

PORCUPINE MARINE NATURAL HISTORY SOCIETY

NEWSLETTER



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Porcupine Marine Natural History Society

Newsletter

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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

 www.pmnhs.co.uk

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EDITORIAL

Many of us who call ourselves marine biologists of one sort or another, started our careers as students, research assistants or technicians in 'marine stations' such as those at Millport, the Isle of Man, Dunstaffnage and Sherkin Island. Many such centres of learning were started by individuals with a passionate interest in the sea, who knew the value of their local shores and seas well. I myself spent three happy years in the Isle of Man at Port Erin Marine Laboratory in the 1970s (yes I really am that old). The island has a wonderful marine heritage. I was therefore greatly saddened to hear (through the grapevine) that Port Erin will be closing in 2006. The Laboratory was founded more than 100 years ago in 1892.

Your Council felt that many Porcupiners would like to visit or re-visit Port Erin and so we are investigating the possibility of holding our own Annual Meeting, (Porcupine 2006) and field excursion at the laboratory. Look out for further news in subsequent newsletters and on your e-mail. Plans for Porcupine 2005, at the Natural History Museum in London, are well advanced and you will find a booking form on the Meetings page of this newsletter. The annual field trip will be in July based on the Wash and North Norfolk coast and with the chance to do some dredging from the Eastern Sea Fisheries excellent boat. Book early!

MEMBERSHIP REMINDER

Please check that you have paid your membership. Some members are in default by two years! If you do not currently pay by Standing Order, please consider doing so. If you do pay by standing Order please check that it is for £10 not the old rate of £8. We will shortly be contacting all those members whose subscriptions are not up to date, by e-mail or post. If you need details for Standing Orders please contact Seamus Whyte.

COPY DEADLINES

December 15th for the February issue

April 15th for the June issue

PORCUPINE MARINE NATURAL HISTORY SOCIETY ANNUAL MEETING 2005

COLLECTIONS, COLLECTORS, COLLECTING
**18th to 20th March 2005 at the Natural
History Museum, Cromwell Road, London
SW7 5BD**

The meeting will follow the format of talks and presentations on Friday 18th and Saturday 19th, held in the Flett Theatre in the Earth galleries section of The Natural History Museum, South Kensington. There is an area for posters adjacent to the Theatre, where they may be viewed during tea/coffee breaks.

Offers of talks and/or posters, either on the theme or on any appropriate subject, are welcome now.

We shall attempt to accommodate talks of from 20 to 30 minutes into the programme. Please specify equipment requirements.

Delegates will be thrown upon the more-than-adequate catering and refreshment resources of nearby South Kensington for lunches. The Conference Dinner will be held on the Friday night. Advance notice of intention to attend the dinner (plus payment of a deposit of £10) is essential. If there is sufficient interest, a pod (or pods) on the London Eye will be booked (at a discounted extra charge) for delegates to rotate together and view London prior to the conference dinner.

The Annual General Meeting of the Society will occur during Saturday's proceedings.

A 'field trip' will be organized on Sunday 20th to such venues as the Porcupine Sea Bight, Rockall, etc., utilizing as yet unsorted material held at the NHM. The delegates will be based in the large laboratory in the Darwin Centre. While a number of microscopes will be available, delegates are welcome to bring their own. Advance expressions of interest are required in order to ensure sufficient space for those wishing to attend, and particularly regarding the taxa in which attendees may be interested. During the day, Museum staff will be available to give behind-the-scene tours of the Darwin Centre and the collections held there.

A social gathering has been organized for those staying over Saturday night.

Options for accommodation will be circulated to those requesting them.

The registration fee for the conference, inclusive of tea, coffee, etc., but not lunches or dinners is £30 for members, £35 for non-members, with a reduced rate of £10 for bona fide students and for speakers.

Please contact either Roger Bamber (R.Bamber@nhm.ac.uk) or Roni Robbins (ronr@nhm.ac.uk) of the Zoology Department of the Museum. Fax: 020 7942 5433.

PORCUPINE FIELD MEETING 2005

The Wash and North Norfolk coast

Provisional dates 11th –16th July 2005 or part thereof

Plans for this meeting are now well underway:

Dredging in the Wash

Two days dredging from the Eastern Sea Fisheries comfortable and well-equipped boat have been arranged leaving from Hunstanton. Maximum number of people for the boat work will be 6-7 (plus Séamus Whyte or Frances Dipper). As we can have the boat for two days if needed, that is 12-14 places. Please let us know **now** if you are considering coming. The exact days the boat goes out will depend on interest and tides. Anyone expressing interest will be kept up to date with the plans by e-mail. We would like to take a mix of 'experts' in different groups eg. molluscs, worms, fish, crustaceans etc., plus others with a general interest or wanting to learn more. Data collected will be shared with the Eastern Sea Fisheries.

Norfolk shores

Depending on interest, visits will be made to sites where recent information on species and habitats is lacking and where we can both collect useful data and where those wishing to learn from the 'experts' can do so. These

may include saline lagoons, saltmarsh and seagrass. There is also a single rocky shore at West Runton. Again further details will be sent to those expressing interest as plans develop.

Please send expressions of interest and suggestions to:
 Frances Dipper (fdipper@dial.pipex.com) or Séamus Whyte (seamouse@ntlworld.com)

PORCUPINE 2005 Conference Booking Form

18th-20th March Natural History Museum, London

If you would like to attend the conference, please photocopy and complete the following form:

Name:

Postal address:.....

Telephone:.....Email:.....

Please delete as appropriate:

I would like an accommodation list Yes/No

I would like to attend the conference dinner Yes/No
 (I would like vegetarian food) Yes/No

I will be attending the laboratory 'field trip' on Sunday Yes/No

I enclose the conference fee of £30 (members) Yes/No

I enclose the conference fee of £35 (non members) Yes/No

I am a student and enclose reduced conference fee of £10 Yes/No

I am a speaker and enclose reduced conference fee of £10 Yes/No
 (to cover refreshments)

I enclose £10 deposit to guarantee conference dinner place Yes/No

I would like a receipt Yes/No

Total fee enclosed.....

Cheques should be made payable to 'Porcupine Marine Natural History Society'
 Cheques with completed forms and **offers for talks** (welcome!) should be sent with completed form to:

Ronni Robbins, The Natural History Museum, Cromwell Road, London SW7 5BD

Readers of PMNHS Newsletter

If you know of any events or conferences that might be of interest to readers of this newsletter, please send details to the editor(s).

The CMS Emailing Service

communicates a wide range of events, posts, consultations, tenders and services to the coastal and marine sector. For details of this service contact Bob Earll:

bob.earll@coastms.co.uk.

From 2005 onward CMS will run a series of one day conferences in conjunction with a wide range of organisations on coastal and marine themes under the Coastal Futures™ banner.

December 14th (Shoreham-by-Sea) and
January 25th (Greenwich)

Shingle Currency Seminars

Would you like to know more about the marine aggregates industry and its interaction with sea bed habitats and wildlife? Do you - or could you - get involved in decisions regarding aggregate extraction and usage in London and the South East (e.g. EIA consultations and minerals plans)?

Or are you involved in raising awareness of wildlife and conservation issues? If so, then you may be interested in attending a free seminar looking at the relationship between marine aggregate extraction and biodiversity. Visit the South East Marine Programme website at www.southeastmarine.org.uk Email: LisaB@hwt.org.uk

18th January 2005

Public Awareness of the Marine Environment

The Resource Centre, London

Organiser: The Wildlife Trusts

Aim: To bring together marine education and awareness providers from around the UK for networking, sharing of good practice and the discussion and development of a set of common messages that we can all promote.

Visit the South East Marine Programme website at www.southeastmarine.org.uk Email: LisaB@hwt.org.uk

19/20 January 2005

CMS Coastal Futures 2005 Review and Future Trends.

The event will start with a keynote presentation from Elliot Morley Minister for Environment who will outline the Government's thinking on coastal and marine management.

Contact: bob.earll@coastms.co.uk

31st January & 1st February 2005
World Wetlands Day Conference 2005
Wetlands - Focus on delivery

Contact: bob.earll@coastms.co.uk

"The Ecology of the Rocky Shores of Sherkin Island. A Twenty-Year Perspective"

by Gillian Bishop, published by Sherkin Island Marine Station, 305 pp., 2003.
ISBN 1 870492 37 4 (hardback, 1 870492 57 9 (softback).

Reviewer: Frances Dipper

I have twice been to Sherkin Island Marine Station in southern Ireland, back in the 1970s to take part in baseline diving surveys. Both visits were memorable particularly the warm welcome from the director, Matt Murphy and his family and the terrible food (much improved now!!). The diving too was excellent in spite of the antiquated equipment we used back then. The clear cool water during the day contrasted well with the dark warm beer in the evenings - followed by a 3 mile hike back from the pub-that-never-closed.

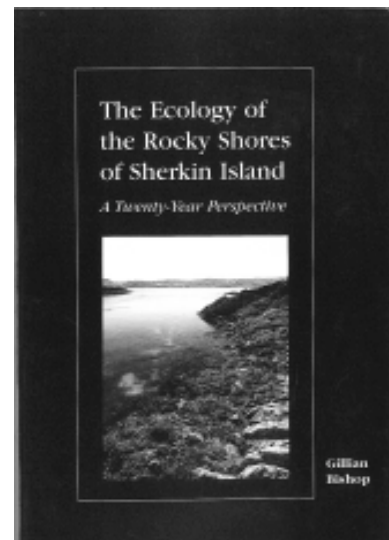
Sherkin Marine Station has always championed the efforts of volunteers and this book is a great tribute to all their efforts over the years as well as being a fascinating record of one of the longest ever European rocky shore studies. At a time when most scientists and politicians (with a few notable exceptions) have accepted that climate change is an uncomfortable reality, long-term data sets are becoming an increasingly important asset. If we don't know the natural variations of abundance within species and populations, we cannot easily attribute changes to global warming, pollution or any other Man-made influence (I can't spell anthropogenic).

Gill Bishop's book is cleanly laid out with uncluttered text, and clear diagrams interspersed with black and white and colour photographs to add interest and visual appeal (well the non-human ones anyway). The straightforward style and clear layout make it both easy to read and a good reference book. The first two chapters provide an interesting background to Sherkin Island, the marine station and the basics of rocky shore ecology. The survey methodology is described in chapter 3. There are now 152 marked monitoring sites extending from Cork Harbour to Bantry Bay with 145 surveyed annually and seven more

on Sherkin Island surveyed monthly from April to October. It is these 7 sites that are the focus of the book. Chapters 4-7 describe 26 species or groups at each of the 7 monthly survey sites. Histograms show variations in abundance of each species down each shore, monthly quantitative changes and annual variations over a 20-year period. Shores with differing exposures can easily be compared as each chapter covers shores in a different exposure range: very exposed, exposed, moderately exposed and sheltered. Scattered throughout these chapters are text boxes highlighting particularly interesting or important species or groups. Trends are discussed at the end of each chapter.

The final chapter covers natural variation of species on the shore and discusses both seasonality and variation over the 20-year period with a summary of key findings. There are also a number of useful appendices. Appendices 3 and 4 list all the species recorded each year at each of the seven sites.

A book review should naturally include any bad points as well as good. However I struggle to find any real criticisms - except perhaps that the book is just a little too heavy to read (physically) comfortably in bed! This book claims to appeal to a wide audience including environmental scientists, students and anyone interested in marine ecology. I think it deserves a place on any of these shelves and more.



REVIEWS

Information requests and observations



Request for records of unusual prawns

From Chris Ashelby, Unicomarine Ltd
7 Diamond Centre, Works Road, Letchworth
Garden City, Herts., SG6 1LW. email:
chrisashelby@unicomarine.com

Recently, a large non-native prawn, *Palaemon macrodactylus* Rathbun, was discovered in the Orwell Estuary, Suffolk (Ashelby *et al.*, 2004). This represented the first record of the species in British waters but it has also recently been found in several other European locations (Cuesta *et al.*, 2004; M. Faasse in prep.; C. d'Udekem d'Acoz in prep.; Cuesta in prep.). The prawn may already be widespread, but unreported, in other parts of the British Isles.

Superficially the prawn resembles *Palaemon longirostris* H. Milne Edwards and *Palaemon elegans* Rathke. Differences may be found in the numbers of rostral teeth (up to 15), the size and shape of pereopod 2 chelae and the mandible palp. Live *P. macrodactylus* are dull green in colour, without pigment streaks, but may have a pale longitudinal dorsal stripe.

I am particularly interested in this species, and trying to establish its current British distribution, but would be grateful for records of any prawns that do not match published descriptions for native prawns.

Ashelby, C.W., Worsfold, T.M. & Fransen, C.H.J.M. 2004. First records of the oriental prawn *Palaemon macrodactylus* (Decapoda: Caridea), an alien species in European waters, with a revised key to British Palaemonidae. *Journal of the Marine Biological Association of the United Kingdom*, **84**, 1041-1050.

Cuesta, J. A., González-Ortegón, E., Drake, P & Rodríguez, A. 2004. First record of *Palaemon macrodactylus* Rathbun, 1902 (Decapoda, Caridea, Palaemonidae) from European waters. *Crustaceana*, **77**(3), 377-380.

Rare fish records

From Douglas Herdson, Information Officer,
National Marine Aquarium, Rope Walk, Coxside,
Plymouth PL4 0LF. Email:
Douglas.Herdson@national-aquarium.co.uk

Two rare Jacks or carangids have recently been caught in Cornwall and taken by the fishermen to Cornish aquariums.

An Amberjack *Seriola* sp., caught by an angler off the rocks of the Lizard in mid-September and taken to Matt Slater at the Blue Reef Aquarium in Newquay for identification, will be a new British rod-caught record. It is thought to be a Lesser Amberjack *Seriola fasciata* which has never been recorded in Britain before, but could turn out to be an Almaco Jack *Seriola rivoliana*, which would be the sixth for British waters, and the first taken by an angler. Two weeks later a related jack known as a Blue Runner *Caranx crysos*, was caught by a fisherman in a bass net just off Mevagissey and taken in to Chris Gilbertson at Mevagissey Aquarium, who passed it on to me for identification. This is thought to be the fourth or fifth specimen of this fish reported in the UK.

The jack family of fish (Carangidae) are widespread in the warmer waters of the world, but the only member of the family which is common in the North East Atlantic is the Horse Mackerel or Scad *Trachurus trachurus*. Carangids seem to be being found more regularly as the temperature of local waters increases. This is a great example of how three West country aquariums working together can build our knowledge of what is happening in the seas around our shores.



Is the mucous mesh of the spionid *Spiophanes wigleyi* used for filter feeding?

By **Peter H. Gibson**

Institute for Evolutionary Biology, The University of Edinburgh, King's Buildings, West Mains Road, Edinburgh EH9 3JT peter.gibson@ed.ac.uk

Abstract

A number of preserved specimens of *Spiophanes wigleyi* were each found to have a free mucous mesh lining part of the tube. The mesh appeared to have been produced by sacks in chaetigers 9-14 secreting strands of mucus through inter-ramal slits as the worm moved up and down the tube in a continuous corkscrew motion. The mesh was probably used to filter food particles from a current produced by a double row of cilia on the rims of the dorsal transverse lamellae. Pairs of mucous sacks in chaetigers 5-8 appeared to produce fibrous rods that projected from the worm. The morphology of *S. wigleyi* was similar to that seen in *S. bombyx* and *S. kroyeri* although the mesh was never found in *S. kroyeri*.

Introduction

Spiophanes wigleyi Pettibone, *S. bombyx* (Claparède) and *S. kroyeri* Grube are tubicolous and like other spionids feed on surface detritus with tentacular palps (Fauchal & Jumar, 1979). This study investigates the possibility that feeding in *S. wigleyi* also involves the use of a mucous mesh, first seen by König (1948), in a manner similar to that found by Hempel (1957) for *Pygospio elegans*.

Results & Discussion

Procedures

In the summer, samples of the seabed were taken by grab at about 200 m depth at the Gullifaks B and Veslefrikk oil fields in the North Sea. The samples were sieved, the collected specimens fixed in 4% formaldehyde containing Rose Bengal and then preserved in 70% methyl alcohol. Many of the specimens of *S. wigleyi*, *S. bombyx* and *S. kroyeri* were found still within their tubes. Whole specimens were examined microscopically and several specimens of *S. wigleyi* were wax embedded, sectioned at 10 µm, stained with Giemsa or methylene blue and mounted in DPX. Since the specimens were not specifically fixed for histology the sections were of poor quality judged by general histological standards. Stained whole mounts were also prepared. A couple of specimens were prepared for scanning electron microscopy with a sputter

coating of gold.

Mucous mesh

When the worms were being removed from their tubes a delicate mucous mesh was found on a number of occasions between the inner wall and the worm. The mesh appeared to be short, about 4 mm, compared with the length of the worm, which was about 15-20 mm. The strands were flat, about 75 µm wide and formed squares with sides of 165 µm orientated at about 45° to the longitudinal axis of the tube. König (1948) thought the mesh contributed to the wall of the tube. In the present study it was not attached to the wall and could be easily removed when the tube was cut open. The mesh might be used to filter food particles. The large frontal neuropodal hooks possibly catch the upper end so when the worm moves down the tube a funnel is produced. *Nereis diversicolor* and *Chaetopeterus variopterus* use suspended mucus nets of unknown mesh size to retain food particles of 1.5-7.5 mm (Harley, 1950; Rüsågård, 1971). When stretched during filtering the pore size of the mesh of *S. wigleyi* would be reduced due to distortion. The mesh would be picked up periodically and passed to the mouth.

Mucous sacks

Chaetigers 5-14, the so-called middle region of the body (Pettibone, 1962), contained prominent sacks filled with mucus (Fig. 1). Some sacks contained fine fibres in addition to mucus. Pettibone described these sacks for *S. wigleyi* and *S. berkeleyorum* (1962). In the present study, two to three slender fibrous rods (Fig. 1) were found on one side of each of the sacks in chaetigers 5-8 and these extended ventrally to the midline. Pettibone depicts skeins of fibres (Pettibone, 1962, Fig. 3, Fig. 6) in this region, and these may form the rods. In the present study the rods passed through a slit at the tip of each inter-ramal lobe (Fig. 2). Pettibone also described interpodial frayed setae which appear from her diagram (Fig. 6b) to be stouter than the rods seen in the present study but may be the same structures. On occasions the rods, where they leave the body, were seen from their broken ends to be made up of fibres. If these fibres were to project from the sides of the rods the structures would be similar to Pettibone's frayed setae.

In chaetigers 9-14 the sacks did not appear to have adjacent rods. When the sacks were broken their mucus content swelled markedly

in contact with tap water. Each sack appeared to lead to a vertical slit of 70-80 mm in the posterior inter-ramal region of its parapodium. The slits were the same width as the strands of the mucous mesh. Therefore, the mesh may be produced by mucus being extruded through them as the worm moves in a corkscrew motion along the tube. The worm would have to return while revolving in the same direction still secreting mucus. The more it moved up and down the finer the mesh would become although very fine meshes were never seen.

The superficial inter-ramal regions of the parapodia of the middle region of the body were swollen with mucus and stained strongly (Fig. 1, Fig. 2). These swellings were very pronounced in *S. kroyeri* (Table 1) and gave the middle region of the body its lobular appearance. In unstained whole mounts the inter-ramal lobes had a translucent appearance (Fig. 3). The mucus in the lobes is probably secreted directly from the epidermis and not via the slits and builds up to form the tube wall.

The tube

Table 1. Comparisons of *Spiophanes wigleyi*, *S. bombyx* and *S. kroyeri*. Numbers refer to chaetose segments; anterior region: 1-4; middle region: 5-14; posterior region: 15-. Superscripts: 1 = Pettibone (1962); 2 = Fauvel (1927); 3 = Hartmann-Shröder (1971). Data when different from that of these authors are given in brackets and are from Gullfåks B and Veslefrikk oil fields in the North Sea

Structure	<i>S. wigleyi</i> ¹	<i>S. bombyx</i> ^{2,3}	<i>S. kroyeri</i> ³
Prostomium	Rounded	With horns	Rounded
Eversible pharynx	Present	Present	Not seen
Length of ciliated epaulettes	1-Apr	1/2-3 (1-4)	Jan-114
Anterior notopodial chaetae	Long (1-3)	Short (1-3)	Short (1-3)
Middle parapodia	5-8, rounded 9-14, conical	9-14, large	5-8, v. large (5-6) 9-15, large (9-14)
Sabre chaetae	9-	15-	2/3- (4/5-)
Mucous sacks	May-114	5-15 (?4-14)	May-114
Inter-ramal genital pouches	None (Small?)	None ? (None)	Present (14/15-)
Hooded crotchets	15- (14-) bidentate	15- bidentate	15- tridentate
Transverse lamellae	15- (16-30)	3 or 4- (16-)	c. 19- (15-)
Approx. no. of chaetigers	62 (39, 45, 57)	180 (42, 43)	106 (40)

Equivalent terms: subulate notopodial lamellae (Pettibone, 1962) = dorsal cirri; caruncle (Hartmann-Shröder, 1971) = ciliated epaulettes (Pettibone, 1962) = sensing organ (organe sensitif) (Fauvel, 1927); middle region (Pettibone, 1962) = thorax; thread glands (Pettibone, 1962) = mucous sacks.

The mucous tubes of *S. wigleyi* were over 20 mm long. Each was limp, gradually tapered from the entrance and had sand grains adhering to the outside except at the rim which was presumably constantly being added to. The fibres of the rods may contribute to the wall of the tube and some appeared to extend from the outer surface. These free fibres possibly help anchor the tube to the surrounding substratum. The tube was not porous to water under pressure from a syringe.

Feeding and respiratory currents

The dorsal transverse lamellae of *S. wigleyi* consisted of two epidermal membranes separated by coelomic space. On the rim of each lamella were two parallel rows of 18 mm long cilia that presumably produce a combined feeding and respiratory current. The ciliary roots consisted of a series of some 40 blocks each separated by a large single cell (Fig. 4). The broad ventral bases of the notopodal cirri contained elongate mucous glands, and a fine tube passed along the cirri. Presumably mucus from the cirri is secreted into the current.

On occasions yellow amorphous material similar to that seen in the gut was found on the dorsum behind the head in the region of the epaulettes and may have been collected by the mucous mesh and the palps. Many specimens were found with the tentacles doubled back with their grooves opposed to the epaulettes. As in most tentacular polychaetes the tentacles were easily torn off the body when the specimens are removed from their tubes. When this occurred the epaulettes and the surrounding epidermis were also torn away (Fig. 5). In other specimens the epaulettes were found to be loose but still attached to the body. The tentacles, therefore, appeared to have stuck to the epaulettes during the transfer of food to the epaulettes.

Food and gut

The first 12 chaetigers of *S. wigleyi* were found from dissection and whole mounts to contain a pharynx, which tapered posteriorly to a muscular gizzard. The wider anterior end of the pharynx had a number of buccal folds, which presumably allows the proboscis to be everted as was seen in many whole specimens. The gut was thin walled and segmental

pouches started behind the gizzard at chaetiger 15. The pouches contained yellow amorphous material, diatoms and 2.6 mm wide fibres with side branches. The diatoms (*Distephanus speculum* and *Cocinodiscus* species) were common and ranged from 26-80 mm but chains of smaller species were also present. On occasions *S. wigleyi* was found doubled up in its tube with the anus next to the head suggesting it was in the process of expelling faeces when sampled.

Comparison of *S. wigleyi*, *S. bombyx* and *S. kroyeri*

The three species of *Spiophanes* looked at in this study were found to be generally similar in structure (Table 1). However, as is known, *S. kroyeri* has longer epaulettes than the other two species. In *S. wigleyi* each epaulette consisted of a pair of dorsal grooves covered with cilia under which were what appeared to be mucus-secreting cells (Fig. 6). The epaulettes may move the food collected by the tentacles towards the mouth (as well as probably being chemo-sensory, Gibson 1997). However, *S. bombyx* and *S. kroyeri*, which appears to live in much the same type of sediment (Table 2), have epaulettes that differ in length. There were conspicuous grooves running around the sides of the head in *S. kroyeri*, which presumably carry mucous food threads to the mouth.

Conclusions

Spiophanes wigleyi was sampled by grab from the North Sea and preserved in methanol. A mucous mesh within the tube was apparently secreted by sacks in the anterior of the body and may have filtered food particles from a water current probably produced by cilia on transverse lamellae. The species is normally a tentacular detritus feeder and the mesh may only be produced under conditions where detritus on the seabed is in short supply possibly due to high densities of individuals.

Table 2. Geographical range, habitat and reproduction of *Spiophanes wigleyi*, *S. bombyx* and *S. kroyeri* in European waters. Superscripts: ¹ = *Marine fauna of the Isle of Man* (Bruce *et al.*, 1963), ² = *Fauna & flora of St. Andrews Bay* (Laverack & Blackler, 1974), ³ = *Plymouth marine fauna* (1957), ⁴ = *The fauna of the Clyde Sea area* (Clark, 1960), ⁵ = *The marine fauna of the Cullercoats district* (Garwood, 1982), ⁶ = Fiege & Ben-Eliahu (1994), ⁷ = Hannrez (1956), ⁸ = Claparède (1870) and ⁹ = this study.

S. wigleyi	S. bombyx	S. kroyeri
North Sea ⁹	Irish Sea ¹ ; North Sea ^{2,5,9} ; English Channel ³ ; Clyde Sea area ⁴ ; German Bight ⁶	Irish Sea ¹ ; North Sea ^{2,5,9} ; Clyde Sea area ⁴ ; German Bight ⁶
Common at 200 m ⁹	Muddy sand, sand & gravel, intertidal to 80 m ¹ ; intertidal - offshore ² ; muddy sand, sublittoral at 79 m ⁴ ; common 14-19 m ⁶ ; common 200 m ⁹	Mud, muddy sand at 50-140 m ¹ ; offshore ^{2,5} , 45 m ⁴ ; common 40-46 m ⁶ ; common 200 m ⁹
Eggs disk-shaped, 78 mm ⁹	Larvae May-June & August - September ⁷ ; eggs disk-shaped, 130 mm ⁸	Eggs in August ¹ ; spawns November - February, planktonic larvae ⁷

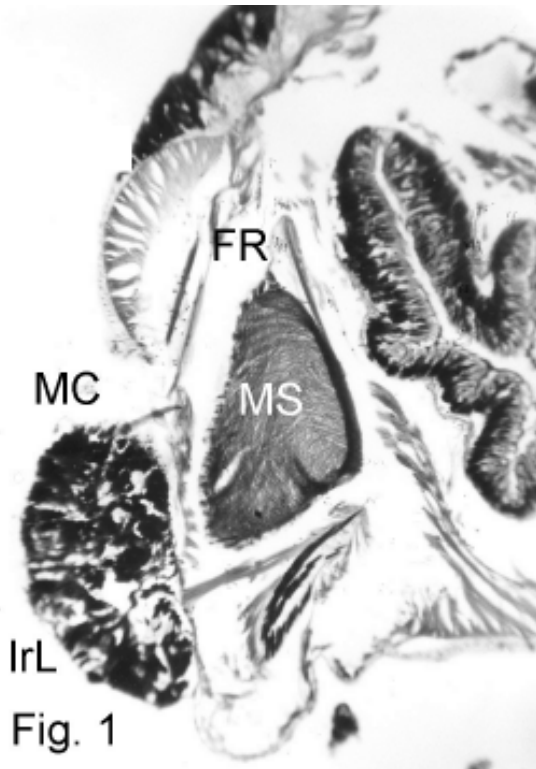


Fig. 1

Fig. 1. Photograph of part of a stained transverse section through *Spiophanes wigleyi* cut from between chaetigers 5-14 (X 125 magnification); fibrous rod: FR; inter-ramal lobe: IrL; mucous cells: MC; mucous sack: MS

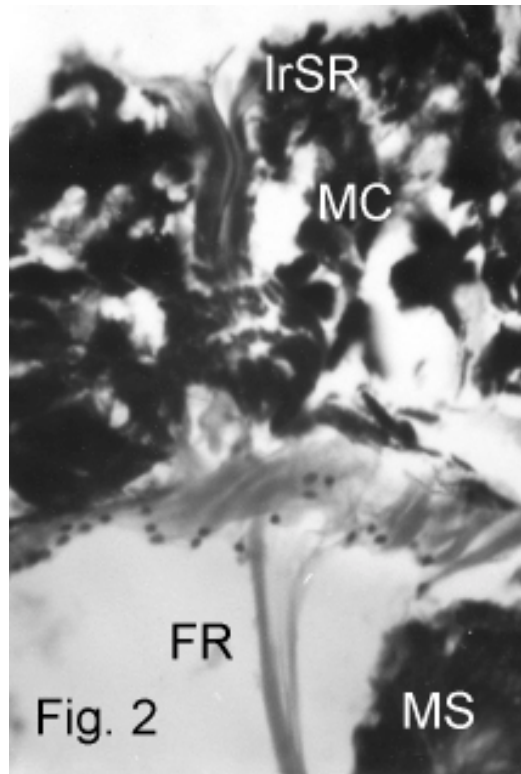


Fig. 2

Fig. 2. Photograph of a stained transverse section through the inter-ramal lobe of *Spiophanes wigleyi* where the rods leave the body (X 50 magnification); fibrous rod: FR; inter-ramal slit and rod: IrSR; mucous cells: MC; mucous sack: MS

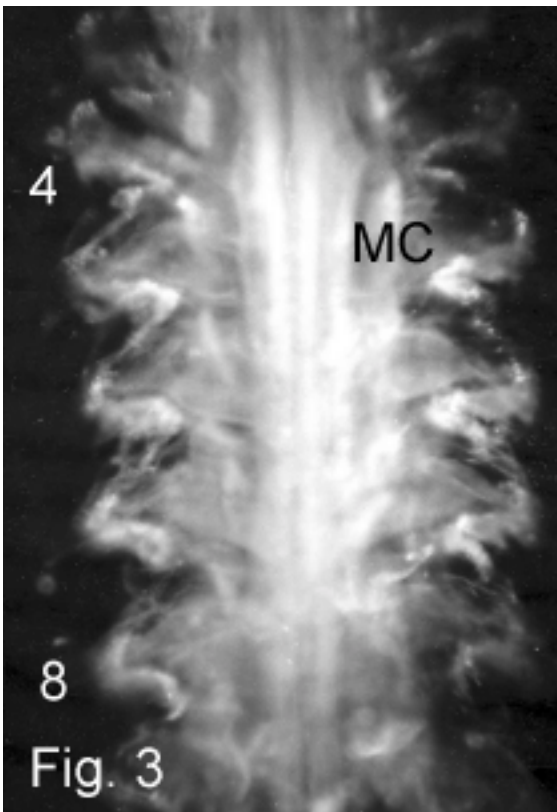


Fig. 3

Fig. 3. Photograph, using dark field illumination, of the dorsal anterior region of a whole mount of *Spiophanes wigleyi* (X 50 magnification); anterior: A; mucous cells: MC; segments: 4, 8

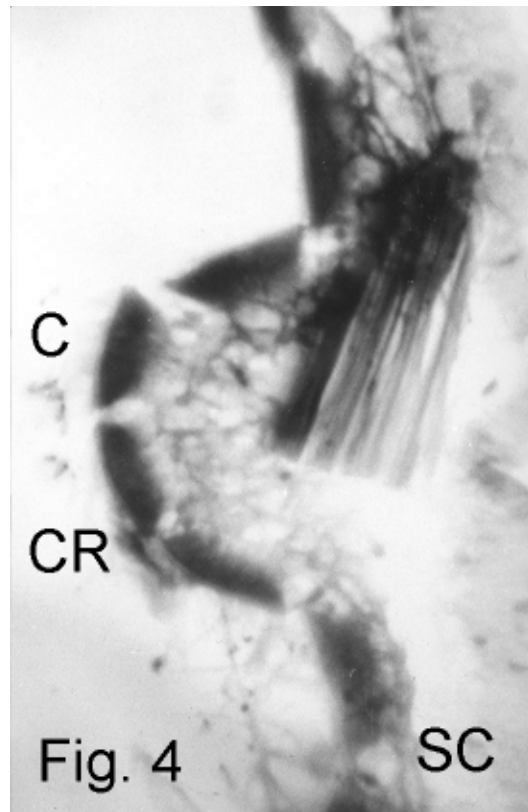


Fig. 4

Fig. 4. Photograph of a stained transverse section through the posterior region of *Spiophanes wigleyi* showing the free edge of a dorsal lamella (X 500 magnification); cilia: C; ciliary roots: CR; single cell: SC

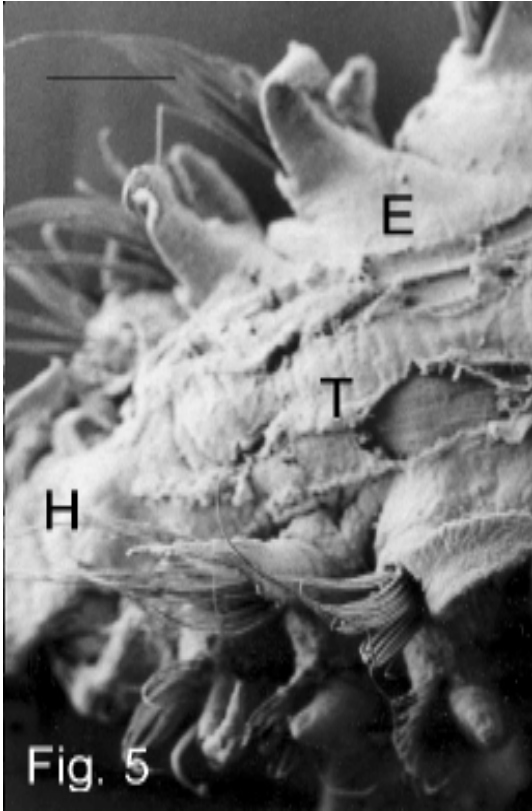


Fig. 5. Scanning electron micrograph of the dorsal anterior region of *Spiophanes wigleyi* (bar = 200 mm); epaulette: E; head: H; tear: T

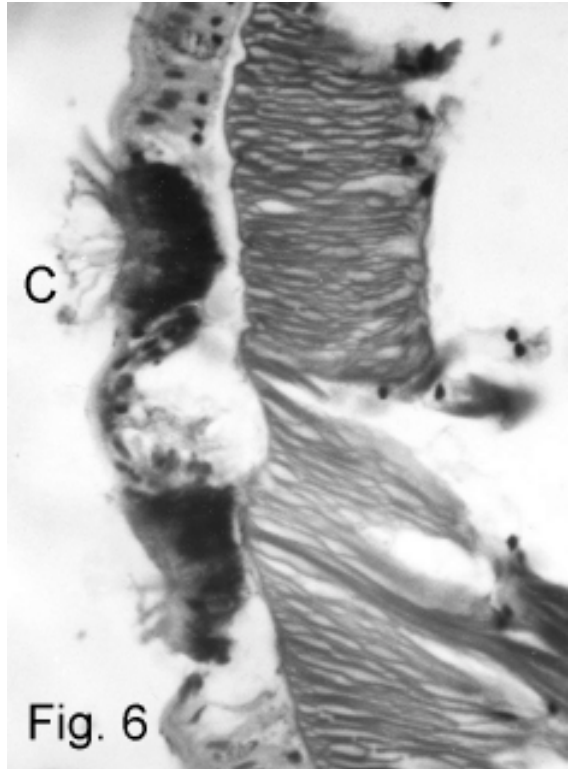


Fig. 6. Photograph of a stained transverse section through an epaulette of *Spiophanes wigleyi* (X 500 magnification); cilia: C

Records of benthic marine invertebrates from offshore waters west of Shetland and Orkney

Peer reviewed article

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Introduction

Samples of benthic marine invertebrates, from offshore sites along the west coast of Shetland and Orkney, were collected in 2000 by BP as part of the Clair partnership. The aim of the partnership was to examine the feasibility of constructing an oil pipeline from the Clair field to the Flotta terminal on Orkney, via Hoy Sound. The purpose of the BP survey was to collect baseline environmental data in order to characterise the seabed along the pipeline route. The results formed part of an assessment in preparation for an Environmental Statement as required by the Offshore Petroleum and Pipelines (Assessment of Environmental Effects) Regulations 1999. Figure 1 shows the sites from which samples were taken. However, before the samples could be processed for biological analysis, another route for the pipeline was chosen. Later, ten sites from the original pipeline route were processed as part of an MSc thesis (G Robinson) and the results are reported here.

Methods

Field Survey

The BP survey took place in July 2000, and was carried out from the research vessel, *Svitzer Meridian*. Benthic samples were collected using Van Veen, Hamon and Day grabs from 48 sites along the proposed pipeline route (See Figure 1). These samples were analysed for chemical data. Photographs and ROV video footage were also taken at each site to provide an overview of the composition of the seabed surface.

For the purposes of the MSc study, 10 of the 48 sites were selected for biological analysis (sorting and identification). The sites chosen covered the length of the proposed pipeline route, as well as a range of depths and sediment types, to give a good cross-section of the benthic communities. Table 1 gives location details of the 10 analysed sites.

At each of the sites two samples were collected for faunal analysis by means of either the Van Veen or Hamon grabs, with the exception of site 5, where it was only possible to take one sample.

The samples were passed through a 0.5mm mesh sieve, the contents of which were fixed in 4-8% formaldehyde and later transferred to 70% IMS for preservation and identification.

Laboratory Analysis

To hasten the sorting process, samples were placed onto a conveyor belt and submerged in water, allowing the lighter fractions, which include the majority of the organisms, to float off. This procedure removes the majority of the sediment present in the sample, drastically reducing the amount of material to be sorted. The floated-off fractions, containing the biological material, were placed into five litre buckets ready for identification. The remaining sediment residue for each sample was then checked carefully for any specimens that had not floated off. Specimens for each sample were separated into major taxonomic groups initially before being identified to the highest taxonomic level possible. S. Hamilton identified the polychaetes and all other groups were identified by G. Robinson.



Figure 1. Map showing route of survey.

Results

The sediment types are all relatively similar and dominated by coarse, sandy sediments. No muddy sediments were identified at the 10 chosen sites (Table 2).

A comprehensive species list of 278 taxa from the 10 sites has been prepared (Table 3). All specimens identified during this work, with the exception of the hydroids, bryozoans and nemertea, were deposited in the National Museums of Scotland.

The sediment at site 15, which had the lowest species diversity, was comprised of bedrock, with interstitial fine gravel and coarse sand. The depth of the sediment on top of the bedrock is unknown but some of the deeper burrowing species were absent at this site, which reduced diversity.

Remarks

Previous surveys in the area of West of Shetland and Orkney identified extensive areas of rock, gravels and coarse sand (Dyer *et al* 1983). These surveys, however, only recorded 30 infaunal species. One possible reason for the low numbers recorded was the use of a large (50mm) mesh sieve as the surveys were largely concerned with epibenthic species.

More recently surveys of two prospective pipeline routes between Foinaven and Sullom Voe were undertaken in 1999 by BP Amoco. A total of 134 infaunal taxa were recorded from

the Foinaven-Sullom Voe route and 118 from the Foinaven- Sandwick route (Hartley Anderson 2000). The BP Clair Field, an area to the west of Shetland, was analysed by ERTSL who identified 238 taxa. (ERTSL Report, 2001).

The BP Clair pipeline survey and the Clair Field survey appear to have a greater diversity than other surveys in the area and this is probably due to the difference in total surface area covered and the smaller mesh size of 0.5mm used in the sieving process of the samples. The variation in design of the sampling and processing techniques makes comparison between surveys difficult to analyse.

In a report on the communities of the continental shelf of the west of Orkney and Shetland (Eleftheriou, 2003) the area was interpreted as "a relatively uniform macrofaunal community characteristic of sand". However, it was noted that this may in part be a result of "self selection" as sampling in areas of cobbles and boulders is largely unsuccessful.

Acknowledgements

This work was funded by the BP Clair Environmental Team as part of the Deep Sea Biodiversity Network. We would like to thank Tammy Horton at Southampton Oceanography Centre for help with Crustacean identification and guidance, Fiona Ware and Sankurie Pye at the National Museums of Scotland for help with literature, and Jonathan Hunt, Clair Dalgleish and Peter Campbell at ERT (Scotland) Limited for help in processing samples.

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Table 1. Location, Depth and Grab Type for the sites analysed for biological content

Site	Longitude	Latitude	Depth (m)	Gear
2	59° 44.7'N	3° 06.0'W	46	Van Veen
5	59° 58.1'N	2° 58.3'W	96	Hamon
6	60° 05.9'N	2° 53.7'W	111	Van Veen
8	60° 15.7'N	2° 48.0'W	181	Van Veen
10	60° 26.1'N	2° 41.8'W	160	Van Veen
11	60° 33.5'N	2° 37.4'W	140	Hamon
12	59° 34.3'N	3° 11.9'W	150	Van Veen
15	59° 28.1'N	3° 15.4'W	73	Van Veen
17	59° 18.8'N	3° 20.6'W	108	Van Veen
41	59° 05.7'N	3° 26.6'W	69	Hamon

Table 2. Sediment Descriptions of sample sites

Sample site	Sediment description
2	Very coarse shelly clean sand with cobbles and interstitial medium sand
5	Bedrock with boulders, cobbles and interstitial medium sand
6	Large ripple features alternating in composition between coarse sand and gravel/ small stones
8	Medium sand with gravel and shell debris
10	Medium clean sand with fines and gravel
11	Bedrock with a thin veneer of silty sand and fine gravel
12	Coarse sand with fines and shell debris
15	Bedrock boulders and cobbles with interstitial fine gravel and coarse shelly sand
17	Coarse clean sand with shell debris
41	Coarse sand and mixed gravel over bedrock

Table 3. Species List from the sites analysed

MCS Biocode	Taxon	Authority	Site												
			2	5	6	8	10	11	12	15	17	41			
G0001	NEMERTA					4									
P0015	<i>Pisone remota</i>	(Southern, 1914)				15	6	6	1	144	80				
P0065	<i>Harmothoe impar</i>	(Johnston, 1839)							4						
P0091	<i>Pholoe assimilis</i>	Ørsted, 1845											1		
P0091	<i>Pholoe baltica</i>	Ørsted, 1843	1						3	5			2	2	
P0094	<i>Pholoe synophthalmica/inorn</i>	Claparède, 1868							5	4					
P0109	<i>Sthenelais limicola</i>	(Ehlers, 1864)		9	1										
P0118	<i>Eteone longa</i>	(Faricius, 1780)	1							5			3	2	
P0122	<i>Hesionura elongata</i>	(Southern, 1914)				2		6					92		
P0130	<i>Mystides caeca</i>	Langerhans, 1880							2		2				
P0136	<i>Pseudomystides limbata</i>	(Saint-Joseph, 1888)				3		8	1	2	18				
P0141	<i>Anaitides groenlandica</i>	(Ørsted, 1842)		1											
P0146	<i>Anaitides rosea</i>	(McIntosh, 1877)		3						3					
P0152	<i>Eulalia bilineata</i>	(Johnston, 1839)				1									
P0155	<i>Eulalia mustela</i>	Pleijel, 1987				1				10			11	2	
P0161	<i>Eulalia cf. viridis</i>	(Linnaeus, 1767)							1						
P0164	<i>Eumida bahusiensis</i>	Bergstrom, 1914								2					
P0169	<i>Nereiphylla lutea</i>	(Malmgren, 1865)	1												
P0195	<i>Lacydonia miranda</i>	Marion & Bobretzky, 1875				1			1		4		1		
P0256	<i>Glycera alba</i>	(O F Müller, 1776)		1	3										
P0257	<i>Glycera celtica</i>	O'Connor, 1987											1		
P0260	<i>Glycera lapidum</i>	Quatrefages, 1866	15	1	3	7			15	28	16	15	3		
P0268	<i>Glycinde nordmanni</i>	(Malmgren, 1866)	1						1	9		2			
P0271	<i>Goniada maculata</i>	Ørsted, 1843		5											
P0276	<i>Goniadella gracilis</i>	(Verrill, 1873)	20			12	16	9	15	7	37				
P0282	<i>Ephesiella abyssorum</i>	(Hansen, 1878)							4		1				
P0289	<i>Sphaerodoropsis philippi</i>	(Fauvel, 1911)								1					
P0291	<i>Sphaerodorum gracilis</i>	(Rathke, 1843)								1					
P0297	<i>Gyptis</i> sp.	Marion & Bobretzky, 1875							1						
P0305	<i>Kefersteinia cirrata</i>	(Keferstein, 1862)	1			2				2	1	1			

P0311	<i>Nereimyra punctata</i>	(O F Müller, 1788)				11	1		
P0319	<i>Podarkeopsis capensis</i>	(Day, 1963)					2		1
P0340	<i>Glyphohesione klatti</i>	Friedrich, 1950	6	6	8		1		
P0349	<i>Ehlersia cornuta</i>	(Rathke, 1843)				1		2	
P0355	<i>Eurysyllis tuberculata</i>	Ehlers, 1864				10			
P0362	<i>Trypanosyllis coeliaca</i>	Claparède, 1868				1	10		
P0364	<i>Typosyllis</i> spp.	Langerhans, 1879					6	5	1
P0380	<i>Eusyllis blomstrandii</i>	Malmgren, 1867					4		
P0387	<i>Odontosyllis fulgurans</i>	(Audouin & Milne-Edwards, 1833)				1		4	
P0390	<i>Opisthodonta</i> sp. A					1	4	3	22
P0395	<i>Pionosyllis prope-weismann</i>				Dauvin & Lee, 1983	2		21	2 3
P0403	<i>Streptosyllis bidentata</i>	Southern, 1914					10		54
P0405	<i>Streptosyllis websteri</i>	Southern, 1914	1		1				
P0407	<i>Syllides benedicti</i>	Banse, 1971	1				3		4 2
P0421	<i>Exogone hebes</i>	(Webster & Benedict, 188	14	22	10		2	22	15 1
P0422	<i>Exogone naidina</i>	Ørsted, 1845	5		2	5		4	1
P0423	<i>Exogone verugera</i>	(Claparède, 1868)	7					1	
P0425	<i>Sphaerosyllis bulbosa</i>	Southern, 1914				4	3	8	5
P0430	<i>Sphaerosyllis taylori</i>	Perkins, 1980	1					7	5 2
P0431	<i>Sphaerosyllis tetralix</i>	Eliason, 1920						5	
P0433	AUTOLYTINAE spp.	Grube, 1850						4	
P0478	<i>Nereis zonata</i>	Malmgren, 1867						1	1
P0493	<i>Aglaophamus rubella</i>	(Michaelsen, 1897)	1		1	1		2	1 3
P0495	<i>Nephtys assimilis</i>	Ørsted, 1843						2	
P0502	<i>Nephtys kersivalensis</i>	McIntosh, 1908		2		1			
P0518	<i>Paramphinome jeffreysii</i>	(McIntosh, 1868)						1	4
P0520	<i>Pareurythoe borealis</i>	(M Sars, 1862)					1	1	
P0539	<i>Aponuphis bilineata</i>	(Baird, 1870)	7	1	1	3			
P0542	<i>Hyalinoecia tubicola</i>	(O F Müller, 1776)							1
P0572	<i>Lumbrineris</i> sp.	de Blainville, 1828						2	
P0577	<i>Lumbrineris fragilis</i>	(O F Müller, 1776)	2			2	1		1

MCS Biocode	Taxon	Authority	Site												
			2	5	6	8	10	11	12	15	17	41			
P0579	<i>Lumbrineris gracilis</i>	(Ehlers, 1868)	1	7	1				2						1
P0591	<i>Driloneris filum</i>	(Claparède, 1868)	1												
P0613	<i>Ophryotrocha</i> sp.	Claparède & Mecznikow, 1869											1		
P0638	<i>Protodorvillea kefersteini</i>	(McIntosh, 1869)	5			3			4			33	12		
P0672	<i>Scoloplos armiger</i>	(O F Müller, 1776)		1	1										
P0678	<i>Aricidea wassi</i>	Pettibone, 1965		126	82										
P0680	<i>Aricidea albatrossae</i>	Pettibone, 1957			1										
P0684	<i>Aricidea catherinae</i>	Laubier, 1967	7	1						1					
P0685	<i>Aricidea cerrutii</i>	Laubier, 1966	2		1	1				11			6	1	
P0686	<i>Aricidea laubieri</i>	Hartley, 1981		12	2										
P0688	<i>Aricidea simonae</i>	Laubier & Ramos, 1974		1											
P0690	<i>Cirrophorus branchiatus</i>	Ehlers, 1908			1					2					
P0699	<i>Paradoneis lyra</i>	(Southern, 1914)		5	2					4					2
P0712	<i>Apistobranchnus tullbergi</i>	(Théel, 1879)		4	1					2					
P0718	<i>Poecilochaetus serpens</i>	Allen, 1904	17	16	26	4	11			23			4	3	
P0723	<i>Aonides paucibranchiata</i>	Southern, 1914	26	63	99	8	3			29	9		14		
P0733	<i>Laonice bahusiensis</i>	Söderström, 1920	2		1	3			3	1	1		3	1	
P0737	<i>Malacoceros fuliginosus</i>	(Claparède, 1868)	4												
P0747	<i>Minuspio cirrifera</i>	(Wirén, 1883)	10	95	23					17					3
P0750	<i>Polydora caeca</i>	(Örsted, 1843)	1												
P0751	<i>Polydora caulleryi</i>	Mesnil, 1897						2	2					3	
P0754	<i>Polydora flava</i>	Claparède, 1870				1							1	2	
P0761	<i>Polydora ?saintjosephi</i>	Eliason, 1920		1											
P0765	<i>Prionospio fallax</i>	Söderström, 1920		2	2										
P0766	<i>Prionospio banyulensis</i>	Laubier, 1966				1	6	12	47				27	19	
P0773	<i>Pseudopolydora cf. paucibr</i>	(Okuda, 1937)		42	7										
P0774	<i>Pseudopolydora pulchra</i>	(Carazzi, 1895)		3											1
P0785	<i>Scoelepis (P.) tridentata</i>	Southern, 1914								1					
P0788	<i>Spio armata</i>	Thulin, 1957													1
P0789	<i>Spio decorata</i>	Bobretzky, 1870								1					
P0794	<i>Spiophanes bombyx</i>	(Claparède, 1870)		9	10	2				46					1
P0795	<i>Spiophanes cf. wigleyi</i>	Pettibone, 1962	2	4	2										

		Site										
MCS Biocode Taxon	Authority	2	5	6	8	10	11	12	15	17	41	
P0796	<i>Spiophanes kroyeri</i>	Grube, 1860	12	34	19			29			3	
P0806	<i>Magelona minuta</i>	Eliason, 1962		4								
P0822	Cirratulidae sp. A							6				
P0823	<i>Aphelochaeta</i> sp.	Blake, 1991			2			1				
P0828	<i>Caulleriella</i> spp.	Chamberlin, 1919						1				
P0828	<i>Caulleriella</i> sp. A		1					1				
P0828	<i>Caulleriella</i> sp. C		3									
P0830	<i>Caulleriella bioculata</i>	(Keferstein, 1862)								1		
P0831	<i>Caulleriella zetlandica</i>	(McIntosh, 1911)	1							1		
P0832	<i>Chaetozone</i> sp. D			1								
P0832	<i>Chaetozone christiei</i>	Chambers, 2000		24	13							
P0834	<i>Chaetozone setosa</i>	Malmgren, 1867		24								
P0844	<i>Monticellina dorsobranchiali</i>	(Kirkegaard, 1959)						2	1			
P0845	<i>Tharyx</i> spp.	Webster & Benedict, 1887	1					3				
P0846	<i>Tharyx killariensis</i>	(Southern, 1914)		19	4							
P0878	<i>Diplocirrus glaucus</i>	(Malmgren, 1867)		4					8			
P0890	<i>Macrochaeta ?caroli</i>	Westheide, 1981							3			
P0891	<i>Macrochaeta clavicornis</i>	(M Sars, 1835)				1			1			
P0892	<i>Macrochaeta helgolandica</i>	(Friedrich, 1937)								3		
P0907	<i>Capitella capitata</i>	(Fabricius, 1780)			1			4				
P0919	<i>Mediomastus fragilis</i>	Rasmussen, 1973						9		1	4	
P0920	<i>Notomastus</i> spp.	M Sars, 1851	7			9	15	11		4	1	
P0925	<i>Peresiella clymenoides</i>	Harmelin, 1968	2	5	5			2				
P0958	<i>Clymenura johnstoni</i>	(McIntosh, 1915)	1		1			2			1	
P0975	<i>Proclymene muelleri</i>	(M Sars, 1856)	1			1					1	
P1001	<i>Ophelia limacina</i>	(Rathke, 1843)								12		
P1014	<i>Ophelina acuminata</i>	Ørsted, 1843			1			1				
P1015	<i>Ophelina cylindricaudata</i>	(Hansen, 1878)		21	2							
P1022	<i>Asclerocheilus intermedius</i>	(Saint-Joseph, 1894)									1	
P1027	<i>Scalibregma inflatum</i>	Rathke, 1843	2	2	1		1	26				

			Site									
MCS Biocode	Taxon	Authority	2	5	6	8	10	11	12	15	17	41
P1062	<i>Polygordius</i> spp.	Schneider, 1868				1	10			13	34	
P1069	<i>Protodrilus</i> spp.	Hatschek, 1882						4				
P1093	<i>Galathowenia oculata</i>	Zaks, 1922	44	lots	lots				9		2	1
P1098	<i>Owenia fusiformis</i>	Chiaje, 1842	4	33	17						1	
P1139	<i>Ampharete lindstroemi</i>	(Malmgren, 1867)		1	2				1			
P1147	<i>Anobothrus gracilis</i>	(Malmgren, 1866)		1	1							
P1157	<i>Mugga wahrbergi</i>	Eliason, 1955		4								
P1160	<i>Sabellides octocirrata</i>	(M Sars, 1835)		1								
P1167	<i>Sosane sulcata</i>	Malmgren, 1866		2								
P1175	<i>Terebellides stroemi</i>	M Sars, 1835		4					1			
P1178	<i>Trichobranchus roseus</i>	(Malm, 1874)		1								
P1195	<i>Lanice conchilega</i>	(Pallas, 1776)	1	1							1	
P1217	<i>Pista cristata</i>	(O F Müller, 1776)		5		1	1		1		1	
P1235	<i>Polycirrus</i> sp. A		3					2	4			
P1243	<i>Polycirrus norvegicus</i>	Wollebaek, 1912	3		1	3		6	5	1	1	
P1244	<i>Polycirrus plumosus</i>	Wollebaek, 1912		2								
P1249	<i>Parathelepus collaris</i>	(Southern, 1914)				10		4	1	1	3	
P1254	<i>Thelepus cincinnatus</i>	(Fabricius, 1780)			1				11		12	
P1266	<i>Chone collaris</i>	Langerhans, 1880			1							
P1267	<i>Chone duneri</i>	Malmgren, 1867		3								2
P1269	<i>Chone filicaudata</i>	Southern, 1914				3		11				
P1281	<i>Euchone southerni</i>	Banse, 1970							1			
P1289	<i>Jasmineira caudata</i>	Langerhans, 1880	1						1			
P1334	<i>Hydroides norvegica</i>	Gunnerus, 1768	1			2			4			
P1341	<i>Pomatoceros triqueter</i>	(Linnaeus, 1758)				1		16				
P1425	Tubificidae spp.	Eisen, 1885			9				3		9	
P1501	Enchytraeidae spp.								46	2	32	
Q0002	PYCNOGONIDA	Latreille, 1810	2		1							
Q0033	<i>Callipallene brevirostris</i>	(Johnston, 1837)				3						
R0014	CIRRIPIEDIA	Burmeister, 1834		1					1			1
R2412	OSTRACODA	Latreille, 1802					1					
S0006	<i>Nebalia bipes</i>	(Fabricius, 1780)							2			
S0106	<i>Apherusa jurinei</i>	(Milne-Edwards, 1830)	1									

MCS Biocode	Taxon	Authority	Site												
			2	5	6	8	10	11	12	15	17	41			
S0118	Oedicerotidae [juv]	Lilljeborg, 1865			1										
S0123	<i>Monoculodes</i> indet.	Stimpson, 1853				1									
S0124	<i>Monoculodes borealis</i>	Boeck, 1871				1									
S0140	<i>Westwoodilla caecula</i>	(Bate, 1856)						1							
S0152	Amphilochidae indet.	Boeck, 1871				2									
S0156	<i>Amphilochus</i> indet.	Bate, 1862								1					
S0158	<i>Amphilochus manudens</i>	(Bate, 1862)		3											
S0176	<i>Leucothoe</i> indet.	Leach, 1814	1		1			1							
S0178	<i>Leucothoe lilljeborgi</i>	Boeck, 1861				1									
S0186	<i>Cressa dubia</i>	(Bate, 1857)									2				
S0187	Stenothoidae indet.	Chevreur	12								10		2		
S0213	<i>Stenothoe marina</i>	(Bate, 1856)									2				
S0214	<i>Stenothoe monoculoides</i>	Montagu, 1815	1												
S0248	<i>Urothoe elegans</i>	(Bate, 1856)				3	4	1	6						1
S0249	<i>Urothoe marina</i>	(Bate, 1857)				1		5					1		
S0252	Phoxocephalidae indet.	Sars, 1891				1									
S0253	<i>Harpinia</i> indet.	Boeck, 1876									2				
S0254	<i>Harpinia antennaria</i>	Meinert, 1890				8	11								
S0257	<i>Harpinia pectinata</i>	G O Sars, 1891					4	1							
S0267	<i>Paraphoxus oculatus</i>	G O Sars, 1891													2
S0271	Lysianassidae [juv]	Dana, 1849	1		1					1		1			
S0274	<i>Acidostoma nodiferum</i>	Costello <i>et al.</i> , 1990	1			1	1								
S0296	<i>Hippomedon denticulatus</i>	(Bate, 1857)								1				3	
S0332	<i>Socarnopsis filicornis</i>	(Heller, 1867)	1												
S0349	Synopiidae indet.	Dana, 1853												1	
S0396	<i>Liljeborgia kinahani</i>	(Bate, 1862)	6												
S0418	<i>Guernea coalita</i>	(Norman, 1868)	5		3							6		18	
S0423	<i>Ampelisca</i> indet.	Kröyer, 1842			1			2							
S0423	<i>Ampelisca typica</i>	(Bate, 1856)								1				2	
S0427	<i>Ampelisca brevicornis</i>	(A Costa, 1853)												6	
S0429	<i>Ampelisca diadema</i>	(A Costa, 1853)					6	1	2					6	
S0438	<i>Ampelisca spinipes</i>	Boeck, 1861							2	3	1			2	
S0464	GAMMARIDEA							1							
S0495	Melitidae [juv]	Bousfield, 1973	8												

		Site										
MCS Biocode	Taxon	Authority	2	5	6	8	10	11	12	15	17	41
S0495	Melitidae indet.	Bousfield, 1973	1					1				
S0503	<i>Cheirocratus</i> indet.	Norman, 1867					1	2		1	3	
S0506	<i>Cheirocratus sundevalli</i>	(Rathke, 1843)						1				1
S0519	<i>Maera othonis</i>	(H Milne-Edwards, 1830)	1									
S0537	Isaeidae [juv]	Dana, 1853			1	1			1			
S0537	Isaeidae indet.	Dana, 1853	6			1	1		3		1	
S0537	<i>Megamphopus cornutus</i>	Norman, 1869	2			1		2		2	1	
S0538	<i>Gammaropsis</i> indet.	Lilljeborg, 1855		1								
S0541	<i>Gammaropsis maculata</i>	(Johnston, 1828)									2	
S0542	<i>Gammaropsis nitida</i>	(Stimpson, 1853)					2					
S0543	<i>Gammaropsis palmata</i>	(Stebbing & Robertson, 1	3									
S0562	<i>Erichthonius difformis</i>	H Milne-Edwards, 1830				1						
S0568	<i>Jassa</i> indet.	Leach, 1814	1									
S0577	Aoridae [juv]	Walker, 1908				1			15			
S0577	Aoridae indet.	Walker, 1908	7						1			
S0579	<i>Aora gracilis</i>	Bate, 1857							1			
S0586	<i>Leptocheirus</i> indet.	(Zaddach, 1844)	1									
S0588	<i>Leptocheirus hirsutimanus</i>	(Bate, 1862)		2	4					1	1	
S0617	<i>Siphonoecetes</i> indet.	Kröyer, 1845				1						
S0622	<i>Unciola planipes</i>	Norman, 1867			1			13		1	1	
S0639	Caprellidae indet.	Leach, 1814	1		1				1			
S0793	<i>Gnathia</i> [juv]	Leach, 1814	1			1		1				
S0797	<i>Gnathia vorax</i>	(Lucas)	1									
S0841	Cirolanidae [juv]	Dana, 1852	2	1								
S0844	<i>Cirolana borealis</i>	Lilljeborg, 1851			2	1				1	2	
S0849	<i>Conilera cylindracea</i>	(Montagu, 1803)								1		
S0883	Janiridae [juv]	G O Sars, 1897								1		
S0892	<i>Janira maculosa</i>	Leach, 1813	4									
S0901	<i>Munna</i> [juv]	Kröyer, 1839							1			
S0907	<i>Munna minuta</i>	Hansen, 1916										1
S0913	<i>Pleurogonium</i> indet.	G O Sars, 1863						3				
S0921	<i>Desmosoma</i> indet.	G O Sars, 1863									1	

			Site									
MCS Biocode	Taxon	Authority	2	5	6	8	10	11	12	15	17	41
S0951	<i>Arcturella dilatata</i>	(G O Sars, 1882)									1	
S1131	<i>Leptognathia</i> indet.	G O Sars, 1832				1			1		1	
S1191	<i>Vaunthompsonia cristata</i>	Bate, 1858						1				
S1194	<i>Bodotria arenosa</i>	(Goodsir, 1842)							1		2	
S1206	<i>Eudorella emarginata</i>	(Kröyer, 1846)					2					
S1247	<i>Diastylis</i> indet.	Say, 1818					1	1				
S1276	DECAPODA [juv]	Latreille, 1803				1					1	
S1370	Pandalidae [juv]	Haworth, 1925							1			
S1383	<i>Crangon</i> [juv]	(Fabricius, 1798)							1			
S1470	<i>Galathea</i> [juv]	Fabricius, 1793							1			
S1477	<i>Munida</i> [juv]	Leach, 1820	1					5		1		
S1504	<i>Ebalia</i> indet.	Leach, 1817						1				
W0050	<i>Leptochiton</i> indet.	J E Gray, 1847	25		2			1			4	9
W0270	<i>Turritella communis</i>	Risso, 1876					1					
W0491	<i>Polinices pulchellus</i>	(Risso, 1826)		1								
W1157	<i>Pleurobranchus membranace</i>	(Montagu, 1815)										2
W1519	<i>Antalis entalis</i>	(Linnaeus, 1758)							1			
W1688	<i>Glycymeris glycymeris</i>	(Linnaeus, 1758)	3									
W1708	<i>Modiolula phaseolina</i>	(Phillipi, 1844)		1	1							1
W1768	Pectinidae [juv]	Rafinesque, 1815			1			3				
W1786	<i>Palliolum tigrinum</i>	(O F Müller, 1776)										1
W1829	<i>Lucinoma borealis</i>	(Linnaeus, 1767)				1						
W1906	<i>Mysella bidentata</i>	(Montagu, 1803)							2			
W1925	<i>Astarte sulcata</i>	(da Costa, 1778)					1					
W1967	Mactridae [juv]	Lamarck, 1809						4	2			3
W1975	<i>Spisula elipicta</i>	(Brown, 1827)			1				1	1		
W2006	<i>Phaxas pellucidus</i>	(Pennant, 1777)							1			
W2023	<i>Moerella pygmaea</i>	(Lovén, 1846)		1	2	4						
W2072	<i>Arctica islandica</i>	(Linnaeus, 1767)							1			
W2090	<i>Circomphalus casina</i>	(Linnaeus, 1758)							1			
W2100	<i>Clausinella fasciata</i>	(Linnaeus, 1758)	1									
W2104	<i>Timoclea ovata</i>	(Pennant, 1777)										2

MCS Biocode	Taxon	Authority	Site											
			2	5	6	8	10	11	12	15	17	41		
W2227	<i>Thracia</i> [juv]	J de C Sowerby, 1823											3	
W2231	<i>Thracia phaseolina</i>	(Lamarck, 1818)	1					2						
W2280	<i>Cuspidaria cuspidata</i>	(Olivi, 1792)						2						
Y0001	BRYOZOA		4							1				
ZB0098	<i>Stichastrella rosea</i>	(O F Müller, 1776)	1											
ZB0124	<i>Ophiothrix fragilis</i>	(Abildgaard, 1789)	7										1	
ZB0147	<i>Ophiopholus aculeata</i>	Forbes, 1843						1						
ZB0149	<i>Amphiura</i> [juv]	Forbes, 1843	8		4			9			4			3
ZB0152	<i>Amphiura chiajei</i>	(Linnaeus, 1767)												1
ZB0154	<i>Amphiura filiformis</i>	(O F Müller, 1776)	9		4					2				1
ZB0161	<i>Amphiopholis squamata</i>	(Chiaje, 1829)	3					1						
ZB0166	<i>Ophiura</i> [juv]	Lamarck, 1816	11		35		1	8	1		7			9
ZB0167	<i>Ophiura affinis</i>	Lütken, 1858					2	1	9				3	1
ZB0168	<i>Ophiura albida</i>	Forbes, 1839	4								3			
ZB0170	<i>Ophiura ophiura</i>	(Linnaeus, 1758)	3				1	1						
ZB0171	<i>Ophiura robusta</i>	(Ayes, 1851)	3											
ZB0195	<i>Echinus</i> [juv]	Linnaeus, 1758	1							1				
ZB0212	<i>Echinocyamus pusillus</i>	(O F Müller, 1776)	9		4		8	5	1				9	1
ZB0217	Spatangidae [juv]	Gray, 1825					4	6						
ZB0219	<i>Spatangus purpureus</i>	O F Müller, 1776	1							1				
ZB0223	<i>Echinocardium cordatum</i>	(Pennant, 1777)											3	
ZB0224	<i>Echinocardium flavescens</i>	(O F Müller, 1776)								1				

“Basketing” disturbance response by young *Amblyraja (Raja) radiata* (Donovan)

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The starry ray *Amblyraja (Raja) radiata* (Donovan) is a northern, cold water species with a distinct response to disturbance. The reaction differs from those of other British rays. Newly caught small individuals of *A. radiata* were observed to have rolled up into ball shapes. This species is particularly well endowed with spines and prickles on the dorsal surfaces, including a line of large curved spines on the mid-line extending to the tail, though it lacks such protection on the ventral surfaces (Wheeler, 1969). When rolled up the spines and prickles gave maximum protection. The reaction seemed analogous to the behaviour of hedgehogs. Similar behaviour was observed by Richards *et al* (1963) when live *Raja erinacea*, a small New England species also with strong dorsal spines, were handled during aquarium based studies. They coined the term “basketing”, describing it as *a curling of the pectoral wings, head and tail ventrally in such away that the animal resembles a round basket*.

The observations on *A. radiata* reported here were incidental to studies of the benthic epifauna in the Fladen Ground part of the northern North Sea (58-59° N, 00° E) during July 2004. Samples were being collected with short tows (5 minutes on the bottom) with an ICES pattern small mesh 2m beam trawl (Jennings *et al*, 1999). The net was fitted with a cod-end liner of 5 mm mesh knotless netting. The Fladen Ground is mud with a relatively low benthic biomass, so the rays would have been subjected to fewer damaging impacts than would be the case with commercial trawls. These collection conditions and because most studies of rays have been based on dead material, could explain why such a striking reaction is not more familiar. All the five *A. radiata* caught during the cruise exhibited the

same behaviour when freshly taken from the net and all were small individuals less than 20 cm disc width.

Taxonomic sub-division of the large genus *Raja* (sensu lato) was examined by McEachran & Dunn (1998). *Amblyraja* is separated on the basis of differences in skeletal structure from *Raja* spp. They showed by cladistic analysis that, of other north east Atlantic ray species, *A. radiata* was closest to *Leucoraja (Raja) naevus*. Both are round winged and proportionately thicker bodied than most other rays such *R. clavata*. Of the above two round winged species *A. radiata* is heavily armoured with dorsal spines and rolls up while *L. naevus* merely curls enough to impede disc width measurement when being handled live. The skeletal characteristics noted by McEachran & Dunn (1998) in museum specimens of *A. radiata* could be phylogenetic, or in part they relate to the ability of this ray to roll up when disturbed by a potential predator.

Acknowledgements

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PORCUPINE 2004 SPECIES AT THE LIMITS OF THEIR RANGE

Papers from the PMNHS meeting held at the University of Bournemouth on 22 March 2004

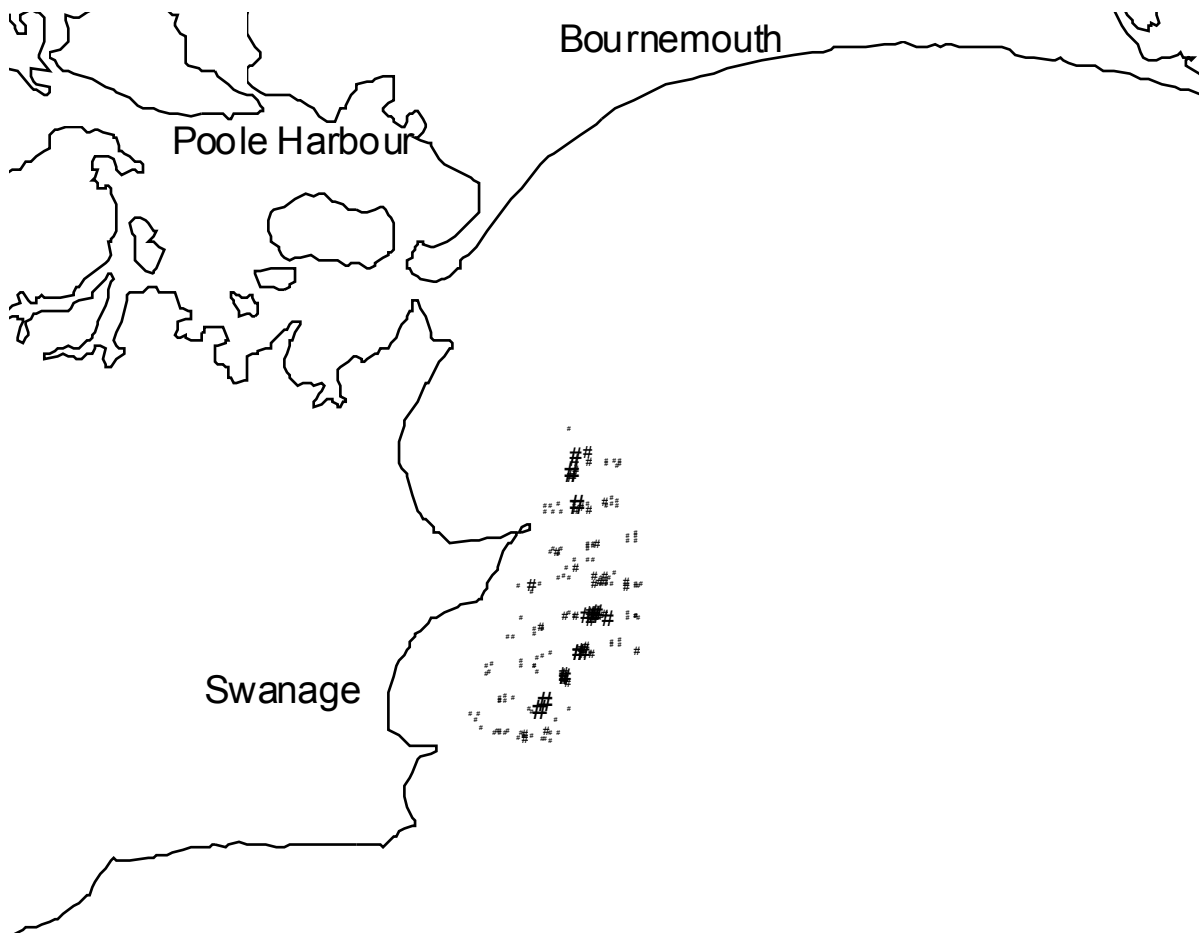
Dorset maerl

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Introduction

Maerl is the generic name for certain coralline red algae that grow unattached on clean, tidally swept seabed. The habitat formed by accumulations of such living and dead organisms have considerable conservation value because of the high diversity of associated organisms. This habitat is designated under both Annex V of the EC Habitats Directive (Council Directive 92/43/EEC, 1992) and the UK Biodiversity Action Plan (Birkett *et al.*, 1998). Two representative species, *Phymatolithon calcareum* and *Lithothamnion corallioides* are included in Annex V(b) of the EU Habitats Directive.





There are extensive deposits off the west coasts of Ireland and Scotland, plus at the entrance to the English Channel, off Brittany and Cornwall (the Fal and Helford estuaries). The presence of maerl beds further up the English Channel have not been acknowledged in UK and European reviews (Birket *et al.*, 1998; BIOMAERL, 1998). Roberts *et al.* (1986) identified a shell gravel/maerl (*Gibula magus-Phymatolithon calcareum*) association off the Purbeck coast. There are extensive areas of this off Kimmeridge but all the maerl is dead. Irving and Chamberlain (1994) noted the occurrence of live *Phymatolithon calcareum* off the Dorset coast. The only extensive area of living maerl known for the Dorset coast is in western Poole Bay. The northern part of this bed was surveyed by Collins *et al.* (1990), as part of a proposed oil pipeline environmental impact assessment. A follow up survey in 1991 by the authors (unpublished) found that the maerl extended southwards to Swanage. Rowe *et al.* (1990) described the infauna associated with this habitat. Beyond Dorset, single specimens of maerl have been found off Bembridge, Isle of Wight (Collins *et al.*, 1995), probably representing its most easterly extent along UK coast of the English Channel.

The UK Biodiversity Action Plan is being implemented regionally; initially producing action plans (UK Biodiversity Group, 1999) for ensuring the continued existence of priority maritime species and habitats. Criteria for selection of the latter, which include maerl, are the existence of international obligations, being at risk, rarity, functionally critical, over 40% of NE Atlantic occurrence in the UK and containing keystone and rare species. This

study was carried out in support of the Dorset Coast Strategy of the Dorset Wildlife Trust and Dorset County Council Joint Dorset Marine Committee to first map the extent of maerl along the Dorset coast.

Methods

Donnan and Davies (1996) describe the application of acoustic survey techniques to Scottish surveys which is appropriate where there are considerable depths of the maerl but in Poole Bay the deposits are very thin, overlying sandy gravels and unlikely to give a characteristic signal. Collins *et al.* (1990) used a pipe dredge to undertake rapid semi-quantitative surveys of the maerl. The heavy steel cylinder (90cm long by 15cm diameter) closed at one end was towed by a fishing boat trawl wire, for a short distance (50-100m) over the seabed, scooping up a sample of the surface sediments. This was particularly suitable for assessing maerl distributions since the maerl lies loosely on the surface of the seabed. Fractions of live and dead maerl in the sample gave a good indication of ground densities. The pipe dredge is more suitable than the conventional grabs, since the seabed in western Poole Bay is largely composed of compact gravels and rock outcrops, which resist penetration by the grab or stones would often hold open the grab jaws, so many attempts are necessary before a successful sample was taken.

The qualitative results of the 1990 and 1991 pipe dredge surveys off Studland Bay and Ballard Down by the authors, formed the basis for quantitative surveys by volunteer scientific and amateur SCUBA divers, annually between May and August from 2000-2003. Since tidal currents are strong in this area (up to 1.5ms^{-1}) surveys were carried out around the slack periods during neap tides. Typically 3 pairs of divers were deployed at 100m spacing. Each pair collected all the live, pink maerl from within two 0.5m^2 quadrats at the drop point and then moved with the current some 100m to repeat the exercise. Notes about the seabed habitat were also recorded. Over 250 samples were collected, dried and weighed to give a quantitative measure of the maerl density and distribution. Data was plotted and interpolated

using ArcView 3.2 (ESRI). Drift dives were also carried out to confirm the general patterns of distribution.

Results

The maerl was identified as being a single species, *Phymatolithon calcareum* (Irving and Chamberlain, 1994; Hall-Spencer, pers. comm.). Fig.1 shows the location of the survey dives in depths of 13m below chart datum for the northern sites to 19m in the south. Densities ranged from 0 at the extremities to 100 g (dry wt) m⁻² in the denser core. Even at its densest, the live maerl coverage is rarely greater than 10% of the seabed, though white, dead maerl fragments cover at least 50% of the seabed along with shells and stones. Drift dives were also carried out to confirm the general pattern of distribution of a distinct band around Ballard Down. Interpolation from survey results suggests an area in excess of 10km² for the bed, though the southern limit has not been determined. Some 150 species of surface macro flora and fauna associated with this habitat were noted.

Discussion

Whilst the density and depth of the maerl overlying sandy gravels is low, the habitat supports a high biodiversity. In addition to the 150 species of surface species noted above, Rowe *et al* (1990) lists 107 infaunal species from this area. To the north, the fraction of silt in the Poole Bay sediments increases, thus the northern limit is probably determined by the light penetration of siltier water and likelihood of being buried by mobile sediments and slipper limpet (*Crepidula fornicata*) chains in depths shallower than 12m. In the south water depth increases, with consequent decreasing seabed light intensities, eventually falling below the compensation depth (at ~20m) for the growth of the maerl. This may only partially explain the eastward limit, as there is a distinct cut off in areas of level seabed. Another factor may be the velocity of tidal currents, which are greater close to the headland than further offshore. In this area, maerl does not appear to occur shallower than about 12m. As with the offshore limit there are probably a number of controlling factors

including competition with other (foliose) algal species and mobility of sediments.

The southern end of this maerl bed is marked by Peveril Ledge, where the seabed drops sharply. Here there are 'waterfalls' of dead maerl over the underwater cliffs. The residual tidal current flow in this area is southward, noted by Alan Lander (pers. comm.), a local fisherman, from the drift of his fishing gear. Presumably there is a general drift of maerl southward by weed dragging and once it reaches deeper water, it has insufficient light to survive.

Potential threats and future management

The Poole Bay maerl exists as a single layer over the seabed unlike many sites described in the literature where there is often an accumulation of living and dead thalli. It is proposed that the maerl here exists in a fine balance between growth and tidal export, making it even more vulnerable to perturbation than deposits elsewhere.

Wytech Farm to the south of Poole Harbour is the UK's largest onshore oilfield, which extends under Poole Bay. In 1990 there were plans to extend extraction by constructing an artificial island in the bay and bringing the oil ashore via a pipeline through Studland Bay. The environmental impact studies for this, first revealed the northern extent of the maerl bed described here. With developments in directional drilling which could reach several miles offshore, the island construction plans were abandoned. However, such a development may yet be envisaged in the future.

Poole Harbour is a busy port, which requires routine maintenance dredging as well as new developments such as currently, the construction of a marina. Dredged spoil (typically mud and silt) from the harbour is dumped in a licenced area some 3-5km SE of the maerl bed. Currently there are plans to dump some 1million m³ of harbour spoil. There are several gravel extraction sites to the east

of Poole Bay. Both spoil dumping and gravel extraction cause water column turbidity which could potentially affect the light intensity at the maerl seabed plus add to the sediment deposition covering the maerl. Another unexpected source of suspended sediment was observed during the survey. The fast cross-Channel ferry from Poole travels slowly out of the narrow approach channels and accelerates over the maerl bed. On one occasion the ferry passed within 100m of divers working on the seabed. As the shockwave from the acceleration hit them and the seabed, silt was resuspended to such an extent to make further work impossible. Apart from sediments, slipper limpet (*Crepidula fornicata*) chains are very common and mobile in Poole Bay overwhelming the northern parts of this bed. Grall and Hall-Spencer (2003) have observed the rapid inundation of maerl bed by *Crepidula* in the Bay of Brest.

Towed demersal fishing gear poses a particular threat to many fragile seabed habitats. Hall-Spencer and Moore (2000) describe the deleterious impact of scallop dredging on maerl beds. Whilst queen scallops (*Aequipecten opercularis*) are present on the Poole Bay there is no evidence of their exploitation to date. However trawling and oyster dredging are common practices in the area, both of which can destroy colonies (up to 30cm across) of the hard, foliose bryozoan *Pentapora foliacea* common in the core of this maerl bed.

Continued surveys along the Dorset coast have revealed isolated pockets extending further west along the Purbeck coast and in Lyme Bay. Annika Mitchell (Mitchell, 2001; Mitchell and Collins, 2003) has made considerable progress towards understanding the environmental parameters controlling the distribution of maerl in western Poole Bay. Another approach employed net oxygen production measurements to determine and thus model its growth potential and health. Laboratory measurements (Barker, 2001) have been made of maerl respiration and photosynthetic rates at different temperatures and light intensities. In 2002 *in-situ* seabed incubation experiments were carried out (Vagianou, 2002), which produced a model of

net production over a whole year, from respiration, production, temperature and light intensity and attenuation data. The model gave an extinction depth of 20m, i.e. below this depth there is insufficient photosynthetic activity for the maerl to survive. These growth rate studies will be used to determine the mass balance (growth vs export) for the bed to help estimate its vulnerability.

The Dorset maerl bed is at its geographical limit and is thus particularly vulnerable. Numerous potential threats have been identified and need to be assessed. Routine monitoring of the extent and density of the Poole Bay maerl bed will be required to determine whether it is surviving or declining. This study, carried out entirely by volunteers, represents a baseline from which change can be assessed and threats addressed.

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Osilinus lineatus and other intertidal Mollusca near range limits in the north of Ireland

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Introduction

During the late 18th and early 19th century, very little work was done on the marine fauna of the north of Ireland. The lack of records was to some extent remedied in the mid 19th century by a unique group, the Belfast Dredging Committee. Two of its members, George Hyndman (1796-1867) and William Thompson (1805-1852) were active in exploring the marine life off the coasts of Down and Antrim by dredging. Other important naturalists were also members, e.g. George Dickie (1812-1882), the first Professor of Natural History at Queen's University, Belfast, and Charles Wyville-Thomson (1830-1882). Many of their results were published in the Reports of the British Association (1857-1859). Dickie (1858) produced the first paper on a distinct geographical area, which appropriately was Strangford Lough. However, all the active workers had died by 1882, and little work was done in subsequent years. Counties Donegal and Londonderry were almost completely ignored by early workers, with the exception of Hart (e.g. Hart, 1892) and Praeger (e.g. Praeger, 1894). All records for the north of Ireland were summarised by Praeger in 1889, whilst Nichols summarised all records for Ireland in 1900 - still the most recent checklist of Mollusca for Ireland.

For most of the early 20th century, there was little recording of marine Mollusca in the north of Ireland, with the exception of Nora Fisher-McMillan (1908-2003). She actively recorded in Antrim and elsewhere, and produced a series of short papers mainly between 1926 and 1952 (e.g. Fisher, 1937). In 1945, Queen's University purchased a house in Portaferry, Co. Down, which became the Marine Biology Station. For about 10 years, many sites in Strangford Lough were investigated, and all these records, together with the earlier ones, were published by Williams (1954) in an annotated checklist. Although the 1960's and 1970's saw an expansion of Queen's University activity in marine biology, very little of the published work during this period concerned the biogeography of Mollusca; although a copy of Williams' paper kept in the Marine Station was annotated by hand with any interesting observations. The most recent specific survey of Strangford Lough for marine Mollusca was carried out by Nunn in 1989-1992 for a M.Sc. Thesis, published as a paper in 1994 (Nunn, 1994).

In the mid 1980's, the intertidal molluscan fauna of Northern Ireland was surveyed by Heriot-Watt University (Wilkinson *et al.*, 1988) as the Northern Ireland Littoral Survey, commissioned by the D.O.E. (NI). In 1986, the north coast of Ireland was surveyed for Mollusca by the author and Shelagh Smith (Nunn & Smith, 1987). A detailed study was also made of the Mulroy Bay area (north Donegal) (Nunn, 1996). Subsequent intertidal records for the north of Ireland have been sparse, mainly casual observations by the author, and some intertidal records from the BioMar survey in Donegal (Picton & Costello, 1998).

A project was initiated in 1992 by the author, in collaboration with Shelagh Smith, Bernard Picton and Dave McGrath, to map the marine Mollusca of Ireland. The results of that project will be published as a CD (Table 1). This project provided a further stimulus to recording in the north of Ireland.

Table 1 Details of CD project

<i>Title:</i> The marine Mollusca of Ireland: checklist, atlas and bibliography
<i>Authors:</i> Julia Nunn, Shelagh Smith, Bernard Picton & Dave McGrath
<i>Publication date:</i> [No idea! But hopefully before the end of this century....]
<i>Format:</i> CD-ROM with accompanying instructions and notes as a sleeve
<i>Content:</i> historical background; text & distribution map for each species; photographs for 200+ species; photographs for marine rocky biotopes in Ireland; ecology & description of biotopes where relevant to Mollusca; etc.

Observations and Discussion

The majority of intertidal Mollusca in Ireland are common and/or widely distributed. However, there are a few species that show distinct patterns of distribution. For example *Barleeia unifasciata* (Montagu, 1803) is found only on western coasts, from Inishowen peninsula (north Donegal) down the west coast to SW Cork. Both *Simnia patula* (Pennant, 1777) and *Eatonina fulgida* (J Adams, 1797) are largely absent from the east coast of Ireland. Within this group of species, a number have their northern or southern limits in the north of Ireland. For example, *Margarites helycinus* (Phipps, 1774) is only present in the north of Ireland in Ireland, from Carlingford Lough to south Donegal, with only a few scattered records south from there to north Galway Bay. The nudibranch *Onchidoris muricata* (OF Müller, 1776) has a similar distribution.

Both *Tonicella marmorea* (O Fabricius, 1780) and *Rissoella globularis* (Forbes & Hanley, 1853) have northern distributions within the British Isles (Seaward, 1990). *Tonicella marmorea* has only been found recently (post-1970) living in the north of Ireland within Ireland (Rathlin Island (Antrim) to Carlingford Lough). *Rissoella globularis* has only been found recently living in the north of Ireland in Ireland (with the exception of one record from Galway Bay). Both these species were found to be relatively common in Strangford Lough in the early 1990's (Nunn, 1994). Visits to the same sites in the late 1990's to date by the author, using the same methodology, suggest that *T. marmorea* is less common, and *R. globularis* can no longer be found. Conversely, *Ostrea edulis* Linnaeus, 1758, an uncommon species in the early 1990's, rarely found in the intertidal in Strangford Lough, is now found at many more intertidal sites, particularly in the northern half of the Lough, and in places can be common. However, the increase in this species is due to the seeding of selected areas of the Lough with young oysters by local fishermen.

Tectura testudinalis (Müller, 1776) is another species with a northern distribution within the British Isles. In Ireland, it is only found in the north east, from Mulroy Bay

(Donegal) to the Cooley Peninsula (Louth). It was common in the main body of Strangford Lough before 1994. When searched for at several sites in 1997 and 1998, the species could not be found. However, in 1999, specimens less than 5mm in length were observed, and in subsequent years, this settlement and others have established the species as common again throughout the lough. Caution should therefore be exercised before ascribing such changes to climate change - an understanding of the recorded history of a species is essential.

The distribution of two species has been studied in detail in Strangford Lough in recent years. These are *Gibbula umbilicalis* (da Costa, 1778) and *Osilinus lineatus* (da Costa, 1778). Both these species are amongst a group of species considered to be indicator species at the limits of their range in the British Isles. In 1952-53, Southward and Crisp recorded the distribution and abundance of a group of relatively common species (including *G. umbilicalis* and *O. lineatus*) around the coast of Britain and the island of Ireland (Southward & Crisp, 1954). This work is being repeated by the MarClim project, and used to monitor potential climate change.

(a) *Gibbula umbilicalis*

Gibbula umbilicalis is a southern and western species in the British Isles (Seaward, 1990). In Ireland, from east of Malin Head (Donegal) to Carrsore Point (Wexford), *G. umbilicalis* is relatively sparsely found. Prior to 1994, this species was absent from the main body of Strangford Lough, and only sparsely present in the Narrows (Nunn, 1994) (Figure 1). Published history suggests that this has been the case since recording in the lough began. Dickie (1858) only recorded dead shells from Castleward Bay, and Williams (1954) only recorded the species from three sites in the Narrows in the 1940's. Records from the Northern Ireland Littoral Survey (Wilkinson *et al.* 1998) must be discounted as the specimen of *G. umbilicalis* lodged with the Ulster Museum was incorrectly identified. The author visited 118 sites in the lough between 1986 and 1992, and the species was

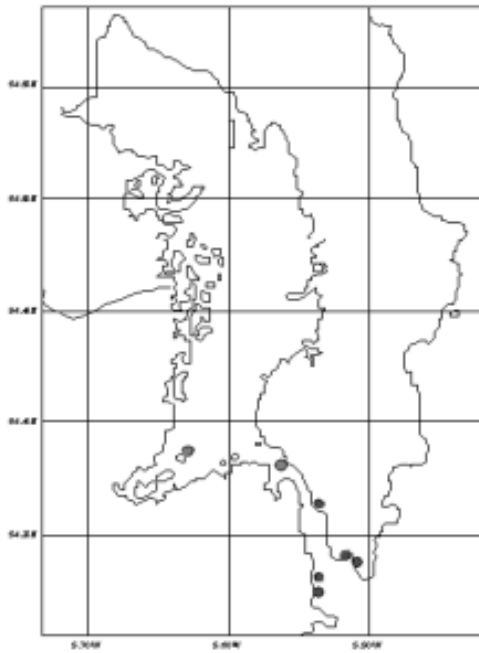


Figure 1. *Gibbula umbilicalis*: all records pre-1994

black dots: live records, post-1969

grey dots: live records pre-1970, or shell only

only found alive (sparse) in the Narrows. Indeed, no dead shells were found in the main lough (normally very persistent).

In July 1999, *Gibbula umbilicalis* was found by the author, during work associated with Queen's University, commonly, at sites in the north-west of the main lough. The species has now been recorded from many sites throughout the lough (Figure 2). Maximum densities have exceeded 120/m². In the Narrows, densities have also increased - from 2/m² in 1989 at Ballyquintin to 15/m² in 2003.

(b) *Osilinus lineatus*

Osilinus lineatus is a largely southern and western species in the British Isles (Seaward, 1990). In Ireland, *Osilinus lineatus* has a discontinuous distribution, being mainly absent from Malin Head down the east coast to Carnsore Point, apart from a stretch of coast from approximately St. John's Point, Co. Down to south of Dublin. This distribution was first published by Southward & Crisp (1954), and a similar distribution (unpublished) was compiled by the author prior to 1994.

On the north coast of Ireland, east of Malin Head, *Osilinus lineatus* has only been recorded from Portballintrae in 1952 by Nora McMillan,

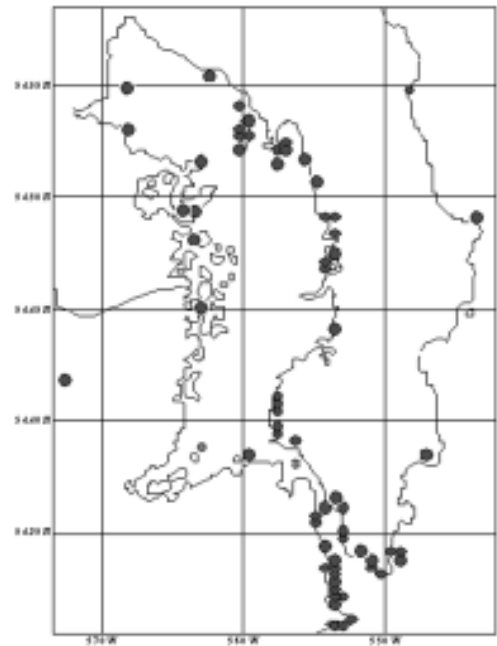


Figure 2. *Gibbula umbilicalis*: all records pre-2004

black dots: live records, post-1969

grey dots: live records pre-1970, or shell only

and from the Skerries, Portrush in 1979 by M. Boyle. There are no extant specimens for the latter record. Several visits by the author to Portballintrae in 2003 and 2004 have failed to find any specimens of this species.

Local records for the Strangford Lough area prior to 1994 are shown in Figure 3. The most northerly accepted station for *O. lineatus* on the east of Ireland was Benderg Bay, last seen in 1901. Casual visits there by naturalists in recent years failed to record the species. The most northerly substantial population is at Killough, recorded in 1971 by Roy Anderson, and in 2003 by MarClim and the author. A good population was also recorded in 2000 further south, from St. John's Point by Anderson. A single specimen was seen in the same year by the author at Phennick, near Ardglass - at that time the most northerly record on the east coast since 1901.

In August and September 2003, the author walked a number of sites in order to determine the current northernmost limit of *Osilinus lineatus* on the east coast of Ireland. A small population was discovered in Benderg Bay (earliest settlement date 1994, ascertained from growth checks on the shell), the first record there for more than 100 years. Further



Figure 3. *Osilinus lineatus*: all records pre-1994
black dots: live records, post-1969
grey dots: live records pre-1970, or shell only

observations extended records of the species into the west side of the Narrows - Millquarter Bay, Kilclief, to Isle O'Valla (earliest settlement dates 1996-1998) - although at very low densities (1-2/25m²). *O. lineatus* was apparently absent from the east side of the Narrows except at Ballyquintin (settlement dates 1998-2001). Although also apparently absent from many sites in the main body of Strangford Lough, a single specimen was found at each of two sites in the south-east at Ballywhite Bank and Marlfield Bay (settlement date 2000) (Figure 4). *O. lineatus* was not found at any of several sites visited on the Outer Ards Peninsula.

Although there are currently no proven explanations for most of the changes discussed above, they raise the possibility of climate change. *Gibbula umbilicalis* and *Osilinus lineatus* in particular are south/western species at the limits of their range, and thus more likely to show changes in their biogeography in response to global warming.

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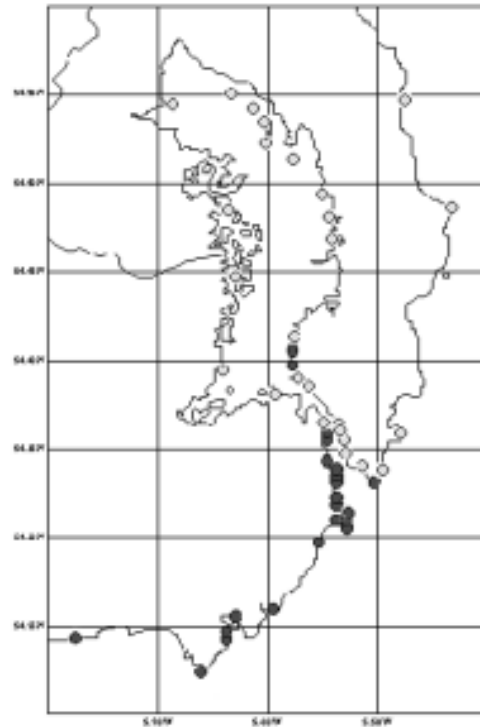


Figure 4. *Osilinus lineatus*: all records pre-2004
black dots: all live records, 1970-2004
grey dots: sites where species searched for, but not found (negative records)

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Note

Since this talk was given, recent fieldwork has now extended the distribution of *Osilinus lineatus*. A single specimen was found in the NW of Strangford Lough at Darragh Causeway in April 2004. It has also now been found at three sites on the outer Ards Peninsula, the most northerly being Slane's Point in July 2004 (four specimens). Visits to sites further north than Slanes Point have not yet yielded any records of this species.

The Status, Distribution and Ecology of *Paludinella littorina* (delle Chiaje, 1828) (Gastropoda: Assimineidae) in the British Isles.

Ian J. Killeen and Janice M. Light.

For the full paper, readers should refer to: Journal of Conchology, vol 37, no.5 pp 551-563.

Abstract

Surveys over the last 15 years have revealed that the assimineid *Paludinella littorina* (delle Chiaje, 1828) is much commoner in the British Isles than previously believed. It is currently known living at 40 sites ranging from the Isles of Scilly, eastwards along the Channel coast of England as far as the eastern end of the Isle of Wight. It extends as far north as the Bristol Channel with sites on the north coast of Devon and the coast of Pembrokeshire. The west coast of the Lizard peninsula, Cornwall and the Isles of Scilly support significant numbers of *P. littorina* populations. The two principal habitats in which we have found *P. littorina* are caves, and shores with a supra-littoral zone comprising large stones and boulders with stable interstitial gravels beneath. Observations on the species' habitats, ecology and conservation are discussed.

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