The Scottish Association for Marine Science NEWSLETTER 26

SAMS

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ENVIRONMENTAL CHANGES IN NORTHERN SEAS

SEE PAGE 5-7

September 2002

Inaugural UHI Lecture

Lord Puttnam Focuses on Education

6 September 2002
5.45 -8.30pm
Eden Court Theatre, Inverness

Tel: 01463 234 234

EUCC-The Coastal Union & EUROCAST

Littoral 2002

22-26 September 2002
Porto, Portugal

Tel: 351 22 508 19 07/ 351 22 508 19 52
Email: fpinto@fe.up.pt
www.fe.up.pt/eurocoast/littoral2002/

Marine Conservation Society

Annual Conference

Sat 26 October 2002
9am-6pm
Royal Museum, Edinburgh

Tel: 01989 566017

Scottish Marine Group

Marine Stewardship

Thu 31 October 2002
University of Stirling

For information contact:
Dr Hamish Mair
Tel: +44 131 451 3314
Email: j.m.mair@hw.ac.uk

SAMS AGM with Annual Newth Lecture

6 November 2002

Dunstaffnage Marine Laboratory, Oban

Nominations for Council Members should be sent to Mrs Elaine Walton at SAMS
Email: ebw@dml.ac.uk

The Ramsar Convention on Wetlands 8th Conference of the Parties

Wetlands: Water, Life and Culture

18-26 November 2002
Valencia, Spain
Email: ramsar@ramsar.org

35th International Liege Colloquium on Ocean Dynamics and Advanced Research Workshop

Dead and Dying Seas

5-10 May 2003
Liège, Belgium

Fax: +32 4 3662355
www.modb.oce.ulg.ac.be/Colloquium

9th Congress of the International Society for Developmental and Comparative Immunology

29 June to 4 July 2003

University of St Andrews

http://www.st-and.ac.uk/%7Eseeb/compimmu/Poster.htm
For information contact:
Dr Val Smith
Tel: +44 1334 463474
Email: vjs1@st-andrews.ac.uk

Freshwater Biological Association

Symposium for European Freshwater Sciences (SEFS3)

13-18 July 2003
University of Edinburgh

Email: sefs3@fba.org.uk
www.sefs.info

Next Underwater Optics meeting at PHOTONEX exhibition

8-9 October 2003
National Agricultural Centre, Coventry

For information contact:
Michael Wall
Tel: 01256 844443

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Front cover photo ©John A Howe, SAMS/UHI

About SAMS

The Scottish Association for Marine Science (SAMS) is a charity committed to promoting research and education in marine science. It is based at the Dunstaffnage Marine Laboratory near Oban, and is a full academic partner in the UHI Millennium Institute.

SAMS is funded by an agreement with the Natural Environment Research Council for its Northern Seas Programme, by commissioned research for other public and private organisations, and by donations and subscriptions from its 600 members from around the world.

SAMS Membership

Ordinary: anyone interested in marine science
Subscription - £12.

Student: any person under 18, or registered students at Higher Education Institutes
Subscription - £5.

Corporate: organisations interested in supporting marine science
Subscription - £60.

Unwaged: anyone without a regular wage. Subscription - £5.

For further information and application forms please contact the editor.

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To keep up-to-date on events at SAMS, visit our website:

www.sams.ac.uk

SAMS Board

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Dear **SAMS** member

Dr Anuschka Miller, EDITOR

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While driving into work this morning listening to the radio I realised just how much SAMS – despite its location in the scenic remoteness of Argyll – participates in one of the most important global debates of our time. The UN World Summit on Sustainable Development in Johannesburg this month is focusing world attention once again on the impacts of economic globalisation on human society and our environment, and on developing and implementing strategies to achieve sustainable development. The SAMS core strategic research programme on the Northern Seas - which takes centre stage in this Newsletter (pages 5-7) - has direct relevance in this debate as it investigates how the climatically critical ecosystem of northern seas responds to anthropogenic and natural changes. With the findings from this programme, SAMS will be able to contribute to providing society and its decision-makers in Northern Europe with the scientific knowledge about the dynamics of this marine ecosystem that is required for making informed decisions about how to achieve its sustainable development.

Also Dr Jo Oliver's article on her vision for the European Centre for Marine Biotechnology (see page 12) demonstrates the Association's commitment to innovative approaches to sustainable development of the marine environment.

Most marine scientists – excluding those who lend themselves to excessive seasickness – describe research cruises as one of the highlights and perks of their job. On pages 6 and 7 two young SAMS researchers, Drs Murray Roberts and John Howe, share some of their memories of a recent Northern Seas Programme cruise into the Arctic Circle. Their article will give especially the uninitiated reader a first glimpse of cruise life, both from a scientific and a personal perspective.

This issue of the Newsletter is the most colourful yet. To portray the advances in marine science in Scotland in all their glory, we felt it was time to print this publication in full colour from now on. I hope you will gain as much pleasure from it as I. ●

SAMSnews

Professor Graham B. Shimmield, DIRECTOR

SAMS OWNS AND OPERATES THE DUNSTAFFNAGE MARINE LABORATORY

On the 1st May 2002, the President of SAMS signed the new Agreement with NERC placing the entire management and operation of the laboratory back with SAMS after 13 years under the NERC lease arrangement. Although it has taken considerable effort on the part of all concerned to achieve this Agreement, I am very optimistic that it represents an innovative and flexible arrangement for the delivery of international quality marine research at SAMS. Embedded within the Agreement is the provision for NERC to fund the £5 million Core Strategic Research Programme on the Northern Seas (see page 5 in this Newsletter).

One aspect following from this change in responsibility has been the increased involvement and support provided by Highlands and Islands Enterprise. At the time of a UK-wide review of the value and links with the Regional Development Agencies and Enterprise Companies by Research Councils UK, it is important to recognise the vision and expertise provided by HIE (and its subsidiary, Argyll and Islands Enterprise), without whose help the new building project and the future for Dunstaffnage would not have been realised.

© J.E. McLoughlin, SAMS

LEFT: The NERC-SAMS Agreement was signed by SAMS President Dr Ian Graham-Bryce (seated). From left to right: Council members Professor Mike Cowling, Dr Alistair Goodlad, Mr William Balfour, Mrs Jane Twelves, Dr Paul Thompson, SAMS Director Professor Graham Shimmield, and Council member Professor Geoffrey Boulton.

UHI PUBLISHES ITS STRATEGIC PLAN

The beginning of August marks the start of the university calendar. Over the past four months, the UHI Millennium Institute has prepared and submitted its Strategic Plan to the Scottish Higher Education Funding Council (SHEFC). The success of UHI in attracting HE student numbers now needs the commensurate financial support from SHEFC to achieve the vision so desperately required by the people of the Highlands and Islands. From the research point of view, Environmental Sciences in the UHI will benefit from over £400,000 of investment each year over the next five years as a consequence of the Research Assessment Exercise.

Another benchmark is the first completions of UHI-supported PhD postgraduate students. From the outset, the recognition of postgraduate education in the Institute has marked its aspiration for university status.

SAMSnews CONT.

SAMS IN THE POLITICAL AND PUBLIC EYE

On 1 August SAMS published the Review and Synthesis of the Environmental Impacts of Aquaculture under the auspices of the Central Research Unit of the Scottish Executive. This milestone document, co-ordinated and edited by Dr Kenny Black, provides an up-to-date and comprehensive view on the state of the environment influenced by the marine aquaculture industry. The recommendations contained therein will form the basis for future governmental deliberation, and the scientific research agenda. It is timely and appropriate that SAMS should take a lead in identifying the challenges for a sustainable industry operating with due environmental criteria, and not shy away from the strong opinions held by the proponents in the debate on the future of the industry.

NEW STAFF MEMBERS

The rapidly evolving organisation of SAMS has required two key new posts to be created. Patricia MacDonald joins SAMS from the SEPA management team as our new Financial Controller, in charge of a £4.5 million year turnover and an £8 million capital project! Dr Jo Oliver has been appointed as Project Executive for the European Centre for Marine Biotechnology. Jo has a distinguished research and commercial venture career to date with Moredun Scientific Ltd and New Park Management Ltd. The experience and ability of Trish and Jo will significantly enhance the capability and operation of SAMS, and we wish them every success with their new careers.

PROGRESS ON THE NEW BUILDING

by Dr Ken Jones, Deputy Director

The developments that have taken place on the Dunstaffnage site since the last Newsletter have been dramatic, and staff and visitors are now in no doubt that some major changes to the laboratory facilities are afoot. Behind the scenes there has been furious interaction between the development design team and representatives of the scientific groups in the laboratory to refine architectural and services specifications, whilst, on the ground, building activity has begun.

A new car park has been constructed around the Aquaculture Laboratory, which has allowed the contractors, the ERDC Group, to 'take over' the construction site at the front of the existing building. Unfortunately, the once pleasant gardens at the front of the laboratory have gone to be replaced by a levelled building site. In order to get to this stage the contractors had to break and remove large quantities of concrete (the foundations of the second world war military base which predated the present lab) and then provide a stable footing for the new building by vibro-compacting about 400 gravel columns into the upper layers of the sandy sediments that compose the site. Concerns that the vibrations associated with these activities might result in premature demolition of the old buildings have proved unfounded, but many staff can justifiably claim that the "earth moved" for them in the last two months. The steelwork for the new building is finally on site and the building 'skeleton' is being erected – a real milestone in the construction. Contractors hope to have a wind- and watertight building by Christmas, and the move to the new building should take place in autumn 2003.

The building projects is funded by ERDF, AIE, NERC, and private sector finance. For readers interested in seeing the transformation taking place, the SAMS website offers a web-cam view of the site **www.sams.ac.uk** ●

Obituary: Robin Millar (1916 - 2002)

Dr Alistair M Bullock, former director of the SMBA

A graduate of the University of Glasgow, Robin Millar joined the staff of the then Scottish Marine Biological Association (SMBA) at Millport in 1947 where he specialised in the study of ascidians and quickly gained an international reputation for his research. He became a world authority on the classification and identification of this complex genus, and his advice and expertise were much sought by marine scientists throughout the world. Between the late 1940s and the mid 1960s he was also closely involved with the development of oyster cultivation in Scotland.

Robin was Deputy Director of the SMBA from 1964 until he retired in 1978, a period which incorporated the relocation of the Association's headquarters from Millport to its present home at Dunstaffnage. He was appointed a fellow of the Royal Society of Edinburgh in 1955 in recognition of his outstanding contribution to marine science, and was awarded a D.Sc. by the University of Glasgow in 1963.

Never keen to take centre stage, Robin was nonetheless the inspiration to many scientists as they embarked upon their careers, and was always willing to offer them the benefits of his extensive knowledge on a wide range of subjects. There are many scientists, some still in service, others retired, who owe much to his generosity of spirit, for he gave freely of his time and knowledge.

An accomplished artist, Robin exhibited his watercolours at many art exhibitions. There is little doubt that, had he so wished, he could have had a successful career as a professional artist. He was also a knowledgeable and talented gardener, not overly impressed with the current fashion in garden design, but rather gardened as nature intended. ●

Northern Seas Programme

"MARINE ENVIRONMENTAL CHANGE IN NORTHERN SEAS: NATURAL AND ANTHROPOGENIC INFLUENCES"

Professor Graham Shimmield, Dr David Hughes & Dr Anuschka Miller, SAMS

The Northern Seas, defined as extending from the Irish and northern North Seas across the Norwegian Sea up to the marginal Arctic pack-ice zone, are important marine environments experiencing increasing pressures from both natural and human impacts. This area - which includes territorial waters of the UK, Norway, Iceland, Denmark, the Faeroes and Russia – plays an important part in regulating world climate due to its crucial role in the origin of the thermohaline circulation and as it acts as a sink for man-made pollutants carried north by ocean currents. An improved understanding of the sensitivity of Northern Seas to climate change, pollution, and resource exploitation is of critical importance to the UK and other northern European countries if we are to balance the need for sustainability with increasing exploitation. A more detailed knowledge and understanding of ecosystem responses to past climate changes will be a prerequisite to providing sound scientific predictions of the likely ecological consequences of potentially rapid future climate change.

A year ago SAMS embarked on a new core research programme measuring, testing and modelling how different northern marine systems from coastal fjords to the oceanic margins function, and how they are likely to respond to natural and anthropogenic environmental change. The SAMS Northern Seas Programme, which is funded for an initial five years by the Natural Environment Research Council, draws on the breadth of scientific expertise within SAMS and takes up over 40% of the laboratory staff's time. The programme is based around closely-linked multidisciplinary studies of ecosystem function and biogeochemical cycling and makes use of a range of state-of-the-art marine technology.

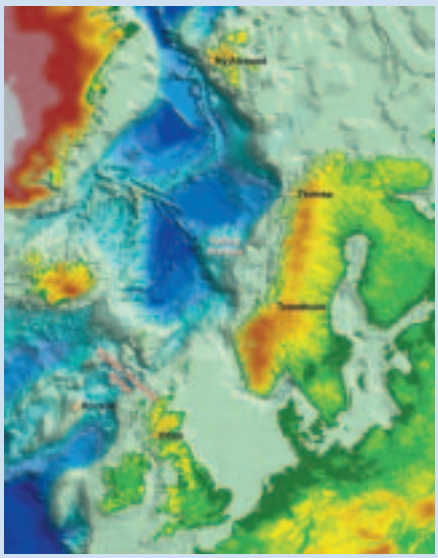
The programme consists of three integrated themes, each comprising several focused sub-questions:

Theme A looks at fjords, important northern systems, which are used extensively by the aquaculture industry. Owing to the slow turnover of water within many fjords, strong water column gradients can become established and pollutants can accumulate in the bottom sediments. Fjords are therefore important model systems that can provide insights into major coastal and oceanic processes, which would be more complex and expensive to study further offshore. In the Northern Seas Programme fjords are used to investigate 1) tidal energy dissipation, 2) the response of pelagic microbial communities to increased nutrient inputs, 3) the relative importance of species-level processes such as herbivore grazing on benthic community structure, 4) the factors determining rates of sediment turnover and contaminant transport by burrowing animals, and 5) the suitability of applying proxy indicators for environmental change to fjordic sediments.

Theme B studies the interface between coastal and oceanic realms at the ocean margins. The programme investigates the role of physical submarine features (seamounts, submarine ridges and depressions) and of species composition and size structure on carbon flow and biogeochemistry at the benthic boundary of the continental margins. To deepen our understanding of the seasonal to decadal changes from the coastal to the oceanic NE Atlantic, the transport of water, heat, and salt is being regularly monitored along the Ellett Line between Mull and Rockall. Theme B also incorporates the further building up of knowledge required for an ecosystem-based management of the deep-water fisheries in the northern Rockall Trough, and the construction of simple food-web models to improve our understanding of the effect of fisheries on the deep-water ecosystem.

The third theme of the SAMS Northern Seas Programme is concerned with developing new tools and technologies to measure and model marine environmental processes. Effort is focused on the further development of smart autonomous platforms such as seabed landers and satellite-linked drifting buoys. Collection and storage of data *in situ* during extended deployments allows a better understanding of the processes that take place in remote areas of the ocean than could be obtained with the traditional ship-based snapshot measurements that have dominated oceanography in the past. The close working relationship between scientists and engineers at SAMS means that research carried out under Themes A and B is increasingly underpinned by this steadily advancing technology.

The Northern Seas Programme is built on the solid foundation provided by 30 years of marine environmental research at Dunstaffnage. By taking maximum advantage of the facilities, material resources and staff expertise available to SAMS, we aim to provide a body of data that will broaden our understanding of the ecology and environment of the Northern Seas. In the decades to come this understanding may help decision-making on issues associated with the management and conservation of Northern Seas resources. ●



ABOVE: Geographic location of the SAMS Northern Seas Programme

On top of the world!

SAMS SCIENTISTS VENTURE FURTHER NORTH THAN EVER BEFORE

Drs John A Howe & J Murray Roberts, SAMS

This summer SAMS conducted a four-week-long research cruise onboard the RRS *James Clark Ross* (JCR) from Scotland to the Arctic. As part of the Northern Seas Programme, the cruise focused on how aspects of the geochemistry, biology and physics of the polar North Atlantic vary in relation to changing environmental conditions along a transect from 67 to 81°N. Sixteen researchers from SAMS were joined by nine colleagues from the NERC Radiocarbon Laboratory, British Geological Survey, University of East Anglia, Scott Polar Research Institute and the UHI's Environmental Research Institute. The specific objectives were to see how the level of contamination from anthropogenic sources varies along the northern transect, how animal burrowing and redistribution of contaminants changes with latitude, how the distribution of benthic animals relates to sediment biogeochemistry, and how past climate changes have influenced deep-sea sediments.

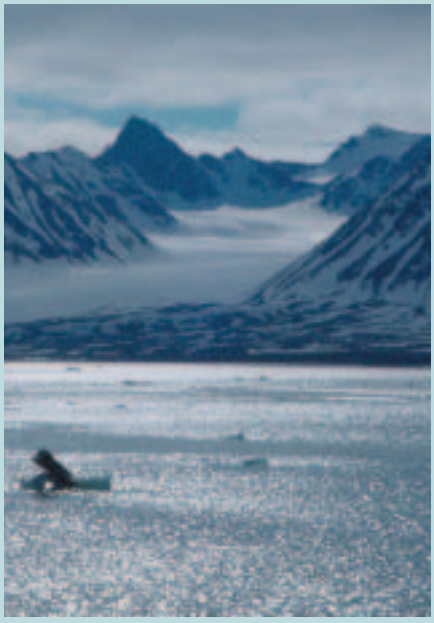
Such grand plans can have inauspicious beginnings, and this cruise started with a very grey, wet day spent at Leith docks loading the vessel. The JCR is a purpose-built polar research ship, launched in 1990. The ship works in the Antarctic during our winter, supporting British Antarctic Survey science, and in the summer months she is found ploughing the Arctic seas. An amazing array of equipment was loaded during that depressingly wet day, everything from landers for recording data from the seabed *in situ* to dangerous-looking giant box corers for collecting sections of soft seafloor. As Leith slipped away, we began our safety briefings and were on our way north at last.

As the ship made her way along the Norwegian coast, we approached the first station, by the Sula Ridge. Here we deployed a photo lander designed to monitor and photograph the seabed along a 14 km cold-water coral reef complex. When the lander was safely on the seabed, the JCR continued northwards – the lander would – hopefully - be recovered on our return, three weeks later.

Once in the Arctic, the serious business of working each sampling station began. Quickly the running order became familiar. First the area was surveyed using sophisticated multibeam and TOPAS echo-sounding equipment. As the ship moved at 6 knots, these acoustic systems worked together to provide a detailed picture of both the seafloor and the structures below it so that sampling areas could be identified.

Having completed the survey and found a suitable site, a routine of water and sediment sampling began. Sediment was collected with box corers, multicorers, megacorers and finally a 6 m long gravity corer. The sediment from the box corers was carefully sorted by biologists looking for large animals capable of turning the sediment over rapidly (a process known as bioturbation) as well as for smaller animals which were preserved for later work. The mud from the smaller multi- and megacorers was

ABOVE: The RRS *James Clark Ross* – here seen from Ny Alesund - took the Northern Seas research team into the Arctic.



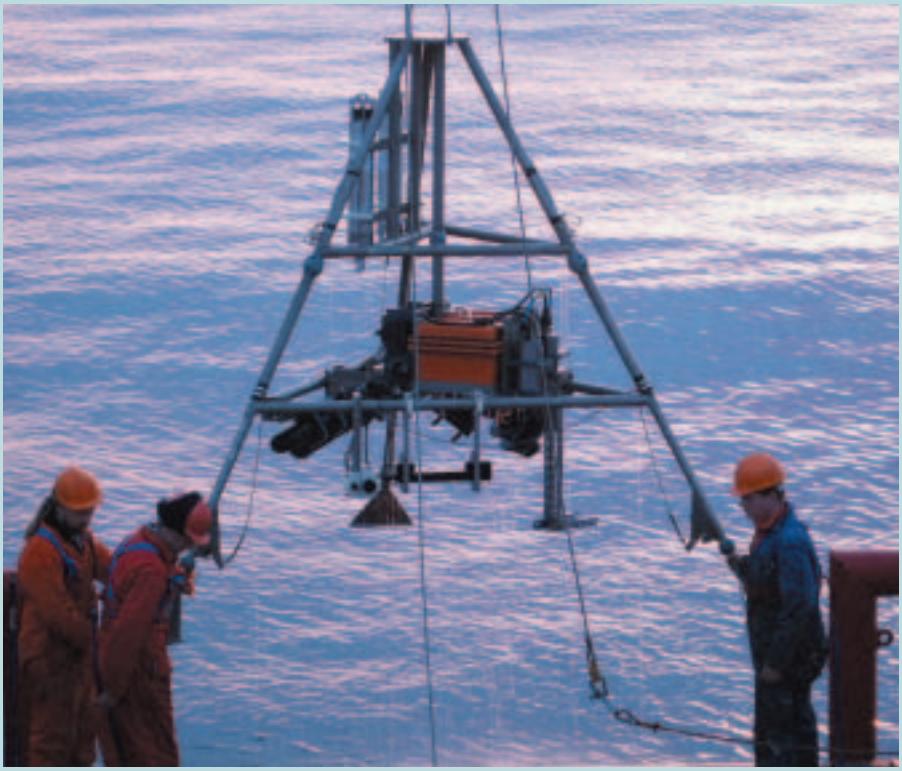
ABOVE: Kongsfjord

divided between the geochemists, for chemical analysis and oxygen consumption profiles, and the biologists, who would try to relate this to the animal communities in the cores. To complement this work on board the ship, a self-contained lander was lowered to the seabed to record the depth of oxygen penetration into the mud. In contrast to the lander that was deployed on the Sula Ridge, this lander was recovered once it had completed the measurements after about 12 hours on the seafloor. Deployment and recovery of such delicate equipment can be difficult depending on the sea state and the composition of the seabed. After several successful deployments, the lander became stuck in the mud at a deep sampling station off Svalbard, and could not be recovered despite much time spent attempting to free it. There it remains, for the time being at least.

Life on board was not all hard graft. Work tended to be very concentrated on the sampling stations. Once these were completed and the ship was on passage to the next site, scientists and crew had time to catch up on missed sleep, read, watch the waves and stunning Arctic scenery, and enjoy the on-board entertainment. There were bar quizzes and impromptu music performances, not to mention the occasional gin & tonic made, of course, with real glacial ice! Memorable experiences include a visit by a large school of dolphins around the ship on Midsummer's Night, the last sunset for several weeks as we crossed the Arctic Circle, and the magnificent views as the JCR pushed through the loose pack ice of the Fram Strait in brilliant midnight sunshine. Apart from our adventures at sea, we also paid two splendid visits to the science station at Ny Alesund in Svalbard. This is a collection of international science bases surrounded by a vast wilderness only to be ventured into by those well armed against the attentions of curious polar bears! In 2002 Ny Alesund was the venue for the most northern and least reported match of the World Cup. Sad to say the SAMS team was soundly beaten 3-nil by the Norwegian locals! We made up for this minor disappointment by taking the JCR further north than she had ever been, as we sampled the Yermak Plateau, north-west of the islands of Svalbard.

This cruise was blessed with superb weather. For those who had taken part in the first Northern Seas cruise to the North Atlantic in 2001, this was a welcome change! Having completed the Arctic work, the long journey back to Stornoway began. Half-way home we revisited the Sula Ridge and, much to the relief of the lander team, recovered the photo lander after its three week deployment.

The cruise was a great success thanks to everyone's hard work and the skill, seamanship and polar experience of the ship's crew and captain, Chris Elliott.



TOP: Early morning recovery of the photolander after 3-week deployment on the Sula Ridge.

BELOW: Scientists and crew prepare to recover the seabed lander in Kongsfjord.

Now back in the laboratory everyone is busy sifting through the information gathered and sorting out the vast collection of samples. The insight this cruise gained into the Arctic environment, integrating the different perspectives of geologists, chemists, biologists and physicists, will help us to understand and monitor the Northern Seas and ultimately predict the possible impacts of climate change. ●

My PhD Project

Zooplankton to the rescue?

The ups and downs of an open-ocean lifestyle

Toby Jarvis, SAMS/UHI

The term ‘zooplankton’ refers to any aquatic animal unable to swim horizontally against the prevailing current (from the Greek, ‘planktos’, meaning drifting). Many species can, however, control their vertical position in the water column quite substantially. A remarkably common pattern of vertical movement in the zooplankton world involves swimming up into the food-rich surface layers of the water column at night, and down into the dark, relatively foodless depths during the day. This is known as diel (daily) vertical migration, or DVM for short. DVM is generally believed to be a trade-off between eating and being eaten: the risk from predators is greater in the sunlit surface waters, so zooplankton avoid this layer by day, hiding out in the safer depths where they adopt the philosophy ‘better hungry than dead’.

Why should this be of interest, you ask? Well, the answer is one of scale. It has been estimated that, over the whole of the world’s oceans, roughly a billion tons of zooplankton swim into the surface layers each and every night, only to descend again at dawn. The interesting story is this: a proportion of the food eaten at the surface at night is released at depth during the day through excretion, defaecation and respiration. This food contains important elements such as carbon which, for the most part, originated in the atmosphere. If taken sufficiently deep, these elements will be stored in the watery depths for substantial periods of time (maybe thousands of years). The DVM of these unassuming creatures might therefore be helping to reduce atmospheric concentrations of carbon dioxide, which, as we all know, is the primary cause of the dreaded ‘greenhouse effect’.

So will it be zooplankton to the rescue? It has actually proven surprisingly difficult to establish this. In 1997, it was suggested that simply measuring the dawn/dusk difference in the body carbon content of individual migrants would provide the necessary information. In 1999, three very different study sites were chosen for field trials of this technique: the Clyde Sea in Scotland, the Sargasso Sea off Bermuda, and Doubtful Sound in New Zealand. A year-long time-series study in the Clyde Sea built on a rich history of zooplankton studies in this region, most notably those of the Scottish Marine Biological Association since 1894. A three-month visit to Bermuda, funded by a SAMS bursary and the Graduate Internship Program at the Bermuda Biological Station for Research, enabled me to test the technique in one of the most heavily documented oceanic environments in the world. A two-month visit to Fiordland in New Zealand, funded by the Link Foundation/Anglian Water Fellowship Award, brought the technique to a remote and beautiful corner of the world to test its applicability even further.

These field trials revealed a variety of interesting results. It was found that the nature of DVM, especially in the Clyde Sea, was variable and often difficult to interpret with the conventional sampling methods used. This resulted in an inability to apply the technique satisfactorily as originally hoped. However, the wealth of biological and physical information gathered, in conjunction with simple modelling considerations, has provided new insights into the nature and global significance of DVM and our ability to quantify this significance in future studies. The use of acoustic techniques in the Clyde Sea, for example, revealed exciting new information regarding the behaviour of copepods and krill at this site, and highlighted the usefulness of acoustic instruments in the study of zooplankton in their natural environment. While we can be sure that zooplankton DVM will indeed be helping to reduce the levels of greenhouse gases, the high levels of individual variability in the physiology and behaviour of individuals have shown that a species-specific approach is required for us to be able to quantify its importance.

Toby Jarvis is a final year SAMS/UHI PhD student working under the supervision of Dr. Geraint Tarling (formerly SAMS, now British Antarctic Survey), Prof. Jack Matthews (SAMS), and Dr. Graeme Hays (University of Wales, Swansea). Toby has nearly completed the write-up of his thesis and will hopefully be one of the first UHI students to obtain a PhD.

ABOVE: Krill – here *Nyctiphanes australis* from New Zealand - in various stages of maturity.

ABOVE: *Calanus finmarchicus* – the most common zooplankton species in the North Atlantic.

Obituary: Jane Foster - Marine Geochemist

Born Liverpool, 24 January 1966; Died Oban, 18 July 2002.

Dr Tracy Shimmield, SAMS

In July of this year we were all saddened by the premature death of Jane Foster. Jane will be sorely missed in the marine science world locally, nationally and internationally.

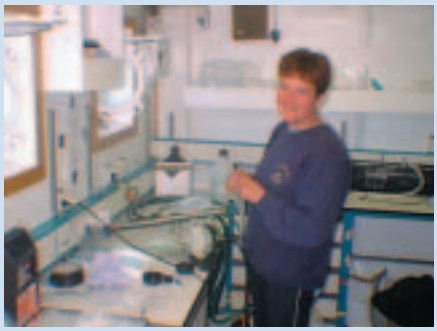
Jane's scientific career started in 1985 at Edinburgh University where she studied geology and gained a B.Sc. (Hons.) degree. She remained at Edinburgh for the following two years working in the geology department with her interest in geochemistry eventually taking her back to university to complete an MSc in Geochemistry at the University of Leeds in 1993. After gaining her masters Jane returned to Edinburgh University to work for Graham Shimmield and Brian Price on the Land Ocean Interaction Study - Shelf Edge Study. This marked the beginning of her sea-going career, an aspect of her work at which she excelled and which she enjoyed immensely, eventually working in many of the world's oceans.

In 1996 Jane moved to Oban as Graham Shimmield's research assistant working for NERC at Dunstaffnage Marine Laboratory. Here her scientific career broadened and she studied the geochemistry of sediments off SW Africa (IMAGES), worked within the Atlantic Database for Exchange Processes at the Deep Sea Floor and the Baltic Sea Study. Besides the many national and international scientific programmes, Jane was actively involved in the core strategic science within both the Centre for Coastal Marine Science and – after joining SAMS in August 2001 – the SAMS Northern Seas Programme. At SAMS Jane was an invaluable member of the geochemistry group participating in deep-sea cruises, presenting scientific results at national and international conferences and publishing her research findings in peer reviewed journals.

Jane lived life to the full and found happiness and fun in all that she did - including her work. She was a great person to have at sea in good or rough weather. She worked hard while keeping everyone amused with witty anecdotes; but woe betide the person that took up the Scrabble or Monopoly challenge, as there was no mercy and Jane took no prisoners! Back on land she was a member of the social club and was always the first to offer to help arrange the many and varied fun evenings that are a part of SAMS. These ranged from *It's a Knockout* and fancy dress parties to Autumn Balls.

Jane's death from cancer came all too suddenly. But true to form, Jane's sense of humour was evident to the end.

The marine community has lost an excellent scientist. Friends and colleagues have lost a great friend and a truly lovely person. But Jane left us all with some wonderfully happy memories which will remain with us always. ●



Scottish Marine Group

Postgraduate Student Presentations

27 FEBRUARY 2002 AT THE UNIVERSITY OF ABERDEEN

It was one of these grey and wet Scottish winter days when a group of marine scientists – many of them postgraduate students – assembled at Aberdeen University for the traditional SAMS prize meeting. Every year, SAMS organises a meeting for postgraduates to give presentations about their research, and awards a prize of £100 to the best oral presentation. The Scottish Environment Protection Agency (SEPA) joins this event and very kindly sponsors a prize for the best visual presentation. This year the judges took a long time to pick the winners due to the outstanding performance of so many of the young speakers. Presentations covering the entire breadth of marine science were given by Lindsay Wilson (University of St Andrews), Yasser Qureshi (The Robert Gordon University), Hector Lizarraga (University of Aberdeen/FRS), Rebecca Dean (SAMS/UHI), Jens Rasmussen (University of Aberdeen/FRS) and the two eventual winners Richard Corner (University of Stirling) and Colin MacLeod (University of Aberdeen). Summaries of the two winning presentations are provided on the following two pages.

Thanks are due to Dr Selina Stead from the Department of Land Economy for organisation of the day on the ground, and of course to Dr Hamish Mair from Heriot-Watt University, who convenes and organises all Scottish Marine Group meetings. ●

SAMS PRIZE FOR BEST POSTGRADUATE PRESENTATION

Nutrient Loading at a Fish Farm using an Adaptive Feeding System

Richard Corner, Institute of Aquaculture, University of Stirling

When I arrived in Scotland two years ago to start a PhD on the environmental benefits of using adaptive feeding systems in the cage culture of Atlantic salmon, *Salmo salar*, I knew little about fish farming and even less about the high feeling that surrounds the issue. Initial concerns, that there might be little new to discover about the environmental impacts of aquaculture, abated when I realised that much of the published research was fairly old and did not evaluate modern technology and husbandry techniques.

While hand feeding still dominates the production of Atlantic salmon in Scotland, adaptive feeding systems are increasingly being used to improve food conversion ratios and thereby reduce costs. But do these new feeding systems also bring environmental benefits? Adaptive feeding systems provide the optimum level of food that the fish require and should thus result in reduction of particulate waste - especially uneaten food pellets - released from cages.

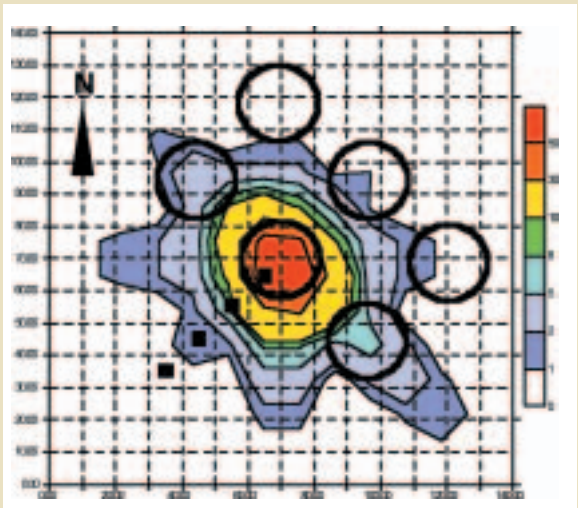
This study investigates the flow of feed, faeces and particulate matter from a cage to the seabed at a farm site at Portavadie on Loch Fyne that uses an adaptive feeding system. A series of sediment traps were deployed at increasing distances from a 22 m circular cage for one tidal cycle. The traps were sampled every three days. Hydrographic data was collected over the same period.

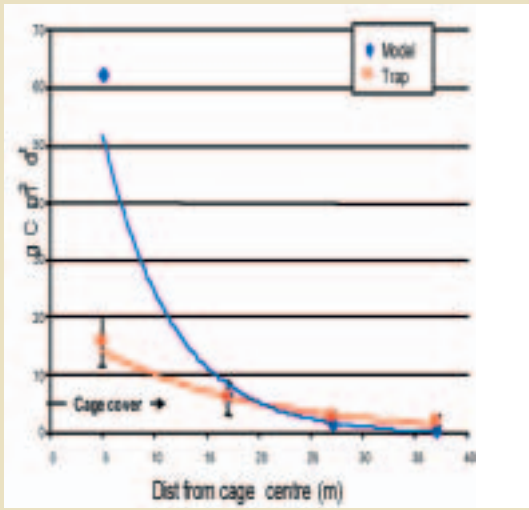
To-date the study has shown that the amount of carbon reaching the seabed does not vary significantly over the two-week sampling period. This is not very surprising as fish biomass and feed quantities change very little over two weeks. Comparisons between samples collected in February and October, when fish biomass had increased significantly, are currently under way.

Carbon was found to decrease exponentially with distance from the cage centre. There were statistically significant differences between samples from under the cage, 5 m distance, and all remaining sample sites. Variability in carbon content also decreased with increasing distance from the cage centre, which highlights the patchy nature of particulate settlement under and around cages. Mean carbon sedimentation rate 25 m from the cage edge - while low at 1.99 gC m^{-2} d^{-1} - was still more than seven times higher than background levels, which suggests that cage outputs continue to influence the seabed beyond 25 m.

The results from this study are used in the testing and validation of computer models. Particulate tracking models are now regularly used to assess the likely effects of fish farming. The DEPOMOD model is frequently used both by regulators and decision-makers. Using the Institute of Aquaculture's own spreadsheet model, the results from this study suggest that the model overestimates nutrient loading directly beneath cages. Further validation is under way and includes comparisons with 'hand fed' sites, an assessment of nutrient deposition relative to feed input and fish growth, and a benthic survey, all of which is required to fully assess the benefits of using adaptive feeding systems. ●

Richard Corner is a second year PhD student at the University of Stirling, working under the supervision of Trevor Telfer (Stirling), Donald Baird (Stirling), James Deverill (Akvasmart), and Kenny Black (SAMS). His project is funded by a NERC Case Award and Akvasmart Limited.





ABOVE: Sediment traps for collection of waste feed faecal material and particulate matter.

RIGHT: Distribution of carbon sedimentation rates over one tidal cycle from a sediment trap study.

FAR RIGHT: Comparison of model to sediment trap results.

SEPA PRIZE FOR BEST VISUAL PRESENTATION

What do Beaked Whales eat?

Colin D. MacLeod, UNIVERSITY OF ABERDEEN

The beaked whales are an enigmatic family of oceanic cetaceans and are amongst the least known of all mammals. Despite making up around one quarter of all whales and dolphins, little is known about the biology of most beaked whales, and several species have never been seen alive.

I am studying the ecology of the six beaked whale species that are found in the North Atlantic as part of a PhD in the Zoology Department at Aberdeen University. The first step in this study is to understand what beaked whales eat. This is not an easy task as beaked whales are deep-divers, that have been recorded to remain under water for over an hour and to dive to depths of 1,500 m in search of food. The most readily available source of information on the diet of beaked whales comes from analysis of the stomach contents of animals that wash up dead on the shore. Most of this information relates to only two species, the northern bottlenose whale and Cuvier's beaked whale. There is, furthermore, some information on stomach contents of a number of *Mesoplodon* species, such as Blainville's beaked whale.

My work focuses on comparing data from stomach contents analysis within and between species to see what this tells us about beaked whale ecology. So what does such a comparison show? Firstly, beaked whales take a wide variety of deep-water squid and fish, suggesting that they are generalists and consume pretty much any prey that is locally abundant in the deep oceans. Secondly, *Mesoplodon* species consistently contain smaller prey – mostly squid weighing less than 500 grams – than either Cuvier's beaked whales or northern bottlenose whales. Finally, Cuvier's beaked whales and northern bottlenose whales not only consume the same prey species, but also show a definite preference for the same size of prey; both species commonly containing squid estimated to weigh over a kilogram. This means that these two species could compete with each other for food. To reduce this competition, however, they inhabit different parts of the North Atlantic: northern bottlenose whales are found in colder areas, such as the waters of the Atlantic Frontier, the Shetland-Faroes Channel and the Norwegian Sea, while Cuvier's beaked whales live in warmer waters, such as the Bay of Biscay, the Mediterranean and around the Canaries. *Mesoplodon* species in contrast do not compete with either northern bottlenose whales or Cuvier's beaked whales because they target smaller prey. This allows *Mesoplodon* species to coexist alongside the other two species. Sowerby's beaked whales, for example, are found alongside northern bottlenose whales in colder waters in the North Atlantic, while Blainville's beaked whales inhabit the same warmer waters as Cuvier's beaked whales.

It is, however, important to understand that stomach contents analysis only reveals the last meal that a whale ate. We are currently not in the position to decide whether this last meal accurately represents long-term dietary preferences. To explore this problem, I am preparing to analyse the stable isotope ratios in the bones of beaked whales, and to compare the results to stomach contents analysis. If stomach contents provides reliable and representative information on the general diet of beaked whales, then stable isotope ratios of their bones should display very similar patterns to stomach contents data.

I am planning to conclude this project by relating diet to habitat preferences. Cuvier's beaked whales and northern bottlenose whales might be expected to prefer similar habitats, while *Mesoplodon* species could prefer different habitats where their smaller prey is more common. ●

ABOVE: A newly born Blainville's Beaked Whale *(Mesopodon Densirostris)*, one of the six beaked whale species in the North Atlantic.

ABOVE: Cuvier's Beaked Whales, such as this adult female, tend to eat large squid.

ABOVE: Blainville's Beaked Whales tend to eat relatively smaller deep-water squid and fish.

The European Centre for Marine Biotechnology

Dr Jo Oliver, SAMS

For the past two years I have watched from a distance as the concept of a European Centre for Marine Biotechnology (ECMB) took shape, never thinking that it would fall to me to move it from concept stage to reality. Although undoubtedly the road ahead will be steep and have its fair share of potholes, I am delighted to be leading a project that involves three areas I hold dear, namely the marine environment, biotechnology, and the commercialisation process.

Scotland has a thriving biotechnology sector, well able to hold its head up in Europe and the wider world, and yet to date we have paid little attention to our richly resourced coastline, offshore deep-water sites and sea lochs. Marine biotechnology is too often interpreted to mean biotechnology as applied to the marine environment and as a consequence often appears to be irrelevant to those operating outside the field of marine science. In an era when biotechnology will impact on each and every one of us, I hope to turn this definition on its head and show that marine biotechnology is much more about deriving biotechnology based products and solutions from the sea; learning from marine flora and fauna of ways to tackle everyday issues from healthcare to agriculture. Throughout, we need to be ever mindful that we are only temporary guardians of this vast, untapped, natural resource, and our pursuit of answers must have no lasting environmental impact.

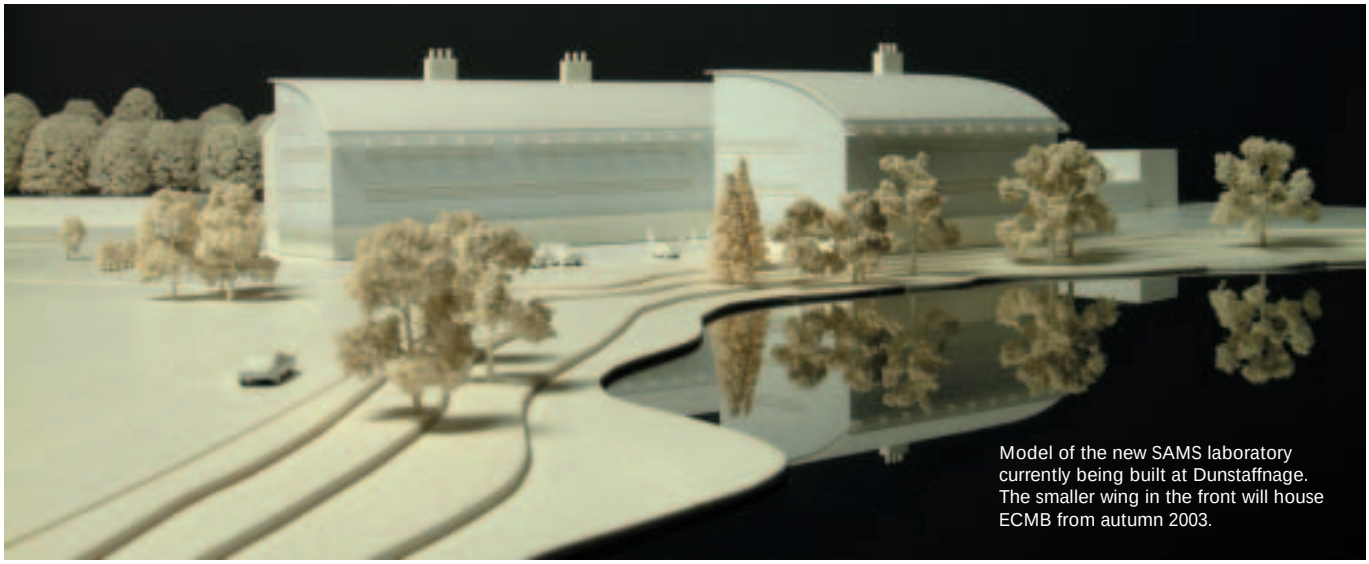
As ECMB takes shape over the next two years it will emerge as both a company in its own right, conducting its own commercial marine biotechnology programme, and as a state-of-the-art incubation facility for home-grown and incoming organisations operating in and related to the field of marine biotechnology.

The scientific work programme will most likely be governed by the elements of the existing SAMS programme that are most closely aligned with biotechnology, in addition to the superb natural resource available. When considering these two factors it is perhaps not surprising that exploitation of high-value products from micro- and macroalgae comes readily to mind, and work has already been initiated in these areas working with groups located elsewhere in Scotland.

It is now well recognised that business incubators greatly increase young company survival rate, providing a supportive environment from which to grow. It is intended that the ECMB will provide commercial, incubation-style laboratory and office accommodation, attracting organisations wishing to operate from the centre of a marine focused cluster. A tailored package of business support will be available to all tenants, along with an extensive range of support services. Moreover groups will have access, on a pay-as-you-go basis, to the well equipped scientific facilities, thereby reducing, and possibly negating, the need for expensive capital outlay. It is intended that graduation space will also be available in the area allowing companies to plan for the long-term.

ECMB will actively encourage networking between tenant organisations and will seek to form strategic alliances with groups operating from the site and in complementary geographic regions, within Europe and further afield. The aim will be to establish in each case a multi-layered relationship where, as appropriate, teaching, research, and commercial collaboration can be nurtured. The longer-term aim is to position ECMB as part of a network of facilities, with individuals, groups and companies moving freely between centres located across the globe, thereby greatly facilitating market penetration and further enhancing collaborative opportunity. ●

Dr. Jo Oliver is the newly appointed ECMB Project Executive and a member of the SAMS directorate.



Model of the new SAMS laboratory currently being built at Dunstaffnage. The smaller wing in the front will house ECMB from autumn 2003.