

LUNDY'S MARINE LIFE - A BALANCING ACT OF PROTECTING AND PROMOTING

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ABSTRACT

The waters around Lundy exhibit a great wealth of marine habitats and wildlife rarely seen in such a small area. A statutory Marine Nature Reserve was established around the island in 1986, and since then the same area has also become a Special Area of Conservation. In 2003 part of the area was also designated a No-Take Zone. The purpose and function of these designations is explained and an assessment given of what effect they may have had on Lundy's marine life. The need for protecting Lundy's near-shore seabed is examined. It is concluded that the protection offered is adequate but could be improved in certain areas. A review is given of the various means by which the area has been, and is being, promoted.

Keywords: Lundy, Marine Nature Reserve, Special Area of Conservation, marine life, protection, management, No-Take Zone

INTRODUCTION

Although it is only a small island, and consequently in the minds of many people fairly insignificant, within the sphere of marine nature conservation Lundy is one of the top sites within British waters. Indeed, Natural England¹ has described the waters around the island as being 'the jewel in the crown' of their marine nature conservation policy (English Nature, 1993). So what is it that makes Lundy's marine life and seabed habitats be regarded so highly, and what measures are in place to ensure that these special features are maintained for future generations? Has the creation of a marine nature reserve around the island helped or hindered the marine life and seabed habitats? Is it feasible to 'manage' a marine nature reserve in a similar way to managing a nature reserve on land? Should one overtly publicise these natural riches beneath the waves, or should one keep quiet about them, in order to minimise possible disturbance? Should commercial exploitation of a resource within the area (such as fishing) be allowed to continue whilst at the same time ensuring that adequate protection is afforded to delicate habitats and species?

¹ Natural England is the Government funded body whose purpose is to promote the conservation of England's wildlife and natural features. This includes marine habitats and species. Until October 2006 it was known as English Nature, but after its amalgamation with the Countryside Commission and the Rural Development Service it has become Natural England.

This paper seeks to address these and other questions by reviewing what is known about the island's marine life and habitats to date; by assessing the need for protecting this natural resource and how such protection has been put in place; and by reviewing the means by which the area has been promoted since becoming England's first and only (to date) statutory marine nature reserve.

WHAT MAKES THE MARINE LIFE AROUND THE ISLAND 'SPECIAL'?

There are several reasons why Lundy's marine life is regarded as being of particular note. Within the SCUBA diving community, the island is well-known for its spectacular underwater scenery, its clear waters (especially if visited after a spell of calm weather) and its colourful marine life. There is no doubt that, for such a small area, a remarkable variety of marine habitats are present around the island, with each displaying its own characteristic wildlife. The niches available to would-be colonisers are further enhanced by the range of environmental conditions which the island experiences. Indeed, Natural England (previously English Nature) proudly boasts on its website (<http://www.english-nature.org.uk>) that 'Lundy has the finest diversity of any marine site in the U.K.'

As well as escaping mainland sources of pollution, being an offshore island has other advantages. Simply by being an island, Lundy has an exposed side and a sheltered side to it. The prevailing wind direction is from the south-west, leading to the west and south coasts being exposed to the full force of Atlantic gales, while the east coast remains relatively sheltered. Not only is this reflected in the shore biota (the west coast shores are dominated by barnacles and limpets with very few seaweeds apparent; the east coast shores, by contrast, have a far more diverse biota with lush seaweed growths), but also in the seabed types. The west coast is dominated by huge 'slabs' of granite bedrock scoured by sand trapped in the base of gullies, whilst the sheltered east coast has large areas close inshore of mud or muddy gravel. Off the south-east coast the bedrock is of slate, which fragments into smooth, flat pebbles forming mobile areas that are frequently colonised by beds of brittlestars.

With its north-south orientation, the island acts as a breakwater across the flow of the tides up and down the Bristol Channel. The tidal range at Lundy is almost 8 m (on spring tides), leading to strong currents being experienced around the north-west, south-west and south-east corners of the island in particular. Lying 11 miles from the nearest point of the mainland, Lundy is also on the border between a coastal, relatively murky, body of water and an oceanic, relatively clear, body of water. This situation also contributes to the existence of conditions which are conducive for a wide range of species to flourish. Bedrock reefs extend to well over 1 km offshore from the west coast and, unusually, deep water (30-40 m) is found relatively close to the island (particularly off the north and north-east coasts). Steeply-sloping, vertical and overhanging underwater cliffs are present here, typically covered by dense growths of sessile marine invertebrates and providing impressive underwater scenery for divers. Indeed, the variety of habitats and the associated species on Lundy's reefs is outstanding and includes, for example, over 300 species of seaweeds and many rare or unusual invertebrate species. The diversity of habitats

is further enhanced by the large number of shipwrecks which are present, as well as man-made structures such as the jetty pilings in the Landing Bay.

As a result of its geographical position, Lundy acts as an outpost for several species whose centres of distribution lie much further to the south, often as far south as the Mediterranean. The reason for the occurrence of these species at Lundy is the influence of the north-flowing Lusitanian current emanating from the Mediterranean. This current is slightly warmer than the Atlantic water around it and, from time to time, it may bring with it larval forms, a few of which may be able to survive the slightly cooler northern waters. However, the populations of certain of these Mediterranean-Atlantic species, such as the sunset cup coral *Leptopsammia pruvoti*, are dwindling in size and now exist as isolated, 'relict' populations (see Box 3 below). Several of these Mediterranean-Atlantic species are rare and, being at the extreme edge of their range, are particularly susceptible to changes in their environment. As a result, several have been the subjects of monitoring studies. These pioneering studies, undertaken from 1984 to 1991, have confirmed the slow growth and longevity of many of the species of high conservation interest, such as the sea fan *Eunicella verrucosa*, the sunset cup coral *Leptopsammia pruvoti* and various species of erect sponges (Fowler & Pilley, 1992).

A summary of the wide range of Lundy's intertidal and subtidal habitats and wildlife, and the various studies that have been undertaken on them over the years, is given by Hiscock (1997).

THE ESTABLISHMENT OF THE MNR AND THE SAC

Whilst SCUBA diving as a recreational sport was in its infancy during the 1960s, a growing number of enthusiasts were keen to be the first to visit 'un-dived' locations around the British coastline. Lundy quickly became recognised as a sought-after place to visit, though getting to and from the island was not at all straightforward. A few of those that did make it sought to collect souvenirs of their underwater exploits, and would bring up items such as sea urchins and sea fans at the end of their dives as mementoes. Spearfishing was also popular (frequently leading to the largest fish within a population being removed), as was hunting for lobsters, crawfish and scallops (with the same result). By the end of the 1960s, diving biologists recognised that Lundy had an exceptionally rich variety of marine life which was threatened by certain of the aforementioned practices. Around the same time there was also a growing worldwide movement to establish marine parks and reserves, and Lundy seemed an obvious candidate. However, it was not simply a matter of announcing that a marine reserve had been set up. It took a great deal of persuasion to convince the many interested parties of the need to protect the island's marine habitats and species, and a long and arduous course has had to be followed to reach the position we are now at (as set out in Table 1).

Following initial recognition of the scientific importance of the island's marine habitats and wildlife, a voluntary marine nature reserve was set up in 1972. This worked well to begin with, but as time went by it was apparent that tougher measures were needed to protect the area. There was a constant threat that someone

might use dredging gear to take scallops from off the east coast and at the same time cause irreparable damage to the communities of high nature conservation interest there. With the Wildlife and Countryside Act becoming law in 1981, it became possible to establish statutory Marine Nature Reserves (MNRs) which were accompanied by byelaws. However, there was a considerable amount of opposition to the proposals, particularly from fishermen who could see the designation being 'the thin edge of the wedge' and that many more MNRs would sprout up elsewhere in no time. It took several years to allay these fears and eventually a statutory MNR around Lundy was declared in November 1986. A more comprehensive history of Lundy's marine nature reserve (up until 1996) is given by Irving & Gilliland (1997).

Lundy's Special Area of Conservation (SAC) status came about after the adoption of the Habitats Directive into U.K. law in 1994. This Directive, correctly referred to as 'Council Directive 92/43/EEC on the Conservation of natural habitats and wild fauna and flora', requires EU Member States to create a network of protected wildlife areas across the European Union, collectively known as Natura 2000 sites. These sites include both SACs and Special Protection Areas (SPAs), the latter being sites designated for their bird life interest. The U.K. statutory provisions applying to Natura 2000 sites are contained in the Conservation (Natural Habitats &c) Regulations 1994. Initially, SACs (both terrestrial and marine) were notified as 'candidate' sites (cSACs), with formal designation as SACs not taking place until April 2005.

Table 1: Major steps in the protection of Lundy's near-shore waters

DATE	DESIGNATION	NOTES
1972	Formal recognition of a voluntary marine nature reserve (VMNR) around the island, the first of its kind in the country.	Covered foreshore and sea bed from High Water Mark to 1 km offshore. Sufficiently large to include habitats and species of high scientific interest, yet small enough to monitor activities within it. Excluded main fishing banks. <i>Ref.</i> Hiscock <i>et al.</i> (1973).
1979	'Gentleman's agreement' between fishermen and conservationists to observe a ban on dredging/bottom trawling west of a line between the Knoll Pins and Surf Point.	Brought about to protect, in particular, the population of burrow-dwelling red band fish and other communities present in soft sediment areas. <i>Ref.</i> Hiscock (1983).
1985	Formation of the Lundy Marine Consultation Group (re-named in 1994 the Lundy Marine Nature Reserve Advisory Group)	One of the main aims of the Group was to provide a forum for exchanging views on present and proposed activities around Lundy. <i>Ref.</i> Cole (1986); & e.g. Irving (2003).

1986	Designation of a statutory Marine Nature Reserve (MNR) around the island, the first such reserve in British waters (Fig.1).	Designated under the Wildlife and Countryside Act 1981 on 21 November 1986, following a 3-month period of notification and 4 years of consultation! Included new DSFC byelaws restricting certain fishing practices. <i>Ref.</i> Nature Conservancy Council (1987).
1990	Designation of two of the island's many wrecks, the <i>Iona II</i> and the 'Gull Rock site', as protected sites.	Designated under the Protection of Wrecks Act 1973. The <i>Iona II</i> was a paddlesteamer built as a fast ferry for the Clyde in 1863 but sank a year later on her way to America. No wreck has been found at the Gull Rock site, but several stone shot and other artefacts dating from the sixteenth century have been found. <i>Ref.</i> Robertson & Heath (1997).
1994	Publication of a Management Plan covering the MNR and the (terrestrial) SSSI.	One of the aims of the Plan was to 'establish an effective structure for overseeing the management of the reserve'. A Management Group was formed from the statutory bodies involved in the management of the MNR. <i>Ref.</i> English Nature (1994).
1994	Launch of the Zoning Scheme, allocating different zones for different activities within the MNR.	A 'useful tool' pioneered in marine reserves abroad for summarising byelaws and other regulations in an easy-to-understand visual way. <i>Ref.</i> English Nature (1995).
1996	Notification by the Department of the Environment as a 'candidate' Special Area of Conservation (cSAC), and in 2005 as an officially recognised SAC by law.	Notified under the EC Habitats Directive (1992) for certain of its marine habitats and species (rocky reefs, shallow sandbanks, sea caves and grey seals).
2003	Designation of the No-Take Zone off the island's east coast - the first such statutory area in the country to ban all forms of fishing within it.	Primarily established to protect vulnerable habitats and species of conservation importance off the east coast, by means of Devon Sea Fisheries Committee byelaws. Popularly viewed as a means of enhancing numbers and sizes of commercially exploitable species.
2005	Formal designation of the Special Area of Conservation (SAC).	Designated by the Secretary of State for Environment, Food and Rural Affairs on 1 April 2005.

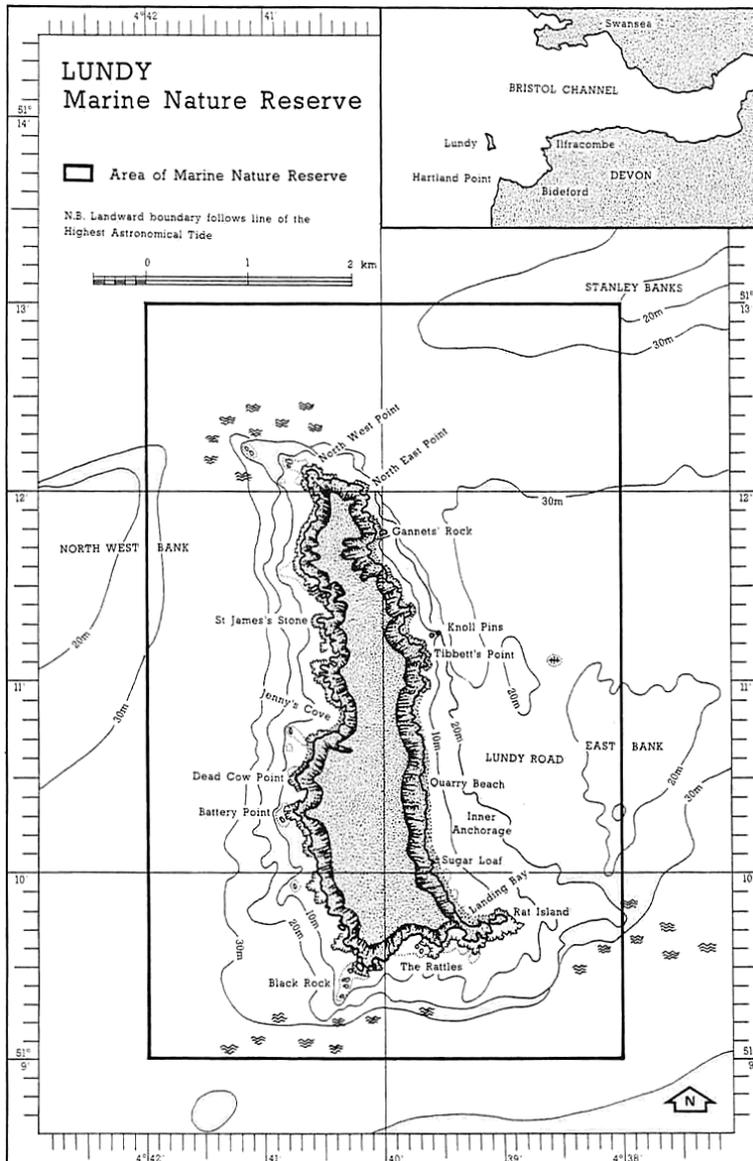


Figure 1: The 'box' boundary to the statutory MNR, which came into force on 21 November 1986 (Nature Conservancy Council 1986). Keeping the seaward boundary of the MNR to straight N/S and E/W lines between four points was done on purpose to simplify the identification of the area for both legal representations (byelaws) and for visitors to/users of the area. Note that the boundary to the SAC is exactly the same.

HOW DO THE MNR AND THE SAC DIFFER?

Both the MNR and the SAC share the same boundaries (Figure 1) - the 'inner' boundary being the island's high water mark and the 'outer' one following the four sides of a rectangle between 1-2 m offshore. For all other purposes, the two

designations are quite separate, though they do share the same overall conservation goals. One of the major benefits of the MNR has been the provision of an on-site full-time Warden, which SAC status alone would not have merited (although the site would have had a dedicated SAC Officer). One other point of difference is that the SAC status is based on certain named features of the site (see Table 2), whereas the MNR status covers all the habitats and wildlife within its boundary. Lundy was selected as an SAC on account of its 'outstanding representation of reef habitats in south-west England' (<http://www.jncc.gov.uk>). Designation as a SAC also brings with it international recognition for Lundy's marine habitats and wildlife.

Table 2: Named features for which the Lundy SAC was designated

FEATURE	
Reefs	An Annex I habitat - the primary reason for the selection of Lundy. The reef extent, water clarity, water temperature and salinity are all attributes to be monitored.
	SUB-FEATURE ATTRIBUTES TO BE MONITORED
	Rocky shore communities Distribution of characteristic range of biotopes; species composition of rockpool communities; characteristic species: Devonshire cup coral <i>Caryophyllia smithii</i> and scarlet and gold star coral <i>Balanophyllia regia</i> .
	Kelp forest communities Distribution and range of kelp biotopes; algal species composition.
	Subtidal vertical and overhanging circalittoral rock communities Species composition of characteristic biotopes.
	Subtidal bedrock and stable boulder communities Distribution and range of circalittoral biotopes; distribution and extent of sea fan <i>Eunicella</i> -characterised reef; species composition of characteristic biotope (MCR.ErSEun); characteristic species - density and quality of sea fans <i>Eunicella verrucosa</i> ; species composition of sponge-dominated biotope (MCR.ErSPbolSH).
FEATURE	
COMMENT	
Sandbanks which are slightly covered by seawater all the time	Annex I habitat present as a qualifying feature, but not a primary reason for selection of this site. The two (of the four) main sub-types which occur at Lundy are: gravelly and clean sands; and muddy sands.

Submerged or partially submerged sea caves	Annex I habitat present as a qualifying feature, but not a primary reason for selection of this site. According to Hiscock (1982), there are 37 known intertidal caves on Lundy - though this figure may be an under-estimate. Many of the caves extend for tens of metres into the island. There are also a number of subtidal caves.
Grey seal <i>Halichoerus grypus</i>	Annex II species present as a qualifying feature, but not a primary reason for selection of this site. Lundy is an important pupping site for grey seals, with approximately 10% of pups (about 20 individuals) born in the south-west region annually (Duck, 1996). Numbers of adults vary but are in the region of 70-120 individuals (Irving, 2005).

Monitoring studies of certain intertidal and subtidal species and communities of particular interest were initiated in 1984, although these studies were not a requirement of the MNR. However, there is now a legal obligation for Natural England to report on the overall condition of the listed 'features' of the SAC (see Table 2) once every six years. The report, submitted to Brussels, is required to state whether the feature in question is being maintained in a 'favourable condition' or not. There are various targets which need to be met before the feature's condition can be said to be favourable. Many of these targets require monitoring work to be undertaken in order to provide the information on which to base the judgement. For the first reporting round (submitted in 2006), monitoring of the intertidal and subtidal reef features was undertaken during the summers of 2003 and 2004.

WHY DOES THE AREA NEED PROTECTING?

Lundy is offered a certain degree of protection by its geographical position alone, thereby avoiding much of the human-generated disturbance (recreational, commercial or industrial) that would affect the area if it were adjacent to the mainland coast. However, there are certain activities which are known to have an impact on the seabed around the island and which are likely to harm the wildlife interest.

The most obvious of these are certain fishing activities, particularly those which are known to disturb the seabed, such as bottom trawling, scallop dredging or tangle netting. The extensive muddy sediment area off the east coast hosts an array of rare and vulnerable species, such as the burrowing anemones *Mesacmaea mitchellii* and *Halcampoides elongatus*. It is this habitat in particular which would suffer as a result of such destructive practices. Recovery of such areas from the impact of towed fishing gear can take several years, and even then the community which develops is likely to show differences to the original community for an even longer length of time. Potting for crustaceans has far less of an impact and consequently this activity has been allowed to continue within most of the MNR/SAC, though it too has now been banned from within the No-Take Zone off the island's east coast.

Commercial fishing is not the only activity which may harm the marine life. SCUBA diving too may result in damage to certain habitats and/or species. Consequently, divers to the MNR/SAC are asked to abide by a Code of Conduct which instructs them (i) to demonstrate good buoyancy control (contact with the seabed should be avoided wherever possible); (ii) to avoid careless finning (inadvertent fin strokes can damage erect species such as certain sponges, sea fans and cup corals); (iii) to avoid disturbing the marine life by direct contact; and (iv) to remember that exhaled air bubbles can lodge in subtidal caves and kill the marine life there.

The Code of Conduct has always requested that anglers return to the sea any territorial fish they may catch. These include all of the five wrasse species (ballan, cuckoo, goldsinny, rock cook and corkwing) and conger eels. These species are long-lived and are likely to remain in or return to the same area over many years. Discarded angling hooks, weights and line can also create hazards to marine wildlife (and also to divers), though this is a relatively minor problem. Angling is now prohibited anywhere within the No-Take Zone.

Other threats to the area are likely to be harder to identify, particularly with regard to their source(s). Local pollution has been reduced dramatically in recent years, thanks to a concerted effort by the Landmark Trust/the Lundy Company, with advice from the Environment Agency. Gone is the practice of tipping incombustible rubbish over the cliff; and the run-off from island-generated sewage now receives treatment so that it is no longer a pollution hazard. However, there still remains the problem of pollution emanating from sources outside the area, including oil spills (oiled auks continued to be found along the strandline in the Landing Bay from time to time) and seaborne litter (particularly a problem after a spell of easterly winds). Unfortunately, little can be done on the island to prevent these from occurring.

WHAT PROTECTION CAN BE OFFERED?

Protecting a nature reserve on land is likely to involve a suite of measures designed to prevent unwanted predators or invaders from entering, and other measures, such as habitat creation or the removal of unwanted plant species, which could be classified as 'active management'. With a marine reserve, the term 'protection' needs to be viewed slightly differently. Clearly, it is impossible to 'fence in' an area of sea. Protection should be seen more in terms of the management of the area, what activities should be allowed (or not allowed) in particular parts of the reserve, and whether any form of 'active management' can be undertaken.

Byelaws

Byelaws are clearly the strongest deterrent for anyone intending to disturb the sea bed or destroy the marine life. Section 37 of the Wildlife and Countryside Act (1981) states that: 'without prejudice ... byelaws made under this section relating to a marine nature reserve may provide for prohibiting or restricting ... (i) the entry into, or movement within, the reserve of persons and vessels; (ii) the killing, taking, destruction, molestation or disturbance of animals or plants of any description in the

reserve, or the doing of anything therein which will interfere with the sea bed or damage or disturb any object in the reserve; or (iii) the depositing of rubbish in the reserve.' This would appear to provide all the protection for the area that was needed. However, any prohibition or restriction on fishing activity would have to be made through the Devon Sea Fisheries Committee (DSFC). At that time, the DSFC were reluctant to introduce any new byelaws which would discriminate against any one type of fishing. This even included spearfishing. After careful negotiations however, the DSFC agreed to introduce a byelaw which would restrict the use of bottom gear (dredging/trawling) and tangle nets within the MNR.

More recently (2002), the DSFC introduced a byelaw preventing all fishing activity from taking place within the No-Take Zone off the island's east coast (see below).

Management of the area

The writing of a Management Plan was seen by the Nature Conservancy Council as being one of the first requirements in the move from voluntary to statutory status for the MNR. The first draft plan was compiled by Dr Keith Hiscock (Hiscock, 1983), then of the Field Studies Council's Oil Pollution Research Unit in Pembrokeshire and the main instigator of the scientific research which took place within the voluntary reserve during the 1970s and early 1980s. The Management Plan was re-written in 1994 (English Nature, 1994) and, for the first time, covered the island's Site of Special Scientific Interest (SSSI) as well as the MNR, as by this stage separating the two for management purposes was becoming increasingly difficult. The stated aim of the Plan (for the MNR) was 'to manage the MNR for the benefit of its wildlife, reconciling this with the sustainable use of its fisheries'. The five-year plan included a register of projects from which the annual work programme for the Warden was based. The Zoning Scheme was introduced soon afterwards in early 1995 (English Nature, 1995). This split the MNR into a number of 'usage zones' (see Figure 2 for the most recent version of the Zoning Scheme). The scheme, first pioneered in marine reserves abroad, helps to summarise the various byelaws covering the reserve in an easy-to-understand way.

Whilst the day-to-day running of the MNR/SAC is looked after by the Warden, the overall management is overseen by the Lundy Management Group. This body also has responsibility for nature conservation matters on the island itself. The Group consists of all Statutory Consultees (with respect to the island's management) and advisory organisations with specific interest in the management of the island and its environs (Lundy Management Group, draft Terms of Reference, 2006). Currently the Group consists of the following: Natural England, Devon Sea Fisheries Committee, Environment Agency, English Heritage, Landmark Trust, National Trust, RSPB, Lundy Field Society, MNR Advisory Group Chairman, and Defra RDS. The Group meets a minimum of twice a year following meetings of the MNR Advisory Group.

The Advisory Group acts as a forum for all those with an interest in the waters around Lundy. It restricts itself to just the marine reserve and does not discuss issues affecting the terrestrial part of the island. It provides an opportunity to discuss the day-to-day running of the MNR/SAC amongst those who actually use the island's

waters, such as fishermen, divers, charter boat skippers and scientists. It also allows representatives of the Management Group to air new ideas and new policies. A report of the Advisory Group's discussions is published annually in the Lundy Field Society's Annual Report (for instance, see Irving, 2003)

The role of the Warden

Clearly the Warden plays an important part in the overall protection of the area, simply by being on site. With the provision of a patrol boat, visiting dive boats and other craft are able to see that a certain amount of 'policing' of the site is being done. Sadly though, with the other duties the Warden is expected to carry out, relatively little time is actually spent out on the water interacting with visitors to the MNR/SAC. Even with the help of an assistant during the summer months to help (amongst other duties) with the boat patrols, there will be long periods of time when there is no policing presence.

The Warden also acts as the Devon Sea Fisheries Committee's eyes and ears on the island, reporting any suspicious behaviour by fishing boats seen within the MNR/SAC, and within the No-Take Zone in particular. However, he/she has no powers of arrest or powers to confiscate gear and firm evidence of actual illegal fishing taking place would be required before any form of prosecution could be contemplated.

The No-Take Zone

The declaration of the statutory No-Take Zone (NTZ) in January 2003 has added another 'layer' of protection for habitats and species present off the island's east coast (Figure 2). The concept is well established in other countries (particularly New Zealand) but it is a relatively new idea for the U.K. It was first put to local fishermen in March 2001, but had been bandied about as an idea for at least three years prior to that. Essentially, all forms of fishing are prohibited from taking place within the NTZ.

The NTZ covers an area of approximately 8 km² of sea and is governed by a Devon Sea Fisheries byelaw which states, 'for marine environmental purposes, no person shall remove any sea fish from the area'. The hope is that the NTZ will have a number of long-term benefits including (i) increasing populations of fish and shellfish stocks within and outside the closed area; (ii) greater catches of fish for fishermen around the edges of the closed area; (iii) increasing the wealth of marine life, recreating the natural ecosystems and (iv) increasing benefits to local economies from tourism, diving and research. A comprehensive monitoring programme to study the impact of the NTZ began in 2004 and will continue until at least 2007. There are two parts to the monitoring programme: firstly the effects of the NTZ on commercial species (such as lobster, edible crab, spider crab, velvet crab and scallop); and secondly, the effect on long-lived sessile biota on rock habitats such as sea fans *Eunicella verrucosa*, erect sponges, ross or rose coral *Pentapora foliacea* and dead man's fingers *Alcyonium digitatum*.

During the consultation period prior to the designation of the NTZ, it was pointed out that as very little fishing effort was undertaken off the east side of the island, the benefits of introducing the NTZ may be quite difficult to determine.

However, Hoskin *et al.* (2006) have stated that, after two years of monitoring, initial indications are that:

- (i) Lobsters appeared to have doubled in abundance (probably as a result of immigration of adult lobsters into the NTZ) and that their size was slightly larger within the NTZ.
- (ii) None of the crab species had shown significant changes in terms of abundance or size.
- (iii) The greater size of populations of several of the epifaunal species being monitored, when compared to populations outside the NTZ, probably reflects the situation before the NTZ was established.
- (iv) Finally, the size of individual scallops was found to be significantly larger within the NTZ and they were also more abundant. However, these differences are likely to have originated prior to the designation of the NTZ.

Policing of the NTZ is the responsibility of the Devon Sea Fisheries Committee. There have been two known infringements by pot fishermen during 2005 and 2006, when pots have been set inside the NTZ boundary. In the first instance, the culprit was given a severe warning but escaped having a fine imposed. In the second instance, the culprit was anonymous and the 30 or so pots were confiscated.

Other protection measures

Ironically, before the declaration of the No-Take Zone, the two areas with the greatest protection for marine nature conservation purposes within the MNR/SAC were the exclusion zones around the two protected wrecks. Divers are prohibited from entering these two areas (extending to a radius of 100 m around the Gull Rock site, and for 50 m around the *Iona II*) unless they are in possession of a licence to dive them. They have therefore been the least disturbed sites around the island.

The Code of Conduct requests that boats do not anchor within 100 m of the Knoll Pins, and that dive boats are requested not to drop shot (weighted) lines there too, on account of the high concentration of delicate marine life. The concern that has been raised by the potential damage that anchors can do to the seabed has led to a flexible mooring being set in place in Gannets Bay close to the north-east corner of the island in 2005. The mooring can best be described as resembling a buoy fixed to an immovable concrete base by means of a giant rubber band. The benefit of this system is that it avoids the sunken part of a mooring chain being swept around on the seabed and damaging the biota.

Three species which occur within the MNR/SAC have greater protection than all others. These are the pink sea fan *Eunicella verrucosa* (see Box 2) and the basking shark *Cetorhinus maximus* (listed on Annex V of the Wildlife and Countryside Act, 1981); and the grey seal *Halichoerus grypus* (notified as an Annex II species present as a qualifying feature under the Habitats Directive, 1992).

Occasionally, hands-on active management can be undertaken to remove what could be termed a 'threat' to the area. This happened in the spring of 2005 with the removal of young 'japweed' *Sargassum muticum* plants from the Landing Bay area by volunteer divers from the Appledore Sub-Aqua Club. Japweed is a non-native

species of brown seaweed originating from the N.W. Pacific which is capable of out-competing native seaweeds for space in the shallow sublittoral and in low shore rockpools. Whilst it is unlikely that it could be eradicated from the MNR/SAC entirely, it is important that the rockpools in the Devil's Kitchen (which are part of the SAC intertidal reefs monitoring programme) remain free of this invasive seaweed.

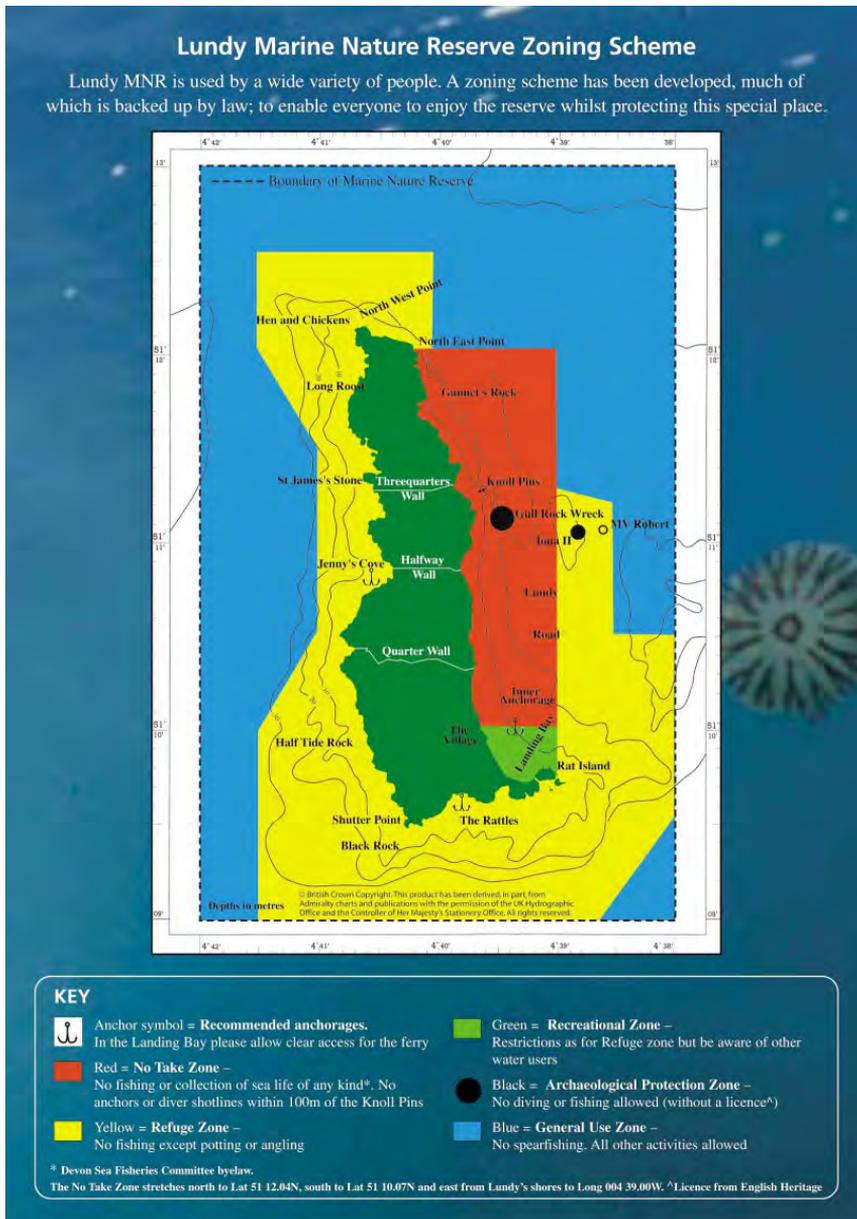


Figure 2: The Lundy Marine Nature Reserve Zoning Scheme (2003). The No-Take Zone is shown in red. The outer (hatched) line marks the boundary to both the MNR and the SAC.

MONITORING CHANGES TO THE MARINE LIFE

Appropriate management of the MNR/SAC depends, in part, on adequate knowledge about recruitment and longevity in species of nature conservation importance (Hiscock, 1994). Prior to 1984, little was known about the ecology and life history of many of these species, or whether they were particularly sensitive to changes or impacts. The monitoring programme, which ran from 1984 to 1991, was designed to address some of these unknowns. Results from this monitoring programme revealed that many of the most interesting species are very long-lived, but only recruit intermittently (Fowler & Pilley, 1992). Overall trends in their abundance are downwards (see Box 3), but what is unclear is whether this is merely a temporary downturn or whether it is part of a long-term pattern. On-going monitoring includes recording seawater temperatures throughout the year using automatic data loggers (Plate 1). A comprehensive programme monitoring the intertidal and subtidal reef 'features' around the island took place in 2003/4, forming a baseline study for assessing the overall condition of reefs within the SAC (Mercer *et al.*, 2006).

Clearly it is important to know if changes are taking place, whether these are for the better or the worse. Detecting such change can be extremely difficult, particularly as changes may be very subtle and may take several years to manifest themselves. Very little management intervention is possible however, should one wish to remedy a worsening situation.



Plate 1: Divers attaching an automatic temperature logger to the superstructure of the wreck of the M.V. *Robert*, off Lundy's east coast. *Photo: Paul Kay*

WHY PROMOTE THE AREA?

As part of its role as the Government's nature conservation advisor for England, Natural England (and its predecessors English Nature and the Nature Conservancy Council) has an obligation to identify and promote the best examples of marine habitats and species within the country. Putting on view something which might be better off being hidden presents somewhat of a dilemma. Some would argue that one of the best ways of protecting an area is to tell people why it is special, educate them in understanding which habitats or species are vulnerable, and hoping that by so doing they will 'take care' of the area and the wildlife within it. An example of this approach can be taken from the late 1960s. At this time (as mentioned earlier

Box 1: The Fall and Rise of the Red Band Fish at Lundy

The red band fish *Cepola rubescens* is a bottom-dwelling species found in areas of muddy gravel. This muddy-gravel seabed type usually occurs in depths of 70 m or more further offshore, but at Lundy this habitat type is present off the east side of the island in depths of 12-22 m (below chart datum). The eel-shaped fish, up to 70 cm long, spends much of its time hidden within a vertical burrow, emerging only to feed on passing plankton or to 'socialise' with others within harem-type groups.

In 1977, the population of these fish at Lundy was estimated to be about 14,000 individuals (Pullin & Atkinson, 1978). However, by 1983 not a single fish nor a single burrow could be found: the whole population appeared to have completely disappeared. Towed diver searches continued on an annual basis but it was not until 1987 that a small number of burrows (some with fish in them) were re-discovered (Irving, 1989). Since then the population has steadily grown, but numbers are still far less than they were in the late 1970s.

It is not known what may have caused this sudden decline in numbers. Atkinson *et al.* (1977) reported that there appeared to be a constant recruitment of young *Cepola* into the Lundy population, though there was also a high proportion of older fish present (9-12 yr old cohort), many of which may have died of natural causes within a short space of time. The recruitment of young fish may not have been able to continue had there been a high mortality of older fish. Alternatively, a mass mortality event may have occurred (the cause of which is unknown); or a disturbance of some sort may have caused the whole population to move away from the island; or there may be some other cause.



Plate 2: The anterior 12 cm of a red band fish *Cepola rubescens* appearing out of its vertical burrow. Note another burrow is present bottom right of the photograph. Photo taken in Halfway Wall Bay in 1987.

Photo: Robert Irving



Plate 3: Two thirds of the length of a male red band fish emerging from its burrow. Males have a distinctive iridescent blue colouration to their dorsal and ventral fins. Photo taken in Halfway Wall Bay in 1987.

Photo: Robert Irving

Box 2: The case of the sickly sea fans

The pink sea fan *Eunicella verrucosa* (Plate 4) is protected under Appendix V of the Wildlife and Countryside Act 1981 against killing, injuring, taking possession and sale. Since 1999, it also has had its own Biodiversity Species Action Plan, recognising its status as being rare and vulnerable. It is found throughout south-west Britain, from Portland (Dorset) to north Pembrokeshire, as well as in southern Ireland.

Monitoring studies of the sea fans at Lundy, which started in 1984, showed a marked deterioration in the overall condition of Lundy's sea fans from 2000 to 2002 in particular (Irving & Northen 2004). Indeed, when compared to the condition of sea fans from other sites, the population at Lundy was shown to be in a particularly poor state of health (see Fig. 3). The cause of this decline in condition was clearly not due to physical disturbance as individual fans remained attached and partially living. Instead it was thought that some change in water quality was affecting the fans. Studies at Plymouth University and at the Marine Biological Association have since shown that a bacterium *Vibrio splendidus* was attacking the soft tissue of the fans (pers. comm., J. Hall-Spencer) (Plate 5). It is believed that the infection has now passed through the population, as individual sea fans appear to be recovering (pers. comm., C. Wood).

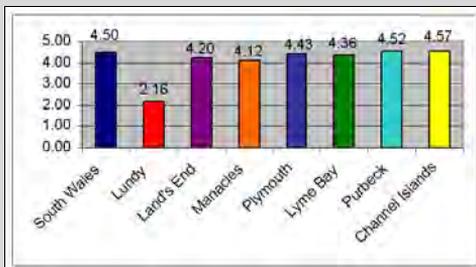


Figure 3: Chart showing the average 'condition' of sea fans at eight sites in southern Britain during 2001/02. 'Pristine' condition scores 5, 'sickly' condition scores 1. (After Wood, 2003).



Plate 4. A sea fan *Eunicella verrucosa* in 'pristine' condition at Lundy in 1997. The size of this fan is approximately 25 cm x 25 cm.

Photo: Paul Kay



Plate 5. Close-up view of part of a 'sickly' sea fan at Lundy in 2000, overgrown by barnacles and bryozoan turf.

Photo: Robert Irving

Box 3: The decline in the population of sunset cup corals

In the U.K., the sunset cup coral *Leptopsammia pruvoti* is a species of particular marine natural heritage importance: it is nationally rare and has its own Biodiversity Action Plan (BAP). As a Mediterranean-Atlantic species, *L. pruvoti* is at the northern extreme of its range at Lundy. It is only found at a handful of other sites in south-west Britain: the Isles of Scilly, off Plymouth Sound, in Lyme Bay and at Portland Bill. Within these populations there appears to be very little new recruitment in evidence and, consequently, the number of individuals is declining. This is of particular concern to conservationists. The population of *L. pruvoti* re-photographed at the Knoll Pins on an annual basis between 1983 and 1990 was found to have lost 8% of its individual corals (Fowler & Pilley, 1992), and between 1984 and 1996 part of this same population had declined by 22% (Hiscock, 2003).

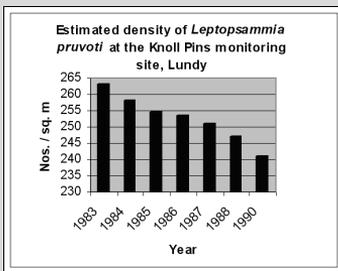


Figure 4: Diagrammatic representation of the decline in numbers of *Leptopsammia pruvoti* from 1983 to 1990 from a population at the Knoll Pins (after Fowler & Pilley, 1992).

The cause of this decline is not known for certain, but studies undertaken at Lundy indicate that the presence of the horseshoe worm *Phoronis hippocrepia* around the base of several individual cup corals could be important (Irving, 2004). These worms bore into the calcium carbonate skeleton of the cup coral, thereby weakening its attachment to the underlying rock and possibly causing it to fall off the rock. Several skeletons of dead cup corals, collected at the foot of cliffs below *Leptopsammia* populations have been found to have worm-borings in their bases.



Plate 6: A cluster of sunset cup corals *Leptopsammia pruvoti*, photographed at the Knoll Pins.

Photo: Paul Kay



Plate 7: A *Leptopsammia pruvoti* individual with the lophophores of several *Phoronis hippocrepia* horseshoe worms emerging from its base.

Photo: Robert Irving

in this paper), sea fans used to be collected as souvenirs at Lundy. Those divers collecting them probably had no idea that the sea fans' growth rate of just 10 mm/year meant that an average sized specimen measuring 50 cm in height was at least 50 years old. By explaining this fact to divers, it became much easier to persuade them not to collect sea fans, and the practice was soon ended.

However, by promoting the area one would expect more people to visit than might otherwise have done so. Thus there is an increased risk of damage to the very thing one is trying to protect, simply by an increase in 'visitor pressure' (see Box 4). A profit-making business may well wish to advertise its wares in order to get more people to buy whatever it might be trying to sell. But nature conservation organisations do not work like that: there is a genuine desire to want to inform and educate people for the ultimate benefit of wildlife. This is particularly the case with underwater habitats and species which, for the majority of people, remain as total unknowns and outside their own personal experiences. Even divers are often unaware of the biology of, and conservation interest in, many of the species they see under water.

Box 4: The Gull Rock wreck site

In 1968, some stone cannonballs and iron cannon were found in the vicinity of Gull Rock by John Shaw, one of Lundy's diving pioneers. The artefacts were well camouflaged and the site was not found again until 1983. Since then a series of surveys have shed light on what may be Lundy's most important underwater site (Robertson & Heath, 1997). It is thought that the artefacts date from the 15th or 16th centuries, but it is not certain how they came to be there - was there a shipwreck (no evidence of one has been found) or were they jettisoned from a ship? Whatever their origin, in 1989 the Archaeological Diving Unit decided that the remains were of national importance and the site was designated in 1990 under the Protection of Wrecks Act, 1973.

When the site was first discovered, it was realised that the artefacts were likely to generate considerable interest amongst 'wreck hunters' and so the location of the site was kept a closely guarded secret. Ironically, with the notification of the Protected Wreck status and the 100m diameter exclusion zone, the location of the artefacts became public knowledge and within a matter of months, several of the artefacts had mysteriously disappeared.

One wonders whether, in this case, informing all and sundry about the importance of the site prior to its announcement as a protected wreck would have avoided the looting of the site (for that is probably what has happened). An alternative solution, though one that would be far more expensive, would be to remove the artefacts from the seabed and conserve them by the appropriate means at a safe location. This solution would involve a long-term commitment of funding, time and space, and satisfying all three requirements would seem to be extremely unlikely.

There is also the 'kudos' factor - the more people that visit an area, the more it can be said to be popular and appealing. This can help with attracting more people to visit the island and with grant applications (grant-awarding bodies often require some indication of visitor numbers to a site).

HOW IS THE AREA BEING PROMOTED?

One of the most beneficial things to come about from the establishment of the voluntary marine nature reserve at Lundy was the six-month appointment of the country's first marine Warden in 1978. This was viewed as a pilot project aimed mainly at assessing the work of a marine warden. As part of his brief he was asked to:

1. ensure the Code of Conduct was abided by;
2. provide guidance and information to visiting divers;
3. assist field workers in carrying out their studies;
4. assist in organising and running field courses in sublittoral ecology; and
5. prepare illustrated guides for the reserve.

As part of point (5) above, an illustrated guide to an underwater nature trail at the Knoll Pins was prepared. Whilst being regarded as an excellent idea, sadly the popularity of this experiment proved to be its downfall, as it encouraged divers to follow a set route around the site leading to the very marine life they had come to see being inadvertently damaged.

Despite the success of this pilot project, there were insufficient funds to continue it and a further eight years had to pass before the next marine warden was appointed after the designation of the statutory MNR. Since then there have been a further five incumbents, each bringing something new to the role. The post of Warden has been fundamental to the success of the MNR/SAC. Not only have they acted as a point of contact for the MNR/SAC on the island, they have also been instrumental in the educational promotion of the area for divers and non-divers alike. Illustrated talks are given on a weekly basis to those staying on the island; there are rockpool rambles in the Devil's Kitchen; and the snorkel trail between the jetty and Rat Island has proved a great success.

Table 3: A selection of initiatives used to promote Lundy's MNR/SAC.

PROMOTIONAL INITIATIVES	COMMENT
Information panels	All-weather promotional panels at Bideford and Ilfracombe - the main crossing points to Lundy. Information panels on board the M.S. <i>Oldenburg</i> and as part of the display area at the back of the Church on Lundy. Information panels in the Beach Building on Lundy.
Literature	ID book: The Scuba Diver's Guide to the Lundy Marine Nature Reserve. Numerous leaflets. Schools educational packs to fit in with various curricula.

Video/Media	Numerous TV and radio clips and some full-length programmes about Lundy's marine life. 1996: first video about the MNR using donated footage. 2002: EN-commissioned video about the MNR ' <i>Lundy - an island to treasure</i> ' shown on board the M.S. <i>Oldenburg</i> during crossings to the island.
Web cam and virtual web tour	Underwater images from the Landing Bay broadcast on EN's website. Interactive web tour of the Lundy MNR on EN's website.

CONCLUSION

A great deal has been written over the past 30 years extolling the merits of Lundy's marine life and underwater scenery. The increase in interest in the site during this time has been accompanied by a considerable amount of marine biological research taking place, leading to a corresponding increase in our knowledge of the island's seabed habitats and marine life. The place has not been swamped by divers as was once feared would happen (its isolation has seen to that), and yet the amount of educational material about the marine life has increased considerably.

One can try to imagine what the waters around the island would be like today had no marine nature reserve been established. It is likely that the level of potting would have found its own equilibrium (probably similar to the level that can be sustained at present), though this may have come about after cycles of boom and bust years. It is highly likely that the soft sediments off the east coast would have been dredged for scallops and possibly other species, destroying the scientific interest of that particular area. The number of visiting divers would probably have been similar to the number which visit at present, though there would have been no restrictions on their activities.

On balance, one could conclude that the various designations have certainly been beneficial to the island's marine habitats and wildlife. Given the resources available to the statutory bodies responsible for the site's management, there will always be gaps in the protection that these designations should offer. However, it would be welcome if more resources could be put into patrolling the island's near-shore waters, and more emphasis be placed on a research programme assessing the declining fortunes of certain of the species of high nature conservation interest. It is appreciated, though, that little can be done to protect against external influences which may be detrimental to important species or communities. The management requirements of a marine reserve are clearly different to those of a nature reserve on land, with far less emphasis on human interference and more on long-term monitoring to distinguish natural trends from anthropogenic-generated anomalies. Finally, the long-term success or failure of the No-Take Zone will have a considerable bearing on the way fisheries interests are managed within marine reserves in future.

Please note that the views expressed in this paper are those of the author alone.

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