INTRODUCTION TO THE MARINE AND FRESHWATER HABITATS OF LUNDY

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ABSTRACT

The marine and freshwater habitats of Lundy are populated by very different species and communities and have a contrasting history of habitat creation and colonisation. Marine habitats are largely natural and are very varied, particularly reflecting the wide range of conditions of wave and tidal stream exposure around the island. The variety of freshwater habitats is surprising for such a small island, including ponds, cisterns and reservoirs as well as the streams. Both marine and fresh waters have great fascination and importance for their natural history and both are special features of Lundy.

Keywords: *Lundy, ponds, streams, freshwater habitats, marine biology, marine habitats, conservation*

INTRODUCTION

Both salt and fresh water have always been important to Lundy. The sea, before its special wildlife features were revealed, for its fish and shellfish; the ponds and streams because access to freshwater was essential for human survival on the island. Both have been affected by human activities but both have an enormous fascination and value for the wildlife that they support.

The major groups of plants and animals that populate the shore and seabed around Lundy are very different to those of freshwaters on the island. In the sea, algae are the plant species colonising the seabed whilst, in freshwaters, it is flowering plants (angiosperms) that are the attached species. In the sea, sponges, sea anemones and their relatives (Cnidaria), polychaete worms, crustaceans, molluscs, bryozoans (sea mats), echinoderms (sea urchins, starfish and their relatives) and ascidians (sea squirts) are dominant whilst, in freshwaters, the variety of major animal groups is much smaller with crustaceans and insects dominant and a few flatworm, annelid worms, arachnid (spiders) and mollusc species also present.

My first visit to stay on Lundy was in 1967 and I dived there for the first time to study marine wildlife in 1969. Since then, I have returned to the island in most years and, in the 1970s and ’80s, brought many colleagues to help in documenting the marine wildlife - admittedly therefore being on the sea rather than the land, and anywhere near Lundy’s fresh waters.

MARINE HABITATS

Marine habitats and the communities of species that populate them are shaped by wave action, tidal flow velocity, the underlying geology including geomorphology and sediment types, depth to the seabed, 'water quality' (meaning especially salinity, turbidity, nutrients) and the prevailing currents that bring water masses and larvae. Studying maps and charts of Lundy as well as the 'Coastal Pilot' makes it clear that there are going to be a wide range of habitats there. Both granite and slate rocks slope steeply into the subtidal and extend to considerable depths in places. The shore and seabed are exposed to extremely strong wave action on the west coast but are much less exposed on the east coast, and there are very strong tidal flows off the north and south ends of the island compared to 'weak and intermittent' currents off parts of the west and east coast. There are extensive sediments off the east coast. The island stands at the meeting point of clear oceanic waters to the west and turbid Bristol Channel waters to the east suggesting influence from both.

Despite the difficulties of getting there, Lundy has attracted the attentions of marine biologists for over 150 years. The earliest recorded studies near to Lundy are noted in the work of Forbes (1851) who took dredge samples off the east coast of the island in 1848. The first descriptions of the seashore wildlife on Lundy are those published in 1853 by the foremost Victorian marine naturalist and writer, P.H. Gosse, in the *Home Friend* (reproduced later in Gosse 1865). However, his descriptions are unenthusiastic, reveal nothing unusual and draw attention to the very few species found on the granite shores. There are further brief references to Lundy in the literature of other Victorian naturalists. Tugwell found the shores rich collecting grounds and cites the success of a collecting party who (with the help of 'an able-bodied man with a crowbar') returned from Lundy in 1851 'laden with all imaginable and unimaginable spoils' (Tugwell, 1856). However, Lundy never achieved the popularity of the nearby North Devon coast amongst Victorian sea-shore naturalists and significant published studies of the marine life of the island did not appear until the 1930s.

Each summer between 1934 and 1937, G.F. Tregelles visited Lundy to collect seaweeds. His records are summarised in Tregelles (1937) and are incorporated into the *Ilfracombe fauna and flora* (Tregelles *et al.*, 1946) and the *Flora of Devon* (Anonymous, 1952).

The first systematic studies of marine ecology at Lundy were undertaken by Professor L.A. Harvey and Mrs C.C. Harvey together with students of Exeter University in the late 1940s and early 1950s (Anonymous, 1949; Harvey, 1951; Harvey, 1952). These studies again emphasised the richness of the slate shores especially when compared with the relatively impoverished fauna on the granite shores. A later study (Hawkins & Hiscock, 1983) suggested that impoverishment in intertidal mollusc species was due to the isolation of Lundy from mainland sources of larvae.

When marine biologists started to use diving equipment to explore underwater around Lundy at the end of the 1960s, they discovered rich and diverse communities and many rare species. These finds led to a wide range of studies being undertaken, both underwater and on the shore, in the late 1960s through to the mid-1980s. The

flora and fauna were catalogued and ecological studies resulted in a detailed knowledge of the inshore marine biology of the island, contributing significantly to the understanding of subtidal marine ecology in Britain. A summary description of the marine ecology of Lundy is given in Hiscock (1997). More recently, particularly as Lundy became Britain's first marine nature reserve, surveillance studies have revealed the great longevity of many species and their likely irreplaceability if damaged. The wide range of studies undertaken are catalogued in Hiscock (1997).

Although the great interest and value of Lundy's marine life is in natural habitats, there are habitats that result from human activities or which have been affected by human activities. The wrecks around Lundy are mostly flattened and now merge with the surrounding seabed except that the M.V. *Robert* (which sank off the east coast in 1975) is intact and has a community of species not found on natural substrata. The jetty, built in 1998, has particular communities of species on the pilings. However, the richness of the rockpools that once existed in the Landing Bay is now severely degraded by the spoil from the beach road excavations in the late 1980s.

Although the 'connectedness' of the sea means that larvae, spores and migratory species can readily colonise the island from afar, there remain mysteries as to how certain species with short-lived larvae reached the island. Our knowledge of reproductive biology of species is far from complete but some such as sea fans (*Eunicella verrucosa*), the sunset cup coral (*Leptopsammia pruvoti*) and most likely many of the sponges have very short-lived larvae and now only recruit locally - so how did they get to the island in the first place?

The richness and composition of marine life around Lundy is not static. The profusion of colourful Mediterranean-Atlantic species, especially sponges, corals and anemones, may have reached a 'high point' in the '70s or '80s but has been in decline since the mid '80s (Hiscock, 2003) for no clear reason except that there may be some variability that is so long-term we do not yet recognise it. In 2001 and 2002, the sea fan (*Eunicella verrucosa*) population was decimated by a bacterial infection, now passed. Non-native species have appeared - most conspicuously japweed (*Sargassum muticum*) in the Landing Bay and climate warming is encouraging some previously sparse southern species to thrive (notably the toothed topshell *Osilinus lineatus* in the Devil's Kitchen).

Lundy was established as a voluntary marine nature reserve in 1972 (Hiscock *et al.*, 1973) and as a statutory marine nature reserve in 1986. The area around Lundy is a Special Area of Conservation established under the EC Habitats Directive and has the only No-Take Zone, established by fisheries bye-law, to protect wildlife in the U.K. Now, much of the marine biological research is focussed on monitoring the effectiveness of the various conservation measures.

FRESHWATER HABITATS

Freshwater habitats include streams and standing waters: ponds, cisterns and reservoirs. On Lundy, the soil is acidic and therefore streams and ponds tend towards acidic rather than alkaline and, because dissolved mineral levels are low, are 'soft' rather than 'hard'. Both of those factors will affect the communities of plants and animals that develop in freshwaters but colonisation of those waters by plants and

animals on an isolated island must be more problematic than for the sea. Plants and animals, including their propagules, may be brought to the island by birds, and humans have doubtless introduced some. Long (1994) has noted how Lundy streams are impoverished compared to similar streams on the mainland. However, George (1997) also observes that there are usually fewer parasites, predators and competing species present in such isolated locations.

Lundy is a small island and most of the rain that falls is likely to run away to the sea without ponding. However, the largest standing water body, Pondsbury, is natural, albeit modified by damming and dredging. Many of the standing freshwater habitats were created by human activity to provide a regular supply of water. The older examples of such habitats are open and colonised by plants and animals. But many of the freshwater habitats are in danger of drying-up during extended periods of dry weather, placing significant stress on the component flora and fauna.

Lundy does not have a long history of study of freshwater habitats. The earliest recorded observations of the freshwater flora and fauna are those of Morgan (1948) who studied the streams and Fraser-Bastow (1950) who studied diatom algae. It seemed likely that the field courses from Exeter University run by one of the LFS founders, Professor L. A. Harvey, would have sampled and documented pond life, In fact, although marine records are very full from those courses, there is nothing in the original field records to suggest what could be found in freshwater.

The variety of freshwater habitats is catalogued by Langham in the *Annual Report* of the LFS for 1968 (Langham, 1969). In that *Annual Report*, location, size and dominant vegetation was recorded. The first detailed records of freshwaters was that undertaken by Jennifer George, Brenda McHardy (Stone) and others. Information collected up to 1996 was included in the review by George (1997).

George (1997) concludes that the isolation of Lundy is not a major limiting factor for the freshwater fauna and flora but that drying-up of habitats during drought is an important environmental factor. Whilst it seems that, in the 27 years that Jennifer George and her colleagues have studied freshwaters, there has been a high degree of constancy in the fauna and flora present (see George, this volume), long-term variability is uncertain and there will doubtless be surprises in the future.

Although most of the island is scheduled as a Site of Special Scientific Interest, there is no mention of freshwaters in the citation.

Plates 1-25 on pages 68-80 show the diversity of the marine life occurring in the Lundy Marine Nature Reserve.

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Plate 1: Boulders at Ladies Beach provide a habitat for a rich variety of algae and animals, especially under the boulders. *(Photo: Keith Hiscock)*

Plate 2: The anemone, *Actinia fragacea*, in a rock pool on Divers Beach. *(Photo: Keith Hiscock)*

Plate 3: The scarlet and gold star coral, *Balanophyllia regia*, in a gully at Mouse Island. *(Photo: David George)*

Plate 4: *Lepadogaster lepadogaster*, the shore clingfish or Cornish sucker, under boulders at the jetty. *(Photo: Keith Hiscock)*

Plate 5: The black brittle star, *Ophiocomina nigra*, north of Rat Island.
(Photo: Keith Hiscock)

Plate 6: The seven-armed starfish, *Luidia ciliaris*, north of Rat Island.
(Photo: Keith Hiscock)

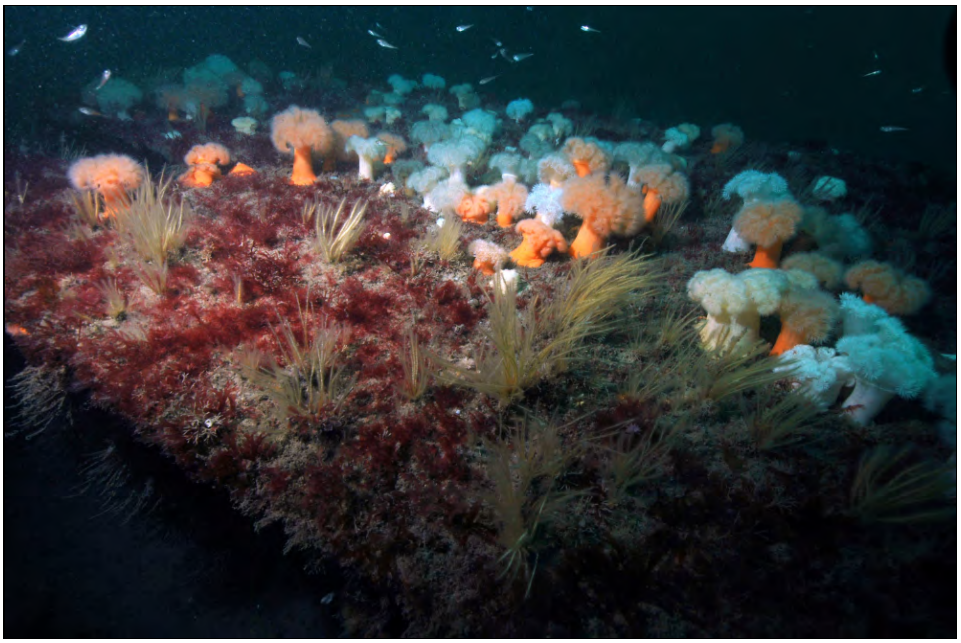

Plate 7: On the bridge of the M.V. *Robert* wreck, showing the plumose anemone, *Metridium senile*, the sea fir, *Nemertesia antennina*, and a red alga. *(Photo: Keith Hiscock)*

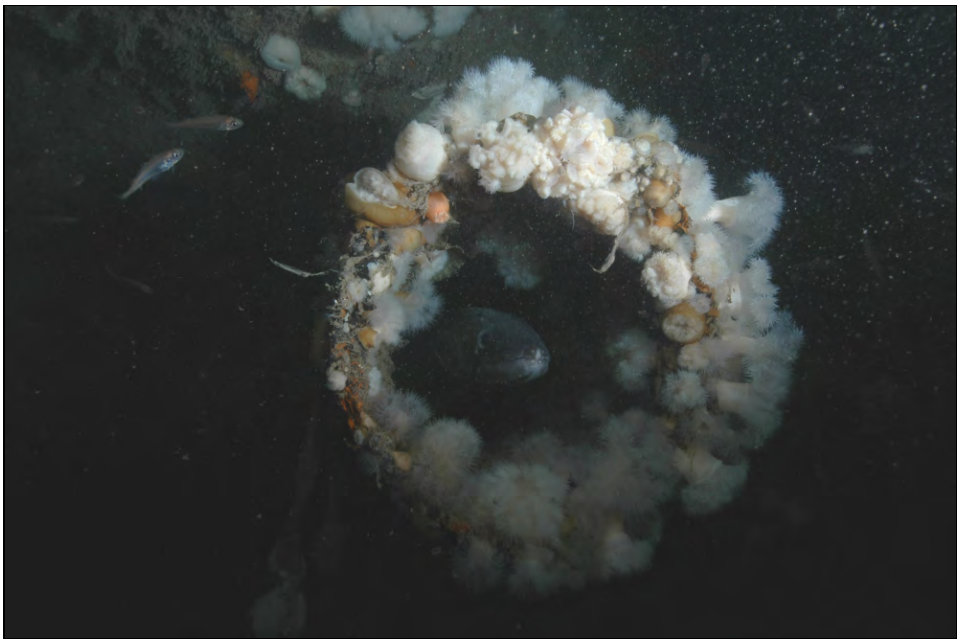

Plate 8: A conger eel, *Conger conger*, framed by plumose anemones on the M.V. *Robert*. *(Photo: Keith Hiscock)*

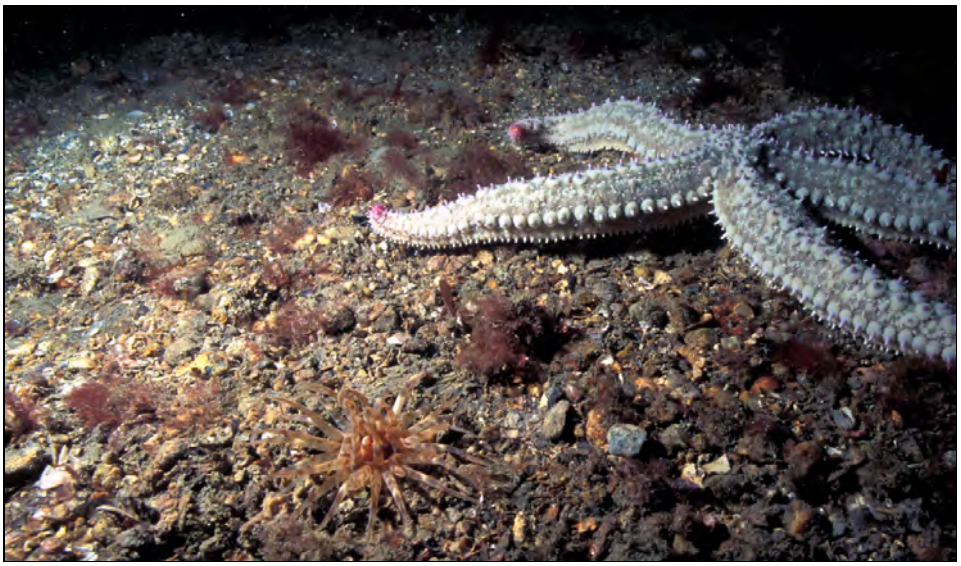

Plate 9: Undisturbed sediment on the east coast showing the spiny starfish, *Marthasterias glacialis*, and the anemone, *Mesacmaea mitchelli*. *(Photo: Keith Hiscock)*

Plate 10: The branching yellow axinellid sponge, *Axinella polypoides*, on a boulder slope off the Quarries, east coast. *(Photo: David George)*

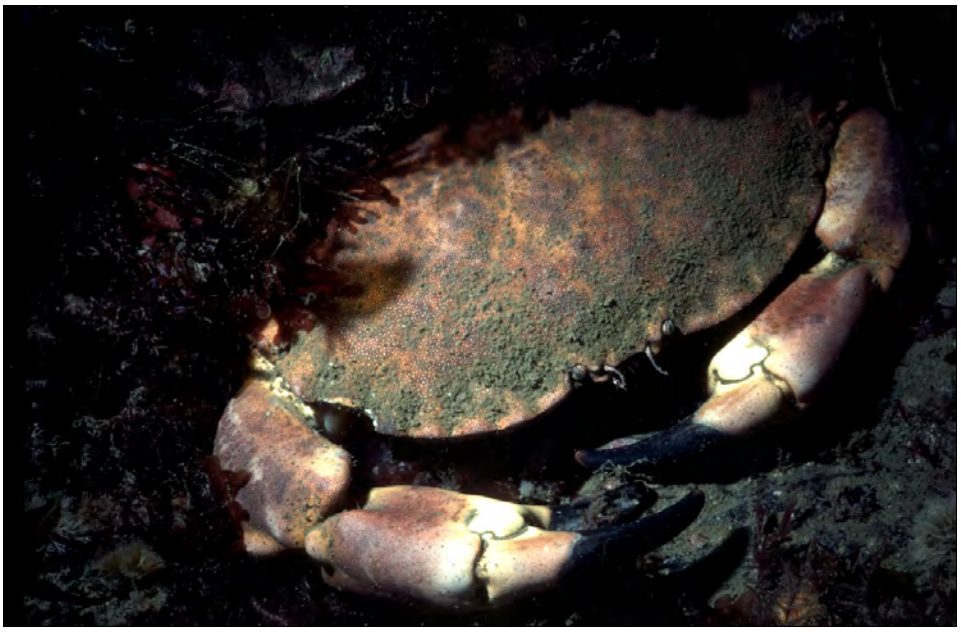

Plate 11: The edible crab, *Cancer pagurus*, 'safe' in the No-Take Zone on the east coast. *(Photo: David George)*

Plate 12: The blue-spot sea slug, *Greilada elegans*, which was formerly common around Lundy but which has not been seen since the mid-1980s. *(Photo: Keith Hiscock)*

Plate 13: Slope at the Knoll Pins showing the sea-fan, *Eunicella verrucosa*, and the red sea-fingers, *Alcyonium glomeratum*. *(Photo: Keith Hiscock)*

Plate 14: Close-up of *Alcyonium glomeratum* at the Knoll Pins. *(Photo: Keith Hiscock)*

Plate 15: The colonial yellow cluster anemone, *Parazoanthus axinellae*, on the Knoll Pins. *(Photo: David George)*

Plate 16: The crab, *Inachus phylangium*, in the snakelocks anemone, *Anemonia viridis*, on the Knoll Pins. *(Photo: Keith Hiscock)*

Plate 17: Scene at Gannets Rock showing the spider crab, *Maia squinado*, the sea-urchin, *Echinus esculentus*, ross, *Pentapora foliacea*, and the yellow boring sponge, *Cliona celata*. *(Photo: Keith Hiscock)*

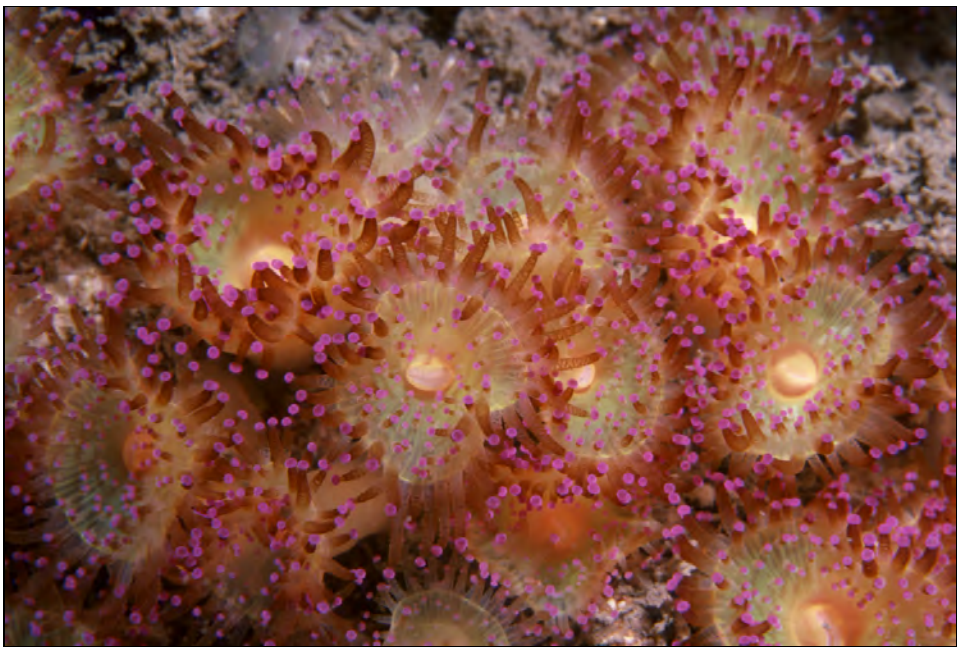

Plate 18: The jewel anemone, *Corynactis viridis*, on a vertical rock face at Gannets Rock. Asexual reproduction by the parent polyp produces clumps which are all of one colour. *(Photo: David George)*

Plate 19: Underwater life at the Hen and Chickens, north coast, showing beds of the hydroid, *Tubularia indivisa*, the boring sponge, *Cliona celata*, and jewel anemones, *Corynactis viridis*. *(Photo: Keith Hiscock)*

Plate 20: The lobster, *Homarus gammarus*, emerging from a rock fissure at Jenny's Cove, west coast. *(Photo: Keith Hiscock)*

Plate 21: The crawfish or spiny lobster, *Palinurus elephas*, showing its heavily armoured body and long antennae, emerging from under a boulder at The Rattles Anchorage, south coast. *(Photo: David George)*

Plate 22: An Atlantic grey seal, *Halichoerus grypus*, swimming in Gannets Bay, east coast. *(Photo: Miles Hoskin)*

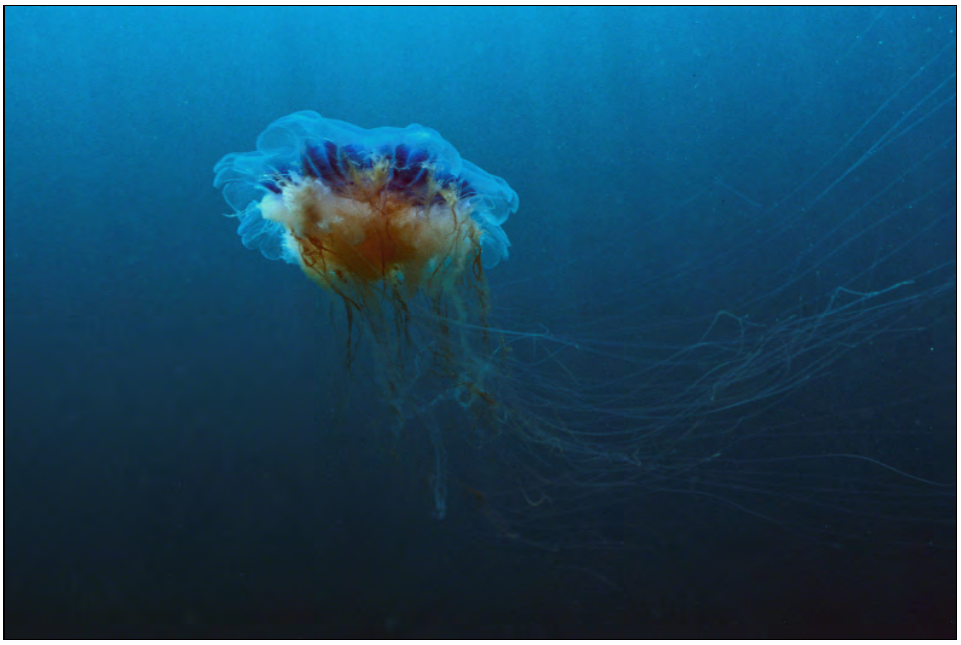

Plate 23: The jellyfish, *Cyanea lamarckii*, with its long stinging tentacles, in the Landing Bay. *(Photo: Keith Hiscock)*

Plate 24: The compass jellyfish, *Chrysaora hysoscella*, with its distinctive markings travelling along the east coast. *(Photo: David George)*

Plate 25: Divers monitoring scallop populations off the east coast. The densities and sizes of the scallop, *Pecten maximus*, that occur within the width of the pipe as it is taken along a set distance, are measured. This procedure is part of the monitoring of the No-Take Zone. *(Photo: Keith Hiscock)*