
North Devon Marine Natural Capital Plan Sustainability Assessment



© Miles Wolstenholme



© Nilfanion



© Dickelbers



© Kate Weld

CONSULTATION DRAFT
February 2020

Suggested citation

Hooper, T., Ashley, M., Mullier, T. and Rees, S. 2020. *North Devon Marine Natural Capital Plan. Sustainability Assessment*. February 2020. Report prepared for the North Devon Biosphere Reserve as part of the South West Partnership for the Environment and Economic Prosperity (SWEEP) and the Marine Pioneer programme.

Contact

Tara Hooper
Plymouth Marine Laboratory
Prospect Place
The Hoe
Plymouth
Devon
PL1 3DH

Acknowledgements

This work was funded by the Natural Environment Research Council through the South West Partnership for the Environment and Economic Prosperity (SWEEP; grant NE/P011217/1). The authors are also very grateful to the North Devon Marine Pioneer teams.

Picture credits

Surfing at Croyde: Miles Wolstenholme [CC BY (<https://creativecommons.org/licenses/by/2.0>)], from Wikimedia Commons

Clovelly Harbour: Nilfanion [CC BY-SA (<https://creativecommons.org/licenses/by-sa/4.0>)], from Wikimedia Commons

Puffin on Lundy: Dickelbers [CC BY-SA (<https://creativecommons.org/licenses/by-sa/3.0>)]

Seastock at Braunton Burrows: Kate Weld [CC BY-SA (<https://creativecommons.org/licenses/by-sa/4.0>)]

1 Summary

The purpose of this assessment is to consider how the Marine Natural Capital Plan (MNCP) could impact upon the marine environment, coastal communities, and maritime economy in North Devon. The MNCP is the first iteration of what is expected to be an evolving process, and serves to build the necessary framework for long term sustainable management. Thus, few detailed benchmarks are included in the sustainability assessment, which instead evaluates the expected direction of travel of the MNCP. The sustainability appraisal uses a natural capital framework in order to continue to test the approach being developed under the SWEEP programme and the Marine Pioneer.

Several plans and policies interact with the MNCP, most of which have similar high-level objectives to: support sustainable development of the maritime economy; protect the marine environment; connect people to nature; and develop strong and just societies. These include the South West Marine Plan, the North Devon and Torridge Local Plan, fisheries byelaws from the Inshore Fisheries and Conservation Authorities, national conservation legislation relating to the protection of landscapes, habitats and species, and the 25 Year Environment Plan.

Thirty sustainability objectives are defined, which overlap significantly with the objectives of the MNCP itself as a result of the overarching aims of the MNCP being intrinsically linked to sustainable development. The sustainability objectives encompass natural, human, social, manufactured and financial capital, and include those for species populations, habitats, heritage; engagement of fishers, recreational users and the wider public; strengthening networks; minimising the impact of new infrastructure; and securing inward investment. Indicators for each objective are given within the sustainability assessment framework. Few policy targets exist at present (and mostly concern water quality and protected areas), but more targets are expected to be defined as the MNCP evolves.

The baseline assessment includes (i) an asset register, (ii) an ecosystem services inventory, and (iii) a risk register. It highlights the large extent of subtidal sedimentary habitats, the presence of estuarine mussel beds, saltmarsh and mudflats, and the important sand dunes. Wetland and sea bird populations are found in the Taw Torridge and on Lundy, demersal fish species as well as crab and European lobster are important for commercial fisheries, and protected species include seals, porpoise, spiny lobster and pink sea fans. Heritage assets range from scheduled ancient monuments and protected wreck sites to memorials to sailors and fishermen. The North Devon marine area also provides important ecosystem services (and associated benefits), particularly related to tourism, recreation and leisure, seascape and cultural heritage, and commercial fisheries. Marine and coastal habitats (especially saltmarsh) also contribute to regulating and maintenance services including carbon sequestration, water quality, coastal defence, and the provision of nursery habitats for fishery species. The continued supply of ecosystem services and benefits from the assets of the North Devon marine area is in some cases at risk however, due to the level of pressure on certain habitats. The ability of subtidal habitats to support food production, and saltmarsh condition are of most concern.

The sustainability assessment compares implementing the plan versus not doing so. In the short term (1-5 years), the principal positive impacts relate to human, social and financial capital, due to the expected strengthening of networks, improved governance, data-sharing, raising awareness, and new finance initiatives. Impacts on natural capital assets, ecosystem services and benefits are largely neutral. In the longer term, positive impacts are expected for subtidal habitats where management measures reduce sea bed abrasion and for local stocks that have limited exposure to external pressures. Water quality is expected to improve as the MNCP supports actions to reduce diffuse pollution, and improved water quality is likely to increase the economic viability of mussel harvesting. There is potential for positive impact on cultivated seafood and macro-algae as well as tidal energy if the MNCP intention to support maritime industries is realised through the establishment of new businesses. A reduction in litter is likely to improve aesthetic quality, with improvements potentially occurring quickly with increasing support for ongoing initiatives. The quality of nursery habitats may increase if management reduces subtidal abrasion impacts, and through increasing saltmarsh area. More saltmarsh will also increase climate regulation, although benefits may be relatively limited, depending on the extent to which current land use promotes carbon uptake. Impacts on recreation are expected to be neutral, although there may be a decline in benefits from bait digging. It is not possible to make useful judgments about the likely effects on erosion control and flood protection. The limited benefits of the MNCP reflect the limitations of local management: ensuring positive outcomes for natural capital is also dependent on national and international governance.

2 Introduction

2.1 Background and Scope

The purpose of this assessment is to consider how the Marine Natural Capital Plan (MNCP) could impact upon the marine environment, coastal communities, and maritime economy in North Devon. The MNCP broadly follows the North Devon Marine Pioneer boundary (Figure 1) but extends seaward to 20nm and includes part of Bridgwater Bay. The MNCP reaches to the tidal limits of the Taw and Torridge rivers, and also includes the area up to 1km inland for the purposes of accounting for economic flows, thus joining to the boundary of the North Devon Landscape Pioneer. The governance and actions of the plan (and hence the scope of the sustainability assessment) are restricted to the marine component of the North Devon Biosphere.

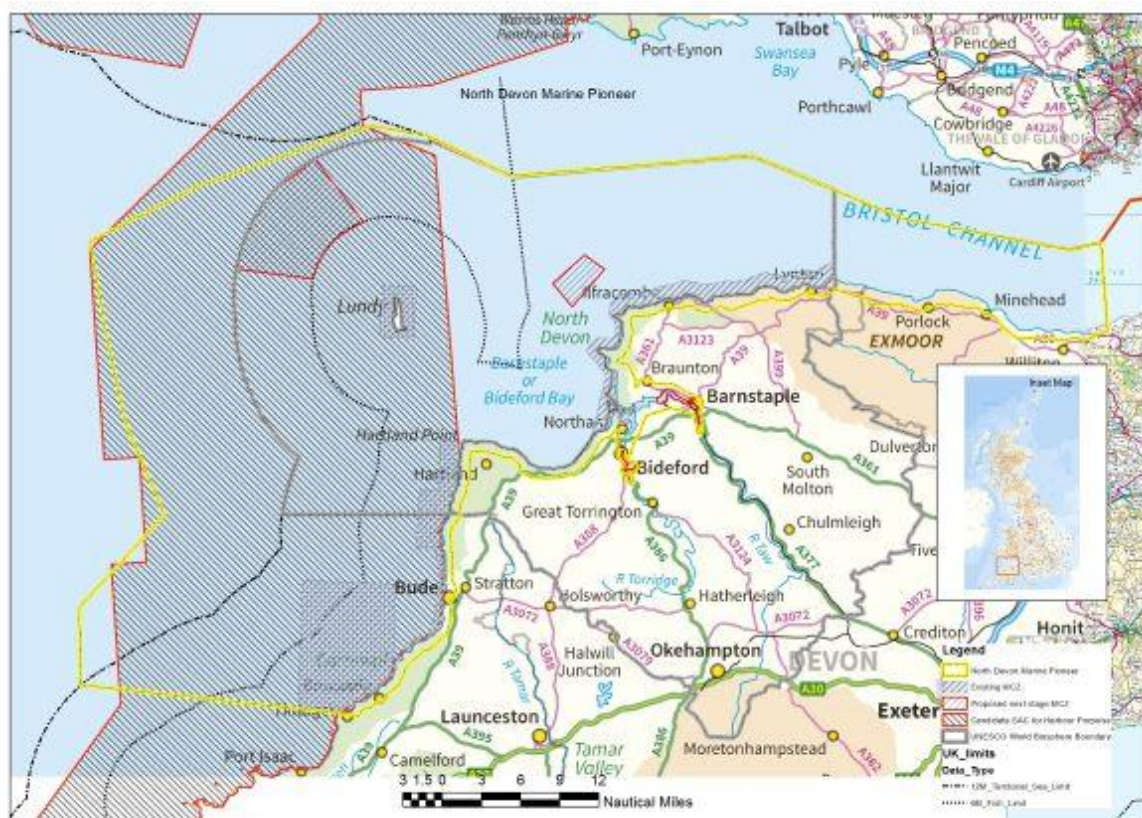


Figure 1. The area covered by the North Devon Marine Natural Capital Plan.

The MNCP is the first of its kind in the UK, and is the first iteration of what is expected to be an evolving process. This initial plan therefore primarily serves to build the necessary framework for long term sustainable management: to put in place a participatory governance structure, and to initiate or support the development of further management plans, financing options, research programmes and data sharing that address specific issues and sectors. Thus, few detailed benchmarks are included in the sustainability assessment, which instead evaluates the expected direction of travel of the MNCP. Future iterations, into which learning from, and specific actions developing as a result of, this first phase will be incorporated, are expected to include more specific targets for species, habitats and maritime sectors.

The sustainability appraisal is structured using a natural capital framework in order to continue to test, and enabling further refinement of, the approach being developed under the SWEEP programme and the Marine Pioneer (Hooper et al., 2019).

2.2 Relevant plans and policies

The principal plans and policies that interact with the MNCP include, at the regional level, the South West Marine Plan (SWMP; MMO, 2020a), which is currently in draft form as it progresses through public consultation. The SWMP has 13 specific objectives within three high level objectives from the Marine Policy Statement (HM Government, 2011): (1) achieving a sustainable marine economy; (2) ensuring a strong, healthy and just society; and (3) living within environmental limits. The SWMP also contains a number of specific policies that support delivery of the objectives. These policies are wide ranging, and concern different sectors and locations. The key text of those with particular relevance to the MNCP are summarised in Table 1.

Table 1. Extracts from the main policies within the South West Marine Plan (MMO, 2020a) of relevance to the North Devon Marine Natural Capital Plan.

Policy code	Policy text
SW-AQ-2	Proposals enabling the provision of infrastructure for sustainable aquaculture and related industries will be supported.
SW-REN-1	Proposals that enable the provision of renewable energy technologies and associated supply chains, will be supported.
SW-WIND-1	Proposals for offshore wind inside areas of identified potential will be supported.
SW-HER-1	Proposals that demonstrate they will conserve and enhance elements contributing to the significance of heritage assets will be supported.
SW-FISH-1	Proposals supporting a sustainable fishing industry, including the industry's diversification, should be supported.
SW-FISH-3	Proposals enhancing essential fish habitat, including spawning, nursery and feeding grounds, and migratory routes should be supported.
SW-EMP-1	Proposals that result in a net increase to marine related employment will be supported
SW-CC-1	Proposals which enhance habitats that provide flood defence or carbon sequestration will be supported.
SW-ML-1	Public authorities must make adequate provision for the prevention, re-use, recycling and disposal of waste to reduce and prevent marine litter. Public authorities should aspire to undertake measures to remove marine litter within their jurisdiction.
SW-WQ-1	Proposals that enhance and restore water quality will be supported.
SW-SOC-1	Those bringing forward proposals are encouraged to consider and enhance public knowledge, understanding, appreciation and enjoyment of the marine environment as part of (the design of) the proposal.
SW-MPA-1	Proposals that support the objectives of marine protected areas and the ecological coherence of the marine protected area network will be supported.
SW-BIO-1	Proposals that enhance the distribution of priority habitats and priority species will be supported.
SW-BIO-3	Proposals that deliver environmental net gain for coastal habitats where important in their own right and/or for ecosystem functioning and provision of ecosystem services will be supported.
SW-NG-1	Proposals should deliver environmental net gain for marine or coastal natural capital assets and services.

At a more local level, the North Devon and Torridge Local Plan (Torridge District Council and North Devon Council, 2018) has four strategic aims:

- Aim 1:** A Vibrant Northern Devon Economy – where excellent opportunities support diverse low carbon growth and moves towards an economy that supports our world class environment.
- Aim 2:** A World Class Environment – where important assets are valued and enhanced for future generations.
- Aim 3:** A Balanced Local Housing Market – where a choice of decent housing of all types is available and new development meets community needs.
- Aim 4:** Mixed Communities – where there is a strong community spirit and the opportunity for an excellent quality of life.

A number of the general Local Plan objectives (such as diversifying the local economy without adverse environmental and social impacts, learning and skills development, habitat protection, and improving public access to the environment to support wellbeing) apply to marine and coastal areas, but the plan also includes objectives that make explicit reference to marine and maritime issues:

- sustainable growth in the maritime, engineering, tourism and leisure economies;
- the undeveloped coastline, estuarine and important countryside assets of northern Devon are protected and enhanced;
- development improves water quality in rivers, lakes, estuary and coastal waters to help deliver the South West River Basin Management Plan objectives

The Local Plan also includes a Coast and Estuary Strategy (Policy ST09), elements of which concern maintaining and enhancing the cultural heritage and landscape setting of coastal communities; a diverse maritime economy; defence against coastal erosion and tidal flooding; and improving water quality, as well as stressing the importance of the coastal, estuarine and marine environments. The Devon and Severn Inshore Fisheries and Conservation Authority (IFCA) are responsible for legislation and enforcement specific to fisheries (both wild capture and mariculture), which includes byelaws related to permitting for mobile fishing, potting, netting and diving for scallop, crab and lobster, and the management of shellfish beds. The IFCA are also developing Fisheries Research and Management Plans. Voluntary agreements are also in place for ray and whelk fisheries (Ashley et al., 2018).

Also pertinent to the MNCP is national conservation legislation relating to the protection of landscapes, habitats and species associated within the designated Sites of Special Scientific Interest (SSSIs), Marine Conservation Zones (MCZs), Area of Outstanding Natural Beauty (AONBs), and Special Areas of Conservation (SACs) within the marine and coastal areas of the North Devon Biosphere Reserve. These highlight the important species, habitats and other features that require protection. The MNCP interacts with the North Devon AONB, four SACs (Braunton Burrows, Lundy, Bristol Channel Approaches and Tintagel-Marsland-Clovelly Coast), five MCZs (Lundy, Northwest of Lundy, Morte Platform, Bideford to Foreland Point, Hartland Point to Tintagel, and the South West Approaches) and more than 20 SSSIs in coastal areas, including the Taw-Torridge estuary, Exmoor coast, Saunton to Baggy Point, and Northam Burrows. Salmon and Sea trout are also subject to national management objectives (Cefas, Environment Agency & Natural Resources Wales, 2018).

Defra's 25 Year Environment Plan (25YEP; HM Government, 2018) sets out the vision for national environmental policy. It seeks to secure clean, healthy productive and biologically diverse seas and oceans through implementing a sustainable fisheries policy, and achieving good environmental status while allowing marine industries to thrive and completing an ecologically coherent network of well-management marine protected areas. The 25YEP also contains commitments to reduce marine litter and reduce risks from flooding and coastal erosion as well as having wider objectives (not linked explicitly to the marine environment but of relevance to it), to recover nature and enhance the beauty of landscapes; connect people with their environment; and reduce pollution.

3 Sustainability Objectives

The overarching aims of the MNCP focus on ensuring environmental improvement, empowering communities, and securing coastal livelihoods, and thus are intrinsically linked to sustainable development. Therefore, there is significant overlap with the sustainability objectives and those of the MNCP itself. A similar approach was taken for the South West Marine Plan (MMO, 2019), for which the sustainability appraisal does not have separate objectives, but instead considers the wider objectives of the Marine Plan and associated policies. The five capitals model (Forum for the Future, undated; Table 2) was used in formulating the sustainability objectives, to ensure that they had relevance across different aspects of the environment, society and the economy. The full list of sustainability objectives is given in Table 3.

Table 2. Descriptions for each of the five capitals (Hooper et al., 2019).

Capital type	Description
Natural	Encompasses natural resources as well as the processes needed to sustain life and produce goods and services.
Social	Networks together with shared norms, values and understandings that facilitate cooperation within or among groups (such as families, unions, schools, voluntary organisations)
Human	The health, knowledge, skills and capabilities of individuals.
Manufactured	Goods or assets that contribute to the production process or the provision of services, rather than being part of the output itself. It includes, for example tools, machinery, buildings and infrastructure.
Financial	Those assets of an organisation that exist in a form of currency that can be owned or traded, including shares, bonds and banknotes.

Table 3. The sustainability objectives for the North Devon Marine Natural Capital Plan

<p>Natural Capital (including related heritage)</p> <ul style="list-style-type: none"> • Disturbance of waterbirds, sea birds and marine mammals is reduced • All mussel beds in the Taw Torridge estuary rated at least Class B by 2030 • All designated bathing waters reach guideline standards by 2025 • All estuarine and coastal water bodies reach appropriate standards under the Water Framework Directive • Commercial stocks of fish and shellfish (wild capture) increase • Stocks of salmon and sea trout are maintained above their conservation limits • Health of fish habitats is maintained and where possible improved • Disturbance of intertidal mudflats in the Taw Torridge estuary from recreational bait collection (bait digging, crab tiling) is reduced • The quantity of plastic waste and litter on beaches and in the water column is reduced • Carbon storage capacity of the Taw Torridge estuary is increased • Disturbance (scour) of subtidal sediments is reduced • Levels of protection for environmental assets are maintained and where possible improved • Environmental quality in protected areas reaches at least minimum acceptable status • Likely relative condition of subtidal habitats is maintained and where possible improved • The cultural heritage value of ongoing inshore fisheries is maintained
<p>Human Capital</p> <ul style="list-style-type: none"> • Employment opportunities increase in mariculture, shellfish hand-harvesting, and value-added activities for wild capture fisheries, where these do not exceed levels of sustainable exploitation • The availability of data on (and therefore knowledge of) environmental, social and economic issues related to marine areas is increased • Local people are motivated to take part in environmental initiatives • Members of the public are motivated to improve their behaviour around waste disposal • Recreational users are motivated to improve their behaviour in order to minimise environmental disturbance • Fishers and harvesters are more engaged in sustainable fisheries management
<p>Social Capital</p> <ul style="list-style-type: none"> • Networks for sustainable management of coastal and marine areas are strengthened • Recreational users are more engaged with sustainable management • Conflict amongst marine users is reduced • The use of citizen science data in decision making is increased
<p>Manufactured Capital</p> <ul style="list-style-type: none"> • New infrastructure for renewable energy and mariculture conforms to sustainability criteria • New mooring infrastructure is installed to reduce habitat damage due to anchoring and scour from traditional moorings
<p>Financial Capital</p> <ul style="list-style-type: none"> • Incomes for fishers/harvesters using low-impact techniques are maintained, and where appropriate increased, through sustainable management of resources and value-added activities • The economic contribution of recreation and tourism linked to marine and coastal natural capital is maintained • New financial mechanisms and products are established to support maritime activities and environmental protection

4 Baseline

Extensive, detailed information on North Devon's marine area, including on species, habitats, and activities such as fisheries, recreation and tourism has already been collated and analysed by Ashley et al. (2018) and Rees et al. (2019), much of which is available through the geodatabase (<https://pioneer-geonode.plymouth.ac.uk>), and so will not be duplicated here. This assessment will instead provide a short narrative summary taken, with the exception of the information on heritage assets, primarily from Ashley et al. (2018) and Rees et al. (2018), with additional information from Hooper (2013). This is accompanied by a series of summary tables comprising: (i) an asset register (with both species and habitats), (ii) an ecosystem services inventory, and (iii) a risk register.

In terms of natural capital assets, the marine area is dominated by sedimentary habitats, particularly sand and coarse sediments. There are also rocky reef areas, and pockets of macro-algae. Intertidal habitats include mussel beds, saltmarsh and mudflats within the Taw Torridge estuary, as well as rocky shores and sandy beaches. The sand dunes at Braunton and Northam Burrows are important coastal margin habitats and support protected species including the petalwort and sandbowl snail. The estuary supports some regionally and nationally important populations of waterbirds, and curlew, lapwing and golden plover are designated features of protected areas. Protected seabirds including puffins, razorbill, Manx shearwater, guillemot and kittiwake are found in the area, primarily on the cliffs of Lundy. Subtidally, demersal fish species as well as crab and European lobster are important for commercial fisheries, and protected species include seals, porpoise, spiny lobster and pink sea fans.

The evaluation of heritage assets was beyond the scope of Ashley et al. (2018) and Rees et al. (2019), but they were described by Hooper (2013), whose work was informed particularly by Preece (2005, 2008). The estuary contains two scheduled ancient monuments (a buried Bronze Age stone row at Isley Marsh, and the Bideford Long Bridge), as well as three prehistoric sites at Westward Ho! The remains of several fish weirs can be found in the Taw, and assets related to shipbuilding remain on the banks of the Torridge. Historic military infrastructure can be found at Instow and, particularly, on Braunton and Northam Burrows. Further heritage assets are recorded on local lists maintained by local authorities (North Devon Council, undated; Torridge District Council, undated). These include memorials to sailors and fishermen, buildings associated with the former uses of Fremington Quay and with Victorian/Edwardian seaside tourism in Ilfracombe and Woolacombe, a former lifeboat station, and riverfront warehouses. Historic England (undated) lists two wrecks designated under the Protection of Wrecks Act 1973, both close to Lundy: the *Iona II*, an American paddlesteamer lost in 1864, and the remains of a 15th/16th Century ship wrecked at Gull Rock.

Tourism, recreation and leisure are extremely important in North Devon, with watersports participation making a significant economic contribution. The seascape and cultural heritage of the area are also important services that contribute to its popularity as a visitor destination. Ray, whelk, lobster and sole contributed over 80% of the value of annual landings into North Devon ports in 2018 (MMO, 2020b). There are also moderate levels of hand-harvesting of mussels from beds within the estuary, a commercial operator culturing oysters in Porlock, and occasional harvesting of purple laver and cockles from rocky shores. Bait collection (particularly for rag- and lugworm, and tiling for moulting shore crabs) occurs frequently on mudflats in the estuary. Spat for seeding mussel beds elsewhere has previously been collected, but is not occurring at the present time. The estuary is also used for commercial shipping into Appledore and Bideford and for military exercises, particularly amphibious craft training. A tidal energy test site can be found at Lynmouth, although is currently dormant. Marine and coastal habitats (especially saltmarsh) also contribute to regulating and maintenance services including carbon sequestration, water quality (through filtration, remediation and other processing of waste and toxins), coastal defence, and the provision of nursery habitats for fishery species. The continued supply of ecosystem services and benefits from the assets of the North Devon marine area is in some cases at risk however, due to the level of pressure on certain habitats. The ability of subtidal habitats to support food production and the condition of saltmarsh are of most concern.

The following tables summarise data on the key habitats, species and ecosystem services in the North Devon marine area. Their extent (quantity), trends in that extent, and condition are summarised, and some monetary values for benefits from ecosystem services are provided. Quantified information is given where available for extent and value, while trends and condition are categorised. The information in Tables 4–7 is primarily from Rees et al. (2019) and Ashley et al. (2018), with further information from Hooper (2013), and additional fisheries landing values from MMO (2020). Rees et al. (2019) and Ashley et al. (2018) also include confidence assessments and caveats related to the data. For example, the data on which fisheries stock assessments are based is collected on a much larger spatial scale and the sampling methods used are not the most appropriate for some of the species documented. The method for development of the risk register and the justification for the risk scoring are also given in Rees et al. (2019).

4.1 Asset register summary





Habitats











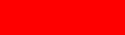

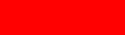









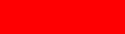

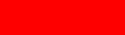












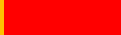




























Table 4. The extent and condition of the major habitats in the North Devon marine area

		Key:					
		Trend	Positive	Stable	Negative	Insufficient data	
		Condition	Good	Acceptable	Of concern		
Broad Habitat	Detail (with EUNIS code)	Extent (km ²)	Extent trend	Condition			
Sparsely vegetated land							
Supralittoral sediment	Sand dune	6.72					
	Sand dune with shrubs	0.39					
	Shingle	0.17					
Marine inlets and transitional waters							
Littoral rock	Littoral rock and other hard substrata (A1)	11.31					
	High energy littoral rock (A1.1)	5.73					
	Moderate energy littoral rock (A1.2)	2.98					
	Low energy littoral rock (A1.3)	1.69					
	Features of littoral rock (A1.4)	0.38					
	Littoral chalk communities (B3.114, B3.115, A1.441, A1.2143)	0.002					
	Honeycomb worm, Sabellaria alveolata reef (A2.71, A2.711, A5.612)	0.004					
	Intertidal underboulder communities (A1.2142, A3.2112)	0.03					
	Estuarine rocky habitats	1.18					
	Supralittoral rock (lichen or splash zone) (B3.1)	0.85					
	Littoral sediment	Littoral sediment (A2)	29.31				
		Littoral coarse sediment (A2.1)	0.76				
		Littoral sand and muddy sand (A2.2)	14.99				
Littoral mixed sediments (A2.4)		0.45					
Littoral biogenic reefs (A2.7)		0.01					
Features of littoral sediment (A2.8)		0.03					
Coastal saltmarshes and saline reedbeds (A2.5)		2.80					
Blue mussel beds	0.28						
Littoral mud (A2.3)	9.98						
Sublittoral habitats							
Sublittoral rock	Infralittoral rock and other hard substrata (A3)	17.27					
	Atlantic and Mediterranean high energy infralittoral rock (A3.1)	11.19					
	Atlantic and Mediterranean moderate energy infralittoral rock (A3.2)	2.12					
	Atlantic and Mediterranean low energy infralittoral rock (A3.3)	0.07					
	Features of infralittoral rock (A3.7)	0.0003					
	Cirralittoral rock and other hard substrata (A4)	876					
	Atlantic and Mediterranean high energy cirralittoral rock (A4.1)	477					
	Atlantic and Mediterranean moderate energy cirralittoral rock (A4.2)	394					
Sublittoral sediment	Fragile sponge & anthozoan communities on subtidal rocky habitats						
	Sublittoral coarse sediment (A5.1)	2,845					
	Sublittoral sand (A5.2)	1,690					
	Sublittoral mud (A5.3)	10.85					
	Sublittoral mixed sediments (A5.4)	48.56					
Sublittoral vegetated habitats	Tide-swept algal communities (L.hyperborea) (A3.126, A3.213)	0.68					
	Kelp and seaweed communities on sublittoral sediment (A5.52)						
Transitional and shelf waters	Shelf waters	5,500					
	Estuarine waters	2.45					

Species

Table 5. The extent and condition of key species (designated as protected features or particularly important for ecosystem services) in the North Devon marine area

	<i>Trend</i>	Positive	Stable	Negative	
Key:					
	<i>Condition</i>	Good	Acceptable	Of concern	Insufficient data

Scientific name	Common name	Quantity	Quantity unit	Quantity trend	Condition
<i>Uria aalge</i>	Guillemot	6,198	Census count		
<i>Rissa tridactyla</i>	Kittiwake	238	Apparently occupied nests		
<i>Puffinus puffinus</i>	Manx shearwater	3,451	Pairs		
<i>Fratercula arctica</i>	Puffin	375	Census count		
<i>Alca torda</i>	Razorbill	1,735	Census count		
<i>Numenius arquata</i>	Curlew	623	Annual peak count		
<i>Pluvialis apricaria</i>	Golden Plover	3,184	Annual peak count		
<i>Vanellus vanellus</i>	Lapwing	2,765	Annual peak count		
<i>Branta canadensis</i>	Canada Goose	597	Annual peak count		
<i>Anas penelope</i>	Wigeon	391	Annual peak count		
<i>Anas crecca</i>	Teal	290	Annual peak count		
<i>Anas platyrhynchos</i>	Mallard	236	Annual peak count		
	Waterbird assemblage				
<i>Gadus morhua</i>	Cod	0	n per km ²		
<i>Pleuronectes platessa</i>	Plaice	2,698	n per km ²		
<i>Solea solea</i>	Sole	4,437	n per km ²		
<i>Clupea harengus</i>	Herring	0	n per km ²		
<i>Raja clavata</i>	Thornback ray	444	n per km ²		
<i>Raja microocellata</i>	Small eyed ray	67	n per km ²		
<i>Raja brachyura</i>	Blonde ray	200	n per km ²		
<i>Dicentrarchus labrax</i>	Bass	22	n per km ²		
<i>Loligo vulgaris/forbesii</i>	Squid	469	n per km ²		
<i>Salmo salmar</i>	Salmon	1	n per license day		
<i>Salmo trutta</i>	Sea trout	1	n per license day		
<i>Cancer pagurus</i>	Crab				
<i>Homarus gammarus</i>	Lobster				
<i>Petalophyllum ralfsii</i>	Petalwort				
<i>Palinurus elephas</i>	Spiny lobster				
<i>Eunicella verrucosa</i>	Pink sea-fan				
<i>Catinella arenaria</i>	Sandbowl Snail				
<i>Buccinum undatum</i>	Common whelk				
<i>Halichoerus grypus</i>	Grey seal				
<i>Phocoena phocoena</i>	Harbour porpoise	278-1713	individuals		

Ecosystem Services

Table 6. An inventory of the main ecosystem services provided by the North Devon marine area

Key: Trend Positive Stable Negative Insufficient data

Category	Services/benefits delivered	Quantity	Trend	Value	
Food: Cultivated seafood	Oysters	Low			
	Foraged plants	Purple laver (<i>Porphyra</i>)	Low		
	Game and wild fish (commercial harvesting)	Cod	2.82 t/yr		£13,206
		Plaice	3.37 t/yr		£5,728
		Sole	4.75 t/yr		£111,799
		Herring	0.17 t/yr		£441
		Thornback ray	71.07 t/yr		
		Small eyed ray	7.25 t/yr		£480,906
		Blonde ray	93.02 t/yr		
		Crab	16.18 t/yr		£95,107
		Lobster	14.61 t/yr		£285,213
		Whelk	117.97 t/yr		£400,226
		Squid	0.05 t/yr		£39,376
		Bass	2.46 t/yr		£20,058
		Other marine species	222 t		£128,324
		Mussels	Moderate		
		Cockles/whelk	Low		
Materials: Non-food products	Bait	High			
	Genetic resources	Mussel spat	Inactive		
Energy: Energy from non-living sources	Tidal energy testing	Inactive			
	Carrier: Commercial and other transport	Commercial shipping	Low		
Military training/operations		Amphibious craft training	Moderate		
Environmental quality: Water quality	Bioremediation, filtration, dilution	4,607km ^{2*}			
	Maintaining wild populations:	Nursery habitat	3,400km ^{2*}		
		Hazard and nuisance reduction: Erosion control	Sea defence	47km ^{2*}	
Flood protection					
Climate regulation	Pest and disease control				
	Carbon sequestered	7,572 t/yr		£168,689	
Physical, experiential, intellectual interactions:	Recreation, tourism, other experiential opportunities	Watersports participation [#]	34,070 people	£28million	
	Scientific and educational opportunities		Moderate		
	Cultural significance of nature: Aesthetic	Heritage, spiritual and representational significance		High	
Non-use values			High		

* Area of habitat providing moderate or significant contribution to the service

[#] By local residents. Includes swimming and angling

5 Sustainability Assessment Framework

5.1 Objectives and indicators

The sustainability assessment framework, with indicators, objectives and the sources of data for the indicators is presented in Table 8 (see following page). Indicators are suggested for each objective, but it is not always the case that the relevant data is currently available (either it is not yet collected at all, not at an appropriate resolution, or not publicly available). However, these indicators have been included as it is anticipated that data gathering and information sharing will be strengthened under the MNCP, allowing these indicators to be monitored in the future.

5.2 Targets

Policy targets relevant to the sustainability assessment are listed in Table 9. Although currently there are few, more targets are likely to be defined as actions within the MNCP (such as the development of fisheries management plans) progress.

Table 9. Policy targets relevant to the sustainability assessment objectives and indicators.

Objective	Indicator	Target	Source
All mussel beds in the Taw Torridge estuary rated at least Class B by 2030	Annual rating of shellfish water quality	Harmful plankton and reported toxin levels are below action levels	Water Framework Directive
All designated bathing waters reach guideline standards by 2025	Annual rating of bathing water quality	Number of designated bathing waters maintained or increased. All bathing waters are at least 'sufficient'	Bathing Waters Directive
All estuarine and coastal water bodies reach appropriate standards under the Water Framework Directive	Annual water body status rating	All water bodies achieve 'good' or 'high' status	Water Framework Directive
Stocks of salmon and sea trout are maintained above their conservation limits	Stock status category	Conservation limits are met or exceeded in at least four out of five years	Cefas, Environment Agency and Natural Resources Wales, 2017
Levels of protection for environmental assets are maintained and where possible improved	Percentage area within designated and voluntary marine protected areas	10% of habitats are within marine protected areas	CBD, 2010
Environmental quality in protected areas reaches at least minimum acceptable status	Condition assessment in protected area monitoring reports	At least 95% of habitats within marine protected areas has the conservation objective 'maintain' or is in 'favourable' condition	Natural England, 2017

Table 8. The sustainability objectives and indicators, including the expected sources of data for monitoring the indicators, and the likely availability of those data.

Objectives	Indicators	Data source and availability*	
Natural Capital (including heritage)			
Disturbance of waterbirds, sea birds and marine mammals is reduced	Number of disturbance incidents (from disturbance surveys)	NDBR ¹	C
All mussel beds in the Taw Torridge estuary rated at least Class B by 2030	Annual rating of shellfish water quality	CEFAS ²	A
All designated bathing waters reach guideline standards by 2025	Annual rating of bathing water quality	Environment Agency	A
All estuarine and coastal water bodies reach appropriate standards under the Water Framework Directive	Annual water body status rating	Environment Agency	A
Commercial stocks of fish and shellfish (wild capture) are within safe biological limits, and where possible are increased	(i) Stock sizes for, particularly, herring, bass, whelk, squid, skates and rays;	(i) CEFAS, IFCA ³	B
	(ii) Extent of Taw Torridge mussel beds;	(ii) IFCA	B
	(iii) Size structure of Taw Torridge mussel beds	(iii) IFCA	B
Stocks of salmon and sea trout are maintained above their conservation limits	(i) Catch per unit effort (from stock surveys) (ii) Stock status category	CEFAS, Environment Agency	A
Health of fish habitats is maintained and where possible improved	Extent and condition of spawning and nursery habitats	CEFAS	B
Disturbance of intertidal mudflats in the Taw Torridge estuary from recreational bait collection (bait digging, crab tiling) is reduced	Size of disturbed area (from aerial photography)	IFCA, NDBR	C
The quantity of plastic waste and litter on beaches is reduced	Quantity of litter removed from beaches	MCS ⁴	B A
Carbon storage capacity of the Taw Torridge estuary is increased	Extent/condition of saltmarsh (from aerial photography/LiDAR)	NDBR	B
Disturbance (scour) of subtidal sediments is reduced	(i) Frequency of anchoring within restricted zones (from aerial photography)	NDBR	C
	(ii) Area of scoured seabed around moorings (from surveys)		
Levels of protection for environmental assets are maintained and where possible improved	(i) Percentage area within designated and voluntary marine protected areas; (ii) Percentage area protected by management measures;	Natural England, IFCA	A
Environmental quality in protected areas reaches at least minimum acceptable status	Condition assessment in protected area monitoring reports	Natural England	A
Likely relative condition of subtidal habitats is maintained and where possible improved	Intensity of fishing and other activities (e.g. aggregate extraction) that impact on the seabed	IFCA, MMO ⁵	B
The cultural heritage value of ongoing inshore fisheries is maintained	Number of licenced inshore fishing vessels	MMO, IFCA	A

* Baseline data for the indicators, where available, has already been compiled within the asset and risk register (see Rees et al., 2019 and Ashley et al., 2018)

Data key: A = Appropriate data currently available; B = Some available data but may be issues with e.g. access to it or spatial resolution; C = Data not yet available

Acronyms: 1 = North Devon Biosphere Reserve; 2 = Centre for the Environment, Fisheries and Aquaculture Science; 3 = Inshore Fisheries and Conservation Authority;

4 = Marine Conservation Society; 5 = Marine Management Organisation; 6 = Office for National Statistics.

Objectives	Indicators	Data source and availability*	
Human Capital			
Employment opportunities increase in mariculture, shellfish hand-harvesting, and value-added activities for wild capture fisheries, where these do not exceed levels of sustainable exploitation	(i) Number of new businesses and employees	(i) ONS ⁶ (Nomis)	B
	(ii) Number of new shellfish/mariculture licences	(ii) IFCA	A
	(iii) Number/extent of mariculture areas	(iii) IFCA	A
The availability of data on (and therefore knowledge of) environmental, social and economic issues related to marine areas is increased	Number of datasets added to the NDBR centralised database	NDBR	C
Local people are motivated to take part in environmental initiatives	Number of people engaged in beach clean ups	MCS	A
	Number of people engaged in citizen science		
Members of the public are motivated to improve their behaviour around waste disposal	Quantity of locally-derived litter on beaches	MCS Environment Agency	A
Recreational users are motivated to improve their behaviour in order to minimise environmental disturbance	(i) Number of disturbance incidents	NDBR	C
	(ii) Number of accredited recreational boats		B
	(iii) Frequency of use of eco-moorings		C
Fishers and harvesters are more engaged in sustainable fisheries management	Number of fishermen supplying data to the NDBR centralised database	NDBR	C
Social Capital			
Networks for sustainable management of coastal and marine areas are strengthened	Number/diversity of individuals and organisations involved within the NDBR marine governance structure	NDBR	A
Recreational users are more engaged with sustainable management	Number of individuals/businesses adopting and promoting codes of conduct	NDBR	C
Conflict amongst marine users is reduced	Number of infringements of recreational code of conduct and zoning restrictions reported	NDBR	C
The use of citizen science data in decision making is increased	Examples of use in management plans	NDBR, IFCA	C
Manufactured Capital			
New infrastructure for renewable energy and mariculture conforms to sustainability criteria	Number of consent applications adhering to the recommendations	Council, MMO, IFCA	C
New mooring infrastructure is installed to reduce habitat damage due to anchoring and scour (from traditional moorings)	Number of eco-mooring buoys installed	NDBR	C
Financial Capital			
Incomes for fishers/harvesters using low-impact techniques are maintained, and where appropriate increased, through sustainable management of resources and value-added activities	(i) Value of landings/sales	MMO IFCA	B
	(ii) Landings per unit effort		
The economic contribution of recreation and tourism linked to marine and coastal natural capital is maintained	Number of visitors undertaking fishing, outdoor swimming, visits to beaches, coastal walking, wildlife watching and watersports	Natural England	A
New financial mechanisms and products are established to support maritime activities and environmental protection	(i) Number of new blue investment funds	NDBR	C
	(ii) Amount of new blue funding invested in North Devon		

6 Comparing Plan Alternatives

In its current phase, the MNCP does not propose different options for achieving specific plan objectives, as in most cases the objectives relate to very specific high-level tasks (such as the development of codes of conduct or management plans). In the absence of alternative options, this sustainability assessment considers the binary choice of implementing the plan versus not doing so. The expected impacts of implementing the MNCP in terms of the degree to which it will have positive, negative or neutral effects, are made using expert judgment and are summarised in Table 10, which considers both the short (1-5 years) and longer term (more than five years). The assessment of longer term implications is particularly speculative as it relies, for example, on the management plans that are being developed in the first phase of the MNCP resulting in the expected actions that will protect stocks and habitats and support local fisheries. Similarly, the projections assume that governance structures are accepted and maintained and that new financing mechanisms are sufficiently successful to become self-sustaining. More accurate assessment of the outcomes of these strategies and actions will be possible in future phases of the MNCP.

Table 10. The expected direction of impacts of the marine natural capital plan on assets, ecosystem services and benefits, and human, social, and financial capital, when compared to not implementing the plan

	Key:			
	Strongly positive	Neutral	Strongly negative	Not assessed
	Short term (1-5yrs)		Longer term (>5yrs)	
Natural capital assets				
Geology				
Supralittoral rock				
Supralittoral sediment				
Littoral rock				
Littoral sediment				
Saltmarsh				
Mussel beds				
Sublittoral rock				
Sublittoral sediment				
Commercial finfish				
Crab and lobster				
Wetland birds				
Seabirds				
Marine mammals				
Heritage assets				
Designated and non-designated sites				
Ecosystem services and benefits				
Cultivated seafood				
Foraged plants				
Game and wild fish				
Non-food products from plants, animals & algae:				
<i>Bait</i>				
<i>products from cultivated macroalgae</i>				
Genetic resources (<i>mussel spat</i>)				
Energy from non-living sources (<i>tidal energy</i>)				
Commercial and other transport				
Water quality				
Maintenance of nursery populations and habitats				
Erosion control				
Flood protection				
Climate regulation				
Recreation, tourism and other experiential opportunities				
Scientific and educational opportunities				
Aesthetic				
Heritage, spiritual and representational significance				
Existence, bequest and option values				
Social and human capital				
Community networks				
Knowledge, skills and capabilities				
Financial capital				
Inward investment				

In the short term, the principal positive impacts of implementing the MNCP relate to human, social and financial capital, due to the expected strengthening of community networks, improved governance structures, data-sharing, raising awareness and the inward investment from new sustainable finance initiatives. There is the potential for increased positive impact on financial capital in the longer term, as successful funds attract snowballing investment. As the Marine Pioneer, SWEEP and similar recent activities in North Devon have demonstrated, the MNCP area has provided significant opportunities for research, which are expected to continue in the future now that key partnerships have been established. The MNCP is also expected to have a positive impact on education through proposed citizen science and wider engagement initiatives, and on non-use values (existence and bequest) as awareness and understanding of the marine environment increases.

Impacts on natural capital assets, ecosystem services and benefits are largely neutral in the short term. In this inception phase, the MNCP is seeking to put in place the necessary structures to support environmental growth and to aid the development of management plans for specific natural capital assets and ecosystem services, such as those related to fisheries. Thus, direct impacts on the environment in the initial years will be limited. Improvements in the quality of subtidal habitats are expected where eco-moorings are installed and recreational anchoring reduced (and so scour and abrasion impacts decrease) although the spatial scale of these will be small. Management of bait digging is likely to reduce disturbance of intertidal mud. Further increases in the extent or quality of species and habitats may also be secured as sustainable finance allows investment in local conservation initiatives, although these cannot be predicted at this stage.

Even in the longer term when more detailed management plans have been put in place, impacts may not be universally positive. The fisheries management plans are expected to focus on improving the status of species and habitats of particular local importance, and to have impacts in the longer term when the resulting management measures have had time to take effect. Positive impacts are expected for subtidal sedimentary habitats in inshore areas where fisheries management measures reduce sea bed abrasion and for local stocks which have limited exposure to external pressures. However, these external pressures (such as fishing activity beyond the 6nm limit) as well as climate change will influence the condition, and indeed the continuing presence, of many of the fisheries species important in North Devon. Similarly, the impacts on services and benefits from wild capture fisheries are expected to be broadly neutral even in the longer term, although improved shellfish water quality is likely to increase the economic viability of mussel harvesting resulting in a positive outcome. It is expected that fisheries management plans will seek to maintain the livelihoods of inshore fishermen. Ensuring the continuation of an active inshore fishing fleet in North Devon also secures the connection to the maritime history of the area, preventing a decline in the value of cultural heritage. There is greater potential for measurable positive impact on the supply of cultivated seafood and macro-algae as well as tidal energy if the MNCP intention to support mariculture and other maritime industries is realised through the establishment of new businesses. Similarly, opportunities to re-establish a limited export of mussel spat may be explored, which could also bring economic benefit.

Water quality is expected to improve in the long term as the MNCP supports actions within the North Devon Catchment Management Plan to reduce diffuse pollution, although this is reliant on suitable investment being secured. An increase in the aesthetic quality of the area is also expected. The main land/seascape features (such as cliffs) will not be affected, but a reduction in litter is likely to improve aesthetic quality of specific sites, with improvements potentially occurring quickly as a result of increasing support for ongoing initiatives. The expansion of saltmarsh may also improve visual amenity, although aesthetic judgements are subjective and benefits will depend on relative perception of the current landscape. Increasing the extent and quality of saltmarsh will also provide nursery habitat, with benefits increasing with further expansion in the longer term. Fisheries management plans may have positive impacts on wider nursery habitats in the longer term through the potential protection of important subtidal areas. New areas of saltmarsh will also increase climate regulation,

although benefits may be relatively limited, depending on the extent to which current land use promotes carbon uptake. The rate of carbon sequestration in saltmarsh decreases as the habitat matures, tempering the scale of the longer term benefits of continuing to create new areas of saltmarsh in the future. Saltmarsh areas also support significant recreational benefits. Recreation more generally may see a possible slight negative impact for those whose activities are restricted by codes of conduct, although this is likely to be balanced by the increased positive experience of others who benefit from improved environmental quality and noise reduction. There may be a decline in benefits from bait digging, as future management of effort may restrict opportunities for individuals and prohibit expansion.

The implications of the MNCP for erosion control and flood protection have not been assessed. Changes in these services would be related primarily to the expansion of saltmarsh and its role in moderating tidal inundation and attenuating wave action. However, these issues are very complex and require consideration of factors such as whether the saltmarsh replaces hard defences, the extent to which landward expansion is possible, and wider topographical and hydrographic parameters within the estuary. Without sophisticated modelling, it is not possible to make useful judgments about the likelihood of positive or negative effects.

The limited positive benefits of the MNCP are also a reflection of the limitations of local management effectiveness where access rights or species' ranges exceed the governance jurisdiction (as is the case for example with wetland and sea birds and most commercial fisheries species). Ensuring positive outcomes for natural capital in these cases is therefore also dependent on national and international governance. The legislative landscape is particularly uncertain at present (especially for fisheries) with the UK's exit from the European Union and the forthcoming Agriculture, Fisheries and Environment Bills. Local management nonetheless remains extremely important, as any reduction in stress will benefit the resilience of species and habitats, and exemplary management practices may be adopted more widely, increasing the scale of benefits to natural capital.

7 References

- Ashley, M., Rees, S.E., Cameron, A. (2018). *North Devon Marine Pioneer Part 1: State of the art report of the links between ecosystem and ecosystem services in the North Devon Marine Pioneer*. A report to WWF-UK by research staff the Marine Institute at Plymouth University
- CBD. (2010). *Convention on Biological Diversity. COP 10. Decision X/2. Strategic Plan for Biodiversity 2011-2020*
- Cefas, Environment Agency & Natural Resources Wales (2018). *Salmon stocks and fisheries in England and Wales, 2016 Preliminary assessment prepared for ICES, April 2018*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/709614/SalmonAssessmentReport-2017-final.pdf.
- Forum for the Future (undated). *The Five Capitals* <https://www.forumforthefuture.org/the-five-capitals>
- Hooper, T. L. (2013). *Evaluating the costs and benefits of tidal range energy generation* (Doctoral dissertation, University of Bath).
- Historic England. (Undated). Protected Wreck Sites. <https://historicengland.org.uk/advice/planning/consents/protected-wreck-sites/> Accessed 09 February 2020
- HM Government. (2018). *A green future: our 25 year plan to improve the environment*. London: Department for the Environment Food and Rural Affairs. <https://www.gov.uk/government/publications/25-year-environment-plan>
- HM Government (2011). *UK Marine Policy Statement*.
- MMO (2020a). *South West Inshore and South West Offshore Marine Plan Draft for consultation January 2020*. Marine Management Organisation, 56pp.

- MMO. (2020b). UK and foreign vessels landings by UK port and UK vessel landings abroad: 2014 to 2018 and 2019 (year to date). Latest update 24 January 2020. Underlying dataset November 2019. <https://www.gov.uk/government/statistical-data-sets/uk-and-foreign-vessels-landings-by-uk-port-and-uk-vessel-landings-abroad>
- MMO (2019). *South West Inshore and Offshore Marine Plans Sustainability Appraisal Part 1: Introduction and Methodology*. Draft Report. A report produced for the Marine Management Organisation, MMO, September 2019, 45pp.
- Natural England. (2017). *Designated Sites View: Natural England Conservation Advice for Marine Protected Areas: Advice on Operations, Supplementary Advice on Conservation Objectives*. Natural England. [Online]. Available at: <https://designatedsites.naturalengland.org.uk/>.
- North Devon Council. (undated). *Local Interest List*. <http://northdevon.gov.uk/council/strategies-plans-and-policies/environment-and-planning-policies/local-plan/planning-policy-supporting-documents/environment/local-interest-list/> Accessed 09 February 2020
- Preece C. 2008. *A Field Guide to the Archaeology of the Taw and Torridge Estuaries*. Edward Gaskell, Bideford. 48pp
- Preece C. 2005. A Conflict of Interests: The Fish Traps of the Taw and Torridge Estuaries. *Proceedings of the Devon Archaeological Society*. **63**: 139-165
- Rees, S.E., Ashley, M., Cameron, A. (2019). *North Devon Marine Pioneer 2: A Natural Capital Asset and Risk Register*. A SWEEP/WWF-UK report by research staff the Marine Institute at the University of Plymouth
- Torridge District Council. (Undated). *The Local Heritage list in Torridge* <https://www.torridge.gov.uk/article/11094/The-Local-Heritage-list-in-Torridge> Accessed 09 February 2020
- Torridge District Council and North Devon Council. (2018). *North Devon and Torridge Local Plan 2011-2031* Adopted October 2018 v1 31 October 2018.