Marine Species Biology & Ecology
Porcupine Annual Conference

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Abstracts

The value of Seasearch divers

Charlotte Bolton & Paul Kay

Seasearch coordinators, Marine Conservation Society.
charlotte.bolton@mcsuk.org & pkay@marinewildlife.co.uk

The role of amateur volunteer divers in surveying the near-shore marine environment is presented in its historical and present context. Seasearch divers are contributing to a very large, up-to-date and public dataset on the National Biodiversity Network which informs marine management and conservation measures as well as highlighting the exciting and beautiful life in UK waters. First records of some species were reported on Seasearch surveys in 2016 and are presented here.

From cetaceans to crustaceans: the role of natural history in marine science

Dr Nicholas Higgs

Deputy Director, Marine Institute, Plymouth University.
nicholas.higgs@plymouth.ac.uk

Natural history plays a key role in facilitating new discoveries in marine science. In this talk I will give an overview of the role that natural history has played in my scientific career to date, illustrating my point with two case studies. The first will look at the discovery of a peculiar group of marine worms that subsist entirely on the skeletons of dead whales, *Osedax* annelids, and the huge range of research that has subsequently arisen from this. The second will look at how observation-based knowledge led to a rethink in our understanding of a large commercial lobster fishery. In an age of science that often sees observational enquiry as subordinate to hypothesis-driven research, I will argue that observation plays a necessary and complimentary role in driving marine biological science forward.

Marine Protected Areas: benthic recovery, storm impacts and lessons learnt.

Dr Emma Sheehan

Marine Institute, Plymouth University.
emma.sheehan@plymouth.ac.uk

The Lyme Bay reefs (south west UK) have been annually monitored since they were protected from towed demersal fishing in 2008. Following the extreme storm events in 2013/2014 additional research was carried out to assess if the benthos within the Marine Protected Area (MPA) were more resilient than the benthos in areas, which remain open to fishing. While MPAs are thought to be more resilient against natural disturbance, the benthic community in the MPA was significantly affected by the storms. Lessons learnt from this nine-year study will be presented that could be used to inform MPA management measures around the UK, such as Cardigan Bay.

Dr Emma Sheehan is a marine ecologist leading a research team at Plymouth University. Her research focuses on the effects of human activities on marine ecosystems to inform environmental policy and management. Her work includes marine protected areas, fisheries, offshore aquaculture, marine renewable energy and mitigating dredging operations. To detect changes in benthic habitats and species assemblages over large spatial and temporal scales Emma has developed cost and time effective methods using high definition cameras that are relatively non-destructive and suitable for deployment from fishing vessels

Arctica islandica: understanding impact on this protected feature offshore.

Dr Becky Hitchin

Offshore Industries Advice Manager, Joint Nature Conservation Committee, Aberdeen.
Becky.Hitchin@jncc.gov.uk

Arctica islandica, the ocean quahog or Icelandic cyprine, is a large bivalve mollusc with a thick, dark coloured, cockle-shaped shell. It lives buried in the top layers of a range of mainly sandy and muddy sediments, occasionally in large beds of great density. *A. islandica* is a protected feature of seven Marine Protected Areas in UK offshore waters, associated with its inclusion in the OSPAR list of Threatened and/or Declining Species & Habitats, as well as being a feature of conservation importance in MCZs and NCMPAs. This protection is based on trends of declining abundance and a high level of sensitivity to anthropogenic and natural pressures associated with a long life span and intermittent recruitment.

Much of current knowledge on North Sea *Arctica islandica* distribution and abundance comes from North Sea trawl surveys as well as baseline and monitoring surveys associated mainly with the oil and gas industry. Several of the areas of higher abundance coincide with areas of interest to oil and gas, especially the Fladen Grounds.

However, there is still considerable lack of understanding of the abundance, distribution and density patterns of *Arctica* within the offshore areas of the North Sea, associated with both difficulties in estimating these parameters using standard survey equipment, realistic amounts of survey time, and translating the evidence available into understanding of significant impacts and conservation objectives. With video tows, siphons are not always visible on the surface of the sediment, and correctly identifying *A. islandica* siphons can be difficult if the sediment contains more than one species of large bivalve. Grab samples often do not provide deep enough samples to capture *Arctica*. Taking dredge or core samples can lead to removal of the feature.

Benthic impacts of a novel, non-native shellfishery in a marine protected area.

Leo Clarke*, Dr Roger Herbert and Dr Richard Stillman

*Postgraduate Research Student, Bournemouth University.
lclarke@bournemouth.ac.uk

Fishing is a significant source of environmental disturbance. The types of gear employed can vary at local and regional scales according to the target species and local physical environment. Understanding the complex interactions between such gear types and habitats is necessary for effective management in marine protected areas. Moreover, as a result of climate change and multiple invasion pathways, harvestable populations of non-native species of significant commercial value can emerge that lead to the development of novel techniques by local fishermen. This study assessed benthic impacts of a Manila clam (*Ruditapes philippinarum*) fishery within Poole Harbour Special Protection Area. The Manila clam is a venerupid bivalve native to the Indo-Pacific that was introduced to the harbour in 1988. The fishery utilises a unique ‘pump-scoop’ dredge developed by local fishermen, unlike any elsewhere in the world. Impacts on the physical environment, benthic invertebrate communities and implications for the SPA are discussed.

The lives and times of tompot blennies

Dr Paul Naylor

marinephoto
paul@marinephoto.co.uk

The tompot blenny (*Parablennius gattorugine*) is one of our most distinctive and charismatic coastal fish but it's fascinating behaviour and life history has previously received little attention. During this study, individual tompot blennies are recognised and tracked by their unique skin markings and this is continually shining new light on their territoriality and interactions. Observations on a Devon reef are showing that a male often holds a territory for up to 3 consecutive breeding seasons. Rivalry for the best crevices is intense, involves fighting and displays, and may be prolonged. It also starts at a young age!

Being able to recognise the individual females that lay their eggs in male territories has now shown how a female will remain in the same area of reef for extended periods and visit several males within a breeding season and over subsequent years. Recent observations suggest that there is competition between females, and reveal there are also particularly intriguing exchanges between males and females outside the breeding season. These and other new observations of tompot blenny behaviour and their interactions with other species will be presented, including use of an impressive technique for displacing a feisty velvet swimming crab.

Behavioural field observations of black bream (*Spondyliosoma cantharus*) at breeding sites along the Dorset coast.

Matt Doggett

mattdoggett@hotmail.com

The black sea bream *Spondyliosoma cantharus* is a sea fish exploited by sport anglers and commercial trawlers. Despite its popularity and its known propensity to nest over large areas of sea bed, most understanding of the species' breeding behaviour draws upon observations from aquaria in the 1950s, rather than observations of wild fish. Despite its territorial nature, the black bream is a shy species, often vacating nesting areas when divers are present, thereby reducing opportunity for direct observations. By placing remote video cameras among nests over two consecutive seasons a unique insight was gained into the annual spawning cycle from arrival of the first shoals to final hatching of eggs. Behaviours observed included: initial nest building; male-male territorial disputes and a flux in nest ownership; male-female interactions on the nest; nest maintenance; rapid colour changes due to aggression or excitement; and, parental care of eggs by male fish including removal of debris and predator defence. Furthermore, in each year multiple spawning events several weeks apart suggest that the reproductive season at any one site might last longer than previously anticipated. The results demonstrate both the vital role of male fish in ensuring the survival of the next generation and offer new evidence with regard to fishery advice and management for both commercial and recreational sectors. The use of stills and video footage has been highly useful in providing engaging online content to inform stakeholders of the processes taking place each year on the seabed and justifying any management advice given.

Extending the knowledge of *Raja undulata* site fidelity and their movement along the Dorset Coast.

Martin & Sheilah Openshaw

Martin@stardis.co.uk

Individual undulate rays, *Raja undulata* can be uniquely identified from photographs of their dorsal surface which exhibits a unique pattern. The methodology was first presented at the Porcupine Annual Conference in 2015. The return of individual undulate rays to one known UK ray congregation

site has continued to be monitored over a successive four year period. A database of ray sightings with recognition photographs for over 100 individual fish has been established and site fidelity demonstrated to within approximately 30-metres.

This presentation will contain the latest data to the end of 2016 and detail plans to evaluate the methodology for wider application of non-intrusive monitoring of ray movements. The internet, Facebook and citizen science will be used as an alternative to more conventional tag and release programs. Currently supported by Dorset Wildlife Trust and The Shark Trust it is hoped to foster a wide engagement between anglers, divers and fishermen.

Where's Onchi? A look at the occurrence of Onchidella celtica and its role as a climate change indicator species

Mike Kent

Wadebridge, Cornwall.
rmike.kent@tiscali.co.uk

Onchidella celtica, the Celtic Sea slug, is an air-breathing, obligate crevice-dwelling, intertidal gastropod mollusc, used as a potential climate change indicator. Its ability to indicate climate change is evaluated. Historical records of its occurrence in Great Britain and Ireland are reviewed, and their reliability discussed. Methods of assessing the occurrence of *O. celtica* on rocky shores are compared. An investigation using time-lapse photography to find out when *O. celtica* is most likely to be found on a rocky shore is described. It is suggested that the results can be used to make surveys of *O. celtica* more effective, thereby improving its role as a climate change indicator.

How many species are there? DNA taxonomy and digital photography of nudibranchs with implications for recording of distributions, diets and other aspects of their biology

Bernard E. Picton

Queen's University, Belfast.
bernard.picton@gmail.com

DNA sequencing is revealing many cryptic species amongst the nudibranch fauna of the NE Atlantic. The common shallow water species *Diaphorodoris luteocincta* was believed to exist in two colour forms since 1960. CO1 sequences reveal that these two colour varieties represent two well separated species. Despite overlap in external colour patterns and sympatric distributions these species have distinctly different distributions. The common grey sea slug, *Aeolidia papillosa* is also revealed to be a species complex, with two separate species in the NE Atlantic. Despite clear genetic differences it is still unclear how these species can be separated by colour pattern and ecology. Incorrect alpha taxonomy has huge implications for recording of species, ecology and biogeography.

PMNHS Annual Field Trip: Staffa Archipelago, 16-20 September 2016

Emily Priestley

St Agnes, Cornwall.
emily.f.priestley@gmail.com

An intrepid team found themselves on the shore on west Mull looking out to the rugged seascape that is the Staffa Archipelago. Heaps of kit on the pontoon; inflatable boats at the ready; otters patrolling the rocky shores; sea eagles wheeling above the hill tops…

We were heading for the low lying islands of Inch Kenneth and Little Colonsay flanked by the magnificent hills of Mull to the south and the rocky islands of Ulva and Gometra to the north. In the distance were the jagged profiles of the Treshnish Islands (recently SPA designated for wild bird

conservation). Historically a Viking settlement, the shapes of these uninhabited islands appeared suspended between sea and sky: Lunga, Fladda and Bac Mor, the 'Dutchman's cap' to name a few.

In this challenging area we sought species amongst the diverse range of habitats: from maerl beds to tide combed sea grass, exposed tidal channels and pinnacles laced with *Swiftia* and soft corals. What made the trip really special was the discovery of new connections – our hosts, custodians of the islands, who shared their enthusiasm for the environment and its wildlife.

This short talk aims to illustrate what we did over those few days and to provide a taster of what a Porcupine Field trip in a remote place can be like! We wish to thank Rayner Piper for facilitating this amazing trip and to our hosts, Michael Blakenham, Claire Barlow, Jim Woodhouse and Roc Sandford for their generous hospitality and continued support. A special thank you to Frances Dipper for co-ordinating a report due out later this year and to all who helped to make the trip a success.

Shore: Rayner Piper: Organiser , Mia (Rayner's niece), Frances Dipper: Report co-ordinator, Juliet Brodie (seaweeds NHM), Jo Wilbraham (seaweeds NHM), Rosemary Hill (molluscs), Lisa Kampfhausen (SNH), Phillip Cowie (FSC).

Divers: Emily Priestley: Dive co-ordinator, Rob Scobie, George Brown: RIB owner, Nick Owen (marine ecologist), Ali Bessell (benthic ecologist Fugro), Fiona Crouch (MBA Plymouth), Franki Perry (PML), Becky Hitchen (JNCC), Trudy Russell (Cornwall College/Natural England).

Innovative Uses of ICT in the Delivery of Rocky Shore Fieldwork

Dr Mark Ward

Project Officer, Field Studies Council, Preston Montford
mark.ward@field-studies-council.org

The Field Studies Council has been one of the UK's leading providers of rocky shore field courses to schools and universities for over 70 years. Recently, it has been exploring and trialling new and innovative ways of delivering fieldwork to students using ICT to support learning and to record and analyse data.

A new approach to carrying out community level surveys of rocky shores has been developed by FSC Pembrokeshire, in conjunction with the Open University, using a Field Network System (FNS) and student held mobile devices. This system allows student data to be combined and analysed *in situ* so that any ecological patterns can be discussed whilst still in the field and any discrepancies and anomalies can be identified and addressed during data collection.

For those shores with good 4G connectivity, survey data can also be recorded on mobile devices using ArcGIS software and results can be plotted and overlaid on Google Earth satellite images.

Often students (especially at sixth form level) are taught about ecological energetics (food webs, trophic levels, pyramids of energy and energy transfer) using field data from terrestrial and freshwater ecosystems. The FSC has now produced a new teaching resource that allows collection and analyse of energetics data from rocky shores, with supporting spreadsheets and secondary data that can produce estimated quantitative values for biomass and energy for different trophic levels.

The FSC is training its staff to use 'iRecord' for both common and rarer marine species found around its field sites. All of its new data collection systems are also being standardised so that they can be collated centrally and shared with national databases such as NBN. This will enable our students and the public to study data from rocky shores at our locations across the UK and to make geographical and seasonal comparisons.

Are jellyfish blooms born of the elusive polyp?

Dr Cathy Lucas

Associate Professor in Marine Biology, National Oceanography Centre, Southampton.
cathy.lucas@noc.soton.ac.uk

Over the past 10-15 years scientists have become increasingly interested in jellyfish blooms, some of which are detrimental to human activity such as beach tourism, fisheries and aquaculture. There is much scientific *and* public debate on whether these bloom events have become more prevalent (or not) throughout the worlds' oceans and whether factors associated with climate change and anthropogenic disturbance, e.g. overfishing, coastal sprawl and eutrophication, are driving these changes. To help inform these debates, there is a focus on understanding the biology and ecology of jellyfish so that we can understand *where* and *how* jellyfish outbreaks can occur in response to various environmental drivers.

The majority of bloom-forming species are in the Class Scyphozoa, with UK examples including the common (*Aurelia aurita*), lion's mane (*Cyanea capillata*), barrel (*Rhizostoma octopus*) and compass (*Chrysaora hysoscella*) jellyfish, and other notable examples including the giant jellyfish (*Nemopilema nomurai*) in SE Asia and the mauve stinger (*Pelagia noctiluca*) in the Mediterranean. Apart from the mauve stinger they all share the characteristic of a having a complex, metagenic life cycle consisting of a perennial asexually-reproducing benthic polyp and an annual sexually-reproducing pelagic medusa. Historically, scyphozoan jellyfish researchers have studied only the medusa phase of the life cycle, possibly because the 3-4mm polyp is so hard to find in the wild, and their potential importance in jellyfish population dynamics was not appreciated. However, it is the growth and reproduction of the polyp population that determines the magnitude and timing of recruitment to the pelagic medusa phase. In addition, the perennial polyp can survive stressful conditions in the form of podocysts, thus enabling populations to be maintained over the longer-term. In this presentation, I will summarise what we have learnt about the distribution and ecology of scyphozoan polyps, focusing on the effects of temperature and food on growth and asexual budding and strobilation, and how this translates into jellyfish populations and bloom events.

Parasites in the plankton.

Dr David Conway

Associate Fellow, Marine Biological Association, Plymouth.
dvpc@MBA.ac.uk

While examining plankton samples, especially live samples from shallow inshore areas such as marinas, a range of parasites will commonly be observed. These may be seen attached to or detached from organisms, inside transparent organisms, or caught while they have been searching for a host. Many of them are close relatives of other planktonic organisms, but because of the niche they occupy, have developed some incredible life-cycles and adaptations. Almost every group of organisms have parasitic representatives, even algae, but the commonest easily seen in plankton samples are platyhelminths, copepods, isopods, cirripedes and nematodes. Many of these can have considerable impact on their hosts, affecting their general condition, fecundity and even swimming ability, making them more vulnerable to predation. Production and marketability of important commercial species can be affected by infestations and a few have human health implications. Some of the more bizarre marine parasites have even starred in horror movies. However, marine parasites are poorly researched and some species we know virtually nothing about.

Maxmuelleria lankesteri, Photographing a shy worm.

Nick Owen

Freelance Ecologist, Wool, Dorset.
n.owen865@btinternet.com

Maxmuelleria lankesteri (Herdman, 1897) is an Echiuran related to the more frequently recorded *Bonellia viridis.* It is currently placed in the Annelida as the animal possesses two chaetae. They live long (it is thought) sedentary lives in a U-shaped burrow from which only the feeding proboscis emerges to plane sediment off the surrounding mud surface, sometimes leaving radial tracks. They are thought to be important bioturbators and feature in some sediment biotope descriptions as indicator species. In the ultra-sheltered conditions of Scottish sea lochs they accumulate large mud "volcanoes" from their faeces and burrow ejecta. When seen on video, these "volcanoes" are the usual sign that triggers a record of the species and the "volcanoes" can occur over large areas.

Generation times are thought to be long and breeding thought to be sporadic. Males have never been reported, larval stages are unknown and (in sea loch populations) small individuals are rare. *Maxmuelleria* is reported to be nocturnal but the pictures of the feeding probosci in the presentation were recorded in daylight hours. *Maxmuelleria* is green in colour, the colouration being due to the presence of bonellin, which when exposed to light liberates oxygen free radicals causing the worm's tissues to break down so samples can be hard to keep intact.

Maxmuelleria is extremely light-shy; in dark conditions they quickly withdraw their proboscis into the burrow as a diver's light draws near. Where conditions do not allow the production of "volcanoes", their presence probably often goes unremarked unless they turn up (usually mangled) in dredges and grab samples. This leads to the likelihood that Maxmuelleria is under-recorded. Sporadic records cover a geographic range from the Kattegat, around northern and western Britain to the eastern Channel and northern Spain.

This presentation reveals a simple trick that allows a diver enjoying a dive on soft mud or muddy sand in dark conditions to get high quality stills of Maxmuelleria by tricking the worm into leaving it's proboscis on the surface. The hope is that this will generate more records and lead to the eventual removal of terms like "probably" and "thought to be" from descriptions of the life-cycle of this "probably" important and widespread habitat modifier.

Sharing Shells: Hermit Crabs and Worm Lodgers

Dr Andrew S.Y. Mackie

Honorary Research Fellow, Amgueddfa Cymru – National Museum Wales, Cardiff
asymackie@btinternet.com

Partnerships between different species always intrigue. What is the relationship between the partners? Is the symbiosis friendly and cooperative, opportunistic, mutually beneficial, or to the detriment of one partner? The association between the Common Whelk *Buccinum undatum* and the ragworm *Neanthes fucata* in European waters is well-known. This is an account of observations made in an aquarium as part of a popular museum exhibition — *Wriggle! The Wonderful World of Worms*.

Using citizen scientists to help understand reproductive resilience

Dr Gordon Watson

Reader in Marine Zoology, Institute of Marine Sciences, University of Portsmouth
gordon.watson@port.ac.uk

Associates: K. Bohn (Institute of Marine Sciences), M. Burrows (Scottish Association of Marine Science), J. Delany (Dove Marine Laboratory), M. Evans (Earthwatch); S. Evans (School of Ocean

Sciences), S. Hull (University of Hull), N. Mieszkowska (The Marine Biological Association), L. Richardson (Marine Conservation Society).

Capturing our Coast (CoCoast) is a national citizen science project (funded by the Heritage Lottery Fund) which trains volunteers to collect data on the abundance and diversity of the coastal flora and fauna of their local shores. Volunteers receive training in general survey techniques and species identification, and are also invited to take part in the setting up and monitoring of question-driven experiments and targeted surveys to investigate a range of fundamental ecological questions. To date, over 3000 people have registered with CoCoast and we have trained over 1800 volunteers. The University of Portsmouth southeast hub is leading on a series of phenology studies that investigate the drivers of reproduction and larval settlement of a range of marine invertebrates from rocky and soft sediment shores. The approach uses targeted searches for berried females (e.g. crustaceans) and egg masses (e.g. molluscs) as well as specialist campaigns (e.g. Spermwatch) for polychaetes such as the lugworm *Arenicola marina*. These data will enable researchers to assess the spatial and temporal synchrony of reproduction across the UK and understand the level of reproductive resilience in a changing world. This talk will present data on some of these studies including lugworm reproduction and will also assess the advantages, limitations and challenges of using national citizen science project in providing robust data to answer fundamental ecological questions.

A touch of Anchovy

Doug Herdson

Marine Fish Information Services, Plymouth
douglas.herdson@btinternet.com

Anchovies are more familiar as Mediterranean or tropical fish, but have been found in British waters for many years. However, they appear to have become more common and widespread in recent years; and to have become a valuable catch for south west fisheries.

This presentation will look at the occurrence and distribution of the anchovy *Engraulis encrasicolus* in British waters and especially in the Western Channel. It will also consider other species of pelagic fish in relation to the shoals of anchovy.

Three observations...

Peter Barfield

Postgraduate Research Student, Institute of Marine Sciences, Portsmouth
pdbarfield@googlemail.com

Abstract: By way of an introduction to the session on Biological Observations this talk presents three examples of such phenomena. These type of encounters might, at first glance, elicit an open-mouthed, head-scratching moment of delight as we ask ourselves, 'just what am I seeing?'. Two personal observations from 2016 are provided here and a third from fellow Porcupiner, Richard Lord. The three parts are titled as follows:

(1) The curious case of the crab in the daytime;

(2) The tortoise and the hare or, slowly, slowly catchy monkey; and,

(3) Mud-shrimp mind map.

Monitoring nursehound eggcases at Wembury Point

John Howard

Mewstone Enterprises
mewstone.enterprises@gmail.com

At Wembury Point there is an apparently stable *Scyliorhinus stellaris*, Bull Huss or Nursehound hatchery, in the very low intertidal, making it possible to study the egg cases by snorkelling. Since April 2014 the egg cases have been tagged with a view to finding out how long they take to hatch, what the success rate is, when they are laid, and whether biofouling has any effect. A bonus would be recovering any stranded tagged cases indicating the distance egg cases might travel from laying sites. Environmental data is recorded with a view to determining if temperature and wind velocity (as a proxy for wave energy) affect hatching success. The tagging and recording process has evolved to overcome a number of difficulties, and some tentative, preliminary conclusions can be drawn:

Eggs are laid throughout the year, although not every year.

Gestation does appear to be about 9 months, but with a possible minimum of 4 months.

Eggs laid on *Cystoceira tamariscafolia* have a better success rate than on other weeds.

Two tagged cases have been recovered approximately 500 m from the hatchery.

This is a citizen science project initiated by John Hepburn, advised and supported by the Shark Trust, with Cat Gordon who runs the Great Egg Case Hunt mentoring. Teagan Consol, a student at Plymouth University and volunteer at the Shark Trust is using the data for her degree project examining the growth of biofouling.

Other similar sites are rumoured to exist, and protocols developed for this project could enable further research.

Recent UK Maerl Discoveries

Francis Bunker

MarineSeen
fbunker@marineseen.com

This talk explores the biology of maerl, the distribution of species in the NE Atlantic and the importance of species identification.

Maerl is a fragile long-lived and slow growing calcified seaweed which grows in unattached nodules on the seabed. It favours clear clean seawater and is intolerant of siltation and so thrives mainly in areas of moderate tidal flow. Maerl beds are an important habitat for a multitude of animals and plants, which live, attached to the branches, in the spaces between, or burrow in the coarse gravel of dead maerl beneath. Due to the fragility of maerl, the beds are easily damaged.

Maerl is a UK Biodiversity Action Plan (BAP) habitat and two maerl forming species, *Phymatolithon calcareum* and *Lithothamnion corallioides* are listed in the EC Habitats Directive Annex Vb (European Union, 1992) with *L. corallioides* being defined as nationally scarce in the UK. Until recently three maerl forming species were known from the UK; *Phymatolithon calcareum*, *Lithothamnion corallioides* and *Lithothamnion glaciale* with another *Lithophyllum dentatum* known to occur in Ireland.

Maerl, like most other species of calcareous corallines are notoriously difficult to identify to species. Identifying from morphological characteristics requires sectioning and microscopic examination. Before sectioning, the living tissues must be soaked in acid to dissolve the calcite skeleton. To distinguish some species, specimens must be reproductive, but this tends to be in winter months when samples are more difficult to obtain.

Recent advances in molecular taxonomy techniques enable maerl species to be identified via molecular markers without specimens being reproductive. Using these techniques two new maerl

species have been described from the waters around Britain and Ireland in recent years; *Phymatolithon lusitanicum* and *Lithothamnion erinaceum*.

The slow growing and long lived nature of maerl together with its fragile nature and associated species diversity makes it an ideal habitat to monitor when gauging the health of coastal water. Determining the geographical distribution and abundance of the various maerl species and monitoring this over time provides a good indication of changes in climatic conditions in the sea.

Cladophora – a field biologist's dilema

Anne Bunker

MarineSeen
abunker@marineseen.com

A glimpse into the evolving taxonomy of the green seaweed genus *Cladophora* and realities of identifying species.

There are a number of green branching *Cladophora* seaweeds in Britain and Ireland. A few species can be identified in the field but many cannot. Lily Newton, in her Handbook of the British Seaweeds (1931) described 23 species and varieties. There was only one illustration in her book; an excellent drawing of *C. rupestris*, the most common species. Sixty years later when Elsie Burrows "greens" volume of Seaweeds of the British Isles was published (1991), 16 species were described and only 6 had the names used by Newton. There were line drawings to illustrate the text but these were mainly of small parts of the seaweeds. When Brodie, Maggs and John brought out Green Seaweeds of Britain and Ireland in 2007 with colour photographs, the prospect of identifying green seaweed in general and *Cladophora* in particular was much improved. It still isn't an easy group to get to grips with though. Brodie, Maggs and John describe 18 species but *C. rupestris* and *C. pellucida* are the only ones most people can name with certainty.

This talk will look at the biology and ecology of *Cladophora* to shed some light on why identification is difficult and will give you some pointers if you want to have a go.

Pink sea fans: their life, death and importance for biodiversity.

Dr Keith Hiscock

Associate Fellow, Marine Biological Association, Plymouth.
khis@MBA.ac.uk

The pink sea fan (*Eunicella verrucosa*) is admired and greatly used in promoting marine conservation in Britain. It has been studied around our coasts especially since the late 1960s and, during the past 50 years, we have mapped its distribution and abundance, measured growth rates and longevity, seen a significant disease event, catalogued the species that are associated with it and speculated about reproductive mode, about dispersal potential of larvae and about possible impacts of seawater warming. The knowledge that we have is briefly catalogued in the presentation and gaps in knowledge that would inform conservation are identified.

Poster abstract

Torrey Canyon, 50 years after the disaster

Southward, E. C., Readman, J. A. J., Pack, K. E., De-Bastos, E. S. R., Evans, A. J., Hawkins, S. J.

The tanker *Torrey Canyon* struck the Seven Stones Reef off Land's End, Cornwall, in south west England, on the 18th March 1967. The cargo of about 100,000 tonnes of Kuwait crude oil started to escape from the damaged ship immediately and continued until the empty wreck sank in late April. The spill became notable for the enormous amount of oil-spill dispersants used in operations at sea and on Cornish shores. The toxicity of such dispersants was not fully understood at the time of the disaster and they had a devastating effect on the fauna and flora.

Most limpets and other grazing animals on affected shores were killed by the dispersant. In the absence of grazers, ephemeral green algae settled and grew, turning the shore green within the first year. The green algae were succeeded by heavy settlements of brown algae (*Fucus* spp.) New generations of young limpets settled underneath the fucoid canopy and grazed the algae down to bare rock. The full recovery of dispersant-treated shores to 'normal' took approx. 10 years (Southward & Southward, 1978; Hawkins & Southward, 1992). One shore studied, Godrevy Point, received patchy oil from the slick but was not directly 'cleaned'. There was no obvious major recruitment (or settlement) of green or brown algae and the site returned to 'normal' within 2 to 3 years.

Up to 50 years' follow-up observations, including many photographs, are now available for five of the major *Torrey Canyon* sites, showing the extent of the recovery phases and later fluctuations in algal cover and animal populations.

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Southward, A.J. & Southward, E.C. 1978. Recolonization of rocky shores in Cornwall after use of toxic dispersants to clean up the *Torrey Canyon* spill. *Symposium on Recovery Potential of Oiled Marine Environments*. *Journal of the Fisheries Research Board of Canada* 35, 5: 682-706.