Appendix A. Desk Review

This Appendix is provided in support to the following report:

Marine Planning Consultants Ltd. (2014). Lyme Bay Fisheries and Conservation Reserve: Integrated Fisheries Management Plan. A report produced for the Lyme Bay Fisheries and Conservation Reserve Working Group, UK.

Submitted 18/09/2014.

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Acronyms and Abbreviations

CCO	Channel Coastal Observatory
Cefas	Centre for the Environment Fisheries and Aquaculture Science
CFP	Common Fisheries Policy
DBRC	Devon Biodiversity Records Centre
Defra	Department for Environment Food and Rural Affairs
DEM	Digital Elevation Model
DWT	Devon Wildlife Trust
EDF	Environment Protection Fund
EUNIS	European Nature Information System
FAO	Food and Agriculture Organisation
GEBCO	General Bathymetric Chart of the Oceans
GIS	Geographic Information System
GRT	Gross Registered Tonnage
HRA	Habitat Regulations Assessment
ICES	International Council for the Exploration of the Sea
IFCA	Inshore Fisheries and Conservation Authority
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
LOA	Length Overall
MBA	Marine Biological Association of the United Kingdom
MCA	Maritime and Coastguard Agency
MCZ	Marine Conservation Zone
MESH	Mapping European Seabed Habitats
MFA	Marine Fisheries Agency (now the MMO)
MMO	Marine Management Organisation
MNCR	Marine Nature Conservation Review
MPA	Marine Protected Area
MSC	Marine Stewardship Council
MSP	Marine Spatial Planning
NE	Natural England
RBS	Registration of Buyers and Sellers
SAC	Special Area of Conservation
SCI	Site of Community Interest (or candidate SAC)
SI	Statutory Instrument
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
SWIFA	Southwest Inshore Fishermen's' Association
TAC	Total Allowable Catch
UNESCO	United Nations Educational, Scientific and Cultural Organisation
VMS	Vessel Monitoring System

Overview

This current document provides a Review of Current Understanding, to inform the wider project. A draft of this document was circulated to the Working Group for technical review, and subsequent comments have been incorporated into this document. Following this review, MPC will be producing three streams of work focused on fisheries sustainability, habitat risk assessment and fisheries management, as detailed below.

The outputs and findings of this project will be developed for and guided by the Working Group to plan for the future of the fishery in Lyme Bay and identify gaps in evidence and knowledge. The science will be independent and all Working Group members will be consulted at every stage. This project will use the results of other work commissioned by the Working Group where this can be made available, such as the Lyme Bay potting trials (University of Plymouth); the fishermen's environmental monitoring pilot and traceability study (Seafish through the Responsible Fishing Scheme); and other studies external to the Working Group, whether within the Lyme Bay area or elsewhere in the UK.

This document seeks to summarise the current evidence and understanding of:

- The ecological status of the natural environment / wildlife resources
- The location and nature of conservation features in the area
- The nature and geographical extent of commercial fisheries operating in the area
- The location of core fishing grounds
- Other uses of the marine environment, which interact with fishing and conservation efforts
- Issues facing the local fishing communities
- The extent and nature of local tourism
- Issues facing local communities

This document presents the most up to date data and information made available to the project team. All of the spatial data used in figures presented within this Appendix are listed in **Table A1** (marked as 'sourced') and are referenced within the figures themselves. Whilst Lyme Bay is a very well-studied and surveyed area, not all of the data could be made available for use in this study; those unsourced data are also catalogued in **Table A1** (marked as 'not sourced').

Temporal Scope

Wherever possible, information describing the character of Lyme Bay has been sourced for the year 2000 onwards. However where data is lacking or context required, reference is made to studies prior to this date.

Table A1: Spatial datasets sought to inform the Habitat Risk Assessment

Note that datasets / surveys that have been incorporated into amalgamated datasets that have been sourced for the project, have not been individually named unless critical datasets.

Sector	Information Type	Source Project	Source Organisation	Data Type	Project Usage	Comment
PHYSICAL ENVT	Seabed bathymetry	Dorset Integrated Seabed Study (DORIS)	Dorset Wildlife Trust	Multibeam	Not sourced	Very marginal coverage of AOI
PHYSICAL ENVT	Seabed bathymetry	N/A	General Bathymetric Chart of the Oceans (GEBCO)	GIS Model	Sourced	Map provided in report
PHYSICAL ENVT	Seabed bathymetry	N/A	OLEX	GIS Model	Sourced	Map provided in report
PHYSICAL ENVT	Seabed bathymetry	N/A	SeaZone	GIS Model	Not sourced	Background context only (not required for habitat risk assessment)
PHYSICAL ENVT	Light penetration	UKSeaMap 2010	JNCC	GIS Model	Sourced	Map provided in report
PHYSICAL ENVT	Wave and tidal energy	UKSeaMap 2010	JNCC	GIS Model	Sourced	Map provided in report
PHYSICAL ENVT	Biological Zone	UKSeaMap 2010	JNCC	GIS Model	Sourced	Map provided in report
PHYSICAL ENVT	Solid Geology	BGS Solid Geology / DigRock 250	BGS	GIS Model	Not sourced	Background context only (not required for habitat risk assessment)
PHYSICAL ENVT	Seabed sediments	UKSeaMap / BGS Sediments	UKSeaMap / BGS	GIS Model	Not sourced	Incorporated into other datasets (provided in report)
BENTHIC HABITATS	Benthic habitat model	UKSeaMap 2010	JNCC	GIS model	Sourced	Map provided in report
BENTHIC HABITATS	Biotope model	Various	Devon Wildlife Trust (Devon Biodiversity Records Centre)	Point and line data	Sourced	Map provided in report
BENTHIC HABITATS	Nationally collated biotope maps	MESH	JNCC	GIS model	Sourced	Map provided in report
BENTHIC HABITATS	Reef map	cSAC characterisation	Natural England / Cefas	GIS model	Sourced	Map provided in report
BENTHIC HABITATS	Various	Various	University of Plymouth / Defra	Various	Not sourced	Unavailable until work published
BENTHIC SPECIES	Video transects and diving observations	Various	University of Plymouth / Defra	Point and line data	Not sourced	Unavailable until work published
BENTHIC SPECIES	Diving observations, benthic grabs and video transects	Various	Devon Wildlife Trust (Devon Biodiversity Records Centre)	Point and line data	Sourced	Map and Table of species of conservation importance provided in report
BENTHIC SPECIES	Various	Various	NBN	Point and line data	Sourced	Map and Table of species of conservation importance provided in report
BENTHIC SPECIES	Diving observations	Various	Seasearch	Point and line data	Sourced	Map and Table of species of conservation importance provided in report

Sector	Information Type	Source Project	Source Organisation	Data Type	Project Usage	Comment
BENTHIC SPECIES	Video transects	Impacts of scallop dredging on epibenthic fauna	Bangor University / NERC	Point and line data	Sourced	Table of species of conservation importance provided in report
FISH	Fish Distribution	Nursery and spawning areas	Cefas (Ellis, *et al.*, 2012)	Gridded	Sourced	Map and Table of species of conservation importance provided in report
FISH	Fish Distribution	Various	Devon Wildlife Trust (Devon Biodiversity Records Centre)	Point data	Sourced	Table of species of conservation importance provided in report
FISH	Fish Distribution	N/A	MARINE-Life	Point data	Sourced	Not provided in time to be included in report (but will be assessed)
FISH	Fish Distribution	NBN	JNCC	Point data	Sourced	Table of species of conservation importance provided in report
CETACEAN	Fish Distribution	Various	Devon Wildlife Trust (Devon Biodiversity Records Centre)	Point data	Sourced	Table of species of conservation importance provided in report
CETACEAN	Cetacean sightings	N/A	MARINE-Life	Point data	Sourced	Not provided in time to be included in report (but will be assessed)
CETACEAN	Cetacean sightings	SCANS-II	University of St Andrews	Point data	Sourced	Not in AOI
CETACEAN	Cetacean sightings	N/A	SeaWatch	Point data	Not sourced	Review of data sourced will dictate requirement to source
CETACEAN	Cetacean sightings	N/A	WWT	Point data	Not sourced	Review of data sourced will dictate requirement to buy licence
TURTLES	Turtle sightings	Various	Devon Wildlife Trust (Devon Biodiversity Records Centre)	Point data	Sourced	Table of species of conservation importance provided in report
TURTLES	Turtle sightings	N/A	MARINE-Life	Point data	Sourced	Not provided in time to be included in report (but will be assessed)
TURTLES	Turtle sightings	N/A	NBN Gateway	Point data	Sourced	Map and Table of species of conservation importance provided in report
BIRDS	Bird sightings	N/A	MARINE-Life	Point data	Sourced	Not provided in time to be included in report (but will be assessed)
BIRDS	Bird breeding, wintering and moulting sightings	N/A	JNCC	Point data	Sourced	Map and Table of species of conservation importance provided in report
BIRDS	Bird sightings	N/A	WWT	Point data	Not sourced	Review of data sourced will dictate requirement to buy licence
BIRDS	Bird sightings	European Seabirds at Sea (ESAS) and Seabird Monitoring Programme (SMP)	JNCC	Point data	Sourced	Map and Table of species of conservation importance provided in report
FISHING	Vessel sightings: vessel patrol	N/A	DSIFCA	Point data	Not sourced	Requested
FISHING	Vessel sightings: vessel patrol	N/A	SIFCA	Point data	Sourced	Data is biased by patrol effort
FISHING	Vessel sightings: aerial and vessel patrol	N/A	MMO	Point data	Sourced	Data is biased by patrol effort
FISHING	Combined VMS and sightings data	N/A	Cefas	Gridded	Sourced	Data accounts for survey effort but timescales straddle closure of Designated Area

Sector	Information Type	Source Project	Source Organisation	Data Type	Project Usage	Comment
FISHING	Raw VMS	N/A	MMO	Point data	Not sourced	Useful only if combined with sightings data that have been normalised by patrol effort
FISHING	Processed VMS by gear type	N/A	MMO	Gridded	Sourced	Too coarse resolution for inclusion; also covers small section of AOI (both of which lead to mis-representation)
FISHING	iVMS trial data	N/A	IFCAs	Point and line	Not sourced	Background context only as limited to few vessels (not required for habitat risk assessment)

Natural Resources of Lyme Bay

Before we are able to assess the sustainability of fishing in the Lyme Bay region it is imperative to fully understand the natural resources that exist here, and their significance in terms of the functioning of the wider ecosystem. There have been numerous environmental studies undertaken in the Lyme Bay region, owing to a number of factors including the value of fishing to the local area, interest and conservation value of the subtidal reefs and tourism value for the area as a whole. Previous studies have often targeted specific species or habitats of conservation interest and have been carried out by a range of stakeholders with differing purposes. Here we provide an up to date assessment of the best available evidence regarding the natural resources of Lyme Bay.

Physical Environment

This study covers the area between Sidmouth and Abbotsbury which sits within the English Channel, the geological origins of which can be traced back over 550 million years. The physical environment within the English Channel continues to change and evolve under the influence of present-day conditions and it is therefore important to understand the physical controls that shape the marine environment that we observe today.


Coastline from Charmouth to Golden Cap and beyond

Baythymetry

The English Channel is a shallow sea which only exceeds 100 m depth in its far western limits and in the Hurd Deep (James, et al., 2011). The marine environment covered by this review extends down to a depth of around 50 m as shown in **Figure A1**. Whilst there are a number of other data sets (both national and local) providing high resolution bathymetry (see **Table A1**), **Figure A1** serves as a general outline, showing the General Bathymetric Chart of the Oceans (GEBCO) data at approximately 900 m resolution.

The higher resolution bathymetry datasets have not been obtained as the cost required is not justified by the project objectives, i.e. depth is not required to inform the sensitivity of features (ecology) or fishing pressures, which are both used to inform the risk assessment. Whilst depth can be used in predictive habitat models, i.e. to predict where habitats and biotopes occur, this project aims to collate the wealth of existing information already available for these. Depth is however critical in informing 'biological zones', and these resulting products have been sourced and are discussed in more detailed in the following sections.

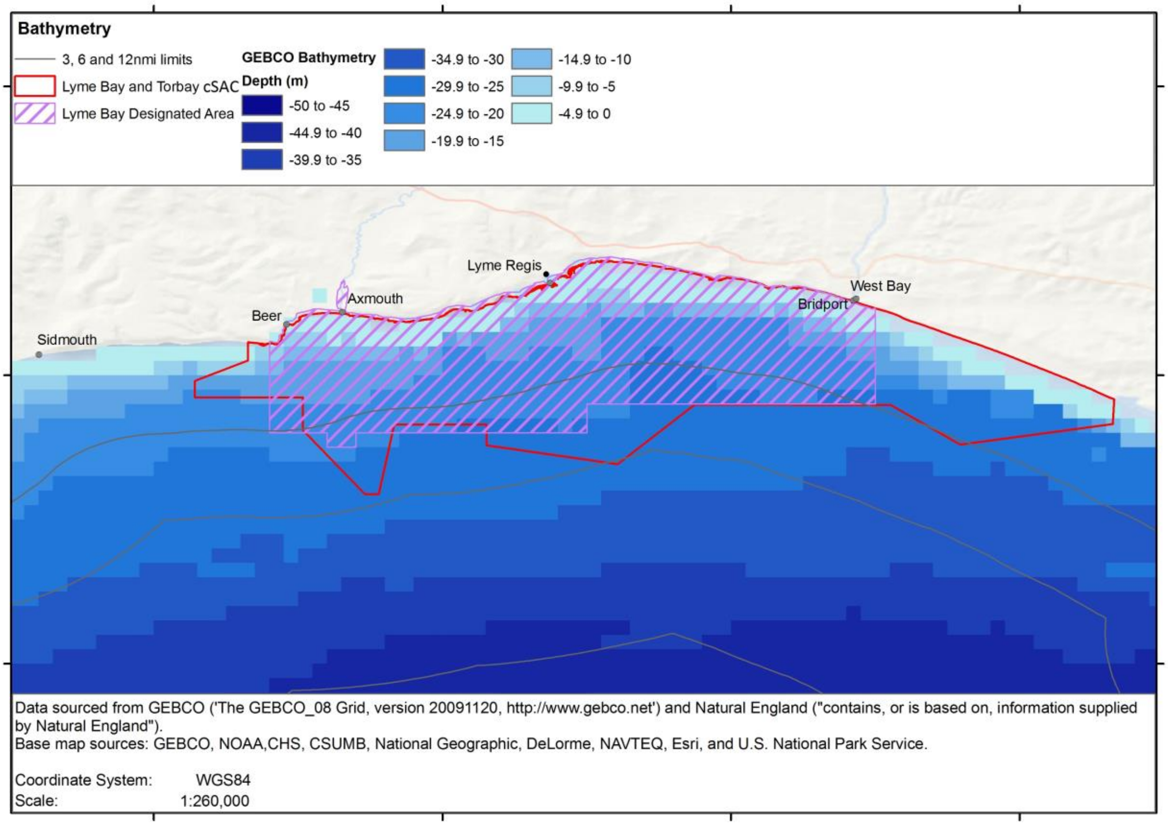


Figure A1: Map showing the seabed bathymetry across the Lyme Bay study area © General Bathymetric Chart of the Oceans (GEBCO)

A second source of bathymetry data has also been sourced from the OLEX system. OLEX is a system for navigation, fishery plotting and ocean mapping, based on vessels' own echosounder and GPS measurements. Many commercial fishermen now log depth though their own single beam acoustic equipment using OLEX. This data is uploaded to a central / national Data Archive Centre, where it is processed and combined into one dataset. Overtime this data has built up to give full coverage of the seafloor in many areas (**Figure A2**), although the nearer shore data within the Lyme Bay project AOI is limited currently and depends on the increased use of OLEX by smaller boats that frequent this area. Whilst OLEX data is corrected against modeled tidal heights to give depth to a common datum, it may include errors (±5m) in depth due to e.g. changes in vessel draught, meteorological effects. However the most important output from OLEX is not depth but the seabed morphology. The mapping of this allows delineation of seabed substrata type. Whether to inform depth or seabed morphology, OLEX is an excellent example of how fishermen can help to progress science and conservation.

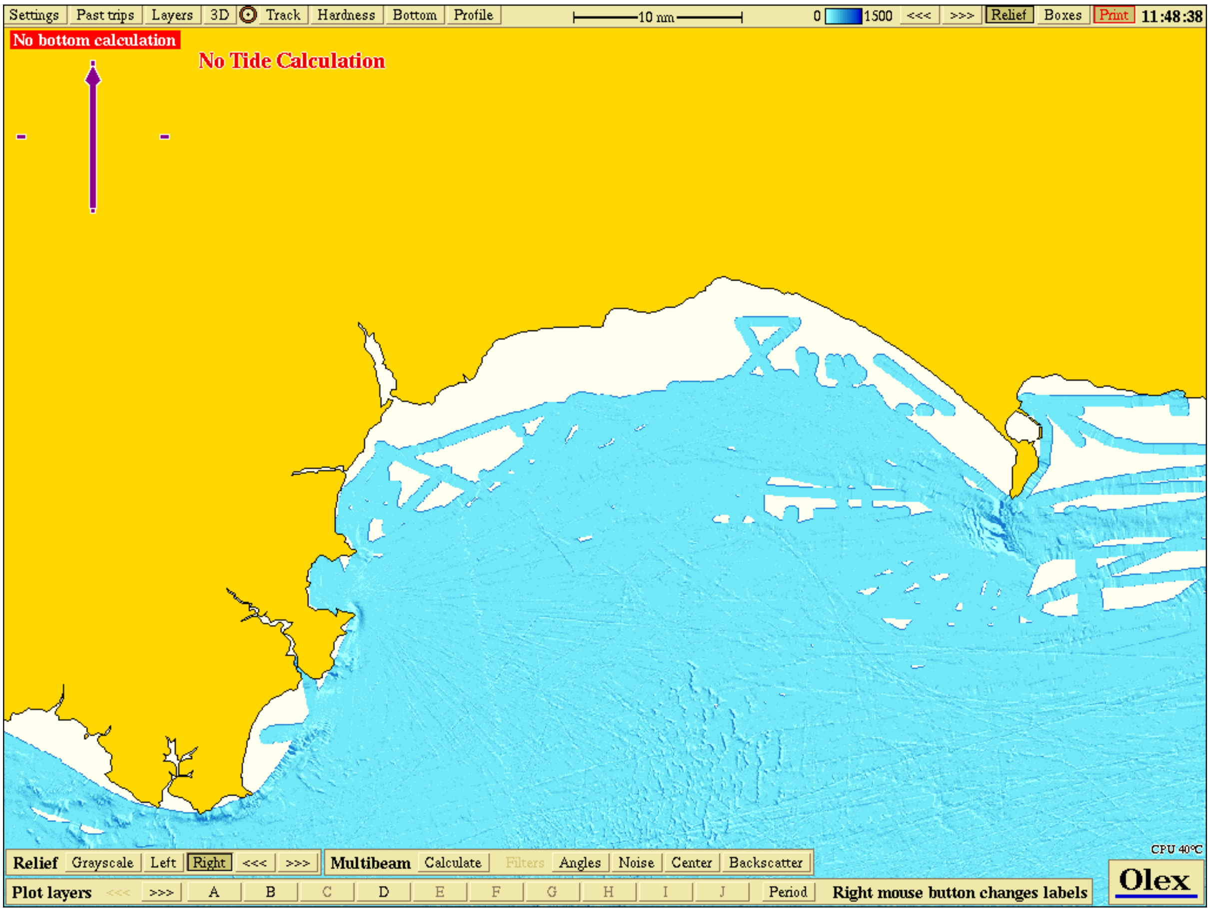


Figure A2: Map showing the seabed bathymetry across the Lyme Bay study area based single and multibeam data collated in OLEX (all data uploaded to OLEX until 30/05/2013).

Underlying Seabed Geology

The Lyme Bay study area sits with in the 'Jurassic Coast' World Heritage Site, an area famed for its abundant fossils and varied coastal geomorphology. Unfortunately, the same geology that gives rise to these glimpses of history is known to make this coastline vulnerable to marine erosion and landslips. The unique geology observed onshore in Lyme Bay is largely mirrored in the offshore environment with mudstones and limestones[1] being overlaid by a highly variable thickness of stony sand and clay (Gallois & Davis, 2001). The seabed sediments, as discussed below, originate from the quaternary period.

Seabed Substrate

The seabed substrate, i.e. the layer of the seabed exposed to the sea itself, is comprised of outcropping rock or stony reef together with a full range of seabed sediments.

Seabed sediments are routinely provided by British Geological Society (BGS) using the commonly applied 'Folk' classification, e.g. with classes such as sandy Gravel, gravely Sand etc. However this has since been modified in the European and nationwide projects Mapping European Seabed Habitats (MESH) and UKSeaMap (McBreen, et al., 2010), which were carried out to support increasing developmental pressures and national and regional scale marine planning and management requirements. These modified the Folk system as shown in **Figure A3**, to form broader sediment groups that are considered to be of more relevance to the ecology. Whilst the sediment classes are relatively self-explanatory, note whilst the coarse sediment category contains the largest sediment size, gravel, it also contains sandy gravel and gravelly sand.

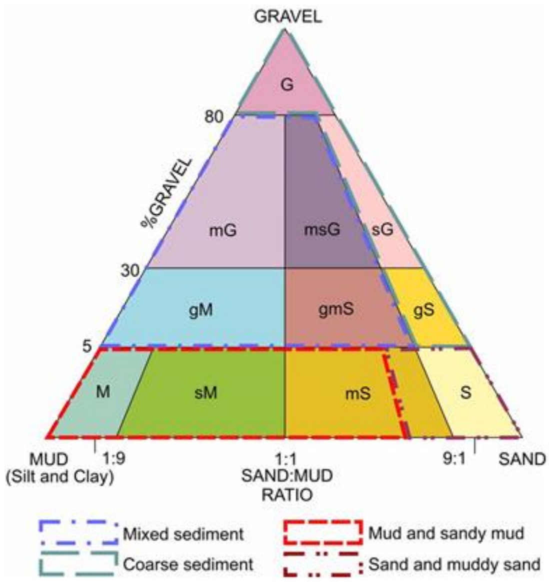


Figure A3: Folk diagram showing the conversion from the Folk sediment classification to the EUNIS sediment classes used in UKSeaMap 2010 (McBreen, et al., 2010)

[1] An organic rich clayey oil-source mudstone rock of the Shales-with-Beef geology layer; and limestone and shale layers within the Blue Lias foundation geology layer

Hydrodynamics

The movement of the sea can play a significant role in shaping the physical environment by lifting and re-depositing sediment in some areas and eroding and removing rock in others. The energy arising from currents, waves and tides also plays an important role in shaping the biological communities, since different species have evolved different tolerances. Some species rely on the movement of the sea for food and oxygen provision as well as for the removal of waste and transportation of reproductive products, whist others are very fragile and are only able to survive very slight water movements.

The energy at the seabed resulting from both the waves and tides has been combined within UKSeaMap 2010 to produce a single seabed energy layer, an approximation to the maximum level of water movement ('shear stress') benthic communities are experiencing. As presented below in **Figure A4**, the seabed within the Lyme Bay study area is exposed to a small area of moderate wave and tidal energy offshore, increasing to high wave and tidal energy in most of the nearshore areas (there are no low energy areas).

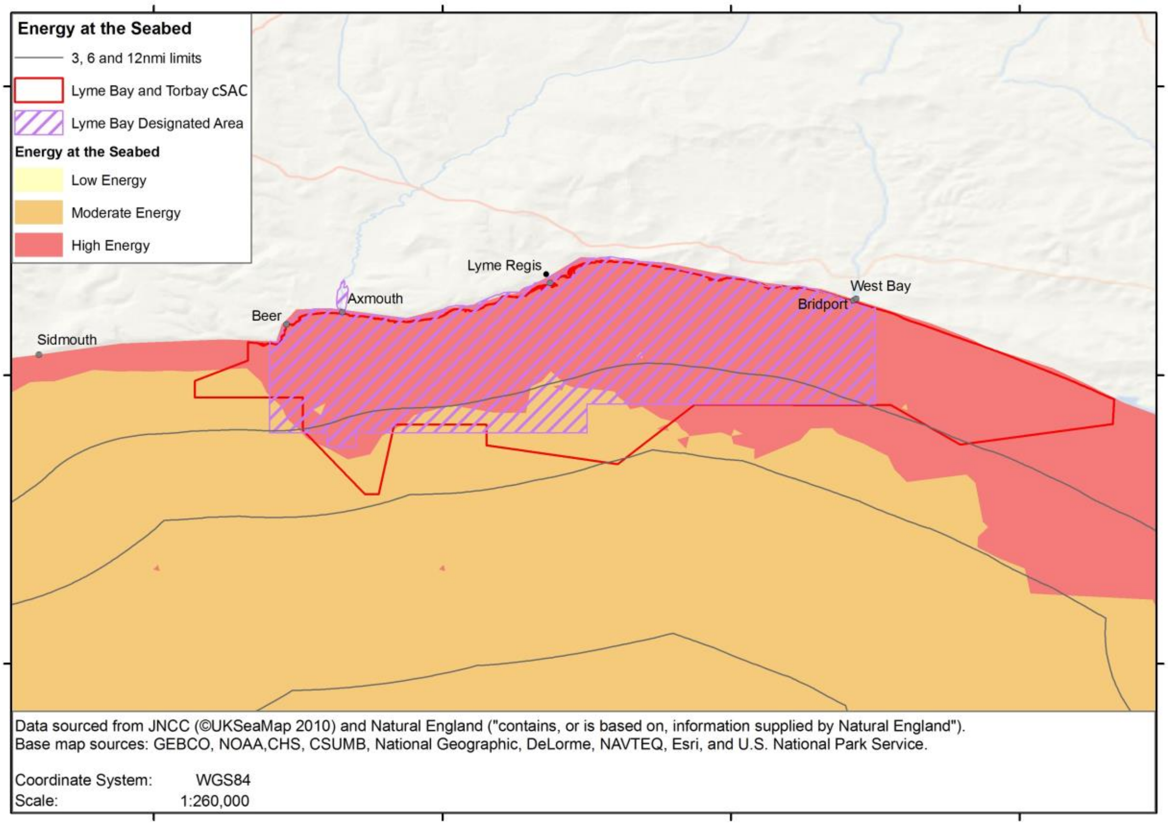


Figure A4: Map showing the combined wave and tidal energy acting on the seabed across the Lyme Bay study area (McBreen, et al., 2010)

Light Attenuation

Another physical characteristic that strongly influences the location of particular habitats is the level of light reaching the seabed. This defines whether certain species can grow, in particular macro algae which depend on light for photosynthesis. The seabed is commonly divided into two areas, one as having good light ('photic'); and the other as insufficient or no light ('aphotic')[2]. The delineation of these areas depends not only on depth but also on, for example, turbidity of the water column. As shown by UKSeaMap 2010 in **Figure A5**, the majority of the Lyme Bay AOI has good light levels, allowing a productive ecosystem. Only a very small corner in the south eastern is aphotic, closely linked to the greater depths here.

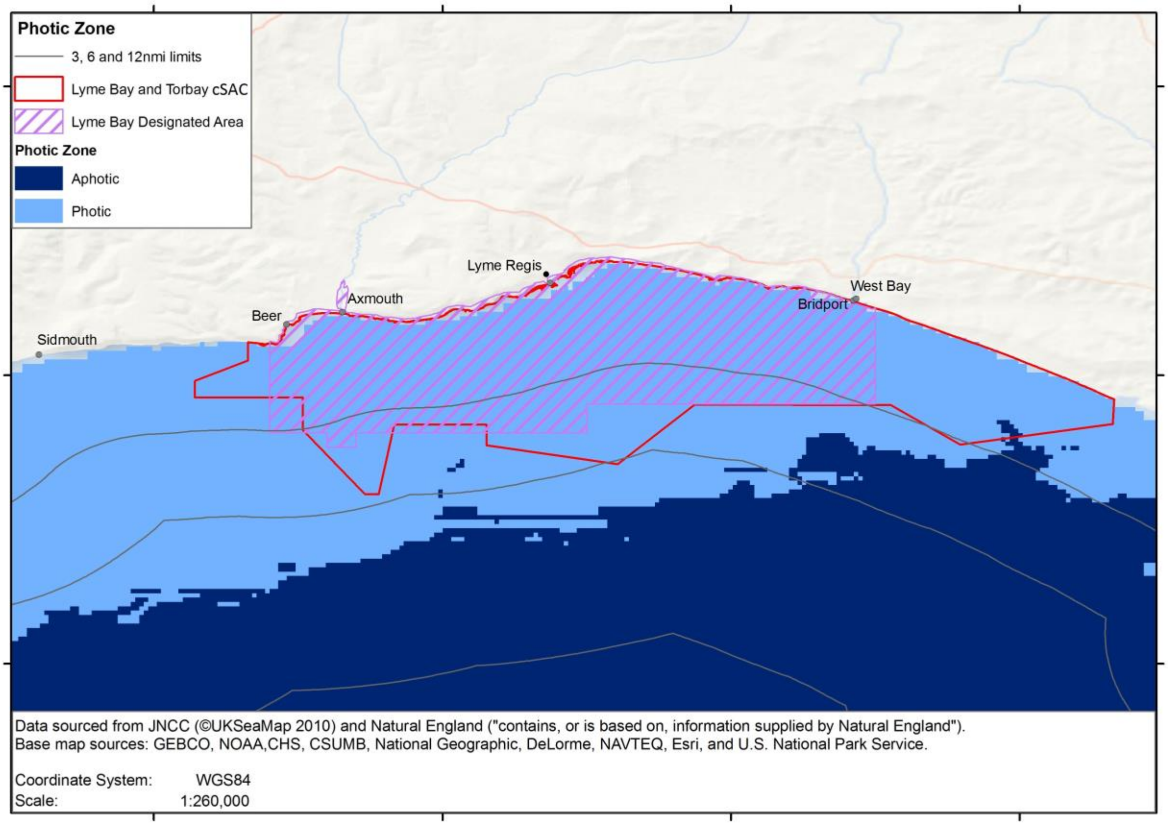


Figure A5: Map showing the light attenuation at the seabed across the Lyme Bay study area (McBreen, et al., 2010)

[2] The boundary between the two is defined at the point at which light reaching the seabed is 1% of the surface irradiance (Coggan and Diesing, 2009).

Biological Communities

The character and distribution of biological communities within Lyme Bay results from a number of characteristics in the environment, including depth, energy, light attenuation, temperature, transport of nutrients, as well as other species specific requirements. In particular, Lyme bay's position between the warm waters of the South West, and the colder waters of the North Sea and eastern English Channel give rise to a diverse marine community (including warm water species reaching their easterly and northerly limits). This includes rare and unusual species such as the pink seafan, *Eunicella verrucosa*, a coral found on the seabed as pictured below.

Different biological communities will be more or less susceptible to damage by fishing activities than others, and some communities may be considered to have a higher societal value than others, either in terms of their intrinsic conservation value or because they play a significant role in ecosystem functioning.

Numerous research and monitoring surveys have been carried out within the Lyme Bay study area in recent years and these are listed in **Table A1**. The following sections of this review summarise the findings of those studies which are either publically available or that were made available to this project through the purchase of a license.

Pink seafan, *Eunicella verucosa* © Colin Munro Photography

Benthic Communities

Of the numerous research and monitoring surveys that have been carried out within the Lyme Bay study area in recent years, many of these have focused on benthic communities, that is the plants and animals living on or in the seabed. The majority of the benthic surveys undertaken in the Lyme Bay area have collected habitat and species distribution data through the use of towed videos, drop cameras and diver observations (Attrill, et al., 2011; Attrill, et al., 2012; Attrill, et al., 2010; Attrill, et al., 2009; Hiddink, et al., 2008; Seasearch, 2010; Seasearch, 2009; Seasearch, 2004; Seasearch, 2006; Seasearch, 2008) with a comparatively few choosing to take samples of the seabed using a mechanical grab or scientific trawl (Cefas, 2008; Devon Wildlife Trust, 2007). Similarly only a few studies have used the benthic data collected in this area to create a continuous biotope map of the area (Vanstaen & Eggleton, 2011; Devon Wildlife Trust, 2007; McBreen, et al., 2010; MESH Partnership, 2008). Those studies that have mapped the biological resources in this area are summarised below.

Devon Wildlife Trust Lyme Bay Biotope Map 2007

The first significant attempt to produce a full coverage map of the biological communities across the whole of Lyme Bay was carried out by Devon Wildlife Trust (DWT). Prior to this, there were smaller surveys concentrating either on one area for full coverage substrate mapping; or a mapping of a particular target feature of Lyme Bay. In 2007, DWT commissioned Ambios to produce a full coverage biotope map, that is, a map showing both the combined physical habitat and the biological communities (collectively known as biotopes[3]). This was based on both historic data and new gapfilling survey data, including:

- Dive surveys: historic surveys carried out by DWT in association with Seasearch (Seasearch, 2004; Seasearch, 2006; Seasearch, 2006; Devon Wildlife Trust, 2007)
- Grab samples: 1) Ambios survey 2005 for 133 stations (benthic and sediment) to gapfill existing data and to give good coverage; and 2) unspecified historic samples
- Side scan sonar: 1) MOD mid 1980s (pers. Comms Ambios Environmental Consultants) covering central and eastern parts of Lyme Bay[4]; and 2) Ambios survey 2005 to gapfill MOD
- Seabed sediment: 1) grab samples/cores (above); and 2) all available historic data cores including that from the British Geological Survey
- Depth (UKHO)
- Tidal stream information (various historic sources)

The habitat model developed by Ambios found that the various biological communities defined from the grab samples and dive surveys corresponded well to the physical characteristics of mud content, peak tide velocity and depth each substrate type. Therefore

[3] http://www.dbrc.org.uk/lyme-bay-dive-survey/

[4] Note the project defined Lyme Bay from Dartmouth to Portland and so central and eastern differ to the current AOI being considered

these parameters were used to model the biotopes across the whole of Lyme Bay. The resulting map shown in **Figure A6** is classified according to the Marine Habitat Classification for Britain and Ireland, sometimes referred to as Marine Nature Conservation Review (MNCR) biotopes (Connor, et al., 2004).

As with any habitat map, whilst the seabed substrate can be surveyed with full coverage through remote sensing techniques (Side Scan Sonar in this case), this is not possible for the biological communities which rely on samples. Therefore the map is a modeled product and the biological communities are only validated where sampled. The substrate, whilst not modeled and interpreted from full coverage data, does depend in the majority of data up to ~30 years old. Whilst sediment may not change significantly in some places during this timescale, any new substrate surveys are of great interest, as described below.

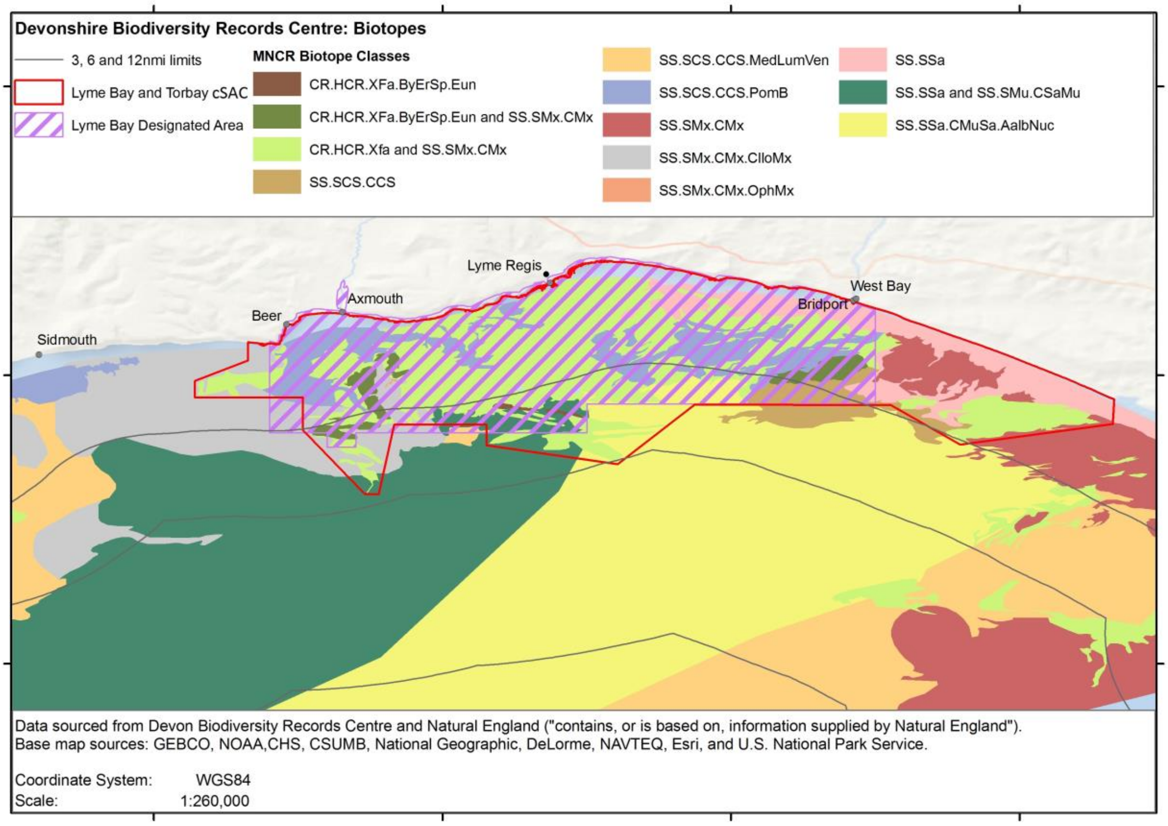


Figure A6: Map showing the distribution of MNCR biotopes across the Lyme Bay study area as reported by Devon Wildlife Trust (2007).

Mapping European Seabed Habitats (MESH) 2008

The Mapping European Seabed Habitats (MESH) project was an initiative set-up to develop a framework for seabed mapping which encourages unity and best practice. As part of this six year project existing survey data were used to develop and demonstrate the best techniques for processing, analyzing and combining datasets from different sources. Lyme Bay was mapped as part of this exercise using the DWT data supplemented with MNCR records for the same area (Moore, et al., 1999). In this instance the biotopes have been translated from the MNCR classification (shown in **Figure A6**) to the European Nature Information System (EUNIS) classification scheme which has since been widely adopted across Europe. The resulting map is shown below in **Figure A7**.

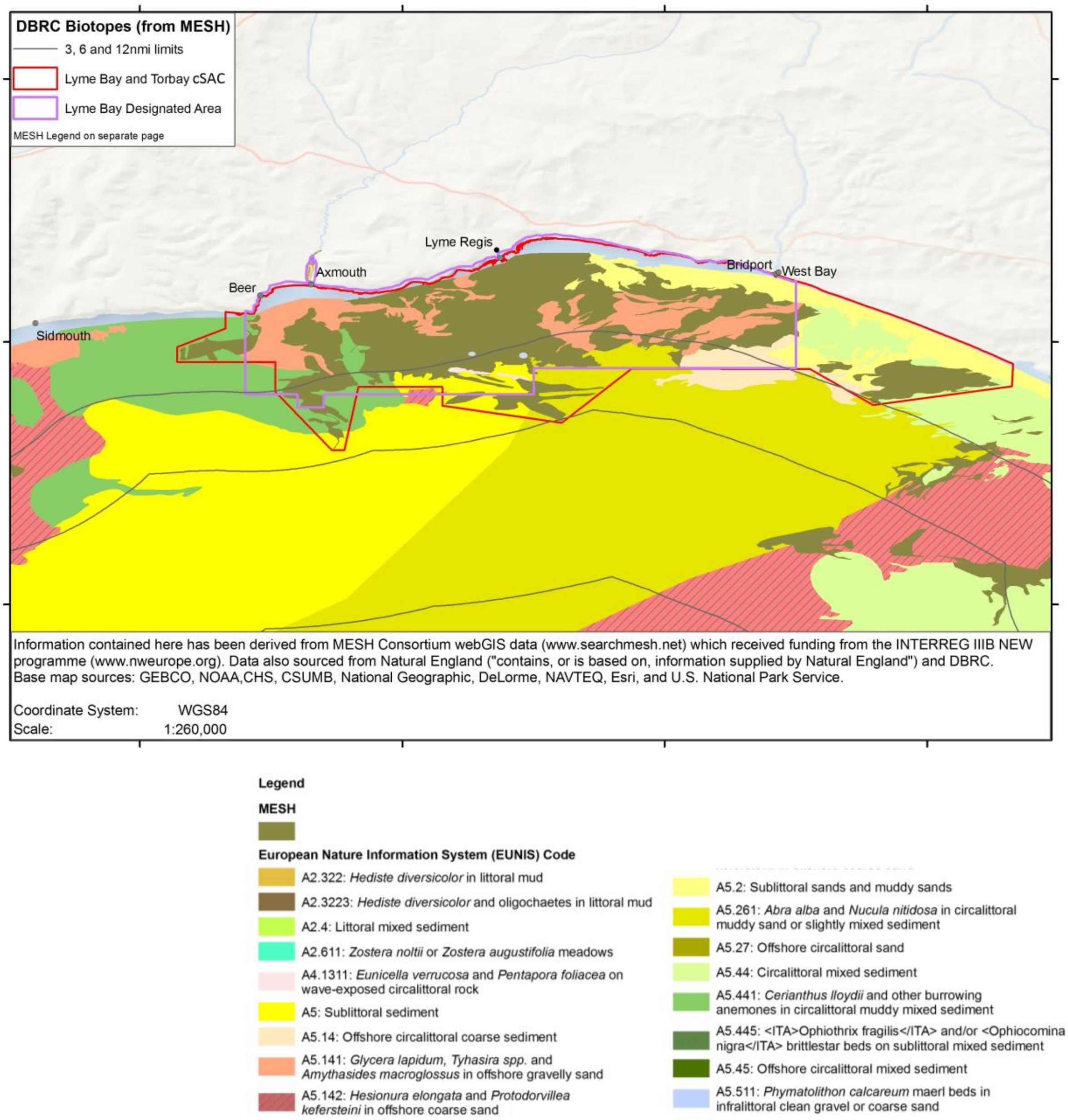


Figure A7: Map showing the distribution of EUNIS biotopes across the Lyme Bay study area as reported by MESH (MESH Partnership, 2008), showing the translated DBRC biotopes.

UKSeaMap 2010 (EUNIS Level 4)

As discussed in reference to the Physical Environment, UKSeaMap's primary purpose is to provide modeled biotope maps of the seafloor. The previously described physical layers of light attenuation, energy at the seabed, as well as a third layer, maximum depth impacted by the waves, are all used to inform the 'biological zone'. The biological zone, together with the seabed substrate (classified as described above into sand, mud, coarse, mixed sediments and hard substrate), are combined to form a habitat classification to level four of the EUNIS classification scheme, as shown in **Figure A8** (McBreen, et al., 2010). EUNIS Level 4 biotopes essentially describe the physical habitat, sometimes with an indication of the types of communities found there for example A5.13 Infralittoral coarse sediment or A3.21 Kelp and red seaweeds (moderate energy infralittoral rock). Due to the limited description of biological communities at this level, restricted to rock only, this map is of limited use to the project which aims to provide a risk assessment not only to substrate habitats but all biotopes also. It also, as with DWT, relies on relatively old data as described above.

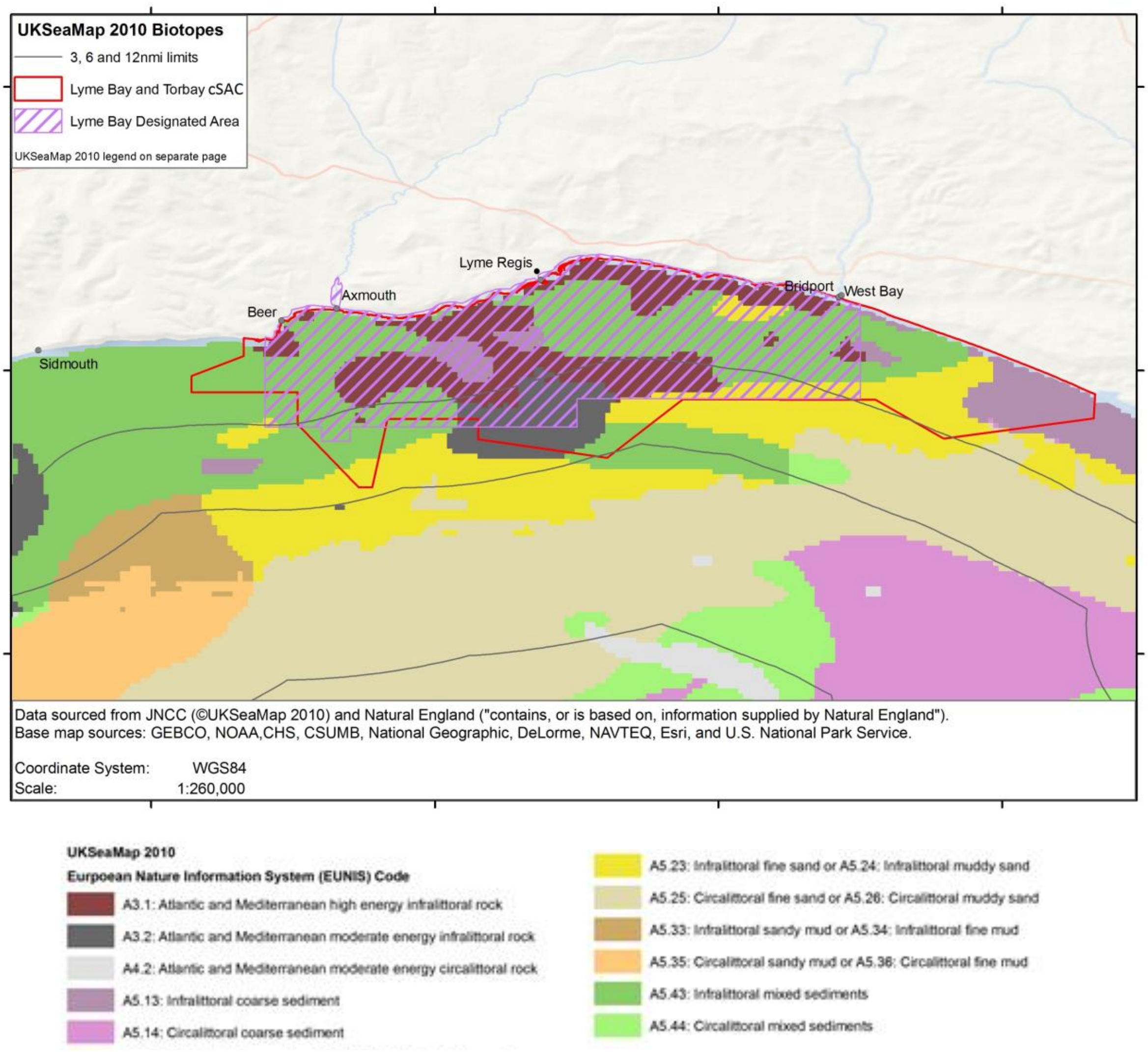


Figure A8: Map showing the distribution of EUNIS level 4 biotopes across the Lyme Bay study area as predicted by UKSeaMap 2010 (McBreen, et al., 2010).

Natural England Reef Maps 2011

In 2010 Cefas were commissioned by Natural England to define the boundaries of the Lyme Bay rocky and stony reef habitats using existing data, to inform the candidate Special Area of Conservation (cSAC), as shown in **Figure A9** (Vanstaen & Eggleton, 2011).

The maps were produced used high resolution multibeam data as follows:

- Cefas / Marin Matteknik survey on behalf of Maritime and Coastguard Agency (MCA) and Natural England, between June and July 2010
- Channel and Coastal Observatory (CCO) and MCA, collected primarily by Halcrow June to September 2007, between Portland Bill and Petit Tor Point from MLW out to 1km offshore

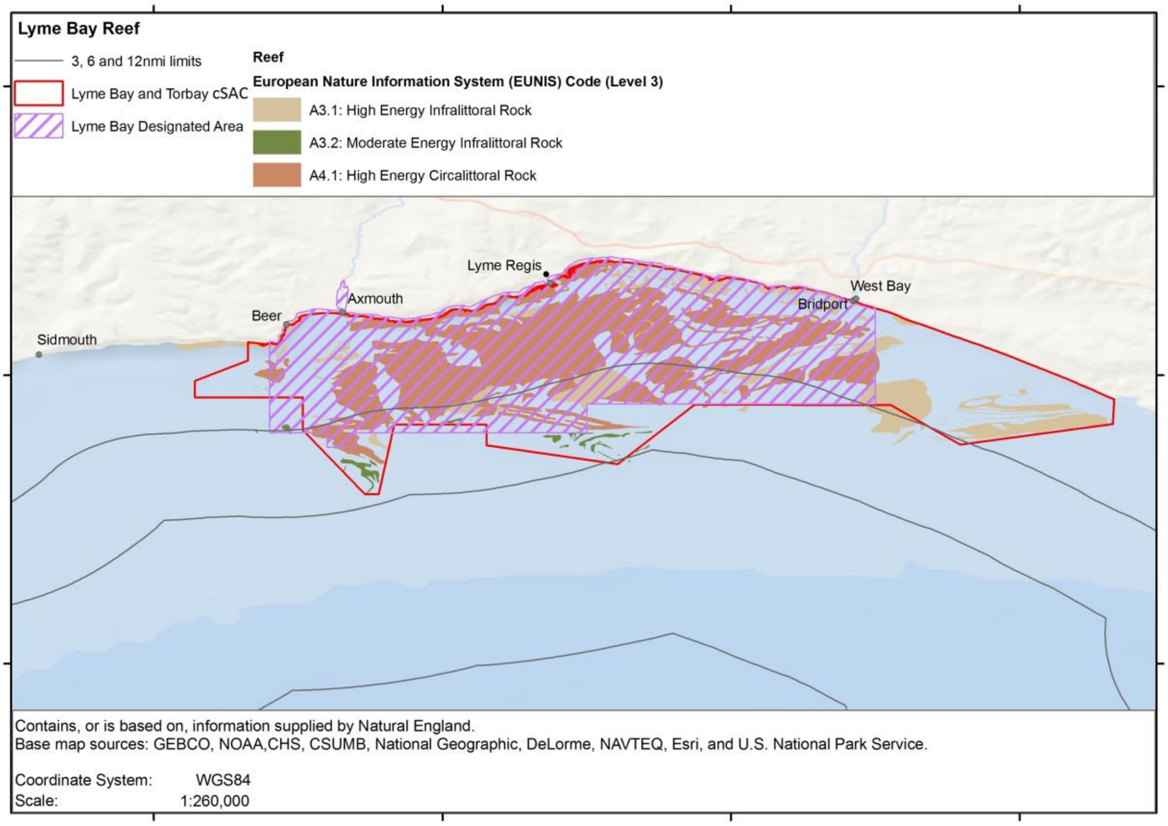


Figure A9: Map showing the Annex I reef features in Lyme Bay as mapped by Cefas on behalf of Natural England in 2010 / 2011 (Vanstaen & Eggleton, 2011).

This high quality multibeam data was complemented by the following ground truthing data:

- Devon Biodiversity Record Centre (DBRC) Extract from Marine Recorder (2004-2007) Diver survey observations
- Marin Matteknik: samples collected during the 2010 Lyme Bay multibeam survey (physical only)

- University of Plymouth: video transects collected as part of Defra contract MB0101 in 2010 (NB. biological data not available for inclusion)
- DWT video monitoring of reef sites in 2003 and 2004
- DWT video transects collected within the cSAC in 2006

Rocky reefs were easily identified from acoustic data but stony reefs relied more heavily on sample data. Attempts have been made to classify habitats according to EUNIS, however it does not map non-reef habitats.

The cSAC reef surveys and resulting maps have used the most up to date full coverage survey data and as a result are likely to represent the best habitat mapping available at this time for reefs. However as reefs were the only habitats targeted, the map product clearly contains gaps where no habitats are marked. The commissioned multibeam survey did, however cover these areas

Summary of suitable biotope maps

For the purpose of the next phase of our work, the Habitat Risk Assessment, we propose to combine the detailed Natural England / Cefas map of the reef features with the MESH translated DBRC biotope map which provides a more detailed context. We would however strongly recommend that the Working Group considers commissioning their own more detailed biotope map making best use of the abundant data that have been collected since these maps were produced. There is enough high resolution acoustic data and ground truthing data to provide a much improved map of the biotopes in this area, both in terms of the resolution and the associated confidence.

Benthic Species

A total of 951 different benthic invertebrate and tunicate (sea squirt) species are reported to have been recorded in the Lyme Bay area, as identified from the spatial data provided to this project. This includes 859 invertebrates and 56 tunicates. Those that are of conservation status are presented in the Conservation section together with the source of data (data sources are also provided in **Table A1**).

Lichen & Algae

A total of 251 algal and lichen species are reported have been recorded in the Lyme Bay area, as identified from the spatial data provided to this project. This includes 63 brown algae, 25 green algae, 139 red algae and 18 lichen.

Those that are of conservation status are presented in the Conservation section together with the source of data.

Mobile Species

As well as considering the permanent or semi-permanent inhabitants of the Lyme Bay study area it is important to consider the transient species which may use this area at different times of the year to feed or reproduce. The protection of mobile species is intrinsically more difficult to manage than it is for sedentary species but there are still measures that can be taken. For example activities known to disturb spawning behaviours might be limited at certain times of the year or in particularly important areas.

Fish Spawning and Nursery Grounds

The Lyme Bay study area is home to an active inshore fishing fleet and fish populations occurring in this area are explored in more detail in later sections of this project (**Appendix B** and **I**). Here we look at the use of the Lyme Bay study area by fish species as a spawning habitat and as a nursery ground. **Figure A10** illustrates areas that are reported by Cefas to be used for these purposes (Ellis, et al., 2012). The whole area has been identified as a low intensity spawning area for sand eel and sole and a low intensity nursery for anglerfish, mackerel, plaice, sole, spotted ray, spurdog, thornback ray and whiting. The westerly section of the study area has also been identified as a high intensity mackerel nursery area. Others have reported the area as being an important spawning ground for cuttlefish (Jackson & Bloor, 2010) and sardine (Coombs, et al., 2005).

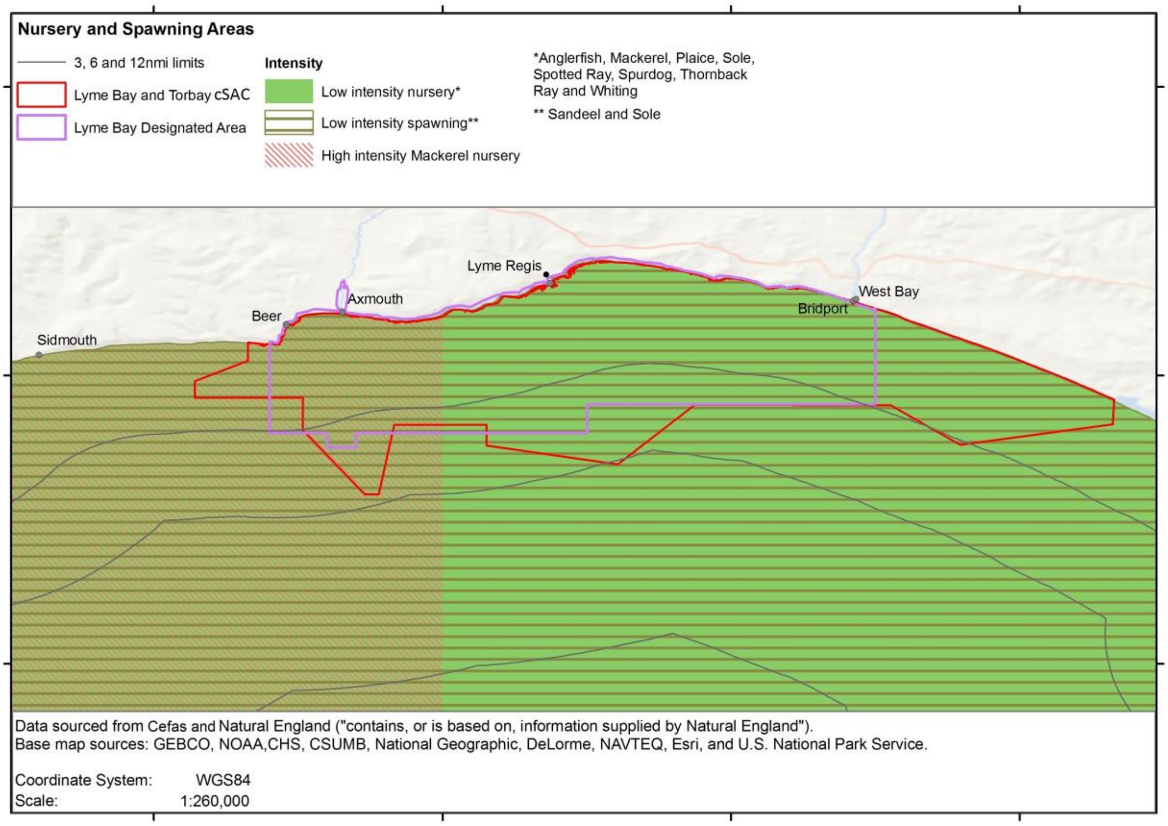


Figure A10: Map showing the distribution of fish nursery and spawning areas across the Lyme Bay study area (Ellis, et al., 2012)

A total of 80 species of bony fish and 10 cartilaginous fish (sharks, rays) are reported to have been sighted in the Lyme Bay area, as identified from the spatial data provided to this project. Those that are of conservation status are presented in the Conservation section together with the source of data.

Data from MarineLife was received one day prior to submission of this Appendix. It includes birds, cetaceans, sharks and turtles from both MarineLife targeted surveys as well as public sightings. Where of conservation interest or considered to be an indicator of nursery grounds / spawning areas, these will be added into the subsequent reports and assessments.

The spawning areas of species that are largely sedentary are likely to correspond with adult distributions and therefore Lyme Bay is likely to play an important role in the reproductive cycle of local king scallop and whelk populations.

The resolution and accuracy of the spawning and nursery ground distribution presented in **Figure A10** is unlikely to be useful in a regional management context but by exploring the life histories of these species it may be possible to identify areas within Lyme Bay that are most likely to be used by these species. This may help steer the development of management options as well as future research. The spawning and nursery requirements of these species are explored in more detail in the following sections of this Appendix.

Mackerel, *Scomber scombrus*

Mackerel is a widespread and abundant pelagic fish which spawns in the summer, releasing eggs and sperm into the water column. Eggs hatch after 2-6 days and the juveniles move inshore, where they reside until they are sexually mature (Food Certification International Ltd, 2012).

There are numerous dedicated surveys that examine the distribution of mackerel eggs west of the British Isles for stock assessment purposes because the outer continental shelf is known to be an important area for mackerel spawning (Ellis, et al., 2012; Coombs & Mitchel, 1981; Priede & Watson, 1993; Coombs, et al., 2001). The split between low and high intensity nursery grounds that is evident in **Figure A10** is thought to be an artefact of the groundfish survey sampling as there were fewer surveys in this area (Ellis, et al., 2012).

Sandeel, *Ammodytidae*

There are five species of sandeel in the UK and these are widely distributed and often abundant on suitable habitats. Identifying spawning and nursery areas for sandeels is particularly difficult as the eggs are demersal and the juveniles are not efficiently sampled using beam or otter trawls (Ellis, et al., 2012). It is also thought to be likely that sandeels will spawn on seabed ridges and along the margins of larger sandbanks into which they conceal themselves when alarmed (Gubbay, 2003; Ellis, et al., 2012), making sampling all the more difficult. There are a small number of records of sandeel larvae and juveniles from the Lyme bay study area indicating that there may be some reproduction occurring here. More established spawning and nursery grounds have been identified in the Bristol Channel, Liverpool Bay, Dogger Bank and the east coast of Scotland however and these areas are likely to be far of far greater significance for this species (Ellis, et al., 2012).

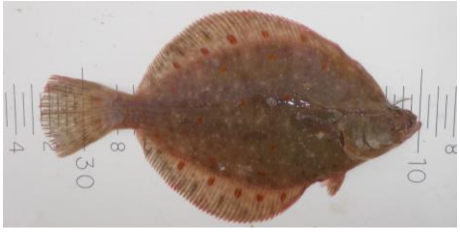
Dover Sole, *Solea solea*

Dover sole undertake asynchronous spawning in the English Channel (Riou, et al., 2001) and are reproductively active between February and April. Spawning peaks in May, triggered by rising sea water temperatures (Food Certification International Ltd, 2012). Sole have shown a preference for spawning in large bays along the English Channel which may include Lyme Bay. Data were limited for the western English Channel and it is therefore possible that the importance of Lyme Bay as a spawning ground for sole has been underestimated (Ellis, et al., 2012). Juvenile sole spend the first 2-3 years of their life in coastal nurseries (i.e bays and estuaries) and again Lyme Bay maybe an important area for this. During this time the sole grow rapidly before moving into deeper coastal waters in winter when temperatures drop (Marine Management Organisation, 2011; Food Certification International Ltd, 2012).

Anglerfish, *Lophius piscatorius* and *Lophius budegassa*

Lophius piscatorius is a North Eastern Atlantic species, distributed from the Barents Sea in Norway to the Strait of Gibraltar including the Mediterranean and the Black Sea. *Lophius budegassa* has a more southerly distribution form the British Isles and Ireland to Senegal including the Mediterranean and the Black Sea. Both species are found within the Lyme Bay study area. The spawning behaviours of anglerfish are very particular, with eggs being extruded in a buoyant, gelatinous ribbon that may measure up to 10 m long (Hislop, et al., 2001). This sort of spawning behaviour results in a highly concentrated distribution of eggs and newly emerged larvae (Hislop, et al., 2001) making this species particularly susceptible to disturbance at this time.

Very little is known about the spawning grounds of anglerfish but they are presumed to spawn in deep water along the edge of continental slope (Hislop, et al., 2001). To date there have been very few records of the egg ribbons or the larvae of this species. Juvenile anglerfish were captured from the Lyme Bay area during the Cefas groundfish surveys and hence it seems likely that this area is used as a nursery area by this species, although much higher densities of juveniles were recorded around Cornwall, western Ireland and Scotland (Ellis, et al., 2012).



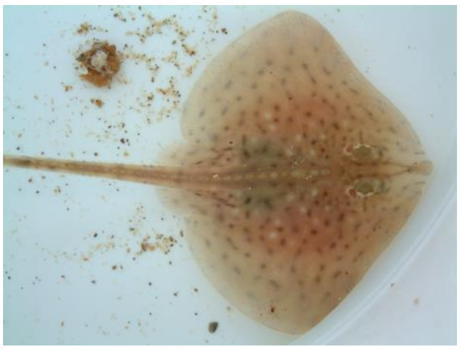
Plaice, *Pleuronectes platesssa*

Like sole, plaice undertake asynchronous spawning in the English Channel (Riou, et al., 2001). Adults spawn from December to March at water depths between 20-40 m (Food Certification International Ltd, 2012). Their eggs are pelagic and the demersal post-larval stage begins at a length of approximately 13 mm. Plaice nursery grounds ate located in shallow waters in proximity to areas receiving seasonal freshwater input (Marine Management Organisation, 2011). In general, juvenile plaice are found in well-defined nursery areas (Poxton & Nasir, 1985; Wennhage, et al., 2007) although their distribution extends as juveniles grow in size and start to recruit to the adult stock (Lockwood & Lucassen, 1984).

Tagging studies have shown that plaice undertake spawning migrations from the North Sea to the Atlantic in the first quarter of the year (Hunter, et al., 2004; Hunter, et al., 2004). Accordingly, 65% of plaice catches from the English Channel in the first quarter of the year have been found to be North Sea migrants, underling the importance of managing this stock at a national level.

Thornback Ray, *Raja clavata*

The thornback ray is a fully marine species that is recorded occasionally from estuaries. Juveniles may occur in shallow coastal waters, although they are mostly found in waters >10 m deep (Wheeler, 1978). Relatively high numbers of juvenile thornback rays were recorded in Lyme Bay during the Cefas groundfish surveys, indicating that this area is probably used as a nursery by this species (Ellis, et al., 2012). There are insufficient data on the occurrence of the egg cases or egg-bearing females in the spawning season with which to delineate spawning grounds although these are thought to overlap broadly with their nursery grounds (Ellis, et al., 2012).



Spotted Ray, *Raja montagui*

Like the thornback ray, the spotted say is a fully marine species that is recorded occasionally from estuaries. Juveniles may occur in shallow coastal waters, although they are mostly found further offshore (Wheeler, 1978). Females lay their egg cases in shallow water in early summer from April through to July. They lay a maximum of 60-70 eggs per year with an average of 24-60).

A small number of juveniles were caught from the Lyme bay area during the Cefas groundfish surveys indicating that this area may be used as a nursery. The most important areas for this species though are found further North around the coasts of Wales and Scotland (Ellis, et al., 2012). There is currently insufficient information upon which to delineate spawning grounds although these are expected to overlap broadly with their nursery grounds (Ellis, et al., 2012).

Spurdog, *Squalus acanthias*

A very small number of juvenile spurdog were sampled by Cefas from the Lyme Bay study area, during the groundfish surveys which form the basis of their spawning and nursery ground distribution maps (Ellis, et al., 2012). Since spurdog are viviparous, that is they give birth to live young, the presence of gravid females is also considered to be a good indicator of their birthing and nursery grounds. However, spurdog carry their pup for 22-24 months and undergo widespread and complex migrations (Vince, 1991) making it difficult to accurately delineate these areas.

Whiting

The whiting is a bentho-pelagic species usually found from 30 to 100 m, mainly in mud and gravel bottoms but also on sand and rock. Whiting spawn in batches (Prevost, 2005) and their eggs are pelagic. The post-larval stage begins at a length of about 4.3 mm (Russell, 1976), when they are often associated with jellyfish before switching to a more pelagic existence (Ellis, et al., 2012). There are well documented spawning grounds in the Bristol Channel and Irish Sea and new records indicate the widespread spawning may also occur across the North Sea. The distribution of whiting spawning in the English Channel has yet to be determined as few surveys have taken place here and the separation of whiting eggs from eggs produced by other gadoids requires specialist equipment and techniques.

There were numerous records of juvenile whiting in the Lyme Bay area from the Cefas groundfish surveys although much higher densities were recorded in northern Britain (Ellis, et al., 2012).

Pollack, *Pollachius pollachius*

Juvenile pollack are found in shallow coastal waters and move to rocky areas and wrecks as they grow. Maturity occurs at approximately three years of age and spawning occurs mainly in the first half of the year, at depths of around 100 m. Spawning is highly unlikely to occur within the Lyme Bay study areas but they may well use the area as a nursery. Both aspects of the pollack life history are as yet poorly understood (Marine Management Organisation, 2011).

Sardine, *Sardina pilchardus*

The sardine can be found throughout the North Atlantic eastern continental margin from Senegal to the British Isles, including the Mediterranean and adjacent seas. Schools of juvenile fish tend to be separated from adults and are found closer inshore, typically associated with estuaries and rivers. Sardine spawning has been observed throughout the English Channel (Coombs, *et al.*, 2005). Sardine eggs are first observed in the far western English Channel in March and April, then extend eastwards up the Channel in greater abundances in May, June and July before declining to relatively low abundances in the eastern English Channel in August and September. In October there is a shift back to high egg numbers throughout much of the Channel, followed in November by a shift in the main concentration back to the western Channel (Coombs, et al., 2005).

Cuttlefish, *Sepia officinalis*

Cuttlefish distribution is very seasonal and is closely linked to their life cycle. In the first year of life cuttlefish can be found in the inshore areas of Devon and Dorset in late summer and autumn, before they migrate offshore to their overwintering grounds. The maturing cuttlefish migrate onshore again the next spring where they reach lengths of between 14 and 19 cm by the autumn before migrating once more to their offshore overwintering grounds. Finally, cuttlefish migrate inshore for a second time in the spring to spawn. They are known to spawn along the coast of the English Channel including Lyme Bay before a final post-spawning mass mortality (Marine Management Organisation, 2011).

King Scallop, *Pecten maximus*

There is considerable variation in the timing of Scallop spawning but those in the English Channel are reported to spawn just once in early summer (Marine Management Organisation, 2011). The eggs are fertilized externally and larvae spend 3-4 weeks in the water column prior to metamorphosis. This means that there is considerable potential for dispersal. When the juvenile shell reaches approximately 0.25 mm the spat attach themselves to a suitable substrate with byssus threads. At some point, when the shell reaches a size of between 2 mm and 15 mm, they detach and recess on the seabed. It is possible therefore that minimum adult densities are necessary to ensure good recruitment. Scallops in the English Channel and particularly those in Lyme Bay are reported to grow very quickly, often reaching the minimum landing size before they spawn for the first time

(Marine Management Organisation, 2011). This obviously has important implications for stock management since it will be important to allow sufficient numbers of adults to spawn in order to maintain the natural population.

<u>Common Whelk, *Buccinum undatum*</u>

The common whelk can be found from the extreme low water mark of the intertidal zone down to depths of 1200 m. It can live on a wide range of substrates from muddy sand and gravel to rock. *Buccinum undatum* is a carnivorous snail that feeds on a variety of bivalves including cockles and mussels. However, whelks do also feed on carrion such as dead fish and crabs when these are available. Whelks are predated upon by large fish such as cod and dog fish as well as a range of crab species.

Unlike many other gastropod snails, whelks have separate sexes which can easily be distinguished by the presence of a relatively large penis directly behind the head of the males. In UK waters internal fertilization takes place in autumn followed closely by spawning, usually between November and December when temperatures drop below 9°C. The females spawn clusters of egg capsules which they attach to stones or shells on the seabed. Only a small proportion of the egg capsules will develop, on average 13-14 individuals from each mass, with the remainder providing food for the developing embryos.

Growth of whelks varies dramatically with individuals living in estuaries tending to be much smaller than those living offshore. Whelks have also been found to grow more slowly in cooler waters than they do in warmer waters.

Additional species may be added to the above descriptions in the subsequent project assessments (**Appendix C**), depending on conservation importance, considered importance and subsequent inclusion in habitat risk assessment.

Marine Mammals & Turtles

Marine mammals can be divided into two major groups; the Cetacea (whales, dolphins and porpoises) and the Pinnipedia (seals). Both groups are observed regularly in the Lyme Bay study area. However, the patchy distribution of marine mammals and their elusive nature means that they can be difficult to observe and consequently little is known about their behaviour and distribution. It is known however that UK waters provide a year round habitat for numerous species of marine mammals many of which have been observed in the Lyme Bay Area (Brereton, et al., 2010; Edwards, 2010; English Nature, 1997). Turtles are similarly elusive but have are also known to occur in UK waters all year round (Marubini, 2010). All marine mammals and turtles are subject to international protection through a number of conventions and agreements. In European waters, they are listed in Annex IV or Annex II of the Habitats Directive and hence the UK has a responsibility towards maintaining and restoring favourable conservation status of these animals as well as considering the risk of incidental capture. A further commitment is made by the UK through OSPAR as many of these species are listed as threatened and / or declining species.

Cetaceans

Five out of the 26 cetacean species recorded in the UK occur regularly in the Lyme Bay area. These are the harbour porpoise, *Phocoena phocoena*, the bottlenose dolphin, *Tursiops truncatus*, the white beaked dolphin, *Lagenorhynchus albirostris*, the common dolphin, *Delphius delphus*, and the long finned pilot whale *Globicephalus metas* (English Nature, 1997; Edwards, 2010; Brereton, et al., 2010; Edwards, 2010). In addition, as shown in **Figure A11**, there have been sightings of common (or harbor) porpoise, grey seal, humpback whale and at least one fin whale stranding in the Lyme Bay study area. Whilst not a cetacean, this map also shows sighting of the basking shark, for interest. In addition, the MarineLife dataset has a sighting of a Minke Whale *Balaenoptera acutorostrata*.

Whilst cetacean species may avoid areas used more intensively by boats, increasing evidence is being found on individual collision incidents (Dolman et al. 2006). This will be further addressed in the subsequent habitat risk assessment, exploring other risks, e.g. entanglement. Cetaceansmay also be impacted by changes to their food source though deliberate and incidental catches.

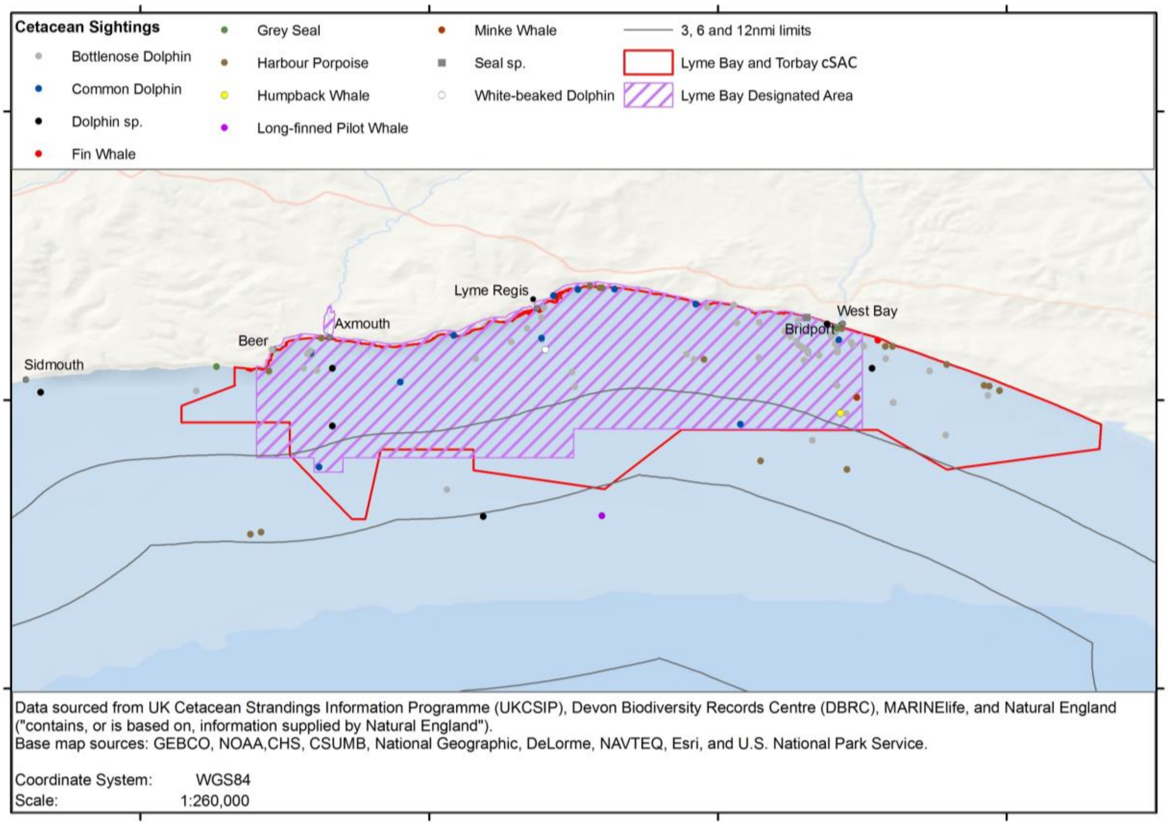


Figure A11: Map showing the distribution of cetacean (plus shark) and turtle sightings collected by UKCSIP as compiled from the NBN Database[5]; and from the Devon Biological Records Centre (DBRC)

Turtles

As also shown in **Figure A11**, three turtle species have been sighted within the Lyme bay study area: the green turtle, *Chelonia mydas*, the leatherback turtle *Dermochelys coriacea* and the loggerhead turtle, *Caretta caretta.* There are no additional turtle species in the MarineLife dataset.

[5] http://data.nbn.org.uk/

Seabirds

Land based records collected by SeaWatch SW indicate that in recent years, internationally important numbers of the IUCN critically endangered Balearic Shearwater have visited the Lyme Bay area (Brereton, et al., 2010). Chesil beach is also an internationally important breeding ground for Little Terns and it is likely that they will use the adjacent marine area for feeding. In addition as can be seen in **Figure A12**, a range of seabirds have been noted in the area, including Auks (*Alcidae*), Cormorant (*Phalacrocorax carbo*), Fulmar (*Fulmarus glacialis*), Gannet (*Morus bassanus*), Seagull (*Laridae*), Petrel (*Procellariiformes*), Shearwater (*Procellariidae*), Seaduck diver (*Merginae*), Grebe (*Podicipedidae*) and Skua (*Stercorarius*). Of these, Fulmars, Gannets and Auks have been noted at a significant number of locations offshore; and Cormorants inshore.

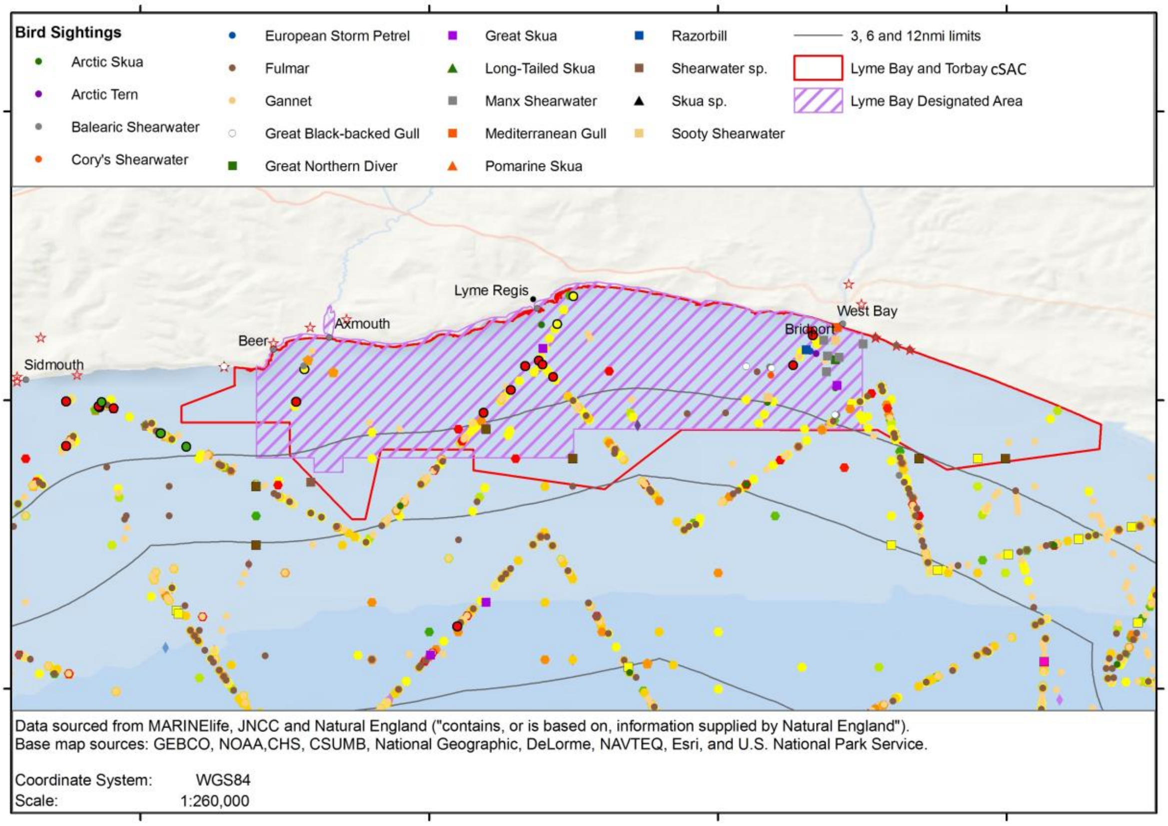


Figure A12: Map summarising the seabird sightings collated by the NBN: from the European Seabirds at Sea programme (1979 – 2011); and Seabird Monitoring Programme (1987 – 2002)

A total of 55 bird species are reported to have been sighted in the Lyme Bay area, as identified from the spatial data provided to this project. Those that are of conservation status are presented in the Conservation section together with the source of data. Additional species of conservation interest may be added to **Figure A12**, depending on considered importance and subsequent inclusion in habitat risk assessment.

Resources of Nature Conservation Significance

The Lyme Bay study area contains a number of rare habitats and species and is a recognised biodiversity hotpot so it is unsurprising that this area also contains a number of areas that are currently designated for conservation protection as well as areas that have been proposed for protection in the future.

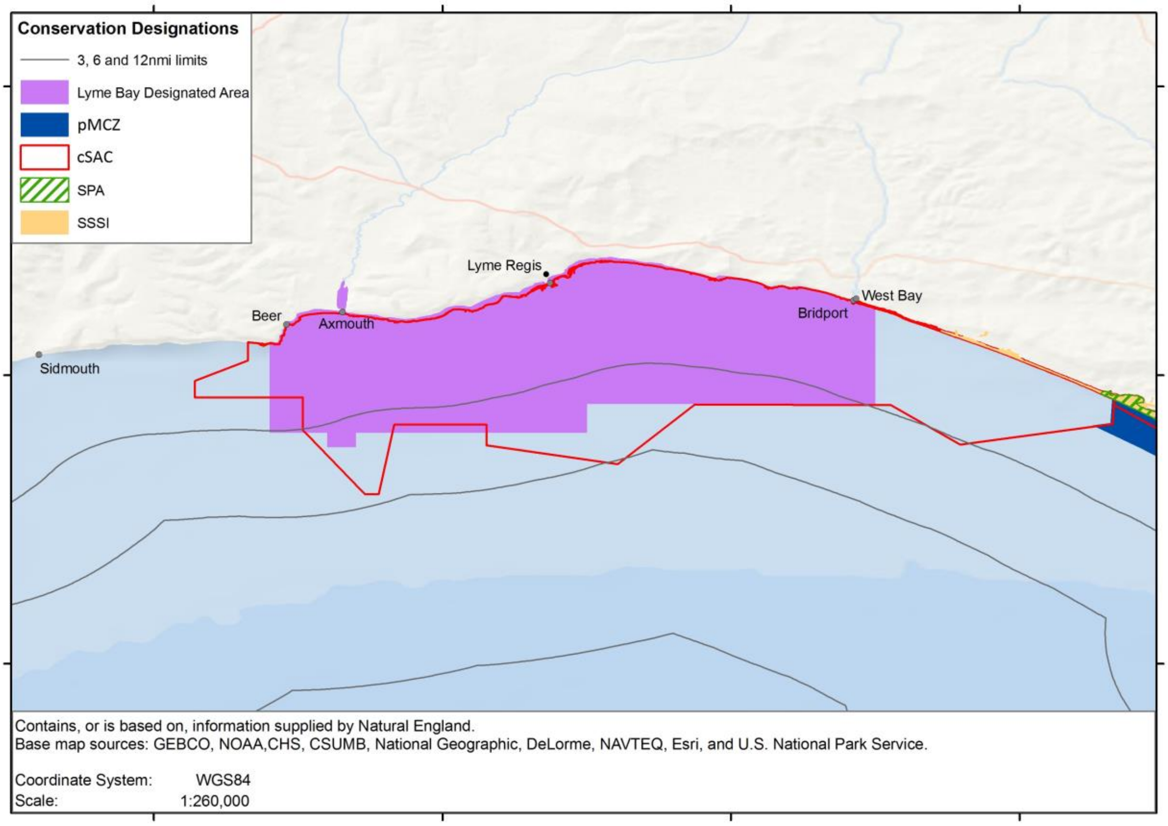


Figure A13: Map showing areas that are currently designated conservation protection or proposed for conservation protection within the Lyme Bay study area (no Ramsars present).

The primary conservation designations that fall within the study area are the Lyme Bay and Torbay candidate Special Area of Conservation (cSAC) / Site of Community Importance (SCI) and the Axe Estuary (pMCZ) although the study area also overlaps the Chesil and Fleet SAC and SPA, Chesil Beach and Stennis Ledges proposed Marine Conservation Zone (pMCZ) 'Tranche 1' site (intertidal rock, pink sea fan and native oyster) and Sidmouth to West Bay SAC (vegetated cliffs) (**Figure A13** and **Table A2**). In addition, the Lyme Bay Designated Area (Fishing Restriction) Order 2008 was implemented to prohibit dredging for shellfish and demersal trawling in 206km^2 (60nm^2) to protect marine biodiversity.

Table A2: Summary of current and proposed conservation designations within the Lyme Bay study area. Areas with qualifying features that have the potential to be impacted by offshore commercial fishing activities are highlighted in pale blue.

Designation	Location	Description
SI	Lyme Bay Designated Area	The SI prohibits dredging for shellfish and demersal trawling within a designated 60 square mile area of Lyme Bay. This measure was brought in to protect reef habitats.
cSAC/SCI	Lyme Bay and Torbay	Designated to protect the primary Annex 1 habitats; Reefs and Submerged or partially submerged sea caves. The site has been adopted by the European Commission but not yet formally designated by the government as a SAC.
SAC	Chesil and the Fleet	Designated to protect the primary Annex 1 habitats; Coastal lagoons, Annual vegetation of drift lines, Perennial vegetation of stony banks, Mediterranean and thermo-Atlantic halophilous scrubs
SAC	Sidmouth to West Bay	Designated to protect the primary Annex 1 habitats; Vegetated sea cliffs of the Atlantic and Baltic coasts, and *Tilio-Acerion* forests of slopes, screes and ravines.
SPA	Chesil and the Fleet	Designated for the protection of a breeding little tern *Sterna albifrons* population and an overwintering population of dark-bellied Brent geese *Branta bernicla bernicla*.
pMCZ	Axe Estuary	Recommended by the Finding Sanctuary regional project. Not included in the first tranche for designation.
pMCZ	Chesil Beach and Stennis Ledges	Tranche 1 site proposed for designation in 2013, Initially proposed for designation for the features: High energy intertidal rock, Intertidal coarse sediment, Pink Sea Fan (*Euincella verrucosa*), and Native Oyster (*Ostrea edulis*).
SSSI	West Dorset Coast	Notified for its internationally important geology including fossil reptiles and varied under cliff habitats supporting rare plants and animals.
SSSI	Sidmouth to Beer Coast	Notified for its examples of species-rich chalk grasslands and a diverse invertebrate fauna associated with the site.
SSSI	Hope's Nose to Walls Hill	Notified for its botanically rich habitats, including limestone grassland supporting many rare and local plants.
SSSI	Chesil and the Fleet	One of three major shingle structures in Britain for coastal geomorphology, which encloses the Fleet, the largest tidal lagoon in Britain. Including the beach and associated habitats the site is internationally significant for wildlife.
Ramsar	Chesil and the Fleet	Saline lagoon with rare reedbed and rich intertidal habitats, supports 15 specialist lagoonal species, 5 internationally scarce wetland plants, 10 nationally scarce wetland animals. Shingle habitat and speices. Supports large numbers of wildfowl and waders, a nursery for bass.

As with many coastal strips of this length, there are a large number of Sites of Scientific Interest (SSSI), many of which overlap the SACs mentioned above. Those SSSIs within direct vicinity of the Lyme Bay study area include the Axmouth to Lyme Regis Undercliffs, Sidmouth to Beer Coast, West Dorset Coast and Chesil Beach and the Fleet. Although many of these designated sites have a terrestrial bias, some do contain qualifying features such as nesting seabirds which should be considered in any holistic management plans for this area.

Designated Sites

Of the 11 sites listed in **Table A2** just five contain qualifying marine features that could feasibly be impacted by commercial fishing activities within the Lyme Bay study site and these are outlined in more detail below. The terrestrial, estuarine and intertidal features of the other designated sites listed may however need to be considered in the future, should they coincide with any changes to the shore based infrastructure and activities associated with the Lyme Bay fishing fleet.

Lyme Bay Designated Area (SI)

Up until July 2008, parts of Lyme Bay were voluntarily closed to mobile fishing gear to avoid damage to the reefs. Within nine months of these voluntary measures, up to a ten fold increase in abundance of three of the five key species was recorded in the protected zones compared with fished areas (Hiddink, et al., 2008). This included some of the key reef species, e.g. *Alcyonium digitatum* and *Eunicella verrucosa*.

However, the voluntary measures were not considered to be sufficiently followed and did not enclose all Annex 1 habitats in the area. Therefore an area was then closed to fishing in July 2008 under the Lyme Bay Statutory Instrument (SI), now referred to as the Lyme Bay Designated Area (Fishing Restriction) Order 2008. This prohibits dredging for shellfish and demersal trawling within a designated 60 square mile area of Lyme Bay. It is now considered that the area should restore its structure and function over the forthcoming years.

Lyme Bay and Torbay candidate Special Area of Conservation (cSAC)

Lyme Bay and Torbay candidate Special Area of Conservation (SAC) was put forward for designation as a candidate SAC (cSAC) on the 20th August 2010. As such, it is now termed the Lyme Bay and Torbay “Site of Community Importance” (SCI) and upon designation will become the Lyme Bay and Torbay SAC. Lyme Bay and Torbay SCI is split into two distinct areas: i) Mackerel Cove to Dartmouth; and ii) Lyme Bay. The CSI was primarily designated for the Annex 1 habitats:

- Reefs (Lyme Bay & Mackerel cove to Dartmouth)
- Submerged or partially submerged sea caves (Mackerel Cove to Dartmouth)

Due to the focus of this project on Lyme Bay, further reference is made to the Lyme Bay portion of the CSAC only.

The Lyme Bay Annex 1 Reefs comprise of outcropping bedrock, stony reef and biogenic reefs[6]. The range of bedrock types found within the area contributes to the variety of different habitats and subsequently adds to the diversity of the site. A study by Hiscock & Breckels (2007) described the site as a biodiversity "hot spot" after identifying particularly high species richness in the area.

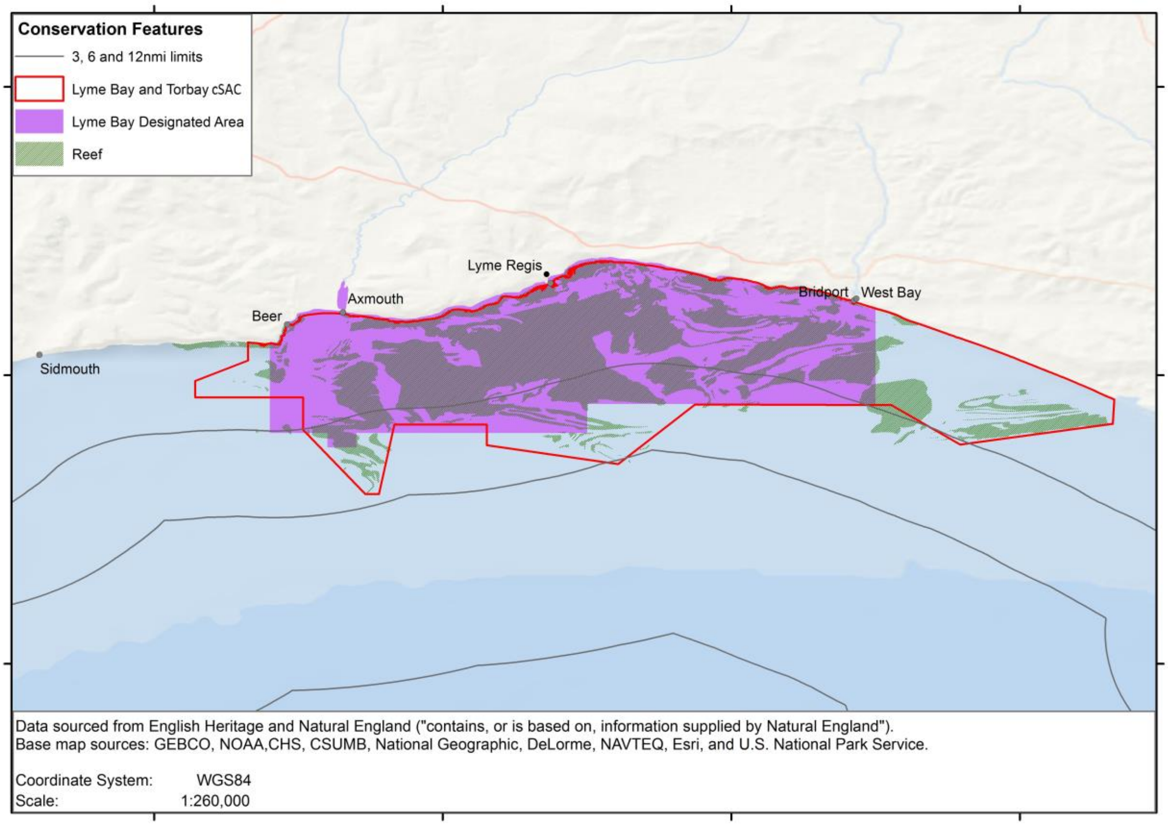


Figure A14: Chart showing the Annex I reef features identified as the qualifying features for the Lyme Bay section of the Lyme Bay and Torbay cSAC (Vanstaen & Eggleton, 2011).

The reefs are renowned for their dense floral and faunal assemblages, and are known to support both nationally and internationally important marine species including:

- Sponges (*Cliona celata*)
- Corals (*Alcyonium digitatum*, *Caryophillia smithii*)
- Anemones (*Aiptasia mutablilis*)
- Bryozoans (*Pentapora fascialis*)
- Sea fans (*Eunicella verrucosa*)

The colonial pink sea fan (*Eunicella verrucosa*) is of particular note and is listed for conservation under the Wildlife and Countryside Act 1981 and is included in the IUCN Red List. It grows only 10 mm per year and typically lives for 50 - 100 years. Other notably rare

6

species recorded in the area include the sunset cup coral *Leptopsammia pruvoti* and nationally rare sponge *Adreus fascicularis*.

These conservation features have historically been impacted by extensive commercial fishing up until the statutory closure of the area in July 2008, (to demersel towed fishing gears). The closure was in response to the impact of both scallop dredging and demersal fishing on the reef features and associated biota. The conservation objectives of the Lyme Bay and Torbay SCI Annex 1 reefs are now to 'maintain or restore the reefs to favourable condition'.

Chesil Beach and Stennis Ledges pMCZ

The site shares a boundary with a number of existing and proposed environmental designations. The recommended Marine Conservation Zone (pMCZ) runs along the length of Chesil Beach from the top of the Fleet lagoon at Abbotsbury to Portland in the south-east, extending from the high water mark out to about 1.8km, with an extension to about 5km over the Stennis Ledges, an area of rocky ridges and rugose sea bed. The deepest parts of the site are approximately 40 m below sea level. The nearby southern and western side of Portland has been identifies as an area of higher than average benthic species diversity and anecdotal evidence indicates the possible geological interest of the site, with soft Lias reefs believed to be present.

Chesil Beach itself is a linear, pebble and cobble beach which links the Isle of Portland in the east to the mainland in the west and extends for over 18 km. The beach is separated from the mainland by a shallow tidal lagoon known as the Fleet (outside the pMCZ). The beach crest is intermittent at the western end, but becomes continuous from Abbotsbury with a maximum height of 7 metres increasing to 14 metres above sea level at Chesilton. There are marked variations in particle shape along the length of the beach.

Rocky outcrops and boulders separated by patches of sand, mud and gravel have been observed down to 14 metres. Associations found were *Laminaria hyperborea* on bedrock and boulders, *Pagurus bernhardus–Nassarius reticulatus* on sand and *Hydrozoa–Ascidiacea–Porifera* on all grades of rock debris (including *Lithothamnion* and *Ostrea edulis*). At the west end of Chesil Beach, an inshore narrow zone of pebbles/shingle has been observed extending from the beach, then a wider zone of pebbles/stones mixed with sand grading into a third zone of sand/mud. Associations found were *Pagurus bernhardus–Maja squinado* on pebbles on sand. The large boulders at Chesil Cove have a low algal diversity but support a rich *Hydrozoa–Ascidiacea–Porifera* community.

Eunicella verrucosa and *Ostrea edulis* have been recorded in the pMCZ. Anecdotal evidence indicates the presence of bream nests and the Features of Conservation Importance habitat fragile sponge and anthozoan communities in the area (Lieberknecht, et al., 2011)

Chesil and the Fleet SSSI

Chesil Beach is one of the three major shingle structures in Britain and is of international importance for coastal geomorphology. Along about half its length it encloses the Fleet, the largest tidal lagoon in Britain. This, together with the Beach and associated habitats, incorporates a site that is of international importance to wildlife. The fossil-rich and stratigraphically important sequence of Jurassic strata exposed along the landward side of the Fleet adds further value to the site.

The Chesil and Fleet SSSI supports a varied array of terrestrial habitats, plants and bird species but in the context of this study it is the seabirds that this area supports that are most significance. Chesil Beach is the breeding site for about 50 pairs of Little Tern, *Sterna albifrons* and 30 pairs of Ringed Plover *Charadius hiaticula*, the only sizeable populations of these species in South West Britain. Ringed Plover are wading birds that feed on insects as well as marine invertebrates taken from the intertidal zone, as such they are unlikely to be impacted by changes to fishing practices in the Lyme Bay area. Little terns on the other hand dive for fish and so will need to be considered as part of the revised management practices.

Chesil and The Fleet SPA

The Chesil Beach and The Fleet SPA is a long linear shingle beach (Chesil Bank) enclosing a brackish lagoon (the Fleet). The Fleet is the largest and best example of a barrier-built saline lagoon in the UK and Chesil is one of the three major shingle structures in the UK. The salinity gradient, peculiar hydrographic regime and varied substrates, together with associated reedbed and intertidal habitats and the relative lack of pollution in comparison to most other lagoons, have resulted in the Fleet being extraordinarily rich in wildlife. Outstanding communities of aquatic plants and animals are present, supporting large numbers of wintering waterbirds, including Dark-bellied Brent Goose *Branta bernicla bernicla*. In spring and summer, Chesil Bank is an important breeding site for Little Terns *Sterna albifrons* which feed in the shallow waters of the lagoon, as well as adjacent waters outside the SPA.

Benthic Species of Conservation Importance

Within the Lyme Bay study area it is primarily habitats that are designated for protection but within and outside these there are also a number species which have special conservation significance, either because they have been afforded some level of statutory protection or because they are nationally or internationally rare or scarce. **Table A3** (overleaf) provides a summary of the benthic and tunicate species recorded in this area that have some level of conservation importance.

A key to the conservation status stated in **Table A3** is provided below.

Bern species	The Convention on the Conservation of European Wildlife and Natural Habitats (the Bern Convention)
SPA	Conservation of Wild Birds 79/409/EEC (the Birds Directive)
Migratory species	The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention or CMS)
OSPAR listed	The Convention for the Protection of the Marine Environment of the North-East Atlantic (the OSPAR Convention)
SAC	The Conservation of Natural Habitats and of Wild Fauna and Flora 92/43/EEC (the Habitats Directive)
CITES	The Convention on Trade in Endangered Species of Wild Flora and Fauna (CITES)
IUCN Red list	IUCN Red List of Threatened Species
National concern	Red data categories - birds (not based on IUCN criteria)
Nationally scarce	Rare and scarce species (not based on IUCN criteria)
UKBAP priority species	Biodiversity Action Plan UK list of priority species
Biodiversity species	Biodiversity Lists - England
SSSI species	Wildlife and Countryside Act 1981

Table A3: Summary of rare and protected marine benthic species (invertebrates and tunicates) known to occur in the Lyme Bay study area. Sources (textual): 1 (English Nature, 1997), 2 (Langmead, et al., 2010).

Common Name	Latin Name	Conservation Status	Primary Habitat	Source: Textual	Source: Spatial
Branched yellow sponge	Adreus fascicularis	Nationally scarce	Sand covered rock 10-30 m	1, 2	DBRC; NBN - JNCC; NBN - Seasearch
A hydroid	Aglaophenia kirchenpaueri	Nationally scarce			NBN - Seasearch
Trumpet Anemone	Aiptasia mutabilis	Nationally scarce	Infralittoral rock Under stones / overhangs oand amongst algal holdfasts	1,2	DBRC; NBN - JNCC; NBN - Seasearch
Sea-fan Anemone	Amphianthus dohrnii	Nationally rare UKBAP priority species SPI	Grows attached to seafans and other 'tubular' oranisms Always subtidal	2	NBN - Seasearch
A sponge	Axinella damicornis	Nationally scarce	Sublittoral sloping rock surfaces Often with other sponge, anemones and bryozoans	1,2	Bangor; DBRC; NBN - JNCC
Gold and scarlet star coral	*Balanophyllia regia*	Nationally scarce	Rock overhangs and surge gullies	1	None
a Sponge	Dysidea pallescens	Nationally rare	Subtidal rock	1,2	DBRC; NBN - JNCC; NBN - Seasearch
Edible Sea Urchin	Echinus esculentus	IUCN Red list post 1994			DBRC; NBN - Seasearch
Pink Sea Fan	Eunicella verrucosa	Nationally scarce IUCN Red list post 1994 UKBAP priority species SSSI species SPI	Upward facing bedrock in areas of moderate water movement	1	Bangor; DBRC; NBN - JNCC; NBN - Seasearch
Weymouth carpet coral	Hoplangia durotrix	Nationally rare	Shallow sublittoral rock 0-25m	2	DBRC; NBN - Seasearch
Sunset Cup Coral	Leptopsammia pruvoti	Nationally rare UKBAP priority species SPI	Subtidal rock 10-30m	1,2	DBRC; NBN - JNCC; NBN - Seasearch
Dog Whelk	Nucella lapillus	OSPAR Listed			DBRC; NBN - JNCC; NBN - Marine_Conchological_Soc; NBN - Seasearch
a Brittlestar	Ophiopsila aranea	Nationally rare			DBRC
an Oyster	Ostrea edulis	OSPAR Listed			DBRC; NBN -

Common Name	Latin Name	Conservation Status	Primary Habitat	Source: Textual	Source: Spatial
Drill		UKBAP priority species			JNCC; NBN - Marine_Conchological_Soc; NBN - Seasearch
Lagoon Snail	Paludinella (Paludinella) littorina	IUCN Red list post 1994 SSSI species			NBN - Marine_Conchological_Soc
Purple Sea Urchin	Paracentrotus lividus	Nationally scarce			NBN - MBA
Pink sea fingers	*Parerythropodium coralloides*	Nationally scarce	Shaded vertical or overhanging rock surfaces 1-30 m moderate water currents	2	None
Sea squirt	Phallusia mammillata	Nationally scarce	Intertidal and subtidal rock	1,2	Bangor; DBRC; NBN - JNCC; NBN - Seasearch
Paper Piddock	Pholadidea loscombiana	Nationally scarce			DBRC; NBN - JNCC; NBN - Marine_Conchological_Soc
Orange Lights Seasquirt	Pycnoclavella aurilucens	Nationally scarce			DBRC; NBN - JNCC; NBN - Seasearch
Worm anemone	*Scolanthus callimorphus*	Nationally rare	Subtidal sediments, lagoons	1,2	None
A Bryozoan	Schizobrachiella sanguinea	Nationally rare			NBN - Seasearch
A sponge	*Suberites massa*	Nationally rare	Subtidal rock including variable salinity harbours, estuaries and inlets	1	None
a Sponge	Tethyspira spinosa	Nationally scarce	Subtidal rock	2	DBRC; NBN - Seasearch
a Sea Slug	Trapania pallida	Nationally scarce		1	DBRC; NBN - Seasearch
a Sea Slug	Tritonia nilsodhneri	Nationally scarce			DBRC; NBN - JNCC; NBN - Seasearch
Alien species					
Portuguese Oyster	Crassostrea gigas	Alien in UK			NBN - MBA
Slipper Limpet	Crepidula fornicata	Alien in UK			DBRC; NBN - EA; NBN - JNCC; NBN - MBA; NBN - Marine_Conchological_Soc; NBN - Seasearch
a Barnacle	Elminius modestus	Alien in UK			DBRC; NBN - JNCC;

Common Name	Latin Name	Conservation Status	Primary Habitat	Source: Textual	Source: Spatial
a Sea Squirt	Styela clava	Alien in UK			DBRC; NBN - Seasearch
Striped Venus	Chamelea gallina	Not found in UK			NBN - JNCC; NBN - Marine_Conchological_Soc
An amphipod	Jassa falcata	Cryptogenic			NBN - Seasearch

Pink Seafan, Eunicella verucosa

The pink seafan, *Eunicella verucosa* is the only protected invertebrate species known to occur within the Lyme Bay study area. Listed on the UK Wildlife and Countryside Act, 1981. It is illegal to intentionally disturb this species on the seabed, or be in possession of its parts. The pink seafan was also subject to protection through the UK Biodiversity Action Plan, now superseded by the Natural Environment and Rural Communities (NERC) Act 2006 which lists it as a Species of Principal Importance in England. Under the NERC Act 2006 decision-makers including local and regional authorities are required to have regard to the conservation of biodiversity in England, when carrying out their normal functions, and must pay particular attention to species and habitats identified under section 41.

Pink seafans are only found in the most southerly parts of the UK. More typically found in North West Africa, Western Europe (Spain, Portugal and France) as well as the Mediterranean Southern Britain represents the most northerly part of this species distribution. However, it is thought that the range of this species may extend further up the British Isles and Ireland in response to global warming.

The pink seafan is a colonial organism made up of millions of anemone-like polyps. The structure is profusely branched and planar giving it its fan-like appearance. Colonies may grow up to 80 cm high but are more typically observed to be up to 25 cm high. Colonies are fixed to the seabed with a holdfast (similar to those found in kelp plants) and never move during their adult life making them very susceptible to damage through physical disturbance. Pink seafans feed by capturing zooplankton (microscopic animals) from the water column and are generally orientated at right angles to the prevailing currents, maximizing the surface area exposed to passing water (and food).

Like other gorgonian corals, pink seafans appear to be separate sexes, producing eggs and sperm which are released in late August or early September, coincident with maximum water temperatures. Large amounts of energy are expended on reproduction with colonies typically producing around 100 eggs or 200 sperm per centimeter (Munro, 2004). It is thought that fertilization occurs in the water column and that fertilized eggs may be dispersed anywhere between 10's and 1000's of meters, although this has yet to be observed in the field. Pink seafan colonies grow incredibly slowly at a rate of approximately

Pink seafan, *Eunicella vericosa* © Matt Doggett – Devon Wildlife Trust

10 mm per year. This coupled with their apparent low reproductive success means that pink seafans have a limited capacity to recover from population level impacts.

Pink seafans have been recorded from depths of 4m down to at least 50m and they are typically found in areas of stable bedrock and boulder fields that won't be turned over in storms. Pink seafans can only tolerate fully marine conditions and have a requirement for moderate (1-3 knots) of tidal strength although they can tolerate most levels of wave exposure. The bedrock and stony reefs in the Lyme Bay study area are therefore an ideal habitat for this species.

Figure A15 (below) shows the distribution of the pink sea fan across the Lyme Bay study area as recorded in the NBN database and Devon Biological Records Centre (DBRC). This shows that there is a strong correlation between the occurrence of this species and the reefs (surveyed by Cefas) that form the qualifying feature of the cSAC.

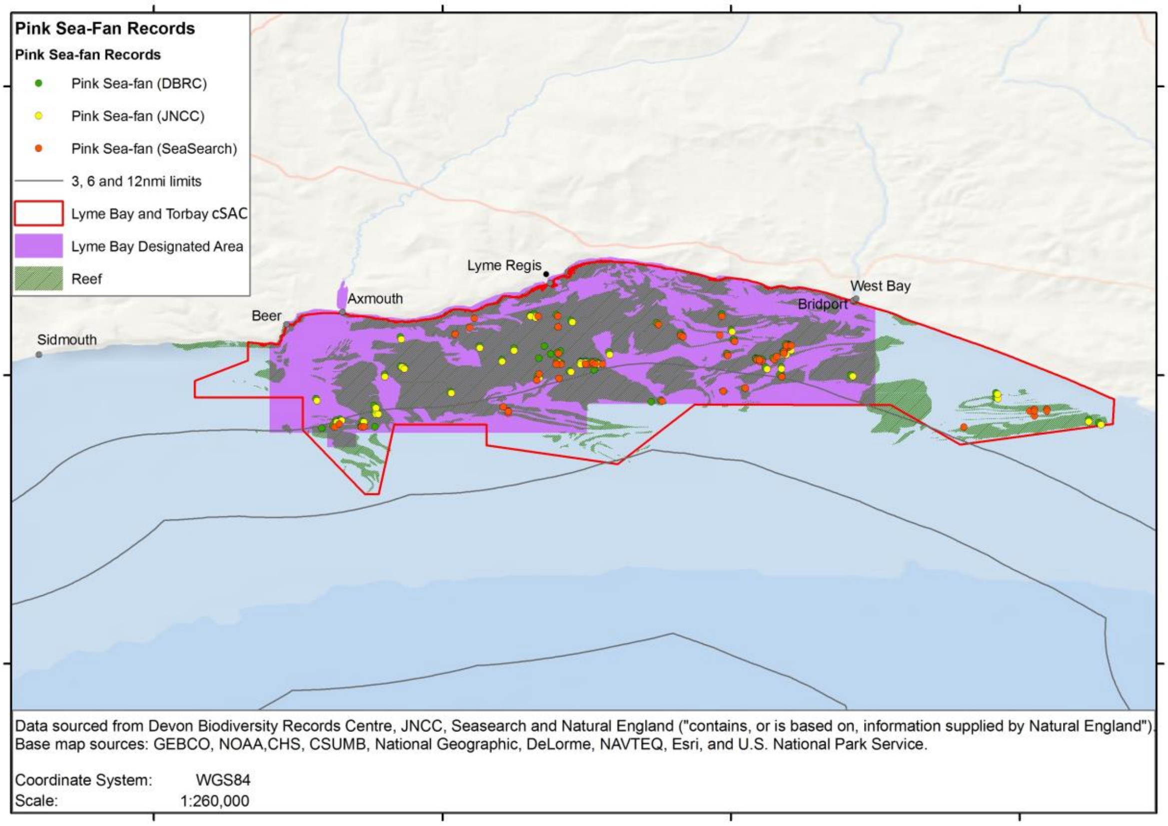


Figure A15: Map showing the distribution of the Pink Seafan, *Eunicella verrucosa* across the Lyme Bay area compiled from the NBN Database[7]; and the Devon Biological Record Centre.

[7] http://data.nbn.org.uk

Seafan anemone, *Amphianthus dohrnii*

The seafan anemone, *Amphianthus dohrnii* is as its name suggests a small species of anemone that is usually found attached to the branches of the sea fans *Eunicella verrucosa and Swiftia pallida*, although it is also found on other 'tubular' organisms such as the hydroid *Tubularia indivisa*. *A. dohrnii* rarely exceeds 10 mm across the disk, exceptionally up to 25 mm along the axis of the base. It is pink, buff, orange or red in colour, with streaks or splashes of opaque white. Because of its small and cryptic nature this species is likely to be under-recorded. However, since it occurs in close association with the Lyme Bay reef features it is afforded the same protection by default.

Like its host the pink seafan, the seafan anemone is listed as a Species of Principal Importance in England under the NERC Act 2006.

Sunset cup coral, *Leptosamnia pruvoti*

The sunset cup coral is a bright yellow or orange stony coral. It has a tentacular polyp that emerges from a porous, calcareous skeleton. The skeleton may be short and cylindrical or tall and inversely conical. It is typically solitary but is rarely found in small groups forming 'pseudocolonies'. The tentacles are quite long and number around 96. When fully retracted the tentacles are barely visible inside the skeleton.

Leptopsammia pruvoti prefers shaded bedrock or stable boulders and is typically found in caves and gullies or under overhangs. Found at open coast locations mainly facing away from prevailing winds. It is commonest between 10 and 30 m with a maximum depth of 40 m recorded in the western Mediterranean.

As with the pink sea fan, the cup coral also shows a strong correlation between the occurrence of this species and the reefs (surveyed by Cefas) that form the qualifying feature of the cSAC.

Algal Species of Conservation Importance

The following table details all species of conservation for algae. These will be considered in the habitat risk assessment for inclusion where relevant / practical to map.

Table A4: Summary of rare and protected marine algae known to occur in the Lyme Bay study area.

Common Name	Latin Name	Status (TREX)	Source
PeacockÆs Tail	Padina pavonica	Nationally scarce UKBAP priority species	DBRC; NBN - JNCC; NBN - Seaweed_Phyc_Soc
a Brown Seaweed	Zanardinia prototypus	Nationally scarce	DBRC; NBN - JNCC; NBN - Seasearch
Maerl	Phymatolithon calcareum	Biodiversity species (since replaced by UKBAP but this species not included in UKBAP)	DBRC; NBN - Seasearch

Mobile Species of Conservation Importance

The following table details all species of conservation importance for each of birds, fish, cetaceans and turtles. These will be considered in the habitat risk assessment for inclusion where relevant / practical to map.

Table A5: Summary of endangered or threatened bird species which utilise the marine area of Lyme Bay (adapted and added to from Natural England, 1997).

Common Name	Latin Name	Conservation Status	Primary Habitat	Primary Food Source	Source
Wigeon	*Anas peneolope*	Amber (not in current JNCC listing of all significant legislation but as per source)	Intertidal flats, estuaries	Aquatic plants, grasses, roots	1
Dark bellied Brent Goose	*Branta bernicla bernicla*	Amber (not in current JNCC listing of all significant legislation but as per source)	Intertidal sediments, saltmarsh, estuaries and sand dunes	Vegetation, especially eel-grass	1
Dunlin	*Calidris alpine*	Red (not in current JNCC listing of all significant legislation but as per source)	Intertidal flats, estuaries	Insects, snails and worms	1
Oystercatcher	*Haematopus ostralegus*	SPA Annex I/II Migratory species National concern - Amber	Intertidal flats, estuaries, sand dunes	Mussels and cockles on the coast; mainly worms inland	1
Bar-tailed-Godwit	*Limosa lapponica*	SPA Annex I/II Migratory species National concern -Amber	Intertidal flats, estuaries, sand dunes	Worms, snails and insects	1
Black-tailed Godwit	*Limosa limosa*	SPA Annex I/II Migratory species IUCN Red list post 2001 National concern -Red	Salt marsh, estuaries	Insects, worms and snails, and some plants, beetles, grasshoppers and other small insects during the breeding season	1
Curlew	*Numenius arquata*	SPA Annex I/II Migratory species IUCN Red list post 2001 National concern –Amber UKBAP priority species	Saltmarsh, intertidal sediments, estuaries	Worms, shellfish and shrimps	1
Whimbrel	*Numenius phaeopus*	SPA Annex I/II Migratory species National concern -Red	Intertidal flats, estuaries	On breeding grounds insects, snails and slugs; on passage, crabs, shrimps, molluscs, worms	1
Grey Plover	*Pluvialis squatarola*	SPA Annex I/II Migratory species	Shingle and intertidal flats, estuaries	Shellfish and worms	1

		National concern -Amber			
Avocet	*Recurvirostra avosetta*	Bern convention SPA Annex I/II Migratory species National concern -Amber	Intertidal flats, estuaries	Aquatic insects and their larvae, crustaceans and worms	1
Little Tern	*Sterna albifrons*	Amber (not in current JNCC listing of all significant legislation but as per source)	Shingle, lagoons	Fish	1 (and ESAS though only states 'tern')
Greenshank	*Tringa nebularia*	SPA Annex I/II Migratory species SSSI species Green (not in current JNCC listing of all significant legislation but as per source)	Intertidal flats, estuaries	Worms, snails and fish	1
Redshank	*Tringa totanus*	SPA Annex I/II Migratory species National concern -Amber	Intertidal sediments, saltmarsh, estuaries	Insects, earthworms, molluscs and crustaceans	1
Guillemot	*Uria aalge*	Migratory species National concern -Amber	Hard cliffs and open sea	Fish and crustaceans	1
Lapwing	*Vanellus vanellus*	SPA Annex I/II Migratory species National concern –Red UKBAP priority species	Intertidal flats, agricultural land, estuaries	Worms and insects	1
Northern Fulmar	Fulmarus glacialis	National concern - Amber			NBN - JNCC
Herring Gull	Larus argentatus	SPA Annex I/II Migratory species National concern –Red			NBN - JNCC
Lesser Black-backed Gull	Larus fuscus	SPA Annex I/II Migratory species National concern -Amber			NBN - JNCC
Great Black-Backed Gull	Larus marinus	SPA Annex I/II Migratory species National concern -Amber			NBN - JNCC
European Shag	Phalacrocorax aristotelis	Bern Convention National concern -Amber			NBN - JNCC

Great Cormorant	Phalacrocorax carbo	Migratory species			NBN - JNCC
Black-legged Kittiwake	Rissa tridactyla	Migratory species OSPAR Listed National concern –Red			NBN - JNCC
Common Guillemot	Uria aalge	Migratory species National concern -Amber			NBN - JNCC
Fulmar	Fulmarus glacialis	National concern -Amber			NBN - JNCC
Gannet	Morus bassanus	Migratory species National concern -Amber			ESAS
Cormorant	Phalacrocorax carbo	Migratory species			ESAS

Table A6: Summary of endangered or threatened fish species which utilise the marine area of Lyme Bay.

Common Name	Latin Name	Conservation Status	Source
Mackerel	Scomber scombrus	UKBAP priority species	Ellis, *et al.*, 2012
Lesser Sand Eel	Ammodytes tobianus		DBRC; NBN - JNCC; NBN - Seasearch
European Eel	Anguilla anguilla	OSPAR Listed IUCN Red list post 2001 UKBAP priority species	NBN - Seasearch;
Atlantic Cod	Gadus morhua	OSPAR Listed IUCN Red list post 1994 UKBAP priority species	DBRC; NBN - JNCC; NBN - Seasearch
Angler	Lophius piscatorius	UKBAP priority species	DBRC; Ellis, *et al.*, 2012
Whiting	Merlangius merlangus	UKBAP priority species	NBN - MBA; Ellis, *et al.*, 2012
Ling	Molva molva	UKBAP priority species	DBRC; NBN - JNCC; NBN - Seasearch
Plaice	Pleuronectes platessa	UKBAP priority species	DBRC; NBN - JNCC; NBN - Seasearch; Ellis, *et al.*, 2012
Sand Goby	Pomatoschistus minutus	Bern species	DBRC; NBN - JNCC; NBN - Seasearch
Sole	Solea solea	UKBAP priority species	DBRC; NBN - JNCC; NBN - MBA; NBN - Seasearch; Ellis, *et al.*, 2012
Basking shark	Cetorhinus maximus	Bern species OSPAR Listed IUCN Red list post 2001 UKBAP priority species SSSI species	DBRC;
Thornback Ray	Raja clavata	OSPAR Listed IUCN Red list post 2001	NBN - MBA; Ellis, *et al.*, 2012
Spotted Ray	Raja montagui	OSPAR Listed	NBN - Seasearch; Ellis, *et al.*, 2012
Nursehound	Scyliorhinus stellaris	IUCN Red list post 2001	NBN - Seasearch;
Spurdog	Squalus acanthias	OSPAR Listed IUCN Red list post 2001 UKBAP priority species	NBN - MBA; Ellis, *et al.*, 2012

Table A7: Summary of endangered or threatened cetacean species which utilise the marine area of Lyme Bay.

Common Name	Latin Name	Conservation Status	Source
Common dolphin	Delphinus delphis	Bern species Migratory Species SAC CITES UKBAP priority species SSSI Species	DBRC; NBN - UKCSIP
White-beaked dolphin	Lagenorhynchus albirostris	Bern species Migratory Species SAC CITES	NBN - UKCSIP;

		UKBAP priority species SSI Species	
Bottlenose dolphin	Tursiops truncatus	Bern species Migratory Species SAC CITES UKBAP priority species SSI Species	DBRC; NBN - UKCSIP
Risso's dolphin	Grampus griseus	Bern species Migratory Species SAC CITES UKBAP priority species SSSI species	SCANS-II
Bottlenose dolphin	Tursiops truncatus	Bern species Migratory Species SAC CITES UKBAP priority species SSSI species	DBRC; NBN - UKCSIP
Harbour porpoise	Phocoena phocoena	Bern species Migratory Species OSPAR Listed SAC CITES UKBAP priority species SSI Species	DBRC; NBN - UKCSIP; SCANS-II
Grey seal	Halichoerus grypus	Bern species Migratory Species SAC	DBRC; SCANS-II
Harbour seal	Phoca vitulina	Bern species Migratory Species SAC UKBAP priority species	SCANS-II
Fin whale	Balaenoptera physalus	Bern species SAC CITES IUCN Red list post 2001 UKBAP priority species SSI Species	NBN - UKCSIP
Long-finned pilot whale	Globicephala melas	Bern species Migratory Species SAC CITES IUCN Red list post 2001 UKBAP priority species SSSI species	DBRC; NBN - UKCSI

Table A8: Summary of endangered or threatened turtle species which utilise the marine area of Lyme Bay.

Common Name	Latin Name	Conservation Status	Source
Loggerhead Turtle	Caretta caretta	Bern species Migratory Species OSPAR Listed SAC UKBAP priority species SSSI species	NBN - Turtles Marine Envt Mtg
Green Turtle	Chelonia mydas	Bern species Migratory Species SAC SSSI species	NBN - Turtles Marine Envt Mtg
Leatherback turtle	Dermochelys coriacea	Bern species Migratory Species OSPAR Listed SAC UKBAP priority species SSSI species	DBRC; NBN - Turtles Marine Envt Mtg

Interactions with Other Stakeholders

Both the fishing industry and the conservation status of the Lyme Bay study area have an influence on and are influenced by other stakeholders, including local communities, other industrial uses of the area, such as those working with aquaculture and factory effluents, as well as tourism and recreational activities that occur in the area. All of these must be considered in future planning if true sustainability is to be achieved.

In the following sections of this Appendix we explore what is currently known about the interactions between the Lyme Bay Fisheries and Conservation reserve and others with an interest in this area. Where possible we have identified areas where there is potential conflict, as well as areas where there is potential for greater collaboration or consideration in the future.

Local Communities

The Lyme Bay study area straddles the districts of West Dorset and East Devon. There are three principle urban areas that interface with the area, these are: Seaton (East Devon), Lyme Regis (West Dorset) and Bridport & Bothenhampton, via West Bay / Bridport Harbour (West Dorset).

Seaton

Demographics

Seaton includes the parishes of Axmouth, Beer, Colyton and Combpyne Rousdon, as of 2011 census, the Seaton area had a population of 14,606, which is a 5.5% increase on the 2001 population of 13,840, and equates to 11% and 2% of the East Devon and Devon total population, respectively (Devon County Council, 2007).

Overall the population of the Seaton area is predicted to increase by 932 people between 2006 and 2021 – a rise of 7.4%.

The total number in the younger age groups (from 0 to 19) is predicted to decrease by 289 to 1,918, a fall of 13.1%, as well as the 20 to 44 year age band by 115 people to 2,439 or 4.5%. The 45 to 64 age group should see an increase of 134 people (3.8%) to 3,658. Whilst the older age groups (65 years and older) are due to see an increase of 1,202, which equates to a 28.2% increase over the next 15 years, taking the population in this group to 5,457. The largest change is predicted to be in the 70 to 74 age group, increasing by 45.2% (Devon County Council, 2007).

Approximately 42% of current households are considered ‘Active elderly people living in pleasant retirement locations’, whilst just over 25% are residents of ‘Small and mid-sized towns with strong local roots’. 13.6% are residents of ‘isolated rural communities and 6.6% are elderly people reliant on state support, a greater proportion than the 4.4% of households considered successful professionals living in suburban or semi-rural homes (Devon County Council, 2011).

Deprivation

The measure of deprivation is assessed on 4 dimensions, employment, education, health and disability and housing. As of 2011, 41% of all households in the Seaton area are considered not to be deprived in any of the above dimensions, which is below the county wide level of 44% (Devon County Council, 2011). However, 38% of households are considered deprived in at least on dimension, in contrast to 34% within the Devon County. Households deprived in 2 or more dimensions are either the same or below the county level (Devon County Council, 2011).

Within the whole Seaton area 19.3% of children are considered to live in poverty, this is in comparison to 12.9% at the county level and 11.2% at the national level. Whilst 6.1% living in fuel poverty is the same as the national level and marginally lower than the county level of 6.3%. Average income is £25,100 compared to £26,800 within Devon and £35,100 at a national scale. However, despite lower wages benefit claimants are below national figures, with income support at 3.1% (4.8%), job seekers at 1.7% (3.6%), disability allowance at 3% (5.3%), 65+ attendance allowance at 17.6% (19.1%) and pension credit at 12.6% (21.2%), (Devon County Council, 2011).

Employment

In 2011 2% of the Seaton population were unemployed, well below the national level of 8.3% for the same year (BBC, 2011). With regard to the proportion of the population employed within different sectors and industries, 16% of the population were classed as working in the wholesale and retail trade (including motor vehicle repair), whilst 15% were employed in human health and social work activities. Accommodation and food services, manufacturing, construction and education all accounted for 9%. In comparison agriculture, forestry and fishing only accounted for 3% (Devon County Council, 2011).

Of the employed population, 17% are deemed to work in skilled trade occupations, 16% make up managers, directors and senior officials, whilst 14% are in elementary occupations (including cleaners, refuse workers, agriculture and fishing labourers). Caring, leisure and other service occupations account for 10%, as do administrative, associate professional and technical occupations (Devon County Council, 2011).

Lyme Regis

Demographics

Lyme Regis is the most westerly town of Dorset and as of the 2011 census had a population of 3,671. The proportion of the population in the young people (0-17) and young adults (18-29) age group is well below the national level, at 15% (21.3%) and 7.9% (16.2%) accounting for 841 people in total. This is in contrast to 34.1% of the population >65, a total of 1,251, which is significantly higher than 16.1% for the national level. The overall population has declined since a high in 1991 (3,760 people), but is up on the 2001 population of 3,500 (Dorset CC, 2011[a]).

Deprivation

The socio-economic ACORN classification for Lyme Regis, in comparison to the county as a whole, found that 38.4% (40.1%) of households were 'wealthy achievers', 35.2% (33.2%) were 'comfortably off', whilst 12.5% (10.2%) were 'hard pressed' and 11.7% (9.2%) had 'moderate means' (Dorset CC, 2011[a]). A total of 527 people claim benefits, which accounts for 14.4% of the total population.

Employment

The total number employed were 1,300, working in 200 firms (excluding self-employed), as of 2009. 48% were in full-time employment, whilst 52% were part-time. Distribution, accommodation and food services accounted for the fast majority at 49%, public administration, education and health employed 29% of the population; Dorset County Council and Lyme Regis Community Care Ltd were the main employers (Dorset CC, 2011[a]). 14 fishing vessels were registered to Lyme Regis harbour as of 2010, along with West Bay, Lyme Regis is only one of two fishing harbours in the whole of West Dorset (Dorset CC, 2011[c]).

Bridport & Bothenhampton

Demographics

The total population of the "built-up" area of Bridport, which includes Allington, Bradpole and Bothenhampton & Bridport (which also includes West Bay) in the 2011 census, was 13,568. The total number in the 0 to 17 year old young people group was 2,295, accounting for 16.9% of the population, down on the national level of 21.3%, whilst 18 to 29 year olds only totalled 1,479, 10.9% of the population, significantly lower than the 16.2% national level. In contrast, as with Lyme Regis, over 65s make the majority accounting for 28.1% of the population, or 3,818 people, well over the national level of 16.4% (Dorset CC, 2011[b]).

Deprivation

Only 16.4% of the population were classed as 'wealthy achievers' in the 2010 ACORN analysis, significantly lower when compared to the Dorset county level of 40.1%, although 15.4% of the population were considered as 'urban prosperous', compared with only 7.1%

for the whole of Dorset. 39% were ‘comfortably off’, compared to the county level of 33%, and 12.4% had ‘moderate means’, against only 9.2% for county. However, those classed as ‘hard pressed’ accounted for 16.4% of the population, compared to 10.2% for the county. The total number of benefit claimants were 2,414, or 17.8% of the population (Dorset CC, 2011[b]). Bridport South & Bothenhampton ward, which includes West Bay, had the highest unemployment claimant rate of the all 33 wars in West Dorset, which was 66, this equates to 2.1% of the population of the ward, higher than the county average of 1.8% (Dorset CC, 2011[c])

Employment

The total number of people working in the built-up area of Bridport totalled 5,000, 59% of which were full-time, whilst 41% were part-time. As with Lyme Regis the majority, 40%, were employed in distribution, accommodation and food, 24% in public admin, education and health, and 22% in production and construction (Dorset CC, 2011[c]). 15 fishing vessels were registered to West Bay harbour as of 2010 (Dorset CC, 2011[c]).

Fishing Industry

Please see the separate desk review of the fishing industry in Lyme Bay (**Appendix B**).

Tourism & Recreation

Lyme Bay is one of the most emblematic coastlines of Britain. East Devon and West Dorset share the dramatic and scenic landscape of the Bay, which includes the World Heritage ‘Jurassic Coast’, the southwest coastal pathway and iconic fishing villages, coastal towns and the ‘English Riviera’, which has seen tourism steadily develop since Victorian times. The designation of the MPA within the Lyme Bay area, the largest inshore protected area in the UK, is hoped to aid the attraction of the area, through the protection of ecologically and economically significant areas (Rees *et al*, 2010[b]).

Whilst fishing has long been an important part of the Lyme Bay economy - Brixham harbour is one of England’s most significant fishing ports (Abernethy *et al*, 2010) – tourism has become a vital component to the Southwest economy. In terms of domestic tourism the Southwest, as a whole, sees over 19.2 million trips a year, with £3,606m spent in the region (Tourism Alliance, 2012). Tourism along the 22 miles of coastline between Torquay and Brixham, which make up the English Riviera and constitutes the borough of Torbay, on the west coast of the Bay, accounts for ~£450 million to the local economy (TDC, 2009). 17% of Torbay’s population is employed in tourist related activities, the highest proportion in the country - by comparison London has 10% - and 11% of jobs, either main or secondary, are related to accommodation, food and beverage services (ONS, 2012). Torbay hosts 18 sandy beaches, 5 of which have been designated as Blue Flag beaches, the international, voluntary eco-label for cleanliness and water quality, and 9 others which have received 'Quality Coast' awards. This is an obvious attraction for visitors, especially families who are likely to spend time on the beach and come to the area (TDC, 2009).

Torbay has long been a holiday attraction, but Lyme Bay also supports a number of estuaries, forming parts of important river catchment areas, which are a haven for wildlife; a significant pull-factor for visitors to the area. The three largest rivers to flow into Lyme Bay are the River Exe, Dart and Teign. At 50 miles long the Exe is the largest, with the estuary covering 3000 hectares of diverse terrestrial and marine habitats. The estuary is of international conservation importance and is designated as a SSSI and SPA, under national and European legislation (Exe Estuary Management Partnership, 2006). This rich biodiversity attracts not only attracts wildlife enthusiasts, but also a range of waterborne recreation users, such as canoeists, windsurfers and dinghy sailors.

Exeter City, which sits at the head of the estuary, attracted £165.6 million of tourist spend in 2010, and it is hoped a number of new developments, including a cycle network from Exmouth to Dawlish around the estuary, as well as new RSPB facilities for visitors, will increase the tourist potential of the estuary area (Exeter City Council, 2012). However, whilst tourism and visitors are encouraged to enjoy the natural environment of the Exe estuary it has been important to set out clear management objectives, to maintain, monitor and enforce recreation use of the area (Exe Estuary Management Partnership, 2006).

Away from the tourist trappings of the west coast of Lyme Bay, the actual shoreline of the MPA is located within UNESCO's World Heritage designated 'Jurassic Coast'. This internationally famous heritage coastline represents some of the most significant geological and geomorphological features in the world (UNESCO, 2013). At the heart of the MPA shoreline lies Lyme Regis, one of the towns that has made the area famous for its fossil collecting and ancient sea cliffs, such as Blue Lias (Lyme Regis, 2013).

Aside from the attraction of prehistoric tourism, Rees *et al.* (2010[b]) also identified scuba-diving, sea angling and wildlife watching as key marine based recreation and leisure activities in the Lyme Bay area and the designated MPA, attracting revenues of £18,279,867 per year. Sea anglers make the highest contribution of ~£13.6m, whilst dive and boat operators, which rely on the success of the marine biodiversity, had a combined turn-over of a little over £3.5m. Although marine biodiversity is a significant attraction for divers, Lyme Bay is also home to large number of wrecks, and has been known as the 'Bay of a thousand wrecks' (Westbay, 2013).

When considering just the MPA site footprint Rees *et al.* (2010[b]) found local dive and charter boat businesses generated a turnover of £676,734 per year, whilst sea angling and diving spent over £3m visiting sites in the MPA, giving a total value for recreation in the MPA of nearly £4m per year. To assess this against visitor intensity, the Lyme Bay area was divided into 1km^2 planning units, of which less than 3% were deemed 'hotspots' (frequency count >38/year). However, nearly a quarter of these (22%) were identified within the MPA.

Unlike the long track record of tourism in other areas of Lyme Bay, as identified above, the impact of the MPA on tourism, or importantly what the impact of tourism will have on the MPA, is still to be fully assessed in the long-term (Rees *et al*, 2010[b]). The economic indicators described above certainly show there is a value in conserving the marine environment within the MPA, but conflict could arise in the future. Dive tourism, for example, has already been identified in other areas of the world as a negative impact on benthic features (Rees *et al*, 2010[b]; Luna *et al*, 2009; Hasler and Ott, 2008), so setting out management objects for recreation activities will be important for the MPA going forward.

Recreational Use of Lyme Bay

Recreational use of Lyme Bay is significantly high owing to the environmental features / beauty, which is captured by the World Heritage designation of the Jurassic Coast. There are a number of small marinas along the coast (with larger sites at Portland Bill / Weymouth and from the Exe estuary southwestwards) which support a significant region of sailing, as highlighted during the 2012 Olympics, which saw Weymouth and Portland Harbor hosting the sailing events through the National Sailing Academy. Torquay also hosts the annual P1 Superstock powerboat race, which is an attraction on the local tourist calendar (Torbay Council, 2013) Diving is relatively low within the Lyme Bay Designated area according to national Seasearch dataset, though in practice it is realised that this is mis-represented; and there is only one reported surf site through the user led online mapping portal Wannadive.com. The area is known to be used significantly for coastal walking along the South West Coast Path, and has multiple beaches for bathing.

Other Industrial Activities

Aside from fishing activities and a few large outfalls, the Lyme Bay study area has a low level of industrial use. As shown in **Figure A17**, there are no other significant marine industries in the immediate vicinity of the Lyme Bay Designated Area. However to the west of this area there are three offshore aquaculture areas which have recently been licensed by the Crown Estate for the development of the UK's first offshore mussel farms.

Also to the south and east, there is one oil and gas well ~8nm south of West Bay. Otherwise, there are submarine cables south of the main area of interest (operating out of Strete / Slapton Sands) and ship routing in the centre of the English Channel. (For reference, whilst out of the map window below, Navitus Bay wind farm lease site is positions just to the east of the map window shown, i.e. east and south of Portland Bill.)

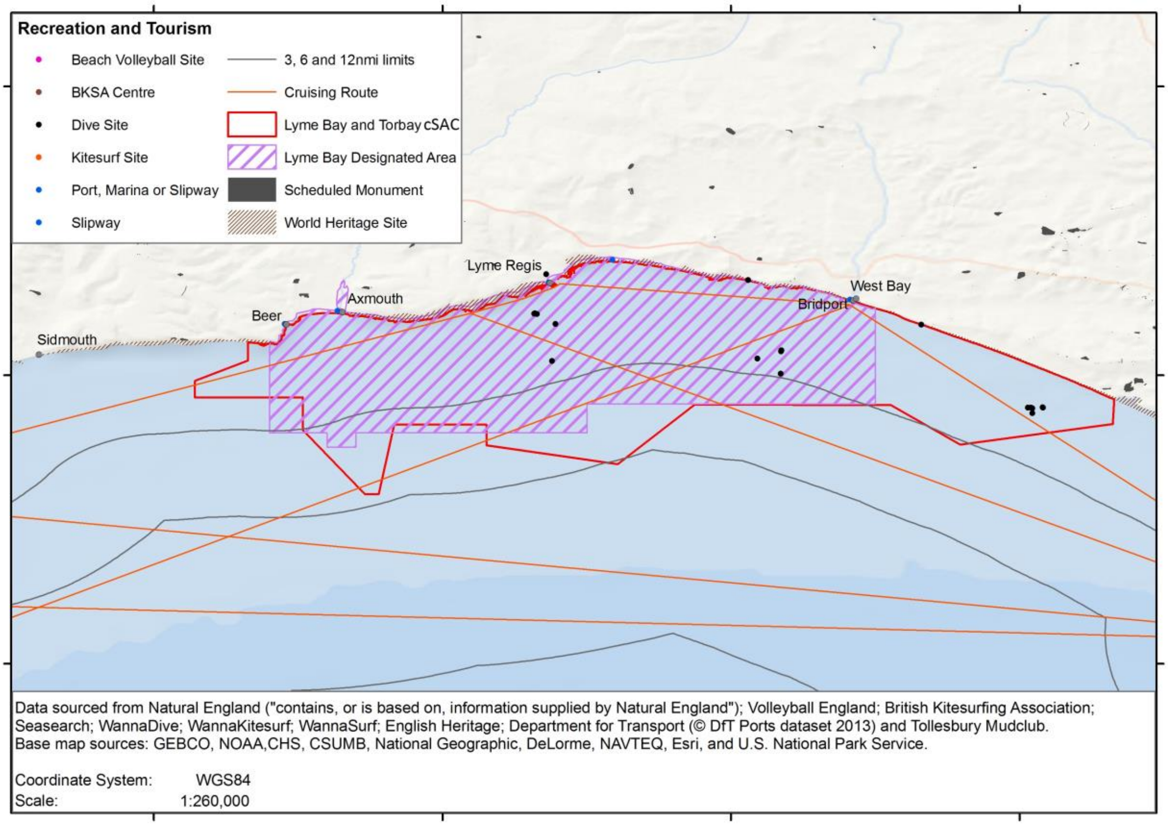


Figure A16: Chart illustrating the use of the Lyme Bay study area for recreational purposes

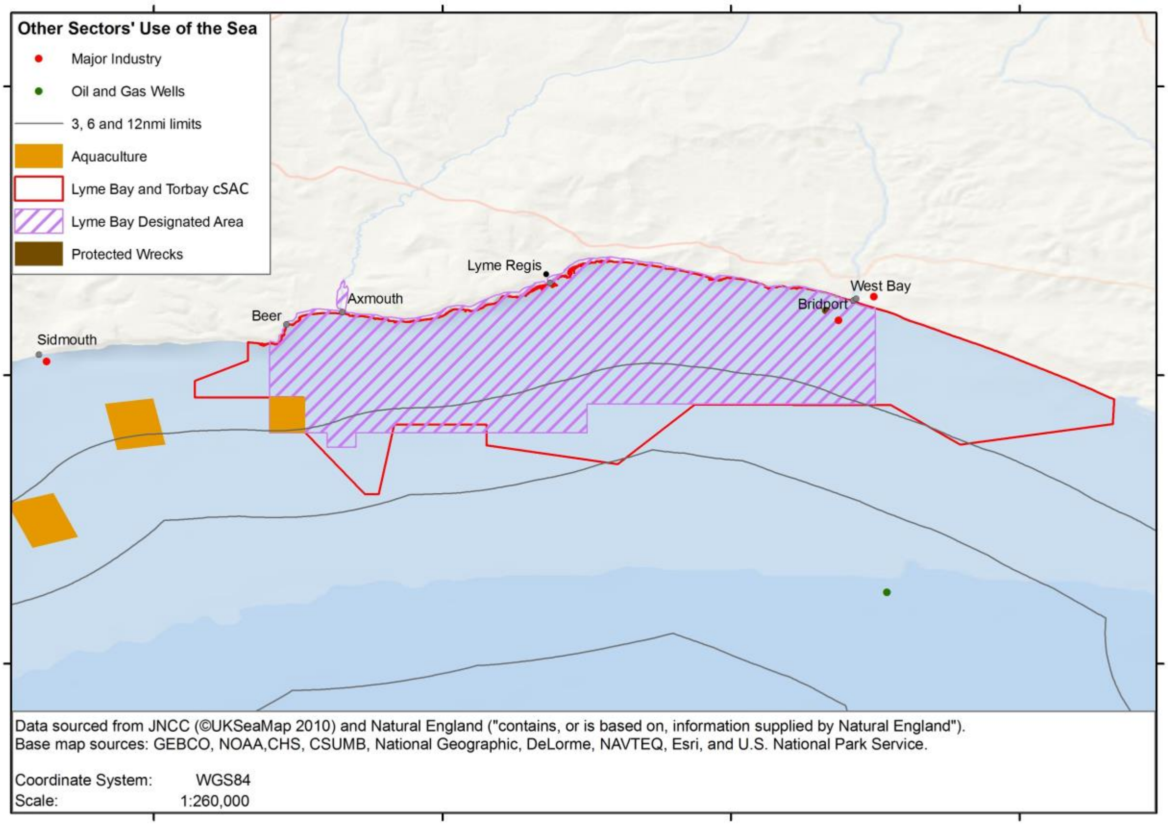


Figure A17: Chart illustrating the use of the Lyme Bay study area by other industries

The area is void of any use within the following industry sectors: offshore renewable, aggregate extraction, dredge disposal sites.

There are no Designated Areas under the Shellfish Waters Directive within the immediate vicinity of the Lyme Bay Designated Area. However some designations exist around Portland Bill (a significantly sized area); and the Exe and Dart Estuaries (smaller in comparison).

Socio-Economic Interactions

One of the principle objections of the fishing industry to the Lyme Bay closure, or indeed any restrictions imposed from a top-down approach, is the belief in the public right to fish (Appleby, 2007). Under the ancient custom of common law, or public right, fishing is only limited to 'what is legal, reasonable and activities which do not interfere with the rights of owners of the "solum" or seabed', (Appleby, 2007). The fishermen for Lyme Bay perceive the marine environment as a common resource, with rights of access granted to all. If this right is taken away it is understandable that fishermen will find it difficult to accept. For researchers and policy makers this provides a basis for understanding how conflict arises, given that conservationists consider access to the sea as a privilege, for recreation users it's their right to enjoy and fisherman it's their right to exploit (Mangi *et al.*, 2011).

When considering Lyme Bay the focus of contention has been over the use of towed gear by commercial fishermen. The composition of activity in Lyme Bay has traditionally been able to avoid serious conflict, with fishermen using heavy gear avoiding rocky areas and fishing in mixed sediment areas, allowing static gear fishermen to exploit these areas with pots.

Divers, anglers and charter boat operators have been able to enjoy the wrecks and reefs, provide wildlife tours and supplement incomes by providing angling tours in the Bay (Rees *et al.*, 2010[a]). However, as evidence mounted of the destruction of the reefs in 1992, so these groups have come together.

Engaging stakeholders has been a priority during and after the implementation of the Designated Area in Lyme Bay, not least because of the failure of the voluntary scheme in 2006 and the subsequent intervention of Natural England with a Ministerial Stop Order, which caused distrust, particularly amongst the fishing community, and the eventual implementation of the MPA in June 2008 (Rees *et al.*, 2010[a]).

Tale of two studies

Rees *et al.* (2013) surveyed 239 stakeholders, including 67 fishermen (static, towed and one scallop diver), 51 divers and 24 dive businesses, 68 anglers and 29 charter boat operators, over a three year period from 2008 - 2010 about the social, economic and environmental costs and benefits to the MPA. These findings complemented a previous study by Mangi *et al.* (2009), who contacted 157 fishermen, 19 dive businesses, 587 dive clubs (~200 were unsuccessful due to old/out of date details), 57 charter boat operators, 62 angling clubs, 68 hotels (inc. B&Bs) and 7 fish processors and merchants; this survey was replicated in 2010, contacting the same stakeholders and reported in Attrill, *et al.*, 2011.

All stakeholders from the leisure and recreation sector showed support for the MPA, whilst mobile gear fishermen showed the least, followed by static gear fishermen and anglers showed the greatest support for the policy. These results were in contrast to the most common expression, from 7 of the 8 stakeholder groups, that in fact it would be the fishermen who would benefit the most, economically, from the MPA in the coming years as a result of over spill of species. But small boat fishermen would suffer in the short-term from displacement and a decreasing resource area from which to fish.

The wider economic appeal of the MPA was reflected by some stakeholders who saw the potential benefit of attracting more tourists and visitors to the area, as a direct result of its implementation. This was in line with the views of the angling and diving community, who recognised the improvement to the environment and, therefore, improving their experience and enjoyment of the area.

Divers & Dive Businesses

Underlying the perceptions of the recreation and leisure industry questioned in Rees *et al.* (2013), Mangi *et al.* (2009) reported that divers supported the closure, although only 20% of respondents reported they were making more trips to the MPA since the closure. Large scale protection from industrial fishing activities was called for to aid ecosystem recovery, and some also expressed concern that displacement would put pressure on other favourite dive sites, but they acknowledged reduced conflict between fishermen and recreation users. The general feeling of support for the MPA was also expressed by dive businesses, but they couldn't attribute any tangible benefits from the MPA closure directly to their business, as there are too many variables and it was too soon to say what impact it has had or would have in the future.

Charter Boat Operators

As with Rees *et al.* (2013), charter boat operators were supportive of the MPA closure, but were worried for the livelihoods of the fisherman and wanted clarity and insurances that the MPA would be effectively managed. Again charter boats reported little change in business before and after the MPA closure, with other attributes, such as fuel costs, economy, poor weather and business expansion as more relevant (Attrill, *et al.*, 2011).

Anglers

There were mixed reactions reported from anglers. Both Mangi *et al.* (2009) and Rees *et al.* (2013) found anglers were concerned over the enforcement of the MPA and the wider implications/pressures this would have on fishing grounds outside the area. However, increased catch sizes were reported inside the MPA, whilst little or no change was reported outside.

Fish Processors & Merchants

In the initial aftermath of the MPA closure merchants and processors expressed concern over the decreased number of vessels landing scallops, increased haulage costs and lower scallop quality (Mangi *et al.* 2009). However one year on, the same merchants and processors reported that the closure had had little effect to their business (Attrill, *et al.*, 2011). Quality had remained largely the same, whilst they acknowledged that volume reduction was likely to be more to do with natural/seasonal cycles of scallops than the MPA, specifically.

Hoteliers & B&Bs

Although Rees *et al.* (2013) did not question this group, it is important to note the perception of hotel owners as a broader reflection of the image the MPA brings to Devon and Dorset, which rely heavily on the tourist trade. As with many stakeholder groups there were mixed feelings of concern expressed about the impact on the fisherman's income, in conjunction with the 'green' image and potential tourist boast it would give Lyme Bay.

Overall feeling and response

Within both studies, stakeholders showed a level of disquiet about the impact on the fishing industry. The towed gear fishermen, especially, saw themselves as being directly impacted the most, economically, by the MPA and Rees *et al.* (2013) reported that they saw the policy as unfair and directly discriminating against them; affecting 'their traditional user rights'.

But the mobile fishermen were not alone. As testament to the long fishing heritage of the area there was a strong local sense of empathy with the towed geared fishermen affected by the MPA, who were also seen as suffering a social cost, as a result of displacement and increased effort at sea, as well as the obvious economic implications. Equally, reduced conflict was broadly acknowledged, despite some reports of agitation between towed gear and static gear vessels, where displacement and increased effort were seen as a probable root cause (Rees *et al.* 2013).

By and large both reports (Mangi *et al.* 2009 with later findings reported in Attrill, *et al.*, 2011; Rees *et al.*, 2013), found that there was strong support for the policy amongst the majority of stakeholder groups. But whilst the conservation aspects were understood and recognised, and were broadly perceived to provide a future economic benefit, the overall costs and benefits of the MPA, at present, differed between the groups.

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