Porcupine Newsletter

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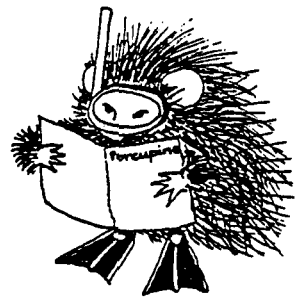

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PORCUPINE

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EDITORIAL

Readers', Members' and Porcupines' attention is drawn to the Future Meetings announcements to be found on p.202 (i.e. the back!). A circular with reply slip for the Spring 1994 Meeting in Edinburgh is enclosed with this Newsletter. Note also that feedback is requested for the Autumn meeting to the Channel Isles.

Discerning readers may have noticed that no Newsletter appeared in August of this year. The reason was entirely due to lack of copy - I apologize to the author who had sent copy by then, but Council considered that we would rather issue a reasonably-sized document than a thin leaflet.

The problem with reminding potential contributors that this is their Newsletter, and a vehicle for dissemination of their articles, is that the repetition can become boring and ignored. Yet this truism remains. The average number of Porcupines attending one of the Meetings is of the order of 20 to 30, i.e. some 10-15% of the Membership. The remaining majority are served wholly by the Newsletter, notably to disseminate the proceedings of meetings.

Assuming that the readership does appreciate the Newsletter and that readers know what they wish to see in it, then as a humble Editor I would have thought that the same membership would have known what to contribute, know the value of such contribution and be keen to do so. And do not worry about making my life "easier" (as if you would). The somewhat informal editorial style remains, within the constraints of meritorious science and correct "English". The Porcupine Newsletter remains the principal existing publication for the dissemination of marine records of a biogeographic and taxonomic nature; there is also the unrivalled ability to engender discussion, debate, interchange of information and ideas and controversy (why not?).

So I cordially invite Porcupines and all other readers to talk to each other via their Newsletter. For that is why it and my office exist.

I should express many thanks to Bill Farnham for giving (the only) positive feedback on my suggestion for an annual nomenclatural updating service (see previous editorial). Given a couple of other people to cover "animals", its inception cannot be too far away!

Finally I should remind all **Porcupines** not paying by some regular banking arrangement that annual subscriptions are due imminently.

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Report from the Peterborough Meeting

MARINE COMMUNITY OBSERVATION: A VIEW FROM AUSTRALIA AND NEW ZEALAND

by Dan Laffoley

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INTRODUCTION

Between October and December last year, I was lucky enough to be awarded a Churchill Travelling Fellowship to study the establishment, development and promotion of marine reserves in Australia and New Zealand. The purpose of such Fellowships is to enable people to gain experience overseas that they can put to use on returning home. The trip came at an opportune time, as English Nature had launched its campaign for a Living Coast and had just started developing a marine conservation strategy.

In this paper, the various techniques that have been developed overseas to manage marine areas and to protect marine communities of particular nature conservation importance are described and illustrated by particular examples.

GREAT BARRIER REEF

Background

The Barrier Reef is one marine area where large scale environmental management has really taken off, providing ideas which could be applied in Britain.

The Barrier Reef covers an area of over 300,000 km^2, stretches for over 2000 km from north to south, has over 2900 islands and comprises perhaps one of the most diverse ecosystems in the world. In addition it is very beautiful and attracts substantial numbers of tourists. It is under pressure from these tourists (up to 300,000 visit a single reef each year) and from the crown-of-thorns starfish phenomenon; in the 1960s and early 1970s it was under more serious threat of permanent damage from limestone mining and oil exploration.

Legislation

Public concern and a Royal Commission led to the passing of the Great Barrier Reef Marine Park Act in 1975. This strong piece of legislation provides for the establishment, control, care and development of the marine park. It prohibits oil exploration, mining, spear fishing by SCUBA and the taking of certain fish. Its protection covers the seabed, the reef and the air above it.

However, the Act also creates a problem. The Federal Government is empowered with control of everything below low water, but the State controls everything above that level. In practice, this is resolved by the Federal Government exercising overriding powers but involving the State Government in decision-making. By contrast, the day to day management is undertaken by the State's parks and wildlife service.

In addition to this Act, further protection is afforded through compulsory pilotage. Introduced by the International Maritime Organisation in 1991, it applies to all ships over 70 m and all oil and gas carriers.

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Management and Zoning

After legislation comes the question - how does one actively manage such a considerably large area? Under the legislation the Great Barrier Reef Marine Park Authority (GBRMPA) was established with the role of determining the management of the Reef. It is clearly impossible to police such an enormous area, with only one park ranger per each 13,000 km^2. Accordingly, management is directed at reef users rather than reef resources and active participation of the public in determining the management is considered the key to success.

The legislation also states that the GBRMPA should prepare zoning plans for the reef; the reef is, after all, a multiple use area. Zoning is used to ensure that people know what to do and what not to do, by the means of clear plans made available to the public. To develop the plans, the Reef has been divided into manageable sections, within each of which a zoning plan was developed. The whole reef had been zoned by 1988. Plans are developed by the Authority through public consultation, and each plan will be revised after about five years. Although the public consultation is expensive, it is considered well worthwhile as it involves and develops a level of understanding in the public of the Authority's work of reef management.

Each zoning plan includes the full range of activities which occur in that area, indicating both where people may undertake certain activities and areas of restriction.

The advantages of these zoning plans are that:

1) full detailed surveys of the area need not have been completed. As the zoning plans are revised, so the information on the extent of marine interests can be updated. For example, it was not until the 1970s and the advent of satellites that the number and location of all the islands and reefs in the area was determined.

2) they give the public an involvement in managing the reef and a clearly illustrated set of targets.

3) in one document they visually portray regulations and management in an attractive format.

In addition to the zoning plans, GBRMPA also produces user-guides for each section of the reef. These are very simple, as much of the information is already given on the zoning maps. In addition, certain specific customers, such as fishermen, are catered for by a video-magazine.

Such, briefly, is the state for the Great Barrier Reef, protected by a specific Act of Parliament, very much orientated towards self-policing through the involvement of the public and the production of clear and user-friendly explanatory material.

SOLITARY ISLANDS MARINE RESERVE

Background

South of the Great Barrier Reef, in New South Wales lies the recently designated Solitary Islands Marine Reserve, covering some 75 km of coastline from Grafton to Coffs Harbour.

This coastline is predominantly of rocky headlands and sandy bays interspersed with estuaries. The marine life of the area is outstanding, possessing, amongst other things, corals bathed in warmer waters originating from further north with, reputedly, the densest populations of clown fish and anemones in Australia.

The idea of creating a marine reserve along this stretch of coastline originated within the local community as long ago as 1969. Neither local divers nor other parts of the community were in favour

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of the plans at that time for having spear-fishing competitions in the area. The community asked the New South Wales Fisheries Department to protect the area. Concern increased and in 1979 an amendment to the Fisheries Act allowed for the creation of aquatic reserves rather than just the restriction of fishing by closures.

The area has a thriving tourist industry, there are commercial fisheries as well as sports fishing for marlin, and a generally high level of user activity. As a community proposal, to be successful the reserve clearly had to cater for the full range of different user groups. In practice some of the best ideas from the Great Barrier Reef Reserve were applied to this smaller area.

Management and Zoning

As with the Barrier Reef, involvement of the local communities was seen as essential to the success of the reserve. The proposal was developed into a user-friendly consultation document and widely circulated, together with a draft zoning scheme, worked out by the New South Wales Fisheries Department and sectors of the community to allow for zoned multiple use incorporating both user activities and conservation. At that time they used community service announcements on television and radio to obtain the views of over 120,000 people.

As a result of this, a revised zoning scheme was discussed and agreed by the local community, supported by a management plan and fisheries regulations. In May 1991, the reserve was finally gazetted under the Fisheries and Oyster Act of 1935. The Reserve is managed by the NSW Fisheries Department, the Liaison Officer and in association with the Water Police. As with the Barrier Reef, the community use the zoning plan, rather than the management plan or regulations, in order to understand how to use the area.

The end product of the zoning is similar to that of the Barrier Reef, but far simpler and easier to use. Again, the beauty of it is that it translates difficult legalistic language of fisheries regulations, with closure lines and latitudes and longitudes, into a very easy to use map and table. To assist further, NSW Agriculture and Fisheries has produced a user guide to explain the areas of restriction in more detail.

The Solitary Islands Reserve, as a community based reserve, takes a lot of the good points developed on the Barrier Reef and develops some of these ideas a stage further in applying them to a much smaller area. What the Fisheries Department now hope is that, armed with understanding, self-policing will develop.

THE MARINE RESERVE PROGRAMME IN NEW ZEALAND

Background

In New Zealand, the situation is different from Australia and more akin to what we have in Britain. In New Zealand marine reserves are administered by the Department of Conservation, a Government Department based in Wellington, and there exists a specific Act of Parliament - the Marine Reserves Act of 1971.

Many marine conservationists in Britain will have heard of the successes New Zealand has had, not the least the success of Leigh Marine Reserve and the advocacy of Bill Ballantine. Their success - they now have 7 statutory reserves - makes us wonder what we are doing wrong in Britain. Some say that the answer is that there are fewer people and fewer problems; fewer people yes, but isolated communities there, just as in Britain, are highly resistant to outside interference. And fewer problems?

Marine Reserves Act 1971

The New Zealand Marine Reserves Act is not a straightforward piece of legislation. It has many

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problems which make it difficult to apply. In New Zealand a marine reserve can only be established for scientific research. Usually they are "no-take" areas.

In particular, a marine reserve proposal cannot:

> interfere unduly with any estate or interest in land in or adjoining the proposed reserve;
>
> interfere unduly with any existing right of navigation;
>
> interfere unduly with commercial fishing;
>
> interfere unduly with or adversely affect any existing usage of the area for recreational purposes;
>
> be contrary to the public interest.

If that were not enough, marine reserves can be in conflict with traditional Maori rights now increasingly recognized under the Treaty of Waitangi. "Taiapure" are estuarine or littoral coastal areas which are traditionally important to Maori. Legislation allows for Maori and the local community to manage fisheries within Taiapure for their own use. In addition, individual transferrable quotas have been allocated for commercial species, which further complicates the situation as these are now being sold on to multinational companies.

Mechanisms to Achieve Success

There are probably three important elements to the success of New Zealand's reserves.

Firstly, they are very good at "selling the good points" of marine reserves. These include the increased densities of commercial species inside reserve boundaries which act as a source to repopulate depleted areas outside the reserve, the educational opportunities and the sheer enjoyment that the public can obtain from hand-feeding fish at, for example, the Leigh Marine Reserve.

Secondly, marine reserves are designated in the national interest. The Minister does not insist on 100% agreement before designation occurs. He does wish to satisfy himself, however, that full and proper consultation has been undertaken during the statutory phases and that the views of objectors have been taken into account in so far as is possible without compromising the nature of the reserve proposal. He does commission independent enquiries to this end. If satisfied, with concurrence of the Ministers for Transport and for Fisheries he will designate the reserve and turn down outstanding objections.

Thirdly, marine reserves can be proposed by bodies other than the Department of Conservation. Such bodies include Universities, land owners with sea-frontage and natural history societies with a stated interest in marine conservation. They undertake the non-statutory process which the Department then takes through the statutory process.

Such "freeing-up" of the process would initially seem to have dangers. For example, proposals may arise for silly areas or without community support. In reality this does not occur: proposals cost money, and there are guidelines set out by the Department in their external applicants guide.

As a result, a large number of proposals can be generated at once and the front-runners taken forward by the Department. The sheer number of proposals which they process at any one time (they currently have around 21) means that some proposals are ready or near to being taken forward by the Department through the formal process. This has resulted in proposals being generated by as diverse organisations as commercial fishermen's associations, schools and universities and natural history societies such as Forest and Bird.

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CONCLUSIONS

So what can we learn from this experience which will be of use to us in Britain? There are probably four areas to think about.

The first of these relates to Government. Overseas, marine reserves are designated in the national interest. They are treated in the same way as other activities or restrictions in the sea and are designated when broad approval has been reached. In relation to some restrictions, such as fisheries, broad approval may not be reached but the measures are introduced. So why do we treat marine reserves in Britain so differently from other users of the sea? There are, after all, many examples in other spheres where conclusive agreement is not reached, for example oil and gas exploration, aggregate extraction and restrictions on fishing. Perhaps, as a result of the EC Habitats and Species Directive, the day may arrive when marine sites and species are protected in the *international* interest.

Secondly, we need to consider the relationship between strong legislation and the winning of hearts and minds to develop an understanding and a degree of self policing. Much effort has been directed over recent years towards the form that possible new marine legislation should take. We certainly need strong legislation to protect the most precious areas, but there isn't much more that we can achieve with existing legislation. We do need to win hearts and minds and perhaps this is where we need to direct far more effort than we do at present.

Thirdly, what about "Joe Public"? How involved should they be in the process of site selection, designation and management? Involvement is ownership. If we are to consider anything it is to involve the public at all stages and to produce self-explanatory material, not just regulations and management plans which the public do not read.

Fourth and finally are ourselves - marine biologists. Clearly there is a role in all this for us. Quality research and survey are essential, but we must strive as never before to translate our findings into material that the public and the decision-makers within organizations can understand.

Marine reserves overseas are not as easy to designate or to manage as we might have been led to believe, but there are techniques they have developed which we can use to achieve eventual success and enhance the effectiveness of our current efforts to conserve marine communities. What we have to do now is to consider which are the most appropriate for Britain and the best ways of taking them forward.

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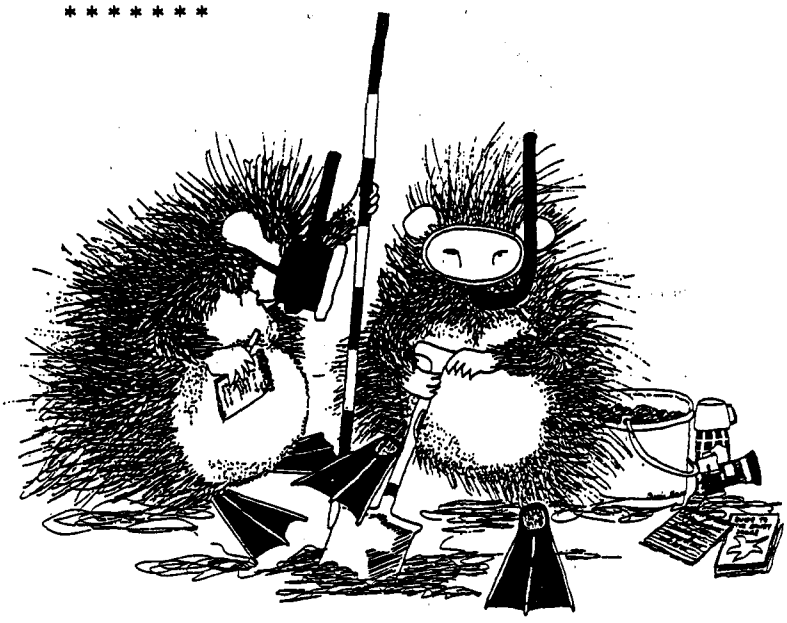

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Porcupine Reviews

Larvae and Evolution: Toward a New Zoology

by D. I. Williamson
Chapman & Hall, 1992, 223 pp., £35

Review by Frank Evans

A few years ago, at his own request, Porcupine Member Don Williamson came to my university department to address a meeting. He wanted to present a new theory concerning evolution and the natural classification of the animal kingdom. In his discourse he took pains to point out that his theory in no way conflicted with conventional Darwinism but that it contained an element which had hitherto been excluded from the accepted Darwinian theory.

Williamson is a carcinologist and plankton biologist and in particular an authority on crustacean larvae. The starting point of his investigation was the difficulty, known to carcinologists for over a century, of reconciling the adult stages of sponge crabs, which being dromiaceans are clearly brachyurans, with their zoea larvae, which are strongly anomuran in character. His previously passive acceptance of these differences was disturbed when he discovered that the larva of another decapod, the spider crab *Dorhynchus thompsoni*, first described by him in 1960 but only united with the adult in 1982, had an equally aberrant larva, bearing a powerful resemblance, not to other inachid larvae, but to certain dromiaceans.

In his address to us, Williamson attempted to make the case that genetic material from the one group had been captured by another, widely separated species and that the two life cycles had been merged into one. In a word, he believed we were observing a form of hybridisation between a brachyuran and an anomuran but with a developmental sequence.

It was a courageous performance in the face of the inevitable reaction of the learned academics in the hall. Confronted with a totally unfamiliar concept and with little attempt to digest it, our response was immediate and entirely predictable: "What a load of tosh".

When Williamson first began to proselytise for his theory, visiting, I believe, many establishments, it was upon these crustaceans that he dwelt. But as time went on he perceived powerful supporting evidence in other major groups, in particular in the echinoderms. In his book he bluntly calls adult echinoderms "radially symmetrical"; there is no shilly-shallying about secondary radial symmetry. But, of course, the larvae are bilaterally symmetrical. Moreover, it is from the larvae that evidence is adduced for the enterocoelous, deuterostomatous nature of the phylum. Williamson believes this is false and that early echinoderms were truly radially symmetrical, with direct development, and that echinoderm larvae are derived from a quite separate group. Moreover, basing his assertion on the growth of the little-known "Kirk's ophiuromorph" he boldly proposes that like this living species, all echinoderms were originally schizocoelous protostomes although, as observed, they are now universally thought of as enterocoelous deuterostomes, with developmental features shared by e.g. chordates.

This is a remarkable statement, paralleled by many similar ones in Williamson's book. By abandoning the taxonomic larval connections between widely separated groups of adults he detaches, for instance, the echinoderms from the hemichordates despite their auricularia and tornaria larvae, and the annelids from the molluscs despite their corresponding trochophores; moreover he provides new

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insights into the systematic position of chordates, sipunculans, echiurans, flatworms, nemertines, bryozoans and so on.

Williamson pays particular attention in his book to what he calls "cataclysmic metamorphosis". The curious case of the starfish *Luidia sarsi* is noted, where the bipinnaria sheds the subadult settlement form before continuing an apparently aimless existence in the plankton, in one recorded instance for a further three months. He also cites the formation of settlement stages of *Echinus esculentus* within the pluteus larva, where their development appears dependent on no more of the pluteus tissue than the coelomic sacs. Williamson believes that cases such as these, where the larval stage is little more than a nurse for the settlement stage, derive from hybridisation.

After a great deal of struggle people at last began to acknowledge that this senior and highly respected marine biologist deserved at least the right of attention. Yet scepticism remained, of the sort reminiscent of the trials of early continental drift proponents. Some while after his visit to Newcastle I was invited by Williamson to go to Port Erin as an external examiner for a higher degree. Kindly, he entertained me at home, where he spoke with enthusiasm of his theory. I learned that the interest kindled in his hypothesis had resulted in an invitation by a well-known British popular science journal to submit an account of his work for publication. This he did, but after a long interval the document, although it had been commissioned by the journal, was returned, together with a notification that they were unwilling to publish it and a cheque in offered recompense. His first scientific paper on the subject was similarly treated, being rejected by seven journals before acceptance at last.

Williamson shows refreshing vigour in his consideration of some more conventional aspects of invertebrate biology. Confronting the challenge to his hypothesis that convergent evolution may have produced similar larvae in such dissimilar groups as the polychaetes and molluscs he points out that within the plankton there seems to be nothing to choose from a survival viewpoint between, for instance, trochophores, nauplii and the "miniature wigwams, easels and shuttlecocks" of echinoderm plutei. Evolutionary pressure has not produced anything like uniformity there.

One of the most vital parts of Williamson's book is his setting forth of possible tests for his theory. The book has an introduction by Lynn Margulis in which she describes the author as functioning for too long alone in a nineteenth century mode in a laboratory with little in the way of modern technology. Nevertheless Williamson's proposals for confirming his theory demand a sophisticated technical approach; they include a structured review of certain fossil genital pores, the electrophoresis of enzymes, DNA annealing and immunotaxonomy, and experimental cross-fertilisation. This last, the one perhaps most congenial to Williamson himself he has attempted. The frontispiece of the book shows a photograph of a larva resulting from the fertilisation of the egg of an ascidian by the sperm of an echinoid. The result, a month-old ascidian larva, has the indisputable appearance of a pluteus. On seeing this a respected embryologist of my acquaintance said: "Yes, but if you stick a needle into a frog's egg you also get development." The answer is that what you get in that case is still only a frog.

We Porcupine members are concerned with records and recording. That means we have to take a view on classification. Invertebrate classification has always been a mess, with whole phyla hauled from time to time from one side of the phylogenetic tree to the other (ectoprocts v. endoprocts; the removal of the Pogonophora from the enterocoels to beside the annelids, etc., etc.). While we will not suffer the seismic disturbance that Williamson's theory, if true, will cause the neo-cladists and pheneticists, we should receive with an open mind the considered proposals of a careful and competent fellow-Porcupine. Many questions are answered as well as asked in his book. And watch for further developments. If you cannot afford the book, at least try to borrow a copy. It deserves very serious attention.

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NOTICES

The Joint Nature Conservation Committee announces the publication of:

D.R.Seaward, 1993, Additions and amendments to the *Distribution of the marine molluscs of north west Europe* (1990). *Joint Nature Conservation Committee Report*, No. 165. iv+22 pp softback, A4. ISSN 0963-8091.

The work of the Conchological Society's marine census was brought together and published in 1982 as the *Sea area atlas of the marine molluscs of Britain and Ireland* (Ed. D.R.Seaward) and updated and extended as the *Distribution of the marine molluscs of north west Europe* (Ed. D.R.Seaward), published by the Nature Conservancy Council in December 1990. This new JNCC report updates that volume to the Conchological Society's new marine census datum of 1 January 1991. In addition, the opportunity is taken to add earlier records notified or confirmed too late for inclusion in Seaward (1990).

Nomenclature is also updated, the North Sea/Baltic boundary is amended to take account of important surveys in that region, and errata are incorporated.

The *Additions and amendments* supplement has been published, in association with the Conchological Society of Great Britain and Ireland, as *Joint Nature Conservation Committee Report* No.165, and is available, free of charge, from:

> Colin McLeod, Publications Manager, Marine Conservation Branch, JNCC, Monkstone House, City Road, Peterborough PE1 1JY, UK.

The original *Distribution of marine molluscs of north-west Europe* (1990) is still available at its original price of £9.50 + £2.00 p&p. Conchological Society members can buy the book at the special member's price of £5.00 + p&p. Orders for the book (which comes complete with the *Additions and amendments* supplement) should be sent to the distributors of JNCC publications:

> Natural History Book Service Ltd, 2-3 Wills Road, Totnes, Devon TQ9 5XN, UK.
> Tel: 0803 865913 Fax: 0803 865280 GreenNet Mailbox: nhbs

A catalogue of JNCC publications is available from the Publications Branch, JNCC, Peterborough (see above).

THE ESTUARINE AND COASTAL SCIENCES ASSOCIATION (ECSA) is holding a number of workshops next year.

Estuarine Habitat Restoration workshop is to be held in Flanders, Belgium in June 1994, and will last for 3-4 days, including a one-day excursion to the Schelde Estuary. The workshop of formal lectures and extensive discussion time will review as many projects of estuarine restoration from as wide a geographical range as possible. The review will include actual and proposed projects and the creation of new intertidal area ("managed retreat") will form an important topic. Full details are yet to be published, but those interested should contact Dr Patrick Meire at the Institute of Nature Conservation, Kiewitdreef 5, B3500 Hasselt, Belgium (Tel. +32 11 210110; Fax. +32 11 242262).

ECSA Mollusc Workshop will be held at Heriot-Watt University, Edinburgh on 21-25 March 1994. This workshop will cover the identification of marine and estuarine molluscs, concentrating on preserved material (principally bivalves and gastropods). The usual course structure consists of short talks highlighting the key features of particular taxa followed by laboratory sessions examining

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material. A maximum of 30 participants can be accommodated so early registration is essential. Contact Myles O'Reilly, Clyde River Purification Board, Murray Road, East Kilbride, Glasgow G75 0LA.

Numerical Techniques in Estuarine and Coastal Biology workshop will be held at Heriot-Watt University, Edinburgh from 28-31 March 1994, concentrating on numerical and statistical techniques used to analyze community data. Interested attendees should contact Mike Elliot, Dept. of Applied Biology, University of Hull, Hull HU6 7RX (Tel. 0482 465503), outlining the topics which they would like discussed.

A RECORD OF THE TURTLE BARNACLE *CHELONOBIA TESTUDINARIA* (L.) IN THE IRISH SEA

by E.I.S. Rees & G.A. Walker

School of Ocean Sciences, University College of North Wales, Menai Bridge, Gwynedd LL59 5EY

A leather-back turtle, *Dermochelys coriacea*, was found stranded on Porth Neigwl ("Hell's Mouth") Beach towards the end of the Lleyn Peninsula, Gwynedd, North Wales (Latitude 52°49'N Longitude 04°34'W) on 15th July 1993. A number of barnacles were found on it, all of a single species which was subsequently identified as *Chelonobia testudinaria* (L.).

The turtle was reported to us by a visitor, Mr P. Wiggin, who had found it that morning, apparently freshly dead, with the remnants of lobster pot gear around it. It was a female with a carapace length of 1.9 m. When examined later the same day, the epizoic barnacles were noticed on it and some were removed for identification.

There were only about 15 barnacles as well as a few pits which might have represented sites from which barnacles had been rubbed off. All the barnacles were of a similar small size, indicating that their settlement had probably been simultaneous. The *C. testudinaria* specimens on this turtle were all about 5 to 6 mm in rostro-carinal diameter, although fully grown specimens would be expected to be 40 to 50 mm across. All the barnacles were on the softer areas of skin adjacent to the bases of the limbs of the turtle, most being on the flank of the right hind limb.

Not including offshore sightings and the several records of decayed pieces of carapace, this particular turtle was the fourth leather-back reported to have come ashore intact in North Wales since 1960, and to have been examined by persons likely to have noted the presence of barnacles. None were noted on the previous three, although *C. testudinaria* is regularly found on turtles in warm-temperate and tropical seas (Newman & Ross, 1976). Leather-back turtles now appear in British and Irish waters almost every year, but as this barnacle species was not included in the Marine Conservation Society's Species Directory (Howson, 1987), it may not be universal on the leather-back turtles that reach Northwest Europe.

References

Howson C.M., 1987. Directory of the British Marine Fauna and Flora. A coded checklist of the flora and fauna of the British Isles and its surrounding seas. Marine Conservation Society, Ross-on-Wye; 471pp.

Newman W.A. & Ross A., 1976. Revision of the balanomorph barnacles, including a catalogue of the species. *San Diego Society of Natural History Memoirs*, **9**; 1-108.

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THE *CORALLINA* RUN-OFFS OF BRIDGEWATER BAY

R N Bamber & P W Irving

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INTRODUCTION

The littoral rock-platform at Hinkley Point, Somerset, comprises alternate strata of limestone and mudstones or shales, dipping to seaward at a shallow angle of about 5°. Erosion has created a topography of scarp cliffs facing the land with gentle slopes to seaward (Fig.1). The resulting gullies above the scarps retain water as the tide drops, either as pools or streams running off to the east or west. In places there is a breach in the scarp, allowing the water to run off down the seaward slopes. Here, water is present across the rock surface at all states of the tide, forming an environment analogous to that of a rock pool, but of negligible depth.

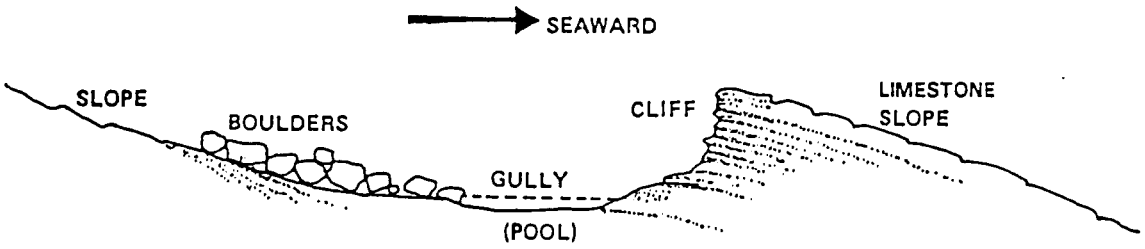

FIGURE 1 . REPRESENTATIVE DIAGRAMMATIC SECTION OF HINKLEY POINT ROCK FORESHORE

It is in run-offs such as these towards the lower shore that dense mats of the coralline red sea-weed *Corallina officinalis* L. have developed. At certain times of year *Ulva lactuca* grows within the *Corallina*, and there is often *Fucus serratus* growing down the edges of the run-off.

The small red calcareous alga *C. officinalis* is a common denizen of rock pools around the coasts of the British Isles, normally in the lower littoral. This species commonly supports a community of invertebrate animals, including small crustaceans, molluscs, echinoderms, polychaete worms and pycnogonids, of higher diversity than other littoral seaweeds (e.g. Bamber, 1988).

The shores in the Hinkley Point locality normally support a low density and diversity of plant and animal species, as is characteristic for the Severn Estuary littoral where there is extreme turbidity and sediment instability (e.g. Boyden & Little, 1973). Below mean low water mark algae are effectively absent owing to the inability of sufficient light to penetrate the highly turbid waters of the Severn. From surveys undertaken in 1984-1986, Bamber & Coughlan (1987) found that the restricted environment of these *Corallina* run-offs supported a diversity of animals representing the densest faunal community of the foreshores in this area.

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Accordingly, these run-offs were surveyed intensively at 6-weekly intervals over 12 months from September 1991, to determine their distribution and stability and their associated community and thereby to determine their conservation importance.

METHODS

In September 1991 the shore was surveyed on foot and *Corallina* run-offs were identified. Aerial surveys using vertical colour stereophotography from 1250' (resulting in a scale of 1:2500) were undertaken on the equinoctial low spring tides of 19 March (13.25 GMT) and 27 September (13.27 GMT) 1992. A map of the run-offs was compiled from these photographs and shore measurements.

Samples of the *Corallina* and its associated community were collected by scraping clear a transect, 1 m long and 75 mm wide (= 750 cm^2).

In September 1991 three transects were sampled horizontally across run-off 2. On subsequent visits, at approximately 6-weekly intervals coinciding with spring tides, one transect was collected from the central area of run-off 2, to study seasonality, and one from at least one other run-off to compare the communities between run-offs. The samples were collected from areas of 100% algal cover wherever possible. All transects were scraped "vertically" in the direction of the slope of the shore, this being considered to pose least threat to the integrity of the remaining run-off structure or community. Thus, by September 1992, ten samples had been collected from run-off 2 and all other run-offs had been sampled once, with the exception of numbers 3 and 7 where there was insufficient *Corallina* to fill one transect.

Measurements of air temperature, sea temperature, rock surface shade temperature and the temperature of the water flowing through the run-off are taken at each sampling, using an electronic thermistor probe. Salinity measurements were also taken in the run-offs on each visit, using a Reichert® refractometer.

RESULTS

The distribution of *Corallina* run-offs is shown in Figure 2. Twelve were identified along the shore from west of the power stations to Benhole Point, all on limestone, and ranging in width from < 1 m to 6 m and in length downshore from 4 m to 25 m. The main group (numbers 1 tp 9) is located along the same shore slope configuration. Run-off 10 is an interconnecting complex. A pair of run-offs, 11 and 12, are on the lower shore west of Benhole Point. In addition, a run-off is present on the low shore opposite the power station cooling-water intake tower (designated run-off 0). The run-offs are all at a similar shore level between +5.9 and +3.2 m CD (spring tidal range here being 12.2 m).

The total area of *Corallina* run-off habitat is 570 m^2 (0.06 ha), of a total foreshore area of some 120 ha. All the run-offs are situated where the flow of pool or gully water, normally retained by a scarp parallel to the shore, breaks through the scarp and proceeds across the lower limestone slope. The lateral edges of the *Corallina* sward are limited by the presence of flowing water, usually showing an abrupt transition to bare rock or fucoid cover (see below) without any discontinuity in the rock surface. The lower edge of all run-offs is well above LWST; topographically similar flow features higher on the shore than +6 m CD did not support *Corallina*.

The *Corallina* sward had a depth of 1 to 4 cm, with the tops of the plants uncovered by run-off water during low tide exposure. The density of *Corallina* per sample as indicated by wet weight is shown in Table 1. Run-off 2 supported the greatest weight, ranging approximately from 250 to 500 g per transect (= 3.3 to 6.7 $kg.m^{-2}$). Weight of *Corallina* showed a steady increase, implying growth, over the spring-summer months, declining after July. The original three horizontal transects scraped in September 1991 were observed on each visit for recolonization; in August 1992 new plants of

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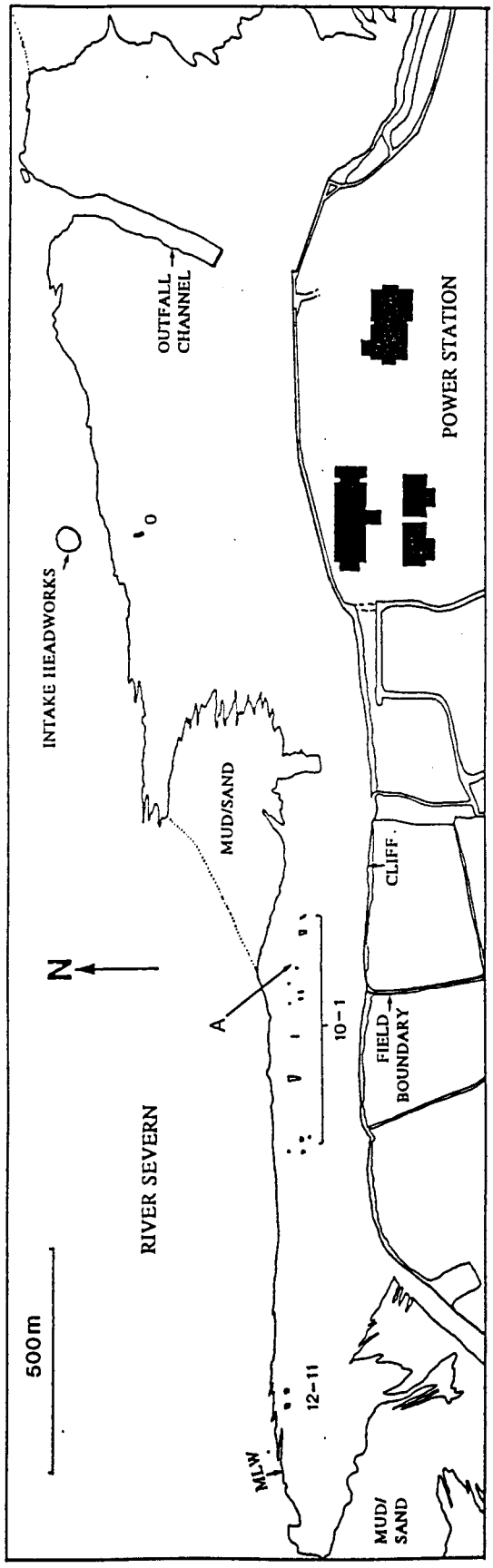

FIGURE 2. HINKLEY POINT FORESHORE, SHOWING RUN-OFFS 0 TO 12 AND LOCALITY FEATURES

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Corallina were clearly present in these scrapes and these had grown on in September. Up to that time only *Ectocarpus* sp. was apparent. Other than the effects of transect scraping, the swards remained uniform in both space and time, with no apparent natural impacts from, for example, grazing or abrasion.

TABLE 1. WET WEIGHT OF *CORALLINA* PER 750 cm^2.

DATE	Wet weight of *Corallina*, g	
	Run-off 2	Other run-offs*
SEP 1991	246.18	
OCT 1991	398.31	
NOV 1991	280.80	104.06 (6)
JAN 1992	256.76	171.25 (9)
FEB 1992	293.01	86.00 (1)
MAR 1992	322.93	290.73 (12)
MAY 1992	444.42	194.05 (4) 109.43 (8)
JULY 1992	490.68	212.45 (5) 278.21 (10)
AUG 1992	331.83	228.56 (0)
SEP 1992	350.44	224.16 (11)

* Numbers in parentheses are designated run-offnumbers; run-offs 3 and 7 were not sampled.

All run-offs monitored showed a similar pattern of water temperature. While the temperature within the run-offs and that of the adjacent rock responded to air temperature when uncovered by the low tide, that within the run-offs changed more slowly, remaining closer to sea-water temperature. Indeed, the water temperature in the run-offs represents an integration of the sea temperature, air temperature and rock-surface temperature (insofar as the latter indicates insolation or wind chill): Chi-squared comparisons between the run-off 2 temperatures ("observed") and the others ("expected") showed closest association with the mean of the other three "expected" temperatures (χ^2 = 1.113) than to any of them individually (χ^2 for sea temperature = 1.658, for rock surface = 2.043, and for air, not including the zero of January 1992, = 2.666).

Salinity was normal for this part of the estuary, ranging from 24‰ in January to 28‰ in late summer. Salinity within run-offs was identical to that of the adjacent estuary water.

The associated fauna of the run-offs is shown in Tables 2 and 3. A total of 38 animal species was identified. All but six of the species occurred in run-off 2. Sixteen of the species had not been recorded elsewhere on this foreshore (Bamber & Coughlan, 1987: Appendix 1; indicated on Table 3), two of which, the isopod *Jaera praehirsuta* and the pycnogonid *Anoplodactylus pygmaeus*, had not been

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recorded previously from the Severn Estuary (Boyden *et al.*, 1977); this is the more notable since *J. praehirsuta* was very common in all run-offs sampled other than 6 and 9. This isopod was also found to be common amongst littoral *Corallina officinalis* in southern Norway (Dommasnes, 1989). All the species are typical of structured ramifying algal habitats (cf. *Laminaria* holdfasts: e.g Bamber, 1991).

The only other dominant alga was the sea-lettuce, *Ulva lactuca*; it was not practical to quantify the presence of this weed, but its occurrence was seasonal, being most prevalent during late summer months. Of the recorded fauna, only the herbivorous isopod *Idotea granulosa* would exploit this alga (e.g. Bamber, 1988). Fucoid algae, predominantly *F. serratus*, were present along the lateral edges of some run-offs, notably run-offs 0, 2, 9 and 10. Both of these algal species are common on this rocky shore away from the run-offs.

The fauna at run-off 2 was dominated by the amphipod *Melita palmata* and the ophiuroid brittle-star *Amphipholis squamata*; the dominant annelid was *Platynereis dumerilii*; the isopods *Idotea granulosa* and *J. praehirsuta* were common, as were littorinid gastropods and juveniles of the shore crab, *Carcinus maenas*, and the common mussel, *Mytilus edulis*. While many species, notably the last two, occurred as newly settled juveniles only (and in their case develop little further judging by their paucity as adults elsewhere on this shore: cf Bamber & Coughlan, 1987), most were present as permanent populations including breeding adults. For example, the material of *Melita palmata*, *Jaera praehirsuta* and *Idotea granulosa* included brooding females.

Both *M. palmata* and *Amphipholis squamata* showed recruitment after the summer growth of the *Corallina*, with peak numbers in autumn. This accords with the known reproduction of the former: van Maren (1974) found brooding females in June and July in Brittany. Greatest recruitment of *Carcinus* juveniles was also at this time of year. In contrast, the small *J. praehirsuta* appeared to recruit to the samples in late winter, while densities of *Platynereis dumerilii* showed an erratic pattern over the year (perhaps indicating more than one recruitment).

The other run-offs showed a basically similar fauna with the notable exception of the brittle-star *Amphipholis squamata*: 28 occurred in run-off 9 in January (comparable to the 33 in run-off 2) but it was almost or entirely absent from the other run-offs. The recorded species which had not occurred in run-off 2 were present only as single individuals at one or two sites, other than 3 *Syllis armillaris* at run-off 0. Run-off 8, identified above as having the poorest *Corallina* cover of any sample, supported a very impoverished fauna of only 19 individuals (compared with 278 for run-off 2 in the same month). The number of species present per run-off (not including *A. squamata*), expressed as a proportion of the number for the same month at run-off 2, tended to increase in relation to the *Corallina* cover (again expressed as a proportion of that at run-off 2 for that month), although the relationship was not significant if run-off 8 was excluded.

Analysis of the species showed that *Platynereis dumerilii*, *Idotea granulosa* and *Jaera praehirsuta* are the most characteristic dominants of the stable community; *Mytilus edulis* spat, *Littorina obtusata* agg. (possibly including *L. mariae*), *Melita palmata* and *Amphipholis squamata* are the other important species, but these show marked variability in their seasonal presence or between run-offs (the last mentioned species being characteristic of run-off 2).

DISCUSSION

The current surveys have confirmed that the *Corallina* run-offs are a limited habitat resource on this shore. The essential rock configuration to produce this habitat is of rock scarps parallel to the shore, such that sufficient water to feed the run-offs is retained over the duration of low tide. No such rocky

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shores occur to the east of Hinkley Point, while those to the west do not form scarps parallel to the shore (the 1992 aerial surveys included the Bay to the west of Benhole Point, aerial photographs taken in 1986 covered the shores as far as Watchet).

The present run-offs have been found to be seasonally stable. With a continual supply of sea-water around the low tide, this environment is analogous to a rock-pool (the preferred habitat of *C. officinalis*) and maintains less variability in physical environmental characteristics (for example temperature) than the adjacent open rock face.

The associated fauna is both dense and diverse for the littoral zone of this area. The community is not transient, but is dominated by resident, breeding species, a large number of which are absent elsewhere along these shores. That a dominant member of this community, the isopod *Jaera praehirsuta*, has not previously been recorded for the Severn Estuary is remarkable. In addition to the presence of this species and of the pycnogonid *Anoplodactylus pygmaeus* being regionally novel, a number of the other species had only rarely been recorded before on the English coasts of the Severn according to Boyden *et al.* (1977). The syllid worm *Odontosyllis ctenostoma*, the sipunculid *Golfingia minuta*, the ragworm *Perinereis cultrifera* and the amphipods *Apherusa bispinosa* and *Ampelisca* sp. (the genus) all exist previously only as single records. Even the dominant polychaete *Platynereis dumerilii* has only previously been recorded as "occasional" plus two single records. Interestingly, the previous sparse records for the chiton *Acanthochitona crinitus* are also from *Corallina*.

These data therefore demonstrate that the run-offs with their associated community represent a rare environmental resource, at least in a regional context, and they confirm the conclusion of Bamber & Coughlan (1987) that this habitat represents the most important in conservation terms along this foreshore.

The Marine Nature Conservation Review (MNCR), originally of the Nature Conservancy Council, now Joint Nature Conservation Committee (JNCC), established 14 criteria for defining the conservation importance of marine sites (Mitchell, 1987). These may be applied to the *Corallina* run-offs at Hinkley.

1. **Naturalness**: rated by the MNCR as "desirable", the run-offs are natural features.

2. **Representativeness**: these run-offs are the only representatives of this habitat in the Severn Estuary.

3. **Rarity**: not only is this habitat resource rare on at least a regional scale (information is not available from wider afield), it supports regionally rare species.

4. **Diversity**: the community is the most diverse of those found littorally in the Severn Estuary.

5. **Fragility**: these habitats would be completely lost if their essential water-supply were removed.

6. **Size:** not necessarily relevant here, although the larger run-offs tend to support a denser community, making them of greater conservation merit.

7. **Situation**: a category relating to the close association of different important habitats; this foreshore is within the Bridgwater Bay Nature Reserve.

8. **Recorded History**: the existence of historical information on a habitat increases its merit, as is the case of the present report and the cited previous studies at Hinkley.

9. **Research and education potential**: in this case, as has been shown, the existence of a number of accessible run-offs would allow continuing research on their status and communities.

10. **Restoration potential**: the criteria for the existence of the run-offs which have been determined

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herein would allow the potential restoration or recreation of such habitats at this site (see below).

11. **Intrinsic appeal**: a somewhat subjective criterion, but the run-offs do stand out on intrinsic or aesthetic merit owing to their situation within an otherwise comparatively poor littoral zone (other than geologically).

12. **Vulnerability**: the only potential threat to this habitat would be from local industrial development, including the possibility of a further power generation station or the proposed Severn Barrage.

13. **Urgency**: the present analysis is opportune insofar as it comes at a time when potential developments such as cited under 12 above are under consideration.

14. **Feasibility**: the protection of this habitat at Hinkley is totally feasible now that its distribution, fragility and vulnerability are understood.

Under all of these criteria, the *Corallina* run-offs meet the requirements for the MNCR definition of conservation importance.

ACKNOWLEDGEMENTS

We are grateful to Sonia Batten for the sorting of the faunal samples and to Cartographical Services Ltd for the aerial photography. This paper is published by permission of Nuclear Electric plc.

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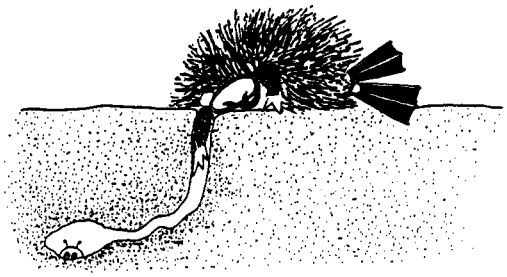

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TABLE 2. FAUNA OF *CORALLINA* RUN-OFF 2 (NUMBERS PER 750 cm^2).

SPECIES DATE	09.9.91	09.10.91	22.11.91	22.1.92	19.2.92	18.3.92	17.5.92	02.7.92	13.8.92	27.9.92
ANTHOZOA indet	2		3			7	1			2
NEMERTEANS indet			3		4	3	5	11	8	
Golfingia cf minuta			1				1			
Platynereis dumerilli	60	32	67	32	15	38	60	18	49	21
Nereis pelagica	1	2								
Perinereis cultrifera	6							1		
Odontosyllis ctenostoma										1
Syllis armillaris										
Analrides maculata									1	
Sabellaria alveolata					1	1		1	1	
Lanice conchilega		1								
Scolelepis tridentata						1		1		
Lepidochitona cinereus						1	1	1		
Acanthochitona crinitus			1							
Patella vulgata										
Mytilus edulis	3	14	16	7	9	19	21			6
Musculus discors										1
Macoma balthica										
Hydrobia ulvae		1				1	5	1		
Littorina obtusata agg	6	32	13	15	12	22	13	13	5	109
Littorina littorea		2		1			1	2		
Littorina saxatilis agg		4		4	1		10		6	
Onoba semicostata	1		4	1		1	2		2	
Gibbula umbilicalis				1		2	2			
Nucella lapillus										
Cyathura carinata										
Idotea granulosa	1	19	12	17	20	17	5	2	9	14
Jaera praehirsuta		19	7	14	56	28	54	1	2	65
Sphaeroma monodi	1									
Ampelisca sp. indet				1						
Melita palmata	184	540	212	116	80	67	58	149	232	204
Gammarus locusta	10	8			2		2	2	35	9
Gammarellus homari				1						
Calliopius laeviusculus										
Apherusa bispinosa										1
Carcinus maenas	41	18	7	2		3	3	49	33	10
Anoplodactylus pygmaeus	1					1				
Amphipholis squamata	412	77	19	33	24	10	34	70	207	25

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TABLE 3. FAUNA OF *CORALLINA* RUN-OFFS OTHER THAN 2 (NUMBERS PER 750 cm²).

SPECIES / RUN-OFF: / DATE:	0 13.8.92	1 19.2.92	4 17.5.92	5 02.7.92	6 21.11.91	8 17.5.92	9 22.1.92	10 02.7.92	11 27.9.92	12 18.3.92
ANTHOZOA indet	3	2	6	16						4
NEMERTEANS indet				2		2		3		
Golfingia cf minuta *										
Platynereis dumerilii	5	27	69	22	20	5	10	36	13	8
Nereis pelagica										
Perinereis cultrifera *										
Odontosyllis ctenostoma *										
Syllis armillaris *	3									
Anaitides maculata *										
Sabellaria alveolata	9						1			25
Lanice conchilega *										
Scolelepis tridentata	1	1								
Lepidochitona cinereus		3			1					1
Acanthochitona crinitus *										
Patella vulgata					1		1			
Mytilus edulis		6	9	2	8	4	2	2		16
Musculus discors *										1
Macoma balthica										1
Hydrobia ulvae				2	1					
Littorina obtusata agg		5	2		25		38	2	1	5
Littorina littorea		3			1					
Littorina saxatilis agg		3								
Onoba semicostata *		1								
Gibbula umbilicalis		1				1				
Nucella lapillus			1							
Cyathura carinata						1				
Idotea granulosa	40	21	31	6	36	4	1	27	148	1
Jaera praehirsuta *	29	2	29	6		1		25	33	36
Sphaeroma monodi									1	
Ampelisca sp. indet *										
Melita palmata	102	16	18	46	74		48	2	22	35
Gammarus locusta *	15		1	10				47	61	
Gammarellus homari *										2
Calliopius laeviusculus									1	
Apherusa bispinosa *									4	
Carcinus maenas	1		3	25				29	6	1
Anoplodactylus pygmaeus *										
Amphipholis squamata *		1		3		1	28	2	2	

* - Species not recorded elsewhere along the Hinkley foreshore

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NOTICE OF ANNUAL GENERAL MEETING

The 17th Annual General Meeting of **PORCUPINE** will be held at the Royal Museum of Scotland, Edinburgh, on Sunday 6th March 1994 at 9.30 a.m.

The Agenda will include:

1. Minutes of the 15th Annual General Meeting (published in PORCUPINE NEWSLETTER, Vol.5 No.7)
2. The Hon. Secretary's Report
3. The Hon. Treasurer's Report
4. The Hon. Editor's Report
5. Election of Office Bearers and Council

In connection with Item 5, attention is drawn to the relevant Rules of Procedure:

(2) The maximum and minimum numbers of Members on the Council shall be left open.

(4) The Office-Bearers retire annually and are normally available for immediate re-election.

(5) Council members shall at present serve for three years, at least two retiring each year, who are not normally available for immediate re-election.

(6) Voting shall take place at the Annual General Meeting and shall be restricted to Members present.

(7) Names of persons seeking election to the Council (as chosen by the Council) will appear in a notice prior to the AGM together with an intimation that proposals from ordinary Members of additional candidates are welcome. Candidates must give their assent in person or in writing before voting takes place.

The present Office-Bearers are as follows:

Hon. Secretary	Ian Killeen
Hon. Treasurer	Jon Moore
Hon. Editor	Roger Bamber

The present Council Members are as follows:

Dave Connor	Willie Fowler	Ivor Rees
Mark Davis	Robin Harvey	Ralph Robson
Iain Dixon	Christine Howson	Dennis Seaward
Frank Evans	Antony Jensen	Martin Sheader
Bill Farnham	Jan Light	Shelagh Smith
		Fred Woodward

Proposals from the floor are welcome.

6. Election of auditors. The present auditor is Nick Light.
7. Future Meetings
8. Any Other Business.

If Members have a point which they wish to have discussed, particularly if they are unable to attend the AGM, please will they contact the Hon. Secretary Ian Killeen.

Porcupine Newsletter, 5 (8), 1993.

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EXAMINING THE IMPORTANCE OF *NUCELLA LAPILLUS* IN SHORE COMMUNITIES FOLLOWING POLLUTION EFFECTS

S.V. Proud & S.J. Hawkins

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The effects of tributyl tin (TBT) on the common dogwhelk (*Nucella lapillus*) are now well documented. Concentrations of TBT as low as 0.5 ng tin/l are known to induce the formation of male sexual characteristics in the female, a phenomenon termed "imposex". At levels of 4 ng/l the females become effectively sterile after the vasa deferentia occlude the vulva. This leads to a build up of egg capsules in the capsule gland which are unable to be released; the capsule gland eventually bursts and the female dies. *N. lapillus* has no planktonic larval stage; instead it lays its egg capsules directly on to the shore. Consequently the effect of TBT contamination has been to reduce the numbers of juveniles and females in affected populations, leading eventually to a localized extinction of dogwhelks from some shores.

Most of the work on the effects of TBT on *Nucella lapillus* has been done at cellular, individual and population levels, but the question of the significance of this pollutant on rocky shore communities has not been examined.

On moderately exposed rocky shores in Britain, a natural cycle of barnacle / fucoid domination exists which is mediated by patellid limpets. High barnacle densities reduce the foraging efficiency of *Patella*, allowing vulnerable algal sporelings to "escape" grazing and to form algal clumps. These create a valuable resource as food and shelter for many intertidal organisms. Manipulative field experiments have been used to examine the role of dogwhelks, an important predator of barnacles, in this cycle at sites on Port St Mary Ledges on the Isle of Man.

The absence of dogwhelks was found to be effectively increasing the algal cover in areas on this shore in two ways. Firstly, following the continual removal of dogwhelks from clumps of *Fucus vesiculosus* between January and September 1993, those clumps with no dogwhelks were found to survive longer and grow to a larger size than those where dogwhelks had been allowed to shelter and feed. This was caused by the dogwhelks eating the barnacles to which the *Fucus* was attached, reducing the security of attachment of the plant to the substratum and effectively undermining the foundations of the clump.

Secondly, the removal of dogwhelks from vertical areas over an 18 month period produced dense patches of barnacles over which the limpets were unable to effectively graze. Consequently, *Fucus* 'escapes' occurred. In comparison, areas where dogwhelks had been allowed to feed were sparsely covered with barnacles and had no *Fucus* escapes.

These experiments show that dogwhelks mediate the effect of *Patella* on a moderately exposed shore on the Isle of Man. This shows the possible 'knock-on' effects of tributyl tin contamination on rocky shore communities.

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PROBLEMS OF SEWAGE DISPOSAL IN TROPICAL PLACES

Richard Hartnoll

Port Erin Marine Laboratory, Isle of Man

The environmental considerations regarding sewage treatment and disposal in two contrasting tropical situations were reviewed.

The first case was the capital of Mauritius, Port Louis. Mauritius is a small volcanic island in the Indian Ocean, surrounded by clear, deep water and a narrow fringing reef. Port Louis has a reasonably comprehensive sewerage system, from which the effluent is discharged after only coarse screening. The four outfalls are short and open at a depth of less than 10 m at the reef crest or on the shoreline. The effluent is often blown into the lagoon and onto the shore by onshore winds. The environmental results are poor water quality, public health risks and serious degradation of the fringing reef.

It was concluded that land-based treatment using the existing outfalls was not a sound option, as eutrophication of the lagoon would continue, and full treatment would require major technological input for efficient operation. Limited treatment with a long sea outfall was considered as a superior alternative.

The second example was Cirebon on the north coast of Java. Here the coastline and sediments are muddy and the offshore areas are very shallow, reaching a depth of 10 m only about 5 km offshore. Cirebon has a sewerage system for only 10% of the population, the effluent being discharged untreated via a canal within the city boundary. The rest of the sewage reaches the sea via a series of heavily polluted rivers and canals. The inshore waters are polluted, with high levels of faecal coliforms, ammonia and BOD. However, they are not seriously deoxygenated and support a productive ecosystem and a substantial fishery.

Nevertheless, there is an obvious health risk and an aesthetic problem. In this situation a long sea outfall was not an option. Eutrophication of this type of inshore environment is not a major problem, so treatment and inshore release was considered appropriate. The preferred treatment option was waste stabilization ponds, which operate well in the tropics and require limited maintenance for efficient operation. It is hoped to install a novel prototype marine-based pond system.

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Press Release

WWF UK (World Wide Fund for Nature) launched a major campaign to save our Endangered Species on 29 September 1993.

"At the start of its new campaign, WWF is calling on the Government to put into place effective legislation that will genuinely protect the UK's wildlife sites. At the moment, existing legislation is woefully inadequate and up to 300 precious wildlife sites are damaged or destroyed every year by far ranging threats, including road building and pollution.

"The most important thing for now is for the public to motivate the Government" said Carol Hatton, WWF's Planning Officer. "The Government will soon be planning how it intends to implement the

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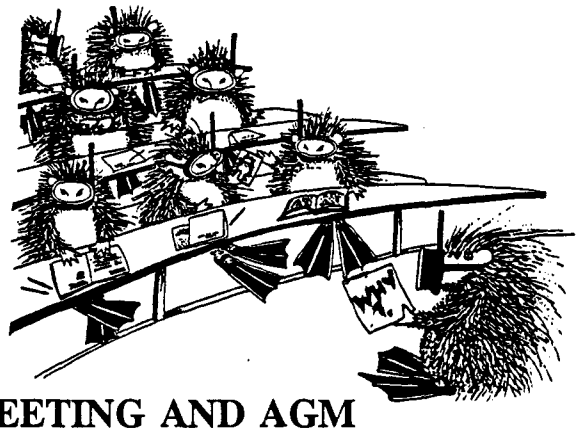
European Commission's Habitats Directive. WWF views the Directive as the most significant initiative ever drawn up for the protection of UK habitats and species, but is worried that the Government will simply tinker with the existing legislation. Unless the UK public voices its concern over these endangered spaces, many of them will be lost within 20 years."

WWF plan to lobby the Government itself. The WWF report *Time for Action* sets out the measures it wants the Government to put in place and at the same time the conservation organisation is collecting signatures for a petition to be presented to the Environment Minister John Gummer. The organisation is calling on members of the public to write to the Department of the Environment as well as their local MPs. Copies of the petition and further information are available from the WWF Hotline Number 0483 426236.



FUTURE MEETINGS

PORCUPINE SPRING 1994 MEETING AND AGM

The Spring 1994 Meeting and 17th Annual General Meeting will be held at the Royal Museum of Scotland, Chambers Street, Edinburgh on 5 and 6 March 1994. The Saturday involves presentations on the environmental effects of the Braer oil spill in Shetland, a year on. The Sunday theme is marine environmental monitoring, and contributions for the latter would be gratefully received.

A First Circular regarding this meeting, with response slip, and giving fuller details, is enclosed with this Newsletter (*q.v.*).

Members are reminded of the AGM announcement (p.199 above) and that they should submit nominations and Agenda items to the Hon.Sec. Ian Killeen.

PORCUPINE AUTUMN 1994 MEETING - ADVANCE NOTICE

We are hoping to hold the Autumn 1994 meeting in the Channel Islands. This would be based on Guernsey and would take place over the period of good spring tides, 5 to 11 September. Fieldwork would be a major part of the trip, with excursions to Herm & Sark, and it may be possible to organize some boat work. There would be an indoor programme at the weekend on the theme of "Marine Sampling Techniques" covering all aspects of onshore and offshore sampling, planning, surveying, etc. There would be all the usual jollity, dinners and so on!

In view of the time of year, distance and cost of going to Guernsey we need to get an indication of Member's interest in this meeting. If there is insufficient interest then an alternative will be planned. If you would like to attend all or part of the meeting please drop a postcard to, or 'phone, Ian Killeen, 163 High Road West, Felixstowe, Suffolk IP11 9BD (Tel: 0394 274618) by the end of February. Indicate what you are particularly keen to do and whether you would like to give a presentation.