PORCUPINE MARINE NATURAL HISTORY SOCIETY

NEWSLETTER

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Porcupine Marine Natural History Society

Newsletter

No. 7 March 2001

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Porcupine MNHS welcomes new members- scientists, students, divers, naturalists and lay people. We are an informal society interested in marine natural history and recording particularly in the North Atlantic and 'Porcupine Bight'. Members receive 3 newsletters a year which include proceedings from scientific meetings.

Individual £10 Student £5

CONTENTS

EDITORIAL

The theme for 'Porcupine 2001', our annual scientific meeting, held this month, was 'Long-term Studies'. There was an extremely good turnout for the meeting (around 45) which was very pleasing to the organisers (myself included!). Our heartfelt thanks must go to the Environment Agency at Brampton, for their generosity in providing us with a superb venue. Sixteen excellent papers were presented plus an extended discussion session on the Wash. Several of the papers from the meeting are presented here. The rest will be published in the July and November issues.

The annual meeting is, without doubt, an excellent time to catch up with colleagues and friends as well as to find out what your fellow Porcupines and their friends are doing in scientific terms. So if you missed it this time, then make a note of next year's in your diary NOW – March 15-17th 2002 in Edinburgh (*see* Porcupine Meetings).

Extra curricular activities included an excellent conference dinner at a pub renowned for its real ale and a Sunday morning session looking at fresh and preserved dredge hauls from the Wash. I was particularly pleased with the bucketful of fish presented to me! Did you know that a smelt (*Osmerus*) is so called because it smells distinctly of cucumber when fresh caught? I do now!

Porcupine Council is very keen to heighten the profile of our Recording Scheme. One of our main aims is, after all, supposed to be the collection and collation of interesting records from the NE Atlantic (and elsewhere). In this issue there is an article on the Recording Scheme. It tells you what it is (again) and how it is progressing. PLEASE READ IT if you have any interest at all in marine recording. The scheme has great potential and is particularly pertinent in the light of general efforts worldwide to document and conserve species and habitats (biodiversity is the in word). For further information on this topic see the articles in Porcupine newsletter No. 4 (March 2000).

Frances Dipper

COPY DEADLINES
June 1st for July issue
Sept 1st for Oct/Nov issue

Summary of Minutes of the Council Meeting held on 17th March 2001 at the Environment Agency, Brampton, Huntingdon.

Present: J. Nunn (chair), M. Bailey, R. Bamber, F. Dipper, I. Killeen, A. Bunker, A. Little, J. Moore, F. Evans.

Council composition. Dale Rostron has resigned. Council will propose Anne Bunker for Council member at the forthcoming AGM. She will continue to maintain the Porcupine website for a nominal fee. Council was reminded that the Society will contribute towards heavy expenses incurred by members attending Council meetings.

At the last AGM, formation of the new posts of Hon. Chairman and Hon. Publicity Officer was agreed; this requires ratification at the forthcoming AGM. It was decided that the post of Hon. Chairman is to be confirmed but that that of Hon. Publicity Officer would be left in abeyance, pending clarification of the role of such an officer.

Website: It was reported that the website was on-line and will be further developed. Suggestions for this are welcome. The site has a hit counter. To publicise the site, sticky labels giving its URL (address) are to be attached to our promotional leaflets. It

was also proposed that separate leaflets, simply printed, should be produced to publicise the site. A regular half-yearly change of a leading feature was required to maintain interest, possibly with earlier material from the newsletter. This should be organised at the next Council meeting. Links to other societies should be listed.

Newsletter: To date all the newsletters under the current editorship have been produced on time although the next issue will be a week or two late due to the time spent by the editor organising Porcupine 2001.

Conference and AGM: The next conference and AGM will be in Edinburgh 2002, where the Society began, to celebrate our 25-year anniversary. In this connection Shelagh Smith is writing a history of Porcupine, which is to be produced as a booklet. The Edinburgh meeting will be organised by Sue Chambers with the suggested dates at about the same time of year as the 2001 meeting. Easter would not clash with this date. A firm date for the meeting is to be arranged as soon as possible. The topic will be 'The marine natural history of the North East Atlantic', with no restriction *via* a specific theme.

Finance: The Society's funds are down about £850 on last year due to the production of new leaflets and recording cards and the production of four instead of three newsletters. Finances remain healthy and the reduction in our credit balance is considered desirable to support the activities of the Society.

Membership: This stands at 193 with 20 new members joining in 2000.

Recording: Activities were at a low level. Recording cards are now available.

Field meetings: The July 2000 field meeting aboard the Newcastle University research vessel to the Trink followed by shore collecting on the Farne Islands was poorly attended. The organisation of the next field meeting in Dorset, undertaken by Peter Tinsley, is well advanced. Suggestions are needed for the 2002 field meeting. Shelagh has offered to lead a trip to the Firth of Forth.

Poster: The Society's promotional poster is progressing. Sue Chambers will send a draft copy for the consideration of Council before production is undertaken. A proposal to seek sponsorship for the poster was not agreed.

Further matters: At the next Council meeting sponsorship of the activities of the Society is to be considered.

MINUTES OF THE TWENTY-FOURTH ANNUAL GENERAL MEETING OF PORCUPINE MARINE NATURAL HISTORY SOCIETY

Held at the Environment Agency, Brampton, Huntingdon on Friday 16th March 2001.

Chair: Julia Nunn

1 Apologies for absence

Ivor Rees, Shelagh Smith, Susan Chambers, Lin Baldock, Judy Foster-Smith, Dennis Seward, Jan Light, Pamela Thomsett.

2 Minutes of last AGM

These were accepted.

3 Matters arising from the last AGM

The publicity leaflet has been produced and is being distributed. The new logo is now in place.

4 Officers reports

Hon. Treasurer, Jon Moore

Details of the finances are shown in the accounts. Income increased in 2000. Expenditure also increased because there were 4 issues of the Newsletter instead of the usual 3, with concomitant extra postage, and the leaflets and recording scheme cards were printed. We have therefore used part of our capital in order to get the society moving.

There were 194 members in 2000, of which 166 were full members, 10 were library memberships, 3 were life members, 6 were student members and 9 were free (these latter included the copyright libraries). It was enquired whether membership was tax deductible, to which the answer was that it was if you were employed in Marine Sciences.

The Report was accepted following proposal by Frances Dipper, seconded by Mike Bailey.

Hon. Editor, Frances Dipper

There have been three newsletters since the last AGM. New material is always needed. Papers from this meeting will go into the Newsletter, not a separate journal. Material published in the Newsletter can be peer reviewed if the authors require it. Information requests, short articles, advertisements for your own interests, information on web sites and links can all be included, and it's a great vehicle by which to reach around 200 like-minded people.

The Report was accepted following proposal from Roger Bamber, seconded by Ken Collins.

Hon Records Convenor, Jon Moore

Jon passed the reporting to Jenny Mallinson.

She reported that there is a sub-committee comprising:

Jan Light checking record validity

Lin Baldock trying to promote local links and publicity

Jon Moore advertising the scheme through the website

Jenny Mallinson providing articles on the scheme to the Newsletter

So far there has not been a great response. There was a request to all to read the article on the Website and in the Newsletter, and send in records. Jon Moore had cards available at the meeting.

The Report was accepted following proposal from Anne Bunker, seconded by Dick Hamond.

Chairman, Julia Nunn

Jon and Frances were thanked for their reports. There have been two meetings of Council: one in October at the Natural History Museum, (thanks go to Roger Bamber for hosting/organising), and one just before this meeting. It has been a year of consolidation after the frantic activity of the pre-ceding year, so there is not so much to report.

The annual meeting last spring (2000) in Plymouth was a great success. The convenors of this years meeting (2001), Mike Bailey, Frances Dipper, Annette Little and Anne Bunker, were thanked for organising and running the meeting at the Environment Agency, Huntingdon.

The publicity poster is in the final stages of preparation by Sue Chambers. The draft poster will soon be circulated around the Council.

The Trink Field meeting was not very well attended. Judy Foster-Smith was thanked for organising the trip. The next field meeting is in early May near Swanage, organised by Peter Tinsley. There will be a team of divers there from JNCC. Details will be on the Website shortly.

It was decided that this year that Anne Bunker would be employed to take the Website forward. Anne Bunker reported on progress with the website: Mike Bailey was thanked for constructing the initial stages of the

site. The address for the site is: **www.pmnhs.org.uk** Different search engines vary in the how it is picked up. Anne asked that if any idiosyncrasies are spotted, that they be reported to her. The site is still being generally developed, and Anne requested that feedback is sent to her. There is also now a hit counter. The current feature is about *Sabella*. The idea is to change the feature every 6 months. Anne asked for any ideas such as suggestions for links. The meeting was invited to inspect the site on Jon Moore's computer during the weekend.

Anne Bunker was thanked for her hard work in organising the successful launch of the site.

The Report was accepted following proposal from Annette Little, seconded by Frank Evans.

5 Ratification of new honorary posts for Constitution

It had been proposed to Council that there be two Honorary posts added to those already mentioned in the Constitution of the society 1. Chairman and 2. Promotions and Publicity Officer. Council proposes not to pursue post 2 at present, as a definition of the role of the post must be clarified. Council proposes that the Constitution, paragraph 2, should now read:

'This Society shall consist of Hon. Chairman, Hon. Secretary, Hon. Treasurer, Hon. Editor, Hon. Records Convenor, an appropriate number of Council members, in addition to ordinary members.'

The ratification of the post of Chairman was accepted following proposal by Jenny Mallinson, seconded by Jon Moore.

6 Election of Officers and Council

There are currently 16 Council members. Dale Rostron has resigned. The rest of the Council has expressed their willingness to continue. The post of Hon. Secretary remains vacant. The Chairman asked if there were any offers from the floor. The Council has nominated Anne Bunker to join Council as she's working on the web site. It was pointed out that if any one would like to join at a later date they could be co-opted onto the Council.

Roger Bamber proposed an en-block election, Ralph Robson seconded. As there were no objections the council for the next year is as follows:

Julia Nunn: Hon. Chairman
Frances Dipper: Hon. Editor
Jon Moore: Hon. Treasurer & Hon. Records Convenor

Mike Bailey, Roger Bamber, Anne Bunker, Susan Chambers, Frank Evans, Judy Foster-Smith, Nigel Grist, Annette Little, Bridget Loveday, Ian Killeen, Ivor Rees, Shelagh Smith, Peter Tinsley.

7 Any other business

Frank Evans congratulated the Society for providing the seed money that enabled production of the Cullercoats List of Marine Flora and Fauna. This is available from the Dove Marine Laboratory at the full price of £95, with a 10% reduction for Porcupine members. Judy Foster-Smith was thanked for almost single handedly assembling it and seeing it through to publication.

The Chairman was delighted to announce that the Council proposed that Ian Killeen be made a Life Member of the Society. Frances Dipper spoke for the Council in proposing Ian for the huge amount of work done for the Society as Secretary, and in organising no fewer than 3 meetings such as this weekend. He expressed his delight in accepting.

As there was no further business, the Chairman declared the meeting closed.

PORCUPINE

RECEIPTS AND PAYMENTS ACCOUNT

for the year ended 31 December 2000

Year to 31.12.99 £	£			Year to 31.12.00 £	£
		RECEIPTS			
2		Subscriptions-	1997 & 1998	51	
1247			1999	172	
10			2000	1572	
10			2001 & 2002	60	
	1259				1855
	89	Bank Interest (net of tax)			76
	0	Sale of PN Back Number			10
	1348	Total Receipts			1941
		PAYMENTS			
883		Newsletter-	Printing	1965	
183			Postage	438	
1066		Total Newsletter Costs		2403	
0		Bank charges		5	
0		Membership leaflets - printing		357	
0		Recording Scheme cards - printing		94	
0		Hon Sec/Treas Expenses		125	
214		Council expenses		58	
1000		Executive Officer Honorarium		0	
	2280				3042
	(932)	**SURPLUS BEFORE MEETINGS & DONATIONS**			(1101)
	0	**MEETINGS** – Plymouth (2000)			361
	0	**MEETINGS** – Huntingdon (2001)			(99)
	0	**DONATIONS**			0
	(932)	**SURPLUS (DEFICIT) FOR THE YEAR**			(839)
	5140	**BALANCE BROUGHT FORWARD**			4208
		BALANCE CARRIED FORWARD			
2383			Current Account	1503	
1825			Deposit Account	1866	
	4208				**3369**

J.J. Moore

Jon Moore, Hon Treasurer
16th March 2001

N. Light.

Nick Light, Hon Auditor

MEETINGS, MEETINGS, MEETINGS, MEETINGS, MEETINGS

PORCUPINE MEETINGS

Porcupine Field Trip
Isle of Purbeck, Dorset 5-7 May 2001

A long weekend exploring the shores and seabed of this beautiful part of Dorset - including the Purbeck Marine Wildlife Reserve.

Accommodation is in the Brenscombe Centre, near Corfe Castle. Based on shared rooms (max 4 per room, but we can spread out) with all meals and 24hr tea/coffee provided.
Cost: £39.95 per night.

There will be a diving option, working from RIBs - costs no more than £3 per dive. Shore visits will include the Kimmeridge Ledges, Studland Bay/Old Harry and possibly Poole Harbour.

Call Peter Tinsley on 01929 481044 for more details and an application form (or visit the Porcupine web site www.pmnhs.org.uk)

PORCUPINE 2002
15-17TH March 2002, Edinburgh
'The marine natural history of the North East Atlantic'

In 2002 our annual conference will be in Edinburgh, to celebrate Porcupine's 25th anniversary. Porcupine has its origins in Edinburgh and it seemed fitting to return there. The conference is being organised by Dr Susan Chambers, contact her on: s.chambers@nms.ac.uk Further details in the July issue.

OTHER MEETINGS

26-28 April. Marine biodiversity in Ireland and adjacent waters. Ulster Museum, Belfast. Contact: julia.nunn.um@nics.gov.uk

5-10 May. Biodiversity of Coastal Marine Ecosystems. Pattern and Process: A EuroConference. Corinth, Greece. Contact: www.esf.org/euresco

6 June. CoastNET Dynamic coastlines: Practical Steps towards implementation. SOAS London. Contact: Bob Earll 01531 890415, www.coastms.co.uk

8-11 July. Changing Coastal Margins: Chemical Processes and Dynamics. 6th Annual Cerci Conference. Scarborough Centre for Coastal Studies first annual conference. Contact: m.barry@biosci.hull.as.uk

2-6 August. 7th International Polychaete Conference. Reykjavik, Iceland. Contact: www.ni.is/7ipc

7 August. Achievements of the Continuous Plankton Recorder Survey and a vision for its future. Royal College of Physicians, Edinburgh. Contact: jama@dml.ac.uk and www.npm.ac.uk/sahfos/cprsymposium.htm

19-21 August. The 7th Circumpolar University Co-operation conference. When Distance is a Challenge. Tromso, Norway. Contact: Frits.Jensen@arctic.uit.no and www.arctic.uit.no/cua

21-25 October. 7th International Conference on Coelenterate Biology (ICCB) Annual European Meeting of the International Society for Reef Studies. Eilat, Israel. Contact: team4@congress.co.il and www.congress.co.il

4-8 November. ECSA 32. An Estuarine Odyssey, St. Petersburg, Florida. Contact: Mark Luther luther@marine.usf.edu

25-29 November. Baltic Sea Science Congress 2001. Past Present and Future a joint venture. Stockholm, Sweden. Contact smf@smf.su.se

REVIEWS

A History of Oceanography: Susan Schlee (Robert Hale, London, 1975, ISBN 0 7091 4559 4)

Review by **Frank Evans**

The world of second-hand books always seems to contain much of value that I have overlooked and Susan Schlee's volume was one of my better late purchases. It tells the story of the development of oceanography from an American viewpoint and is thus particularly revealing to a British audience. In it we have an overview of the progress of the discipline through a century and a half, from the predominance, first of hydrography, then of marine biology and finally of physical oceanography, as at the same time much of the scientific lead migrated from Europe to the United States.

After a momentary glance at such earlier interests as those of Newton in tides and Boyle in salinity a base line is set in the first part of the nineteenth century and the story kicks off in 1838 with an expensive American farce. This farce, named the United States Exploring Expedition, is little-known among British students yet it was an enormous enterprise involving six naval vessels over a period of nearly four years in which a ship was lost with all hands, eighty thousand miles were covered and for which Congress had voted $300,000, by my reckoning around £20 million of modern money. And this presumably did not include the wages of the warships' crews.

It would be hard to imagine money worse spent. The whole project was devoid of focus. No proper arrangements were made to deal with collections. For example, plants sent back by the expedition to America from the Hawaiian Islands were carried by commercial ship to Valparaiso, thence to China and were finally discharged at Havana. There were few civilian specialists to examine the finds. Such physical results as had been obtained were dealt with by naval officers with little expertise in the subject. The volume on hydrography, written by the expedition's leader, Lieut., subsequently Rear-Admiral, Wilkes, was not published until 1873, over thirty years past its sell-by date. At the Smithsonian the Curator "ineptly unpacked the collection, parts of which he inadvertently ruined and parts of which he proudly gave away to his admiring friends".

Meanwhile in a quieter corner American hydrography was merging into physical oceanography as rivals Maury and Bache took soundings and measured ocean currents, most particularly in the Gulf Stream but also across the width of the Atlantic. At the time people were unsure whether currents were caused by wind or by density differences but gradually,

albeit in a simplified form, the truth began to emerge. In 1856, in the oddly inappropriate *Nashville Journal of Medicine*, William Ferrel introduced the first ever discussion of the effect of the earth's rotation on ocean currents.

Following the Civil War the US Fish Commission was set up under S. F. Baird. He established a summer station in temporary quarters at Woods Hole, Massachusetts, having spent several holidays there. Much of the cost was found by "friends of science", as indeed it has been subsequently; he was a successful fund-raiser. Many other US marine establishments have been similarly funded, examples at random being the admired Lamont Geological Observatory and the Captain Alan Hancock Foundation, whose publications had greasy salutations to the Captain alternating with scholarly research papers. On the West Coast marine laboratories sprang up about fifteen years later than Woods Hole and tended to develop as part of a college or university. In 1892 the Scripps Institute at La Jolla, California, was begun by William Ritter, in a tent. E. W. Scripps was a wealthy and philanthropic newspaper owner. Neither Scripps nor Woods Hole has ever looked back. As noted, their principal interests, especially towards the beginning, were in marine biology.

Over the next ninety pages Schlee skilfully considers early oceanography in Europe, most of which will be familiar to Porcupine members and will not be further discussed here. There is mention of HMS "Porcupine" herself and a very good consideration of the achievements of the "Challenger" Expedition, and indeed the whole section is very well done.

As the century ended familiar names from mainland Europe begin to appear. These included the Swedes, Ekman and Otto Pettersson and the Norwegians, Nansen, Helland-Hansen (who first computed the speed and direction of geostrophic currents) and Bjerknes. Interest began to focus more closely on the physical characteristics of the oceans, greatly aided by the arrival of reliable reversing water bottles with protected and unprotected thermometers.

Perhaps the apex of achievement of physical measuring was attained by the German vessel "Meteor". This vessel set out from Wilhelmshaven in 1925 in a bid to elucidate the total water movements of the Atlantic. By now it was thought that the basic structure of this ocean consisted of four layers, warm surface water, Antarctic intermediate water, Atlantic deep water and extremely cold bottom water and not the two simple layers of warm and cold water earlier imagined. On her return to Germany in 1927 this more complex pattern was largely confirmed by the results of thirteen precise east-west crossing between latitudes 20° North and 55° South occupying over three hundred stations, and supplying in addition thirty three thousand echo soundings. The material was very efficiently handled and published in sixteen volumes.

But as physical oceanography was advancing marine biology was dividing. The interest in general marine biology was undiminished (as I have noted elsewhere, fifty years ago every zoology professor in the UK had studied some aspect of marine biology) but the demands of the fishing industry were calling for special attention. The advent of steam increased fishing pressure and the question of whether annual catch variations were natural or induced was becoming urgent. Although America had long had fisheries problems, particularly with Pacific salmon, Schlee's attention dwells on Europe and the International Council for the Exploration of the Sea, inaugurated under the patronage of King Oscar II of Sweden in 1902. The investigations of the fisheries of the North East Atlantic were aided by the use of fish

tags, first implemented by the Dane, C. G. J. Petersen, by the aging of fish by scale rings, practised by Friedrich Heincke of Germany and much advanced by the Norwegian, Johan Hjort, and by the advent of the First World War which, by reducing fishing pressure, gave a graphic indication of the separate effects of fishing and natural mortality. Schlee's writing is far from dry and she records Hjort as being almost as well known for his volcanic temper as for his fine work.

A largely American chapter is devoted to the Second World War. Interest now became concentrated to a huge degree on the passage of sound in water, obviously related to the detection of submarines by asdic (sonar). The mapping of density discontinuities on a vast scale was demanded for this and for other submarine operations. Older Porcupine members may recall seeing, or even using, a bathythermograph. These were expensive American-designed brass instruments which recorded temperature and depth on a smoked glass slide while the ship was under way and they were not very common in European laboratories. An indication of US industrial strength is given by the fact that by 1945 sixty thousand bathythermograph profiles in the North Atlantic alone had been collected from American vessels. It was during this time, also, that the widespread existence of underwater biological sound was first perceived and largely interpreted.

Schlee's book concludes with a chapter on sea-floor spreading. Until the mid-century Wegener's postulation of continental drift was in abeyance (it has been said that the old guard of geology professors would have to die off before it could be given proper consideration). Among the classical sciences, geology, unlike physics, chemistry and biology, lacked a basic theory. This was supplied through the first full understanding of sea-floor spreading in 1963, although I recall hearing Professor P. M. S. Blackett in 1959 revealing that he had demonstrated continental movement through the carbon dating of Australian aboriginal domestic fires, whose fossil magnetism deviated further from the current magnetic poles the older they were. From several directions continental drift was a theory whose time had come.

The discovery of sea-floor spreading, although made by Frederick Vine at Cambridge, was the result of a large American exploration programme. Numerous American geologists were making seismic examinations of the sea floor, discovering the overlying sediment thickness (too thin to accord with the supposed age of the earth) and looking hard at the volcanoes on the mid-oceanic ridges. Vine's validation of the theory derived from a large number of magnetic anomaly readings from towed magnetometers. This is well known. What is less well known is that at the same time highly automated gravitational measurements were also taken in great quantity worldwide from shipboard and these measurements, although of interest and importance, yielded no such spectacular results. We observe once again the large and diverse power of American marine research.

Schlee leaves us in the 1970s as the drilling ship "Glomar Challenger" drives through hundreds of feet of seabed sediment to bite into the basaltic basement below. Typically, she tells us that the ship's name is partly for the Global Marine Company, owners of the vessel and partly in honour of HMS "Challenger".

If you find the above of interest and if you see a copy of this book, then I recommend you buy it.

Sea Beans and Nickar Nuts. A handbook of exotic seeds and fruits stranded on beaches in north-western Europe by **E.Charles Nelson**. BSBI Handbook No 10 (Botanical Society of London, 2000. ISBN: 0-901158-29-1)

Review by **Frances Dipper**

When this little book arrived in the post one morning, I was going to put it aside to look at later in an idle moment. I was still reading it at lunchtime. Being an inveterate beachcomber both in this country and abroad, I have always been fascinated by the amazing variety of flotsam and jetsam that gets washed up on the shores. After reading depressing reports from the Marine Conservation Society about categories of beach litter and SRD (Sewage Related Debris i.e. everything unmentionable), it was a pleasure to find that some nice things also get washed up! The book covers the history, folklore, origins and identification of all the various drift-seeds that arrive on our shores and shores in the rest of north-western Europe. We are even told which ones have a chance of germinating and how to nurture the resulting plants if you succeed.

The first part of the book is the bit to sit down and read for interest. Some of it is slightly hard work and not designed for late night sessions, but there is plenty there that is fascinating and entertaining. It has sections that cover amongst other things, buoyancy and flotation times, ocean currents, how and where to look for sea beans, how to grow them, and what significance and interest they are to biologists (e.g. colonisation of new islands such as Surtsey). The second part of the book has a short identification key followed by a descriptive catalogue of 55 species.

I now know that my single, treasured sea bean is in fact *Entada gigas*. It makes no difference as I just use it as a worry-bead. But it's nice to know!

Definitely one to buy.

By the way, in case you were wondering, "Nickar Nuts" are amongst the earliest reported drift seeds, the first record being in 1698 from the Orkney Islands. A *Knikker* in Dutch was a boy's marble baked in clay. Don't misspell it as "knicker nuts " could have quite another connotation.

Members at the Porcupine 2001 workshop Sunday session (photos by Jon Moore)

PORCUPINE PROBLEMS
Information requests

Information request 1. From: Jane Lilley, Lance's Cottage, Parkgate Rd., Newdigate, Surrey RH5 5DY.

Sensory appendages in fish

A number of British fish species belonging to several families have sensory barbels or modified fin rays which are used to detect prey. Examples include several gadoids with chin barbels. Bib *Trispoterus luscus* and poor cod *T. minutus* both have a chin barbel and what appears to be a bifurcated first pelvic fin ray, (or perhaps the first two rays are separated in their lower parts) used for 'feeling' the substrate. Red mullet *Mullus surmeletus* have a pair of long chin barbels, gurnards have the first three pectoral fin rays modified into feelers and pogge *Agonus cataphractus*, have a large number of short barbels on the underside of the head. When I see these when diving, these sensory appendages almost always appear dead white in colour, often strikingly so. Can anyone suggest a reason for this?

Response to query re *Cereus pedunculatus* beds

Jane Lilley received a response to her query in the July 2000 (No. 5) issue of the Porcupine newsletter. Her original query mentioned large beds of *Cereus pedunculatus* dominated by specimens with only two disc patterns. Marco Faasse replied quoting a paper in the Proceedings of the 23rd European Marine Biology Symposium (Swansea 1988) by Shaw, P.W.: seasonal patterns and possible long-term effectiveness of sexual reproduction in three species of sagartiid sea anemones. Apparently Cereus pedunculatus reproduces sexually further south in Europe, but in Britain, young are entirely or almost entirely produced parthenogenetically. So the predominance of a smaller number of disc patterns is explained by this.

Information request 2. From: Shelagh Smith, Woodleigh, Townhead, Hayton, Brampton, Cumbria CA8 9JH. E-mail: shelagh@smithurd.demon.co.uk

A history of Porcupine

It is proposed that I, as a founder member of Porcupine, write a history of the first 25 years of Porcupine, from its beginnings to its present status as the **P**orcupine **M**arine **N**atural **H**istory **S**ociety.

I would much appreciate help from members (and ex-members). Do you have any anecdotes or photographs of people, meetings and field meetings which would be useful, factual and entertaining? Photographs would be returned and acknowledged if used.

As the 25th annivarsary meeting is in Edinburgh in March 2002, I hope to complete the history before this and launch it at that meeting. Therefore I would like to set a deadline for receiving items of 1st September 2001 to give me time to write and to allow for peer review. I look forward to receiving your contributions!

PORCUPINE PIECES

The Porcupine Recording Scheme

Jenny Mallinson

S.O.E.S, Southampton Oceanography Centre,SO14 3ZH (jxm@soc.soton.ac.uk).

One of the stated aims of PMNHS is to gather species records. To this end the Porcupine Recording Scheme is an attempt to revive the concept of the very successful Observation Scheme that was run by the Marine Conservation Society in the 1980s. Divers, snorkellors and rock-poolers sent in their observations on simple record cards. A regular summary of these was written for the MCS Newsletter, generating further reports which could reveal national trends or patterns. It was simple and successful.

With a lot of thought about what was wanted by Porcupine from such a scheme, a working group of four, Jon Moore (the PMNHS Hon. Records Co-ordinator), Jan Light (Conchological Society Marine Recorder), Jenny Mallinson and Lin Baldock, launched the new recording cards in 1998. Cards were printed and put on the website (www.pmnhs.org.uk), with instructions. Two cards were sent to every member, that is 400 cards - a significant proportion of our stock. None has been returned YET, although some verbal records and letters have been received. The cards are probably in your 'Porcupine file' but, just in case you have lost them, there is a page in the back of this Newsletter for you to photocopy.

Initial results - A start has been made.

Verbal records have been received from five (out of 194) Porcupine members, the rest are from divers and fishermen. These records have been grouped into six categories:

1. Unusual species

Boar fish *Capros aper* (Maggie Gray). Everything about this record is amazing. The species (backed up by superb photographs) which would be more at home in the Mediterranean, the location in 9m (seen in the same place on two consecutive days), close to the inhospitable surf of the Portland end of Chesil beach, and the time of year, late November 1997, all seem to be at odds for this tiny (4-5") fish – an exciting observation.

Ocean sunfish *Mola mola,* (Mike Markey) is occasionally seen in the Southwest (Herdson, 2001). This record, an 18" – 2' specimen, seen at the surface in Poole Bay in June 2000, follows a similar sized one 'rescued' off Weymouth in 1990 and taken to Southsea Sea Life Centre, and one seen by a diver on their first dive at Kimmeridge. Can anyone help with closer dates and location of the latter two?

Zebra bream *Diplodus cervinus* (Ken Lynham) caught by a fisherman in monofilament net off Portland. Thought to be a first, one was also reported off Cornwall to the National Marine Aquarium ('Today' Radio 4, 23.3.01).

Crab *Goneplax rhomboides* (Nick Weeks) trawled from the East Solent, more common in sand off Devon and Cornwall.

Mantis shrimp *Rissoides* (*Meiosquilla) desmaresti* (Jenny Mallinson) from Southampton Water, where a few have been caught in the past by the marine lab at Fawley and University of Southampton and North Wales by Rohan Holt. There are historic records from the South West so these animals may be more widespread than current records suggest. Their distinctive burrows may have been seen in Poole Bay but the animal itself has yet to be seen off Poole.

The large anemone *Arachnanthus sarsi* (Jon Moore and Ben James) from the East coast of the Shetland

Islands mainland – a first record for the Shetlands.
Starfish *Stichastrella rosea* (Jane Lilley) from South Uist, Jane asks if this is commonplace or not?

2. Species outside their expected range
Devonshire cup-coral *Caryophyllia smithii* (Mike Markey), in Poole Bay. They are being spotted further east all the time but this patch of over 50 in a square foot is the furthest so far.
Pink sea fan *Eunicella verrucosa* (Mike Markey) Reasonably common in Lyme Bay, Devon and an isolated 'twig' off Chapmans Pool, Dorset. This well developed colony in Poole Bay will be closely monitored.

3. Unusual (or is it usual?) seasonality
John Dory *Zeus faber* (Lin Baldock) in Poole Bay in March. Recorded for 7 of the last 10 years on the Poole Bay Artificial reef (Mallinson, *et al* 1999).
Moon jelly *Aurelia aurita* (Jenny Mallinson) in Horsea Island 'lake', an enclosed reduced salinity site near Fareham, Hampshire. Believed to breed throughout the year at Horsea, their scyphistomae, strobilae and ephyrae were identified and photographed for the first time by divers in November and have been monitored monthly ever since.

4. Identification queries (we have or can get photos and/or specimens, if anyone can help)
Juvenile seahorse (Linda Percy) found in a plankton trawl from Poole Harbour. The National Marine Aquarium thought it could be a broad nose pipefish ?
Sand smelt (Jenny Mallinson), **anemone** (Christine Wood) and **spirorbid worm** (Colin Stead) all from Horsea, Hampshire. None sampled yet, undergoing further investigation.

5. Behaviour
Sponge *Cliona celata,* soft coral *Alcyonium digitatum, nudibranchs Tritonia nilsodhneri, T. hombergi, Aeolidia papillosa, Onchidoris bilamellata,* and starfish *Porania pulvillus* (Jane Lilley). Growth rates, feeding, defence, breeding, etc are described for specialists in the field of these groups and written up (e.g. as articles in this newsletter) in an effort to learn more about these creatures in life.

6. Species list (with 'added value' - abundance and distribution)
Horsea Island lake, (Colin Stead). Detailed monthly accounts of sightings of some of the Horsea species have been submitted.

Identified fish records have been sent to the National Aquarium as requested by Doug Herdson, in MCS 'Marine Conservation' Spring 2001.

Support
So why was there such a low return from Porcupine members? Everyone has his or her own, perfectly valid, reason for not responding. Think, for a moment, beyond "I'm too busy" to "It is not important enough to me because .....". If your answer has anything to do with "They won't do anything with it, anyway .....", then fear not. That is the next part of our investigation and it will depend upon what Porcupine members are prepared to support.

This is your project
You must provide the data you want co-ordinated. How do you want this done? We can only decide what to do with the data when we know what it is we have to do something with. We can't work with 'If only ....' and 'What if .....?', that would be inefficient (we are busy, too!). If we receive accurately identified, verified records, they will be entered into the database that Jon has prepared and copied to specialists in the relevant field. If we get "I saw a green crab and a yellow starfish", that will be treated somewhat differently.

Jon is particularly keen to receive the detailed authenticated records of interest, which experienced marine

observers in Porcupine can provide. Jan and Jon will consider a system to verify identification for the less experienced members and for less familiar groups. Lin and Jenny intend building on current success, by putting 'visitors observation' type books and a less daunting fun version of the recording card in dive shops and on boats. It works for bird-watchers and might even bring in a few more members.

How do we proceed ?

The project will only succeed if it saves time and people actually want to use it. I find it does just that. People tell me about their rare sightings (and I am sure I am not alone in this), and I then feel responsible for these significant biogeographical records. What can I do with them? They can't even go in my logbook as I didn't see them. But they mustn't be wasted. By using the Porcupine recording card, the appropriate questions can quickly be addressed, notes jotted down and, with minimum effort, the record is there, ready to move to the next stage.

We would like to receive records that you think are interesting. It may be a species that you had not seen before in that area, a particularly high abundance or some other apparent change. If you want to check whether the species has been recorded in that area before, a good start is to search the JNCC's 'Mermaid' database on www.jncc.gov.uk/mermaid/. It should give you an idea of the known distribution and rarity of marine invertebrates.

If you have views on how PMNHS should handle its claim to be collecting records, this is your opportunity to have a say and an effect. Send in some records - a record - in whatever form you think is best for PMNHS.

If you are recording anyway, you could photocopy your species list and send it to Jan. For quick submission of individual species, yours or those reported to you, there is Jon's web version. It needn't take more than 10 minutes. If the dive shop you frequent has a sympathetic proprietor, try giving them a notebook and a few simple instructions and check on it now and again. Tell Lin. Jenny will be delighted to receive cards with whatever information anyone would like to offer. All will be acknowledged. When we see what members want us to work with, the working group will decide how to make best use of the data received.

There are other ways to promote a project; this can be seen by looking at those that work well. Without doubt, a vast amount of work from dedicated organisers showing a constant presence produces successful results, e.g. *SEASEARCH* expeditions. Massive publicity and feedback, with all the resources and expense involved in that, may be another. However, both of these depend on volunteers and funding, neither of which has been offered.

The choice is yours. If PMNHS members don't want to do any of the above, this will be apparent from the response. We will re-consider at the end of the summer. N.B. If your access to the coast is restricted just now, records from last year will do just as well to make your point.

Acknowledgement

I would like to thank Jane and Peter Lilley for taking time to convey useful comments on the progress of this project.

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' PORCUPINE 2001. THE MARINE NATURAL HISTORY OF THE NE ATLANTIC: Long-term Studies'

Papers from the PMNHS meeting held at the Environment Agency, Brampton, Huntingdon from 16-18th March 2001

Long term monitoring of an artificial reef in Poole Bay, U.K.

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Abstract
A ten-year study of the epifauna and flora of an artificial reef complex in Poole Bay, Dorset has highlighted some interesting patterns of species settlement. Seven characteristic patterns of colonisation were identified, determined by the timing of first colonisation of the reef and subsequent seasonal appearance. Maximum taxonomic diversity on the artificial reefs was shown to occur between mid-July and early August, though the timing may differ for some groups of organisms (e.g. hydroids). Differences were found between artificial and natural reefs with the former generally supporting a more diverse biota (in terms of simple species numbers). However, sponges were very slow to colonise the artificial reefs. There were a number of species not yet recorded on the artificial reefs, but which were common on the natural reefs. This included five species of sponge. The implications of the sequence of the colonisation process and of the differences between artificial and natural reefs for the design of long-term monitoring studies is discussed.

Introduction
Consequent on the recent designation of marine SAC's (Special Areas of Conservation) around the UK coast, has come the requirement to develop programmes to monitor the status quo and to detect change in the marine communities for which the SAC has been identified. The Joint Nature Conservation Committee (JNCC) has been developing methodology suitable for quantifying change (or lack of it) in marine communities (Worsfold and Dyer, 1997). There has been on going discussion as to which species should be selected and how the monitoring would be best achieved. There are now draft guidelines published by the JNCC on monitoring in SACs (Davies *et al.*, 2000).

The ten-year study of an artificial reef complex in Poole Bay off the Dorset coast has generated the long-term data set discussed in more detail below. The results presented here have highlighted interesting aspects of the occurrence of some common species on the artificial reefs. These

observations serve to illustrate some criteria which need to be borne in mind when developing a monitoring programme and/or selecting taxa for long term study at a site.

Study Location and Methodology

The artificial reef complex was deployed in July 1989 in Poole Bay off the Dorset coast (Collins *et al.*, 1990). The study was initiated to investigate the environmental compatibility of cement stabilised coal ash and the fishery enhancement potential. Eight reef units were constructed of blocks 20cm x 20cm x 40cm: six units comprised blocks of pulverised fuel ash mixes. Two other units were built of concrete blocks to serve as controls. Blocks in each unit were arranged in a heap about 1m high and 5m in diameter in a water depth of 10m below chart datum.

Records of the epibenthic flora and fauna colonising the artificial reef units were made by an experienced diver using SCUBA equipment whenever opportunity offered over a ten year period between August 1989 and October 1999. Only certain taxa, reliably identifiable *in situ* by a diver, were selected for routine monitoring (Mallinson *et al.*, 1999). Records were also made from time to time on a number of natural rocky reefs located in Poole Bay. Data from these sites provided a comparison with the colonisation process taking place on the artificial reefs.

Results

A full list of taxa from the Poole Bay artificial reef has been reported by Mallinson *et al.* (1999) indicating those taxa recorded routinely *in situ*. A detailed study of the long-term data set from the reef complex identified a number of taxa which showed characteristic patterns of reef colonisation and/or seasonal occurrence. Seven broad groups of species records were identified:

- A species colonised the reef very soon after deployment and was present there after (e.g. *Nemertesia antennina*, Fig.1 and *Flustra foliacea*).
- A species colonised the reef rapidly and abundantly after deployment, but disappeared as the community matured (e.g. *Tubularia* spp., Fig.1 and *Vesicularia spinosa*).
- The species was slow to colonise, but once established was recorded regularly. Sponges, in particular, followed this pattern (e.g. *Dysidea fragilis, Hemimycale columella*, Fig.1) and the red weed *Delesseria sanguinea*).
- The species colonised the reef soon after deployment but showed a strong seasonal bias (e.g. *Leucosolenia botryoides, Bugula plumosa*, Fig.1 and *Clavelina lepadiformis*). Species in this category may be perennial but have resting stages not readily recognisable at all times of year.
- The species occurred somewhat erratically, dependent on a combination of environmental factors not achieved every year (e.g. *Laminaria* sporelings, Fig.1).
- The developing skills of the recorder during the course of the programme: i.e. "Did we fail to recognise it before?". For example on the Poole Bay reefs the red alga *Spyridia filamentosa* was first recorded in 1996 (Fig.1) but it is possible that the species may have been overlooked in earlier years.
- Rare species. Species with very few records over the monitoring period.

The present observations on a limited number of taxa have drawn attention to interesting differences between the artificial and natural reefs (Fig.2). This demonstrates the much higher overall

taxonomic diversity of the macro-biota on the artificial reefs on the majority of sampling dates, which is also true of the hydroids. By contrast, natural reefs support a wider range of sponge taxa than the artificial reefs.

In addition to these broad observations on taxon diversity, species have been recorded from the natural reefs that have not yet appeared on the artificial reefs. Species that are notably absent from the artificial reefs include:

Sponges
Dercitus bucklandi
Pachymatisma johnstonia
Stelligera rigida
Raspailia ramosa
Tethya aurantium
Sarcodictyon roseum
Worm
Bispira volutacornis
Mollusc
Tritonia lineata

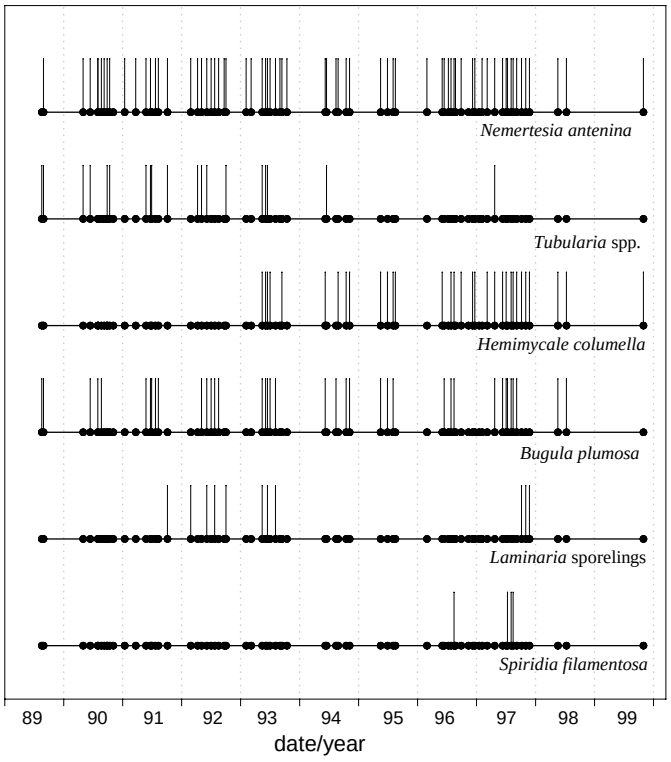


Fig.1. The presence (indicated by a vertical line) of six species on the Poole Bay artificial reef during surveys ( ) between 1989 and 1999.
Cnidaria

Discussion

Most taxa recorded during the ten-year study period can be fitted into one of the above categories describing reef colonisation and seasonal occurrence. The recognition of these different groupings has implications both for the planning of a monitoring programme and for the interpretation of the results. In particular the following points need to be among those considered during the planning phase.

Taxon selection. It is necessary for the type of investigation undertaken in this instance, to select those taxa that can be reliably identified in the field by an experienced surveyor. Furthermore, the likely seasonal occurrence of the selected taxa, as categorised above, in the habitats of interest must complement the aims of the monitoring programme.

A suitable time of year must be selected during which to undertake the survey. The precise timing will, to a certain extent, be determined by the aims of the survey and the particular taxa and/or habitats of interest. Should the period of maximum species diversity be selected? This would be mid-July to

early August in Poole Bay. Local seasonal, environmental factors will also influence timing. For example, in Poole Bay in August, huge masses of detached algae routinely smother reef surfaces making it difficult and very time consuming to record taxa accurately from many reef habitats. If a certain taxonomic group is of special interest mid-July might be too late to record the maximum diversity of the group (e.g. hydroids which tend to be more abundant from
mid- to late June).

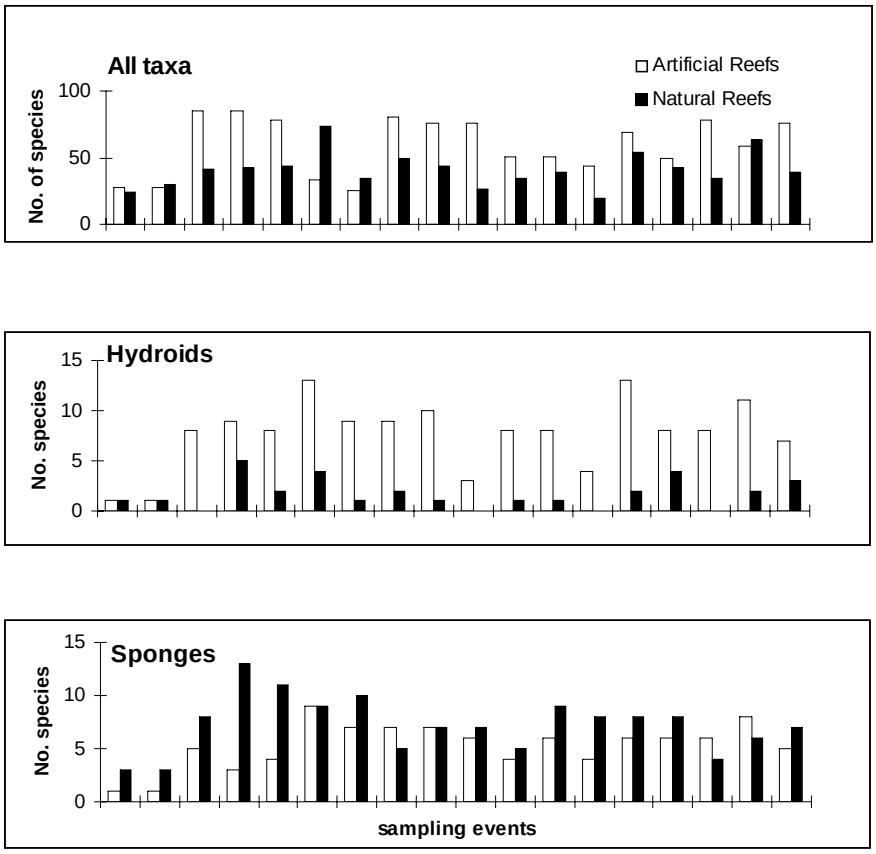
Last but not least surveyor selection. Accurate local knowledge and consistent identification and recording of the selected taxa are essential. Consistency during the fieldwork will greatly facilitate interpretation of the results and comparison with subsequent surveys.

The results presented above highlight the importance of season in determining the taxa likely to be recorded during a study. Furthermore, other site-specific factors, which influence the species distribution, were identified: location and age. Location within Poole Bay is critical. The inner reefs, which include the natural reefs visited during the present study, are subject to lower current velocities and hence higher levels of sedimentation than the artificial reefs. This in part explains the richer hydroid and bryozoan fauna on the artificial reefs that experience higher currents speeds (up to 0.6ms-1 during spring tides, Smith *et al.*, 1998) and also the denser algal growth. The affect of reef age on the species present is exemplified by the pattern of colonisation by sponges.

The absence of certain species from the artificial reefs that are present on the natural reefs is likely to be due to a complex web of differences in the structure of the two habitats. The nudibranch *Tritonia lineata* is probably absent because its preferred prey organism, the octocorallian *Sarcodictyon roseum* has never been reported from the artificial reefs, but occurs abundantly on the natural reefs. Substrate stability and aspect are also important for some sessile species. The polychaete *Bispira volutacornis*, and the two sponges *Pachymatisma johnstonia* and *D. bucklandi* tend to inhabit crevices. It is possible that the artificial reefs do not provide sufficiently stable fissures for these species to colonise. Additionally, the two sponges often occur in overhangs or on relatively large vertical surfaces, another micro-habitat not represented on the artificial reefs. The absence from artificial reefs of the sponges, *Stelligera rigida, Raspailia ramosa* and *Tethya aurantium* is more difficult to explain, though these species seem to prefer relatively large areas of low lying rock and are tolerant of a certain amount of silt cover, at least in the Poole Bay area. Competition with algae may be a factor here: algal growth on the natural reefs is less diverse and considerably less dense in comparison with the artificial reefs.

Acknowledgements
The initial studies on the Poole Bay artificial reef were sustained by funds from National Power and PowerGen. Subsequent research was supported by the Ministry of Agriculture, Fisheries and Food (MAFF) for a number of years. The long term monitoring aspects of the study were made possible by the participation of members of the Southampton University's Department of Oceanography diving team and many volunteer assistants over the years.

Fig.2. The total number species of all taxa, hydroids and sponges recorded concurrently on artificial and natural reefs in Poole Bay between 1989 and 1999



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The Natural History Museum Stranded Whale Recording Scheme

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Introduction

For almost a century, the Natural History Museum in London has been recording and examining the carcasses of whales, dolphins and porpoises that have stranded around the coasts of the British Isles. The result is an invaluable database of biological and ecological information, supported by an extensive skeletal and anatomical research collection not rivalled anywhere else in the world. Today, the Environment, Coastal and Marine Sector of the Natural History Museum studies stranded whales, dolphins and porpoises under two Government contracts. The first is a contract awarded by the Department of the Environment, Transport and the Regions to the Natural History Museum. Under the terms of this contract, we are asked to undertake the following work:

To find out how many cetaceans are stranded or wash up on the coasts of England, Wales, Scotland and Northern Ireland each year
To determine their species
To record where and when they strand
To arrange, if suitable, their transportation to the Institute of Zoology at London Zoo, so that a full post-mortem examination can be made by veterinary staff (or get the vet to the carcass if it is a large animal)

The second contract was awarded by the former Welsh Office to the NHM, and has the following objectives:

Work out the ages of stranded toothed cetaceans by looking at growth lines in their teeth
Identify all the parasites found both internally and externally during post-mortem examinations
Identify the stomach contents found during the post-mortem examinations.
To fulfil this contract we rely heavily on several of our colleagues in other Divisions at the NHM.

Scientific background

Very little is actually known about causes of death in cetaceans around the British Isles. Without this knowledge it is difficult to interpret the significance of individual strandings or the sudden die-off of large numbers of animals. For example:

In 1992 more than 100 dolphins were accidentally drowned in fishing nets off Southwest England.
In 1988 a newborn bottle-nosed dolphin found stranded in Cardigan Bay, Dyfed, was tested for pollutants and very high levels of contaminants were found in the blubber.
In 1993 a new *Brucella* organism was found in marine mammals around the UK.

It is very important that we try to get information about every carcass as soon as it appears so that we can, if possible, arrange for a post-mortem to be carried out. However, although a decayed carcass will not yield much information about health or feeding habits, it will still tell us something about the distribution of the different species and the age of the individual animals.

Legal background

In 1324, a statute was enacted giving the sovereign the right to cetaceans (known as "Fishes Royal") stranded on, or caught in the waters around the coasts of England & Wales. Scotland has a different legal system and the

situation is slightly different there. In Scotland, Royal Fish are cetaceans over 25 feet in length, except for bottle-nosed whales and long-finned pilot whales, which are not Royal Fish whatever their length. Legally, the situation has become further complicated by some local exceptions such as the Duchy of Cornwall and the Cinque Ports, where strandings are actually the concern of the Duke of Cornwall (Prince Charles) and the Warden (The Queen Mother) respectively, rather than the Queen. However, it is always safest for us to presume that a carcass cannot be disposed of without the permission of the Receiver of Wreck.

In 1913 the Board of Trade and the then British Museum (Natural History) set up a scheme for recording strandings of whales (including dolphins and porpoises), and the Natural History Museum still has first claim to these carcasses. The Stranded Whale Recording Scheme is now part of a co-ordinated investigation funded since April 1990 by the UK Department of the Environment, Transport and the Regions, into the biology and ecology of cetacean populations around the British Isles. It is a contribution to DETR's programme of research on the North Sea and its response to ASCOBANS (the **A**greement on the conservation of **S**mall **C**etaceans **O**f the **B**altic **A**nd **N**orth **S**eas). The Institute of Zoology at London Zoo and the Scottish Agricultural College in Inverness are also involved in this research, and have responsibility for co-ordinating post-mortem investigations into the causes of death of cetaceans and seals found around the coasts of England, Wales and Scotland respectively. In Northern Ireland, the Ministry of Agriculture's Veterinary Science Division based at Stormont undertakes this work.

Procedures

All UK cetacean strandings and cetaceans accidentally caught at sea are reported to the Natural History Museum using a special telephone number which is monitored 7 days a week, 365 days a year (020 7942 5155). Recent reports have been received directly from members of the public, Local Authorities, the RSPCA, the Environment Agency, County Trusts, sealife centres, or via organisations such as the Police, Coastguard and the Royal Museums of Scotland. If we receive a report of a live stranding, it is immediately passed on the RSPCA, the SSPCA or USPCA, with a view to keeping the animal alive and possibly returning it to the sea. As much information as is feasible is obtained over the telephone on the precise location, species, size and condition of the animal, and if dead a decision is made on whether to collect the carcass for detailed examination and post-mortem investigation, either at the Institute of Zoology or in situ. Failing this, arrangements are made for its immediate disposal which is usually carried out by the Local Authority concerned, who can then claim some financial assistance from the Receiver of Wreck, but only if the Receiver is informed in advance of removal of the carcass. We may ask the finder to further assist us in keeping the carcass safe from drifting away, by dragging it above the strandline or tying it to a suitable anchor. We may also ask that the carcass be marked by tying an identifying label with the name of the reporter and the place and date of stranding around the tail. This label will be useful if the cetacean is reported to us twice, either from the same beach or from a different location if it floats away again on the tide. If the carcass is that of a toothed whale and is not worth dissecting, we ask the informant to volunteer to cut off a piece of lower jaw with four to six teeth in it, which will then be used to age the animal. **We always stress**

that strong rubber gloves should be worn when handling dead animals, as some diseases can be transmitted to humans.

We are greatly helped in our work by the Cornwall Wildlife Trust (01872 240777), Brixham Seawatch in South Devon (01364 631578), and Marine Environmental Monitoring based in Wales (01348 875000), to whom strandings are reported locally before the information is passed to the Natural History Museum in London. This is because the Southwest of England and Wales have particularly high numbers of strandings, and it is better for local specialists to examine carcasses while they are still fresh, rather than waiting for staff to travel down from London. For this reason, the Institute of Zoology also makes use of experienced vets in Cornwall, Merseyside and Norfolk. Scottish strandings are reported to the Scottish Agricultural College Veterinary Investigation Centre (01463 243030), and in Northern Ireland to the Ulster Museum in Belfast (028 90665510). All the data from these strandings is then passed on to the Natural History Museum in London, where the information is collated and entered into the NHM strandings database. This is then used to produce distribution maps and information about the biology and ecology of each species. These are presented as regular reports to the Department of the Environment, Transport and the Regions and the Welsh Office, and when suitable are published in the scientific press. All data received since 1913 has now been entered into this database and several species new to UK waters have been recorded. Additionally, the collections and exhibitions at the Natural History Museum have been considerably enhanced by this work. Similarly, the data from all cetacean and seal post-mortem examinations is entered into a database at the Institute of Zoology. Reports and scientific papers can then be produced on such aspects as diagnosis of cause of death, diagnosis of live stranding in a cetacean later found dead, correlation between contaminant levels and disease, reproductive and immunological status.

Some preliminary findings

There are usually between 250 and 450 cetaceans reported either stranded alive or washed up dead on the coasts of the United Kingdom in an average year. This can increase dramatically if there is a series of mass strandings such as there was in Orkney and Shetland in 1983, or some other unfortunate event such as the multiple drownings off Cornwall in 1992. The most commonly stranded cetacean species is the harbour porpoise - *Phocoena phocoena.* This is the smallest cetacean found in UK waters and is generally under 2 metres in length, with no beak and small spade-shaped teeth. This is followed by the common dolphin - *Delphinus delphis,* which can be up to 2.8 metres in length with a 15-centimetre beak and pointed, roughly conical teeth. The harbour porpoise is found all around our coasts, while the common dolphin is concentrated in the Southwest of England. Other species have different distributions - the white-beaked dolphin, *Lagenorhynchus albirostris*, is more common in the North Sea. Larger animals like the great sperm whale - *Physeter catodon*, the fin whale - *Balaenoptera physalus* and the minke whale - *Balaenoptera acutorostrata,* are rarer and more often found in Scotland than in England. Some exotic species are only found stranded years apart, such as the narwhal - *Monodon monoceros,* last found in 1949, and the white whale or beluga - *Delphinapterus leucas,* last found in 1932. The first British Fraser's dolphin - *Lagenodelphis hosei*, a species usually found in tropical waters, was found stranded in the Outer Hebrides in 1996, whilst in 1993, 1997 and 1999, a total of five specimens of Pygmy sperm whale - *Kogia breviceps,* stranded in North

Devon, Carmarthen Bay and on the south-west coast of Scotland.

Data from the NHM strandings database shows that year on year, harbour porpoise account for roughly half of all reported strandings. Similarly, analysis of data across the whole period of recording shows that changes in apparent species distribution may be occurring. For example, numbers of harbour porpoise observed along the English Channel coast in the last half of the twentieth century appear to have declined significantly when compared with data for the preceding 40 years. The reverse is true for the Cardigan Bay area of Wales, where observed numbers of harbour porpoise appear to have increased over the past few decades. Of course, improved reporting procedures combined with a rapidly growing UK network of observers, has helped to increase figures and coastline coverage overall. Great opportunities now exist for comparing data with that held by other organisations, which have been studying different aspects of marine life in UK waters.

The Natural History Museum would not be able to continue recording strandings without the invaluable help of all those individuals and organisations who have previously been mentioned. Their dedication, care, resourcefulness and attention to detail has made, and continues to help make an important contribution to our understanding of cetacean strandings, and for this we owe them our very great thanks.

Monitoring and Management of Wash shellfish stocks since 1990

Matt Mander

Eastern Sea Fisheries Joint Committee, 6 North Lynn Business Village, Bereen Way, Kings Lynn PE30 3JG

Introduction

The main aim of the Eastern Sea Fisheries Joint Committee is to regulate, protect and develop fisheries within the Committee's District, in a manner that ensures sustainable viability for the foreseeable future and compliance with the Committee's environmental responsibilities.

This approach can be seen clearly in the Committee's effort to manage the molluscan fisheries in the Wash.

The legislation that enables the Committee to regulate the Wash cockle and mussel fisheries is a combination of Byelaws and the Wash Fishery Order 1992. The latter enabled the Committee to limit exploitation by restricting the issue of licences to fish, closing areas to fishing, specifying types of gear and operating seasonal closures and quotas (T.A.Cs).

Examples of the application of these measures on the fishery, include that:

The level of entitlement holders has fallen from in excess of 120 to 68. During the previous season a maximum of 26 vessels were known to have exploited the fishery.
Sands are closed regularly to safeguard spatfall.
Approved gear must be used onboard each vessel; a current example is the design of the riddle used.

The fishery does not open until there is enough evidence to prove that the adult stock has spawned.
The fishery does not open unless there is over 3000 tonnes of fishable stock available to the industry. A T.A.C of 30% of the total fishable stock has been used since 1995. The quota is applied to the estimation of stock, given by the extensive spring surveys.

The fluctuations in the recruitment level to any bivalve fisheries means that the management of the commercially exploited stocks is difficult. The introduction of these measures did not change the short-term prospect of the fishery. It was hoped that, with the controls in place, they might help reduce the effect felt during periods of poor recruitment in the future.

Surveys
Naturally enough, the survey techniques used today are very similar to those that have been used by MAFF and subsequently by CEFAS. The cockle surveys are still carried out during the spring and autumn. The autumn surveys are used primarily for the assessment of spatfall and are still conducted by CEFAS and ESFJC. The spring surveys, used to assess the total biomass, have been the remit of Eastern Sea Fisheries since 1992. Intertidal mussel beds are surveyed by ESF during the late autumn using a standard technique that had been adopted from CEFAS.

Since 1992, there has been a slow but significant divergence from the original survey technique, in regard to the spring surveys. The lack of exploitable stock on the traditional beds in the Wash, meant that the surveys were expanded in order to cover the vast majority of the intertidal beds, which were below 4 metre drying height. The increase in the area meant that the traditional transect surveys undertaken at low water, could not cope with the coverage required. Grab sampling over the high water periods using a day grab with a $0.1m^2$ opening, allowed for these beds to be surveyed fully and indeed reduced the distance between the sampling points. The low water period continued to be utilised in the 'traditional' manner but the primary function is now to validate the accuracy of the samples taken by the grab. The change in survey technique has allowed the sampling interval to be standardised at 350m; previously the sampling interval was at least 500m and could be as high as 1km. The change in survey technique was initiated in 1995 and was fully adopted in 1998. The introduction of onboard DGPS and mobile DGPS has also increased the accuracy of the surveys.

The fishable stock available to the fishery has been quantified by estimating the total biomass of cockle with a shell width of 14mm or greater. It should be noted that there is no MLS (minimum landing size) in the Order but the Industry has worked to these limitations. The minimum landings size for mussel is currently 45mm.

Utilisation of GIS software to aggregate survey datasets has greatly advanced the determination of bed area and hopefully the accuracy of the results. The MapInfo package also provides a database for all the survey results that are in a format readily available to other users.

Cockles
The fortunes of the fishery have been very mixed with the highest landings at the start and end of the decade and with a complete closure of the fishery in 1997.

During the 1990's the fishery has been heavily dependent on strong single year classes. The 1992-year class supported the fishery in both 1994 and 1995. The 1997-year class supported the fishery in both 1998 and 1999. It is envisaged that the recruitment from the heaviest spatfall recorded in 1998, will support the fishery in 2001 and

hopefully beyond. The spatfall in 2000 was also much heavier and widespread than normal but was confined to the southern and eastern sides of the Wash. The greater spatfalls at the end of the decade have eased worries about the state of this fishery.

The period between heavy spatfalls and subsequent successful recruitment, which can significantly increase the stocks, has occurred throughout this century on an average of once every 6 –7 years (Bannister and Dare 2000). The recruitment from the spatfall is a more important indice to the health of the population than the magnitude of spatfall. The mortality of cockle through the first winter in the Wash is normally high at 85 – 90 %. The mean survival rate is much higher in the Thames estuary (26%) and the Burry Inlet (39%). In 1995 there was no appreciative recruitment from a moderate spatfall in 1994.

The Wash is a dynamic environment and stocks are vulnerable to periodic damage from extreme conditions. The severe north easterly storms at the beginning of 1996 removed thousands of tonnes of cockle from the beds.

The autumn survey in 2000 showed that the location of the spat cockle was generally across the areas that harboured low densities of adult stock. It is known that adult cockle may reduce settlement by ingestion of settling larvae and juveniles, or smothering by sediment displaced in burrowing and feeding (Montaudoin and Bachelet 1996). Recruitment may be dependent on adult population density (Andre et al.,1993). Other factors may have contributed to the pattern of distribution recorded. Wind induced currents were found to influence the transport of larvae to suitable settlement sites within the Wash (Young 1996).

The immediate future for the Wash cockle fishery and the wider ecology would seem to be good. The adult 1998-year class cockle is set to support the fishery for at least another two years, given favourable natural mortality rates. The possibility of stabilising the overall population structure, by the recruitment of another strong year class, makes the first winter mortality of the spat cockle very important. The total fishable stock identified from the autumn surveys was 26743 tonnes compared to the low of 379 tonnes in 1997.

Mussel

The level of exploitation of the intertidal beds from the mid 1980's was high with very few restrictions imposed. No maximum level of exploitation from the public fishery has been set, and this area should be addressed to safeguard stocks, when settlement does re-occur on the intertidal banks. Indeed, the reduction in the MLS from 50mm to 45mm in 1986, increased the stock available to the fishery. The fishery became nearly entirely dependent on these stocks and by the beginning of the 1990's, the remaining scalps were under extreme pressure.

The only significant intertidal beds remaining within the Wash are situated on the Gat Sand. These beds reflect the fortunes of the fishery as a whole (Figure 1). This area has been closed to fishing since 1994. The total stock on these beds by the end of 2000 was estimated at 4155 tonnes, compared with 4080 in 1999. Mussel situated on high scalps continued to be relayed to more suitable ground by the industry, for on-growing.

The effect of the high exploitation rate was compounded by the lack of settlement on these intertidal scalps. The recruitment in 1995 was higher than in the early 1990's, but the stock was lost during the period of north easterly gales that had accounted for the cockle. This lack of recruitment remains the main concern of the

Committee and the other organisations that have a commitment to the Wash.

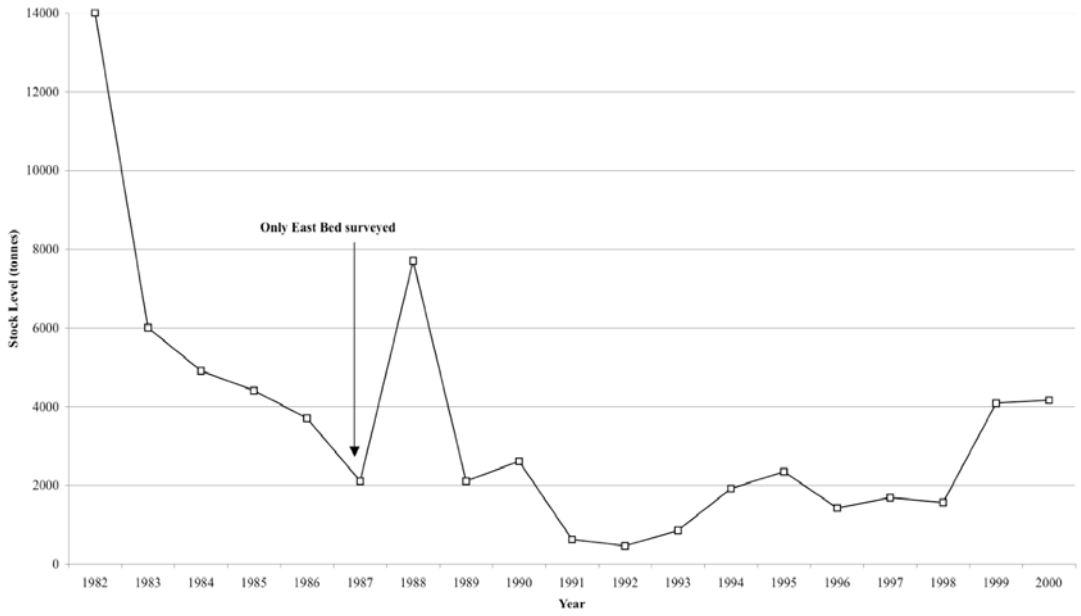
The emphasis at present has turned to look at the availability of suitable substrate for settlement. Spat collector programmes have indicated that the level of spat present in the water column may not be the inhibiting factor to settlement.

The possibility that the dredging has not just removed the mussel stocks, but has also changed the substrate characteristics, has yet to be investigated. A project has been organised to commence in early 2001, to look into mussel settlement and links with available substrate types. Historically the Wash has harboured numerous intertidal scalps. The number of these productive public beds has fallen from 14 at the beginning of the 1980's to one - the present Gat beds.

This was unfortunately symptomatic of the increase in pressure on the public intertidal stocks, by the private lay fishery. The success and expansion of the cultivated fishery since 1997 stemmed from the exploitation of seed mussel from subtidal sources within the Wash. The ESFJC surveys, undertaken annually, had failed to identify any mussel beds during 2000. This meant that the Industry had had to look for alternative supplies for two successive years. The residual stock that had survived in other areas of the Wash, mainly across the Mare Tail region, had been fished heavily for diminishing returns during the autumn. The stock situated on the Gat beds offered a much more accessible stock.

The fact that the Gat beds had remained closed to fishing meant that the majority of the Industry had refrained from fishing illegally. Any natural regeneration of the public beds would depend on the intertidal

Figure 1 : Total Mussel Stock on the Gat beds 1982 - 2000



The fishing activity on the Mid Gat during 2000 was the most conspicuous, but further dredge tracks were located on the other Gat areas. The surveys indicated that all the beds had suffered from reduced coverage.

settlements being allowed to establish permanent beds. The closed areas would have to be extended to encompass these areas. The requirement to supply the private several fishery with juvenile mussel

would increase the pressure to exploit these stocks.

The inefficiency of the Baird dredge in removing mussel situated in runs and drains on the sands, was thought to have been a natural protection for this stock against high exploitation. The level of stock situated within these areas was hard to estimate, due to the natural low coverage across the sand. The prolonged fishing effort had eventually allowed access to this stock and it was removed from the public fishery. The shift from the exploitation of the public intertidal beds must be achieved to allow for possible natural regeneration of the stock. The cultivated fishery should not be reliant on intertidal stock within the Wash to continue the production cycle when subtidal seed is not available.

The benefits to the wider ecology from the Several fishery should be remembered. The level of stock held on the leased ground, by the end of 1998, due to relaying, was equivalent to the total stock on the main public beds. The distribution of the lay ground saw the introduction of stock to some of the areas that had previously harboured natural stocks.

The lack of recruitment to the cockle fishery for three years 1995 – 1997 combined with the ongoing problems with the mussel fishery had triggered concern. Other cockle fisheries are known to suffer from periods of poor recruitment including the Dutch Waddensea, which experienced a serious cockle spatfall failure in 1993 – 1996. The same is true of the Dutch mussel fishery that had successive failures during 1988 –91(Bannister and Dare 2000). The prolonged absence of significant recruitment on the intertidal mussel beds and the effective collapse of both fisheries at the same time in 1996, had the effect of concentrating minds, culminating in the setting up of the Wash Forum.

Of all the possible factors that can affect the populations of both cockle and mussel, the one measurable and controllable action is that of fishing. A continued high exploitation rate, coupled with poor recruitment, is bound to have an adverse effect on the size of the populations. The cockle stock has come through a low period and is now buoyant again but measures including a further reduction in TAC levels must be looked at.

The mussel fishery has undoubtedly suffered from over exploitation. The lack of suitable substrate would be just a further compounding of the original problem of over fishing. The hope that the fishery can rebuild itself in the medium term is fading. The return of the public fishery will become more reliant on a large scale restocking programme of the intertidal beds, possibly by utilising sublittoral stocks. The fact that good mussel spatfall occurring in the Wash appears to be higher after a cold winter, would seem to reduce the chances of natural regeneration further, bearing in mind the shift in temperature due to global warming. The importance of these features to the Wash ecology means that their re-establishment will remain the top priority of the Committee.

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Long-term studies of bivalves in Dublin Bay, Ireland.

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(Jim Wilson was unable to present this paper at Porcupine 2001 due to the foot & mouth epidemic)

Summary

The population densities of the prominent bivalves in Dublin Bay have

been followed over the past 20- 30 years. Most species showed a decline in numbers in the decade 1985 – 1995, which in the case of *Cerastoderma edule* at one location led to the species' virtual disappearance. However, older records suggest that these low numbers may not be exceptional, and may also be tied in to a 6-7 year cycle. Since 1995, there has been a recovery in most species/sites, and a spectacular ten-fold increase in the numbers of *Tellina tenuis*.

Introduction

There have been relatively few studies dedicated to long-term monitoring of bivalve populations, with the exception of such as those of Beukema and of Reise in the Wadden sea (e.g. Beukema 1979, Decker & Beukema 1999). However, through the EC COST 647 programme, data on selected species was collated, giving both a spatial and temporal perspective on population fluctuations (Desprez et al. 1991, Ducrotoy et al. 1991, Essink et al, 1991). Arising from such studies was the finding that certain species such as the cockle, *Cerastoderma edule* showed remarkable temporal variability, to the extent that in some years populations could be at a very low ebb, to be followed within a couple of years by densities high enough to play a major role in the induction of anoxia, as has been suggested in the Somme estuary (Rybarczyck *et al*. 1996). On the other hand, the populations of other, often sympatric, species such as *Macoma balthica* showed no such dramatic fluctuations. Such fluctuations, great or small, were more extreme at continental locations than under the temperate Irish climate, leading to the conclusion that population fluctuations could be correlated with climatic variability.

Beukema's (Decker & Beukema 1999) populations of *Tellina (Angulus) tenuis* in the Wadden sea are greatly affected by harsh winters, and Barnett and Watson (1986), working in the Firth of Clyde also suggested a link, but Wilson (1997) found no relationship with temperature, seasonal or annual for the same species in Dublin Bay. In fact Wilson's findings (Desprez *et al*. 1991, Ducrotoy *et al*. 1991, Wilson, 1993, 1997), which show a long-term decline in all the common bivalve species in the Bay, would seem to indicate a long-term, and perhaps permanent, shift in the environmental conditions. This paper sets out to identify the long-term trends in populations of the most abundant bivalves, to verify if a common trend among species or among sites within Dublin Bay can be identified.

Materials and Methods

Three sites in Dublin Bay, Bull Island, Sandymount and Blackrock (Figure 1) have been sampled more or less regularly over the past 20 years. Bull Island is a muddy sand habitat, with slightly reduced salinities (around 26 - 30‰) while the other two are cleaner sands in the open Bay at around mid-tide level and near LWN respectively. The samples were sieved through a 1mm mesh sieve and sorted, identified and counted in the laboratory. *C. edule, M. balthica* and *Scrobicularia plana* were sampled at Bull Island, *C. edule, M. balthica* and *T. tenuis* at *Sandymount* and *T. tenuis* and *Tellina fabula* at Blackrock.

Results

The average annual densities are shown in Figures 2, 3 and 4. For *M. balthica* (Figure 2) there were high densities in the early 1980s but these declined and have varied between around 40 up to 200 individuals m^{-2} at both Sandymount and Bull Island over the past 12 years or so. The populations at the two locations appear to vary in parallel, with the variations at Bull Island slightly more pronounced. There is perhaps some suggestion of a seven- year periodicity with peaks around 1986, 1992/4 and 2000 and troughs in 1991 and 1997/8.

Like *M. balthica, S. plana* (Figure 2) again peaked in 1986, but rapidly declined and densities have continued low since then, despite a mini-recovery in the early 1990s, and the recent samples have shown densities not seen since the 1980s.

The cockle, *C. edule*, populations are found at the same sites as *Macoma*, and like *Macoma* show a peak in the mid 1980s (Figure 3). However, the decline at both sites into the 1990s was marked, to the extent that they vanished completely from the Bull Island sample in 1993. Over the last five years or so, there appears to have been a partial recovery, at least to the stage where densities are back to those West *et al*. (1979) thought might represent 'historic' levels. However, these numbers rest largely on occasional collections of recent juveniles (≤ 5mm SL), so the picture may not be as rosy as it seems.

The *Tellina* densities (Figure 4) are presented on a log scale to allow for the extraordinary leap in numbers since 1995, which has seen the population at Blackrock increase more than ten-fold. The pattern at Sandymount mirrors that, albeit at a fraction of the density, at Blackrock, with the exception of a solitary peak in 1989, and again the past few years have seen population levels rise to previously unrecorded heights.

Discussion

Overall, the various bivalve populations in Dublin Bay show broadly similar patterns of population densities. Almost all were at their highest in the mid 1980s compared both to earlier (West et al. 1979, Wilson, 1983) and recent data. Again, almost all showed a decline into the early 1990s with recoveries, exceptional in the case of *T. tenuis* at Blackrock, toward the end of the Millennium. The declines have been particularly marked at Bull Island, where Wilson (1993) suggested that the increasing coverage by macroalgal mats was inhibiting juvenile recruitment into the sediments. However, inspection of recent data would seem to indicate that there is some settlement, even if not to any great densities, but that the survival to the following year is poor. Dublin Bay, and specifically Bull Island, is a wildfowl and wader reserve of international importance, supporting large numbers on a very prescribed area, and it would not be impossible for the feeding pressure of the birds to be keeping the densities down.

Wilson's (1995) speculations on the (then) decline of *T. tenuis* could find no link with bird numbers, or with environmental variables such as annual or winter temperatures. Dekker and Beukema (1999) have shown clearly the deleterious impacts of continental winters on *T. tenuis*, followed by external-derived recruitment. However, such severity of winters rarely visits Dublin Bay, and the rise in population density seen (Figure 4) at the end of the 1990s can be followed through the year classes from the 1-y-o cohort. Nevertheless, temperature may also have played a part, and it is tempting to adduce as supporting evidence the coincident appearance of the southern species *Abra tenuis,* again toward the latter half of the 1990s. This species is now found regularly in the Bull Island samples.

Although up to thirty years data is available, we are still far from a complete picture as regards population fluctuations, especially for these larger, long-lived bivalves, for whom this time may represent as little as two or three generations.

These data do give some pointers as to the relative influences of local *versus* large-scale climatic factors, and it is to be deplored that the COST 647 project (see e.g. Desprez et al. 1991, Ducrotoy et al. 1991, Essink et al, 1991) was discontinued just as it was starting to yield useful information.

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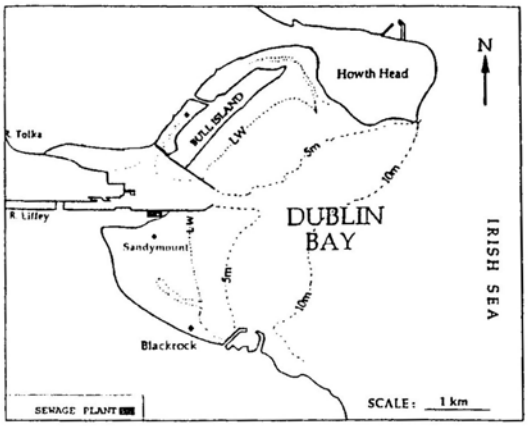

Fig 1. Map of Dublin Bay showing sample locations in relation to low water mark (LW).

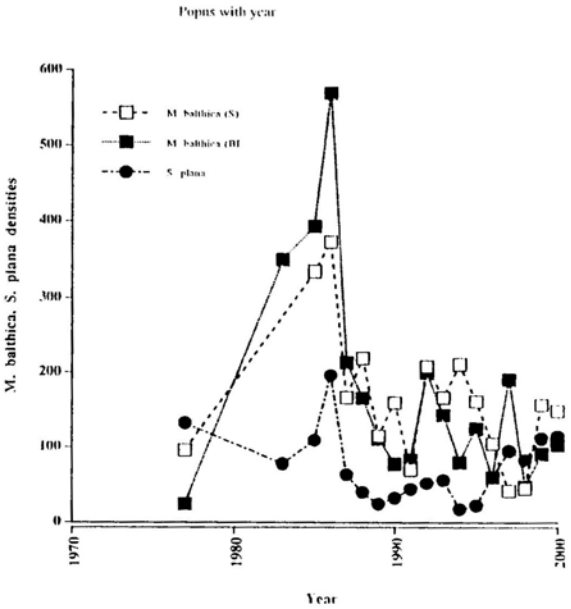

Fig. 2. *M. balthica* and *S. plana* densities ($N^o s\ m^{-2}$) at Sandymount (S) and Bull Island (BI) from 1977 – 2000.

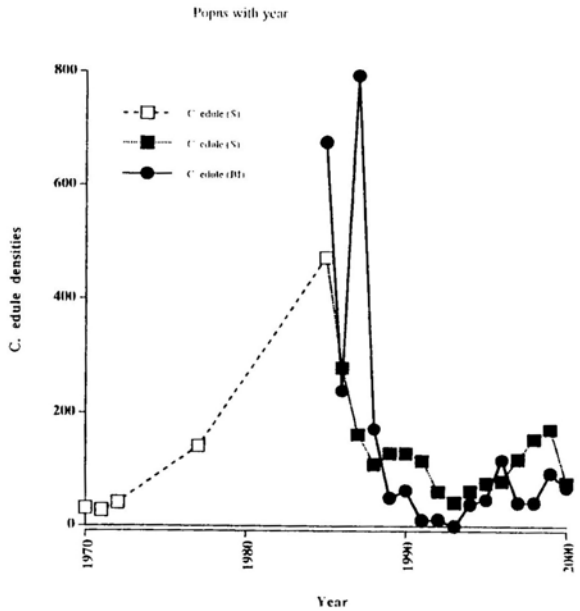

Fig. 3. *C. edule* densities ($N^o s\ m^{-2}$) at Sandymount (S) and Bull Island (BI) from 1970 – 2000.

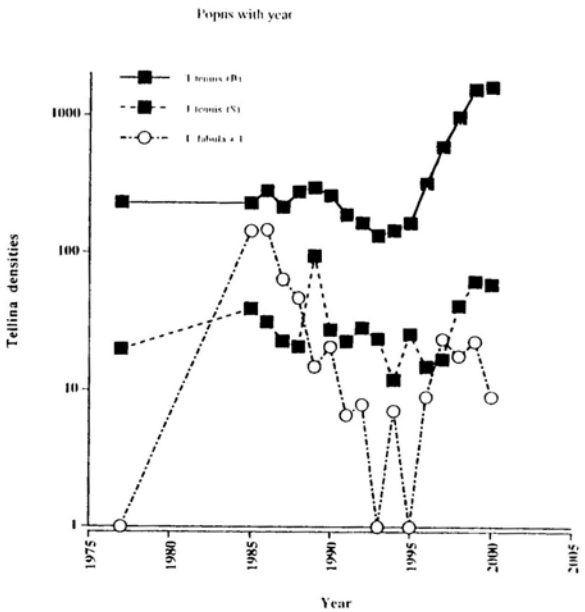

Fig 4. *T. tenuis* densities ($N^o s\ m^{-2}$) at Sandymount (S) and Bull Island (BI) from 1974 – 2000.

Brief Overview of the Wash

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My first talk at the Huntingdon meeting was a collection of photographs I had taken during two separate aerial surveys of the Wash, not easily reproducible in this newsletter! I did make some notes, the following were taken from Doody and Barnett (1987) and Bailey *et al* (1994) with a few personal observations. Most of the locations and features mentioned are shown in Figure 1.

The Wash estuary, perhaps better regarded as an embayment, and its four main tributary rivers forms one of the largest estuarine systems in Britain (by some definitions it is the largest, by others the Severn Estuary is).

Between Gibralter point and Hunstanton, the Wash embayment covers an area of *ca*. 700 km^2 at high water on a spring tide. At low water, numerous sand banks and mud flats are exposed. These cover about half the area of the wash, some 350 km^2.

Four main rivers discharge into the Wash, the total catchment area being some 15,650 km^2. The River Great Ouse, contributing 50% of the freshwater flow into the Wash, has an estuarine section downstream of Earith, a distance of some 60 km. The River Nene has a 40 km estuarine section from the Wash to the Dog-in-a-Doublet sluice. The Welland estuary extends 22km upstream to Spalding and the smallest of the four tributary estuaries, the Witham Haven, runs between the Grand Sluice in Boston to Tab's Head in the Wash (11km). There are several smaller rivers flowing into the Wash but even the largest of these, the Babingly (which joins the lower Great Ouse Estuary), is insignificant when compared to the four main tributaries.

The Witham and Welland estuaries have a common confluence, which is at Tab's Head. The boulders and rocks used here to construct the sea wall, provide the only habitat I am aware of that supports fucoid algae in the Wash and here are classic patterns of zonation, with *Pelvetia canaliculata* on the upper shore.

The tidal range in the Wash is about 6.5m on a spring tide, and on the biggest spring tides there is a 9-hour ebb and a 3-hour flood. 6m of tide in 3 hours = 3cm a minute = ½ mm a second = scary! The vast majority of our intertidal benthic samples are collected from the relative safety of a small boat.

The main water current in the Wash is an extension of the Norwegian current, itself an extension of the north Atlantic and Gulf Stream. This current flows in a SE direction from Scotland and likely transports waters from the Tees and Humber estuaries, as well as 1000s of tons of sediment. It has been estimated that between 30,000 and 120,000 tons of sediment are carried on each tide (depending on tidal cycle) – more than the total annual load from the rivers, estimated at between 40 and 170,000 tonnes.

The Wash is therefore a very turbid estuary, and light penetration is usually limited to at most 25 and 50cms. Very rarely, in the deepest waters on extremely calm days I have seen grabs at a depth of about 15 feet, more usually we just see the shackle coming out of the water.

There is a natural tendency for sediments to accrete in areas that are only covered by the highest tides, and historically these areas have been turned into agricultural land, once a sea wall has been erected and the salt

has been leached from the sediments. It has been estimated that 32,000 hectares have been lost to agricultural reclamation since the Middle Ages. Despite this reclamation, the Wash still has one of the largest salt marshes in Britain, with an almost continual fringe between Snettisham and Gibralter Point.

Seawards of Snettisham are large expanses of sandy beach, and these are very popular tourist areas, with Hunstanton and Heacham the main attractions. This NE corner of the Wash is where most of the water sports are carried out, with windsurfers and jet skiers in abundance in the warm weather. Elsewhere in the Wash, water activities are very uncommon, navigation and difficult currents being the main difficulties.

Apart from supporting an interesting and diverse benthic community the Wash is an internationally important area for nature conservation. It was designated as a SSSI between 1972 and 1976, was declared a RAMSAR site and Special Protection Area in March 1988 and was recently designated as a Special Area of Conservation. The Wash National Nature Reserve, in the SE Wash, is the largest in England.

The Wash is of national and international importance for waders and wildfowl and supports significant wintering passerines and breeding bird populations, twelve internationally important bird species and many species of national importance.

Latest surveys show the Wash to support a population of 4000 common seals, the 2nd largest in Europe after the Shetland Isles. This number has been revised from the 1978 figure of 7000 seals. Some of these losses were directly attributable to the phocine distemper virus in 1988, when 1400 corpses were removed from the Wash alone. However, previous populations had been overestimated due to the sampling methodology.

There are many commercial fisheries in the Wash. The mussel fishery is now limited to about 3 beds, one of them a private fishery off Hunstanton. The decline of the mussel fishery in the Wash has been well documented. Many of the historical mussel beds are now cockle beds, which are usually fished by suction dredges.

There is a large shrimp fishery in the Wash. Brown shrimp are mainly caught now, but historically there was a pink shrimp fishery associated with the *Sabellaria* reefs in the deeper sections of the Wash. The pink shrimp are still there, but have no marketable value and are not exploited.

More recently razor shells have been harvested, using modified suction dredges. On the western side of the Wash is an oyster fishery. Additionally, fin fish (e.g. skate), whelks and eels are exploited.

Finally, a quick mention of the bane of my sampling life in the Wash (no, not the Pilot cutters!). There are two live bombing ranges in the Wash, and a variety of fighter / bomber aircraft dive bomb both specifically located target barges (with real ammunition) and many other targets such as survey vessels and biologists on foot (though thankfully to date minus the firepower!).

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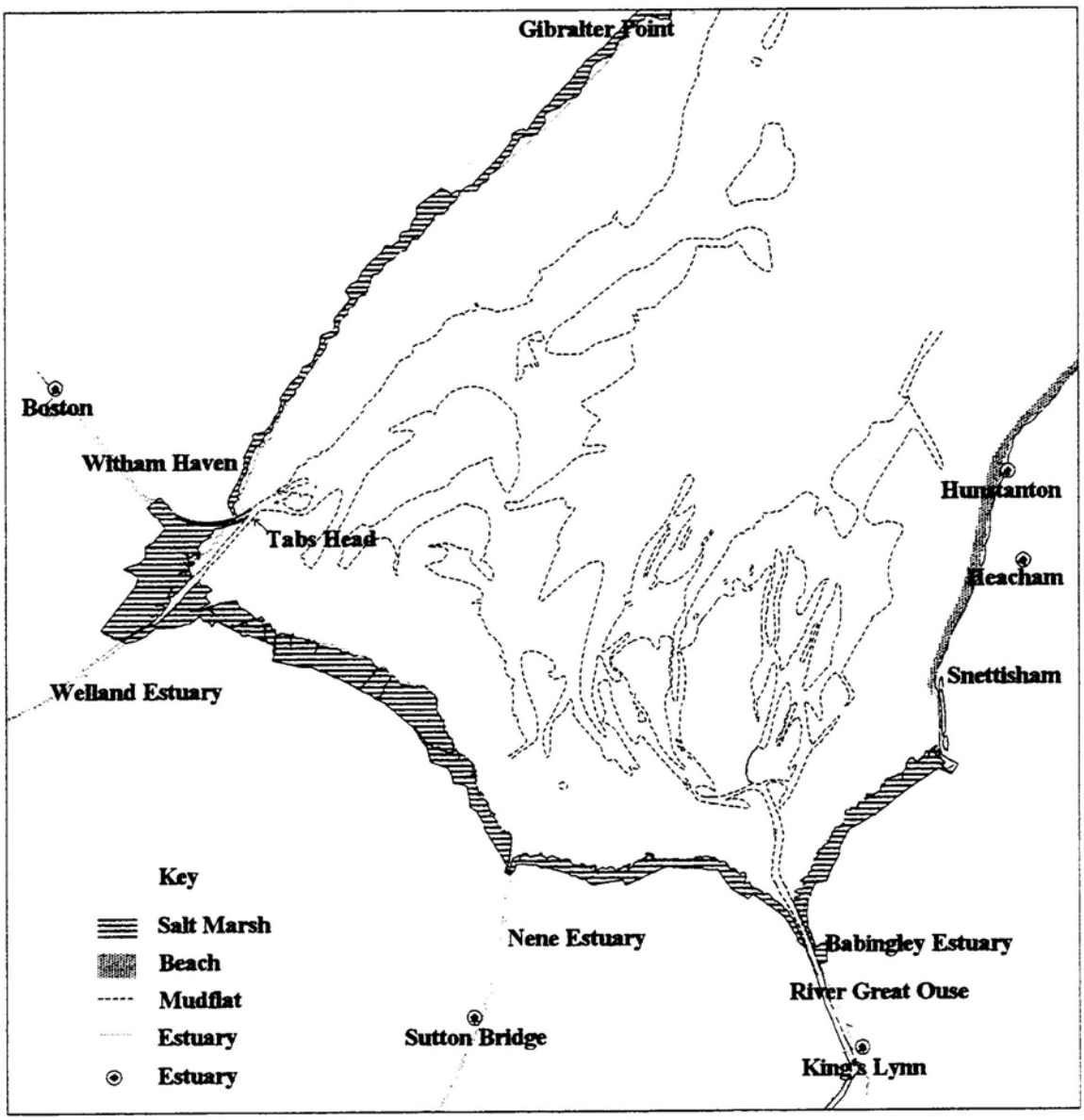
Figure 1



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