate	Good	Moderate	Supports Good
Bridgwater Bay	Moderate	Moderate	Good	Good	High

Table 11. Bathing Water Quality classification for beaches within and adjacent to NDMP. 0 = poor, 1 = satisfactory, 2 = good, 3 = excellent. Trend = increase ↑, decrease ↓ or no change ↔ between 2017/18 and mean of previous assessments 2014/15-2016/17. Pollution incidents are recorded as total over last 2 years.

Beach (Sample Point)	Bathing Water Quality Classification				Trend	Pollution incidents 2017-2018	No. bathers per 100m, 2017 season (mean)
	2015	2016	2017	2018			
Somerset beaches							
Blue Anchor West	2	2	2	2	↔	0	no data
Minehead Terminus	2	2	2	2	↔	0	no data
Porlock Weir	3	3	3	3	↔	0	no data
Devon beaches							
Lynmouth	3	3	3	3	↔	0	no data
Combe Martin	0	2	1	0	↓	1	4.91
Ilfracombe Hele Bay	1	2	2	2	↑	0	1.52
Ilfracombe Tunnels Beach	3	3	3	3	↔	0	4.4
Ilfracombe Wildersmouth	0	0	0	0	↔	0	0.73
Woolacombe - Barricane Bay	3	3	3	3	↔	0	5
Woolacombe Village	3	3	3	3	↔	0	24.55
Putsborough	3	3	3	3	↔	0	14.75
Croyde Bay	2	2	2	2	↔	1	35.45
Saunton Sands	3	3	3	3	↔	0	25
Westward Ho!	3	3	3	3	↔	0	15.65
Instow	0	0	0	0	↔	0	1.15
Hartland Quay	3	3	3	3	↔	0	0.55
Cornwall beaches							
Bude Crooklets	2	2	2	2	↔	1	13.7
Bude Sandy Mouth	3	3	3	3	↔	0	11.15
Bude Summerleaze	2	2	3	2	↓	0	42.5
Widemouth Sand	3	3	3	3	↔	0	45
Crackington Haven	3	2	3	3	↑	0	9.2

Table. 12 Shellfish water monitoring data for NDMP shellfish waters

Estuary - Shellfish monitoring site	2018 Status (Data from, Food Standards Agency, 2018)		
	Incidents harmful plankton identified above trigger levels	**Occasions biotoxin monitoring of flesh detected toxin (clinical signs below action level**	**Occasions biotoxin monitoring of flesh detected toxin (clinical signs above action level**
Taw/Torridge - Spratt Ridge East	6	6	0

References

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