Editorial

Being a regular user of Facebook I follow with interest the increasing number of posts both in the Porcupine group and also the British Marine Life Study Society group asking for help identifying a huge variety of marine flora and fauna. What has come to light is the rapid way that information on recent sightings and name changes are exchanged as part of the thread. The ability to upload images quickly and easily in the field has the potential to speed up validation of identification through contact with many knowledgeable individuals and should hopefully lead to more accurate identification of difficult species. Each thread provides an opportunity for online discussion - perhaps of features, habitat, location and often specialists have been able to question and query as well as put forward suggestions for further study. That there are so many keen and enthusiastic people who are part of these groups and forums, means that there is a huge resource of readily available knowledge and support just at our finger tips.

The advancements in mobile internet technology are allowing greater scope for online recording in both terrestrial and marine fields and this is clearly an area that is fast becoming a way of encouraging more professional and amateur enthusiasts to record their observations (for example iSpot and the Big Seaweed Search). This does mean that there is a much greater potential for individual sightings and observations, which are not part of a bigger survey, to be properly verified and placed into a recording scheme so they can be added to the NBN gateway.

Porcupine has its own recording scheme which rarely has many submissions. My question therefore is how can Porcupine keep up with all these technological advancements and how can we bring the Porcupine recording scheme up to date? If you have any suggestions please let the editorial team (viks@sun-fish.co.uk) or the Porcupine Records Convenor (Roni Robbins, ronirobbins@artoo.co.uk) know.

Photo: Peter Barfield

Porcupine Marine Natural History Society Field Meeting April 2012

Guernsey, Channel Islands

Thursday 5th – Tuesday 10th April 2012

Guernsey (49°28′ N, 2° 35′ W), the second largest of the Channel Islands at around 25 square miles (65 km^2), lies 27 miles northwest of Jersey and 30 miles off the French (Normandy) coast. The spectacular coastline is about 25 miles in length and has granitic cliffs to the south and southeast, but is flatter to the west and north, with a series of large sandy bays. The Channel Islands have long been of interest to marine natural historians; for example, Koehler (1886) published a three-part collection of "Contributions to the study of the littoral fauna of the Anglo-Norman Islands (Jersey, Guernsey, Herm, and Sark)" in volume 18 of series 5 of the *Annals & Magazine of Natural History*.

The tidal range is large; 10m at Spring tides. The tides at Easter 2012 are among the best of the year and ideal for intertidal sampling.

Tides: April (BST adjusted) – Easter

Thursday 5th	12:39	1.4m
Friday 6th	13:26	0.9m
Saturday 7th	14:10	0.5m
Sunday 8th	14:52	0.5m
Monday 9th	15:32	0.7m
Tuesday 10th	16:12	1.1m

Water quality in the Channel Islands is excellent, however, tidal currents are strong. On Springs the maximum tidal flow (high/low water) can reach 5 knots! Although the fieldtrip is focused on the intertidal, **diving** may be a possibility if there is sufficient interest (**see below**).

Dredging may also be possible if we can secure a suitable and affordable vessel one day.

Laboratory: A laboratory will be set up in the 'Reading Room' at *Les Cotils*, St Peter Port, from the 5th-10th April 2012: http://www.lescotils.com/the_reading_room

Accommodation:

There is no requirement to stay at *Les Cotils*. Some participants may wish to stay elsewhere. *Porcupine* is not taking responsibility for arranging accommodation for attendees. Costs at *Les Cotils* (1st April – 31 October 2012) are:

Bed and breakfast: standard room £41.00 per person, Sea view £45.50 per person Bed breakfast and evening meal: Standard room £53.00 per person, Sea view £57.50 per person.

These prices are slightly higher (£2.50-4.00) than those currently on the website for 2011:

http://www.lescotils.com/room_tariffs

If you are interested in staying at Les Cotils, you can book online (1 night deposit): https://portals.uk.rezlynx.net/lescotilspportal/wfrmpakquery.aspx?siteid=lescotils

Les Cotils is up-hill at St Peter Port, but is in easy walking distance of restaurants etc.

Other accommodation: http://www.visitguernsey.com/

Getting there:

Information here: http://www.lescotils.com/travel_information and here: http://www.visitguernsey.com/transport/

Rough estimates of travel costs are around £250-300 return for a car (2 adults) by ferry. There are fast 2.5 hr and slow ferries (variable

Instructions to authors

Although we can deal with most methods and styles of presentation, it would make our editorial lives easier if those wishing to contribute to the Newsletter could follow these simple guidelines. Please submit all material in electronic format if at all possible either by e-mail or disc/CD.

Text

Please submit your paper, article, request for information etc. as a Word document. It will be a great help if you use styles to format titles, headings etc. Please use the following style names:
General text: "Normal"
Title: "Heading 1"
Subtitles and section headers: "Heading 2"
Author details/address: "Name"
Figure or table captions: "Caption"
Footer/endnote: "Footer"
Don't add any spaces after paragraphs.
Insert placeholders to indicate where illustrations, photos, etc should be placed e.g. Insert Fig.1 here, and attach the illustrations, photos, etc separately rather than within the text.
Spaces between paragraphs, page numbers, headers and footers are not necessary.

Illustrations (Figures and Plates)

Photographic images should be supplied as greyscale or colour (RGB) JPGs with a resolution of 300 pixels per inch and width of 7 cm. Save at high quality.
Line drawings, particularly maps, are best supplied as WMF files. If it is a detailed map which will need the full page width, save it with a width of 15 cm. Graphs, histograms, etc. are best supplied as Excel files – save each graph as a separate sheet.
We can scan good quality photographs, transparencies and hard copies of drawings, where necessary.
For each illustration, photo etc. submitted, please provide the following information:
Filename, Caption, Photographer (if appropriate) and please be aware of any copyright issues.

References

Do not leave a line space between references. Please follow the examples below for format. Journal titles should be cited in full.
Citations are as follows ….Brown & Lamare (1994)… or…. (Brown & Lamare, 1994)…, Dipper (2001)… or …(Dipper, 2001).
Brown, M. T. and Lamare, M. D. 1994. The distribution of *Undaria pinnatifida* (Harvey) Suringar within Timaru Harbour, New Zealand. *Japanese Journal of Phycology* **42**: 63-70.
Dipper, F. A. 2001. *Extraordinary Fish*. BBC Worldwide Ltd. 96pp.
That said, we will do our best with whatever you send.

7-12+ hrs depending on sailing time) from Weymouth or Portsmouth; fast one a little more weather susceptible: http://www.condorferries.co.uk/Media/Timetables.html). Flights are 'around' £100 (est. £80-120) from various airports (e.g., in the south - Bristol, Gatwick, Southampton: 45-80 minutes), but excess baggage is likely to be expensive! If you fly, you will need transport from the airport to St Peter Port.

Getting around:

We are hoping that some attendees and perhaps some Guernsey participants will have cars and be willing to help transport people to the shores.

There is (currently) a bus service too, though apparently the renewal of contracts is up in the air just now (contract ends 31st March!). Cars can be hired on Guernsey too, but hopefully this will not be necessary.

Costs:

The cost (to cover lab costs etc) will be £50 for the period; deposit of £10 required on booking.

Should diving or dredging be possible, some additional costs will likely arise for the participants involved

Booking:

To book your place please fill out the booking form and send a cheque for £10 (deposit) made payable to the ***Porcupine Marine Natural History Society***

to Andy Mackie, Marine Biodiversity, National Museum Wales, Cathays Park, Cardiff CF10 3NP

(andy.mackie@museumwales.ac.uk)

If you are interested in attending:

- Book early, send in the booking form now!
- It is imperative that you book your accommodation as soon as possible (for those interested in diving, see next point). Guernsey at Easter can be popular. Do not leave things until the last minute as you may be disappointed.
- Diving: If you are interested in diving, it is vital that we hear from you a.s.a.p. Diving will only be organised (by Sue Daly and Fiona Crouch) if enough participants are obtained to make it a viable operation.

The Channel Islands Seasearch Coordinator Kevin McIlwee is keen to get more records from Guernsey and is planning to come over from Jersey during the Porcupine trip to meet up with us. There are shore diving options, and maybe RIB diving. Air fills £2.50 from Donkey Divers. It'd be good to hear from anyone who's interested in diving, or any one who's dived Guernsey before and can recommend good sites!

Organisers: Andy Mackie, Richard Lord, Fiona Crouch and Sue Daly

Enticing images from the Channel Islands

Richard Lord: http://www.sealordphotography.net/Nature

Sue Daly: http://www.suedalyproductions.com/

Porcupine Annual Conference – Hull 23rd-25th March 2012

The Meeting will be held at The Deep (http://www.thedeep.co.uk/) from 23 to 25 March, 2012.

The Deep is conveniently located in close proximity to the train station, as well as a number of hotels.

Friday and Saturday will be the normal sessions of oral and poster presentations. Sunday will involve a field trip to Thornwick Bay (lunch included) with the use of Hull University labs afterwards for sample/specimen examination.

The provisional theme is "Why Marine Taxonomy?"

Please send offers of talks and posters to Ann Leighton Ann.Leighton@hull.ac.uk

The Conference fee will be £50, to include refreshments morning & afternoon, lunch at the Deep on Friday and Saturday, as well as Fish & Chips on Sunday and coach travel to and from Thornwick Bay on Sunday

The Conference dinner on the Friday night will be at the Deep Two Rivers Restaurant, preceded by a private tour of the Deep (cost £35).

A booking form can be downloaded from the Porcupine website (http://pmnhs.co.uk/)"

Porcupine Grant Scheme 2011: Recipients and Progress

Last year, *Porcupine* awarded two research grants. The recipients were Rayner Piper for a study of the provenance of North Sea *Pampas argenteus* and Emily Priestley as part funding for an expert team to conduct an underwater survey of north Cornwall. The projects are progressing well and both recipients hope to present accounts of their findings at the *Porcupine Conference* in Hull in March, with articles later appearing in the *Newsletter*. The north Cornwall underwater investigations off the coast of St Agnes and Newquay, involved 20 Seasearch volunteers led by Emily and Angie Gall have already received publicity in several newspaper articles and press releases. Preliminary results from the 12 subtidal sites and 7 shore sites surveyed included over 180 species of algae (Prof. Juliet Brodie) and around 70 polychaete species (Teresa Darbyshire). In addition, Dr Claire Goodwin gathered over 100 sponge samples from dive sites like the Bawden Rock off St Agnes and Medusa Reef off Newquay. A general species list was collated from the participants who came from as far afield as Suffolk, Cardiff and Belfast — as well as local divers who knew the area.

Readers are reminded that information on the *Porcupine Small Grants Scheme* is posted on the *Porcupine* website (http://pmnhs.co.uk/). The deadline for 2012 is 29th February, with successful applicants announced at the Hull conference in March.

Porcupine Newsletter Student Prize 2011 - Winner

We are pleased to announce that Kathryn Ross is the winner of the 2011 Porcupine Newsletter Student Prize.

You can read her article, Invertebrate life of Brownsea Island Lagoon and its importance to the birds of Poole Harbour, in the Autumn 2011 Newsletter (no. 30).

Well done Kathryn and we look forward to hearing more about how your research is progressing in future issues of the newsletter.

We would also like to thank all the other writers who entered the competition and we are sorry that there can only be one prize!

It is reassuring to see numerous non-native species in the guide, which is valuable in ensuring that these, sometimes very localised species, will be spotted by enthusiasts whilst beach walking or diving.

Good quality, glossy paper will see this guide cope with plenty of handling with damp hands, so I can see it surviving in my armoury of identification books for a long time. The guide is available for £20 (incl. P&P). For further details, contact Lin on Polychaos6@virginmedia.com

An example page from the guide.

C.A. Maggs & M.H. Hommersand. 1993. Seaweed of the British Isles. Volume 1, *Rhodophyta*. Part 3A, *Ceramiales*. xv, 444p. London: HMSO.

Bunker, F. StP. D., Maggs, C. A., Brodie, J. A., & A. R. Bunker. 2010. *Seasearch Guide to Seaweeds of Britain and Ireland*. Marine Conservation Society, Ross on Wye.

iSpot - An innovative, interactive way to have your marine questions answered.

Increasing public engagement and understanding of local wildlife and biodiversity has long been a priority for conservation organisations, government bodies and many individual experts, and has long been a core principle of the Porcupine Marine Natural History Society. iSpot (www.ispot.org.uk), which is operated by the Open University (www.open.ac.uk) and was developed as part of the Open Air Laboratories (www.opalexplorenature.org) (OPAL) project, was launched in the Summer of 2009. It is an innovative approach to public engagement in nature by allowing anyone with an interest in wildlife to share their observations and get help with their identifications. At its core, the iSpot user is the active contributor rather than the passive consumer - users can upload their own observations as well as observing and commenting on the observations of other users. The distributions of any species which have been identified are available to see on maps, either by local area or nationwide, whilst other links provide further information from the Encyclopaedia of Life or the NBN gateway. In addition to this, the site hosts an ever increasing set of interactive and user-friendly identification keys as well as now producing a phone app (Bugs Count) which allows for observations to be uploaded from mobile devices in the field.

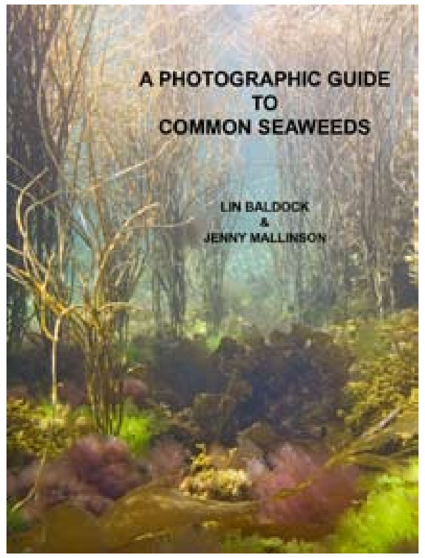
The Porcupine Marine Natural History Society is one of many biological recording schemes represented on iSpot. Users that represent their natural history societies have a "badge" next to their username. Each time they make a contribution to iSpot, the badge of their organisation appears with a link back to the scheme or society they represent. Should you wish to become a representative of the Porcupine Marine Natural History Society, please fill in the relevant form on the iSpot website as well as sending an email to a member of council.

iSpot provides a valuable resource which will not only help people identify what they have seen or found, but it also motivates learners to engage with existing resources available within a community of like-minded individuals.

A photographic Guide to Common Seaweeds by Lin Baldock and Jenny Mallinson

2010, version 3

Book Review by Paul Brazier



This guide was borne out of a need, by amateurs and professionals, for useful seaweed identification aids, and Lin required such a guide to support her training classes. At the time, there was the out of print (and, in part, out-of-date) red seaweeds by Sue Hiscock and the somewhat technical and relatively expensive Natural History Museum Guides to work from. This guide lies comfortably between these two sources of material.

The seaweeds that are included reflects the experience of the two authors, Lin and Jenny in the intertidal and subtidal of the Dorset and Hampshire areas, but fear not, the guide covers the vast majority of conspicuous UK algae. It certainly lives up to its title, having a flourish of photographs for each seaweed described. This is where its strength truly lies, for each photograph is annotated with the pertinent characteristics, illustrating each seaweed at a scale that best demonstrates the necessary features for identification. In doing so, the guide also illustrates the beauty that lies within the detail of so many of our marine macro-algae.

The guide has a very practical and robust wire spiral bind with plastic protectors front and back. It consists of 9 pages of introduction, 10 pages of green algae, 22 pages of brown algae and 59 pages of red algae and in most cases, presents two seaweed species per A4 side. This photographic guide was published just prior to the Seasearch Guide (reviewed previously) and, like the Seasearch guide, meets the modern expectation of excellent quality photographic prints.

The introduction to the guide includes information on collecting, recording, identification and some good sources of additional information. For each entry, there are typically a number of photographs, illustrating the salient points for identification, a brief description of the seaweed and some further information. I would have liked to see a consistent approach to describing the habitat and geographic range, but this is version 3, so it would be the next obvious step to add this information, where missing in the future.

The 15 green algae include those that you frequently find and the guide deals with some of the difficulties of this group of algae. In some cases, those species that may be confused are also described, and where relevant, the guide mentions where there are other species in the genus, that are not covered, for example *Cladophora* species. It is important for the reader to have this information to be able to appreciate the likelihood of their specimen being a different species of the same genus. It is fair to say that, in the case of *Cladophora* and some other green seaweeds, a more specialist key would be necessary for a confident identification. The 50 brown algae included, neatly illustrate the range, from shore to underwater, that the brown seaweeds cover, again with good examples of fresh material in its natural environment, plus useful scans of pressed material to illustrate certain features. The majority of the entries in this guide are in the red algae section, with 125 taxa. In the interests of including all of the seaweeds that will be spotted by non-specialists, the numerous species of *Ceramium* and *Polysiphonia* have not been explored, but this does not detract from the guide. For those who wish to delve into that level of detail, other books are far more suitable (e.g. Maggs & Hommersand 1993).

Porcupine Newsletter Prize 2012

For the second year a prize will be awarded to the best article published in the newsletter by a student or amateur enthusiast (i.e., not professionally employed in the marine field), as judged by a subcommittee of the Council.

The prize will consist of £50, plus 1 year's membership.

There are no exclusive themes. An article could be on a project or thesis you are working on; a visit or field trip you have made to a shore or dive site; a particular marine organism you are interested in and have been researching (in the field or desktop) etc. There are many examples you can draw on for inspiration in past newsletters.

We ask only that there be no multiple authors.

To be considered for the prize, please make your status clear on submission of your article to the Honorary Editor – Vicki Howe, viks@sun-fish.co.uk

For Instructions to Authors please see http://www.pmnhs.co.uk/files/instructionstoauthors.pdf

The PMNHS looks forward to your contributions.

We are grateful to Frank Evans for his suggestion that a prize be created.

Porcupine Website Revamped!

Tammy Horton, the *Porcupine* webmaster has been working with a trusty web designer to create a more modern and user friendly website. On the website, Tammy writes "above all the transition to *WordPress* means that I will be able to manage the website and upload articles/news with much greater ease!" Please visit the website at http://pmnhs.co.uk/ for the latest news. We welcome feedback, so don't be afraid to let us know what you think.

HYDROID & BRYOZOAN TAXONOMY TRAINING WORKSHOP FIRST NOTICE

Portaferry, Co. Down, Northern Ireland

18th-22nd August 2012

This Workshop will be a five day introductory training course to hydroid and bryozoan ecology and taxonomy. It will combine lectures, fieldwork (shore and diving) and practical laboratory work. No prior knowledge is required. The aim is for all participants to be able to identify any British and Irish species to at least genus level. Topics to be covered include: hydroid and bryozoan morphology, an outline of major hydroid and bryozoan groups, hydroid and bryozoan reproduction and ecology, hydroid and bryozoan bio-invasions and *in situ* identification of the hydroids and bryozoans of Britain and Ireland. Practical sessions will cover field and laboratory identification, and preservation techniques.

Tutoring the course will be Professor Ferdinando Boero (University of Salento), Professor John Ryland (University of Swansea), Dr Jo Porter (Heriot-Watt University) and Bernard Picton (Ulster Museum).

FIELD TRIP 2011

September 2011 Fieldtrip to Kent

Fiona Crouch

The diverse coastline of Kent was the venue for the 2011 fieldtrip and this was the first time PMNHS had visited these shores. The Sandwich Bay Bird Observatory provided an excellent base camp, with very comfortable and good value accommodation and a class room for our makeshift laboratory.

On Saturday a couple of intrepid Porcupiners arose before dawn (4 am) to join a team of birdringers, setting mist nets on the Reserve. Those not willing to get up so early had the opportunity to watch the team in action as they brought the birds back to the Observatory to apply the rings. A rather unusual start to a Porcupine fieldtrip but very enjoyable, especially as we were given the opportunity to release the birds once they had been identified, weighed and measured.

Bird ringers

Later on Saturday Porcupines headed to the chalk reefs of St. Maragrets Bay near Dover. Basking in sunshine, the chalk cliffs provided a stunning backdrop for fieldwork and brought back some fond memories for me. This was where I spent many a happy day as a child exploring the shore where my interest in our amazing marine life began. We were joined by Ian Tittley, once of the Natural History Museum and phycologist extraordinaire. We were captivated as he imparted his knowledge of all things algal. Ian has written his own detailed account of what we discovered over the weekend.

Ian Tittley in St Margarets Bay

Dragging ourselves away from seaweed we conducted a 20 minute timed search for 22 climate change and non-native species as part of the Shore Thing Project (www.marlin.ac.uk/shore_thing). One species of note found during the search was *Gibbula umbilicalis*. Range extensions of many species have been attributed to rising sea temperatures. However, research has shown that the movement of *G. umbilicalis* has instead been due to its ability to colonize artificial structures such as sea defences. (Mieszkowska, N, *et al* 2006). MarLIN describes its distribution as follows: *Gibbula umbilicalis* is found on western shores of the UK as far north as Scotland and on suitable shores in Ireland. It is absent from the North Sea coast and eastern English Channel. The National Biodiversity Network's (NBN) maps now show some points on the east coast of England and the Porcupine record confirms that *G. umbilicalis* is now established in the Dover area.

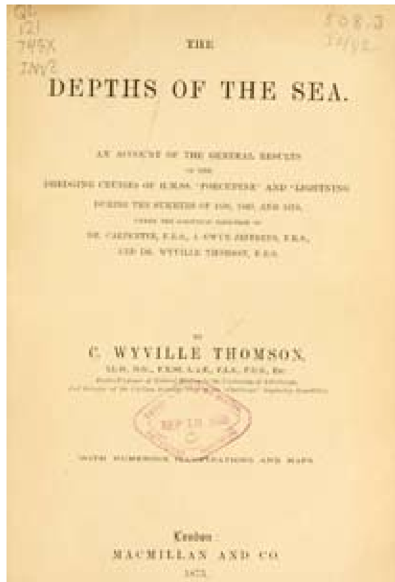
Frances Dipper scoured the shore for fish whilst Susan Chambers collected sediment and chalk samples in search of polychaetes. Neither fish nor polychaetes were abundant (see species list).

In contrast to the chalk reefs of St. Margarets Bay, the mudflats at Seasalter near Whitstable were the location for Sunday's survey. Once over the substantial seawall the narrow pebble

REVIEWS

The Biodiversity Heritage Library

Tammy Horton


THE

DEPTHS OF THE SEA.

C. WYVILLE THOMSON

London:

MACMILLAN AND CO.

For those who have not yet come across this invaluable resource – this review will be a welcome read, and for those of you (hopefully many) who are already using the website, it will probably just give a little background to what you already enjoy.

On the front page of the website at http://www.biodiversitylibrary.org/ we find the following statement: "The Biodiversity Heritage Library (BHL) is a consortium of natural history and botanical libraries that cooperate to digitize and make accessible the legacy literature of biodiversity held in their collections and to make that literature available for open access and responsible use as a part of a global "biodiversity commons." The BHL consortium works with the international taxonomic community, rights holders, and other interested parties to ensure that this biodiversity heritage is made available to a global audience through open access principles. In partnership with the Internet Archive and through local digitization efforts, BHL has digitized millions of pages of taxonomic literature, representing over tens of thousands of books and journal volumes.

And it does exactly that. While it is, of course, a work in progress, I have found that the majority of the older literature that I have needed can be found on the site. As a taxonomist access to older literature in the original format is both a necessary and time-consuming part of my work. I have spent many hours (probably days) wandering libraries in search of and then photocopying large format, old, rare and fragile texts. The BHL greatly facilitates this process by doing it all for you! With access to the internet everyone has these texts available at their fingertips with no charge for photocopying or interlibrary loans!

No matter how obscure you think your text is there is a good chance of finding it here and if you can't find it you can even put in a request to have it found and scanned and added to the resource.

The thing to remember as is that to perform a simple search of BHL, you need to enter an EXACT PHRASE such as "proceedings of the academy" (without quotation marks). Entering keywords such as "proceedings academy" will not return results. This is very important and worth remembering. Just using a keyword will NOT necessarily return what you are after. If what you are searching for does not get a hit first time it is often worth persevering and trying again with an author or journal search as I've sound this can sometimes work.

There is plenty of information on the site itself and there is a very comprehensive help and tutorial section (top right menu) giving information on how to search, download, save and open the files. There is also further information with an FAQ section and list of the library consortium that contribute to the work. It really is an amazing resource and one we should all be supporting and using! Go there and have a look around!

The BHL can also be found on Facebook (https://www.facebook.com/pages/Biodiversity-Heritage-Library/63547246565) and followed on Twitter (@BioDivLibrary) and there is also a blog to follow (http://blog.biodiversitylibrary.org/) all of which highlight new texts that are being uploaded or give you insights into what is already on the site e.g. the 'book of the week' and notifications of conferences or biodiversity news.

Character	*Pomatoschistus*					
	pictus	*microps*	*marmoratus*	*minutus*	*lozanoi*	*norvegicus*
	Painted Goby	**Common Goby**	**Marbled Goby**	**Sand Goby**	**Lozano's Goby**	**Norway Goby**
Lateral line scales Average (range)	34-43	39-52	40-46 (37-48)	55-75 (58-70 Maitland & Herdson, 2009)	57-65	55-58
Scales on predorsal area (6) (see also Figure 1)	Naked from forward edge of D1	Naked from about interdorsal space between D1 & D2	Naked	Scaled	Scaled	Scaled
Breast	Naked	Naked	Scaled at rear	Scaled	Scaled	Naked
Pelvic fin anterior membrane	More or less straight, smooth rear edge	Crenate rear edge	Rear margin edged with minute villi	Rear margin edged with small villi	Rear margin edged with small villi	Rear margin edged with small villi
Pectoral fin ray count (7) Average (range)	18-19 (16-20)	17-19 (15-20)	19-20 (17-21)	18-21	18-21	17 (16-18)
Vertebra count Average (range)	30 (30-31)	31(30-32)	33 (31-34)	33(32-34)	32 (30-33)	32 (31-33)
Dorsal fins proportional lengths	D2 short, 1.5x as long as D1 (pers. obs)	D2 short, 1.5x as long as D1 (J. Mallinson pers. comm.)	No information	D2 relatively longer, 3x as long as D1 (J. Mallinson pers. comm.)		D2 short, 1.5x as long as D1 (pers. obs)
Branchiostegal membrane attachment	to entire lateral side of isthmus	to entire lateral side of isthmus	to entire lateral side of isthmus	to anterior half of isthmus side	anterior half to quarter of isthmus side	not more than anterior quarter of isthmus side
Sensory papillae	See Miller (1986)	See Miller (1986)	See Miller (1986)	2nd c-row **DOES NOT** continue below horizontal d-line	2nd c-row continues below horizontal d-line	See Miller (1986)
Habitat (Maitland & Herdson, 2009)	Sublittoral to 50m on gravel, shell and coarse sand. Not in estuaries	Intertidal pools and very shallow subtidal, estuaries, brackish locations.	Inshore sandy habitats to 20m as well as brackish and hypersaline waters (Mazzoldi *et al.*, 2001)	Mid-tide to 20m. Enters estuaries but not in reduced salinity. But see Hamerlynck (1990). Potter *et al* (1986) classify this sp as "marine estuarine dependant"	Mid-tide to 8m. Enters estuaries but not in reduced salinity. Wallis & Beardmore (1980) classify this as a more neritic sp. Potter et al (1986) tentatively suggest "marine estuarine dependant"	Deeper water, 30-80m. In the northern part of its range and the Mediterranean it occurs in shallower water (5-15m)
Breeding	April-July	April-August	April to October (Mazzoldi et al., 2001)	March-June	June-August	March-July

Table 2 *Further characters useful for distinguishing Pomatoschistus species.*

Note: Numbers in brackets refer to characters highlighted in Figure 2
All details from Miller (1986) unless otherwise indicated.

beach gave way to a vast expanse of mud with large areas of mussel beds, mixed gravel and coarse sand. Thankfully Ian was with us again to describe the algal species and Sue, armed with shovel, sieves and buckets plus her trusty assistant A.K.A her husband, explored the mud which was of varying degrees of stickiness. Unfortunately the tide was against us and only the brave would go past the limit of the mussel beds for fear of sinking past the tops of their wellies. So after a couple of hours of recording, collecting and photographing we returned to the café for a well-earned cup of tea.

Marine algae recorded during Porcupine visits to St Margaret's Bay and Seasalter, Kent

Ian Tittley

This summer's field visit explored two contrasting sites in Kent. The first at St Margaret's Bay near Dover (TR 368441) on the south coast of Kent was a wave-cut foreshore (reef) backed by high chalk cliffs, typical of the chalk coastline of parts of Kent and Sussex. Chalk shores comprise only 0.6% of the coastline of Britain and are of conservation importance in the UK. Habitat action plans have been prepared for them under the UK Biodiversity action plan and the OSPAR convention.

The intertidal reef extended over 100 m from the cliffs and was densely covered by algae. Towards the centre of the bay the vegetation was dominated by green algae due to freshwater springs flowing over the seashore; away from this area the chalk reef was covered by a canopy of fucoids at intertidal levels and laminarians at low water level. Gullies and rock pools contributed to habitat diversity. Chalk cliffs and caves supported specialist communities, with for example the Ochrophyte species *Apistonema carterae* Anand forming a light to dark brown gelatinous band just above high tide level. A list of species recorded is given below; overall, the Dover area is species rich in algae compared to other parts of the county. In addition to algae the marine lichen *Collemopsidium* sp. (previously referred to as *Arthropyrenia halodytes* (Nylander) Arnold) grew on the lower cliffs and inner chalk reef.

The marine lichen *Verrucaria* spp. occurred very rarely on the chalk cliffs. Lower cliff and inner reef was often tinged blue by the chalk boring cyanobacterium *Hyella caespitosa* Bornet et Flahault. A non-native red alga *Caulacanthus okamurae* Yamada (previously referred to as *C. ustualtus* pacific strain; cf Tittley, 2010) has recently spread to Kent and grows abundantly among the wave-washed *Osmundea-Gelidium* biotope on chalk reefs; at St Margarets Bay it grew especially abundantly at the foot of the cliffs where it formed a distinct zone (Plate 1).

The seashore at Seasalter (TR 072650) near Whitstable on the north coast of Kent comprised an extensive intertidal area of soft London (Eocene) Clay. It was in places covered by mussel beds and soft sediments. Although only a depauperate algal flora was recorded the overall area of London Clay from Sheppey towards Thanet is richer in species than would perhaps be expected (cf. Tittley, 2011). It differs from harder chalk shores in lacking a dense canopy of fucoids and laminarians but pools and firm substrata provide habitat for sporadic growth. Beds of the sea-grasses *Nanozostera noltii* (Hornemann) P.B. Tomlinson & U. Posluszny and *Zostera angustifolia* (Hornemann) Reichb. occur nearby.

Species recorded at St Margaret's Bay are indicated 1 below, those at Seasalter 2; nomenclature and taxonomy follows Hardy & Guiry (2006) with some modifications.

Plate 1. *Caulacanthus okamurae on lower chalk cliff at St Margaret's Bay.*

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Kent Species List

Algae

(St. Margaret's Bay 1, Seasalter 2)
Rhodophyta

Bangiophycideae

Bangiales, Bangiaceae

Porphyra purpurea (Roth) C. Agardh 1, 2 [rafting on small stone at 2]

Florideophycideae

Palmariales, Palmariaceae

Palmaria palmata (Linnaeus) Kuntze 1

Rhodothamniellaceae

Rhodothamniella floridula (Dillwyn) Feldmann 1

Ahnfeltiales, Ahnfeltiaceae

Ahnfeltia plicata (Hudson) Fries 1

Gelidiales, Gelidiaceae

Gelidium pusillum (Stackhouse) le Jolis 1

Gracilariales, Gracilariaeae

Gracilariopsis longissima (S.G.Gmelin) Steentoft, L.M. Irvine et Farnham 2 [drift]

Hildenbrandiales, Hildenbrandiaceae

Hildenbrandia sp. 1, 2

Corallinales, Corallinaceae

Corallina officinalis Linnaeus 1, 2

Phymatolithon lenormandii (J.E. Arechoug) Adey 1

Phymatolithon purpureum (P.L. Crouan & H.M. Crouan) Woelkerling & L.M. Irvine 1

Gigartinales, Caulacanthaceae

Caulacanthus okamurae Yamada 1

Cystocloniaceae

Cystoclonium purpureum (Hudson) Batters 2 [drift]

Dumontiaceae

Dilsea carnosa (Schmidel) Kuntze 1

Furcellariaceae

Furcellaria lumbricalis (Hudson) J.V. Lamouroux 1

Gigartinaceae

Chondrus crispus Stackhouse 1, 2

Phyllophoraceae

Mastocarpus stellatus (Stackhouse) Guiry 1

Phyllophora pseudoceranoides (S.G. Gmelin) Newroth et A.R.A. Taylor 1

Plocamiales, Plocamiaceae

Plocamium cartilagineum (Linnaeus) P.S. Dixon 1

Rhodymeniales, Lomentariaceae

Lomentaria articulata (Hudson) Lyngbye 1

Ceramiales, Ceramiaceae

Aglaothamnion hookeri (Dillwyn) Maggs & Hommersand 1

Ceramium deslongchampsii Cauvin ex Duby 1, 2

Ceramium gaditanum (Clemente) Cremades 1

Ceramium virgatum Roth 1

Halurus equisetifolius (Lightfoot) Kützing 1

Halurus flosculosus (J. Ellis) Maggs & Hommersand 1, 2 [drift]

Character	*Pomatoschistus*					
	pictus	*microps*	*marmoratus*	*minutus*	*lozanoi*	*norvegicus*
	Painted Goby	**Common Goby**	**Marbled Goby**	**Sand Goby**	**Lozano's Goby**	**Norway Goby**
Body proportions (1)	Snub-nosed fish	Snub-nosed fish	No information	A more pointed snout, meaner-looking. A stouter fish than *lozanoi*	A more pointed snout, meaner-looking. A more slender fish than *minutus*	A more slender fish than either *minutus* or *lozanoi*
Colour (2)	5 saddles on back generally very clear, though note these may also be present in other species	Faint saddles may be present	No information	More pigmented than *lozanoi*, with darker reticulate pigment on dorsal half. Tends to be greyer. (Wallis & Beardmore, 1980; Hamerlynck, 1990)	Tends to be smaller, pinker (especially around the head) and paler with pigmentation in discrete freckles. (Wallis & Beardmore, 1980). Unripe fish >30mm **lack** reticulate pigment (Hamerlynk, 1990)	Less pigmented than *minutus*, almost translucent with diffuse rusty, red spotting and reticulation
Dorsal fin pattern (3)	Rows of black spots, red or orange banding may be present towards the outer margin of the fin. Adult males may have intense electric blue markings on the distal part of the fin, much more subdued in females.	May have faint black spots in rows, breeding males have rosy and translucent bands	No information	Very variable. May have faint black, dark brown, white or rosy flecks. These may become intensely coloured in breeding and displaying males (pers. obs).		Faint dark flecks along the fin rays. Impression is of a translucent fin. Breeding males have not been observed.
1st dorsal fin spot (4)	Lacks a single spot	Most prominent in males in **proximal** part of fin. Electric blue with a black proximal margin, becomes black in displaying males (pers. obs)	Dark distal spot (Miller, 1986).	Most prominent in males in **distal** part of fin. Electric blue with a black proximal margin. Miller (1986) states that this does not reach edge of membrane. Absent in fish <30mm long (Hamerlynck1990)	In the **distal** part of the fin. Miller (1986) states that this reaches the edge of membrane. Absent in females (Miller 1986).	Black fin spot in **distal** part of fin in males. Absent in females (Miller, 1986)
Banding on body - males	Four dark, "double" spots along flank (Miller, 1986), rather than banding.	Up to 10 dark thin bars (Miller, 1986). In life only briefly visible in displaying males (pers. obs)	4 dark bars in male (Miller, 1986)	Breeding males with two double vertical bars and one single bar on flank (Hamerlynck, 1990).	Breeding males 7-9 regularly spaced vertical bars (Miller, 1986, Hamerlynck, 1990)	10-12 narrow vertical bars in adult males (Miller, 1986).
Breeding females	No information	No information	Dark chin spot (Miller, 1986)	Less pigmented chin than *lozanoi*, no line from eye to mouth (Hamerlynck1990)	More pigmented chin than *minutus*, dark line (moustache) from eye to mouth which continues under the chin (Hamerlynck1990)	No information
Spots on mid-line of body (5)	Four double black spots	May have up to 10 dark marks along flank	No information	Double chromatophores under either end of D2. Spot midway from tail end of D2 and base of tail fin is double (Hamerlynck, 1990).	15-30mm juveniles tend to have single chromatophores along the lateral line (though these may be absent) (Hamerlynck, 1990).	With a large dark spot on flank below the centre of D1 and another at the base of the tail fin, no others on mid-line (pers. obs.)
Stance of fish	Tends to sit high on its pelvic fin	Tends to sit closer to the seabed	No information	Tends to sit closer to the seabed		Tends to sit high on its pelvic fin

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Note: Tables 1 and 2 should be used bearing in mind the following provisos:

a. Colour Published descriptions of the colour of these gobies have all been made on stressed if not dead fish and it is our contention that colour varies wildly (and within seconds) depending on the age and sex of the fish, its breeding status, its mood, time of day and the texture and colour of the habitat in which it is found.

b. Banding and spots on midline We have not found these characters to be useful in the field, bands and spots can be difficult to distinguish if they are visible at all and we believe the intensity is very dependent on mood, breeding status etc. All species can have a dark spot at the root of the caudal fin, but this may not always be evident.

c. Spot on first dorsal fin The presence or absence of a dark spot and its exact location on the first dorsal fin can be used to distinguish *Pomatoschistus* species. However, this may be absent in female fish or non-breeders. In life this spot on the first dorsal fin often has an electric blue distal margin which goes black in dead fish hence the regular reference in published descriptions to a black spot on the first dorsal fin.

d. Pectoral fin rays – these can be counted in good photographs.

e. The timing of breeding in these species will vary depending on geographical location (Bouchereu & Guelorget, 1998).

Plumaria plumosa (Hudson) Kuntze 1

Delesseriaceae

Cryptopleura ramosa (Hudson) Kylin ex Lily Newton 1, 2 [drift at 2]

Hypoglossum hypoglossoides (Stackhouse) F.S. Collins et Hervey 1

Membranoptera alata (Hudson) Stackhouse 1

Rhodomelaceae

Osmundea pinnatifida (Hudson) Stackhouse 1

Polysiphonia fucoides (Hudson) Greville 2

Chlorophyta

Ulvales, Ulvaceae

Ulva compressa Linnaeus 1

Ulva lactuca Linnaeus 1, 2*Ulva prolifera* O.F. Müller 1

Cladophorales, Cladophoraceae

Chaetomorpha linum O.F. Müller 2

Cladophora sericea (Hudson) Kützing 2

Cladophora rupestris (Linnaeus) Kützing 1, 2

Rhizoclonium riparium (Roth) Harvey 1

Bryopsidales, Bryopsidaceae

Bryopsis plumosa (Hudson) C. A gardh 2 [drift]

Phaeophyceae

Sphacelariales, Sphacelariaceae

Cladostephus spongiosus (Hudson) C.Agardh 1

Dictyotales, Dictyotaceae

Dictyota dichotoma (Hudson) J.V. Lamouroux 2

Ectocarpales, Acinetosporaceae

Pylaiella littoralis (Linnaeus) Kjellman 1

Ectocarpaceae

Ectocarpus fasciculatus Harvey 1

Scytosiphonaceae

Stragularia clavata (Harvey) G. Hamel 1, 2

Ralfsiales, Ralfsiaceae

Ralfsia verrucosa (J.E.Areschoug) J.E. Areschoug 1

Laminariales, Laminariaceae

Laminaria digitata (Hudson) J.V. Lamouroux 1

Fucales, Fucaceae

Fucus serratus Linnaeus 1

Fucus spiralis Linnaeus 1, 2

Fucus vesiculosus Linnaeus 1

Fauna

Ciliata mustela Five-bearded rockling

Lipophrys pholis Shanny

Goby unidentified (glimpsed!)

Actinia equina Beadlet anemone

Nucella lapillus Dogwhelk

Gibbula cineraria

Gibbula umbilicalis

Lepidochitona cinerea

St. Margaret's Bay, Kent – Saturday, 3rd September 2011

Actinia equina Beadlet Anemone– a form with clearly-defined drab red and pale olive green stripes

Alcyonidium mytili Bryozoan

This ID from Hayward Ctensotome Bryozoans Synopses volume. I gather that there has been a partial revision of *Alcyonidium* subsequent to this, which may have changed the name

Balanus crenatus Barnacle

Elminius modestus Barnacle

Gibbula cineraria Grey Topshell

Gibbula umbilicalis Purple Topshell

Halichondria panicea Breadcrumb Sponge

Jaera sp. Isopod – female with brood

Lanice conchilega Polychaete

Lekanesphaera monodi Isopod

Lepidochitonia cinerea Chiton

Lineus sanguineus Nemertean

Littorina littorea Edible Periwinkle

Porcellana platycheles Broad-clawed Porcelain Crab

Sabellaria spinulosa Polychaete

Tubificidae indet Oligochaete

Seasalter, Kent – Sunday, 4th September 2011

Alcyonidium mytili Bryozoan – but see note above

Arenicola marina Polychaete

Balanus improvisus Barnacle – on live *Crassostrea gigas* valve

Conopeum seurati Bryozoan

Corophium volutator Amphipod

Crassostrea gigas Pacific Oyster

Didemnum vexillum? Ascidian, likely

17 small settlements, ranging in size from 1-6mm diameter, on live *Crassostrea gigas* valve; individual zooids and/or common cloacal channels clear in some settlements, with dense white bodies (unresolved at x20, but presumed to be colour granules or, possibly, spicules). *Didemnum vexillum* was found on this shore in July 2011, and the above settlements appear similar.

Electra crustulenta Bryozoan

Elminius modestus Barnacle

Eteone longa Polychaete

Goby sp.

Lepidochitonia cinerea Chiton

Littorina littorea Edible Periwinkle

Malacoceros tetracerus Polychaete

Mytilus edulis Edible Mussel

Nephtys sp. Polychaete – fragment

Semibalanus balanoides Barnacle

Tubificidae indet. Oligochaete *Pygospio elegans* Polychaete

Drift

Alcyonidium diaphanum Bryozoan – drift

Flustra foliacea Bryozoan,– drift

St Margaret's at Cliff

51° 08′ 08″ N 1° 22′ 09″E: Algal Turf at mid shore

Harmothoe impar

Nephasoma minuta

Nereis pelagica

Nicomache sp?

Palaemon longirotris

Pholoe inornata

Polydora ciliata

Pygospio elegans

Sabellaria spinulosa

Seasalter

51° 20′ 55″ N 0° 59′ 22″E

Mussel bed with mixed sediment gravel and coarse sand.

Arenicola marina

Aphelochaeta A

Aphelochaeta B

Crangon crangon

Nephtys hombergii

Nereis pelagica

Phyllodoce mucosa?

Scoloplos armiger

Upper Shore Mixed gravel

Polydora ciliata

Pygospio elegans

NB not all species names are up to date.

We may however, have photographed both species in the wild.

The situation may be further complicated by the fact that we are very likely looking at mixed species populations in the field. To help resolve this problem, it will be necessary to photograph wild fish of these two species in the field, capture the same individuals to study in aquaria and finally as dead specimens. This will be difficult as we cannot tell them apart when photographing them!

The confusion between the two species may be further compounded because there is genetic and morphological evidence that *P. minutus* and *P. lozanoi* hybridise in the wild (Fonds, 1973; Webb, 1980; Wallis & Beardmore, 1980). Hamerlynck (1990) provides descriptions to separate *P. minutus* and *P. lozanoi* derived from dead specimens preserved in formalin and notes are included in Table 1. However, as indicated above, colour can vary greatly in the wild within a species or indeed in one individual over a very short time period (a matter of seconds) and colour and pattern changes after death.

We believe that *P. norvegicus* is distinguishable in the field (Figure 2) given the following characters:

- its tendency to occur in inshore in slightly muddy habitats in deeper water (15-20m),
- its relatively slim build compared with the other two species of the sand goby complex,
- the 17 rays of the pectoral fin clearly discernable in good field photographs (18-21 in the other two species),
- typically rusty red speckles on the back and flanks,
- the presence of two broad, dark spots one on the flank immediately below the first dorsal fin and one at the base of the caudal fin.

Additional help in separating the three species in the sand goby complex is provided by habitat preferences and life history. There is evidence that *P. lozanoi* tends to be present in the very shallow subtidal in the early summer in Scotland (Gibson *et al.*, 1993; 1996) and Wales (Wallis & Beardmore, 1980) but in lower numbers than *P. minutus* which occurs throughout the year. Potter *et al.* (1986) reported peak spawning in *P. minutus* from March to May, and in *P. lozanoi* from April to June in the Bristol Channel.

Pomatoschistus norvegicus is generally considered to be a deep water species with a distribution ranging from Norway to the Adriatic and Aegean seas in the Mediterranean (Webb & Miller, 1975; Stefanni, 2000). Swaby & Potts (1990) included this species in their list of rare British gobies. Lebour (1919) reported larvae of this species from deep water near Plymouth and Gibson *et al.* (1993; 1996) found all three species of the sand goby complex co-occurring in a shallow (<5m) sandy bay on the west coast of Scotland. However, in the latter study *P. norvegicus* was very rare and occurred in only one year out of four. Data from the National Biodiversity Network (NBN) indicate a southwesterly distribution for this species with a number of records from the Celtic Sea as far north as St Georges Channel. We have diver records of this species in water depths of 15m and greater in Scottish sealochs but no diver records from the English Channel.

Sand gobies are often confused with common gobies by divers but careful observation of the distinguishing characters from digital photographs should allow accurate identification. The most useful features are:

- the snub-nose of the common goby compared with the more pointed meaner looking snout of the sand gobies,
- the scale distribution on the nape and back: fully scaled in sand gobies, naked on nape and back in common goby.

Conclusion

We hope that the information drawn together here will help others correctly identify at least some of these very common little fish and we look forward to gathering enough information over time that will allow us to separate *P. minutus* and *P. lozanoi* in the wild. We would be happy to review good quality digital images of these small gobies and advise on their possible identity. Other images of some of these species can be viewed at http://www.welshmarinefish.org/WMF_Home.html

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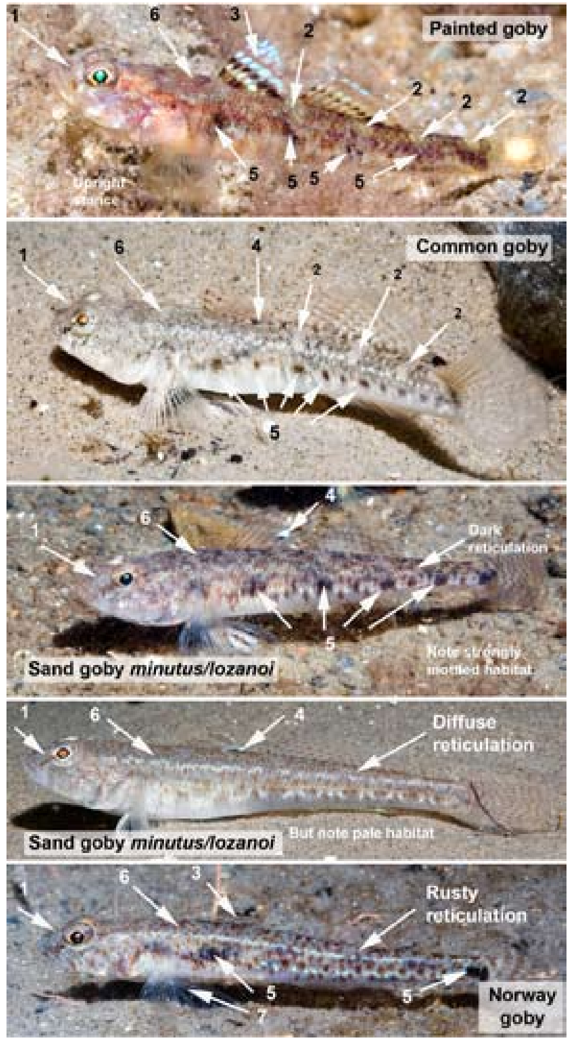


Figure 2 *Pomatoschistus species. Characters useful in identifying the species in the field are numbered in bold type below and listed in Table 1.*

Painted goby*:* **(1)** *snub-nosed,* **(2)** *up to five paler saddles,* **(3)** *rows of black spots on fin often electric blue edge,* **(5)** *four bold spots on flank,* **(6)** *no scales on nape, sits high on pelvic fin*

Common goby*:* **(1)** *snub-nosed,* **(2)** *faint saddles,* **(4)** *proximal spot on 1st dorsal fin,* **(5)** *up to ten small black spots along flank,* **(6)** *no scales on nape or dorsum as far back as the end of the 1st dorsal fin.*

Sand goby *(minutus/lozanoi):* **(1)** *more pointed, meaner snout,* **(4)** *distal spot on margin of 1st dorsal fin,* **(5)** *smudged spots on flank may or may not be distinct,* **(6)** *scales on nape.*

Norway goby*:* **(1)** *more pointed, meaner snout,* **(4)** *distal spot on margin of 1st dorsal fin,* **(5)** *smudged, dark spot beneath 1st dorsal fin and on caudal peduncle,* **(6)** *scales on nape,* **(7)** *fewer than 18 rays in pectoral fin, rusty red speckles, a slimmer fish than minutus/lozanoi.*

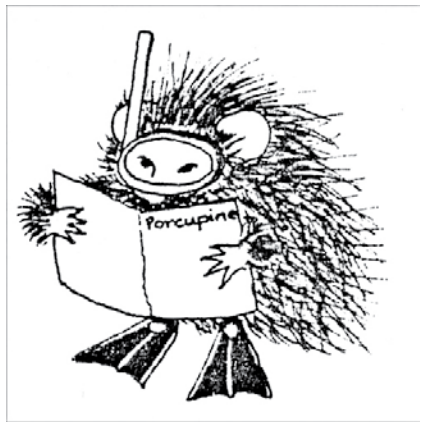
and the texture and colour of the habitat in which it is found. Recent observations made by us after dark suggest that wild, male fish of the *minutus/lozanoi* complex defending a nest showed some of the classic markings described in much of the published literature but rarely seen in the field. Interestingly, fish observed at the same site during daylight hours (not necessarily the same individuals) did not display these characters.

Painted and common gobies. These two species can readily be distinguished in the field, both from each other and from the sand goby complex. With experience the jizz of each of these two taxa is distinctive. They are both snub-nosed fish lacking scales on the nape. The painted goby sits high on its pelvic fin and there are rows of black spots on the first dorsal fin and often an electric blue edge. Juveniles and females often show chestnut shades of colour on the body. The painted goby occurs in a very wide range of coarse mixed sediment habitats and consequently shows a considerable range of colour variation, developed to provide a good match with the background.

The common goby is a grayer fish with a less prominently marked first dorsal fin, though breeding males may show rosy bands. The saddles on the back are usually fainter and scales are absent both on the nape and the back as far as the rear of the first dorsal fin. The common goby tends to be an inshore and often estuarine species.

Marbled goby. This goby has a similar dorsal scale distribution to the common goby. We have no data on its appearance in the field because in the UK it has been reported only once, from the River Fal in Cornwall, where it was collected during routine Environment Agency surveys. This goby is otherwise widely distributed in Europe occurring extensively in the Mediterranean, on the coast of Portugal and in northern Spain.

Sand goby complex. Distinguishing the three species in the sand goby complex (*P. minutus, P. lozanoi* and *P. norvegicus*) is problematic with conflicting information provided in the published literature, possibly due to confusion between the species even in studies purporting to distinguish between them. So far we have been unable to differentiate these two species satisfactorily in the field, with individual fish showing a mix of characters attributed to the separate species in the available literature. This is despite claims that these two species can be distinguished without resorting to studying the dermal papillae (Wallis & Beardmore, 1980; Hamerlynck, 1990). We have not knowingly collected *P. lozanoi* although some material from the Solent showed an intermediate pattern of dermal papillae.



From dive slate to database: sharing marine records through the National Biodiversity Network

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Records of marine species and habitats are made under a wide variety of circumstances, from family rockpool rambles to offshore environmental impact assessments. Data may be collected for academic research, to monitor protected species and sites, to mitigate the impact of development or simply for the pleasure of discovering and recording marine life.

Collating these disparate datasets and making them available for re-use has obvious benefits as we enter the new era of marine spatial planning ushered in by the Marine and Coastal Access Act 2009 and the Marine (Scotland) Act 2010. A robust evidence base is needed to underpin planning decisions and to inform the creation of an ecologically coherent network of Marine Protected Areas.

The Marine Strategy Framework Directive sets targets for the achievement of "good environmental status" (GES) in Europe's seas by 2020. By July 2012, the UK must define what GES means and set specific targets and indicators to ensure its achievement. A monitoring programme must be established and implemented by July 2014, and measures to achieve GES targets must be in place by 2016. Reliable baseline data on marine species and habitats are required for measuring progress against targets and monitoring changes such as the spread of invasive species and the response of marine ecosystems to pollution, marine litter and other anthropogenic pressures.

It is not only policy makers and scientists who need access to marine biodiversity data. Making wildlife records widely accessible can enhance appreciation and understanding of the marine environment amongst the general public and help to generate popular support for marine conservation.

The National Biodiversity Network (NBN) is a partnership dedicated to making biological records freely and easily available to everyone, encouraging and facilitating the use of biodiversity data for conservation, research, planning, policy making, public engagement and education. The NBN was founded in 2000 with the key objective of enabling wildlife data to be captured once but used many times. For over a decade the NBN partners have been working to achieve this objective by developing standards and tools to support the biological recording community, improving communications between data providers and data users and providing a mechanism for everyone to access biodiversity data.

The NBN Gateway - http://data.nbn.org.uk/

That mechanism is the NBN Gateway, which enables anyone to view and download biodiversity data online. The first prototype Gateway was launched in 2001 with just 1.6 million records in five datasets; marine data were part of the package from the outset thanks to the Marine Nature Conservation Review (MNCR) dataset provided by JNCC.

How things have progressed! In 2010, the NBN celebrated their 10th anniversary and the addition of the 60 millionth record to the Gateway. At the time of writing, the Gateway provides access to over 68.6 million records in 614 datasets from 137 data providers, around 35% of whom hold marine data.

The most important providers of marine data to the NBN Gateway include the Marine Biological Association, the Government agencies who supply surveillance and monitoring data, the Marine Conservation Society who provide over 300,000 records gathered by Seasearch divers, and the British Phycological Society who share over 100,000 seaweed records dating from 1750 to the present day. Porcupine Marine Natural History Society recently became a data provider and member of the NBN, sharing over two decades of records made during field meetings at locations from Orkney to Cornwall.

Figure 1: A Seasearch diver gathering records for the Marine Conservation Society dataset during the 2009 Porcupine field trip to St Abbs.

New and updated datasets are added to the Gateway every month, so it is worth revisiting the site regularly. New datasets expected from the MBA in the near future include SEPA fish farm monitoring data, historic deep sea records, Rare Fish Recording Scheme data, non-native species updates including the Chinese mitten crab project data, and the digitised UK Crab Atlas data. The MBA will also soon release an updated version of the database of benthic surveys commissioned by the UK Offshore Operators Association.

Getting the most out of the Gateway

Use of the NBN Gateway has increased steadily since its launch and continues to rise, with the site currently handling over 300,000 data searches per month.

The new NBN website, launched in December 2011, includes a portfolio of case studies demonstrating the wide range of purposes for which data from the Gateway are being used (http://nbn.org.uk/). Only one of these case studies deals with the use of marine data, so if you are using NBN tools, services or data in a marine context, please let us know as we'd love to share your example more widely.

The Gateway is undeniably a useful tool for many organizations and individuals, but with over 68 million species records at your fingertips, not to mention habitats and site boundaries, how do you know where to start?

This is a quick introduction to exploring data on the Gateway:

<u>Logging in</u>

You do not need to register and log in to use the Gateway. However, it is free, quick and easy to do and it brings benefits such as the ability to comment on records or to request better access to data.

<u>Geographic searches</u>

You can produce a species list for a 10 km square, for example a search for SS14 will return all the species records from Lundy and the surrounding waters. You can also produce a species list for any of the designated sites featured on the Gateway, which include SACs, SPAs and Ramsar sites. Heritage Coast boundaries were added to the Gateway in 2010 and the draft Marine Conservation Zone boundaries will be added early in 2012. Species lists for designated sites and 10km squares can be filtered by taxonomic group, date range and designation if desired, for example to show only BAP species. The results of the search can be downloaded as a species list in Excel or as a complete set of records in a .CSV file.

<u>Taxonomic searches</u>

You can produce a distribution map for any species or higher taxonomic group by typing the scientific or common name into the search box. You can filter the results by date range and download the list of 10km grid squares in which the species has been recorded, or download the complete set of records. The Gateway also provides access to taxonomic and designation information, enabling you to check the correct scientific name for a species, or find out whether a species is protected under national or international legislation.

<u>New Interactive Mapping Tool</u>

The NBN Gateway's new Interactive Mapping Tool (IMT) was launched in April 2011, offering a more dynamic and flexible way to explore the data. In a way that will be familiar to GIS users, the IMT enables you to build up your map in layers, selecting from a range of backdrops including OS maps and satellite

The *Pomatoschistus* Problem

Lin Baldock & Paul Kay

Email <u>polychaos6@virginmedia.com</u>

Introduction

Small gobies are generally accepted as difficult to identify both alive in the field and as dead specimens. Descriptions and illustrations from the published literature such as Holt & Byrne (1903), Jenkins (1925) and Wheeler (1978) continue to be used with little reference to field characters of live fish. Small gobies can be a very important component of some fish communities. For example Potter *et al.*, (1986) studying fish assemblages in the Severn estuary found that sand gobies were the commonest group where they comprised 30% of the total sample. It is therefore important to get the identification of these small but numerous fish correct.

The Gobies

Listed below are the six species of small goby in the genus *Pomatoschistus* reported so far from British and Irish waters.

- Painted goby: *Pomatoschistus pictus (*Malm, 1865)
- Common goby: *Pomatoschistus microps* (Krøyer, 1838)
- Sand goby: *Pomatoschistus minutus* (Pallas, 1770)
- Lozano's goby: *Pomatoschistus lozanoi* (de Buen, 1923)
- Norwegian goby: *Pomatoschistus norvegicus* (Collett, 1903)
- Marbled goby: *Pomatoschistus marmoratus* (Risso, 1810)

P. minutus, P. lozanoi and *P. norvegicus* make up the "Sand goby complex" while *P. marmoratus* has only been recorded once in British and Irish waters. These six species are the subject of this guide, which it is hoped will assist in identifying at least some of these small fishes, either in the field or "in the hand".

The Guide

Our observations have largely been based on the study of high quality digital photographs taken in the field, supplemented in some instances by aquarium shots and study of the preserved specimens of the individuals photographed. As well as *Pomatoschistus* species we have also studied other genera of small gobies which are not covered in this guide. If your goby does not fit any of the descriptions given here, it may of course not be a *Pomatoschistus* species. In particular we have found that Jeffreys' goby *Buenia jeffreysii* (Günther, 1867) which has four bold dark spots along its flank has been confused with the painted goby *Pomatoschistus pictus*, which lacks these marks but is a similar size. For example, the photograph in Wood (2007) labelled as a *Pomatoschistus* species is in fact *Buenia jeffreysii*.

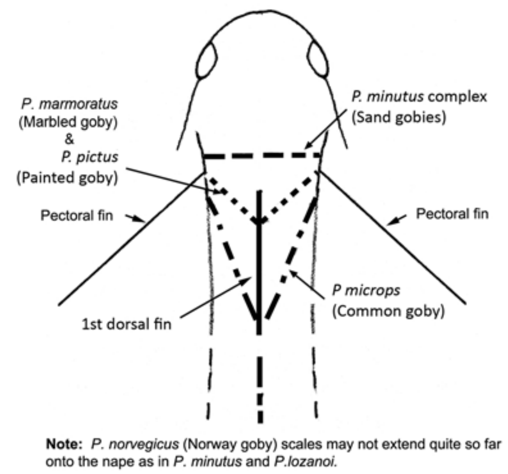

Figure 1 *Diagram showing the forward extent of dorsal scales in Pomatoschistus species.*

Table 1 summarises the characters which can be used to differentiate *Pomatoschistus* species in the field, while Table 2 details features more suitable for use on dead fish, but we have found that some of these attributes are also distinguishable in good field photographs. Vertebrae and lateral line scale counts are taken from Miller (1986), who also provides excellent illustrations of the details of the dermal papillae on the head. This is a useful character in separating the species but is one that is not easy to use and requires experience and practice. Figure 1 shows the forward extent of scale distribution on the nape and back of the six *Pomatoschistus* species. This is a character which can often be clearly seen on good digital photographs taken of wild fish in the field.

Figure 2 shows *Pomatoschistus* species as they appear in the wild during the day. The Marbled goby is not illustrated. Note that the sand gobies (*P. minutus* and *P. lozanoi*) are not distinguished and the photographs may be of the same species, the variation in colour being due to differences in background habitat colour and texture. The colour of all of these species at any one time will depend on a number of factors including the age and sex of the fish, its breeding status, its mood, time of day

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CoML Field Projects:

ARCOD: Arctic Ocean Diversity

CAML: Census of Antarctic Marine Life

Mar-Eco: Mid-Atlantic Ecosystem Project

ChEss: Biogeography of deep-water Chemosynthetically-driven ecosystems

CeDAMar: Census of diversity of abyssal marine life

CenSeam: Global Census of marine life on Seamounts

COMARGE: Continental Margin Ecosystems

CmarZ: Census of Marine Zooplankton

NAGISA: Natural Geography in Shore Areas

Creefs: Census of Coral Reef Ecosystems

GOMA: Gulf of Maine Area Program

ICoMM: International Census of Marine Microbes

POST: Pacific Ocean Shelf Tracking Project

TOPP: Tagging of Pacific Predators

HMAP: History of Marine Animal Populations

FMAP: Future of Marine Animal Populations

The main portal for all these programmes can be found at the Census of Marine Life website www.coml.org/projects

imagery, then adding one or more species, sites and boundary layers, filtering records by date range, changing the order of the layers and adjusting their transparency if required.

You can then share the map you created by clicking the 'Get Map URL' button and embedding the URL as a hyperlink in any digital document, e-mail or website.

The IMT introduced the feature of biodiversity 'hotspot' maps to the Gateway. It is now possible to display all the species records from a given dataset or for a given designation as a density map, with darker squares containing more species and paler squares containing fewer species.

As this is an interactive map, clicking on any square or site boundary will produce information on the species, records and datasets in a pop-up window.

and, most importantly, the level of confidence in the data.

To help tackle concerns about confidence in data, the NBN launched Record Cleaner, an automated validation and verification decision-support tool for biodiversity data managers. Record Cleaner was designed to improve the efficiency of data flow and to ensure the quality of datasets on the Gateway by enabling the automated checking of large datasets in a variety of formats against validation and verification rules.

Validation rules highlight errors such as incorrect dates or marine species being recorded inland. Verification rules flag up records of species that fall outside the known temporal or spatial distribution of that species, as well as highlighting records of species that are inherently difficult to identify. The MBA

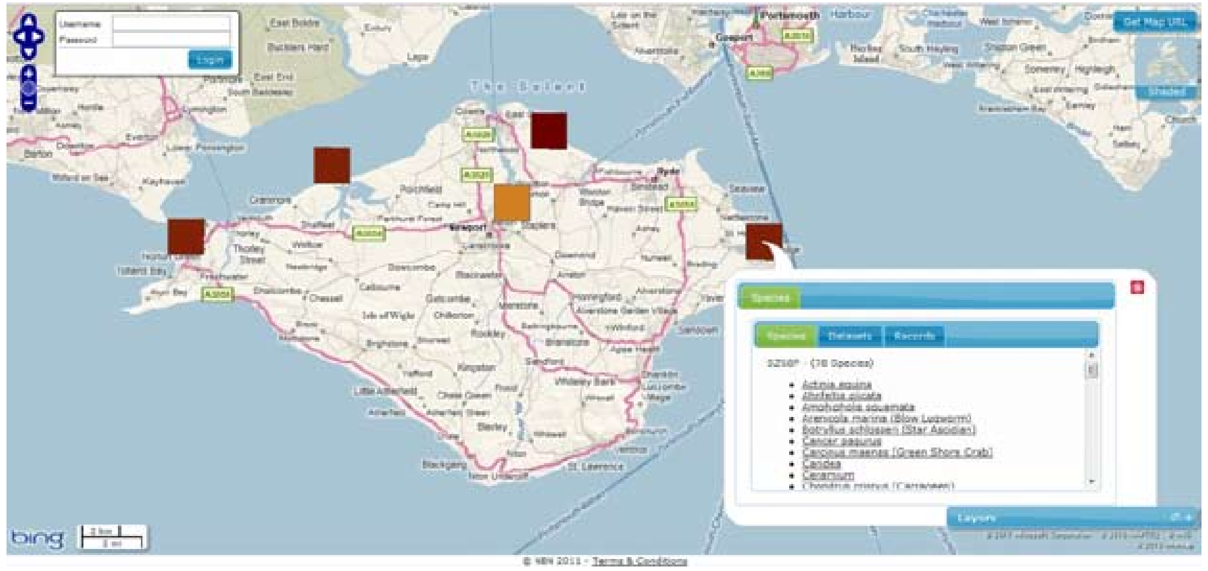

Figure 2: Selection of records from Porcupine Marine Natural History Society's dataset on the NBN Gateway Interactive Map

have already produced verification rule sets for close to 500 priority marine species, and DEFRA have provided funding for the development of rule sets for other taxa over the next two years.

Improving data quality

All of the above methods for exploring the data enable you to customise the output by deciding which datasets to include. To help users make informed decisions about which datasets to use, all datasets on the Gateway are accompanied by metadata which explains why the data were gathered, what survey methodology was used, what geographic area and date range were covered by the survey

Record Cleaner is already widely used as a standalone tool, and plans are underway to develop it as a web service to facilitate integration of the validation and verification rules into existing data management and online recording systems.

Nevertheless, despite the best efforts of data providers, dubious records do make it onto the

NBN Gateway. If you come across such records, please use the record commenting facility on the interactive map, which enables you to label the record as 'incorrect' or 'dubious' and to state the reason for this assessment. This is the quickest and most effective way to bring the matter to the immediate attention of the data provider, and most importantly to all other users of the Gateway.

Data flow

There are a number of different routes by which marine biodiversity data are provided to the NBN Gateway. Many organisations provide their marine biodiversity survey data to the MBA, who provide the facilities to transfer these data from various sources and formats into a standard format, and to progress the data to the Archive for Marine Species and Habitats Data (DASSH) for archiving and to the NBN Gateway for dissemination. Other organisations choose to supply their data to the NBN Gateway directly, or via their local environmental record centre or a national recording scheme. Provided that the same record is not submitted to multiple organisations, it is important to retain flexibility and choice in where individuals lodge their data in order to sustain participation in marine recording. The NBN Trust is working closely with the MBA to overcome barriers to the mobilization and re-use of marine data and to provide guidance on data flow, ensuring that appropriate validation and verification steps are built into the process.

The NBN Gateway is not the end of the line for data; since 2006, web services enable data from the Gateway to be incorporated into other websites and applications. Examples include the MBA's MarLIN website (www.marlin.ac.uk) and the GB Non Native Species Information Portal, which uses NBN web services to embed distribution maps for invasive species including Chinese mitten crabs, wakame and japweed (www.nonnativespecies.org).

Public interest in biological recording is growing thanks to citizen science initiatives such as the MBA's Shore Thing, Newcastle University's Big Sea Survey and the Big Seaweed Search coordinated by OPAL, the Natural History Museum and the British Phycological Society.

Figure 3: Participants in a Shore Thing Survey recording the contents of their quadrat

In addition to their obvious educational benefits, such projects can generate large volumes of data, making it more important than ever to have clear and efficient data flow with automated support for validation and verification procedures.

Recent advances in online recording, including the MBA's Marine Sightings Network and the NBN's Indicia toolkit, have great potential to support wider participation in biological recording, increase the efficiency of data flow and improve data quality. Examples of Indicia-based websites for the online recording of marine species include the North East Cetacean Project (www.northeastcetaceans.org.uk) and the Recording Invasive Species Counts (RISC) project (www.nonnativespecies.org/recording/).

Plans for the future

The NBN has achieved a lot over the last 10 years but there is room for improvement, particularly with regard to facilities for displaying marine data.

Planned improvements to the Gateway include:

- From January 2012, NBN Gateway distribution maps will be able to display absence data. This will be particularly useful for displaying data from the Shore Thing and MarClim projects, which use a standard survey methodology to record the abundance or absence of climate change indicator species.

water column and seabed. At the start of ChEss five main biogeographic provinces were found; The East Pacific and the NE Pacific characterised by different species of tubeworm, the Atlantic characterised by shrimp, mussels and anemones, the Indian Ocean by shrimp and anemones and the SW Pacific by chemosynthetically-driven gastropods. This early biogeography was modified by Bachraty *et al* (2009) and most recently by Rogers *et al*. (2012), the latter as a result of the ChEss programme. During the course of the ChEss programme the hottest vents (407°C) were found in the Atlantic, the deepest vents (4950m) in the Cayman Trough (Connelly *et al*. 2012) and the first black smokers in the Southern Ocean along the East Scotia Ridge (Rogers *et al*. 2012). Tubeworms found at seeps were shown to have a maximum longevity of up to 600 years and tubeworms from vents have the fastest growth rates of any deep-sea organisms. Cold seeps have produced some of the weirdest ecotopes in the deep ocean such as the asphalt communities in the Gulf of Mexico. The discovery of a cold seep community associated with whale remains on the seabed was even eclipsed by the description of the 'zombie worm' that lives on lipids in the bones of dead whales (Rouse *et al*. 2004).

Although hydrothermal vent systems are relatively small, the largest cold seep to date has been the discovery of the 'Builder's Pencil' site off New Zealand at 135,000m^2. A quite remarkable discovery was the larval development of the vent gastropod *Ifremeria nautlei* which has a completely new type of larva (named Waren's larva): the first new type of gastropod larva described since the 19^{th} century (Reynolds *et al*. 2010).

The newly described species from vents and seeps may not be as diverse as those of other deep-sea ecosystems but they make up for it in morphological diversity.

SYNDEEP: Anthropogenic impact and the COML deep-sea field programmes

There is no doubt that man has had an impact on the deep ocean. The 'out of sight, out of mind' paradigm applied to the deep sea and a variety of contaminants, including dredge and sewage spoil. Chemicals and low-level radioactive waste were disposed of without much thought (see Thiel 2003 for details). International law has tightened up the disposal of waste into the open and deep ocean over the last decade. However, exploitation of the deep sea continues and is likely to expand in the future (Ramirez-Llodra *et al* 2011). Scientists from the deep-sea field programmes of the Census met at Scripps Institution of Oceanography in 2009 and attempted to quantify the past, present and future impacts of man on the deep sea. We broke the deep sea down into separate ecosystems such as slope, mid-ocean ridge, cold water corals and vents etc. and assessed the impact on each. Not all ecosystems responded in the same way. At present cold-water corals are particularly vulnerable to fishing and the open slope to the potential of oil pollution such as happened with the Deepwater Horizon oil spill. In the future the abyssal plain may be impacted by the collection of manganese nodules or the mining of rare earth elements whilst vents are likely to be affected by mining for massive sulphide deposits as proposals for mining off northern Papua New Guinea testify. In the more distant future hangs the spectre of climate change. The deep sea relies, primarily, on the input of surface-derived phytodetritus for it energy. Already there is evidence that global warming is increasing the oligotrophic areas over the deep sea by 800,000km^2 per annum. Co-occuring with this change in productivity may be a change in the quality of sinking material that can have an adverse (or beneficial) effect on the deep-sea benthos (for details see Smith *et al*. 2008). The ultimate effect of climate change may be that surface water warms sufficiently to prevent the formation of water dense enough to sink at high latitudes in the North Atlantic and Antarctica (called North Atlantic Deep Water and Antarctic Bottom Water), which provide oxygen to the deepest parts of the ocean seabed. Lastly, the insidious effect of ocean acidification may spread into the deep sea and have a compounding effect on climate change of the next century or so.

Although one of the primary aims of the COML was to put a figure on the number of species in the sea there have been a number of important legacies. On a scientific front, collaboration is at an international and global level and there is a much clearer vision on where research effort has to be directed, made even more pertinent by the economic condition in western countries. The global public are much more aware of the ocean and what services it has provided and is likely to provide to mankind in the future, and it is this knowledge that we must use to guide us in whatever use we make of the ocean.

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However, a significant driving theme of CenSeam was the impact of fisheries on seamounts. Seamounts are restricted spatially and successful trawling relies on heavy fishing gear, which in turn has a greater impact on the seabed especially on erect species such as all types of coral. In some areas of the SW Pacific less than 3% of coral cover remains intact. The concern here is not just the damage to the seabed but the problems associated with restoration and community structure in area where corals are the main frame builders and harbour high biodiversity, as well as being long-lived (Koslow 2007; Rogers *et al*. 2007).

COMARGE (www.ifremer.fr/comarge)

The continental margin occupies only about 8% of the seafloor of the global ocean but probably has the greatest variety of interacting ecosystems. The continental slope has an average inclination of 8°, although this can be much steeper. The dominant ecotope is the sediments of the slope, although this may be replaced by rock outcrops on very steep areas such as the west side of the Porcupine Bank in the NE Atlantic, or in canyons. Sedimentary areas may be modified by a variety of chemosynthetically-driven systems such as cold seeps and mud volcanoes, whilst where there are suitable substrata and at the right depth will be found cold-water corals with their associated rich fauna. The continental slope is not uniform and in many places it is cut across by submarine canyons. Harris and Whiteway (2011) suggest there are 5849 large submarine canyons cutting across the continental slope of the world's oceans. Slopes are some of the most productive areas of the deep, with high biomass and are areas of intense fishery now extending down as deep as 1500m. The slope also shows the main zonation of fauna with depth in the global ocean. The pattern of zonation varies with different taxa, i.e. there are no set depths where there are major changes of all taxa and zonation even occurs in the Mediterranean where the water column is more or less homogenous below 200m. Although regional differences were dominant over global differences on the upper and mid slopes, as one gets deeper an increased uniformity of species composition on a global basis is found.

CeDAMar (www.cedamar.org)

The abyssal plains of the global ocean lie between 3000 and 6000m depth and form ~50% of the surface of the earth. This makes the examination of abyssal plains difficult and to date the total area sampled quantitatively equates to about the size of 6 football pitches. The main areas examined are the NW and NE Atlantic, the central Pacific, extensively in the south Atlantic and in the Southern Ocean sector of the Atlantic and Indian Oceans. In the Southern Ocean particularly, biodiversity in the sediments of the abyssal plain is exceptionally high (Brandt *et al*. 2007). In the ANDEEP project in the Southern Ocean 700 species of isopod were found, 500 of them new to science. In the Angola Basin, 800 species of benthic copepod were collected the vast majority again new to science. And these numbers will surely rise as many 'species' have been shown (by the use of molecular methods) to be species complexes with cryptic speciation. An interesting point for shallow water benthic ecologists is that many of the species found in the abyssal plain sediments are singletons with only a limited number of species being represented by 5 or more individuals in a sample.

MAR-ECO (www.mar-eco.no)

This field programme examined the Mid-Atlantic Ridge (MAR) either side of the Charlie Gibbs Fracture Zone in the North Atlantic by looking at biodiversity throughout the water column, down to the benthopelgic layers immediately above the seabed and the fauna of sediments and rock that make up the MAR. The North Atlantic is one of the best-studied deep-sea regions of the world but MAR-ECO sampling has produced a plethora of new species as well as clarifying the taxonomy of species already known. An example of the latter is the fish family Cetomimidae, the males of which we originally described in the family Megalomycteridae, the females in the family Cetomimidae, and the larvae and post-larvae in the family Mirapinnidae! A notable new species was an enteropneuse that has also been found now in other areas of the NE Atlantic. The establishment of this programme required benthic sampling at four sites to the NW, NE, SW and SE of the Charlie Gibbs Fracture Zone. Comparison of the biomass at the different sites demonstrated different regions of productivity. In the NE holothurians dominated, whilst in the NW sea urchins and xenophyophores dominated. In the SE there was a more even distribution although the two dominant taxa were ophiuroids and sea fans.

ChEss (www.noc.soton.ac.uk/chess)

ChEss is a global study of the distribution, abundance and diversity of species in deep-water hydrothermal vents, cold seeps, whale and wood falls and areas of low oxygen. Hydrothermal vents were discovered along the Galapagos Ridge in 1977 and cold seeps off the Florida Escarpment in 1984. Such chemosynthetically-driven ecosystems are characterised by relatively low diversity and high biomass when compared to the abyssal plains of the deep ocean. In understanding biodiversity at vents sites and their relationship to each other it is important to understand the local and regional oceanographic characteristics of the

- In 2012, the projection system of the NBN Gateway will change from OSGB to WGS84, making it possible to display data from sites outside the national grid, such as Rockall or the Channel Islands.
- Subject to licensing agreements, we hope to offer UKHO nautical charts as a backdrop to marine data on the Gateway in the coming year.
- We are experimenting with ways to display depth and altitude data visually on the Gateway interactive map.
- The ability to display habitat polygons on the Gateway was developed in 2010, and terrestrial BAP habitat layers are already publicly available via the interactive map. In 2012 we will consult with end users about their requirements and explore options for displaying marine habitat data on the Gateway or enabling species data from the Gateway to be displayed on existing marine habitat mapping tools (e.g. www.searchmesh.net).
- It is already possible to incorporate data from the Gateway into desktop GIS using Web Mapping Services. Subject to approval from data providers, it will become possible later this year to download entire datasets, facilitating the use of data for scientific research.
- The British species list from WoRMS (World Register of Marine Species) will be incorporated into the NBN Species Dictionary, which provides the taxonomic information underpinning the NBN Gateway, web services and many online recording and data management systems. This is planned for summer 2012. In the meantime, the Species Dictionary is being updated with over 150 new names provided by the MBA and the Marine Conservation Society.

Figure 4: Simnia hiscocki - one of the new names that will shortly be added to the NBN Species Dictionary © Keith Hiscock

The NBN in context – the bigger picture

The NBN Gateway provides access to data on species and habitats throughout the UK and Ireland, but in order to study the effect of environmental changes on species distribution, these data must be viewed in a European or even global context.

This is made possible by GBIF, the Global Biodiversity Information Facility (www.gbif.org). GBIF was founded in 2001 to facilitate free and open access to biodiversity data worldwide. The GBIF data portal was launched in 2007 and now provides access to over 300 million species records with participation from 57 countries. The NBN Gateway is the UK node of GBIF, supplying regular automated updates of all publicly downloadable datasets. This includes the Porcupine dataset, so if you have taken part in Porcupine's recording scheme or field trips, your records have gone global!

Marine species records from the Gateway are also supplied to the Ocean Biogeographic Information System (OBIS) and its European node, EurOBIS. However, this process is not yet automated, with the result that datasets from the Gateway are more up-to-date on GBIF than on OBIS.

Marine biodiversity data cannot be considered in isolation from other marine environmental data, such as bathymetry, geology, geophysics, oceanography and meteorology. The Marine Environmental Data and Information Network (MEDIN) was formed to harmonise access to all types of marine data, reducing costs and improving the interoperability of datasets.

MEDIN has a network of accredited Data Archive Centres (DACs) able to provide secure long-term storage of and access to marine data. It was agreed in 2007 that DASSH should operate as the archive for marine biodiversity data and the NBN Gateway should act as a key dissemination route. DASSH regularly updates the NBN Gateway with the datasets it hosts in its role as a MEDIN DAC, and has incorporated a clause into data sharing agreements with all MEDIN data providers to ensure that all relevant biodiversity data is made available via the NBN Gateway.

Please keep visiting the NBN Gateway to explore the new data and features that are constantly being added. Whatever your reasons for recording marine wildlife, whether professional, academic or for the pure enjoyment of it, thank you for allowing your records to be shared with others.

What is the distribution of the benthic chaetognath *Spadella cephaloptera* (Busch, 1851) in British Waters?

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Introduction.

The purpose of this article is to highlight the characters of *Spadella cephaloptera* and improve the identification and recording of this unusual chaetognath (Arrow worm).

Spadella cephaloptera is an atypical chaetognath belonging to the family Spadellidae, along with *Paraspadella* and *Bathyspadella* (Bone *et. al.*,1991). These genera are found in the benthos whereas all other genera and species of chaetognaths are planktonic. All chaetognaths are fragile, mostly transparent and consequently difficult to preserve in good condition as sampling techniques, eg plankton nets, often damage the fins, which is an important character for identification. As *Spadella* is found in the benthos it is often overlooked during benthic sampling which usually involves sieving and high pressure hoses. The objectives for benthic and planktonic sampling rarely overlap and neither do the two communities of researchers. Plankton work does not involve looking at sediment samples and benthic workers do not look for animals in the water column. Consequently, *Spadella* is under-recorded as it is not well known to either community.

Taxonomic history.

Spadella (Langerhans, 1880) was first described from the mid-Atlantic off Madeira for four species previously assigned to the genus *Sagitta*. Langerhans' original generic description (loc. cit., page 136) is very short and consists of one line of text with no illustrations. **"Korper gedrungen; subcutanes Gewebe sehr entwickelt und bis zur einzigen Seitenflosse nach hinten reichend; zwei Paar Nebenkiefer."** Translated as "**Body stout; subcuticular tissue with spots and bristles, lateral fins reach right to the end of the body; two pairs of mandibles"** Langerhans included *Sagitta cephaloptera* from the Orkneys and the English Channel, *Sagitta draco* Krohn 1853, from the Mediterranean (which has since been re-assigned to *Pterosagitta*), *S. gallica* Pagenstecher, 1863 from Séte, Mediterranean and *S. batziana* Giard 1874 from I'île de Batz, Brittany. Since 1880 several species of *Spadella* have been described from British, North Atlantic, Black and Mediterranean Seas. Many taxa have been synonymised and the following synonomy is taken from Ritter-Záhony, 1911, *Chaetognathi* in Das Tierreich.

Synonomy of *Spadella cephaloptera* (Busch, 1851).

Sagitta cephaloptera, Busch, 1851 p 98. pl 15, Fig1-3.

Sagitta mariana Lewes 1860 p.266 Pl V fig.1

Sagitta gallica Pagenstecher, 1863 p.308 Pl XXIX fig.8

Sagitta cephaloptera Claparède, 1863 p 9 Pl XVIII fig 8

Sagitta pontica Uljanin, 1870 p.57 Pl

Sagitta batziana Giard, 1874 p.517 Pl X fig.1,2 and 6

Spadella cephaloptera Langerhans, 1880 p 136

Papers from the 2011 Porcupine Annual Conference, National Oceanographic Centre, Southampton

The Census of Marine Life and its impact on studying the deep sea.

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The Census of Marine Life (CoML) was established as a 10-year programme starting in 2001 with the main aim of determining the extent of biodiversity in what is the largest ecosystem on earth. An international steering committee was established and the programme divided into five main categories (Figure 1). Regional committees were established to determine marine biodiversity in their area of the sea such as the waters surrounding South America. In parallel with this was the establishment of 'Field Programmes' which will be the main topic of this report. The information from these two packages was collated by the 'Oceanic Biogeographic Information System' (OBIS) and the data produced were used by the mapping and visualisation group. Lastly there was a significant 'outreach' group that brought this information and the latest findings to a wider public.

The CoML programme (www.coml.org) involved 50 countries, over 500 research and educational institutions, more than 2700 active marine scientists and occupied more than 9000 shiptime days. The investment by the main sponsor, the Sloan Foundation of New York, was $65million and this resulted in an estimated leverage of additional research grants of $650million. As an active participant in COML the main benefits were that the investment brought together like-minded scientists who put together research programmes that were then funded by national research funding agencies. My main contribution was Co-chair of the ChEss field programme responsible for chemosynthetically-driven ecosystems in the deep ocean.

Field Programmes

The Census had a variety of field programmes that covered marine ecosystems from the intertidal to the deepest ocean and looked both back and forward in time (Table 1). The History of Marine Animal Populations (HMAP) examined the decline of marine populations especially fish over the last few hundred years, whereas the Future of Marine Animal Populations (FMAP) attempted to predict what the shape of marine populations would be in the future. Other field programmes looked at particular regions such as the Arctic (ArcOD), the Antarctic (CAML) or the Gulf of Maine (GOMA) whereas Census of Marine Zooplankton (CMarZ) and CReefs (corals) looked at particular global patterns within their sphere of interest. Of particular interest were the programmes that looked at migration of charismatic megafauna such as TOPP (Tagging of Pacific Predators). All these programmes can be traced through the COML portal at www.coml.org

However, in this report I will concentrate on those field programmes that involved determining the biodiversity found within the deep sea. The significance of this was that up to recently the deep sea had been seen as a large basin containing mostly sediment but over the last 30 years has been shown to be a series of interconnecting ecosystems. The field programmes included seamounts (CenSeam); the regions of the slope and continental margin (COMARGE); the abyssal plains (CeDeMar); the Mid-Atlantic Ridge (Mar-ECO) and the chemosynthetically-driven ecosystems (ChEss).

CenSeam (www.niwa.co.nz)

Seamounts are, as the name implies, mountains in the sea scattered over the abyssal plains. There are some 30,000 seamounts in the deep ocean and their peaks can rise well in excess of 1000m above the surrounding seafloor. Seamounts are formed at the mid-ocean ridges and carried across on the oceanic spreading plates, ending their days in the subduction zones of the world ocean. CenSeam had two main themes: **Theme 1:** What factors are driving community composition and diversity, including any differences between seamounts and other habitat types? **Theme 2:** Impacts of human activities on seamount community structure and function. The first theme concentrated on the biodiversity of seamounts from base to top which in many cases was very variable as depth is an important determinant of faunal distribution in the deep sea. A simple question posed was whether seamounts were like islands and had the problems of isolation and retention of species. Studies on deep-water (also called cold-water) corals (including Scleractinia, Antipatharia and gorgonians) in the warm temperate region of the NE Atlantic suggested the level of endemism is low (< 3%), but that the coral fauna on oceanic islands was different from that of the nearest continental slope (Hall-Spencer *et al.* 2007). A detailed comparison of the Davidson Seamount in the Easter Pacific with the nearby Monterey Canyon suggested that there was a remarkable similarity in the species present but the order of importance differed significantly. By comparing biomass it was evident from the SW Pacific that the biomass on seamounts off Australia and New Zealand was greater than the nearby continental slope.

Blackwater Estuary in Essex up to Seahouses in Northumberland via Orford Ness (Suffolk), Sheringham and Hunstanton (Norfolk), Gibraltar Point (Lincolnshire), Flamborough Head and Robin Hoods Bay (Yorkshire) and Seaham (Durham).

Professor Juliet Brodie of the Natural History Museum, Dr Claire Goodwin of National Museums Northern Ireland, Dr Lin Baldock and Dr Frances Dipper all provided advice and support to the event. Lin led the algae work on the trip and performed heroically, conducting delicate work in constantly changing locations. The rest of the team were Seasearch volunteers who donated their time and covered the majority of their own costs to support this unique event.

Headline survey numbers

Bare numbers can't convey the beauty of the East Coast but give some little idea of its biodiversity. The numbers of species recorded are low compared with terrestrial surveys – but those have the advantage that recorders can stay observing while the sandwiches last and can't run low on air!

Provisional species numbers (South to North)

Area / Species	Essex	Suffolk	Norfolk	East Anglia	Lincs*	Yorks	Durham	Northum-berland	Overall
Sponge	7	4	20	20		8	5	0	23
Cnidarians	10	9	27	29		11	8	2	35
Worms	1	4	8	9		4	1	4	11
Crustaceans	8	8	25	27		12	5	4	28
Molluscs	4	7	34	36		8	7	8	41
Bryozoans	0	0	9	9		12	8	0	14
Echinoderms	1	2	7	8		4	4	2	10
Sea squirts	8	3	16	23		5	4	0	27
Fish	1	2	31	33		9	4	3	35
Others	1	1	1	1					1
Algae	24	35	78	97	9	50	20	59	126
Total	69	75	254	292	9	123	66	82	352

**Honestly we didn't do Lincolnshire justice!*

The event was supported by many local, regional and national organisations. We are very grateful to all: The Wildlife Trust's North Sea Wildlife Project, Norfolk Biodiversity Partnership, Norfolk Biodiversity Information Service, The Environment Agency, Durham Heritage Coast, The National Trust – Orford Ness, Marine Conservation Society, The Wildlife Trusts, Yorkshire Naturalists Union, Purling Transport and Diveline.

Organised by Seasearch East – www.seasearcheast.org.uk

Dawn closing in on a rock covered in the new sponge

Sagitta claparèdi Grassi, 1883 p.17 Pl 1 fig.1

Spadella musculosa Doncaster in Lo Bianco, 1883 p.266

Spadella parvula Moltschanoff, 1909 p.889 figs. 2-5

Spadella cephaloptera Ritter-Záhony, 1911 p.35 fig.41

Comments on the synonymy.

***Sagitta cephaloptera* Busch,1851**. In his article on "*Observations of the Anatomy and Development of some Invertebrate Marine Animal*s" Busch described on page 93 the genus *Sagitta* as follows "This remarkable genus is truly one of the most widespread and most numerous of all marine animals and I myself have come across an extraordinary amount when I have been at sea. On the Orkney Islands I had the opportunity to observe a very interesting, not yet described species. As I was fishing in the said area with a drag net of canvas down to a depth of eight to twelve fathoms (= 14-22 metres) where I was seeking to obtain young (comatels) in pentacrinoid condition, I found these small rather abundant animals among the objects retrieved from the sea bed." Finally in a short paragraph on page 98 he describes the species as "this *Sagitta*, which I named *cephaloptera* because of the "head-fin", and the Wilmschen". There is also a good figure of the head end.

***Sagitta mariana* Lewes, 1860.** In the first edition of "Seashore Studies" Lewes, 1858 p 250 referred to *Sagitta bipunctata*, Table 5, figure 1 and on p 251 a description. In the second edition of "Seashore Studies" 1860 Lewes applied the name *Sagitta mariana* to his species and described it as "quarter of an inch in length" and continued to say it differed from species (*S. bipunctata*) described and illustrated by Gosse, 1856. Lewes used the same figures for both his 1858 and 1860 publications. The Lewes specimens were from the SW coasts of England and were well illustrated.

***Sagitta gallica* Pagenstecher, 1863.** This species was separated from other species of *Sagitta* on the structure of the internal organs. There is one illustration of the head but no figure of whole body or fins. It was described from Séte, France, Mediterranean coast.

***Sagitta cephaloptera* Claparède, 1863.** This species is recorded from specimens collected by tow nets at St. Vaast-La-Hougue, France, coast of Normandy. There is a good illustration with a figure of the whole animal.

***Sagitta pontica* Uljanin, 1870.** This species is described from the Black Sea coast of Russia/Latvia.

***Sagitta batziana* Giard, 1874.** This species is well described from the sea bed off Roscoff. It differs from *S. cephaloptera* on the number of teeth and the presence of bristles on the thoracic region. There is a good figure of the whole animal and sections of internal organs. The plate has been incorrectly cited as Plate IX figures 1-3.

***Sagitta claparèdi* Grassi, 1883.** This species was described from the Bay of Naples. There is no illustration but from the details it is probably a *Sagitta* with the characteristic fin shape.

***Sagitta musculosa* Doncaster, (in Lo Bianco) 1883.** A new species described from the Mediterranean in 100-1100 metres. Another new species *S. profunda* was also described and compared to *S. musculosa* and separated by its presence in deep water (1000-1100 metres). There are no figures or description of the shape of the fins etc. ***Spadella parvula* Moltschanoff, 1909.** This species described from the Black Sea coast includes a description and three figures of internal structures.

***Spadella cephaloptera* Ritter-Záhony, 1911 p.28.** There is a description, no illustration and a statement that the distribution is from the coast of Norway to the Mediterranean.

***Spadella cephaloptera* Ritter-Záhony, 1911 p.35 fig 41.** This reference was included in synonymy by Ritter-Záhony for samples collected in the Antarctic and the Irish Sea. The Irish Sea record could be referring to the Clare Island Survey which was not published until 1914. He summarizes distribution information and concludes the northern limit is 62^0 N.

The synonymy of *S. cephaloptera* is in doubt as there are no known type specimens available for examination.

Redescription of *Spadella cephaloptera*

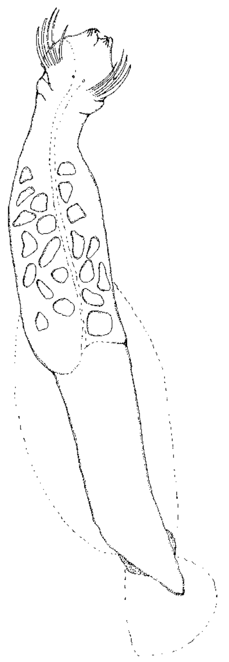

Figure 1. Spadella cephaloptera Whole animal 3 mm in length, from Scilly Isles. NMS 2012.008, St 18. (Fins are absent therefore the discontinuous line is only indicative).

Material examined. The specimens are in poor condition without complete fins.

Body: 4.25-5 mm, opaque but internal organs visible through body wall. Ventral surface convex/ dorsoventrally flattened. Body consists of a head, collar, trunk and tail region.

Head: a retractable hood covers the prehensile spines but not the mouth/vestibular pit. Lateral plates with a set of teeth. Eyes, T-shaped, behind the insertion of the dorsal ganglion. A pair of tentacles on lateral edge near base of prehensile spines.

Collar: also known as the "corona ciliata" on dorsal side of head region.

Trunk: a ventral anal opening on the median line in front of the septum which separates the trunk from the caudal region. The median septum is the entire length of the tail and divided into the left and right sides. In front of the caudal fins there is a pair of seminal vesicles.

Tail: very short, approx a tenth of the body length.

Fins: Lateral fins entire length of tail region.

Habitat:

S. cephaloptera is found in rock pools and sticks to the smooth surfaces of sea-weeds, peebles and rocks with ventral papillae on the caudal region. They can live in reduced salinity of 60-70% but become inactive. Observed from living specimens they are unable to remain suspended in open water and if disturbed move towards a firm surface (John, 1933). *S. cephaloptera* feeds on copepods and other small planktonic species by ambushing rather than chasing prey (Parry, 1944). They lie motionless, fixed to the substratum with the head and trunk raised, until prey at a distance of 1 mm and moving at the right amplitude and frequency is detected by the tufts of lateral and ventral cilia and bristles (Horridge and Boulton, 1967). The hood is pulled back to allow the evagination of the mouth and the terminal prehensile spines which manipulate the prey until it is gripped by the teeth on the lateral lips (John, 1933).

Published British Records

Sagitta cephaloptera Busch, 1851 from Orkney Islands.

Sagitta mariana Lewes, 1860 from SW England.

Spadella cephaloptera Plymouth Marine Fauna, 1957 In laboratory tanks.

Spadella cephaloptera Bruce *et al.*, 1963 Port Erin Bay.

Spadella cephaloptera Bull, 1966 Inner Farnes, Cullercoats Bay, Blyth Bay.

Spadella cephaloptera Pierrot-Bults & Chidgey, 1988 All around the British Isles.

Spadella cephaloptera Muxagata & Williams, 2004, from Southampton Water.

The only known 4 records with specimens are

Introducing *Porcupinella*

Porcupine members familiar with the history of HMS *Porcupine* and the naming of the Porcupine Bank (see Frank Evans, PMNHS website*), and the associated Porcupine Seabight and Porcupine Abyssal Plain, will be interested to hear of *Porcupinella* – a new recently described genus of Sea Pen.

Pablo López-González and Gary Williams (2011) described the new pennatulacean octocoral from material collected from around 4840 m on the Porcupine Abyssal Plain (~48.8°N, 16.5°W), 340 miles southwest of Ireland. Material of the aptly named type species, *Porcupinella profunda*, was obtained from four RRS *Discovery* cruises carried out during the 3-year multidisciplinary EC MAST III BENGAL research programme (Billett & Rice 2001).

The authors also examined accounts of *Umbellula carpenteri* Kölliker from two previous North Atlantic studies. *Umbellula carpenteri* was originally described from Antarctic waters (Australian sector) and the northern material was, in part, newly assigned to *Porcupinella profunda*. This extends the range of *Porcupinella* west to around 40.5°N, 35.8°W in the mid-Atlantic and south to near the equator at 18.7°W, southwest of Liberia; depth 4510–5300 m.

Porcupinella profunda is the first member of the derived Sea Pen family Chunellidae to be found in the Atlantic Ocean; the other two extant genera occur in the Indian Ocean. Furthermore, *Porcupinella* is the deepest chunellid, living at four times the depth of the others.

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* Evans, F. A history of the Porcupine Marine Natural History Society. [http://pmnhs.co.uk/a-history-of-the-porcupine-marine-natural-history-society-2]

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Seaweed East '11 – Not so weedy divers survey the East coast!

Rob Spray

Britain's North Sea coast isn't dived as often as others and doesn't often get the attention it deserves. This summer a group of marine conservationists attempted to survey from Essex to Northumberland to change that. The effort paid off, discovering one entirely new species, and others which weren't expected on the East coast at all. The Norfolk and Suffolk legs of the trip were filmed by the BBC for a half hour special called 'Britain's Great Reef' which reflects the recent work to understand what is acknowledged as the longest chalk reef in Europe. Initially shown regionally, a nationwide repeat is planned the near future (date TBA).

New and unfamiliar species

The survey recorded 352 species, despite weather preventing diving North of Durham. 126 of those were seaweeds – many species were previously unrecorded in the region. One sponge species which was unknown to science has been added to the list of marine animals found in our waters. The find was confirmed by sponge authority Dr Claire Goodwin of National Museums Northern Ireland. The purple *Hymedesmia* species is yet to be named formally. This is a colourful encrusting animal typically covering flint cobbles. There's no truth in the rumour that we are campaigning for it to be called H. *robertoqubyfrontis*!

The event helped to nearly double the number of species recorded by Seasearch East – up to 292 in 2011. Of course there was a fantastic boost in seaweed recording too with a fivefold increase from 20 to 97 species – not long ago Seasearch's overall Eastern total was less than that!

Epic algae road trip

Seaweed may not be the most glamorous aspect of marine wildlife but it is a foundation of healthy and diverse ecosystems. This was a chance to refresh the state of local knowledge and maybe draw out information collected in the past. More than 20 people took part in the trip travelling from the

The spiky bauble

Jon Moore, CALM, jon@ticara.co.uk

Finding an animal that I can't identify during a marine biological survey is not unusual, but finding one that I can't put to a phylum is fairly uncommon – and this time it wasn't just one individual but lots, and they were moving! This was August (2011) in the Menai Strait, Anglesey; surveying on the lower shore for part of CCW's marine SAC monitoring programme. It was an excellent low spring tide and the temptation to delve into the normally hidden goodies of the sublittoral fringe got the better of us. [Only for 10 minutes, and we had been working hard!] There was lots to see, including a number of colonial ascidians (seasquirts) attached to kelp. We have been trying to get a handle on the ascidians of the Strait, which is increasingly difficult with the appearance of various non-natives, so I was looking closely at a golf ball sized clump of a polyclinid (not yet identified). It had some strange spiky projections, which were associated with orange structures under the surface. With the hand lens I was then amazed to see that one of the structures was an embedded capsule full of tiny larvae swirling around like in one of those snowstorm shakers. The immediate assumption was that they were ascidian larvae, but none of us had seen anything like them before. So, I get out my new toy – a Pentax Optio WG-1 digital camera – the one with the inbuilt GPS and, even better, a 'microscope' mode that can fill the frame with 5mm – set it to video mode and film the swirling larvae. Even I am impressed with the results, and you can see it yourself on YouTube at www.youtube.com/watch?v=IFF7DSkf8DI. Back in the lab we were still puzzled, so Paul Brazier had the good idea of sending the images to John Bishop at the MBA. John has the answer – it is almost certainly the egg capsule of a gastropod, in which the eggs have now hatched into veliger larvae and are almost ready to be released through the funnel-like projecting tube. As John says, if you look very closely you can occasionally see the wing-like velum of the larvae. He also says that he sees gastropod egg capsules embedded in ascidian colonies quite often (see Fretter & Graham 1994, British Prosobranch Molluscs, Ray Society, for examples – relevant pages 375 to 377), though usually without the projecting tube, and that it would be good to get mollusc and ascidian people together to look for associations between species. The polyclinid colony was 5 cm long, and the capsule must have been about 4-5 mm. I have tentatively tagged the video with the gastropod genus *Lamellaria*. Has anyone got a better idea?

deposited at the National Museum and of Wales and National Museums Scotland:

NMWZ. 2009.027: Scilly Isles. 1) St 24a, 49° 55.21'N 06° 23.93'W, 47m, 29.06.2009; 2) St 18, 49° 57.77'N 06° 18.36'W, 10m, gravel, 28.06.2009; 3) St 24B, 49° 53.22'N 06° 23.91'W, 47m, 29.06.2009;

NMSZ. 2012.008.1 Scilly Isles St 18, 49° 57.77'N 06° 18.36'W, 10m, gravel, 29.06.2009;

Elsewhere records from the N E Atlantic include Ballynakill Harbour, Bofin Harbour, Clew Bay and Blacksod Bay but they do not include a description or illustration (Southern, 1914).

It is clear from the literature that there are remarkably few records of *S. cephaloptera* in British Waters and even fewer specimens preserved in collections or laboratories. When samples in good condition are preserved an accurate re-description with figures can be published and a re-assessment of the synonomy could begin.

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Lundy – going forward after 40 years of science in support of conservation

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Figure 1 Keith off the south coast of Lundy in 1971, the start of 40 years of research linked to marine conservation at Lundy.

Introduction

The presentation that I gave at the Southampton meeting in March 2011 looked back at what studies around Lundy had achieved over 40 years of research linked to the various marine conservation initiatives there. Essentially, those activities started in 1969 in a very informal way with the finding by a timid undergraduate (yes, me) of the sunset cup coral *Leptopsammia pruvoti* at the Knoll Pins – the first record for Britain. More systematic studies kicked-off in 1971.

The detail of those past 40 years is in the booklet being prepared by myself and Robert Irving (the flyer in the last newsletter that promised publication in autumn 2011 – well, it will be soon). This article is a chance to do a bit of 'lessons learnt' and a forward look especially at what has been and will be the most valuable research in support of management for conservation.

Why catalogue?

Cataloguing the marine fauna (the algal flora had been censused by David Irvine and colleagues in the late 1960s: Irvine *et al.* 1972) was part natural history but part achieved an understanding of the special features of the flora and fauna and gave some 'flags to fly'. For instance, that the algal flora includes the greatest variety of algae (310+ species) of any single location in the British Isles, the diversity of subtidal reef habitats (as level 4 biotopes) is very high – 30 compared to a more usual 15 for similar areas, all five shallow inshore British stony corals are present. 'Flags to fly' are important not only to know what needs looking after but also as part of the promotion of an area. All too often, conservation doubters will state "there's nothing special there" (usually followed by "I've been fishing it for years"). And readers should understand, that 'special' species are not just the Biodiversity Action Plan (and their derivatives) species – there are some rare and many scarce species and species that are in decline or threatened with decline that do not satisfy the quantitative criteria that identify BAP species – they are important to know about and include in management plans.

Has conservation 'worked'?

Never forget the definition of conservation in relation to biodiversity: "the regulation of human use of the global ecosystem to sustain its diversity of content indefinitely." (Nature Conservancy Council, 1984).

In the days of the voluntary marine reserve, a word-in-the-ear of those causing damage, or likely to, worked to a very small extent with

(*Halichondria panicea)* and very large patches of *Myxilla incrustans,* together with Dead man's fingers (*Alcyonium digitatum)* and abundant Oaten pipe hydroids (*Tubularia indivisa)* as you would expect in an area of such strong tidal movement. It was a very impressive sight, but there seemed to be a cover of pink fur over everything, softening the outlines. On closer inspection I realised that all of the rock and attached fauna was covered in Caprellids, millions upon millions of them. I had never seen anything quite like it before and it was a few seconds before I remembered why I was there and started taking photographs and jotting down notes on my slate. It was completely slack, the visibility was good and I felt fine– I glanced over at Bernard and he gave me an okay signal, and we both carried on with our recording.

"Furry" shredded carrot sponge - Jen Jones

After about five minutes, I suddenly felt a barely perceptible pull through the water and realised that was our signal to get out of there. I looked round for Bernard and he was looking right back at me, obviously thinking the same thing. We started our ascent, finning steadily, and I deployed my delayed SMB at about 9 metres as planned. We were just a couple of metres from the surface when I realised that the line of my SMB had done a U-turn and the buoy was making its way back down – a sharp reminder of where we were diving! I reeled it in quickly and we surfaced to find the boat waiting for us. We were de-kitted and back in the boat in less than thirty seconds, and then I watched in some awe as the water gradually began to swirl and boil angrily once again. If we hadn't timed and planned it so carefully it could have been rather scary to say the least – but we had, and we had successfully dived the Routen Wheel – something Bernard had always wanted to do! One of the better experimental dives I have done, but not something I'm in any hurry to repeat!

Field work Forays – Experimental diving

Jennifer Jones

I've been doing field work for many years now - diving and intertidal surveys, in the UK and abroad, in sun, rain and even snow – but I was still stuck for ideas about what to write when I was first asked to contribute to this section of the newsletter. When I started to think about those surveys though, certain events began to come back to me - some funny, some rather scary, but all memorable in a mostly good way! I particularly remember the time I was gently coerced into diving a whirlpool….

The first time I went on a survey with the Ulster Museum diving team led by Bernard Picton was in 2005 to Rathlin Island, six miles off the coast of Northern Ireland, to record all sponge species found and collect samples for identification. We spent six weeks there in total over the summer, diving all around the island identifying, photographing and collecting samples. Rathlin has very strong currents, it goes very deep very quickly, and it is challenging diving to say the least, but I soon realised that Bernard had extensive knowledge of the tidal streams around the island and knew when most sites were suitable to dive. However, I also learnt to be very wary if he casually said the words "this is an experimental dive". For some reason it always seemed to be myself and my buddy undertaking these dives while he supervised and made sure the boat was there when we surfaced – sometimes shortly after descending if the experiment hadn't quite worked!

Over the next few years, I spent many weeks diving and surveying at different locations with Bernard and Claire Goodwin during both the Sponge Biodiversity of the UK and the Sublittoral Surveys of Northern Ireland projects. One of the areas we surveyed was Strangford Lough, a place I'm sure most of you will know or have heard of. The large lough in County Down is approached from the Irish Sea through an 8 km long passage of water called the Narrows that has very strong tidal currents up to 7-8 knots. A particularly turbulent area of boiling water near the entrance is called the Routen Wheel and is caused by a rock ledge coming up from the seabed to around 5 metres below the surface. As far as I knew, nobody had attempted to dive this rock because of the fact that it was in a whirlpool, and as we all know whirlpools have nasty down currents and should be avoided at all costs.

At the beginning of a week-long survey of Strangford Lough in 2007, discussions began as to what sites were to be dived each day. The tides were very small neaps, so we were going to have some reasonably good periods of slack water for diving. That was when Bernard uttered those dreaded words: "Jen, how do you feel about doing an experimental dive with me?"

A couple of days later, when the tide was at its most neap and after a lot of meticulous planning and working out of slack water time and duration, I found myself sitting on our RIB eying a mass of downward-swirling, boiling water that was the Routen Wheel with some apprehension and disbelief that I was actually about to enter the water to survey some rock below all of that. Did it REALLY matter what was there? Couldn't we just assume it would be the same as all the other places in the Narrows that we had surveyed? Apparently not, judging by the speed and enthusiasm with which Bernard was beginning to get all his equipment together. I took a deep breath and began to do the same.

Ten minutes later, fully kitted up and cameras in hand, we went over our dive plan one final time. The water was still churning somewhat, but we had planned to be completely ready and waiting to go in the second it went slack. We knew we would have very little time underwater before the current started again and gave ourselves a total maximum dive time of just10 minutes. By now my apprehension had disappeared and I was beginning to look forward to it. Eventually the water became still, and we were over the side and going towards the rock face and down.

I initially thought that something had happened to my eyesight, everything appeared to be slightly blurred. The rocks were covered with massive sponge growths – Elephant hide (*Pachymatisma johnstonia),* Shredded carrot (*Amphilectus fucorum)* Breadcrumb

regard to the early collection of sea fans and sea urchins as decorations, but crawfish were considered legitimate targets and continued to go to market in the early days. Now, most divers can see how the populations have been decimated and do not take them. But without regulation, the bloody minded or those who see cash can (and do) just ignore voluntary codes. The words of Professor Sir Bob Watson (DEFRA Chief Scientist) at an All-Party Parliamentary Group meeting on Biodiversity in November 2011 ring true: "it may be an inconvenient truth in policy making, but there is not a single environmental issue that has been solved without regulation".

Trawling (actually dredging for scallops, which causes significant co-lateral damage) did stop off the east coast during the days of voluntary agreement and then of the Sea Fisheries Committee bye-law but one had the suspicion it was because it wasn't really worthwhile anyway. Now, with scallops being a valuable species without quota, vessels are fishing the North Devon area and coming close to Lundy where the No-Take Zone is a definite no-no for mobile gear (although suspicions are raised when lights of moving boats are allegedly seen nearshore at 3 am). So, the rich sediments off the east coast to about 1 km offshore have been protected by the marine reserve in its various guises. Maintaining that situation means vigilance and robust action if infringement occurs.

The No Take Zone has been a great success for lobsters (Hoskin *et al.*, 2011) evidenced by well-designed monitoring but much more difficult to judge for scallops and for non-commercial species. It seems most likely that algae, invertebrates and inshore territorial fish were not significantly affected in what is now the No-Take Zone by localized human activities and any changes detected may be natural including that increase in lobster numbers may affect their prey species.

Marine conservation has never addressed prevention of colonization by non-native species and it is very difficult to think how we might do that. In the meanwhile, keeping the rockpools in Devil's Kitchen clear of *Sargassum* seems to be successful and should be continued with the addition of removing *Asparagopsis armata*.

Conservation is not just about regulating to maintain naturalness but includes informing and helping the public to enjoy the marine life present. Lundy has excelled at that aspect of conservation, countering the suggestion that "Plans to create a marine nature reserve at Lundy …. could clear the island of its residents" (North Devon Journal Herald, 31 July 1986). Lundy has benefitted enormously from the marine reserve status but its remoteness prevents it being over-run with divers.

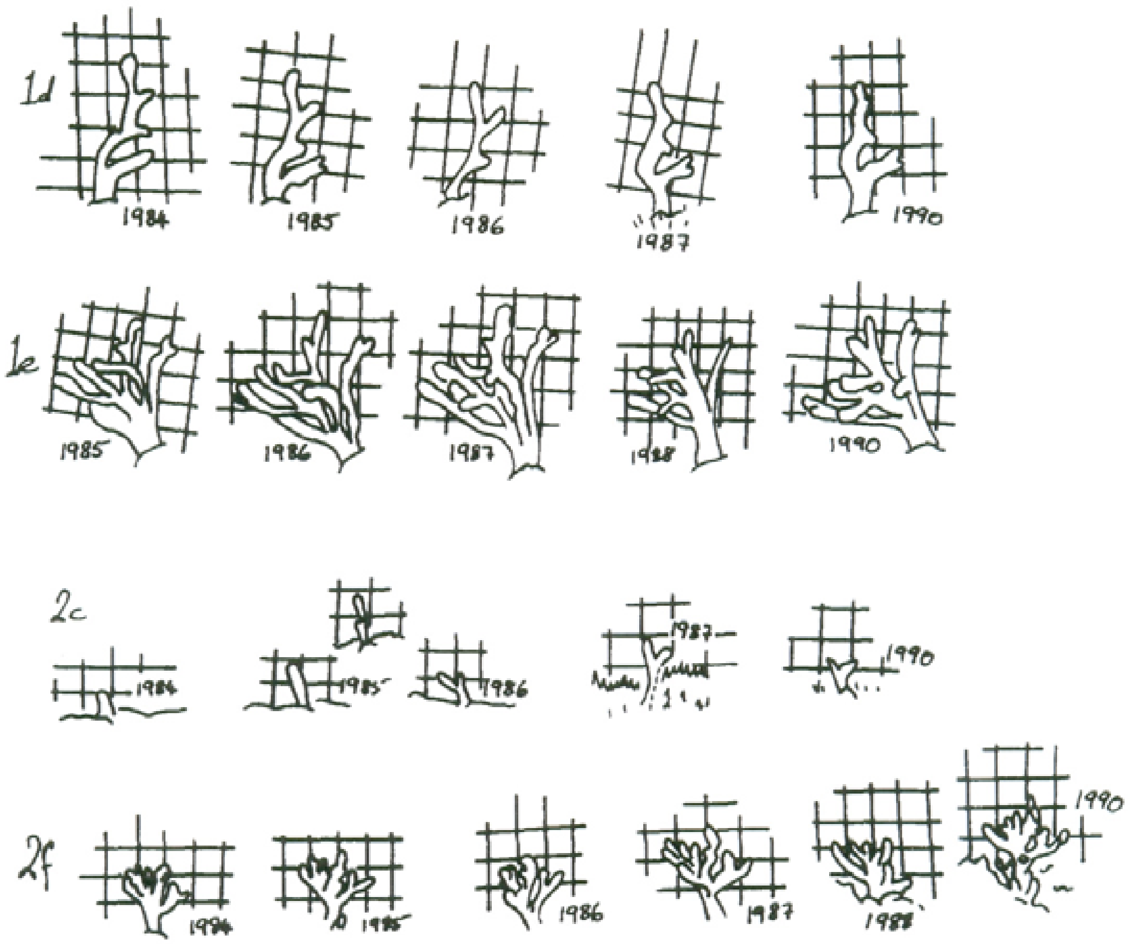
So the answer to the question "Has conservation 'worked'?" is "yes" but within the constraints of a busy area including one that continues to be used for fisheries and the situation in the sea that change, including declines of valued species, is most likely due to natural causes and not something that can be 'fixed' (as on the land) by manipulating habitats and (re) introducing species.

Has survey and monitoring helped management?

There are many forms that survey and monitoring takes. We have reference data from one-off surveys such as the census work done by Lesley and Clare Harvey in the late 1940's or the population estimates for red band fish done in the late 1970s that can be checked against the current situation (intertidal species are much as listed 60 years ago; the red band fish population has collapsed). The establishment of underwater monitoring sites in the 1980s was a highlight and, over the few years that they were continued in a systematic way and later in an occasional survey, gave valuable information on, unfortunately, decline in some populations.

The report on monitoring at Lundy (Haskoning, 2010) is well thought through and thorough but documents an 'impossible' amount of work needed to answer all of the reporting requirements under directives and statutes, etc. It also suffers from the requirement to have targets. For instance, achieving "No change in extent of littoral rock" is

Figure 2 Monitoring of growth rates in axinellid sponges



between 1984 and 1990 demonstrated how slowly they grew and identified them as species that needed to be protected from loss or damage as they were unlikely to come back if lost. Similar information on life history traits from a range of species is needed to understand which especially need protection. From: Fowler & Laffoley (1993).

not difficult but "Maintain presence and abundance of *Leptopsammia pruvoti*" is going to be difficult! Also, 'dumbing-down' to census what biotopes are present does not address the quality of those biotopes and may be a waste of time. Current Natural England staff who are commissioning and undertaking work at Lundy are to be complimented on their thoroughness in understanding what has been done before. However, a conspicuous 'what a pity' is that it seems sensible, if you are establishing rocky shore monitoring transects, to put them in the same locations as were surveyed in 1976 and 1977. 'New' methods especially those that offer apparent shortcuts should be scrutinized carefully – I refer especially to acoustic methods for mapping.

Sometimes we fail to match objectives to methods or are perhaps trying to use statistically robust methods that do not deliver the goods. The unrealistic idea of stratified random sampling of subtidal reef communities was successfully promoted when fixed-point photographic sites would have given meaningful results. The photographs are also 'evidence' – sometimes needed to convince still-wet-behind-the-ears new statutory conservation agency staff members that there really has been a change or that growth rate really is as slow as stated. The photographs also show if it is the same individuals of a species present from year-to-year or whether there is a 'turnover'. However, we learned that re-finding markers of fixed sites underwater after several years of non-maintenance was virtually impossible. A lot to learn about site marking from CCW scientists I think. So, we know much more about the longevity of some species of marine natural heritage importance and have documented change – but without knowing cause of declines or even when we do

Film: "The Rocky Shore" (25 mins.)

Frank Evans

The year is 1975. I am standing with a camera crew on the footpath above Cullercoats Bay in Northumberland, planning the opening shot for my new teaching film on the rocky shore. From where I stand the slope of the shore is heavily interrupted by successive rock strikes and the major tidal zones are far from obvious. However, there is one place where a clear break occurs; it is inside the vertical surface of the north pier, where the line at the top of the barnacle zone shows prominently. Far out, the strapweed of the lower shore protrudes visibly above a calm sea. Now I know that I have all my three major zones set for filming.

Many weeks will pass before the film (and it is film, not video) is complete. We, the crew, must find mutual dates in our diaries, watch the tides and the weather and arrange transport. Being responsible for my own continuity, on location I must always be dressed the same, which may mean nipping home to change. The sound man must bother about such things as wind noise in his microphones and the cameraman must bother about fading light and colour quality. We all three bother about my script.

Later, clambering on the sea wall of the upper shore I am equipped with a microphone clipped to my jacket but it is not a radio mike and the cable passes under my coat to be taped to my long sea boots, all carefully obscured from the camera. In the film, I appear knowledgeable on the different species of upper shore winkle; only in later years does the unitary *Littorina saxatilis* become dissolved into a clutch of species.

Knee-deep in the weed of the lower shore I cut off fronds of *Laminaria* to show the different forms while the cameraman struggles to keep the sea out of his equipment. As the film grows, selections of animals and plants are named and illustrated, with heavy indication of their location on upper, middle or lower shores, and their biological characteristics. We film chance specimens as well as deliberately posed ones; fish, crustaceans, molluscs, worms, sponges, anything to add to our story.

There are tank shots to be taken, too, in the conveniently situated Dove Marine Laboratory in Cullercoats Bay; anemones, starfish, limpets, barnacles and winkles. They will in time be cut into the field sequences as part of the account.

Towards the end of the film I emphasise the stressful nature of shore life and make simple instrumental demonstrations of the differing humidity of exposed rock and crevices and also of the wide variation possible in the salinity of rock pools. I show the extremes of rock temperature as compared with air temperature in full sun, pointing out the demands these variations make on intertidal animals and plants.

I wanted to conclude with a winter shot of the beach in order to contrast it with the different stresses of a hot summer sun. In winter Cullercoats may have snow on the beach, frozen rock pools, frozen weed and crabs, frozen birds and generally harsh weather. But over the many winter months of filming I was never able to gather the crew at such a time, such is the difficulty of part-time film-making. So we finished with a storm as second best. Editing was a later story.

The film, once finished, has been shown many times, happily to general appreciation.

(2009) and by making more use of websites.

Perhaps nothing today quite compares with Cuvier's factory-scale output at the Paris museum, turning out (amongst many other works) 24 volumes of fish natural history in twenty years (1829-49). It is said that he moved on to direct the work of one assistant after another, allowing himself no time even to sit down. In preparing this armchair review, sitting down is all that I have done.

*the Caribbean snail *Anticlimax glabra* Rubio, Rolan & Pelorce, 2011.

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know (in the case of the *Vibrio* bacterium that devastated seafan populations: Hall-Spencer *et al.* 2007) we can usually do nothing about such losses.

Work continues to assess the effect of 'no-take' regulations especially on commercial species and the role of the Sea Fisheries Committee (now Inshore Fisheries and Conservation Authority) in tagging lobsters to aid interpretation of monitoring and, together with their more generally increasing capability for survey and monitoring in relation to biodiversity conservation, is to be applauded. The scallop story is interesting as, once again, stratified random sampling did not deliver the goods – the conclusion being not enough sample locations (expect to run out of time and money before you can take 'enough' samples underwater in random sampling of heterogeneous habitats). The fact being that if the study had been undertaken at several fixed locations, meaningful results may have been obtained. A recreational diver, Chris Mandry, has 'censused' scallops from the same 'run' for in excess of 20 years and numbers have been maintained in that period. Whatever the changes occurring in the NTZ, if human activities that may cause change can truly be prevented, then a valuable understanding of natural fluctuations can be achieved.

The number of seals resident or visiting Lundy has increased over the past 40 years and there must be a question whether they affect seabed or nearbed marine life including territorial fish. If the seals stick to eating sandeels, maybe not, but worth thinking about.

The 'big picture' is that survey and monitoring has informed management of what is where and how some of it has changed or is changing. It has enabled fragile and high diversity locations and 'important' or sensitive species and habitats to be especially protected from damaging activities. It enables or should enable wise decisions to be made about maintaining or improving fisheries. But, it seems that because most of the changes being detected in non-commercial species are either natural (probably declines in abundance of native species) or are impossible to reverse (arrival of non-native species) or are the result of widescale change (climate affecting temperature-sensitive species; overfishing depleting spawning stocks and therefore recruitment to Lundy), then managing human activities locally will not prevent those wider environment impacts affecting Lundy.

Can we establish reasons for change (and do something about those reasons?)

Figure 3 Watch-out for and hope for the return of the conspicuous seaslug Greilada elegans (last seen in 1986) – hopefully a harbinger of better times.

There are mysteries to fathom. From about the mid-1980s the abundance of many of the southern species that made Lundy 'special' began to decline. I suggested that this may be happening in a presentation at the Linnean Society (Hiscock, 1994). Establishment of the cause of change is going to be difficult except where response to removal of a pressure is as obvious as in lobsters. The declines in many of the conspicuous southern species since the mid-1980s is particularly difficult to account for but the change happened at about the same time as documented regime shifts in marine ecosystems in the North Sea (see, for instance, Evans & Edwards, 1993) and those changes probably occurred more widely. The 'flagship species' *Leptopsammia pruvoti* suffered and numbers were, in 2007, about 40% of what they were at monitoring sites in 1984 (Irving & Hiscock, 2010). It would be good to complete the genetic work started on the corals – initial results suggest they are clones of each other (reflecting very localized recruitment). Another lesson learned, assuming very localized recruitment, is about the 'other side' of the connectivity coin. As well as designing MPA networks to cater for species with long-lived larvae and propagules (that are going to recruit from somewhere without help), conservation bodies should think about those species that have limited dispersal capability, most likely *Leptopsammia* for just one, and need to be looked after where they are!

Looking forward

There is a lot of historical data for Lundy – use it to compare with what is being censused and observed today! One of the greatest values of Lundy marine biological data is that it goes back 60+ years (40+ for subtidal) and should be used to check for long-term change – the sort of decadal scale change that characterizes the 'Russell' Cycle in the English Channel. However, much of the information from Lundy is descriptive and collected opportunistically at uneven intervals. Don't dismiss such observations. Some changes are likely to be obvious and will involve recruitment and re-appearance of species that have been in decline – so especially look out for them.

There are always 'gaps' being filled in our knowledge of marine life around Lundy. The multibeam sonar survey undertaken by the Maritime and Coastguard Agency identifies targets worth *in situ* survey. Most recently, the very wide ranging surveys of sediment communities aimed at identifying and mapping biotopes have added greatly to our knowledge (Smith & Nunny, in press). Work planned for 2012 by the Environment Agency and Natural England will collect quantitative samples of sediment fauna in a way that can be repeated as a monitoring programme – and that is important. There will be more good census work done but some targeting at what will be most meaningful for biodiversity conservation is needed. So, apart from looking for change in conspicuous 'important' species, search for and document the smaller and often rare ones. 'Inspection surveys' will be good enough to confirm (for the Habitats Directive etc.) that the reef habitat is still present and public money should not be wasted on repeat survey of broadscale features unless inspection or observations suggest change is occurring.

There have been some changes that can be linked to warming but the greatest changes over 40 years at Lundy have been linked to the arrival or the increase in abundance of non-native species especially algae and especially in the Landing Bay. It is difficult to know what to do about those incomers – extermination is not a possibility although we have managed to keep the rich rockpools in Devil's Kitchen largely free of *Sargassum* for many years now by removing them whenever we see them. Trouble is that we do not know what is around the corner non-natives wise but keeping track of what is there, how far it spreads around the island and how abundant it becomes is important contextual information. Similarly, shifts in abundance and perhaps even new arrivals that result from seawater warming are important to keep track of.

And finally

I will continue to visit Lundy to poke about on the seashore and to dive although do not have command of vessels to go where I want to go these days. I would like to survey some of the deeper reefs revealed by multibeam sonar off the south-west corner. I would like to check for recruitment in the *Leptopsammia* populations and revival of fortunes in some other species. I would like to check-out more caves to see if any of them have anything vaguely interesting in them (but not charging seals). I would like to win a prize in the annual underwater photographic splash-in. But, most of all, I plan to continue to enjoy Lundy for the unique, peaceful and fascinating island that it is.

Acknowledgements

The views in this paper are solely mine, but reviewing what has been done benefits from the work of a very large number of people – thank you. Throughout work on Lundy, the Lundy Field Society has been a great support and has, through their Annual Report and now Journal published many of the papers, fauna lists etc. resulting from marine biological studies at Lundy. Many of those can be accessed via the Societies website: www.lundy.org.uk.

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have market value as food, but might also have made attractive subjects for aspiring naturalist-collectors. An early interest in their identification is to be expected. For all these groups of sea creatures, new species accumulated steadily through the first half of the nineteenth century, before the rate began to decline. Additions to the ranks of crabs and shrimps peak in the 1810s (27 new species named) and gastropods in the 1840s (64 new species); but all had reduced to a trickle (single figure per decade) by the start of the twentieth century.

The number of described species of amphipods and of polychaetes only began to swell after a lag of several decades compared to the above groups. The diversity of amphipods and polychaetes was hardly known to Linnaeus. Neither group make convenient museum specimens (they are best preserved wet and lose most of their charm in fixative), nor have they food market value, so the massive increase in named species probably marks the arrival on the scene of a greater number of dedicated naturalists, prepared to tackle 'difficult groups'. It was the cutting-edge of science at the time. It seems to me unlikely that the appearance of Darwin's *Origin of Species* (1859) provided much immediate impetus in the discovery of our marine fauna (certainly not to some Victorian naturalists such as P. H. Gosse), but the acceptance of Linnaeus's binomial nomenclature a century before must have been a spur throughout. A more modest man than Linnaeus would probably not have been able to convert the world to his system so we salute him, for all his faults.

Because numbers of both amphipods and polychaetes start low and fall off again later, their decadal distributions are almost bell-shaped. Amphipod species peak broadly in the 1850s, '60s and '70s (64, 72 and 52 species respectively); polychaetes have a narrower peak, with a bumper decade (174 new species) in the 1860s (most polychaete families were also established around this time). Records of new amphipod and polychaete species show resurgence in the twentieth century, probably boosted by the rising interest in ecology and the practical needs of environmental impact assessment in marine environments, as well as improving techniques for assessing differences between similar-looking species. Polychaetes, in particular, show a steady accretion (average 36 per decade) in the post-war period, and the *Directory* hints at plenty more new names in the pipeline, many species and genera being in need of revision. Some of the twentieth century records of polychaetes are the result of discoveries in the interstitial fauna, hitherto unknown or ignored. I therefore included the nematodes, as a predominantly meiofaunal group. No marine free-living nematodes were known to Linnaeus, and they remained unknown until the 1840s. Thereafter, there has been a steady rate of accrual, with no sign of a slow-down – certainly no asymptote in sight.

Some groups appear to be well known, others less so. We have clearly not reached the end of discovering new species in the Northeast Atlantic area, even with two and a half centuries of history behind the attempt. We often hear that the current shortage of taxonomists is slowing the rate of description of new species. An analysis of data post-1950 (Joppa *et al.*, 2011) showed that taxonomists are actually increasing in number and that rates of species description have increased exponentially on a global scale (thereby confounding any attempt to extend the method I have just applied locally to the global picture). They show, instead, that individual taxonomists are getting slower and less productive in their output.

The productivity of individuals could be determined from the *Directory* as readily as the timing of their discoveries. It might be interesting but I have not attempted it. Nevertheless it is striking how a few, stalwart authors appear repeatedly in the credits for species names. Much more detail is demanded of taxonomists today than in years past, when a few well-chosen words could suffice to distinguish a new species. Molecular techniques, supplementing traditional morphological ones, are absent for most of the species in the *Directory*, whereas now they are standard ways to resolve ambiguities. More efficient, speedy and less ambiguous descriptions could be made by following a check-list of morphological characters, as proposed by Sundberg *et al.*

I examine the record of two and a half centuries of identifying species, assuming that the rate of describing new species will slow as the record nears completion.

Materials and methods

The information I have used comes entirely from the printed version of *The species directory of the marine fauna and flora of the British Isles and surrounding seas* (Howson and Picton, 1997). For selected groups of animals, I tallied the number of new species described in each decade from the 1750s to the 1980s. It is an easy task since the rules of zoological nomenclature require that the date of the original description of each animal species is part of the formal name – retained in perpetuity, with the specific epithet and authority, regardless of subsequent taxonomic revisions.

Results

The rates of accumulation of species are shown below in condensed form (as the number added in roughly fifty year blocks), the sequence of numbers beginning with the species catalogued by Linnaeus in the 10th edition of *Systema Naturae* (1758). Inconveniently, Linnaeus did not publish at exactly the mid-point of the century, so the first subsequent number applies to fewer years (forty-one rather than fifty) up to 1800. The rest run from 1800 up to 1850, thence to 1900, 1950 and 1990 (the last block is only forty years because the compilation of taxa is too incomplete to include the 1990s). Completeness of the record up to that time is suggested when the accretion of new species trails off – the cumulative number would have reached an asymptote.

The results start with the groups most completely catalogued by Linnaeus in 1758, and the percentage known to him is shown in parenthesis.

	1758	-1800	-1850	-1900	-1950	-1990	Total
Ray-finned fishes (40%)	102	40	83	31	6	5	267
Sharks etcetera (34%)	17	7	14	8	4	0	50
Gastropod molluscs (10%)	34	47	165	78	8	13	345
Crabs and shrimps (<8%)	14	29	83	46	5	7	184
Amphipods (<1%)	3	13	62	248	57	30	413
Polychaetes (<1%)	7	42	115	401	123	144	832
Nematodes (0%)	0	0	2	95	143	149	389

Discussion

I have chosen the groups presented above because each tells a different story about the discovery of our marine fauna. The differences between them can be attributed to a variety of biological and 'socioeconomic' factors. I speculate a little as to what they may be.

The ray-finned fishes (the class Osteichthyes, which here means Teleostei plus one other – *Acipenser sturio* Linnaeus, 1758) include many commercial species that would have been well known in eighteenth century fish markets. The same is true of the sharks, etcetera (the class Chondrichthyes). I have kept them separate from bony fish, however, because the Chondrichthyes is the only group that reaches a clear asymptote – with no new species described since the 1920s. Although the total number is fewer, so the group is easier to complete, another difference may be that there are no really small sharks, as there are with bony fish (new species of which were added at an average rate of just over one per decade throughout the twentieth century).

Gastropod molluscs, although including some commercially harvested species, were included because they might indicate the arrival of a new fad – shell collecting. Dry shells made a good display, alongside minerals and bones for the leisured classes in the 'Enlightenment'–obsessed with classifying everything and showing off their collections in 'cabinets of curiosities'. Crabs and shrimps (Eucarida – here meaning Decapoda plus euphausiids)

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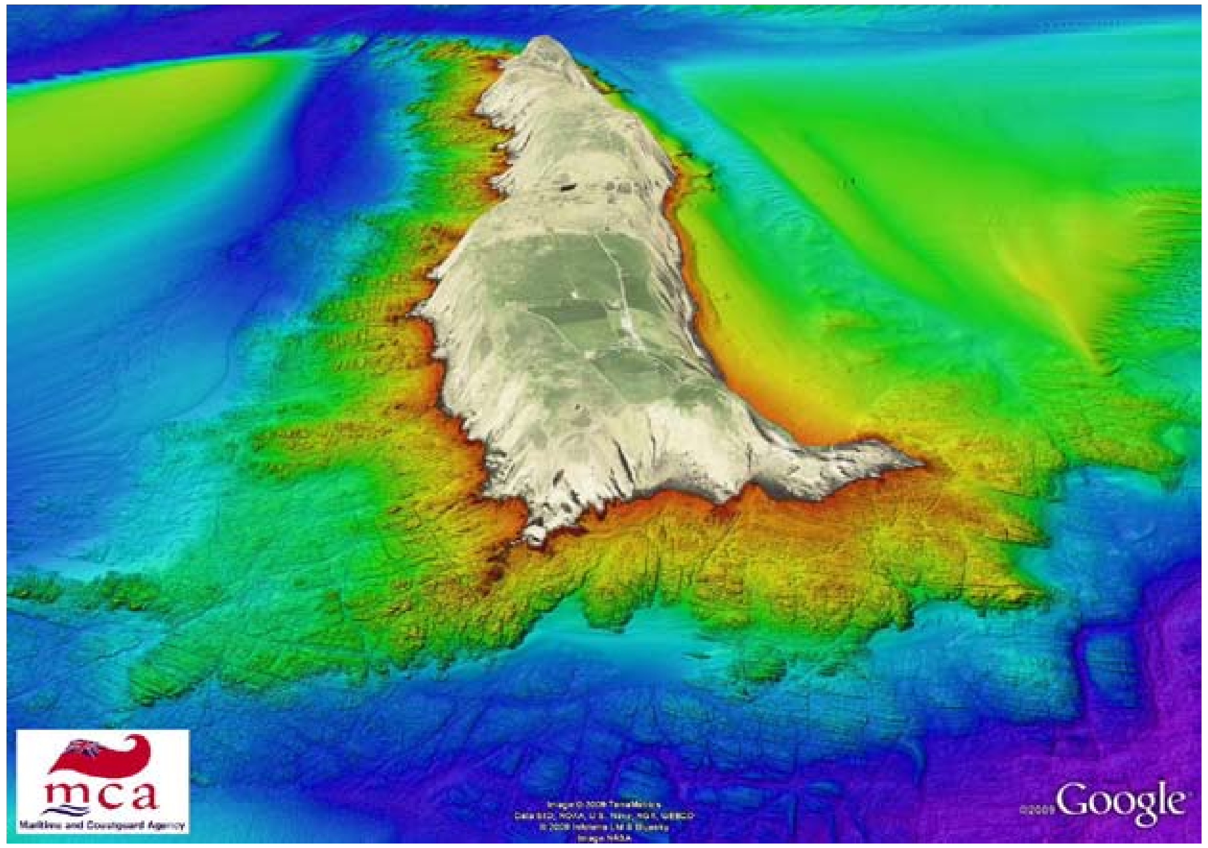


Figure 4 Output from MCA multibeam sonar survey showing subtidal topography

North Norfolk's Chalk Reef

A report on marine surveys conducted by Seasearch East

Rob Spray and Dawn Watson

The East Anglian coast is notably short of significant rocky shores and hard seabed features. This lends the sea an often turbid appearance as most of the seabed is mobile and easily disturbed. That certainly does not mean that these areas are free of life but can make observing it difficult. Hard seabed features allow plants and sessile animals to colonise, forming the foundation of a biodiverse localised ecosystem. North Norfolk is unique in the region in having areas of rocky seabed where chalk is exposed sub-tidally - and inter-tidally, most notably at West Runton.

Sub-tidal chalk is a Biodiversity Action Plan (BAP) habitat and with the encouragement of Norfolk Biodiversity Partnership (NBP) and Norfolk Biodiversity Information Service (NBIS) we have been attempting to survey the extent and biodiversity of the inshore area mostly commonly known as the Sheringham Chalk Gullies (sometimes alternatively attributed to Weybourne).

The reef is a mosaic of different seabed relief and rock combinations. To describe the more significant features of this area merely as gullies is dismissive. There are gullies in the chalk but these are features of a reef complex where some of the most striking sights are dramatic arches more than 2 m high at the seaward end.

The surveys were carried out as part of the Marine Conservation Society's Seasearch project, which asks amateur divers to record flora, fauna and habitat on their dives around the UK and Ireland. The Wildlife Trusts contributed support and we are also grateful to Fugro UK Ltd who supported the survey both through the provision of a sonar system and the benefit of marine survey expertise.

Chalk Primer

The chalk was laid down over 65 million years ago during the Cretaceous Period, formed by the compression of tropical ocean phytoplanktonic diatoms called coccoliths. This has been overlaid by subsequent geological events, most notably clay from glacial deposition. The exposed extent is just the tip of the 'iceberg' with the chalk layer more than 400 m thick in places. This stratum also emerges in other areas of the UK, exposed as the white cliffs of Dover, Flamborough Head and as the monumentally carved downs in the west. Off North Norfolk it emerges through the clay into a surrounding seabed of moving sand and gravel to form features which are little known and poorly recorded. Above sea level the soft, crumbling Norfolk coast is retreating over the chalk as it is eroded by wave action and tidal processes so chalk exposure is increasing.

The rocky nature of this area has given rise to a well-known crustacean fishery. The

Map data © 2010 Google

Fig. 1 An overview of the survey coverage

Yet other worms have been linked with deuterostomes (echinoderms and chordates) in an unsettling way. Witness how 'acoelomorph' flatworms have been bounced from place to place (from being the evolutionary base of the animal kingdom to being a branch of the deuterostomes) as molecular classifiers test the strengths and weaknesses of their inferences (Phillipe *et al.*, 2011). Acoelomorphs now appear to have no connection with the more familiar triclad and polyclad flatworms, requiring the creation of at least one more phylum to accommodate them.

The extraordinary pogonophorans worms, morphologically distinctive enough to warrant phylum status, have, in recent classifications, been subsumed as a mere family within the Polychaeta, following vigorous advocacy driven by a cladistic imperative. Like subsuming birds within the dinosaurs, this extreme action regards putative affinity as more important than distinctiveness, the basis of a Linnaean classification.

Given that contention and dispute have always characterised classification schemes, we should note that Mora *et al.* (2011) turned for their data to the website Catalogue of Life (www.sp2000.org) of which WoRMS is effectively a subset. In the WoRMS listing, species are organised according to a hierarchy of levels for the convenience of locating them. There are no 'superclades'. It appears to use a mix of cladistic and Linnaean-style taxa selectively, retaining the class Aves but rejecting the phylum Pogonophora, for example. The analysis of Mora *et al.* (2011) showed that the internal structure of different animal phyla is reasonably consistent: most classes have less than 20 orders; most orders have less than 20 families; most families have less than 20 genera and most genera have less than 20 known species. In setting up their cataloguing system, the compilers of the Register have inadvertently become the arbitrators of disputed taxonomies; but to start with the premise that there are 32 animal phyla is more than many of us would venture. There are 30 or so, I would say, leaving options open.

The conclusion that we have nearly two million marine animals to find and describe is based on the correlation between taxonomic ranks and the number of taxa they contain. There is a pattern in the assignment of species to the ranks of phyla, class, order, family and genus from which the total number of species can be extrapolated. If the observed correlation is Nature's decree, the taxonomic pattern will determine the number of species, as Mora *et al.* (2011) state. That is a big assumption. A correlation is never a cause and I prefer the simpler theory that it works the other way around. The number of species described determines the complexity of the taxa that accommodate them: the pattern has been determined, not by Nature but by taxonomists. An example will demonstrate this.

When Linnaeus collected all the living things he knew into the 10th edition of *Systema Naturae* (1758), he gave names to seven marine worms. One of them he called *Lumbricus marina*, as counterpart to the earthworm *Lumbricus terrestris*. As more species were described, more genera were needed and *L. marina* was removed to its present genus, as *Arenicola marina* (the familiar lugworm or blow-lug). Today, *Lumbricus* and *Arenicola* are recognised as members of entirely different classes (Oligochaeta and Polychaeta) within the phylum Annelida – one genus then, two classes now! Recent changes in the classification of polychaetes are part of a continuing attempt to distribute species across a range of taxa and bring them closer in line with other phyla. Thus some traditional families have become orders, subfamilies become families and subgenera become genera as more species have accumulated.

If this view of the data of Mora *et al*. (2011) is correct, then, sadly, the correlation they describe (in awe-inspiring detail) is an artefact that can tell us nothing about the number of species yet to be discovered.

How many species in the seas around the British Isles?

The second part of this article may be more relevant to *Porcupine Newsletter* readers. How many animal species can we expect to find in our part of the Atlantic Ocean?

the result was shocking – some people are still reeling.

Last year, the result of an entirely different approach was published online (Mora *et al.*, PLoS Biology, 23 August 2011) as an extension to the recently completed 'Census of Marine Life', and it comes to a precise conclusion. The number of taxa correlates powerfully with the taxonomic level. According to the analysis, the Animal Kingdom contains, in its nested sequence of taxa, 32 phyla, 90 classes, 493 orders, 5404 families, 94240 genera and 953,434 described species. These numbers, plotted on a log base 10 exponential / hyperexponential axis, fall neatly in line, except that the number of species is well below the trajectory of the line – instead of 953,434, the projected number of species is 7,770,000 (Strain, 2011). How then do we stand with naming all the animal species? Roughly speaking, it amounts to nearly one million down and another 6.7 million to go for all species, on land and sea. For marine species only, the figures are 171,082 known, out of an estimated total of 2,150,000. It looks as if we have hardly begun.

The notion behind the method reminds me of the pre-evolutionary concept that taxa progress in an orderly way (presumably according to God's will) with a fixed number of species in each genus, a fixed number of genera in each family and so on. It did not take hold, for good reason. If you think of each phylum as a bush with branching points representing the intermediate taxa and species as the terminal twigs, it is clear that some phyla are very bushy and others hardly branch at all.

The application of taxonomic ranks is also difficult to justify. They are based on past history as much as rationale. Some groups are traditionally treated more generously than others. Even among fishes, sharks and rays appear to be more readily assigned to orders than are bony fish. Allocating numbers in a hierarchy of taxa, therefore, risks being more than a little arbitrary. A few more examples will illustrate this.

Most of us (being terrestrial in the early stages at least) probably began to appreciate biodiversity through observing insects. The distinctly different and instantly recognisable kinds (beetles, butterflies, dragonflies and so forth) more or less fit into different orders. Named largely from their wings (the suffix –ptera) but defined more by their mouthparts, insects conform to one standard body plan (head, thorax with three pairs of legs, abdomen). Morphological differences between families are rather trivial. Within the scaly-winged Lepidoptera, for example, members of the 'white' butterfly family are so similar to the 'brown' family that the butterfly commonly known as the 'marbled white' is actually a 'brown'. Birds rather parallel insects in their classification, as many recognisably distinctive kinds are given the rank of order; although they differ mostly in size and beak shape. Palaeontologists have made a case to subsume the birds within the dinosaurs, thereby reducing the status of birds from one of the major vertebrate classes. That would surely make a difference to the correlation between a taxonomic level and number of its members.

In contrast to insects, the distinctively different kinds of polychaete worms were, for most of their history, traditionally recognised as families. No orders were recognised until relatively recently. Even then, it is arguable that the orders Terebellida and Sabellida for example are more different from each other than are any two insect or bird orders. The rank of order is used sparingly for the prosobranch gastropods: the distinctive groups of prosobranchs seem to me (it is entirely a subjective view) to be superfamilies – a rank that is redundant in the classification of many other animal groups.

Even phyla, traditionally the top taxa, are not without contention. Some, such as Echinodermata, Mollusca and Chordata are distinguished by unique body plans but many 'wormy' animals (around half the animal phyla are worms of one kind or another, depending on the definition of a worm and a phylum) have never been so easy to place. Molecular classifiers have contributed by creating 'superclades', the most striking of which have been the Ecdysozoa, linking some worms with arthropods, and Trochozoa (later expanded to Lophotrochozoa), linking others with molluscs.

distribution of pots along the coast shows that local biodiversity has been common knowledge for a very long time. The stretch of coast between Blakeney and Trimingham has been protected from trawling by local by law since 1962. Divers in this area are less numerous than in most other regions. Their traditional focus was the many wrecks of the North Sea. The acknowledged, dived extent of the chalk was from a gradual start near Weybourne, running east past Sheringham to West Runton.

Clearly, individual fishermen, divers and anglers knew about particular areas but very little had been formally recorded. The character of the underwater chalk and its different features were understood in general terms, not as a reef complex or an ecosystem.

Comparative Importance

Marine chalk is a scarce environmental resource occupying only around 1% of the UK coast line, which represent 75% of the marine chalk found in Europe. The east coast of England has several significant chalk reefs. The most notable, aside from those in Norfolk, are Flamborough Head and the Thanet coast. Both differ from North Norfolk coast in that their sub-tidal chalk is backed by dramatic cliffs – making them much easier to find! According to current surveys Flamborough has the largest area of chalk reef in Europe and the 16 km stretch is third longest behind the Thanet Coast at 23 km which due to the findings of our 2010 survey is now succeeded by the 30 km length of the North Norfolk coast reef as the longest in the UK. This ranking has been confirmed by the JNCC. Whatever the world ranking, the potential for the reef to be significant on a global scale has given rise to a significant increase in public awareness. It is hoped that the North Norfolk chalk will be recognised as part of the current Marine Conservation Zone (MCZ) process.

The 2010 Survey Project

The survey was conducted under the auspices of the Seasearch project which has established a methodology for amateur divers to record flora, fauna and habitats. Professional dive surveying is immensely expensive but by training and encouraging recreational divers to record their observations data can be gathered much more cost effectively, with the significant added benefits of public awareness and local involvement.

This survey is the result of 111 (77 from 2010) diver records, made during boat and shore dives between Cley and Trimingham. We found chalk on every trip and where the chalk appears to run out to the east and west, it gives way to ridges of exposed clay, another BAP habitat.

Diving in North Norfolk

A combination of onshore winter winds and a spring bloom of plankton mean that for much of the period between October and May visibility is practically zero. As summer approaches the winds drop in strength and usually settle to a prevailing South Westerly. This allows the sea water to clear and it is possible to enjoy some excellent diving. Diving often starts in May offshore. By July the inshore visibility has often risen toward 10 m - which is very pleasant.

The shallow inshore waters of Norfolk are some of the warmest in the UK during the summer. They rise from close to freezing in winter to over 20°C in late July. In late summer Norfolk's inshore waters can be 5°C warmer than the Gulf Stream warmed SW coast of Britain.

Wind strength and direction determine sea state and visibility during the summer. Force 4 is the accepted limit for diving, but even weaker onshore winds will quickly build up waves and destroy the visibility close to shore. Weak South Westerly winds are ideal as they flatten the sea, driving the waves away from the shore.

Surveying

This first year of concerted surveys made a narrow, longitudinal scan of the seabed parallel with the coast. It is fair to describe this as a linear survey, recording the length terrain of the reef.

Method

Diving is time consuming and expensive so we tried to identify likely exposures from anecdotal evidence, aerial photographs, surface observation and previous experience before taking to the water. Once on the water we use sonar to identify potential chalk and eliminate obviously mobile seabed.

Seasearch

Our diving is conducted as part of the Seasearch diving survey project. The records are submitted to the National Biodiversity Network (NBN) and are made publicly available via the NBN Gateway.

Seasearch has been active in Norfolk since 2002, although data are limited in depth before 2005. Since then the volume of data has been steadily increasing and we have made efforts to broaden the coverage of the surveys year on year.

There are two levels of Seasearch recording. Both described as 'forms' which are single returns from a recording pair – analogous to a sample in NBN terms.

- **Observer** – two simple sides of A4 where the habitat and species are summarised.
- **Surveyor** – much more detailed assessment of multiple habitats and seabed composition with species assigned to the identified habitats.

During 2010, we received 77 forms contributing to the survey of the chalk, this survey also includes a further 34 forms from dives in previous years.

Drift diving

Many of our diving surveys are conducted during slack tide, but to cover significant areas on each dive, drift diving was often employed. Divers used the current to carry them over the seabed, marked by a buoy so that a boat can follow.

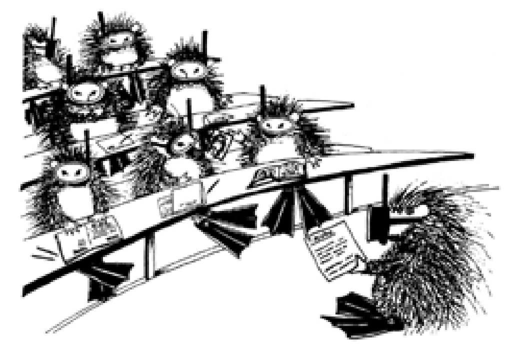
North Norfolk experiences strong and generally predictable tidal cycles. The survey used the tides as much as possible to cover more ground with speeds of 2.5-3 km/h recorded on some dives. This has allowed us to cover approximately 23 km (14 miles) of seabed so far and quickly dispelled the belief that there was only 8 km (5 miles) of significant chalk reef. In a single, short season we have established the length of chalk is at least four times what we anticipated, around 30 km (20 miles).

Photography

Digital photography has become an important part of underwater recording. Images of the marine environment allow volunteers to confirm key ID details, confer over species identification and share finds. Dive duration is limited so having a good visual record allows much more time to be spent assessing surveys and remote experts to be involved when more experience is required.

Year	Samples	Records	Species	Notes
2002	3	39	25	Survey limited to North Norfolk during 2002-2006
2003	10	141	53	
2004	6	87	45	
2005	15	274	90	
2006	3	63	39	
2007	36	825	140	Survey broadened from 2007
2008	42	903	127	
2009	66	1432	152	
2010	102*	3000*	160*	Provisional estimate

Data for 2002-2009 from NBN Gateway



How many species live in the sea? – an armchair exercise.

Chris Mettam

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How many species in the world's seas?

We have the great good fortune to share our planet with a wonderful diversity of other living organisms and the misfortune, it seems, to live on the edge of the 'sixth great extinction' in the history of life on earth. And this time it is our fault. The burgeoning human population is putting the squeeze on many species, reducing their populations to borderline viability. It is still an exciting place to be (none better), but apparently not what it was, even a generation ago. On land and in the sea, many species are said to be poised on the brink of extinction.

Meanwhile new species are constantly being discovered. In 2011, 1003 new marine taxa were added to the compilation of WoRMS – the World Register of Marine Species (www.marinespecies.org). While it is exhilarating to find all these new species (one of them seems to have been more of a disappointment*), they do not compensate for the greatly reduced populations (and impending extinction) of the ones that we already know; particularly those, such as sharks and reef fish, which help determine the habitats of many other species. I am not sure why anyone would want to itemise all the living species on Earth, except that it might be achievable, given the capacity to hold such an inventory. It is clear from the growing multitudes of species known only from genomic data that we know little of the marine picoplankton. But what about animals (Animalia / Metazoa) – surely, they are an easier remit?

With new marine species being discovered at a steady rate, it is natural to wonder if we are nearly there yet or if we are still just scratching the surface, having done the easy ones first. It is popular to remark how little of the sea has been explored – after all, nets and grabs take, at best, only tiny samples from vast areas – but better to ask how much of the marine environment has been 'sampled', and then it does not look so impossibly inadequate. Some inaccessible habitats, such as deep reefs, may be relatively untouched but the water column and many benthic habitats have been sampled for many decades.

It is the nature of samples that we use them to extrapolate and generalise. A few intensively worked samples of coral reef, for example, might suggest how many species are present on the whole reef habitat. Ideally, to extend this method, every habitat patch would be treated individually, which would be slow but fun to do. Recognised trends, such as biodiversity gradients with depth, latitude (polar to equatorial) and geological history (e.g. 'hotspots' in Indo-Pacific reefs), help with some issues of scale. Ecological changes in biodiversity can be driven by community-level responses to consumers ('top-down' control), through 'trophic cascades' (usually adversely, following the removal of predators – think of 'urchin-barrens' produced by overgrazing in the absence of urchin predators) as well as producers ('bottom-up' control). Hence the negative impact of people on biodiversity: the scientific advice, 'fish less to catch more', has always been a counterintuitive remedy for overfished stocks, and fisherfolk quite naturally see removal of predators as the removal of competitors rather than an action leading, in the longer term, to loss of 'ecosystem services' in a degraded environment.

The ecological approach to estimating species richness is bound to be slow and results have been controversial. You would expect high diversity of many animal groups on a coral reef but not, perhaps, in deep-sea sediments. When Grassle and Maciolek (1992) projected a deep-sea fauna of 10 million unknown species,

Coutts, A. D. M. and B. M. Forrest. 2006. Development and application of tools for incursion response: Lessons learned from the management of the fouling pest Didemnum vexillum. Journal of Experimental Marine Biology and Ecology 342: 154–162

Gittenberger, A. 2007. Recent population expansions of non-native ascidians in The Netherlands. Journal of Experimental Marine Biology and Ecology, 342, 122-126.

Griffith, K., S. Mowat, R. H. F. Holt, K. Ramsay, J. D. D. Bishop, G. Lambert and S. R. Jenkins. 2009. First records in Great Britain of the invasive colonial ascidian Didemnum vexillum Kott, 2002. Aquatic Invasions, 4, 581–590.

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Kott, P. 2002. A complex didemnid ascidian from Whangamata, New Zealand. Journal of Marine Biological Association of the U.K. 82 (4), 625–628.

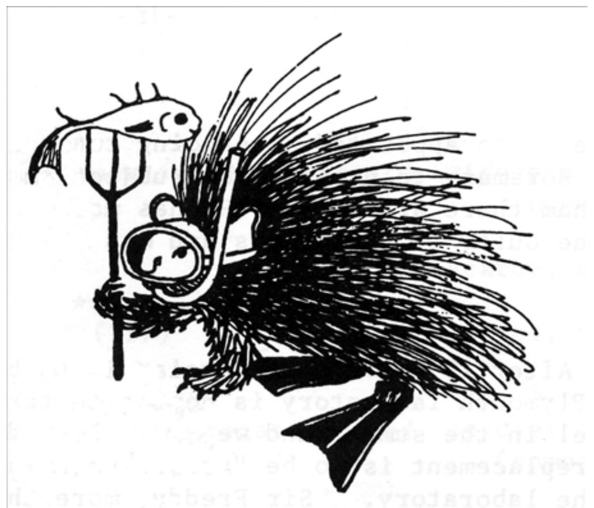
Laing, I. J. Bussell and K. Somerwill. 2010. Defra project report: Assessment of the impacts of Didemnum vexillum and options for the management of the species in England

Morris, J. A., M. R. Carman, K. E. Hoagland, E. R.M. Green-Beach and R. C. Karney. 2009. Impact of the invasive colonial tunicate Didemnum vexillum on the recruitment of the bay scallop (Argopecten irradians irradians) and implications for recruitment of the sea scallop (Placopecten magellanicus) on Georges Bank. Aquatic Invasions 4, Issue 1: 207-211

Valentine, P. C., M. R. Carman, D. Blackwood and E. Heffron. 2007. Ecological observations on the colonial ascidian Didemnum sp. in a New England tide pool habitat. Journal of Experimental Marine Biology and Ecology Volume: 342, Issue: 1, Pages: 109-121

Wallentinus, I. and C. D. Nyberg. 2007. Introduced marine organisms as habitat modifiers. Marine Pollution Bulletin 55: 323-332.

Answer to puzzle picture on p42: Despite appearances these are not marine animals but ichnospecies, i.e. fossil animal tracks (Gk: ichnos, a track or trace). They are from Northumberland, are thought to have been made in what was then soft sediment by crustaceans and are from the Lower Carboniferous, some 350 mya. Ichnospecies are hugely important in sedimentological studies as the types, distribution and intensity of burrow-forms can be extremely useful in determining depositional environments. Ichnotaxa follow Linnaean rules. (I own to never having heard of ichnotaxa until my sedimentologist son-in-law recently enlightened me.) Frank Evans



Survey Coverage

The main advance made by this survey has been to join up the pockets of local knowledge and make it clear just what variation and potential habitats the chalk offers. Our year of surveys started neatly in the west and proceeded generally eastwards. The start of the sequence at Cley was intended merely as a test launch but proved immediately productive and set the trend for the rest of the year.

July was the most productive month for the survey, with 57 records returned. A week's dives enabled us to characterise the most dramatic parts of the reef between Sheringham and West Runton. It was here that we recorded Leopard Spotted Gobies - *Thorogobius ephippiatus* - and a Tompot Blenny - *Parablennius gattorugine* – small fish which favour rugged, overhanging reefs and, respectively, unrecorded and very rare in the East.

It would have been reasonable to expect August to continue in the same vein but unsettled weather and onshore winds limited us to only 6 records in the first half of the month.

Our diving ended in September, we were thankful that the last dives were very productive and established good evidence of the eastern linear extent of the inshore chalk exposure. The recording of a clay layer reappearing over the chalk at Trimingham very neatly bookended the start of the season at Cley.

Cley

As we scanned the seabed here we noticed a selection of interesting features which led us to locate what appears to be the start of the chalk. The inshore initially reflects the shoreline and shingle extends for up to 50 m from the shore before giving way to sand. There are numerous sections of wreckage here, primarily iron from the *SS Vera* but also quantities of rock ballast and remains of concrete wartime emplacements. The main body of wreckage provides a tide shadow which modifies the tidal sorting of sediment and creates an elongated plain of mixed sand and gravel to the east and west of the hull outline. The seabed from Blakeney Point to Cley anecdotally contains hard ground fished for crabs and lobster and may well include further chalk as well as what may be a significant expanse of clay.

The sand plain extends out to around 300 m from shore where we were surprised to find a distinct ridge. This crosses a transition from clay to chalk (west to east) approximately aligned with the wreck of the *Vera*. The clay ridges (shown left) to the west are up to 1.5 m high while the chalk to the east is a low, rough plain with scattered flints. This fringe of the chalk reef is comparatively lightly populated. Mobile sediment makes it a hostile habitat, but some surprise species have been recorded here, such as juvenile Striped Sea Snail (*Liparis liparis*).

Fig. 2. Cley – Hard clay forms ridges high enough to host soft sessile life at both ends of the chalk

Weybourne

We didn't dive from Weybourne but it was the site of some of our first speculative dives based on aerial photography in 2008. Those dives found considerable (2 m high) outcrops and mounds of chalk rather than the regular gully features off Sheringham.

Weybourne is best known amongst divers as the site of the wreck of the *SS Rosalie* which forms an extensive artificial reef which is an important and regularly monitored biodiversity hotspot. The stability of the wreck on top of the underlying chalk may have allowed sediment to collect further around it.

This beach was the traditional, anecdotal start of the chalk for many divers. The stretch of reef east from here to Sheringham is one of the most dramatic sections of the chalk.

Sheringham

The groyne stabilised beach at Sheringham belies the chalk that is at its most dramatic just 400 m off shore. The chalk is easily accessible at the water's edge at low tide.

Sheringham's chalk has three predominant characters. There is a continuum between the low inshore reef which becomes more rugged and uneven with distance from the shore and the gullies which start running perpendicular to the shore after 200-300 m. The gullies deepen over the course of a further 200 m to a step where an upper stratum of chalk gives way to another approximately 2 m lower.

The upper chalk has a verdant growth of red and green seaweeds, this is significantly reduced on the lower strata. The fauna also appear denser on the upper chalk. The lower chalk hosts a low, robust, encrusting animal turf. As the reef proceeds east from the centre of Sheringham, the height of the rugged upper strata declines from 2 m to around 1 m off Beeston. Potters tend to avoid the most rugged areas to minimise loss of gear, especially in rough weather when fishermen will tend to set strings further out - on the smoother, lower plain.

Fig. 3 Sheringham – There are numerous tunnels and arches, this is large enough to swim through

Beeston Regis

The high point of Beeston Bump marks the Western extent of an area which runs until West Runton where the gullies are quite regular and around 1 m deep. Areas of relatively level chalk begin to appear, littered with large sponge encrusted boulders. These encrusted plains extend past Cromer.

Fig. 4 Beeston – Seasearch volunteers prepare to dive off Beeston Bump

West Runton

The exposed chalk at the shore is representative of the relief of the encrusted plain to the west and its polished sand margins to the east. Also typical are the many large annular flints. These are known as paramoudra or pot stones - silica deposits of ancient organic material they are thought to be the result of lithification of ancient sponge material around burrows in the chalk.

The intermediate gullies appear to end here and encrusted plains become the prevailing underwater terrain. This bedrock plain is largely free of light abrasive sediment allowing all but the lowest surfaces to host encrusting fauna.

East Runton to Cromer

The chalk starts in low ridges, emerging from the sand gradually less than 200 m from the shore, increasing with distance. The inshore chalk is 0.3-0.5 m high and although scoured clean at the margins supports extremely vigorous algal growth as the water is so shallow (2-3 m). Further out, the rough, plain topography which started at West Runton continues.

D. vexillum has been found attached to *Sargassum in situ*, but is also commonly found on *Sargassum* that has rafted along the coast attached to either pebbles or *Crepidula fornicata*. *D. vexillum* on *Plocamium* is only found as drift, suggesting the presence of a subtidal reservoir in areas abundant with *Plocamium*.

It is not clear from the literature how common growth on algae is, though Coutts and Forest (2006) mention control measures involving removal of *D. vexillum* from seaweed by hand in New Zealand, or the prevalence / importance of rafting as a means of *D. vexillum* spread.

Correlation with other ascidians

The presence of *D. vexillum* in Kent seems intimately connected with the presence of other ascidians, notably *Styela clava* and *Botryllus leachi*. Where one type is found, it is very likely that all are to be found, and *vice versa*, if few other ascidians are present, *D. vexillum* is unlikely to be found.

Colony health

A last observation on the *D. vexillum* outbreak is that the colonies so far are appearing to follow a normal annual pattern. On the last survey of 2011, colonies appeared to be degenerating – they contained the small brown spots representative of accumulation of faecal pellets in the colony, and also commonly appeared to be peeling away from the substrate.

Conclusions

Didemnum vexillum has spread to numerous subtidal and intertidal habitats over the last 10 – 20 years, and it has not been found along the north coast of Kent. Wallentinus and Nyberg (2007) consider it an ecosystem engineer as it is capable of drastically modifying the habitats it invades through smothering native life, taking up significant areas of sea floor or intertidal area, and also dissuading settlement. This is coupled with a phenomenal growth rate that can see it cover almost every other sessile, and even mobile, species, and a wide range of temperature tolerances (Coutts and Forrest 2007; Gittenberger 2007; Valentine *et al*. 2007).

This drastic modification could certainly be the end result in north Kent. *D. vexillum* exploded onto the scene into 2011, increasing the number and size of its colonies on every survey. Research now needs to be done on its tolerances for growth and reproduction, as well as continuing to monitor the north Kent coast to see how colonies fare in the next few years. Such monitoring is particularly pertinent now, as recommended Marine Conservation Zones are also at risk from the spread of *D. vexillum* in Kent.

Acknowledgements

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Point, RI; Lake Tashmoo, Mass), but literature records that such occurrences are rare. The main known area of intertidal infestation that has been studied is the Sandwich Tide Pool (Valentine *et al*. 2007), but this contains *D. vexillum* in a significantly different habitat to that of the north Kent coast. Unlike the sediment laden water of north Kent, where there are currents and waves, *D. vexillum* in Sandwich occurs in clear water on boulders and cobbles that are generally immersed.

Levels of emersion

Kent's *D. vexillum* also seems anomalous for the amount of emersion it can tolerate. In several cases, colonies are exposed to air for up to several hours on each tidal cycle.

It is clear that other *D. vexillum* infestations cannot tolerate such conditions. In the Sandwich Tide Pool, Valentine *et al.* (2007) undertook a basic series of emersion experiments in 2004 – 2005. They observed that parts of colonies artificially exposed to air for 2-3 hours per tidal cycle were desiccated and predated upon by periwinkles within 30 days. Likewise, they noted that a set of naturally exposed colonies reacted in the same manner, and concluded "colonies died that were exposed to air at low tide".

Even when mention has been made of colonies surviving air exposure, the situation is clearly different from that in Kent – on Jedidiah Island, British Columbia, Bullard *et al*. (2007) stated that "the upper edges of colonies have been observed out of water at low tide".

It is clear that Kent *D. vexillum* can survive emersion to a greater degree. Colonies on the mid shore at Reculver survive and flourish while being out of the water for up to three hours per tidal cycle, though this could be influenced to a considerable degree by the porous nature of the sandstone boulders on which they flourish. Further experiments should be performed to see the extent to which the *D. vexillum* can survive out of the water under laboratory conditions, away from the porous sandstone.

Muddy substrates

D. vexillum worldwide tends to flourish on hard substrates, whether natural or artificial. Valentine *et al.* (2007) had no observations of the species inhabiting solely soft habitats, and Coutts (2002) noted that if colonies of *D. vexillum* fell from a moored barge they survived if they fell onto hard substrates, but eventually died if they landed on sandy or muddy bottoms. Laing *et al*. (2010) also suggested that only sandy and muddy surfaces and substrates are not colonised by *D. vexillum*, and also that it is intolerant to smothering by sand.

Common opinion is again challenged by the Kent outbreak.

While this has not yet been quantitatively studied in Kent, it is clear from surveys that Kent's *D. vexillum* can colonise muddy substrates and substrates with a high percentage of mud. It also seems to thrive in water with a high sediment loading without becoming smothered or being unable to feed.

Surface structure

Fig 2f – Two different morphologies

It is widely acknowledged that *D. vexillum* colonies show a range of surface structure, with some colonies showing prominent dark-coloured water channels and others showing none of those channels. Any one colony can also show a range of surface structure, with some areas showing water channels and other areas not.

The outbreak of *D. vexillum* in Kent shows a range of surface structure, but more often than not, shows no outward sign of water channels as an identifying feature (Fig 2f). Most colonies are pale straw-yellow, but in Seasalter, colonies can be much yellower, and even yellow-orange. As shown in Fig 2c, colonies from Reculver hatchery are bright orange.

Algae

In most places along the area of outbreak, *D. vexillum* is also found growing on algae, particularly *Sargassum* and *Plocamium*.

The terrain is comparatively uniform as it passes Cromer. The chalk bedrock remains quite constant with the superficial coverage of heavy sediments, cobbles and boulders varying in density but retaining a robust, encrusting sponge and hydroid fauna.

Figure 5 East Runton – The gullies rise from the sand and gravel with depth at this algae rich site

Trimingham

The beach sand continues out from the shore, where irregular chalk exposures occur more frequently with distance from the shore. These exposures are cleaned by the extremely mobile sand which is fine enough to form a suspension under even modest tidal flows. Only the most robust epifauna are evident but these become quite dense on the highest rock (~1 m high). There are gullies here but they are very narrow, <0.5 m wide. The chalk becomes more significant to the north west with reducing sand and greater biodiversity. This region appears, inshore at least, to be the south eastern extent of the chalk and there are considerable hard clay plains. Beyond Trimingham we expect the clay to continue for a considerable distance, we believe it underlies the mussel bed we have recorded off Sea Palling.

Conclusion

The chalk reef is a much larger, richer, more dramatic ecosystem and geological feature than the survey team expected to find. Seeing the heart of the reef on the best dive day of 2010 was almost literally mind blowing. It made everyone, and the survey was very much a team effort, realise we were surveying something really, very special. It wasn't until the press asked where it figured on a UK scale that we found it might be the biggest in Europe, or even the world. It was a startling realisation that a group of local divers could define a feature that figures as significant on a world scale, just off a tourist beach!

The initial linear survey has marked a 30 km stretch of chalk but not provided an accurate outer bound. Our surveys have covered approximately 75% of the seabed between Cley and Trimingham. Although we have found distinct chalk/clay transitions it is not unreasonable to predict that both habitats may be irregular and more boundaries may occur.

The surveys conducted so far pose as many questions as they answer. Far from comprehensive, they just scratch the surface of an unexpectedly large ecosystem. In future we will fill the gaps as well as extending the surveying to the east beyond Trimingham and west beyond Cley.

The reef is a biodiversity hotspot, supporting a range of flora and fauna species which are not just the same species as on the surrounding wrecks. The different sections of the reef offer a very varied selection of niches for marine species – which often favour very particular habitat. The reef specific animals, such as the Leopard Spotted Goby, *Thorogobius ephippiatus*, are not known from this area at all.

Other public domain recording around East Anglia is limited and this has led to the unwarranted misrepresentation in reference material as an area of endemic low biodiversity. This is inconsistent with our observations and patently at odds with the long history of fisheries in the southern North Sea. Commercial fish do not exist in a vacuum and require a complex ecosystem to flourish.

Fig. 6 Facelina auriculata *– blue iridescence is the key ID feature*

MCZ prospects

As participants in the Net Gain MCZ (Marine Conservation Zone) project, we support this area for MCZ status. We worked, with help from volunteers and the Wildlife Trusts to get the data from this survey accepted with similar standing and prominence as existing data sets. The MCZ designation would imply consideration of the habitat within it but does not introduce any measures by default. The reef appears to be in generally good condition and recognition will add to the public appeal and awareness of the North Norfolk Coast.

We are pressing for the reef to be recognised as an excellent example of its habitat type and this also offers the opportunity for a highly protected reference zone to be established. This would allow the condition of the chalk as a whole to be assessed in comparison with a control area.

The community associated with the only surviving patch of intertidal sand on the River Arun at Littlehampton, West Sussex

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Like most (all?) rivers in England and Wales, the Arun in West Sussex has been extensively canalized, such that today little of the original deltaic marshland habitat has survived (Morton, 2007). Where the river exits to the sea at Littlehampton, there is similarly little left of the sandy beaches that would once have characterized that estuarine zone. The eastern bank of the river has been reclaimed to allow growth of the town of Littlehampton. The western bank, however, through a lack of total development, has retained a little of the original habitat of clean, aerobic, estuarine sand. This is represented by a small (~100 m^2) patch of sand (Fig. 1, large arrow). The community of animals and the backshore plant, *Halimione portulacoides,* that characterize this small patch of sand have never been described, and we rectify this situation herein.

Fig. 1 West bank of the river Arun

The community associated with the sandy beach on the west bank of the River Arun at Littlehampton is illustrated in Figure 2. The back of the beach comprises a largely monospecific stand of *Halimione portulacoides*

Fig.2c Reculver hatchery (Ian Humpheryes)

Whitstable / Seasalter

The five kilometres long shore from Seasalter to Whitstable consists of wide mud flats with low-lying, outcropping, London clay. For most of the mud flats, there are few places for attachment, but at the lowest shore, a clay substrate forms areas of boulders and mounds where sponges, red algae and small sessile life flourishes.

The shore is part of the Swale SSSI site, the Swale SPA and forms part of a recommended Marine Conservation Zone.

Low shore – *D. vexillum* has been found both on small boulders of London Clay and in shallow pools with muddy substrates.

Fig. 2d Seasalter oyster trestles

Seasalter oyster trestles (Fig 2d) – *D. vexillum* is abundant on the seaward set of a series of oyster trestles. These are often exposed for several hours at low tides. *D. vexillum* is found smothering both the wood and metal framework of the trestles, as well as oyster bags, mussels and oysters.

Secondary areas of outbreak

Fig. 2e Swalecliffe and west Whitstable

Swalecliffe and west Whitstable (Fig 2e) **–** *D. vexillum* has been found mainly on an outfall pipe and its associated wooden framework. The pipe houses a rich fauna and flora, being covered almost entirely with sponges and hydroids, barnacles, green and red algae. It is also found at Swalecliffe attached in tidal pools on muddy substrates. Swalecliffe is in the Thanet Coast SPA.

The only outlying outbreak at present is that in Walpole Bay tidal pool. This swimming pool is drained twice a year for maintenance and in the September 2011 draining, a small patch of *D. vexillum* was seen on one of the walls, as well as being found on attached *Halidrys* within the pool. This record is of particular importance as the Walpole Bay pool lies within the Thanet Coast SAC as well as the Thanet Coast SPA and a recommended Marine Conservation Zone.

Discussion

The outbreak of *D. vexillum* in Kent is anomalous in a variety of ways.

Presence on the natural shore

Previous outbreaks of *D. vexillum* in the UK have all occurred on artificial substrates only, even though there have been apparently suitable natural substrates close by. This, however, appears to not be the case in Kent, with the majority of the outbreak occurring on the shore.

D. vexillum does grow on the shore in many places beyond the UK, in the Netherlands (Terschelling), Canada (British Columbia) and the US (Sandwich Tide Pool, MA; Beavertail

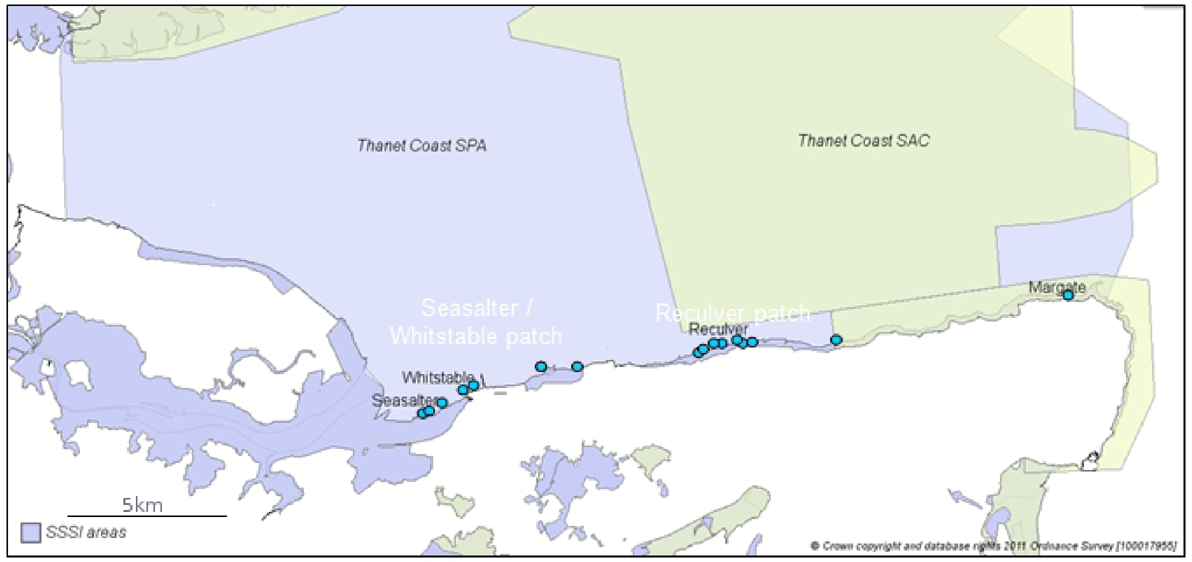

Fig. 1 Geographical location of D. vexillum *outbreak*

0.5 – 2m across and support a community of ascidians, hydroids, bryozoans and green algae. The boulders occur mainly in the mid shore to the upper low shore. The lower area of the shore is characterised by greater areas of sand and mud with low-lying sediment mounds providing attachment areas for sponges, ascidians, hydroids, green and red algae.

The shore is part of the Reculver SSSI site, the Thanet Coast SPA and forms part of a recommended Marine Conservation Zone.

At Reculver / Bishopstone, *D. vexillum* is found in two distinct bands, one on the mid shore tabulate boulders, and one on the lower shore sediment mounds.

Fig 2a Reculver sandstone boulders

Mid shore (Fig 2a) – the sandstone boulder colonies are unusual for *D. vexillum* as they are exposed for a considerable amount of the tidal cycle (up to 3 hours per cycle during springs). It is possible however, that they gain some of the moisture they need through percolation of water through the porous boulders. At Bishopstone, many of the colonised boulders lie at significant angles to the substrate, and so the patches of *D. vexillum* are at least 20-30cm above the substrate. On many of the boulders, the *D. vexillum* shows a lobed / fringed structure, some lobes reaching all the way to the substrate.

Fig. 2b Bishopstone Glen sediment mounds

Low shore (Fig 2b) – *D. vexillum* occurs on the sides on low-lying sediment mounds, growing next to and overgrowing sponges, hydroids and other attached life.

Reculver hatchery (Fig 2c) – a bright orange form of *D. vexillum* has been found in massive quantities at Seasalter Shellfish (Whitstable)'s oyster hatchery at Reculver, covering artificial substrates as well as sessile organisms.

(Fig. 2, A). The ground, beneath the low canopy that this plant creates is wet with a surface cover of decaying leaves and filamentous algae (*Cladophora* sp.). This area of the beach is flooded only on the highest spring tides but the overlying plants ensure it is constantly moist. Such a habitat is suitable for the ellobiid snail *Leucophytia bidentata* (Fig. 2, B) and the prosobranch *Hydrobia ulvae* (Fig. 2, C). Here too lives the shell-less pleurobranch *Limapontia depressa* (Fig. 2, D); this animal is up to 6 mm long, is dark with white spots so that it is difficult to see amongst the decaying leaf litter, or when feeding on the filamentous algae. This moist area is also the home of the sand-hopper, *Orchestia mediterranea* (Fig. 2, E).

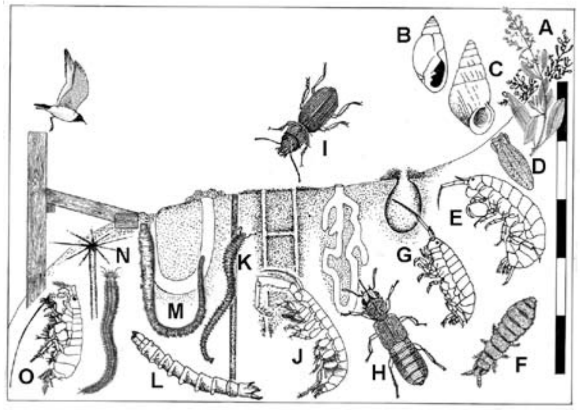

Fig. 2 Schematic of sediment infauna (A – O)

Where the sand beach abuts the surviving island on this bank of the river (Fig. 1, small arrow), there is an ancient embankment, now largely in disrepair, of formed chalk blocks (Fig. 3). This is a perfect habitat for the collembolan *Anurida maritima* (Fig. 2, F), up to only 3 mm long and a dark slate blue, although it superficially appears black. Here this insect is only active in summer, over-wintering as eggs in the rocks. It has a distinctive endogenous tidal cycle (Manica *et al*., 2000), emerging from the rocks as the tide recedes and wandering over the sand surface to feed on superficial decaying organic matter, including carrion if it is present (Joose, 1966). In this it is aided by the production of an aggregating pheromone, so that when a good source of food is found it can occur in large numbers (Manica *et al*., 2001). It returns to its rocky home as the tide returns using visual clues. Elsewhere on the sandy beach at this tidal level another sand-hopper, *Talitrus saltator* (Fig. 2, G), occurs, living in small temporary, drop-shaped, burrows.

Fig. 3 Ancient embankment

Lower down on the shore small burrow entrances surrounded by little piles of whitish sand occur. These mark the presence of the staphylinid beetle *Bledius spectabilis* (Fig. 2, H), which is a colonial, sub-social, species. Each individual beetle digs itself a burrow that has a distinctive structure in vertical section (Fig. 2, H, after Evans *et al*., 1971). At low tide, the beetles emerge to feed on fragments of plant tissues, including green algae but when the tide begins to return, each beetle re-finds its burrow and, once inside, seals up the entrance with a plug of sand taken by the insect's mandibles from the walls of the living-chamber of the burrow. This apparently only takes about four minutes (Wyatt, 1986). The sharp curvature to the entrance of the burrow, moreover, acts to create a surface tension effect, that is, the air trapped inside the burrow acts like a bubble to keep the water out. This is crucial for the animal's survival, because, like most insects, *Bledius* is an air breather and would drown if immersed by the incoming seawater. Back in its sealed burrow, however, each beetle has a pocket of air to last it over the next high tide period until the water falls again. When the tide recedes, the burrow is un-plugged and each beetle emerges to forage again over the surrounding sand surface. The burrow serves another purpose: following successful mating, each female, whose thorax turns a rose pink upon maturity, lays her eggs inside the burrow, each one within its own pocket in the burrow wall; there she cares for the eggs and for the juveniles that hatch out and reside with her inside the living chamber. Over time, each hatchling undergoes a series of molts to eventually become an adult. Such maternal care enables this air-breathing insect to colonize what would at first glance appear to be a wholly inappropriate habitat (Wyatt, 1986; Wyatt & Foster, 1988, 1989a). One would think that occupation of the burrow would protect not just adult *Bledius* but also their eggs and larvae from virtually everything. Not so, however, because Wyatt (1986) has shown that eggs and their contained larvae are preyed upon by another, carabid, beetle *Dichierotrichus gustavi*, while individuals can also be parasitized by the ichneumid wasp *Barycnemis blediator* (Aubert, 1970) (Wyatt & Foster, 1989b).

The solitary carabid beetle *Bembidion laterale* (Samouelle, 1819) (Fig. 2, I) also lives on this region of the beach, where it hunts over the sand surface and feeds on the burrowing amphipod *Corophium arenarium* (Fig. 2, J). This 6 mm long amphipod builds vertical inter-connecting burrows in the sand but emerges when the tide goes down to feed on surface deposits, leaving long meandering trails on the surface. The polychaete *Pygospio elegans* (Fig. 2, K), predominantly a surface-deposit-feeder, occupies long flexible sand-tubes slightly lower on the beach; where the tubes of this spionid occur densely, they can impart significant local stability to the substratum. The predatory larva of a dolichopodid fly (Fig. 2, L) also lies buried in the lower, more muddy, levels of the shore, feeding predominantly on amphipods. Two more polychaete worms, the lugworm *Arenicola marina* (Fig. 2, M) and the omnivorous ragworm *Hediste diversicolor* (Fig. 2, N), build burrows on the middle to lower regions of the shore, both actively recycling organic material from within the sand and, by virtue of their burrows, significantly aerating the sub-surface sediment. The amphipod *Bathyporeia pelagica* (Fig. 2, O) also lives in burrows lower on the shore, and, like *C. arenarium*, leaves conspicuous trails across the surface of the substratum during foraging.

The beach community is maintained by organic detritus, particularly decaying plant material from the upper shore but also material deposited from the river as riverine water mixes with the sea-water. There is a number of superficial and sub-surface detritivores recycling the plant debris right across the shore, themselves being preyed upon by the beetles, the dolichopodid larvae and ragworm; *Corophium arenarium* in particular forms a significant resource for these predators. In addition, shore wading birds exploit the larger macroinfauna during low tide, and fish such as flounder similarly during high tide.

The fauna in this beach forms a gradation from upper to lower shore, with species overlapping in their presence. Thus *Orchestia mediterranea* extends from the upper shore across the mid-shore, where it is allopatric with *Corophium arenarium* and *Bembidion lateralis*. Similarly, *C. arenarium* extends towards the lower shore with *Arenicola marina* and the dolichopodid larvae, overlapping the ranges of *Hediste diversicolor*, *Pygospio elegans* and *Bathyporeia pelagica*. The significant interaction between insects and more "traditional" macrofaunal species in a marine habitat has rarely been recorded.

Interpretation of biotopes is thus (typically) difficult. However, the high shore community does not accord with any biotope listed in Connor *et al*. (2004): while it is somewhat close to LS.LSa.St.Tal (Talitrids on the upper shore and strand-line), this clean sand habitat supports no oligochaetes at all, but does have significant occupation by insects. Equally, the mid- to lower-shore zones (notably lacking molluscs) do not accord with any of the littoral sand biotopes currently classified.

This restricted beach relic on the lower River Arun is thus of significant conservation importance on two counts. Firstly, it represents the only surviving relic of this natural habitat in the Arun Estuary. Secondly, while none of the species present is particularly rare or threatened on a national or regional scale, the community which it supports, and thus the biotopes, appear to be as yet unknown elsewhere in the UK.

New outbreak of *Didemnum vexillum* in North Kent: on stranger shores.

Becky Hitchin

Didemnum vexillum (Kott 2002) is a colonial ascidian (Class *Ascidiacea*, Order *Aplousobranchia*, Family *Didemnidae*) that has invaded marine habitats worldwide. It has spread far across the world in the last few decades, its range now including New Zealand, Japan, Europe, Canada and both coasts of North America, in most cases causing many significant issues for aquaculture and native shellfish beds, as well as outcompeting native wildlife on artificial and natural substrates. Its ability to colonise intertidal and subtidal habitats has now been noted in England, with Defra concluding from their 2010 investigation that it is likely to be rapidly introduced beyond its current range, and could have massive impacts on native habitats and species (Laing *et al*. 2010). These impacts could include smothering the organisms below its colonies, inhibiting settlement of other organisms and their larvae, and reducing spatial complexity of benthic habitats (Bullard *et al*. 2007).

Within the UK, *D. vexillum* is already known from Holyhead Marina, North Wales (Griffith *et al*. 2009; Holt *et al*. 2009), four marinas in Scotland centred around Largs (Beveridge *et al*. 2011), and from southern England, in the Dart Estuary (Devon), Gosport and Lymington (Hampshire) and Cowes (Isle of Wight) (Bishop *et al*. 2010 a, b). These outbreaks have been limited to artificial substrates – docks, walls, pontoons, pilings and ropes, and it was thought likely (Laing *et al*. 2010) that *D. vexillum* would remain contained within those specialised habitats, spreading predominantly through hull fouling on slow moving vessels and aquaculture transfers.

This thought was proved to be erroneous in 2011, when *D. vexillum* was first discovered on the shore in Kent. From its first discovery, the Kent outbreak has proved to challenge many of our currently held assumptions about the ecological and habitat preferences of *D. vexillum*.

The Kent outbreak

In July 2011, a shore survey organised by Kent Wildlife Trust and the Museum of Wales discovered a pale yellow colonial sea squirt covering lower shore London clay boulders on the Whitstable Flats, West Beach, north Kent (Fig 1). These were sent off for identification to Rohan Holt of the Countryside Council for Wales who confirmed that they were *D. vexillum* from characteristics of the larvae.

In August 2011, similar coverings were seen on mid shore sandstone boulders at Reculver, north Kent. These were again identified as *D. vexillum* on larval characteristics.

From that point, a set of shore surveys of the Kent coast was initiated by Kent Wildlife Trust and Natural England, with surveys being conducted on most suitable low tides from September to December 2011. These surveys will continue through 2012.

Results of initial shore surveys

The initial set of surveys reaching from the Isle of Sheppey to Ramsgate were exploratory only, recording the presence or absence of *D. vexillum*, the location of outbreaks, its abundance in those areas of outbreak, and the substrates, habitats and associated species that it was found with and upon. Samples were taken of the colonies and locations were photographed. Presence of drift samples was also recorded, as was evidence of rafting on algae.

D. vexillum was found on a stretch of shore running from Walpole Bay, Thanet to Seasalter (Fig 1). Within this stretch, two major outbreaks were noted, one at Reculver / Bishopstone and one at Seasalter / Whitstable. These two outbreaks are separated by a few kilometres of shingle and mud foreshore. A number of smaller outbreaks were also noted, and drift material has been found along the entire shore from Seasalter to Minnis Bay.

Reculver / Bishopstone

The kilometre long shore at Reculver / Bishopstone consists of areas of tabulate sandstone boulders separated by areas of sand and mud. The boulders are generally between footprint of a long-extinct crocodile during a 'Dinosaur Coast' walk led by Scarborough Museums Trust. This fossil will go on display at the local Rotunda Museum in due course.

The Bioblitz culminated in a public exhibition at Scarborough Spa, which attracted over 700 visitors. Highlights included displays of live specimens provided by Scarborough Sea Life Centre and the North Eastern Inshore Fisheries and Conservation Authority.

So we had great fun, but did we reach our target? At the end of the event, the species count stood at 585. However, in the following weeks and months, local experts worked diligently at identifying preserved specimens and yes, the species count did eventually top 1,000! This included an impressive 622 records of over 250 marine and coastal species, 34 of which were BAP priority or protected species.

Records were collated and entered on site throughout the Bioblitz by staff from North and East Yorkshire Ecological Data Centre, who used Twitter and Facebook to give live updates on the species count and interesting finds. The data will appear on the NBN Gateway during 2012.

Scarborough's intertidal area is a recommended Marine Conservation Zone (NG10 Castle Ground). It is hoped that records gathered during the Bioblitz will help to inform the designation and management of this site.

Figure 1: Pretty in pink - Aeolidia papillosa on coralline algae in a rockpool on Scarborough's South Bay

The Yorkshire Naturalists' Union would like to say a big THANK YOU to Porcupiners Lin Baldock, Paul Brazier, Frances Dipper, Anthony Hurd and Mike Kendall, who supported the event by delivering training, leading activities for the public and helping to find and identify species.

Financial support for the Scarborough Bioblitz was provided by OPAL and Welcome to Yorkshire.

Figure 2: No stone was left unturned in the quest for species at the Scarborough Bioblitz!

Puzzle picture.

What are these figures seen on rocks on an English shore? No, not the pound coin.

Answer on page 48

Image Frank Evans

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PORCUPINE SNIPPETS

Information Requests and Observations

Porcupine Newsletter Questionnaire – Results

Last year we asked members to complete a mini questionnaire about the Porcupine newsletter. The aim of this was to obtain a feeling about how the newsletter is received and what else we could add to the contents. We had 27 individuals complete the questionnaire and the results were encouraging, helpful and thought provoking.

Below are the results and also a snap shot of the comments people made.

Thank you to all those who took the time to answer the questions, provide us with some feedback as well as offer ideas for contribution – I will be in touch if you have left me a contact email!

1. On a scale of 1 to 5 (where 1 is poor and 5 is excellent) how do you rate the overall content of the Porcupine newsletter?

Rating	**5**	**4**	**3**	**2**	**1**
Number of responses	6	16	4	0	0

2. On a scale of 1 to 5 how do you rate the Porcupine Pieces (the main articles in the newsletter?) for:

• interest

Rating	**5**	**4**	**3**	**2**	**1**
Number of responses	8	14	4		

• academic content

Rating	**5**	**4**	**3**	**2**	**1**
Number of responses	8	13	5		

3. What would you like to see more of in the newsletter? Articles on:

	Number who circled category
Taxonomy	10
Life history	10
Habitats	14
Recent surveys	13
Climate change	7
Porcupine Society members	4
Ok as is….	4
Other	See What else section below

1. Would you like to see more peer-reviewed articles?

9 responded **yes** and 7 responded **no**.

2. What else would you like to see in the Newsletter?

Below are some comments members made about what they would like to see in the newsletter. If reading these sparks an interest or if you think you might be able to offer something along these lines then please go ahead write an article and send it to us!

- More photos – at least 4 members asked for more images and this is certainly something we are working on and this issue contains the most images we have ever published.
- More articles on invasive species was another area where a number of members expressed an interest.
- Porcupine as a signpost for articles and surveys published in local journals/grey literature/major journals which are not easily accessible to non professionals. This could be in the form of an annual review or bibliography.
- Practical application of research/survey work for example for spatial planning or conservation
- Work of Porcupine members
- More on marine biology history
- More on flora and fauna where keys are

(3) and the Isle of Man (1). There has also been excellent verbal feedback from a variety of sources. The majority of returns were from individuals, but primary schools and local conservation groups had also taken part.

One of the biggest questions raised by the results of such a study is how reliable are the data and can they be used effectively to monitor change? To test the results, comparisons of the distributions submitted were made with published distribution maps (e.g. Hardy & Guiry 2006). This revealed a good match, with the exception of *Bifurcaria bifurcata*, which is probably being confused with young thong weed *Himanthalia elongata*. For the limpet counts, more data are required with time to draw any real conclusions and some of the counts submitted were 'challenging', raising the question as to whether it is possible to count 900 limpets in a minute.

After two years, the project has raised a number of questions.

1. How can we increase the number of returns? The proportion of hits to returns is roughly comparable to other outreach projects in the OPAL series, but we would like to increase the number of returns.
2. What are the risks of the project becoming too popular? There is a risk that if too many people take part at easily accessible sites some sites may become locally impacted, e.g. At Wembury, *Ascophyllum nodosum* has been damaged from trampling and grabbing.
3. Is the survey challenging enough for some people? Evidence suggests that there are an increasing number of people with the skills to undertake more detailed survey work and this might provide the scope for more specific long-term monitoring.

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Mieszkowska, N., Leaper, R., Moore, P., Kendall, M.A., Burrows, M.T., Lear, D., Poloczanska, E.,Hiscock, K., Moschella, P.S., Thompson, R.C., Herbert, R.J., Laffoley, D., Baxter, J., Southward, A.J.& Hawkins, S.J. (2006). Marine biodiversity and climate change: assessing and predicting the influence of climatic change using intertidal rocky shore biota. Scottish Natural Heritage. Commissioned Report No. 202 (ROAME No. F01AA402).

Scarborough Bioblitz: Celebrating 150 years of the Yorkshire Naturalists' Union

Paula Lightfoot, Yorkshire Naturalists' Union

www.ynu.org.uk/marine_coastal

On a hot and sunny weekend last June, almost a hundred naturalists descended on the seaside town of Scarborough to celebrate the 150th anniversary of the Yorkshire Naturalists' Union.

The event took the form of a Bioblitz, where scientists, naturalists and the public work together to find and identify as many species as they can within a certain period of time.

With the ambitious goal of recording a thousand species, enthusiastic participants set off to search Scarborough's extensive rocky shores and sandy beaches, as well as the cliffs, parks and gardens along the sea front.

Subtidal habitats were not neglected, as Scarborough Sub Aqua Club carried out three survey dives to collect seaweed samples and photographic records of underwater wildlife.

Delving even deeper, examination of local fishing vessel M.F.V. Provider's catch added a good variety of fish records to the species list, as well as some unexpected finds such as the stalked barnacle *Scalpellum scalpellum*.

As the tide rose, the Bioblitz moved inland with activities including bird ringing, pond dipping, fungus forays, invertebrate hunts and botanical surveys. As darkness fell, moth traps were set and bat surveys were carried out. Over 1,100 members of the public took part in these activities over the three day period.

The most unusual find was the fossilised

2008	Inland Sea, Anglesey	**Summer**24: 8-15 **2008**
2008	Pembrokeshire	**Summer**26: 7-9 **2009**
2009	Plymouth	**Winter**27: 7-8 **2009/10**
2009	St Abbs, Berwickshire	**Winter**27: 9-14 **2009/10**
2010	Isles of Scilly	**Spring**29: 5-15 **2011**
2011	Southampton	**Autumn**30: 28-31 **2011**

THE BIG SEAWEED SEARCH: THE FIRST TWO YEARS

Juliet Brodie

Natural History Museum, Department of Botany, Cromwell Road, London SW7 5BD, UK

The Big Seaweed Search is an outreach project developed by the British Phycological Society, Open Air Laboratories (OPAL) and the Natural History Museum to raise awareness of seaweeds. The aim of the project is to get people to undertake a seaweed survey to help monitor the effects of climate change and invasive seaweeds on our shores. This includes recording the presence of 12 different kinds of seaweeds along a stretch of shore with rocks, noting what the shore is like and counting the number of limpets found in a minute. Participants are then asked to send their results to the Natural History Museum seaweeds website (http://www.nhm.ac.uk/nature-online/british-natural-history/seaweeds-survey/).

The seaweeds selected for the survey were chosen partly because of the relative ease with which they could be identified but also in response to reports of changes in their distribution and abundance, notably large brown fucoids and kelps that characterise the shores around Britain. For example, there are reports that egg or knotted wrack *Ascophyllum nodosum* (Figure 1) is disappearing from some UK shores such as Strangford Lough (C. Maggs, personal communication) and that the kelp sugar kelp *Saccharina latissima* has declined dramatically from the Skagerakk coast of Norway (K. Sjotun, personal communication). It has also been suggested that dabberlocks *Alaria esculenta* is an example of a northern species that has shown a small retraction in its southern distributional limit (Mieszkowska *et al.* 2006). Climate change has been suggested as a possible reason to account for these changes, notably milder winters (amongst with other potential factors; see Brodie *et al.* 2009), that reduce the impact on grazers such as limpets which continue to graze, making it difficult for seaweed sporelings to establish. Other seaweeds in the survey included tuning fork weed *Bifurcaria bifurcata* as an example of a species with a south-westerly distribution, Japanese wirweed *Sargassum muticum* an example of a conspicuous and spreading alien, red calcified *Corallina* species and green *Ulva* species (Figure 2).

Figure 1 Egg or knotted wrack Ascophyllum nodosum.

Figure 2 Ulva species in a rockpool.

Since the survey was launched in July 2009, there have been over 7000 website hits and returns for at least 100 sites from England (67), Wales (19), Scotland (10), Northern Ireland

lacking – for example hydroids/bryozoans/ascidians

- What new tools/resources are available to Porcupine members for example statistical packages, BioScribe (http://jncc.defra.gov.uk/page-5776), keys….
- Unusual observations/records – we need you to submit these records!
- Selected press cuttings
- General marine natural history
- and more on algae

Records and Recording in 2011

6th January 2011: A mass stranding of velvet swimming crabs, ***Necora puber***, was seen on the Isle of Thanet coast, Kent. [Daily Mail]

3rd March 2011: A sperm whale, ***Physeter macrocephalus***, was washed ashore at Pegwell Bay in Kent. [Kent Mammal Group]

18th March 2011: Two large algal blooms (***Skeletonema costatum***) have been detected; one off the coast of Ireland and the other covers an area from the Lizard, in Cornwall, to Salcombe, in Devon. [Plymouth Marine Laboratory]

10th May 2011: Two rarely recorded alien species of barnacle were discovered on fishing pots off the coast of Guernsey. These were the stalked barnacle, ***Scalpellum scalpellum,*** and the acorn barnacle, ***Solidobalanus falla***. [Sustainable Guernsey]

11th May 2011: A white-beaked dolphin, ***Lagenorhynchus albirostris,*** was washed up dead at Osmington Mills near Weymouth, Dorset. [Facebook Group (Strandlines and beachcombing)]

20th May 2011: A school of 60+ long-finned pilot whales, ***Globicephala melas,*** were spotted swimming around the shallow coastal sea area of Loch Carnon, South Uist in the Outer Hebrides, Scotland. [BBC News]

21st May 2011: A pod of 21 fin whales, ***Balaenoptera physalus***, was spotted about 60 miles offshore, in the Celtic Deep, between north Cornwall and south-west Pembrokeshire. [MARINELife]

1st June 2011: An otter, ***Lutra lutra,*** was spotted on a Dorset beach at West Bay. [Dorset Wildlife Trust]

17th June 2011: A dead and decomposed Mediterranean moray eel, ***Muraena helena,*** was found in St Peter Port Harbour, Guernsey. This southern sub-tropical species is an extremely rare discovery in British seas and was last recorded in Guernsey waters in 1996. [Sustainable Guernsey]

22nd June 2011: The rare visitor to the English Channel, a spotted bass, ***Dicentrarchus punctatus,*** was caught off the west coast of Jersey. [Sustainable Guernsey]

4th July 2011: carpet sea squirt, ***Didemnum vexillum***, has been discovered on the shore at Seasalter in Kent. [Thanet Coast Project]

9th July 2011: A sperm whale, ***Physeter macrocephalus,*** was spotted off the coast of Devon near Brixham. [Seawatch Foundation]

11th July 2011: A sei whale, ***Balaenoptera borealis,*** was spotted between Islay and Gigha in south-west Scotland. This deep water whale is rarely seen in the shallower seas around the British Isles. [Seawatch Foundation]

22nd July 2011: Several bluefin tuna, ***Thunnus thynnus,*** were spotted off the Dorset coast. [Dorset Wildlife Trust]

23rd July 2011: A crystal jelly, ***Aequorea*** sp., was found in the surface waters around Suffolk. [Jellywatch]

5th August 2011: Two giant gobies, ***Gobius cobitis***, seen at Roskilley, south of Newlyn, Cornwall. This species is protected under Schedule 5 of the Wildlife and Countryside Act. [British Marine Life Study Society]

9th August 2011: A dead 18 m-long fin whale, ***Balaenoptera physalus***, washed ashore at Lynmouth, north Devon. [BBC News]

15th August 2011: A rare Sowerby's beaked whale, ***Mesoplodon bidens***, washed ashore near Thornham, Norfolk. [British Divers Marine Life Rescue]

6th September 2011: A fin whale, ***Balaenoptera*** *physalus,* stranded at Immingham mud flats on the Humber estuary. [British Divers Marine Life Rescue]

17th September 2011: A sperm whale, ***Physeter macrocephalus***, was spotted in the Sound of Raasay, off the Isle of Skye. It is the first time one has been spotted off the Scottish island in three years. [The Hebridean Whale and Dolphin Trust]

23rd September 2011: A sei whale, ***Balaenoptera borealis***, was found washed up near Skeffling in the Humber estuary. [BBC News]

4th October 2011: Another sei whale, ***Balaenoptera borealis,*** was found stranded near Gerinish, Outer Hebrides. [BBC News]

7th October 2011: A juvenile short-snouted seahorse, ***Hippocampus hippocampus,*** was found in the River Thames, Greenwich. [Environment Agency]

8th October 2011: A dwarf sperm whale, ***Kogia sima***, was seen in Mounts Bay, Penzance. This tropical/subtropical species had never been recorded off the UK. [Seawatch Foundation]

12th October 2011: A sperm whale, ***Physeter macrocephalus***, was spotted in Kirkwall Bay in the Orkney Isles. [Seawatch Foundation]

9th November 2011: A white-beaked dolphin, ***Lagenorhyncus albirostris***, was seen about 15 miles south of Worthing, West Sussex. This species is not normally recorded in the English Channel. [Sussex Marine Life Jottings]

20th November 2011: The foraminiferan, ***Halyphysema tumanowixzii,*** was seen off the Norfolk coast (on the wreck of the Rosalie) and on a windfarm cable of Weybourne at a depth of 8m. [Dawn Watson – Porcupine Member (also found on the Porcupine Facebook Group)]

24th December 2011: A sperm whale, ***Physeter macrocephalus***, washed up dead on Hunstanton Beach, Norfolk. [BBC News]

29th December 2011: A Kemp's ridley turtle, ***Lepidochelys kempii***, was found on the shore at Tresilian Bay near Llantwit Major on the south Wales coast. [Marine Conservation Society]

Selected Journal Articles:

Dauvin, J.-C., & Delhay, J.-B. (2011) First record of *Hemigrapsus takanoi* (Crustacea: Decapoda: Grapsidae) on the western coast of northern Cotentin, Normandy, western English Channel. Marine Biodiversity Records **3:**e101

Gallardo, B., Paz Errea, M. & Aldridge, D. C. (2011) Application of bioclimatic models coupled with network analysis for risk assessment of the killer shrimp, *Dikerogammarus villosus*, in Great Britain. Biological Invasions. DOI: 10.1007/s10530-011-0154-0, Online First

Garrick-Maidment, N., Trewhella, S., Hatcher, J., Collins, K. J. & Mallinson, J. J. (2011) Seahorse tagging project, Studland Bay, Dorset, UK. Marine Biodiversity Records **3:**e73

Griffin, R., Herbert, R. J. H. & Pearce, B. (2011) New UK recordings of the mantis shrimp, *Rissoides desmaresti* (Crustacea: Stomatopoda), provided by broad-scale mapping projects. Marine Biodiversity Records **4:**e80

Hope, R. & Shucksmith, R. (2011) Most northerly record of Europe's smallest marine fish Guillet's goby *Lebetus guilleti* in the Shetland Islands, Scotland. Marine Biodiversity Records **3:**e98

Lorenz, F. & Melaun, C. (2011) A new species of *Simnia* from England (Caenogastropoda: Ovulidae). Molluscan Research **31**(3): 165-175

McCollin, T & Stebbing, P. (Spring/Summer 2011) Invaders from the deep: Marine Invasive species in the UK. Shellfish News. Issue No. **31**: 19-21

Piper, R. (2011) Re-occurence of silver pomfret *Pampus argenteus* in the North Sea. Marine Biodiversity Records **3:**e102

Queen's University Belfast (MRRG) (Autumn/ Winter 2011) Horse mussel restoration in Strangford Lough. Shellfish News. Issue No. **32**: 5-6

Robinson, K. P., Eisfeld, S. M., Costa, M. & Simmonds, M. P. (2011) Short-beaked common dolphin (*Delphinus delphis*) occurrence in the Moray Firth, north-east Scotland. Marine Biodiversity Records **3:**e55

Switzer, S.E., Therriault, T.W., Dunham, A. & Pearce, C.M. (2011) Assessing potential control options for the invasive tunicate *Didemnum vexillum* in shellfish aquaculture. Aquaculture **318**: 145-153

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www.mcsuk.org
www.pml.ac.uk

www.seawatchfoundation.org.uk
http://sussexmarinejottings.blogspot.com

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www.whaledolphintrust.co.uk

www.sustainableguernsey.info/blog

Porcupine Adventures

PMNHS prides itself at offering its members the opportunity to partake in field trips around the British Isles. Data collected on these field trips is not only submitted to the NBN Gateway, but it is also published in our newsletter. Presented here is a list of sites visited in approximate chronological order, with their accompanying references. It is important to note that historically, not all field trips undertaken had their data published.

1977	Cullercoats	**Aug-77**	1(3): 31
1977	Orkneys	**Dec-77**	1(4): 45-46
1978	Portaferry, Co. Down	**Aug-78**	1(6): 93
1979	Redheugh, Berwickshire	**May-79**	1(8): 130-131
1980	Channel Islands	**Mar-81**	2(1): 6-7
		Jul-81	2(2): 30-32
1981	Plymouth	**Mar-81**	2(1): 8-9
1981	Rhossili, Gower	**Nov-81**	3(1): 50
1982	Sherkin Island, Co. Cork	**Dec-82**	2(6): 127-130
1983	Rhosneigr, Anglesey	**Jul-83**	2(8): 196-200
1983	Eyemouth, Berwickshire	**Nov-83**	2(9): 245-246
1986	The Fleet, Dorset	**Dec-86**	3(8): 215-217
1988	Ipswich	**Feb-89**	4(4): 77-84
1989	The Trink, Newcastle	**Dec-89**	4(7): 141-149
1990	Easthaven, Dundee	**Dec-90**	4(10): 231-234
1991	Osborne Bay, Isle of Wight	**Feb-91**	5(5): 53-58
1992	Marazion & Falmouth	**Dec-92**	5(6): 117-124
1992	Port Erin, Isle of Man	**Jan-95**	5(10): 252-255
1994	Herm, Guernsey & Sark	**Jan-95**	5(10: 256 -262
		Oct-96	6(5): 142 -150
1997	Connemara, Co. Galway	**Oct-97**	6(8): 211-213
		Oct-03	13: 19-22
2001	Isle of Purbeck, Dorset	**Jul-01**	8: 3-4
2002	Dunbar, Berwickshire	**May-03**	12: 17-19
2002	Rhoscolyn, Anglesey	**Sep-02**	11: 15-23
2003	Aberthaw, Glamorgan	**Oct-03**	13: 12-18
2003	The Trink, Northumberland	**Feb-04**	14: 31-36
2004	Osmington Mills, Dorset	**Jun-04**	15: 25-28
2005	The Wash, Norfolk	**Nov-05**	18: 3-4
		Nov-06	21: 15-22
2006	Langness, Isle of Man	**Jun-06**	20: 9-13
2006	Isle of Wight	**Nov-06**	21: 6-14
2007	Cullercoats	**Jun-07**	22: 24-27