Porcupine Newsletter

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CONTENTS

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NEWSLETTER. This issue features an essay on grey seals written by Sheenah Crane as an undergraduate student. We thought it worthy of publication.

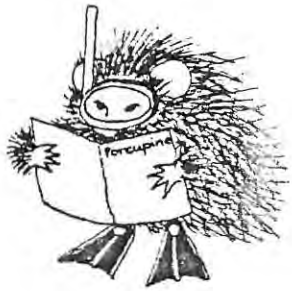
THE TYPE LOCALITY OF **THALASSIOHYSTRIX SCUBA.** There can be no doubt that this is the lost island of St. Brendan found by the Irish saint on his famous seven-year voyage into the western Atlantic in the sixth century. He records the island's flora and fauna as consisting of apples, blossoms and lovely women.

> On the ocean that hollows the rocks where ye dwell
> A shadowy land has appeared, as they tell;
> Men thought it a region of sunshine and rest
> And they called it Hy-Brasil, the Isle of the Blest.

Its former location on the Porcupine Bank is revealed on p. 43.

FUTURE MEETING AND AGM. The next "Porcupine" meeting will be at the Manchester Museum, Manchester University, on Saturday 23 and Sunday 24 February 1985. The 1985 AGM will take place there on 24 February. See Notice 1, p.31 and Agenda, p.35 of this issue.

Frank Evans, Editor,
Dove Marine Laboratory, Cullercoats, North Shields NE30 4PZ,
England.



A REVIEW OF THE REPRODUCTIVE BIOLOGY AND DEMOGRAPHY OF HALICHOERUS GRYPUS, THE GREY SEAL.

Sheenagh Crane
Logwood Hill, Logwood Road, Ballyclare, Co. Antrim.

The grey seal occurs in temperate and subarctic waters on both sides of the North Atlantic; principally around the Gulf of St. Lawrence, around Iceland, off the British and Norwegian coasts and in the Baltic. There are three distinct populations, centred on the Baltic, the eastern North Atlantic and the western North Atlantic (Davies, 1957).

Grey seals usually produce their pups in the colder months of the year; no other phocid shows such a wide range in the timing of the breeding season. Round the coast of Britain the pupping season is between the beginning of September and the middle of December, but the pupping time in the various breeding localities is not exactly the same. The seals on Orkney pup between late September and the end of October, with the greatest numbers in the last half of October (Vaughan, 1975). Births occur slightly earlier in the SW of England (Summers, 1974; Anderson, 1977) and markedly later on the Farne Islands, where pupping occupies from the fourth week of October to the third week of December (Coulson & Hickling, 1964) with most births occurring in the first fortnight in November. The very small breeding colony at Scroby Sands off the Norfolk coast produces a dozen or so pups, usually in the last days of December or early in January. It is tempting to view the situation in the British Isles as representing a cline, with the earliest breeding in the Scilly Isles and the latest at Scroby Sands. If there is such a cline then there is a very marked discontinuity between the stocks at Orkney and the Farne Islands (Bonner, 1981).

The winter pupping season is continued in Canada, where pups are born between the end of December and the beginning of February, with the peak in mid-January (Mansfield, 1966b). The Baltic grey seals, in spite of being geographically closer to the British colonies, pup in early spring, between the last week of February and the first two weeks of March (Curry-Lindahl, 1970). Although most British pups are born in the autumn some spring pups (March- May) have been recorded from South Wales. These are believed to be the first offspring of newly mature cows (Backhouse & Hewer, 1957)

The dates of the first and last births vary considerably, even at a single colony. Coulson & Hickling (1964) suggest employing the standard deviation around the mean date of pupping to indicate the spread of the season, thus avoiding errors inherent in using the time interval between first and last births,

as well as in comparison of large and small groups. In spite of differences in timing , the main events of the reproductive cycle take place, as far as is known, at the same times relative to each other.

The grey seal is polygamous (though the number of cows controlled by a single bull varies widely), and this implies a greater degree of competition between the males than in monogamous species. However, agonistic behaviour and territoriality are not as highly developed as in the other highly social land- breeding phocids such as the elephant seals.

Hewer (1960) has described various types of breeding habitat in the eastern Atlantic. The topography of the breeding site influences the behaviour of seals. There is sometimes a pre-breeding assembly near the breeding grounds (Hewer, 1957; Hickling, 1962; Cameron, 1970). The season starts with the birth of the first pups; shortly after this the bulls arrive and take up position. Birth takes place soon after a cow's arrival on shore. A cow may spend time looking for a suitable place to pup and perhaps hauling out several times to do so. In crowded colonies, where the cows often pup away from the sea they may choose a site near a stream or freshwater pool. Birth is a steady process in all seals. Immediately after the expulsion of the pup the cow turns and sniffs at it. Smelling continues at intervals and the cow also vocalises to the pup; in this way a bond is formed (Fogden, 1971). The cow may defend the placenta, which is delivered 5-40 minutes after birth, from gulls (Burton et al., 1975).

At birth the pup is about 70cms in nose to tail length and weighs about 14kg. It is covered in long, creamy-white silky hair, which is usually shed at the end of the animal's third week, the moult being complete in four to five days. Cows may remain ashore with pups throughout lactation or may return to the sea between feeds, depending on ease of access to and from the sea. Fogden (1971) has described mother-young behaviour at crowded and uncrowded beaches. Disturbance is often caused by human activity (boats, hunters, observers) but may equally be a consequence of increased activity associated with dense concentrations of seals. Disturbance can cause desertion of pups, resulting in starvation and death. Cows with pups are very aggressive to each other (and to bulls) and on a disturbed beach pups may become involved in cow fights, with serious or sometimes fatal consequences.

Grey sea milk contains 67% solids, with over 53% fat (Amoroso et al., 1950) and the pups grow very rapidly, an average of 1.8kg a day on the Farne Islands (Coulson, 1959) and 1.3kg per day (males) and 1.4kg per day (females) at North Rona (Boyd & Campbell, 1971). Lactation lasts about 16- 21 days (Davies, 1949; Coulson, 1959), after which the pups may remain on shore for about 14 days, before taking to the sea and feeding independently.

Cows come into oestrus at the end of lactation. Copulation can take place either in the water or on land. The bull lies at the side of the cow with a flipper over the cow's back, often grasping the cow's neck with his teeth. A cow in oestrus is usually mated a number of times, often by several bulls, copulation lasting from 15 to 40 minutes (Hewer, 1957). Soon after copulation the cow will leave the breeding area and does not reappear until the next season.

As stated above, the bulls arrive and take up position soon after the birth of the first pups, when there are only a small number of cows present. It is usual for the bulls to station themselves in the sea at the approaches to landings but where the cows range far inland, as at the larger and more crowded colonies, e.g. North Rona and the Farnes, the bulls station themselves ashore (Hewer, 1957; Anderson et al., 1975). Hewer has suggested that the bulls with previous breeding experience adopt the most advantagous breeding positions. The breeding behaviour of bulls has been discussed by a number of authors (Hewer, 1957; Hickling, 1962; Peterson, 1965; Fogden, 1971). Bulls do not select individual cows but will approach any cow and attempt to copulate, often being stimulated to activity when a cow changes position. Thus by constant sexual attention to the cows once oestrus animals are present, a bull ensures that no cow in his vicinity is overlooked, so decreasing the chance of a cow being mated by a more distant bull. Thus as part of its reproductive strategy the grey seal bull uses high sexual activity rather than territorial fighting or boundary display to ensure descendants.

Cows and bulls spend about 18 days ashore on average (Anderson et al., 1975) but some individual bulls spend much longer and in doing so may achieve many more copulations. The three most active of the 31 bulls observed at North Rona accounted for 35.6% of the copulations; thus a form of heirarchy exists among the breeding bulls. The average ratio of cows to breeding bulls at North Rona was 7.5 to 1. Quite often some bulls will remain at the rookery for six to eight weeks without food. Some die subsequently from inadequate reserves and starvation.

The account so far has referred mostly to conditions in the eastern North Atlantic. Less information is available about the western North Atlantic or the Baltic. In the western North Atlantic land-breeding grey seals tend to remain ashore for longer after partuition (Cameron, 1967) and the ratio of cows to bulls is lower. In the Baltic the animals breed mainly on drift ice or fast ice. Only rarely do they breed on the rocky skerries that fringe the coast (Curry- Lindahl, 1975).

In the mature cow, even while lactation is in progress, within the ovary one or two of the larger follicles containing maturing eggs begin to grow rapidly. By the end of the period of

lactation at least one is large enough to reach the surface of the ovary, burst and release a mature egg. Oestrus in the grey seal takes place only once a year and then in alternate ovaries. The production of twins is thus rare. The fertilised egg takes about 8 to 10 days to develop into a blastocyst. Now occurs the remarkable phenomenon of delayed implantation, known also in other seals, e.g. the common and elephant seals, and in a few terrestrial mammals such as the badger and the roe deer. The blastocyst lies dormant in the lumen of the uterine horn for a period averaging 102 days (Hewer & Backhouse, 1968). Attachment is then effected to the uterus and a further gestation period of 240 days follows. Total pregnancy is thus about 11 1/2 months.

During the period of feeding at sea between about late November and mid January the seals regain condition. The cows then haul out to undergo their annual moult, which reaches a peak in early February. Moulting immediately precedes implantation of the blastocyst; it seems likely that implantation is consequent upon completion of the moult. The male moult is rather later, centred on mid March. At this time seals spend long periods hauled out, though not usually at the breeding sites.

The testis and epididymis of the bull undergo seasonal fluctuations in weight. Bulls, like cows, become sexually mature at six years old but do not usually achieve the status of territory holders until ten years old.

Clearly the determination of the age of a mammal is a first requisite for the understanding of its life-history and for calculations of mortality, longevity and population age structure. An analysis of the cementum layers in the canine teeth of the grey seal can give an estimate of age since these layers are annual. Maximum ages have been given as follows: females; in Shetland, 46 (Bonner, 1971); in Canada, 44 (Mansfield et al., 1977); males; on the Farnes, 26 (Platt et al., 1975); in Canada, 30 (Mansfield et al., 1977). A male died in captivity at Skansen zoo, aged 41 (Mohr, 1952).

The sex ratio at birth is near to unity (Hewer, 1964; Mansfield & Beck, 1977) but the ratio is not constant through the breeding season, e.g. more males being born early and more females later in the Farne Islands (Coulson & Hickling, 1961). At North Rona more males are born than females but because of differential mortality more female pups leave the rookery for the sea (Boyd & Campbell, 1971).

Hewer (1964), on the basis of life tables which he prepared, gave the seal population associated with the annual production of 1000 pups as 3091 at the beginning of the breeding season. With a pup mortality of 15% the population would be 3941 at the end of the season, of which about 22% would be pups which have moulted their first white coat. In Canadian waters a cohort of 1000 pups

were calculated to be produced by a seal population of 3688. Such values can be used to calculate grey seal total populations from a count of pups; for most populations a multiplier of 3.5-4.5 would be appropriate (Harwood & Prime, 1978). Total annualpup production can be calculated from a single count provided the count is classified into age classes of the pups, enabling the form and timing of the birth-rate curve and estimates of pup mortality rates to be determined (Radford et al., 1978).

The size of a seal population must be known with fair precision if it is to be wisely managed, but only the number of pups born each year can be accurately counted (Summers, 1978). Pup data collected from the principal grey seal breeding assemblies in Britain have shown that, over the period for which reliable statistics are available, stocks not subject to any form of control have been increasing at about 7% annually, i.e. doubling in size in about 11 years (Summers, 1978). The only density dependent mechanism of natural regulation of seal numbers appears to be through the mortality of pups, while the ultimate population determinant is perhaps the availability of breeding sites (Harwood & Prime, 1978).

In the Baltic the species declined dramatically prior to the recent removal of a bounty and is unlikely to recover quickly from its present low level of some 2000 individuals (ICES, 1977) because of the pollution which has caused sterility in breeding females (Helle, Olson & Jensen, 1976). Mansfield & Beck (1977) reported an increase in pup production in the western Atlantic, from 1400 in 1966 to 6400 in 1976, although some, at least, of this apparent gain was due to improved census methods. However, pup production at Sable Island has been measured since 1962 and an annual rate of increase is found there of 10%.

With the general rise in the number of grey seals, fishermen, particularly salmon fishermen, have complained of damage to both nets and netted fish, although it may be observed that the incidence of damage to nets has declined since the introduction of synthetic fibres. One of the main effects of seals on fisheries is their direct predation on marketable fish, which form a major part of the diet of both common and grey seals (Rae, 1968). It is estimatated that grey seals currently consume in excess of 100,000t of commercially exploitable fish annually (Parrish & Shearer, 1977).

The presence of the codworm Phocanema decipiens, a nematode parasitic in cod, presents marketing problems and increases costs. The final host of the parasite is the grey seal. A large increase in the occurrence of the pest in cod flesh in Scottish waters was recorded in the 60s (Rae, 1963, 1972). The incidence appears now to have stabilised.

More than 2/3 of the world's total of about 100,000 grey

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seals occur within British and Irish waters (ICES, 1977). We in Britain have, therefore, a responsibility for their well- being. Additionally, there is an industry based on the utilisation of approximately 2000 pup skins annually. Appropriate management must aim to fulfil the following requirements: (1) It must maintain the population at considerably below the present level, (2) the resulting numbers should be locally stable, (3) the population should return to equilibrium following any possible fluctuation, i.e. it should be resilient (Holling, 1973) and the rate of return should be not much greater than that for an unexploited population (Harwood, 1978).

Harwood found that the use of a proportional pup quota produces a stable equilibrium but with a long return time. Constant pup quotas are potentially destabilising, while a density dependent adult quota will always produce a stable equilibrium with a shorter return time than with an unexploited population. From the Farne Islands an example of successful management following a period of destructive expansion of a seal population has been described in this journal by Hickling (1983). Culling alone is not satisfactory and indeed few seals are now culled on the Farnes. Rather, breeding sites are restricted, with beneficial results, both to the seal population and to the condition of the island soil and flora.

A combination of high fecundity and potentially long life appears characteristic of phocids. In the eight species for which data is available (ACMRR, 1976) the average fecundity rate is 85% and the average recorded maximum age is 33 years. Population size appears to depend as much on available breeding sites as on mortality. In this connection many human settlements on Scottish offshore islands have been abandoned during this century and this has increased the number of potential breeding sites for the seals, many of which have yet to be occupied; it is therefore likely that the British grey seal population will continue to increase.

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PORCUPINE FIELD MEETING IN CORNWALL, SEPTEMBER 21-28 1984

Shelagh Smith.

This meeting was originally mooted by Roger Burrows because of Porcupine's interest in the Roseland voluntary marine nature reserve in the Fal estuary, Cornwall. Although it was hoped that we could visit in 1983, we waited a year in the expectation that planned laboratory accomodation would be completed. As it happened, due to circumstances outwith our control, the building in Falmouth which we were to have used was not yet supplied with electricity. However, Roger Burrows was able to arrange for us to have very comfortable space in the kitchen/coffee room in Hayne Corfe, Truro, a new outstation for Exeter University Department of Extramural Studies.

Despite a considerable initial response, the field meeting was attended by a select few only. We commenced with a show of slides by Victoria Stone and Mark Deeble illustrating a selection of species found in and around the Fal. Discussion showed that there was considerable ignorance all round as to what constituted a 'southern' species. We solved the problem by placing the boundary between north and south somewhere near Cape Wrath!

Several shores were visited in and around the Fal estuary and we were taken beam trawling by Mark and Victoria. Roger operated a dredge from his own boat.

In view of the presence of **Bonamia** in oysters in some parts of the Fal area, to minimise risk or our spreading the disease we avoided certain shores and thus spent most of our time outwith the Fal.

We joined Stella Turk and her associates to make a detailed investigation of the shore at Porthcurnick, the hinterland of which belongs to the National Trust, who had expresed an interest in the shore life. Additionally, time was spent at St. Michael's Mount, The Lizard and, on the north coast, Polzeath and Treyarnon

where ignorant marine biologists stumbled upon, (almost unavoidably crunched underfoot) the land snail **Theba pisana** which has not been previously recorded from this far east on this coast. It was extremely abundant on dunes and amongst scrub.

Unlike last year, when Porcupines basked in the sun at Eyemouth and had the benefit of exceptionally low tides, this year the weather was merely passable and the tides, although predicted to be the lowest for forty years, were disappointing to moderate.

Detailed lists of species found (emphasis on Mollusca) are being compiled but cannot be completed to catch the deadline of this issue of PN. The lists will be available on request. Outstanding finds (if any!) will be noted in a subsequent Newsletter.

Many thanks to Roger, Victoria and Mark for organising the meeting and for the use of their boats.

NOTICES

NOTICE 1. PORCUPINE MEETING AND AGM.

The next meeting of "Porcupine' and the AGM will be in Manchester University on Saturday and Sunday, 23 and 24 February 1985. The venue is courtesy of Member Bill Pettitt. The theme of the meeting will be: "Feeding strategy; the hunter and the hunted". Members wishing to attend should please contact Secretary Shelagh Smith, 17 Sydney Terrace, Edinburgh EH7 6SR for further details. Offers of papers are welcomed. (Shelagh writes that "Porcupine" appreciates the inclusion of a sae in your corespondence.).

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NOTICE 2. MARINE CONSERVATION SOCIETY WORKSHOP:MOBILE MARINE FAUNA.

Purposes and themes: An open forum for all interested in UK fauna or involved in underwater surveys. Discussion of classical and recent work, gaps in knowledge, future prospects etc., following three main themes; identification, biogeography and

ecology.

Topics and session leaders:	
Annelids and other worms	David George
Molluscs	Bernard Picton
Crustaceans	Ray Ingle
Echinoderms	Ailsa Clark
Fish	Alwyne Wheeler
Pelagic fauna and oddities	Frances Dipper

University of Reading, Saturday and Sunday, 1 & 2 December 1984. Cost, £5 with coffee, £6.50 with snack lunch.

For further details or booking please send sae to Dr. Elizabeth Wood, Hollybush, Chequers Lane, Eversley, Basingstoke RG27 0NY (Eversley 734127). Cheques payable to E. Wood.

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NOTICE 3. MARINE CONSERVATION SOCIETY: COASTAL DIRECTORY.

The Coastal Site Directory is a MCS/WWF project which aims to produce a Directory of all maritime and marine areas that are currently under some protection/management in the U.K. and Ireland.

Initially coastal 'types' will be defined to allow regional, national and international comparison. The presence of each type e.g. salt marsh, reff etc. within coastal conservation areas will then be recorded using an atlas style presentation. As a result habitats which are poorly represented or omitted will become apparent. Details of other features of interest to the conservation movement such as the location of seal colonies and coastal bird reserves will also be included.

In the secoNd section of the Directory areas that are interesting for a variety of reasons, but have no protected status at present, will be described. This is particularly relevant to the sublittoral environment as most protected sites do not extend below the mean low water mark.

Finally as there is much variation between organisations in the criteria used to asserss the 'conservation value' of marine areas these criteria will be reviewed to try and clarify the situation.

The completed Directory will provide easily accessible information on the present situation regarding maritime and marine conservation in the U. K. and Ireland. It will indicate if protection is lacking for particular coastal types as well as locate further areas that should be considered for conservation. As a result it should prove valuable for future planning in

coastal and marine conservation.

To ensure that the Directory is a useful source of information we would like the opinions of as many organisations and individuals as possible. If you are interested in helping with this project please contact Dr. Susan Gubbay, Marine Conservation Society, 4 Gloucester Road, Ross-on-Wye, HR9 5BU.

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NOTICE 4. THE OCEANOGRAPHY OF THE ROCKALL CHANNEL: A SYMPOSIUM.

The meeting, organised by the Royal Society of Edinburgh and the Scottish Marine Biological Association, will be held in Edinburgh on 27 to 29 March 1985. The programme will be made up of both invited papers and poster presentations on the geology, hydrography and biology of the Rockall Channel, followed by a multidisciplinary workshop on 29 March. Attendance at this workshop will be by invitation only and the total number of participants will be limited to 40. Active workers interested in the workshop are asked to contact Dr. J. D. Gage at the Dunstaffnage Marine Research Laboratory, PO Box 3 Oban PA43 4AD. Those wishing to present posters are also invited to contact Dr. Gage.

Further details of the Symposium programme itself, together with a registration form and details of accomodation available to participants, may be obtained by writing to the Meetings' Secretary, The Royal Society of Edinburgh, 22 George Street, Edinburgh EH2 2PQ.

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NOTICE 5. (a) SEAWEED WORKSHOP (b) PLANKTON WORKSHOP.

It is proposed to hold another weekend course for algal novices in the spring of 1985, probably at Arundel. A similar course on plankton to cover methods of collection and enumeration, identification and ecology, will also be held on another weekend around Easter. Please contact Member Bill Farnham, Marine Laboratory, Ferry Road, Hayling Island PO11 0DG.

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NOTICE 6. LAGOON SURVEY.

The Nature Conservancy Council is conducting a survey of coastal saline lagoons around the British coast. They constitute a marine habitat which suffers most by direct habitat loss, being easily damaged or "reclaimed" and are physiographically ephemeral. This survey will concentrate initially on selected sectors of the

coast where historical losses will be recorded and existing lagoons described and classified. The intention is to use this information to develop a site consergation strategy, including options for re-creation and rehabilitation.

More recorders are required for the following areas: Most of Scotland (especially west coast), Gwynedd and Anglesey, Somerset, Avon, Kent and the Wash to the eastern border counties. Any information on past or present lagoons (including suggestions for ones to study) would be welcome. Please contact Member Roger Mitchell, NCC, Godwin House, George Street, Huntingdon, PE18 6BU, who will then advise the local recorder.

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NOTICE 7. LAGOON SYMPOSIUM

It is intended to hold a conference on lagoons and other brackish water bodies (but excluding estuaries) at Portsmouth Polytechnic close to Easter 1985. This will be for presentation of observations made during the NCC lagoon survey (above) but it is hoped to present contributions from other workers in this field. The organisers are Members Roger Mitchell (NCC) and Bill Farnham (Portsmouth Polytechnic, Marine Laboratory, Ferry Road, Hayling Island, PO11 0DG).

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NOTICE 8. COELENTERATE GROUP.

The annual informal meeting of the Coelenterate Group will take place at Reading University on Tuesday 26 March 1985. The first circular will be issued in December and anyone interested who is not on the current mailing list should contact Dr. Elaine Robson at the Department of Pure & Applied Zoology, The University, Reading RG6 2AJ (0734-875123 x 7619).

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ANNUAL GENERAL MEETING

The eighth Annual General Meeting of PORCUPINE will be held at the Manchester Museum, University of Manchester, on Sunday 24 February 1985 at 9.30 am.

Agenda

1. Minutes of the Annual General Meeting held in Edinburgh on 26 February 1984. These minutes were published in PN 2, 10.
2. Matters arising from the minutes.
3. Hon. Secretary's Report.
4. Hon. Treasurer's Report.
5. Hon. Editor's Report.
6. Hon. Records Convener's Report.
7. Election of Office Bearers and Council Members.
8. Election of Hon. Auditors.
9. Future meetings.
10. Any other business.

In connection with the election of Office Bearers, Council Members and Auditors, attention is drawn to the relevant Rules of Procedure. Candidates for Office, for Council and for posts of Auditor may be nominated, with their written consent, at any time prior to the AGM or, if they are present, during the AGM. Nominations from the floor during the AGM are in order. Voting is by a show of hands.

The Office Bearers are available for re-election as follows:-

Hon. Secretary	Shelagh Smith
Hon. Treasurer	David Heppell
Hon. Editor	Frank Evans
Hon. Records Convenor	Bob Earll

The present Council Members are:

Roger Bamber	Norman Holme
Roger Brehaut	Ivor Rees
Peter Davis	Ralph Robson
Bill Farnham	Dennis Seaward
Robin Harvey	John Wilson
	Fred Woodward

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Porcupine Notes and News

WE LEARNED WITH REGRET of the death at 81 of H. O. Bull. His most remarkable contribution to marine biology was his pre-war work on the perception of water temperature by fish, but it is probably his immense contributions to the faunal records of north east England that will be remembered longest. His 1933 bibliography of the fauna and flora of Northumbrian seas has just been reisssued (see ads.)

MEMBER BILL FARNHAM has recently taken over as Newsletter Editor for the Underwater Association. He writes that he would welcome articles by diving Porcupines. Good luck in a demanding job, Bill.

THE IBP BENTHIC HANDBOOK (see ads.) was first published in 1971 at £3.75. The price of the newly issued 2nd edition is £25. Prodding a few calculator keys reveals an annual increase of 16%. That's tough on postgraduate students who might wish to own a copy.

RESEARCH SHIPS ARE EXPENSIVE and NERC are wondering about the shape of their research fleet over the next twenty years; they have produced a consultative document asking some sharpish questions about costs and user requirements. Meanwhile the pride of the fleet, the new 210 ft. "Charles Darwin", Appledore-built and high-tech in design has teething trouble and may not be handed over to NERC this year.

SO ALSO IN HOLLAND. A new plankton newsletter has appeared, published by the Organisation for the Advancement of Oceanography in the Netherlands It is staffed by unemployed plankton workers. The subscription is $5 for Vols. 1 and 2 (only Vol. 1 of 16 pages has so far been published). Editor: J. de Visser, PO Box 16915, 1001RK, Amsterdam.

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Around the Marine Laboratories

Number 11.

The Department of Oceanography, Southampton University

The Department of Oceanography was set up in 1964 as a cetre for advanced teaching and research, as the time was regarded as entirely appropriate in view of the growing need for trained marine scientests with the world expansion in oceanography. The University's long-standing interest in marine biology, the geographic position of Southampton and the growth of marine industry in addition to the port's development emphasized Southampton's suitability as a centre for marine sciences. Oceanography was thus spawned from the Department of Zoology chiefly through the efforts of the late Professor John Raymont.

Oceanography is essentially a multidisciplinary subject and the aim was to produce a balanced postgraduate department, and therefore academic staff were appointed to teach in the four major marine disciplines - chemistry, physics, biology and geology. At present there are nine academic staff (four biologists), but over the next few years, following the UGC decision for expansion of oceanography in Southampton,these are to be increased to 16, with appropriate increases in building space, clerical and technical staff and students.

Until recently the main teaching effort has been directed to the M.Sc. course, with relatively litle undergraduate teaching. With the proposed expansion a range of 'oceanography with biology, chemistry, etc', first degrees will commence over the next two years. About twenty students register for the M.Sc. course every year and currently there are some 30-40 research students working for higher degrees.

The department is at present housed in two buildings on the

main university campus situated about 6 km from Southampton Water, though a new building is proposed. A range of research and teaching facilities are available, including a closed circuit aquarium system (about 16 x 10^4 litres capacity), c.t. rooms, an electronics workshop, histology and photographic labotatories, and a departmental launch suitable for work in Southampton Water and the Solent. In addition, mainframe and microcomputer facilities are available and the department houses a well stocked library. There are many advantages within a multidisciplinary department including, for the biologist, access to analytical and hydrographical equipment and expertise.

The research area covered by the department is broad, with many studies of an interdisciplinary nature. A recent example of this is a DOE-sponsored study of bioturbation utilizing biological and geological techniques. On the biological side, open ocean research is undertaken using ships of the NERC fleet, often in association with the Institute of Oceanographic Sciences, with which the department has strong links. Members of the biology group have interests generally in ecological and physiological aspects of marine science with research topics based on habitats ranging from the open ocean to estuaries and brackish lagoons.

The area around Southampton offers a diversity of marine environments, with a variety of substrata; the region also represents a boundary between many western and eastern Channel species. Exotic species are well represented, due principally to shipping and the shelter of Southampton Water and the Solent, with benthic secondary production dominated by these non-native species through much of the area. The exotics include **Acartia tonsa, Mercenaria mercenaria** (for which there is a fishery), **Crepidula fornicata, Elminius modestus, Styela clava, Hydroides** spp. and **Sargassum muticum**, together with several other generally less commonspecies. The Solent is also the site of Europe's largest naturally-settled fishery for **Ostrea edulis.**

Visitors are welcome to the department at any time, though prior notice is useful.

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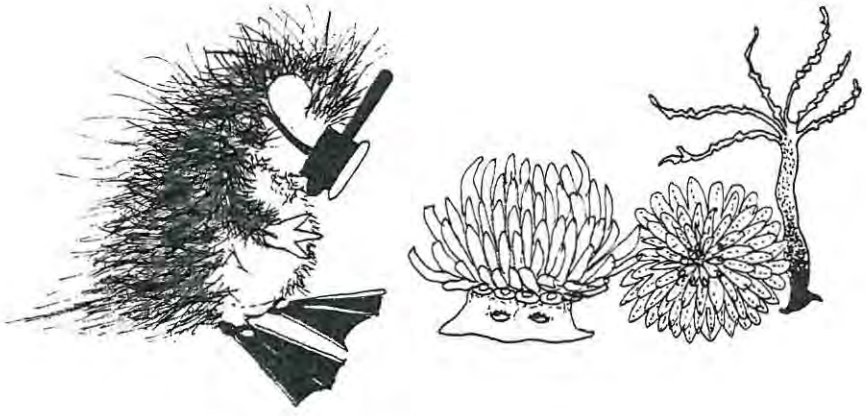

Porcupine Review

Sublittoral Ecology - The Ecology of the Shallow Sublittoral Benthos, edited by R. Earll and D. G. Erwin, 277 pp. Oxford University Press. ISBN 0-19-854573-8. Price £20.

Reviewer: Frances A. Dipper, 1 Smeefield, Hilton, Huntingdon PE18 9NU.

This book is derived from the proceedings of the 15th Annual Symposium of the Underwater Association held at the British Museum (Natural History) in March 1981. However, apart from attending the symposium and reading the preface to this book I would never have known this. So many symposium proceedings are disjointed with a wide variation in the ability of the authors to communicate anything. In this volume all the topics and the authors were pre-selected by the editors who had a very clear idea as to what they wanted the final book to achieve. It seems to have worked; all the authors being eminently suited to their tasks.

The area covered is the 'shallow sublittoral benthic environment' - the region into which a normal SCUBA diver is able to penetrate. This is defined by one of the authors as 'a transition area between the shore environment which can be examined directly in some detail and the deep benthos which can normally only be sampled remotely'. The volume is thus slanted towards contributions made by diving scientists and one of the undercurrents is the encouragement of both amateur and professional diving biologists to do more.

The volume comprises seven chapters with an eighth in abstract form only, due to the ill health of the author. The first is a well written historical perspective where we are informed the the general term in use for divers before the 19th century was 'urinator'; some would argue, an apt term even today. The next three chapters cover Light (A. E. Drew), Water Movement (K. Hiscock), and Substratum (R. G. Hartnell). In each case the authors have carefully defined their topics and clearly shown the role these factors play in determining the distribution and composition of marine communities. In the water movement chapter, Hiscock concludes with a statement that 'if the reader is left puzzled and confused it is most likely for one or more of three reasons'; one of these reasons being that he (the author) may have failed to separate and describe the key facts in a logical manner. He can be reassured that this is not so. I found the chapter on light a little daunting since it really is 'Everything you always

wanted to know about light but were afraid to ask'. However, with careful reading and reference to the excellent diagrams, this complex topic can easily be followed.

The remaining chapters cover biological topics including Biological Interactions (P. G. Moore), The Community Concept (D. G. Erwin) and Biogeography (R. Earll and W. Farnham). These are also well written although the topics do not lend themselves as well to a logical systematic exposition. Biological Interactions covers such diverse aspects as feeding, cryptic colouration, shelter, intraspecific associations and competition. In The Community Concept, Erwin reviews the various concepts of Petersen and successive workers and puts forward an interesting proposal for 'classifying' benthic assemblages using a chain of decisions in a similar way to the taxonomic hierarchy. Earll and Farnham provide a comprehensive review of the sublittoral biogeography of the British Isles. It is a pity that the final chapter on Temporal Relationships could not be written. The topic is of considerable interest to marine conservationsists since it is essential to have a prior knowledge of natural changes in populations and communities before interpreting the results of monitoring and surveillance programmes.

In all the chapters of this excellent book, the authors have thoroughly reviewed their topics and have included many important observations from unpublished reports, recording schemes and 'casual' observations. This volume is a must for all marine scientists and institutions interested in the sublittoral environment; and is written clearly enough to be also appreciated by the informed amateur.

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Letters to the Editor

From Member Roger N. Brehaut,
La Canurie, Collings Road,
St. Peter Port, Guernsey.

Dear Editor,

I wonder if any member has any comments to make on the following observation on the scyphozoan, **Pelagia noctiluca** (Forskål).

F. S. Russell in 'The Medusae of the British Isles'

vol. 2, p.86 implies that **Pelagia** is not noted for its stinging powers, although certain people and tender areas may be affected, and repeated contact may produce severe results. Alister Hardy, in 'The Open Sea: the World of Plankton', p. 131, says: "When out on the 'Discovery II'...we saw them passing along the side of the ship as globes of light. They gave off a phosphorescent slime when handled; after lifting specimens from a dip net we found our hands shining in the dark".

With regard to distribution in the Mediterranean, Carus in'Prodromus Faunae Mediterraneae' says: "Seems to be absent from the Adriatic", while Riedl, in 'Fauna und Flora der Adria' says: "Rare, more frequent in the southern Adriatic, here in most years from October to May with swarms forming, but isolated examples have also been noticed between June and August".

In August 1983, while snorkelling off the island of Cres in the northern Adriatic I encountered a jellyfish which I assume to be of this species and observed it for some time. Then, while turning away I was lightly brushed across the forehead by another specimen which I had not noticed. I immediately suffered from a quite severe stinging sensation and made for the shore. By the time I landed, just a few minutes later, I was feeling a throbbing sensation, and the whole of the side of my head was becoming numb. My wife immediately commented on the red rash. The feeling of numbness took about six hours to wear off, but the rash persisted for several days. A few days later I was careless enough to have another encounter, this time across the chest with identical results.

I noticed a number of other swimmers similarly affected, and the number of jellyfish increased steadily day by day until there were usually several to be seen whenever one looked in the sea. The sport of swimming in the area gave way to the sport of fishing them out with nets, and soon there were piles on the rocks and beaches. One of the most interesting observations was of a group of young people who fished out one with a face mask, and tipped it on to the rock. A few minutes later, one of the party put the face mask on, and immediately ripped it off and threw it across the beach with a cry of pain. Apparently a few detached nematocysts remained on the rubber and were obviously highly active.

Knowing of the reputation of this species for bioluminescence I deliberately went down to the edge of the sea on several occasions after dark, but never saw a glimmer!

This summer (1984) in a similar area the jellyfish were frequent again, although not as abundant as in 1983. However, it was unusual not to spot at least one during each swim - and to quickly move in the opposite direction. These observations appear to conflict with my text book accounts in terms of venom;

luminescence; and geographical distribution. Are we talking about a different species? (The jellyfish were about 5 cm. in diameter and of a speckled pink colour.) Or does the degree of luminescence and venomousness vary in different areas? I would be interested to read the comments of any other Member who has encountered this animal.

Editor: The account of the discharge of nematocysts lingering on a face mask is an example of the delayed action of such detached cells noted by, among others, H. O. Bull, whose death at 81 is reported elsewhere in this issue. He has told of attending to a call of nature at sea, some half an hour after handling specimens of **Cyanea capillata** and stinging himself severely in the process. The skin of his hands was meanwhile too thick to be affected.

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Porcupine Ads.

(Advertisements are published free to Members. Replies should be addressed to the advertisers or to Porcupine Newsletter at the Dove Marine Laboratory, Cullercoats, North Shields, NE30 4PZ, England.

FIELD GUIDE TO THE WATER LIFE OF BRITAIN. Frances Dipper and Anne Powell. Reader's Digest Nature Lover's Library, 1984. £8.25. Describes and illustrates common marine and freshwater animals and plants with notes on their biology and ecology. (It is hoped to review this book in a later issue of PN.)

METHODS FOR THE STUDY OF MARINE BENTHOS. 2nd edition, 404 pp. Ed. N. A. Holme & A. D. McIntyre. IBP Handbook No. 16. Blackwell, 1984. £25.

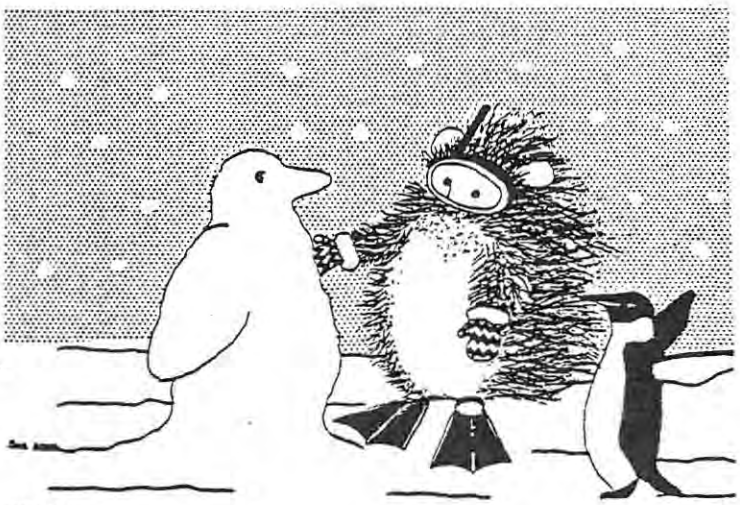
A general introduction to the methods, apparatus and techniques currently used for studying plants and animals living on the sea bed.

THE LITERATURE ON THE MARINE FAUNA OF THE CULLERCOATS DISTRICT, 1933-1984. Judy Foster-Smith. Together with a reprint of "A Classified Index to the Literature of the Cullercoats Marine Fauna and Flora (Exclusive of Birds and Mammals), 1832-1932" by H. O. Bull. Marine Fauna of the Cullercoats District, 14. Rep. Dove Mar. Lab. 3rd ser., 27, 1984. →

Just published. An extension to date of Bull's famous list. Price on request.

PORCUPINE CHRISTMAS CARDS 1985.

Thalassiohystrix and penguin friend. Text: MERRY CHRISTMAS HAPPY NEW YEAR, together with a note on H.M.S. "Porcupine". £1.40 for 10 including p. & p. Support your Society by your purchase. Obtainable from the Editor, PN. (Address, front page.)



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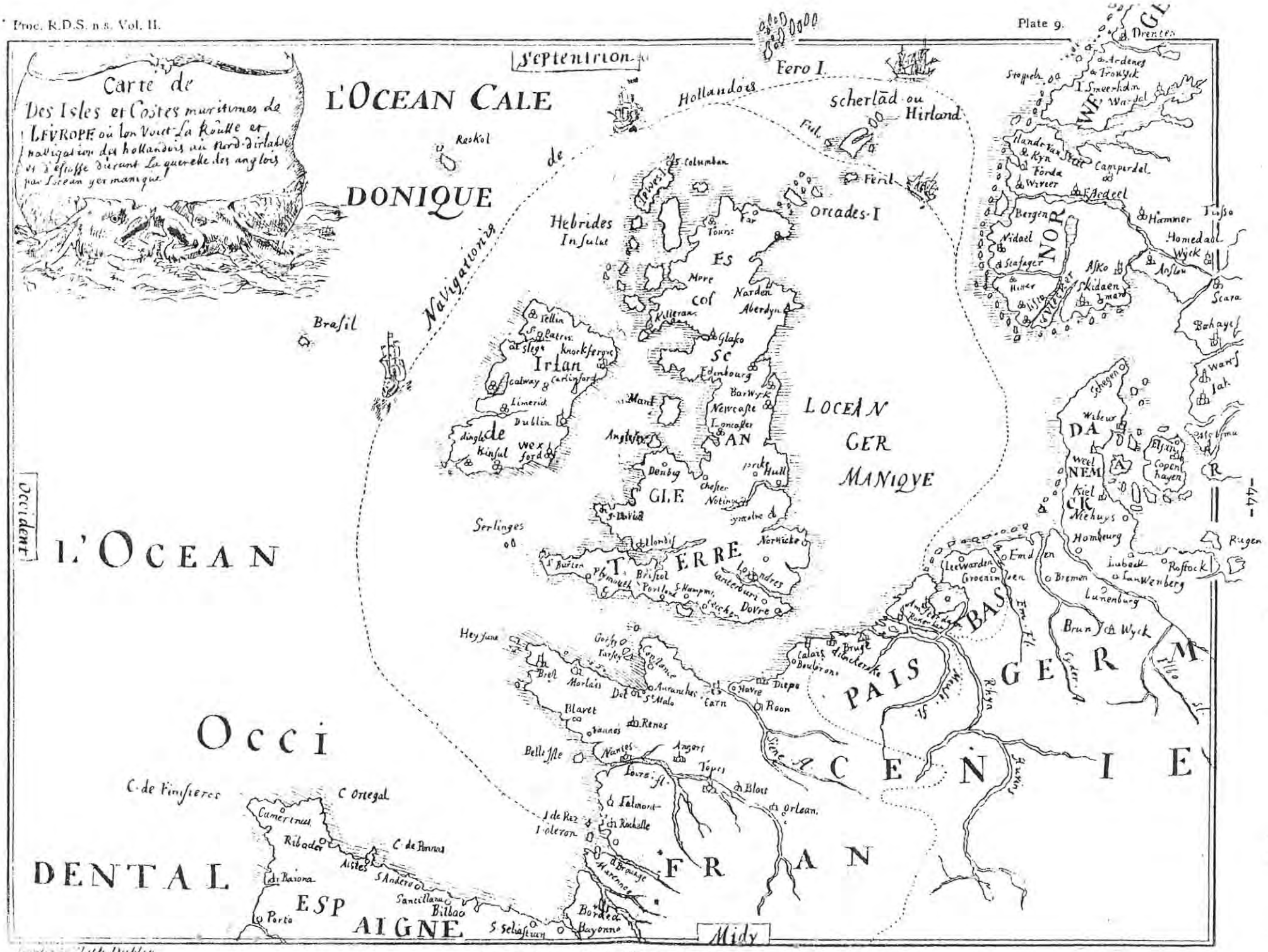
ON HY BRASIL, A TRADITIONAL ISLAND OFF THE WEST COAST OF IRELAND, PLOTTED IN A MS. MAP, WRITTEN BY SIEUR TASSIN, GEOGRAPHER ROYAL TO LOUIS XIII.

By W. Fraser, F.R.C.S.I.

(Reprinted from the Scientific Proceedings of the Royal Dublin Society of 1879)

The French maps of the Geographer Royal, Le Sieur Tassin, in which he gives the different districts and fortified towns of France, with interesting views of the towns themselves, were published in 1634; they were re-issued more than once, the last time being in 1652. The copy which I obtained was made additionally interesting by its containing beautiful plans, drawn by Tassin himself, of several royal fortresses, which were strengthened by Cardinal Richelieu, and also bird's-eye views of Cazal and Evreux.

In the commencement of the volume laid down to scale is a MS. map of the opposite coasts of France and Britain, which I believe to be of scrupulous accuracy, even in rather minute details, end evidently the work of a man who knew the coast thoroughly. Following this is the special map I wish to direct attention to at present. It is entitled a "Chart of the Islands and Maritime coasts of Europe, in which we see the Route and Navigation of the Hollanders by the North of Ireland and Scotland during the wars with the English for the German Ocean."



"Enlarged from Original Manuscript Map."

This course is laid down from Holland along the Norwegian coasts, whence two diverging paths are described - one round the north of Shetland, or "Hetland", and carried to the south of the Ferro Islands; the other, a fair-weather course, passes beteeen Fair Island and Fula or Foula, joins the other line, and then passes inside of Rockall, or, as it is written, Rookal; it then continues along the western coast of Ireland, and Brasil is laid down in its proper place, much in the position now ascertained to be occupied by the "Porcupine Bank"; hence the course continues directly to Rochelle.

The map is evidently not designed as a fanciful sketch. Every sailing point and headland has been laid down by a skilful Geographer, who either passed over the track himself or compilied it from the observations of persons who knew it thoroughly, and this at a time when no British ship appears to have sailed these western seas, though Dutch and French sailors must have made it a daily thoroughfare for their commerce.

Let me call attention to another curious matter. Rockall is represented in this map as consisting of two adjacent islands, a larger one and a smaller one. Well, in the cruise of H.M.S. "Porcupine" two similar banks are represented, one of large size, as occupying the place where now only one comparatively small rock remains above the waters.

In Surgeon Alex. Fisher's History of the Voyage of the **Hecla** and **Griper** in 1821, we have a description of Rockall and of a search made, of course unsuccessfully, for another Phantom land, "The Sunken Land of Busse". "Monday, 24th. - We had a distant view of that remarkable insulated rock, called Rockall. It looked at the distance we were from it (between four and five leagues) exactly like a ship under sail; it was reported indeed by the person who first saw it to be a strange vessel. If we estimated our distance from it at all correctly, its situation, as determined by H.M. Ship **Endymion**, is very accurately laid down (lat. 57°39'30"N., and long. 13°13'W.) In the course of the afternoon, when at least forty miles from this rock, we found soundings in 150 fathoms water, so that it may be regarded as the summit of a very extensive submarine mountain, whose sides, at least the western one, declined very gradually. Thursday, 27th. - Tried for soundings on the supposed sunken land of Busse, according to its situation by Lieutenant Pickersgill, who, in his passage to Davis' Strait, in 1776 struck soundings with a line of 320 fathoms in this very place, 57°N., 24°24'W.; but with 1220 fathoms out we found no bottom."

In the year 1576 this land of "Busse" is described as having been met with by one of Frobisher's ships. It was a long island covered with wood, in lat. 57°30', along which they sailed for three days. So far as I can discover this "Busse" was the ship

Emmanuel of Bridgewater; but it is needless to follow the subject further.

At numerous places round our Irish coasts, in particular along the south and west, there occur submerged bogs bordering along the coast-line, which form a conspicuous feature of our geologic record; these every where yield remains of large forest trees that appear to have grown and decayed in the localities they are found in, and point to a time that cannot have been very remote when the land now sunken must have risen well above the water level.

There is also the traditional story told in O'Flaherty's "Ogygia" published in 1685. He says- "Lough Lurgan is an inlet of the sea, between Tuam and West Connaught, at the mouth of Galway, stretching into the land, which was formerly dry land, until the Western Ocean broke over it. The remains of the barrier are the three Isles of Aran". This traditional name of Lough Lurgan is still used for Galway Bay; and margining the Bay itself below low water mark of spring tides there are numerous bogs with oak corkers in situ at their base, being in place over twelve feet deep.

Nor is this the only evidence of recent subsidence, for in Mr. Kanahan's "Geology of Ireland" he records the fact the the Rev. W. Kilbride, Vicar of Aran, has discovered at Tranmore, on the largest of these islands, even human habitations and other structures that he has traced down below low water of spring tides.

The legend of a buried Atlantis, larger than Libya and Asia, described in Plato's "Timaeus", of course, is one of the earliest records of this land subsidence. So universal was this belief that the first discoverers of Brazil fancied thay had discovered the long-lost continent, and named it accordingly after the vanished land. It is with the last traces of such a subsidence I wish to deal. What I venture to lay before the Geological Society in support of the idea that this little island off our western coast did really exist at no very distant perield, is a map in which it is drawn in its proper alleged position, made about the year 1640; that this map is the hereuntofore unpublished and unknown work of a competent man, a Geographer Royal of France, and in his own handwriting; that it occurs in a volume distinguished by the accuracy of its delineations, and which, so far as I can discover, is conspicuous for its freedom from errors.

This last summer I saw the cliffs of the Isle of Wight; they were disappearing at a rate of upwards of a yard each year, under the comparatively quiet waves of the ocean. Close to Bray, during last winter's storms, no inconsiderable portion of shore was removed; and if, in addition the strong breakers of the Atlantic, we consider that a process of subsidence has been taking place,

submerging not only bogs, but the work of man's hands, as on the Aran Isles, surely it might happen that far less than 250 years of ceaseless surge is capable of removing more clay and rock than this little speck upon the waters must have had. It is hopeless to look for information to English sources; the navigators of their ships appear never to have sailed our western waters, and their maps, so far as I can ascertain, are unreliable; indeed you may look in the present day over numerous English maps and fail to discover Rockall itself. So far as their evidence goes it would be conclusive that there was no such place in existence.

*

TITLE OF MAP

Carte de Des Isles et Costes maritimes de L'EUROPE, où l'on voist La Routte et navigation des hollandois aû nord d'irlande et d'ecosse durant La querelle des anglois par L'ocean Germanique.

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FISH RECORDED IN DRURIDGE BAY, NORTHUMBERLAND, 1975-1980

Peter Walker
MAFF Fisheries Laboratory, Lowestoft

The bottom of Druridge Bay (55° 17'N, 1° 33'W) consists of sand, sandy mud and mud down to a chart depth of 15 metres. Beyond this depth rocky scars run ESE and NNW, almost enclosing the bay on the seaward side (Figure 1).

The bay was one of four studied between 1975 and 1980 by teams from the Fisheries Laboratory, Lowestoft. In this period 17 sets of samples were taken using fine meshed 2 m beam trawls and 1.5 m push nets. On each visit the aim was to take 36 samples between the low water mark and 15 m depth. Bad weather prevented beam trawling in September 1976 and June 1977. Hauls were of 10 minutes duration fished with the tide. Samples were preserved in formo-saline for identification in the laboratory.

A total of 44 species of fish were taken in the bay during the course of the study. Table 1 summarises the numbers of each species. The most common species was the dab, **Limanda limanda**, 57% of the total numbers of individuals being of this species. Plaice, **Pleuronectes platessa**, ranked fourth, was the only species taken on every visit. A single northern rockling, **Ciliata septentrionalis**, taken in February 1977 is of interest as it predates by four years the first record noted by Davis (1983).

Reference

Davis, P. 1983. The Marine fauna of the Cullercoats district. 11. Fishes. Rep. Dove Mar. Lab., 3rd ser., 24.

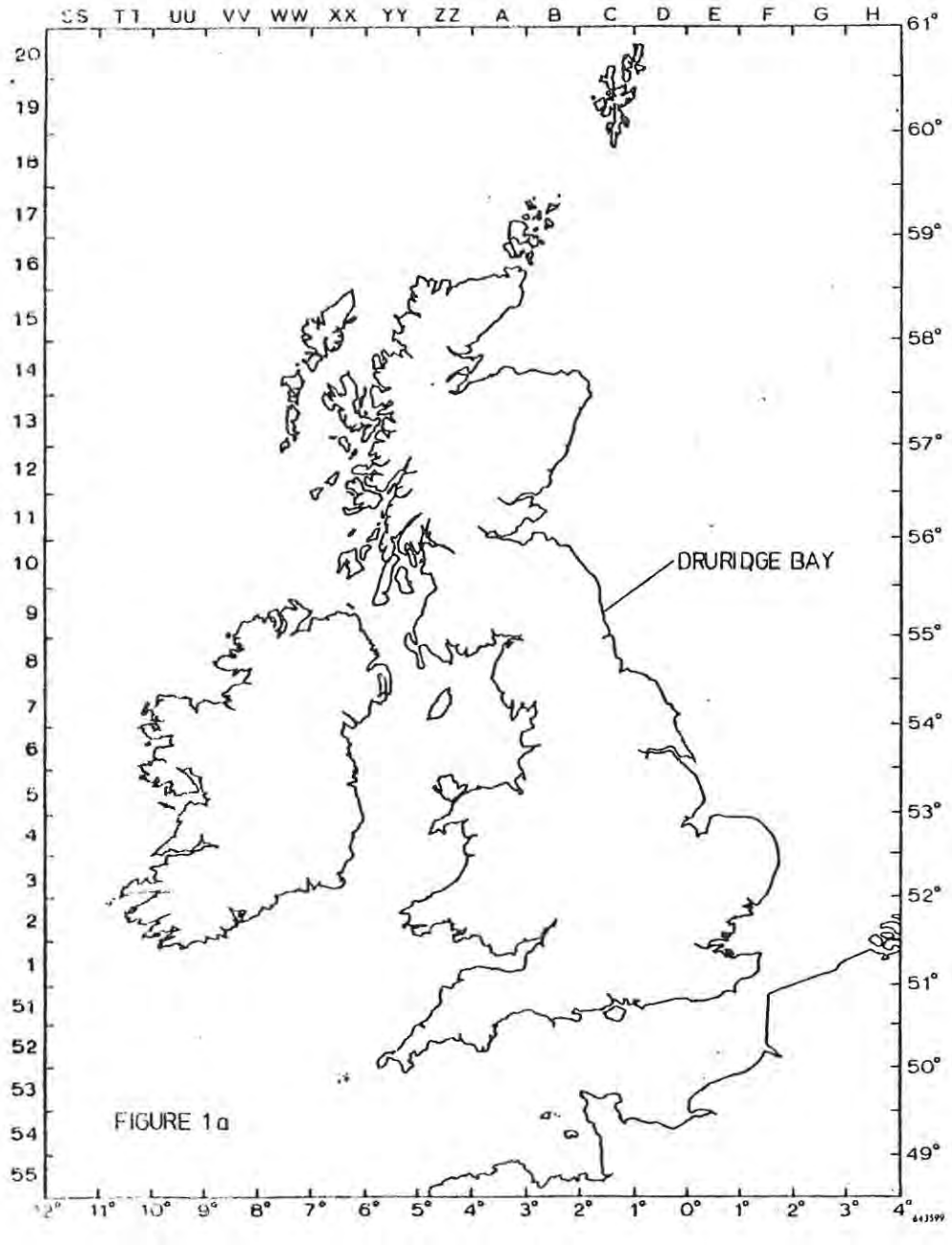

FIGURE 1a

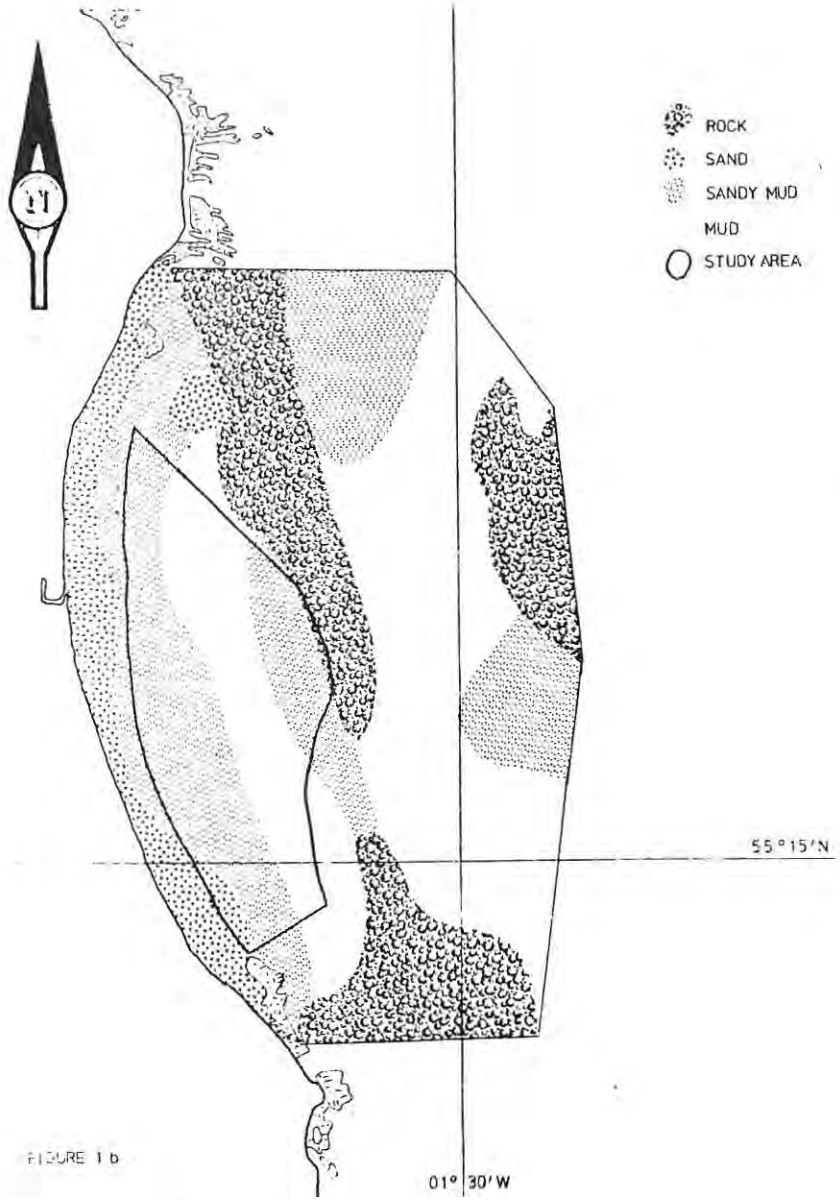

FIGURE 1b

SPECIES	DATE	6/75	9/75	4/76	5/76	6/76	7/76	8/76	9/76*	10/76	12/76	2/77	4/77	6/77*	8/77	9/78	9/79	9/80	6 year total	Rank
Raja clavata						1		2											3	31
Raja montagui							1												1	37
Raja naevus					1														1	37
Anguilla anguilla				1															1	37
Clupea harengus				5			2						1						8	22
Sprattus sprattus				2				5		1			10		3				21	20
Lophius piscatorius					2	5	11	3								4	4	1	30	15
Gadus morhua					1					3	2	1			10		77		94	13
Merlangius merlangus			9	39			3	42		10	72	18	10		236	208	68	107	822	5
Trisopterus minutus										1									1	37
Trisopterus luscus											2								2	34
Pollachius virens						1		1		1	2	1					3		9	21
Ciliata mustella		1	1				1	1				1	1		6	1		10	23	18
Ciliata septentrionalis												1							1	37
Gaidropsarus vulgaris												1							1	37
Zoarces viviparus		11											10						22	19
Atherina presbyter											2								2	34
Gasterosteus aculeatus												1							1	37
Spinachia spinachia			6	2					1				16			13	9	1	51	14
Syngnathus rostellatus		1	44	31	5	11	5	7		1	14	9	13		11	1	9	2	164	9
Trigla lucerna					2	1													3	31
Eutrigla gurnardus		3	8		4	27	25	15							3	10	3	75	173	8
Myoxocephalus scorpius		1		1															5	26
Taurulus bubalis		1	1																2	34
Agonus cataphractus		6	37		7	21	11	30		3	2	1	3		55	32	4	9	221	6
Liparis liparis											2	2	1						5	26
Liparis montagui			3										5		16				24	17
Echiichthys vipera		23	55	55	205	120	180	312	1	9	20	16	15		93	414	203	267	1988	2
Pholis gunnellus				2								1							3	31
Ammodytes tobianus		2	12	6				13		4	8	1	35			74	25	25	205	7
Ammodytes marinus		2	13	2			1	16	5	4		2	13			16	44	7	125	11
Hyperoplus lanceolatus				1		1				1							1	1	5	26
Callionymus lyra		5	15	6	10	14	12	22		2	2		1			9	9	11	127	10
Pomatoschistus microps				12							16								28	16
Pomatoschistus pictus											1	3							6	24

SPECIES	6/75	9/75	4/76	5/76	6/76	7/76	8/76	9/76*	10/76	12/76	2/77	4/77	6/77*	8/77	9/78	9/79	9/80		6 year Total	Rank
Pomatoschistus minutus	11	63	444	64	30	13	34		125	195	121	264		62	42	30	15		1513	3
Scophthalmus rhombus												1							1	37
Scophthalmus maximus	2	13		4	7	5	15	20	12	16		11		11	1		1		118	12
Arnoglossus laterna			1		2		1												4	30
Pleuronectes platessa	17	24	155	59	64	137	110	25	79	62	8	20	2	153	117	119	195		1346	4
Platichthys flesus			1		2										2	1	1		7	23
Limanda limanda	35	2044	391	86	126	319	475		997	148	139	22		1820	1344	773	607		9326	1
Solea solea		1		1		1			2								1		6	24
Buglossidium luteum		1	2	1					1										5	26
																		TOTAL	16504	

Table 1 - Numbers of fish taken in Druridge Bay 1975-1980

* No beam trawl samples

A SPONSORED MARINE SPECIES RECORDING EVENT.

Judy Foster-Smith
(MCS Borders Regional Co-ordinator)
The Old School House, Newton-by-the-Sea, Northumberland.

The thought of a sponsored marine species recording event in aid of the Marine Conservation Society seemed a good one. Not only would it help to raise funds for MCS but it would also serve to make more people more aware of the existence of the society and what it stands for. In addition, participants would be able to benefit by learning from another how to recognise personally unfamiliar species and, not least, a species list would be made available for the site selected.

Consequently the event was organised, and took place at St. Mary' Island, Whitley Bay, Northumberland on Sunday 30 September 1984. It was attended by members of the Borders Region of the MCS and by members of 'Marine Biology North East', a diver-dominated group of largely amateur marine biologists, based in Newcastle on Tyne. Unfortunately the sea conditions on that day were not conducive to diving and so recording had to be limited to the shore, with a low tide level of around 1.3m aove chart datum. Nonetheless, the aims of the event were duly achieved, and the appended list of species was recorded. The majority of these could have been predicted, but there are one or two interesting records. **Amblyosyllis formosa**, for instance, has been found at only one other site on the north east coast, and **Endeis spinosa** has not been recorded at St. Mary's Island since 1936.

Species list

Algae: Chlorophyceae

1. Enteromorpha intestinalis
2. Ulva lactuca
3. Spongomorpha arcta
4. Cladophora rupestris

Algae: Phaeophyceae

5. Spongomena tomentosum
6. Laminaria digitata
7. Laminaria hyperborea
8. Laminaria saccharina
9. Cladostephus spongiosus
10. Ascophyllum nodosum
11. Pelvetia caniculata
12. Fucus serratus
13. Fucus vesiculosus
14. Fucus spiralis
15. Halidrys siliquosa

Algae: Rhodophyceae

16. Rhodochorton sp.
17. Chondrus crispus
18. Gigartina stellata
19. Corallina officinalis
20. Lithothamnion sp.
21. Dumontia contorta
22. Lomentaria articulata
23. Palmaria palmata
24. Ceramium rubrum
25. Laurencia pinnatifidum
26. Polysiphonia lanosa
27. Porphyra umbilicalis

Lichens

28. Verrucaria maura

Porifera
29. Clathrina coriacea
30. Leucosolenia botryoides
31. Scypha ciliatum
32. Leuconia nivia
33. Scypha compressa
34. Halichondria panicea
35. Dysidea fragilis
36. Halisarca dujardini

Coelenterata
37. Dynamena pumila
38. Actinia equina
39. Urcitina felina

Nemertea
40. Lineus longissimus

Platyhelminthes
41. Oligocladus sanguinolentus

Annelida: Polychaeta
42. Lepidonotus squamatus
43. Harmothoe imbricata
44. Harmothoe impar
45. Eteone longa
46. Eulalia viridis
47. Nereimyra punctata
48. Kefersteinia cirrata
49. Amblyosyllis formosa
50. Nereis diversicolor
51. Nereis pelagica
52. Capitella capitata
53. Sabellaria spinulosa
54. Pomatocerus triqueter
55. Spirorbis spirorbis
56. Spirorbis borealis

Mollusca
57. Lepidochitona cinereus
58. Acanthochitona crinatus
59. Acmaea testudinalis
60. Patina pellucida
61. Patella vulgata
62. Gibbula cineraria
63. Lacuna vincta
64. Littorina littorea
65. Littorina obtusata
66. Littorina neglecta
67. Littorina rudis
68. Nucella lapillus
69. Nassarius incrassatus
70. Berthella plumula
71. Goniodoris nodosa
72. Onchidoris bilamellata
73. Cadlina laevis
74. Archidoris pseudoargus
75. Facelina coronata
76. Mytilus edulis
77. Modiolus modiolus
78. Pododesmus squamula
79. Lasaea rubra
80. Venerupis sp.
81. Hiatella arctica

Arthropoda: Pycnogonida
82. Endeis spinosa

Athropoda: Crustacea
83. Verruca stroemia
84. Semibalanus balanoides
85. Idotea baltica
86. Ampelisca sp.
87. Talitrus saltator
88. Gammarus locusta
89. Amphithoe rubricata
90. Eualus pusiolus
91. Galathea strigosa
92. Porcellana longicornis
93. Porcellana platycheles
94. Pagurus bernhardus
95. Carcinus maenus
96. Cancer pagurus
97. Pinnotheres pisum
98. Hyas araneus

Bryozoa
99. Electra pilosa
100. Umbonella littoralis

Echinodermata
101. Henricia sanguinolenta
102. Asterias rubens
103. Ophiothrix fragilis
104. Amphipholis squamata
105. Psammechinus miliaris

Chordata: Tunicata
106. Dendrodoa grossularia
107. Botryllus schlosseri
108. Botrylloides leachi

Chordata: Pisces
109. Pholis gunnelus
110. Lipophrys pholis
111. Taurulus bubalis
112. Ciliata mustela

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