

ROCKY SHORES OF LUNDY, SIXTY YEARS ON: THE RECORDS OF L.A. HARVEY AND INITIAL COMPARISONS

by
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ABSTRACT

An account is given of the records of rocky shore species at Lundy maintained by Professor L.A. Harvey. Those records have now been archived. Following observations in 2006 and 2007 it is concluded that, broadly, the same conspicuous species can be found today as were found by Harvey in the period 1947-1950. However, there are apparently declines in abundance of some species and the addition of a few species not recorded by Harvey. One species, the top shell *Osilinus lineatus*, has increased in abundance most likely as a result of warming conditions. Two non-native species have been added to the Lundy intertidal biota since the late 1940s. Further work is needed especially on algae and inconspicuous animals.

Keywords: *Lundy, rocky shores, Harvey, species records*

INTRODUCTION

The first systematic studies of marine ecology at Lundy were undertaken by Professor L.A. Harvey and Mrs C.C. Harvey together with staff and students of the Department of Zoology at the University College of the South West of England (later to become the University of Exeter). The following is slightly paraphrased from a note from the late Ian Linn: 'He believed that much useful biological knowledge was best gained by studying organisms in their natural habitat; considered a rather bizarre idea at the time. He also had a great affection for small islands, with the inevitable result that he became a co-founder of the Lundy Field Society, and started taking student groups to the island to savour the wind, rain etc. so freely available there.' The work was undertaken between 1947 and 1950 (Anonymous 1949, Harvey 1951, Harvey 1952). Harvey kept records as lists of species, tables of quantitative data and as record cards. He also retained correspondence regarding the identification of species whose taxonomy he found difficult. Those records were originally lent to me by Harvey and photocopied for reference in the mid 1980s. On the death of Professor Harvey, the original records were passed to Professor Richard Warwick, then, in 2004, to me. The original records provide the most detailed account available of the results of the studies undertaken by Harvey and re-survey of the shores to the same level of detail suggested itself as a way of seeing how and whether the components of the rocky intertidal communities at Lundy are different up to sixty years after the original work.

THE NATURE AND FATE OF THE ORIGINAL RECORDS

Harvey researched the accessible shores especially around Rat Island, at Lametry Cove (Beach), Ladies Beach (which was then accessible from the land), Quarry Beach, Brazen Ward, north of Gannets Rock and at Jenny's Cove. Other locations were visited (see Harvey, 1951) but there are few records from those other shores. The locations referred to by Harvey and/or surveyed in later years by others are shown in Figure 1. In the Lundy Field Society Annual Report for 1950, Harvey wrote: 'even after three years of visiting these Lundy shores, it cannot be claimed that more than a proportion of the shore population is known; and the lists which are appended to this brief article do not pretend to be more than a start on the task of cataloguing the fauna and flora'. However, it seems that Leslie Harvey did not continue his studies to the extent that he had expected and all of the records of marine fauna and flora in the archive material are from 1947 to 1950.

The lists of species published in the Annual Report of the Lundy Field Society for 1950 (Harvey, 1951) are derived from entries summarized on record cards that have been used as a part of the comparison described in this paper. However, in many cases, the location at which a species was found is not recorded and, in almost all cases, their abundance is unrecorded. The algae were recorded by Mrs Clare Harvey and feature only as a list of taxa with none of the records (except studies of zonal heights) giving any other detail.

For most of the records, Harvey recorded only the month and the year. Inspection of Hydrographic Office tidal predictions for those months and years suggests that most of the observation would have been undertaken on moderately low spring tides (about 0.4 to 0.8 m above chart datum, corrected for Lundy).

Some of the records are counts of the number of individuals of each taxa recorded in *Corallina* turf in *Laminaria* holdfasts and on *Laminaria* stipes. However, I have been unable to find any record of the sampling units used and, up to now, unable to find anyone who recalls what they were. However, scientists working with Harvey in the Isles of Scilly (Professor Richard Warwick, Dr Tegwyn Harris) have guessed that the *Corallina* samples might have been collected in a 1lb (approx 300 ml capacity) honey jar and that one kelp holdfast may have been taken, although of which of the two likely species (*Laminaria digitata* or *Laminaria hyperborea*) is not known. The full date on which the samples were taken is recorded and they were taken on very good low tides (about 0.2 to 0.4m above chart datum). The samples from *Corallina* turf and *Laminaria* holdfasts were greatly different in their composition at the same location from sample date to sample date; most likely because of naturally large differences from one small sample to another rather than any real change.

There are accounts of exercises to measure the height at which different species occurred on the shore at locations around Rat Island and the Landing Beach in 1949.

All of the original records of marine species have been inspected and information from them entered to a Microsoft® Excel spreadsheet. From that spreadsheet, the records will be entered to the 'Marine Recorder' software and progressed to the UK National Biodiversity Network (NBN), where, once processed, they will be accessible via the NBN Website. The original records have been lodged in the UK Data Archive for Seabed Species and Habitats at the Marine Biological Association in Plymouth. The account that accompanies the archived material is Appendix 1 of this paper.

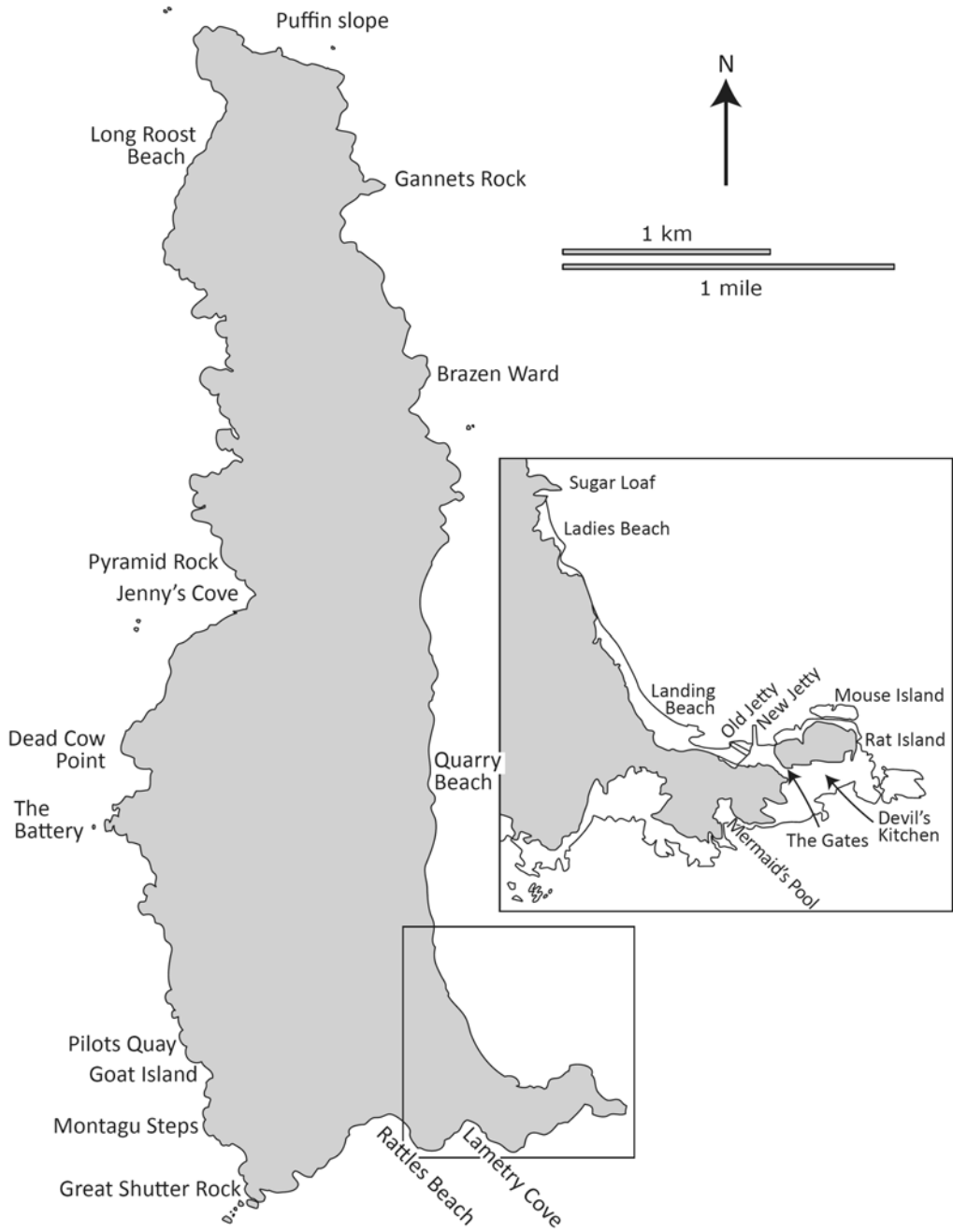


Figure 1: Map showing the shore locations surveyed by Harvey and recent workers

RECENT STUDIES

Rocky shores have continued to be studied by marine biologists but sporadically since the late 1940s. They were a part of an intensive study of algae undertaken in the late 1960s and early 1970s by David Irvine and colleagues (Irvine *et al.* 1972). In 1976 and 1977, Keith and Sue Hiscock undertook surveys of the abundance of species at four sites to describe the zonation of plants and animals (Hiscock & Hiscock, 1980). The studies of major groups of animals carried out in the 1970s and published in the LFS Annual Report included records from intertidal areas (the list of publications is given in Hiscock, 1997). With the establishment of Lundy as a Marine Nature Reserve, some rocky shore monitoring studies were initiated and carried on from 1984 to 1991 (when the Nature Conservancy Council was disbanded). They included studies of rockpool communities at The Gates/Devil's Kitchen, measurements of density and size of the scarlet and gold star coral *Balanophyllia regia* at Devil's Kitchen and north of Gannets Rock and a photographic survey along a marked transect inside one of the small caves in Rat Island. The measurements of density and size of *Balanophyllia regia* at Devils Kitchen, with the first records in 1971, have been continued on a fairly regular basis to the present day by various workers including Lundy wardens.

The main basis for the initial comparison described here has been surveys undertaken at the end of March and beginning of April 2006 at Ladies Beach and around Rat Island, supplemented with observations at Brazen Ward and Quarry Bay in mid May 2007. In 2006, the spring tides were very low (0.1m above chart datum on 30 March, corrected for Lundy).

COMPARISONS BETWEEN 1947-1950 AND RECENT YEARS

As this is a report of an initial study of differences between what Harvey recorded and what I have recorded or others have published, the notes below should be taken as targets to be checked again.

Animals

Balanophyllia regia (scarlet and gold star coral). Harvey (1949) notes from the northern shore of Rat Island or southern shore of the 'Landing Cove' where they were found again in 2006. He also notes them north of Gannets Rock where there has continued to be strong populations.

Bunodactis verrucosa (gem anemone) was described by Harvey as 'common' under stones at The Gates. Whilst still present there and elsewhere on the island, it would be more likely described as occasional in recent years.

Cereus pedunculatus (daisy anemone) was not recorded by Harvey but was present in 'large numbers' on shale rocks amongst dense algae between the old jetty and the Landing Beach on 12th August 1995 (own unpublished records) and again as 'Frequent' in a long rockpool there on 1st April 2006.

Ciliata mustela (five-bearded rockling) were recorded by Harvey as 'Rat Island & Ladies Beach = common among weeds, under rocks etc.'. Pullen (1978) records both five-bearded rockling and shore rockling from intertidal areas. Shore rockling (*Gaidropsaurus mediterraneus*), which have three 'beards', are frequently found today and are not listed by Harvey.

Coryne muscoides (hydroid) was recorded from all of the shores that Harvey described in detail but was not found in 2006 and 2007.

Elminius modestus is an Australasian barnacle that was first reported from British waters in the late 1940s. Harvey did not record it from Lundy and the first published record might be that in the study of zonation of rocky shore species undertaken in 1976 and 1977 (Hiscock & Hiscock, 1980) when it was common on the north shore of Rat Island, and also recorded at a shore east of Lametry Bay but not at Brazen Ward or Dead Cow Point.

Goniodoris nodosa (nudibranch). Harvey (1951) describes this sea slug as a characteristic species in the small caverns and arches on the north-west side of Rat Island. It has not been found in recent surveys although may have a seasonal occurrence.

Littorina littorea (common periwinkle) were recorded in very small numbers by Harvey. S.J. Hawkins (in Hawkins & Hiscock, 1983) notes that, in one week's fieldwork on Lundy, he found no *Littorina littorea*. *Littorina littorea* has been searched for without success at The Gates in recent years but two individuals were found at Quarry Beach in 2007.

Lucernaria campanulata and *Halicyclustus auricula*. These stalked jellyfish were recorded by Harvey in 1950 and by Harvey (1951) where they are described as occasional attached to fine red algae on the sides of reefs at The Gates. In Hiscock (1975), Charles Boyden is reported as having recorded *Halicyclustus auricula* as 'common' at The Gates (Boyden undertook work on Lundy in the early 1970s). Stalked jellyfish have not been recorded during monitoring studies of rockpools at Devils Kitchen commenced in 1984 or during seashore safaris undertaken by the island wardens in recent years (Nicola Saunders, personal communication).

Metridium senile (plumose anemone) occurs in the small cave on the north-west of Rat Island but is not listed by Harvey in any records.

Modiolus modiolus (horse mussel). Harvey (1951) describes this mussel as a characteristic species in the small caverns and arches on the north-west side of Rat Island. Although Hiscock & Hiscock (1980) record *Modiolus* sp. on the lowest part of their zonation transect on the north side of Rat Island, these were small individuals and could have been *Modiolus barbatus*. *Modiolus modiolus* has not been found in recent years, although *Mytilus edulis* is notably present in the small cave on the north-west of Rat Island.

Osilimus (= *Monodonta*) *lineata* (recorded by Harvey as *Osolimus lineatus*) is a topshell that was described as 'not uncommon' on the upper parts of the shore at Ladies Beach in Harvey (1951). The same description could have been applied in 2006. On the upper shore at The Gates, the abundance was about two per square metre in 2006. However, S.J. Hawkins (in Hawkins & Hiscock, 1983) notes that, in one week's fieldwork on Lundy, he saw two *Monodonta lineata*. *O. lineata* is a species that is benefiting from seawater and air warming and, although isolation of Lundy from mainland sources of larvae will probably keep the population low when compared to the mainland, abundance has obviously increased significantly in recent years.

Psammechinus miliaris (green sea urchin) is described as occurring 'more rarely' than other species at Ladies Beach and as 'occasionally' at The Gates, suggesting infrequent occurrence, which is what was observed in 2006.

Sabellaria alveolata (honeycomb worm). Whilst Harvey records this species as 'never in dense colonies, single tubes on & under stones most shores', it is unlikely to be *S. alveolata* but more likely *Sabellaria spinulosa* (ross worm), recorded from the south side of Rat Island in 2006.

Sagartiogeton undatus (anemone) was recorded by Harvey as 'dense groups on the roofs of caverns'. However, it is *Sagartia elegans* that now occurs abundantly in the small cave on the north-west of Rat Island which, although the species is listed by Harvey, it is not specifically noted in his description of those caverns and arches. *S. undatus* was present inside a metal boiler on the shore north of the old jetty during the 1970s (Hiscock, 1975).

The impression from what Harvey writes (for instance, the phrase 'innumerable crustacea occur amongst crevices', referring to Ladies Beach), is difficult to 'square' with observations in 2006 when, although most of the species of crustaceans that Harvey mentions were found, none were abundant. The ones that were present in large numbers in 2006, the two species of porcelain crabs, were not mentioned in the text of Harvey (1951), but are listed by him and as common under stones.

What might be described as 'fortuitous finds' by Harvey and which we might not be fortunate enough to see on a repeat survey include, for instance, the hermit crab *Pagurus prideaux* with its associated cloak anemone *Adamsia carcinopados* (Harvey records one from north of Rat Island), the two-spotted clingfish *Diplecogaster bimaculata* (two were recorded by Harvey on the north of Rat Island), Montagu's blenny *Coryphoblennius galerita* (one was recorded at Ladies Beach). 'Fortuitous finds' in 2006 that Harvey did not list were the blue encrusting sponge *Terpiops fugax* at south-west of Rat Island, the mollusc *Berthella plumula* at Ladies Beach, the squat lobster *Munida rugosa* in the channel between Rat and Mouse Island and frequent finds of juvenile seven-armed starfish *Luidea ciliaris*.

Harvey does not list *Patella depressa* (limpet) although Hawkins & Hiscock (1983) note that it was 'uncommon' with a maximum at some sites of 1-10% of the total limpet population being composed of *Patella depressa*.

The algae

The algae that Harvey refers to and lists would have been especially studied by Mrs Clare Harvey. In Harvey (1949) it is noted that 'Of Tregelles' list of algae (Trans. Devons. Ass. 69, 1937) some ninety species of his 131 have been recorded, in addition to about fifty which he did not'. Subsequent to the work undertaken by the Harvey's, a very thorough survey of marine algae, including sampling by diving, was undertaken by Dr D. J. Irvine (Irvine *et al.*, 1972). The number of species recorded in that study made Lundy the richest known location for algae in Britain, and that record is maintained today. In the current comparison, the algae have been given little proper attention and only the most conspicuous are mentioned here.

Alaria esculenta (dabberlocks) was noted by Harvey at Jenny's Cove as 'scattered plants'. The situation was the same in 1980 (Hiscock & Hiscock, 1981) and more recently in about 2004. Harvey records (as 'present') the species from the lowest shore at The Gates in the transect up the gully in 1948. *Alaria* was present in large amounts on the cobble-scoured rocks at low water in that gully in 2006. The species was also present

on the lower shore at Brazen Ward as scattered plants. The records are notable as *Alaria esculenta* is a northern species and may be adversely affected by global warming.

Asparagopsis armata (harpoon weed) (the gametophyte stage of *Falkenbergia rufulanosa* and a non-native species in Britain) was first recorded in Britain at Lundy (Harvey & Drew, 1949) as the '*Falkenbergia rufulanosa*' tetrasporic phase. *Asparagopsis armata* was recorded in the Landing Bay at Lundy in late September 1972 (Haisworth (*sic*), 1976) but not subsequently until 2001 (Reach, 2003). The species has become a much more regular occurrence each summer and is often abundant in pools in the Plymouth area since about 2002 and might, with seawater warming, become a more regular occurrence at Lundy. However, it was not seen during surveys in 2006 or in frequent 'inspections' of the rockpools in Devil's Kitchen in the past ten years. It has not been seen during seashore safaris conducted by the wardens (Nicola Saunders, personal communication).

Sargassum muticum (wireweed) is a non-native species that can visually dominate rock pools and shallow areas. It most likely first appeared at Lundy during 2000 (Reach, 2003). In April 2006, after clearance during 2005, six plants were found (on a 0.1m tide) and removed from the shore east of the new jetty and 24 from a rockpool between the old jetty and Landing Beach.

Although not an area specifically surveyed by Harvey, the shore between the old jetty and the Landing Beach must be expected to be substantially changed since the late 1940s because shale from the road building rock excavations has covered significant parts of the shore and made incursions into rockpools there.

FUTURE WORK

Future work must record, in sufficient detail for repeat studies in the future, the manner of sampling and to quantify records. Also, current studies of rocky shores are especially looking at how the abundance of species and the composition of communities might change as a result of seawater and air temperature warming. The chthamalid barnacles and the species of *Patella* require specialist skills to identify the different species and their abundance as they will change in proportionate occurrence with warming. With limited opportunities for quantitative studies, majoring on those climate change species would seem most useful. Searches should also be made for non-native species to note, if possible, their year of arrival and their abundance. The comparative studies that have been described here are of conspicuous species that can be readily identified on the shore or with minimal use of microscopes and keys. If the inconspicuous species including polychaete worms, amphipods and small prosobranch molluscs are to be compared, then samples of *Corallina officinalis*, of kelp holdfasts and of filamentous algae will need to be collected and significant taxonomic skill employed to identify the species.

ACKNOWLEDGEMENTS

Nicola Saunders and Charlie Kilgrove undertook surveys in 2006 with me. The late Ian Linn kindly briefed me on the character of the early studies on Lundy. My attempts to establish the units of collection in quantitative studies were advised by Richard Warwick and Tegwyn Harris, both of whom worked with Harvey in the Isles of Scilly. The Lundy Field Society provided a grant for the entry of Harvey's data to spreadsheets. Jayne Evans undertook the work with validation by Becky Seeley.

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* The title of this paper was misprinted and should have been: Hainsworth, S. Some interesting additions to the marine flora of Lundy.

** The correct name is *Asparagopsis armata*.

APPENDIX 1

Account of material lodged in the Data Archive for Seabed Species and Habitats at the Marine Biological Association.

Leslie Harvey intertidal field records - Lundy and Scilly

The notes, tabulated data and record cards were collected between 1947 and 1956 by Professor Leslie Harvey as a part of his field studies together with colleagues and students from the University College of South-West England (Exeter University) on Lundy. Some of the marine biological material is published in Anonymous (1949) and Harvey (1951, 1952).

The records of animals and algae from Lundy, including observation on abundance or quantitative information and notes, has been recorded on a spreadsheet and will be progressed to the UK National Biodiversity Network.

At the time of lodging the field records in the Data Archive for Seabed Species and Habitats at the Marine Biological Association (February 2008), Keith Hiscock is preparing an account of the records for the Journal of the Lundy Field Society.

There is some material in the file that is from the Isles of Scilly or is not marine biological but the material is to be kept together.

Maroon file

1. Typewritten list (two sheets) of mosses, liverworts and lichens (Rosalie Cox, published in LFS Report 13 (1959/60).
2. Typewritten list (three sheets) 'Lundy marine fauna. Total list, at August 1950'. The list is that published by Harvey (1951).
3. Typewritten list (two sides) 'Lundy marine algae, total list, at August 1950'. The list is that published in Harvey (1951).
4. A study in 1948 of critical heights for five furoid algal species at The Gates and some other locations in the Landing Bay. Surveys of shore heights against landmarks.
5. A survey along a 'paced' transect of presence-absence of 32 algal and 63 animal species up a gully at The Gates in 1948.
6. Quantitative lists of animal taxa collected from *Laminaria* holdfasts at The Gates, north side Gannets Rock, Ladies Beach, Lametry Cove, Goat Island, Quarry Beach, north shore of rat Island, Jenny's Cove, Brazen Ward. The table heads are month and year. No record was found of sampling methodology.
7. Quantitative lists of animal taxa collected from *Corallina* turf on the lower shore at The Gates, Ladies Beach, Lametry Cove, Jenny's Cove, Brazen Ward, north shore of Rat Island, Quarry Beach, Goat Island, and midshore at The Gates, north side Gannets Rock, Ladies Beach, Lametry Cove, Brazen Ward, Jenny's Cove, north shore of Rat Island, Quarry Beach, Goat Island,. The table heads are month and year. No record was found of sampling methodology.
8. Mark-recapture and colour variety studies of *Chorthippus bicolor* on west coast siding north of the Old Light and at Jenny's Cove in 1950.

9. Measurements of 26 rats (*Rattus rattus*) picked-up after poisoning in April 1949.
10. Lists of major taxa in Quarry Pool, 15 August 1948.
11. Lists of mosses from various locations, August 1950. (Published in Anonymous 1951.)
12. Quantitative lists of plants on burned ground at North End in each year except 1954, 1947 to 1956.
13. Incidence of albinism in *Calluna vulgaris*. North End 1948.
14. Description of the cliff flora of Lundy in April 1949 from The Battery, Goat Island, Jenny's Cove, Quarry Beach, the south coast.
15. Lists of marine fauna and flora collected from the Isles of Scilly: Porthlooe, Bar Point, Old Grimsby, Samson/Tresco, St Agnes. September 4-8, 1956.
16. Laboratory identifications and counts associated with the studies of kelp holdfasts and *Corallina* turf faunas at Lundy.
17. Correspondence with Shellenberg (Zoological Museum, Berlin) dated 1935 and 1946 with amphipod identifications. There is a typed translation of the handwritten letter in German but no indication of where samples were obtained from. However, the next item mentions the Shellenberg records are from Ladram Bay.
18. Letter from Harvey to Spooner dated 23 January 1950 with lists of amphipods and numbers of individuals of each species collected from holdfasts and *Corallina* turfs at Lundy.
19. A variety of letters from taxonomic experts identifying collected material from Lundy including ectoparasites from *Rattus rattus* and ants.
20. The handwritten tables of species from *Corallina* turfs and *Laminaria* stipes.
21. Lists of species collected with *Callithamnion* on 1/9/47 at Rat Island north, with *Plumularia* on 29/8/47 at Brazen Ward, with *Callithamnion* on 31/8/47 at SW Rat Island.
22. Species lists for Rat Island north on 1/9/47, Quarry Beach on 30/8/47, Rat Island SW shore of a few animals on seven algae, Rat Island SW shore on 31/8/47.
23. Plankton from off Tibbett's Point on 24/8/47.

Card index

The card index includes a transcription of information on each the species recorded in site lists. There are some annotations but little locational or quantitative information. Any general comments have been included on the spreadsheet.

Plates 1-12 on the following pages show some of the plants and animals discussed in this paper. All the photographs were taken by the author, Keith Hiscock.

Plate 1: Harvey collected *Corallina officinalis* turf to identify the associated small animal species. Devils Kitchen. Image width c. 6 cm.



Plate 2: Kelp holdfasts also provided a structurally complex habitat for Harvey to collect for associated worms, crustaceans and other small species. Ladies Beach. Image width c. 14 cm.

Plate 3: Wireweed, *Sargassum muticum*, is a recent arrival at Lundy, probably in 2000. The species is a non-native. Between the jetty and Landing Beach 1 April 2006. Image width c. 30 cm.





Plate 4: The Australasian barnacle *Elminius modestus* had just started to be recorded in Britain when Harvey undertook his work and arrived at Lundy sometime between then and the mid 1970s. This image is from Appledore. Image width c. 3 cm.

Plate 5: At the time that Harvey undertook his work, the two species of *Chthamalus* were not differentiated. *C. montagui* is illustrated here. The proportion of chthamalid species and the cold-water barnacle *Semibalanus balanoides* vary according to temperature. South Rat Island 1 April 2006. Image width c. 4 cm.



Plate 6: The scarlet and gold star coral *Balanophyllia regia* is a nationally scarce species first noted on Lundy by Charles Kingsley in the nineteenth century. It appears to be present in the same places as recorded by Harvey. Image width c. 4 cm.

Plate 7: The toothed topshell *Osilinus lineatus* was recorded by Harvey as 'not uncommon', was very rare in 1980 but, in 2006 and 2007, was common in Devils Kitchen. Image width c. 4 cm.



Plate 8: The common periwinkle *Littorina littorea* was noted by Harvey as present in very small numbers, none were found in 1980 and only two at Ladies Beach in 2007. Image width c. 5 cm.

Plate 9: Species not recorded by Harvey: a juvenile seven-armed starfish *Luideia ciliaris*. North Rat Island, 31 March 2006. Image width c. 8 cm.





Plate 10: Species not recorded by Harvey: the sea slug *Berthella plumula*. Ladies Beach, 30 March 2006. Image width c. 5 cm.

Plate 11: Species not recorded by Harvey: The squat lobster *Munida rugosa*. North Rat Island, 29 March 2006. Image width c. 12 cm.



Plate 12: Species not recorded by Harvey: the daisy anemone *Cereus pedunculatus* which was frequent in pools between the jetty and Landing Beach in 1995 and again in 2006 and 2007. Image width c. 5 cm.