



SCOTTISH  
ASSOCIATION  
*for* MARINE  
SCIENCE

# ANNUAL REPORT 05-06



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# CONTENTS

page

■ Directors Introduction	01
■ Northern Seas Programme (NSP)	03
■ Physics, Sea Ice and Technology Department	10
■ Biogeochemistry and Earth Science Department	13
■ Ecology Department	16
■ Microbial and Molecular Science Department	20
■ National Facilities	23
■ SAMS Higher Education	25
■ SAMS Membership Activities	26
■ SAMS outreach Activities	27
■ Postgraduate research projects	29
■ Publications	31
■ Research Grants and Contract Income Received	37
■ Staff at 31 March 2005	41



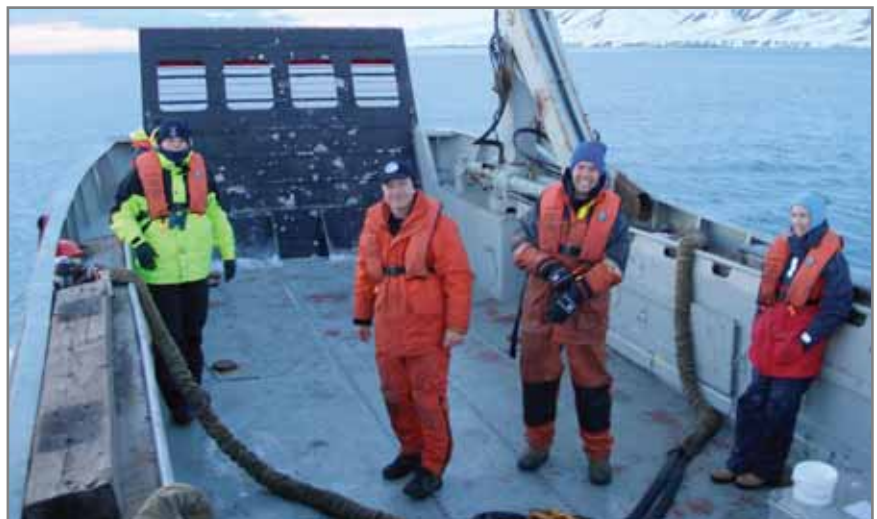
# DIRECTOR'S INTRODUCTION

It is a great pleasure to record the events of 2005-6 for the Association. Having completed all the major capital building work and science audits of the two previous years, this promised to be a year of consolidation and future planning. In this first year of the new SAMS President, Sir John Arbuthnott, SAMS has a major opportunity to play a pivotal role in marine science strategy in Scotland at both an academic and strategic level. Our academic contribution was recognised by a significant award of £5.6 million to SAMS as part of the £11.4 million Addressing Research Capacity (ARC) award to the UHI Millennium Institute. The Scottish Funding Council (SFC), Highlands and Islands Enterprise and European Regional Development Fund are all contributing, allowing SAMS to recruit 14 academic and research fellowship posts, 10 technical staff and to initiate a major refurbishment programme for offices and the procurement of much needed analytical instrumentation. This is an amazing investment in new academic talent in marine science in Scotland, and we have been delighted with the response to the advertisements. Our new staff are drawn from six nationalities, and from countries as far away as Canada and Australia.

At a strategic level, the opportunity for Scottish universities and research institutes to work closely together to develop marine science is now well underway through a process known as "pooling". Under the chairmanship of Professor Ian Boyd from the Sea Mammal Research Unit at the University of St Andrews, who is also a SAMS Council member, an innovative programme of

research coordination and cooperation is being proposed to the SFC. The outcome of the funding bid, likely to exceed £8 million, will be known early next year. In the meantime, SAMS is also a partner in the approved pool for environmental geoscience, known as the Scottish Alliance for Geoscience, Environment and Society (SAGES), coordinated by the University of Edinburgh.

Across the UK, 2006 has seen the emergence of discussion on the proposed Marine Bill, which sets out to tackle the vexed questions of spatial planning, natural resource usage, impact of climate change and data management. The issues of devolution loom large in such discussions, and SAMS is playing a full role in assisting the Scottish Executive Environment and Rural Affairs



On board the landing craft of RRS *James Clark Ross*. Left to right, BAS Medical Officer, Prof Graham Shimmiel, Dr Paul Provost, Ms Suzanne Cox

Following the strategic theme, this last year has seen a great deal of work in preparing a new core strategic programme submission to NERC, to follow the current Northern Seas Programme that ends in 2007. Unlike the situation of 2001 with individual NERC marine Centres and Collaborative Centres working on their own programmes, for the next quinquennial cycle, all seven marine centres will deliver a coordinated programme of activity under the banner "Oceans 2025". This will represent the first time that NERC strategic science has been delivered in this way. The reward should outweigh the challenge of operation and delivery.

Department (SEERAD) in assessing how such measures may be implemented to good effect across Scotland. A subtext for these discussions is the potential launch of the first Marine National Park, of which one candidate site is the Firth of Lorne and Sound of Mull, right on our doorstep. SAMS continues to offer impartial and detailed strategic advice to the discussions that are underway in public and government venues.

# DIRECTOR'S INTRODUCTION

Although not strictly within the reporting year, I am writing this Introduction at the end of one of the most successful scientific meetings ever hosted by the Association. The 2006 Challenger Society biannual conference for UK and European oceanographers took place over 5 days at the Corran Halls and the Dunstaffnage laboratories. The previous occasion that the Association hosted this meeting on its premises was in 1946, immediately after the war, at Millport! Over 270 delegates enjoyed a fantastic programme of science and social events which has really enhanced the reputation of the Association, its staff, and members. Events such as this make the many trials of everyday activity worthwhile, and again, make me realise how fortunate I am to occupy the position of Director in this dynamic, enthusiastic and successful organisation.

In commending this Annual Report to you, I would like to pay special thanks to the members of SAMS Council who give voluntarily of their time and expertise, to assist in the governing of the complex, challenging, but hugely rewarding organisation that is the Scottish Association for Marine Science.

Graham Shimmiel



Challenger Society delegates at the 2006 conference hosted by SAMS.

# NORTHERN SEAS PROGRAMME NSP





# NORTHERN SEAS PROGRAMME NSP

This 5 year NERC-funded programme, which ends in 2007, has provided new insights into environmental processes acting in northern waters. Some of these have direct relevance to our understanding of water circulation in the N Atlantic – a key factor controlling the climate of western Europe. Others attempt to trace the source and fate of anthropogenic pollutants entering the Arctic, as well as natural processes that lead to the burial and/or recycling of carbon. Closer to home, detailed studies on west coast sea lochs have greatly improved our understanding of how tidal energy propagates within complex lochs with several shallow sills. Comparison of

local and regional scale patterns in rocky shore communities has shed light on the role of 'bottom up' versus 'top down' processes in determining these patterns. Finally, the importance of the exact composition of nitrogen sources entering our seas, in determining the growth of phytoplankton, has been elucidated.

## Ellett line hydrographic section

In October 2005 SAMS surveyed the extended Ellett line, from Scotland to Iceland, on one of the last cruises of RRS *Charles Darwin*. Besides making standard observations, the cruise provided data

collection and training opportunities for students from Britain, France, Portugal, the Faroes and Thailand in disciplines ranging from iron biogeochemistry to cetacean monitoring. The cruise demonstrated that Eastern North Atlantic Water continues to predominate in the surface waters of the Rockall Trough, with the most recent observations being the warmest and

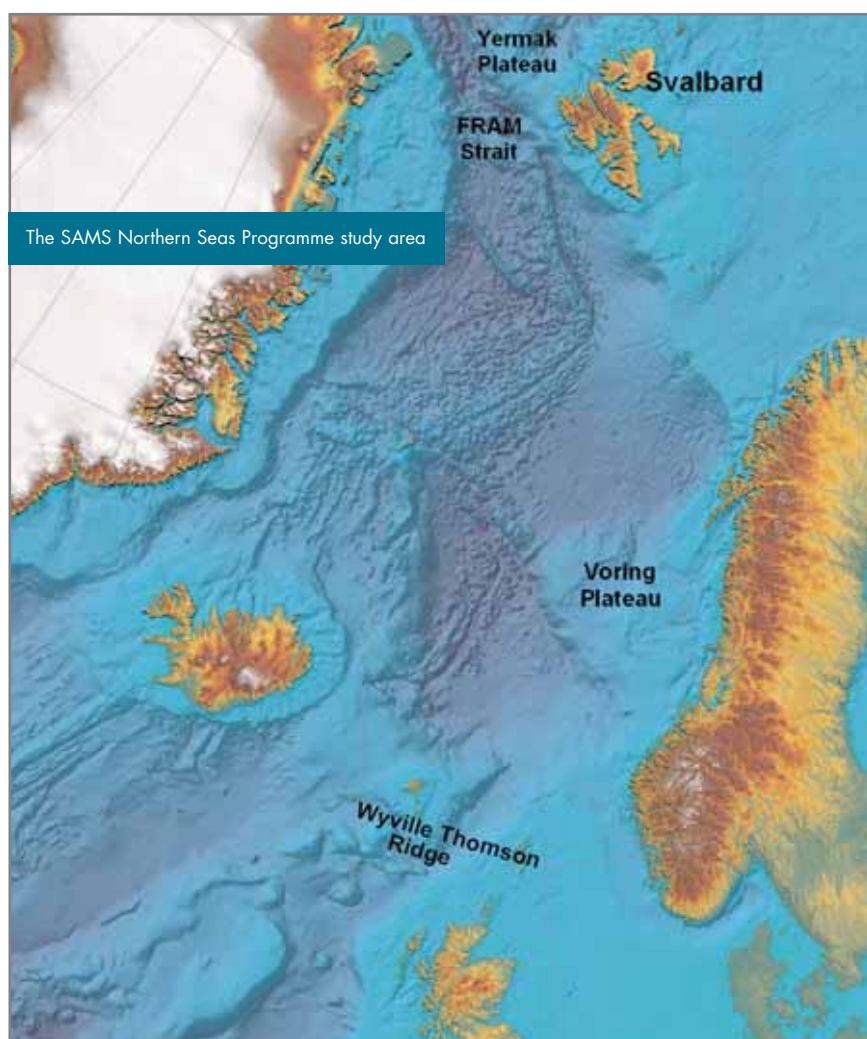


SAMS scientists on RRS *Charles Darwin* at Rockall

saltiest to date (relative to the seasonal mean). Amongst the highlights of the cruise were the confirmation of acorn worms in the muds of the Faroes - Shetland Channel, the observation of a large number of sperm whales in the Rockall Trough, and a swath bathymetry survey which revealed the complicated structure of a gully that entraps deep Arctic water flowing south across the Wyville Thomson Ridge.

## Faroes - Shetland Channel

A joint experiment with POL and NIOZ in the Faroes - Shetland Channel revealed the existence of deep (600m) tidal bores on the continental slope at the interface between waters of Atlantic and Arctic origin. These findings were reported at the American Geophysical Union meeting in February 2006.



# NORTHERN SEAS PROGRAMME NSP

## Fjords

Fundamental research into mixing processes in restricted coastal systems (sea lochs, or fjords) has challenged the accepted wisdom that those systems with strong tidal currents at their entrance have limited vertical mixing in the inner reaches away from the entrance sills. A combination of detailed observations and high resolution non-hydrostatic numerical modelling (with the University of Plymouth) revealed the excitation of a significant, propagating internal tide in Loch Etive, a system with very high currents at the entrance. The implications of this result will apply to many other fjordic systems thought to have very weak internal tides.

Three-dimensional numerical modelling of the water circulation in Loch Torridon, in collaboration with FRS, Aberdeen, revealed the influence that sill regions can exert on the circulation and mixing processes throughout fjord systems. The sill introduced complexity (e.g. clockwise and anti-clockwise gyres) into the residual circulation, with implications for exchange of the system. Barotropic tidal energy loss at the sill was accompanied by an internal tide that propagated seaward along the loch basin and the development of lee waves on either side of the sill that propagated upstream when tidal currents slackened. The model also demonstrated the temporal and spatial variability of mixing in the fjord.

*M Inall, T Sherwin and P Gillibrand*

## The salinity: $\delta^{18}\text{O}$ water relationship in Kongsfjorden, western Spitsbergen, Svalbard

The application of oxygen isotope measurements for differentiating between the two main sources of freshwater - meteoric (atmospheric) and sea-ice



The landing craft of the RRS *James Clark Ross* sampling water and glacial ice in Kongsfjorden, western Svalbard.

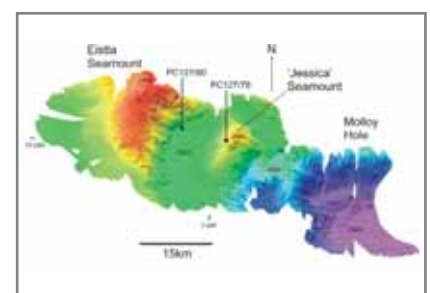
meltwater has been thoroughly demonstrated. The latitudinal variation in the value of  $\delta^{18}\text{O}$  for meteoric water, caused by temperature and distance from the evaporation site, makes  $\delta^{18}\text{O}$  an ideal tracer to identify high latitude freshwater sources. Finally, salinity:  $\delta^{18}\text{O}$  mixing lines are particularly valuable in high latitude locations as they can be used to identify freshwater sources within mixed coastal waters. Stations in the inner basin of Kongsfjorden western Svalbard were sampled for oxygen isotope ( $\delta^{18}\text{O}$ ) composition of glacial ice and seawater. Temperature, salinity and  $\delta^{18}\text{O}$  profiles were used to describe the seasonal evolution of hydrography and to construct a salinity:  $\delta^{18}\text{O}$  mixing line in an area with inputs of freshwater and marine Atlantic Water. The resulting salinity:  $\delta^{18}\text{O}$  relationship was found to be  $\delta^{18}\text{O} = 0.43S - 14.65$ . The Kongsfjorden data provide a northern latitudinal limit for mixing lines in the Northwestern European

coastal system.

*S Cox, J Howe, T Shimmield, F Cottier (SAMS) and W Austin (University of St Andrews)*

## Acoustic seabed mapping and piston coring in western Svalbard and the Fram Strait.

This project examines sediment pathways and the signal of climatic amelioration following the last ice age from high-latitude marine sediments, using sediment



'Sun-illuminated' multibeam bathymetry, viewed from the south, of the basin to the east of the Eisila seamount, Molloy Ridge, Fram Strait. The basin is bounded at its eastern extent by a small un-named feature, informally termed the 'Jessica' seamount. Locations of the two piston cores, 78 and 80 are indicated.

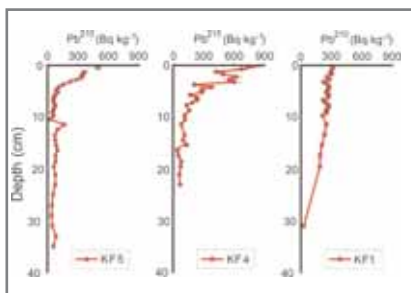


texture and geochemistry. Cruise JR127 surveyed and sampled the Eistla and another unnamed seamount (dubbed 'Jessica') in the southern sector of the Molloy Ridge, Fram Strait. These data will reveal insights into the high-latitude depositional setting and sediment pathways on an active oceanic ridge in a gateway setting. Further sampling was also undertaken in Kongsfjorden and Krossfjorden.

*J Howe, S Cox and C Wilson*

## Sediment accumulation and mixing rates along the Svalbard margin

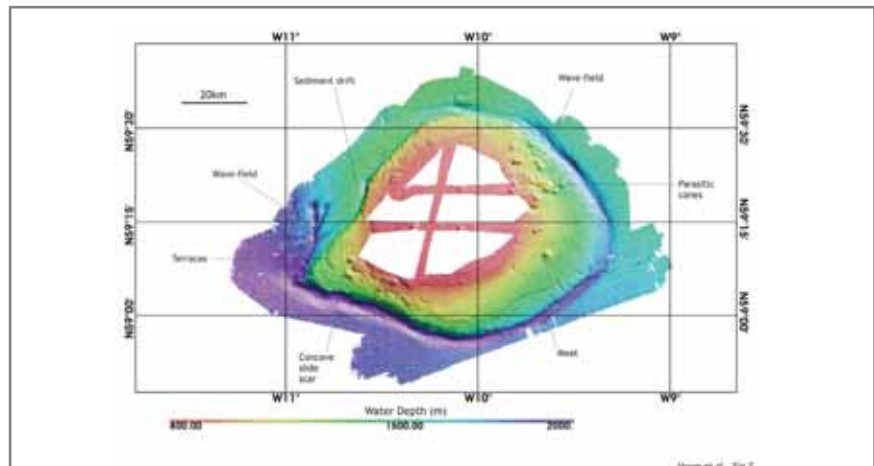
$^{210}\text{Pb}$  activity profiles can be used to assess the rate of sediment accumulation and the extent and depth of mixing within sediment. Both of these processes are important in understanding the transport of sediment, the biogeochemical cycling of carbon and metals and the redistribution of pollutants within the marine environment. To study these processes within the western Svalbard margin, we have analysed cores which lie on a north-south transect, Yermak Plateau (YP), western Svalbard Margin (KF4), Bear Island Fan (BIF) and Voring Plateau (VP) and in addition we have considered an



$^{210}\text{Pb}$  activity profiles along a depth transect from Kongsfjorden (KF1) to Fram Strait (KF5).

STATION	CO-ORDINATES		Waterdepth (m)	Sediment accumulation rate (g/cm <sup>2</sup> /y)	Average liner accumulation rate (mm/y)
VP	N67 12.85	E06 06.54	1433	0.02	0.3
BIF	N73 39.61	E13 46.97	1440	0.02	0.3
KF4	N78 58.40	E06 42.47	1385	0.1	1.4
YP	N80 45.02	E07 38.72	922	0.05	0.7
KF1	N78 57.46	E11 54.48	355	0.15 - 1.3	1.6 - 13.6
KF5	N78.56.85	E05 17.31	2465	0.02	0.5

Table 1: Sediment accumulation rates for cores from western Svalbard.



New seafloor survey image of Rosemary Bank seamount. White areas were not covered by the ship's track.

east-west depth transect, Kongsfjorden (KF1), western Svalbard Margin (KF4) and Fram Strait (KF5).

The results indicate that the sediment accumulation rates are higher at the northern stations and that there is a decrease in sedimentation rate with depth. The sedimentation rate in Kongsfjorden is high and variable. These data have been used to construct chronologies for the cores for the western Svalbard margin.

*T Shimmield*

## Seafloor processes around Rosemary Bank seamount, North Atlantic Ocean

Rosemary Bank is a tear-drop shaped seamount of volcanic origin. The seamount is 70km in diameter and situated in water depths of between 300-2300m, 120km west of the UK mainland. A new seafloor survey from the British Antarctic Survey has been combined with pre-existing commercial oil company data including oceanographic measurements, sub-seafloor seismic reflection profiles and seabed core samples. The spectacular new survey data show features such as

# NORTHERN SEAS PROGRAMME NSP

ancient volcanic cones, slide scars and the terraced slopes of the bank. Deep-ocean currents flowing around the base of the seamount have mounded and sculpted the seafloor around the entire seamount, including generating two fields of giant sediment waves. Current meter mooring and oceanographic measurements indicate that the western flanks of the seamount are strongly influenced by Labrador Sea Water flowing northwest.

J Howe

## Predicting the scale of species patterns in coastal communities

A major aim of the Northern Seas Programme has been to identify the chief causal factors structuring biological communities along large-scale environmental gradients. We chose to address this issue by exploiting the ready accessibility of intertidal and shallow water habitats to collect data on patterns of biodiversity over a range of spatial scales, and to relate these data to patterns in remotely sensed environmental variables such as temperature or pelagic productivity. We concluded the collection of rocky shore data in 2005 by expanding our region of interest to eastern and southern Scotland. This large spatial dataset has allowed us to identify several important processes structuring ecosystems. As in coastal upwelling regions elsewhere in the world, highly productive areas in the region are dominated by fast-growing filter feeders such as barnacles, promoted by an enhanced food supply from the plankton. However, where local conditions favour the recruitment of the dominant grazer in

the system - the limpet *Patella vulgata*, high grazing intensity results in communities dominated by grazer-resistant species of algae, especially those forming short turfs and crusts on the rock.



Distributions of intertidal snails on the west coast of Scotland: the grazer *Littorina littorea* (upper) and the predator *Nucella lapillus* (lower).

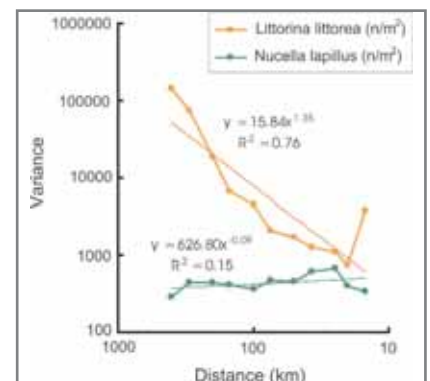
control of ecosystem structure. In open marine systems it seems that top-down control may be limited to small scale patches of high predator abundance, while bottom-up processes may result in



Understanding the effects of ecological processes acting at different spatial scales requires a knowledge of the variation occurring at these scales. Using our spatial dataset we adopted an approach prevalent in analysis of patterns in the open ocean - the concept of 'scale variance'. Statistical techniques allow us to quantify the differences between regions of differing sizes. Analysis of the scale variance of all the species in our 5-year study indicated that most species showed the greatest variability over large spatial scales (e.g. *Littorina littorea*). In contrast, those species classed as predators had far greater small scale variability (e.g. *Nucella lapillus*). This has a very important implication for ecological

much larger scale patterns of community structure. The next five-year programme will focus on experimental manipulation to test this emerging concept.

M Burrows, L Robb and R Harvey

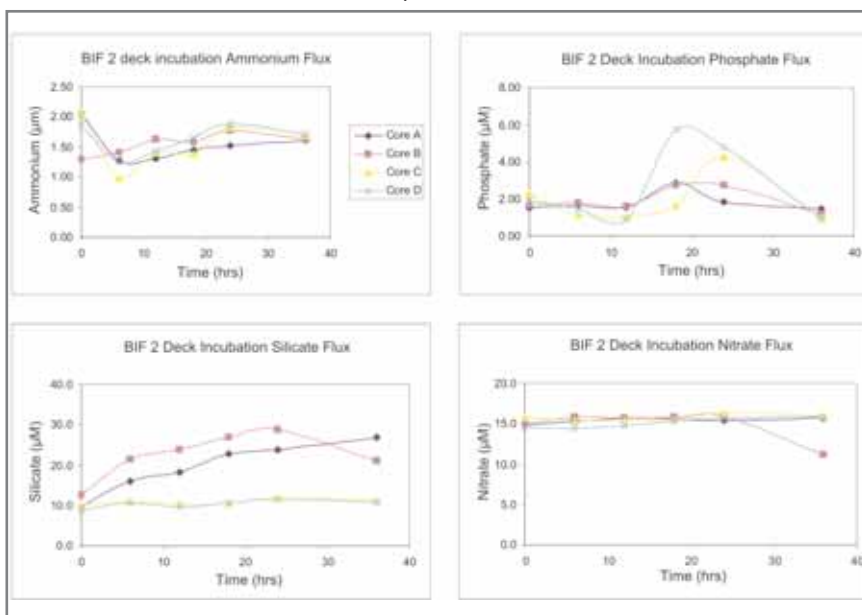


Scales of spatial variation in the grazer *Littorina littorea* and the predator *Nucella lapillus*

## Bioirrigation in Arctic Latitudes

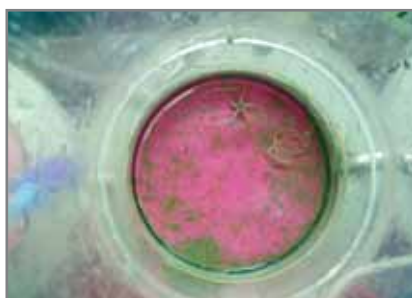
Biological enhancement of particle and solute movement in response to environmental drivers can have critical implications for the burial and remineralisation of organic carbon in the marine environment. At more northerly

latitudes, input of organic carbon is highly seasonally pulsed and it is possible that organisms show rapid behavioural responses in order to exploit this ephemeral resource. During an Arctic cruise in Sept/ Oct 2005 on the RRS *James Clark Ross*, shipboard core incubations with added fluorescent



Nutrient fluxes measured from ship-board core incubations at station BIF2 on the Bear Island Fan (uncorrected for overlying water volumes). Legend applies to all four graphs.

latitudes, input of organic carbon is highly seasonally pulsed and it is possible that organisms show rapid behavioural responses in order to exploit this ephemeral resource. During an Arctic cruise in Sept/ Oct 2005 on the RRS *James Clark Ross*, shipboard core incubations with added fluorescent



Core showing sediment surface with added fluorescent particles, and burial by animal activity.

including fluxes of nutrients, were complex and did not show linearity. Periodicity was evident in bioirrigation rates which may be of great significance in influencing organic carbon degradation rates.

The objectives of this bioturbation work complement those of the European Union funded project Coastal Ocean Benthic Observatories (COBO) which seeks to integrate innovative technologies to provide *in-situ* monitoring of coastal sediment habitats, providing information on processes, such as bioturbation and bioirrigation, and their role in regulating ecosystem function.

L Nickell and S Harvey

## Quality counts: how planktonic ecosystems respond to nutrient inputs to coastal waters

In coastal marine environments, the supply of nitrogen frequently limits phytoplankton production. Nitrogen may be introduced into surface waters from deeper water as regenerated inorganic nitrogen but may also enter in inorganic or organic form via aquaculture inputs, freshwater run-off from land or sewage discharges. These additional sources, many of which result from human activity, may perturb planktonic ecosystems leading to coastal eutrophication. The importance of inorganic nitrogen for the nutrition and growth of marine phytoplankton is widely recognised; however, the influence of organic nitrogen on the planktonic

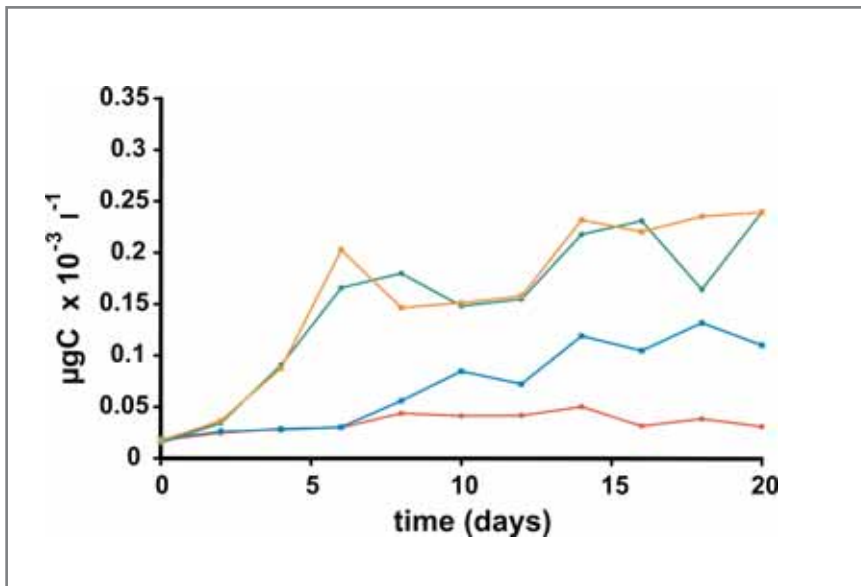


Experimental mesocosms used to test the effect of inorganic and organic nitrogen on planktonic microbial communities (Image: Linda Gilpin)

microbial community and subsequent carbon cycling in shelf seas has received less attention. We therefore investigated the effect of organic nitrogen on a coastal



# NORTHERN SEAS PROGRAMME NSP



Response of phytoplankton biomass to inorganic and organic nitrogen treatments during the 20 day mesocosm experiment. Key: orange – 50:50 inorganic:organic N; green – inorganic N; blue – organic N; red – no addition of N.

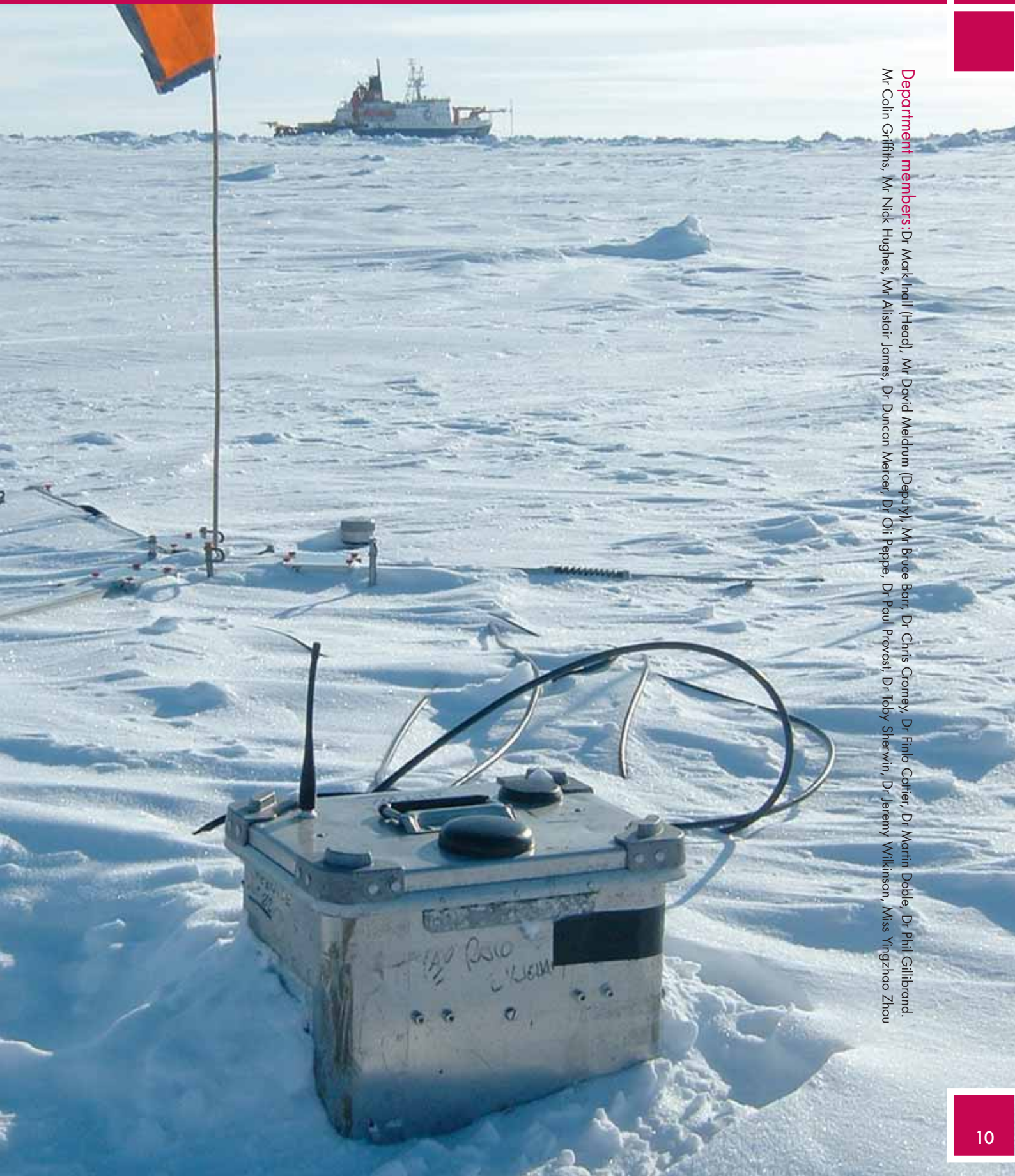
planktonic microbial community using experimental mesocosms in which both inorganic and organic dissolved nitrogen concentrations were manipulated.

We found that the chemical form in which nitrogen was available to the planktonic microbial community, either inorganic or organic, influenced species composition, succession and the efficiency of carbon incorporation into the community. Important processes governing carbon draw-down were the competition between bacteria and phytoplankton for nitrogen, and the activities of microbial grazers. In particular, phytoplankton growth was rapid when inorganic nitrogen was present, whereas organic nitrogen was used more slowly, resulting in a slower and smaller increase in planktonic carbon biomass. Inorganic nitrogen also stimulated the rapid growth of bacteria which escaped grazing control, while organic nitrogen led to a slower-growing bacterial community controlled by

grazers. A rapid succession of microbial grazers was evident but with differences in species and their contribution to biomass depending on the relative availability of the different forms of nitrogen. Overall our research shows that it is the chemical form of nitrogen, as well as the quantity, which influences planktonic microbial community structure. The response of coastal ecosystems to nutrient inputs will therefore differ depending on the quality of nitrogen present.

*K Davidson, R Leakey, E Mitchell, M Hart and Axel Miller*

# PHYSICS, SEA ICE AND TECHNOLOGY DEPARTMENT

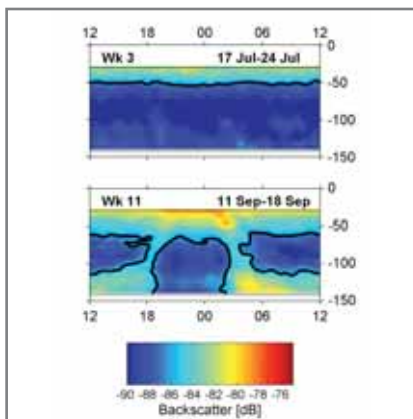


**Department members:** Dr. Mark Inall (Head), Mr. David Meldrum (Deputy), Mr. Bruce Barr, Dr. Chris Cromeey, Dr. Finlo Corfier, Dr. Martin Doble, Dr. Phil Gillibrand, Mr. Colin Griffiths, Mr. Nick Hughes, Mr. Alistair James, Dr. Duncan Mercer, Dr. Oli Pepppe, Dr. Paul Prevost, Dr. Toby Sherwin, Dr. Jeremy Wilkinson, Miss Yingzhuo Zhou

# PHYSICS, SEA ICE AND TECHNOLOGY DEPARTMENT

## Integrated Studies on Arctic Shelves

Unique data from our mooring in Kongsfjorden, Svalbard, have allowed SAMS scientists to establish the link between exchange of Arctic and Atlantic water masses and the structure of the associated zooplankton populations. In a typical day-night scenario, zooplankton will tend to ascend in synchrony at dusk and descend



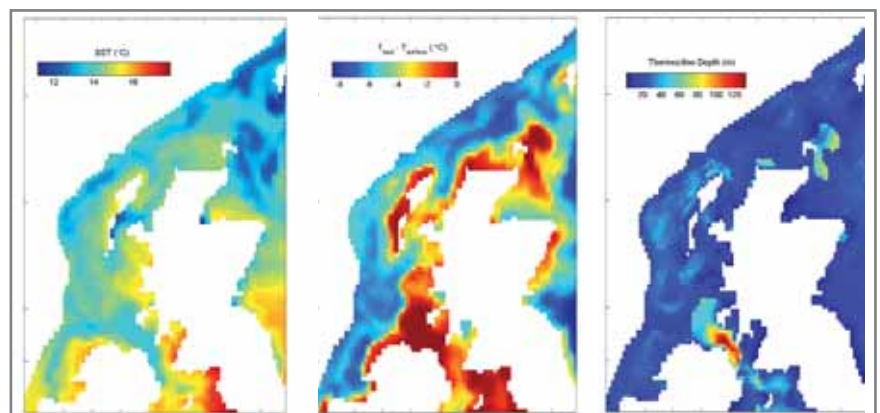
Acoustic backscatter data illustrating the change from mid-summer (Wk 3) where there is no synchronous vertical migration of zooplankton to autumn (Wk 11) when there is a synchronised ascent at 1800 and descent at 0300.

before dawn to avoid visual predators. However, acoustic measurements show that during periods of midnight sun, zooplankton show unsynchronised behaviour and undertake forays to the surface throughout the day. The Arctic winter of 2005-06 was exceptional in that there was virtually no sea ice formation in the fjords around Spitsbergen. Using data from the mooring, we are working with colleagues at the Norwegian Polar Institute and the University Centre on Svalbard to understand the climatic significance of those unusual conditions.

*F Cottier, M Inall, C Griffiths and P Provost*

## The distribution and abundance of marine mammals in relation to physical oceanographic variables in Scottish waters

Archived observations and model predictions have been assembled into a GIS database for access by colleagues at the Sea Mammal Research Unit (SMRU). Observed data comprise satellite images of sea surface temperature and chlorophyll a (courtesy of Plymouth Marine Laboratory), together with CTD profiles. Model data originating from MetOffice runs of the Proudman Oceanographic Laboratory Coastal Ocean Modelling System (POLCOMS) have been reduced



Examples of derived parameters from the POLCOMS model dataset. The three figures shown describe the predicted temperature field on the shelf to the west of Scotland on 1st August 2004: Sea surface temperature (SST, °C), surface-bottom temperature difference (°C), and thermocline depth (m). Similar derivations were made for daily predictions of salinity, density and current velocity.

into two-dimensional spatial parameters for inclusion in the database. Marine mammal distribution and abundance data collected by SMRU are being compared against the database using a tool developed by the SAMS GIS team. The tool also contains a predictive element, allowing marine mammal distributions to be forecast from environmental variables.

*P Gillibrand, M Inall and S Gontarek*

## MOEN

Within this EU project, analyses of altimeter and drifter data from the Faroe-Shetland Channel have revealed two patches of high kinetic energy located northeast of the Wyville-Thomson Ridge. The patches are caused by instabilities in the surface slope current that flows north-eastward through the channel. They are trapped by a strong southward flow of Arctic water below 500 m, and may contribute to the mixing of surface water masses originating from different ends of the channel.

*T Sherwin*

## Sea Ice Research

Three important EU programmes came to a successful conclusion this year, namely:

- GreenICE (Greenland Arctic Shelf Ice and Climate Experiment), a six-partner study, co-coordinated by SAMS, of the ice thickness distribution north of Greenland and Ellesmere Island, together with a study of paleo-ice conditions from



# PHYSICS, SEA ICE AND TECHNOLOGY DEPARTMENT

sediment cores;

- SITHOS (Sea Ice Thickness Observing System), the development of a European monitoring system for sea ice thickness and related parameters for climate change detection, environmental protection and support to sea transport and offshore operations;
- IRIS (Ice Ridging Information for Decision Making in Shipping Operations), a study of the mechanics of ridge building and ridge structure, and the relationship between ridging parameters and ice resistance forces on vessels.

On-going funded projects include:

- The NERC funded Cryosat validation programme;
- The EU funded IPY-CARE (International Polar Year - Climate of the Arctic and its Role for Europe) programme, whose role is to prepare a pan-European science and implementation plan for Arctic climate change;
- Commissioned research for the UK Hydrographic Office to update the sea ice and iceberg limit information in its North and South Atlantic summary charts; as well as updates of all sea ice sections for the Admiralty Pilots;
- The start of a new 47-partner EU Integrated Project 'Developing Arctic Modelling and Observing Capabilities for Long-term Environmental Studies' (DAMOCLES).

*J Wilkinson, N Hughes and M Doble*

## Autonomous Platforms – landers, Homer and ice tethered platforms

As part of our philosophy of moving away from ship-based observations of the ocean, we have continued development of sea-bed observatories (landers) and a unique sea-bed-resident profiling vehicle (Homer). Homer has seen further deployments in Loch Etive and the Irish Sea, and is now capable of 2-way communications with the lab via acoustic and satellite modems. This vehicle is attracting much interest because of its potential to routinely gather water column data without requiring a permanent (and vulnerable) mooring. Within NERC-IPY, we are developing novel Arctic platforms for studying fluxes of heat through sea ice and its relation to thickness changes.



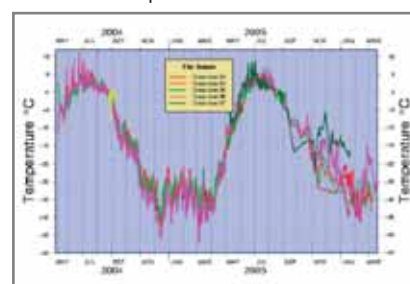
The latest miniature GPS-Iridium drifter being developed for CryoSat.

*D Meldrum, D Mercer, O Peppe, B Barr, A James and Y Zhou*

## Communications techniques

The Marine Technology group has for many years pioneered the use of satellite communications for the collection of data from ocean platforms such as drifting buoys. We have continued to be particularly active in developing the Iridium system, largely for polar applications. Iridium is unique in that it is a true global 24/7 mobile phone system, thus permitting online dial-up sessions between the polar experiment and the

laboratory for diagnostics and control – and for the downloading of large amounts of data. Currently we have four systems operating high in the Arctic Ocean, reporting a wide range of parameters that will help determine whether the Arctic ice is thinning in response to climate change, and a further platform in the Weddell Sea



Temperature data from the SAMS suite of Arctic platforms, published on the Internet in real time at [dalriada.nsm.ac.uk/php](http://dalriada.nsm.ac.uk/php).

in the Antarctic. Latest developments have exploited a new generation of miniaturised modems in a laptop-sized GPS drifter for polar use, particularly to support the CryoSat programme

*D Meldrum, D Mercer, O Peppe and Y Zhou*

# BIOGEOCHEMISTRY AND EARTH SCIENCES DEPARTMENT

Department members: Dr Tracy Shimmield (Head), Dr John Howe (Deputy), Mr Eric Breuer, Dr Tim Brand, Miss Katie Doig, Miss Cheryl Haidon, Mr S Martyn Harvey,  
Dr Angela Hallon, Miss Susan McKinlay, Dr Axel Miller, Miss Terrie Sawyer



# BIOGEOCHEMISTRY AND EARTH SCIENCES DEPARTMENT

This year, much of our fieldwork has again focused on marine processes in the Arctic, but we have continued to work up data from Arabian Sea cruises of past years and also took part in a cruise to Antarctica. In addition to the staff listed under each topic, the Department relied heavily on the commitment of the following SAMS support scientists; T Brand, K Doig, C Haidon, M Harvey, S McKinlay and T Sawyer .

## Recent deep-water sedimentation in the Antarctic region

Twelve stations in the northern Weddell Sea, Antarctica, and adjacent waters have been sampled using sub-bottom profiles, seabed camera and short box cores and multicores as part of the ANDEEP (ANtarctic benthic DEEP sea biodiversity: colonization history and



RV *Polarstern* in the Weddell Sea. Photo courtesy of Armin Rose.

recent community patterns) programme. The German icebreaker RV *Polarstern* spent three months collecting these data during 2005. The cores were studied using x-rays and particle size analysis, and by describing their sediment texture and composition, in order to determine their depositional history and thereby identify and characterise the recent and ancestral (Holocene) sedimentary

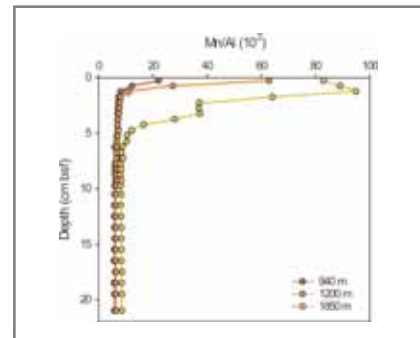
environments. Two cores from the Weddell Abyssal Plain and Bransfield Strait were examined for excess  $^{210}\text{Pb}$  activity. Six sedimentary provinces were identified: Agulhas Basin, a pelagic province; the eastern Weddell Slope, a hemipelagic and contouritic province with turbiditic input; northern Weddell Abyssal Plain, hemipelagic with evidence of recent and ancestral turbiditic input; Powell Basin, a hemipelagic and contouritic province; Bransfield Strait, hemipelagic with a sedimentation rate of  $0.8\text{mm yr}^{-1}$  indicated by the excess  $^{210}\text{Pb}$  profile; and Bellingshausen Sea, a hemipelagic and contouritic province.

*J Howe, C Wilson and T Shimmiel*

## Iron and manganese in organic-rich sediments in Oxygen Minimum Zones

Iron (Fe) and manganese (Mn) are ubiquitous components of most marine sediments. Whilst the behaviour and influence of sedimentary Fe and Mn are well constrained in truly oxic and anoxic environments, detailed biogeochemical information in organic rich, transitional suboxic environments, such as those found in Oxygen Minimum Zones (OMZ), is limited. SAMS geochemists, working with a number of international collaborators, recently presented a novel data set at the European Geosciences Union 2006 meeting. Here, sedimentary Fe/Mn biogeochemistry throughout the Pakistan margin OMZ was detailed. Through pore water modeling and sedimentary analysis, the kinetics of reactions involving Fe/Mn within the OMZ were revealed. The study

showed that under the suboxic conditions present within the OMZ, Fe/Mn minerals played a significant role in microbial



Mn/Al profiles in the sediments of the Arabian Sea at three depths.

carbon degradation. Fe and Mn were also found to greatly affect the behaviour and distribution of other important trace metals as shown in the figure.

*G Law, T Shimmiel, G Shimmiel (SAMS) and G Cowie (Edinburgh University)*

## Unravelling the methane paradox

The 'oceanic methane paradox' questions how the production of methane, a strictly anaerobic process, can occur within the oxygenated upper ocean. Attempts to resolve the methane paradox, have linked methanogenesis with particulate material, e.g. zooplankton faecal pellets, as micro-environments that facilitate oxygen depletion.

Work at SAMS has identified methanogens within copepod faecal pellets and sedimenting particles using 16S rRNA gene analysis. Furthermore, one cluster of sequences was closely related to methanogens of the Methanosarcinaceae family, that metabolise methylated compounds



# BIOGEOCHEMISTRY AND EARTH SCIENCES DEPARTMENT

including dimethylsulphide, a sulphur gas that affects the Earth's albedo. Therefore, zooplankton faecal pellets could be instrumental in facilitating both the production of methane and the removal of



*Temora longicornis* copepod (top) and its faecal pellet (bottom, not to scale).



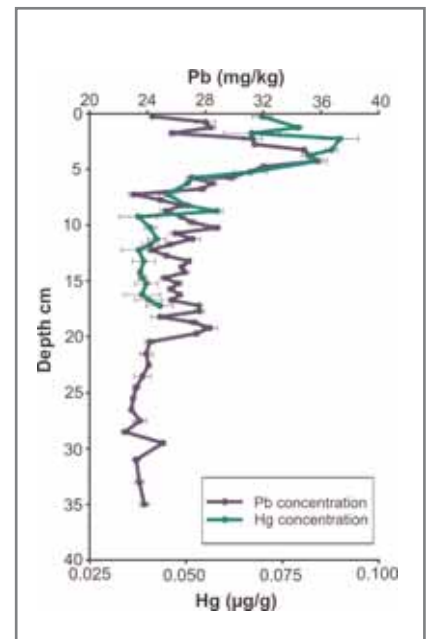
DMS. We have recently received NERC funding to further investigate the interactions of these biogeochemical cycles and the role that anaerobic microbes play in this process. A combination of laboratory and field-based research is expected to further unravel the ocean methane paradox.

*S Wilson, A Hatton, M Hart, Axel Miller and D Green*

## Anthropogenic inputs of heavy metals to the Kongsfjord area, Svalbard, Arctic

One of the pollutants under examination is mercury (Hg). As a known toxicant it is believed to be present in some regions at levels that pose a threat to both the environment and Arctic populations. Four sediment cores have been analysed for total Hg concentrations in the Kongsfjorden area of Svalbard. The figure shows the results from Brandallaguna, a lagoon situated close to the Ny Ålesund research base. There is an increase in the Hg concentration towards the surface of the core, a trend which has been identified in many other Hg studies throughout the Arctic. The profile is interesting in that it is virtually identical to the lead (Pb) profile, suggesting an anthropogenic influence, possibly from atmospheric transport. The other cores analysed do not display a similar Hg and Pb trend. The sediment from Brandallaguna core is anoxic from the surface and further interpretation of the role of Fe/Mn diagenesis and the degradation of organic matter on the distribution of Hg are being investigated.

*L Vare, T Shimmiel, K Black and G Shimmiel*



Heavy metal concentrations within a sediment core from Brandallaguna, Ny Alesund, Svalbard.



# ECOLOGY DEPARTMENT

**Department members:** Dr. Kenny Black (Head), Dr. Michael Burrows (Deputy), Dr. Robert Batty, Mr. Dirk Campbell, Dr. Elizabeth Cook, Dr. Andrew Davies, Dr. Symon Dworjanyn, Mr. Robin Harvey, Dr. David Hughes, Dr. Leahanne Henry (part time), Dr. Maeve S. Kelly, Mr. Peter Lamont, Ms. Hui Jiu, Miss Shona McGill, Dr. Lois Nickell (part time), Dr. Thornyá Nickell, Mrs. Heather Orr, Mrs. Linda Robb, Dr. Murray Roberts, Dr. Merritt Sayer, Dr. David Schoenau, Miss Colleen Stockling, Dr. Tom Whiting, Dr. Kate Willis, Ms. Averil Wilson, Dr. Ben Wilson





# ECOLOGY DEPARTMENT

## Biodiversity of cold-water coral reefs

It is well known that tropical coral reefs support many species and that around the world biodiversity is being lost at an alarming rate. Recent work by the cold-water coral research team at SAMS is showing that these deep-water reefs not only support a similar biodiversity to tropical reefs but contain a surprising number of species unknown to science. With fellowship funding from the European Commission's Marie Curie scheme, Dr Lea-Anne Henry, formerly of the Bedford Institute of Oceanography in Canada, has been examining the animal communities in samples from cold-water coral ecosystems along the European margin. These include the recently discovered giant carbonate mounds from the Porcupine Seabight off SW Ireland,

the Darwin Mounds off NW Scotland and the inshore, shallower Mingulay Reef Complex from the Sea of the Hebrides. Hundreds of species have been identified from each area and taxonomic experts have so far confirmed that several are undescribed including an isopod, four hydroids, a pycnogonid, a bryozoan and an aplacophoran mollusc. Several others await confirmation. As well as new species, one hydroid and the aplacophoran require new genera.

In addition to revealing animals previously unknown to science, this work has shown fundamental differences in the communities on carbonate mounds compared to those on the surrounding seafloor. Because the reefs are such rich storehouses of species, they are helping us better understand species distributions and biogeography. Over the last five years it

has become clear that many cold-water coral ecosystems, including the Darwin Mounds and some carbonate mounds, have been damaged by bottom trawl fishing. This project is clearly showing how little we understand about the biodiversity of these fragile, long-lived ecosystems and how important it is to document biodiversity and biogeography if we are to develop meaningful networks of protected areas in the future.

*M Roberts, A Davies and L - A Henry*



Four species in the diverse animal community from the Galway carbonate mound. Clockwise from top left: an isopod, gastropod, stylasterid coral and a brachiopod.



## Integrated Aquaculture – a glimpse of the future?

Integrated aquaculture, the combination in culture of species feeding from different trophic levels, has been purported to be of benefit to both the species in culture and to the environment. In the project REDWEED, the ability of seaweeds to utilise dissolved nitrogen originating from salmon farms was examined. This three year study is focused on the culture of edible species of seaweed; the red dulse or *Palmaria palmata* and the brown sugar kelp or *Laminaria saccharina* around Loch Duart's salmon farms in north-west Scotland. By growing these additional crops on the salmon farm, the aim is to achieve a harvest of financial value which also represents a loss of nitrogen from the system, ameliorating the impact of salmon farming in that respect.

Both seaweeds were successfully cultured on seeded ropes suspended from long-lines adjacent to the salmon farms. *L. saccharina* in particular benefited from proximity to this nitrogen source, showing enhanced growth rates while growth of *P. palmata* was influenced both by nutrient availability and water motion. The use of stable isotopes revealed that the seaweeds were utilising farm-origin nitrogen and that in some circumstances the nitrogen from the farm could be detected over distances of > 1km.

The data suggest that, were cultivation to be scaled up, a seaweed farm occupying 1ha could remove up to 30% of the dissolved nitrogen resulting from the culture of 500t of farmed salmon. Research continues into ways of scaling up productivity, preventing bleaching of the

plants and minimising fouling.

Other projects at SAMS; SPIINES2, MERMAIDS and AAAG ([www.sams.ac.uk](http://www.sams.ac.uk)) are currently investigating the co-culture of salmon, seaweeds, sea urchins, pacific oysters and scallops. This year also saw the completion of Professor Hui Liu's stay at SAMS, our first Marie Curie Incoming International Fellow. Hui, from the Yellow Seas Fisheries Research Institute in China collaborated with our researchers in sea urchin and scallop cultivation and on the impact of ASP, the amnesic shellfish poison. SAMS is pleased to announce that we have signed a 'Sino-Scottish Aquatic Invertebrate Laboratory Agreement' with YSFRI to help establish further exchanges and collaboration.

M Kelly, C Sanderson and E Cook



SAMS' Craig Sanderson (right) discusses the cultured *Laminaria saccharina* with Loch Duart's Managing Director Nick Joy.

## The European Census of Marine Life (EuroCoML)

EuroCoML is a regional implementation committee for the Census of Marine Life; a 10 year initiative aimed at determining the diversity, distribution and abundance of marine life in the oceans in the past, present and future. Within this framework the aims of EuroCoML are to i) expand partnerships with other relevant European programmes, ii) increase European participation in ongoing CoML projects, iii) improve taxonomy and knowledge of species in European waters and iv) improve information required for resource management in European waters.

EuroCoML has been fully operational for just over a year, with the Project Office being located at SAMS. During this time a number of workshops have been funded bringing together scientists from across Europe to develop potential research programmes which will go some way to achieving the aims of EuroCoML and addressing the questions posed by the global CoML. The workshops so far have looked at "Alien invasive species in European Waters" and "Environmental modulation of Biodiversity and Ecosystem Dynamics," determining the causes of change in marine coastal biodiversity by identifying key ecological processes operating at different scales. A third workshop on the "European Tracking of Predators in the Atlantic" will take place in September 2006, with a further three proposals currently under discussion. All information on European marine fauna collected by the projects will be deposited with the European Ocean Biogeographic Information System.

# ECOLOGY DEPARTMENT

Education and Outreach is also of importance to EuroCoML. A Deep-Sea Education and Outreach (DESEO) workshop was funded, allowing the project officers of the four European led deep-sea CoML projects to exchange ideas and to collaborate. The first activity planned for 2007 is a travelling exhibition on the Mid-Atlantic Ridge and an associated book describing different environments which can be encountered in the deep-sea.

The website, [www.eurocoml.org](http://www.eurocoml.org), is another area where the science carried out by the different programmes is highlighted.

*Graham Shimmield*  
(EuroCoML Chairman)

*Bhavani Narayanaswamy*  
(EuroCoML Project Officer)

The screenshot shows the homepage of the EuroCoML website. At the top, there is a green header with the URL [www.eurocoml.org](http://www.eurocoml.org). Below the header, the website features a navigation menu on the left side with categories such as Home, News, Committee Members, European Projects, Other CoML projects, Meetings, Workshops, Education and Outreach, Training and Capacity Building, Publications, Photo Gallery, and Links. A login form is also present, with fields for Username and Password, and a 'Remember me' checkbox. The main content area is divided into several sections. At the top, there is a large banner image of a deep-sea creature. Below this, there is a search bar and a 'Home' section with a 'News' sub-section. The news section features a headline: 'Longest animal migration distance ever recorded electronically' and a sub-headline: 'Welcome to the European Census of Marine Life'. Below the news section, there are four featured articles with images: 'EuroCoML Outline', 'EuroCoML Aims', 'EuroCoML Exec', and 'EuroCoML SSC'. At the bottom of the page, there are two columns of 'Latest News' and 'Popular' articles, each with a list of links to various news items.

# MICROBIAL AND MOLECULAR BIOLOGY DEPARTMENT

*Department members: Dr Roy Leckey (Head), Dr Fritziot Küpper (Deputy), Mrs Undine Achilles-Day (part time), Mrs Debra Brennan, Mrs Christine Campbell (part time)  
Dr Keith Davidson, Dr John Day, Miss Gostia Gqi, Dr Tony Gutierrez, Dr David H Green, Dr Mark Hart, Miss Sharon MacNeill, Mrs Elaine Mitchell, Dr Thomas Proschold  
Miss Rachel Saxon (Admin), Dr Damodar Shenoy, Ms Sarah Swan, Mr Tim Wilkinson*



# MICROBIAL AND MOLECULAR BIOLOGY DEPARTMENT

## Monitoring and predicting harmful algal blooms

There are approximately 3000 known species of marine phytoplankton of which around 100 are thought to have harmful or toxin producing properties. In Scottish waters, harmful algal blooms are of most concern through the potential for humans to consume shellfish that have ingested sufficient phytoplankton such that toxin levels within their flesh have become concentrated to dangerously high levels.

*Dinophysis acuminata* – a toxic alga responsible for diarrhetic shellfish poisoning



To ensure shellfish safety, there is a requirement for EU member states to monitor the presence and geographic distribution of marine biotoxin-producing phytoplankton in shellfish harvesting areas on a regular basis. In Scotland, phytoplankton monitoring has been carried out by SAMS scientists on behalf of the Food Standards Agency Scotland since September 2005. This monitoring programme acts as an early warning system to ensure that shellfish flesh testing is conducted in the area of concern.

In addition to monitoring toxin producing phytoplankton, we are also conducting a number of research projects to improve understanding of the factors causing their

blooms. These projects include studies of *Pseudo-nitzschia* and *Dinophysis* that are responsible for amnesic and diarrhetic shellfish poisoning respectively. We have also just commenced a collaborative EU program with partners in Ireland and France to study the environmental factors that trigger harmful blooms. Such information underpins the development of tools to predict the occurrence of harmful algal blooms.

*K Davidson, S Swan, T Wilkinson, D Brennan, C Campbell, S Drain, S McNeil and M Hart*

## Algal defence: seaweed immune systems have deep evolutionary roots

The brown alga *Laminaria digitata* is a major constituent of kelp forest biomass on North Atlantic rocky shores where it is subject to attack from bacterial pathogens. In collaboration with French and German scientists, we have discovered that, in order to protect itself from such pathogens, the alga employs a cellular chemical

defence system which is similar to the innate immunity known from both terrestrial plants and animals. We have also found that the chemical defence reaction of the seaweed can be triggered, as in other plants and animals, by lipopolysaccharides (bacterial cell surface macromolecules). The algal response to infection by bacteria involves an oxidative burst followed by release of free fatty acids and accumulation of oxylipins such as 13-hydroxyoctadecatrienoic acid. This mechanism is similar to the oxidative burst observed in mammalian white blood cells and terrestrial plants. Also the recognition of bacterial attack seems highly conserved between major eukaryotic phyla – these results suggest that the signalling pathways involved in the recognition of lipopolysaccharides may include Toll-like receptors.

*F Küpper*

*Laminaria digitata* (in foreground)



# MICROBIAL AND MOLECULAR BIOLOGY DEPARTMENT

## SAMS scientists name a new bacterium and sequence its genome

A fundamental aspect of biology is the cataloguing of new organisms. It is therefore a privilege that we have joined the list of biologists to name a new species; in this case, a bacterium that appears to live exclusively with marine microalgae. The organism is now known as *Marinobacter algicola* [*Marinobacter*, rod of the sea; *algicola*, an inhabitant of algae] found associated with a range of Northern Hemisphere marine dinoflagellates and coccolithophores (see Figure). Interestingly, the *M. algicola* isolates we have come from algal cultures from different oceanic regions, yet, they are nearly all identical to one another despite their origins being so far apart. This remarkable conservatism suggests that this bacterium is highly specialized to a life with dinoflagellates and coccolithophores. We therefore think it may play an important function in the lifecycle of the algal host.

One approach to identifying what a bacterium can do is to sequence its genetic blueprint – the genome. *M. algicola*, along with two other bacteria we have isolated from marine dinoflagellates, were chosen by the Gordon and Betty Moore Foundation Marine Microbial Genome Sequencing Initiative for whole genome sequencing by the J Craig Venter Institute in the USA. These data will greatly aid our study to find out what *M. algicola* is doing for its algal host.

D Green, T Gutierrez and M Hart

Phylogenetic dendrogram detailing the relationship of algal-associated *Marinobacter*'s isolated from around the globe and those isolated at SAMS. The high phylogenetic conservation between the new type species, *M. algicola* (blue), and other algal-derived isolates can be observed. The dendrogram overlays a transmission electron micrograph of *M. algicola* DG893.



## CULTURE COLLECTION OF ALGAE AND PROTOZOA (CCAP)

### CCAP developments

The CCAP is the largest algal culture collection in Europe, covering a wide range of protistan biodiversity. It continues to act as the UK Service Collection for the provision of cultures and their associated data to the UK and world-wide scientific communities. The Collection currently maintains 2800 strains, with 434 new additions in the last year, including 13 type strains. Among the new additions were 276 strains of the increasingly important brown algal model *Ectocarpus*, the entire genome of which is currently being sequenced. The Collection has also increased the diversity and range of protistan and cyanobacterial strains held, and details of new accessions are listed on the CCAP website [www.ccap.ac.uk](http://www.ccap.ac.uk).

Service roles have been expanded over the past 12 months with the servicing of 303 customers, provision of 1024 cultures, accession of 4 patent strains, provision of extracted DNA and the provision of "tailor-made" training for scientists from SEPA and CEFAS. The launch of the new website in 2005 has greatly facilitated interaction with the global user community, and the development of a comprehensive CCAP knowledgebase, including protistan images and bibliographic information, is progressing.

In January 2006 CCAP hosted the final meeting of the EU funded Alginet – (Microalgae as Cell Factories for Chemical and Biochemical Products) project

(<http://www.search-labs.com/Alginet/>), which was attended by 34 delegates from 12 countries. The principal role of CCAP was to develop a single on-line database allowing access to over 10,000 algal strains located in collections throughout Europe.

CCAP remains a focal point for algal research, both in-house and in worldwide collaborations, covering many fields of protistan biology including taxonomy, biogeography, chemical ecology, geochemistry, cryobiology, biogeochemistry, blue biotechnology, and algal pathology. Furthermore, together with an American partner collection, CCMP (Bigelow Laboratory), CCAP is spearheading international efforts to develop molecular barcoding techniques



Photo: John Borowski

CCAP is the largest algal culture collection in Europe, with 2800 strains.

for protists and protistan culture collections in particular.

*F Küpper, J Day, C Campbell, U Achilles-Day, D Brennan, G Gaj, S McNeill, T Pröschold and R Saxon.*



## NERC FACILITY FOR SCIENTIFIC DIVING (NFSD)

The Diving Unit continues to deliver a range of services both in support of SAMS underwater science activities and at the national level. The unit hosts the Natural Environment Research Council (NERC) Facility for Scientific Diving and continues to provide emergency hyperbaric treatment for divers with decompression illness under the national registration scheme for Scotland. In addition the unit is accredited by the Royal Yachting Association for its provision of small boat training.

The NERC Facility for Scientific Diving is part of the NERC's portfolio of National Services and Facilities. The facility provides advice, guidance and training for all diving and small boat operations involving NERC staff and for University groups that receive NERC funding. The NFSD funding also supports the activities of the UK Scientific Diving Supervisory Committee (SDSC) which is the body recognised by the Health and Safety Executive (HSE) as representative of the scientific and archaeological sector under the 1997 Diving at Work Regulations (DWR97). In 2005 the NFSD undertook a programme of equipment evaluation in relation to improving the delivery and safety of full-face diving masks with associated hard wire and through water voice communications systems. Training was also given in the use of mixed gases in diving, dive supervision, full-face mask use, underwater digital photography and recompression familiarisation. The NFSD supported a wide range of NERC-supported underwater science projects, including specimen collection, underwater

survey, subtidal analytical equipment maintenance, underwater photography and environmental impacts. NFSD staff also contributed to a multinational Diving Under Ice workshop held at Ny Alesund, Spitzbergen, in February 2005.

The NFSD was reviewed by NERC in 2005 and received an overall average rating of 4.38 out of 5.00. NERC funding for the facility is assured until 2009.

### DIVING SUPPORT

In 2005, the diving unit supported 522 person dives (266 separate diving operations) in support of numerous science programmes. This was the highest total of diving operations supported by the dive unit since 1982. A total of 35 divers were either employed on diving operations or attended some of the NFSD training courses and workshops. These included maintaining fish count and sub-sea temperature time-series, conducting photographic and video surveys, collecting animal specimens, conducting diving equipment trials and mapping artificial reef module deployments. The total bottom time was 8641 minutes for 2005 at an average of 33.1 minutes per diving operation. Of this total, 83% of the bottom time was accrued in the 10-29 metre depth range, 16% was shallower than 10 metres and 1% was 30 metres and deeper. The unit provided support that underpinned eight peer-reviewed publications in 2005.

### DUNSTAFFNAGE HYPERBARIC UNIT (DHU)

In 2005, 18 divers suffering from symptoms of suspected decompression sickness were examined at the hyperbaric unit and 14 received treatment. In addition, there was one diving-related fatality. The divers treated received, in total, 96 treatment hours in the chamber. As in previous years, the unit continues to benefit from the medical support it receives from diving medics from the Lorn Medical Centre.

The unit continues to be part of the National Registration Scheme for Scotland. DHU staff continue to act as technical advisers for the registration scheme.

### RYA SCHOOL

The small boat facility continues to provide RYA accredited training programmes. 2005 again saw the provision of a seamanship module for students on the UHI Marine Science degree and all students successfully completing their RYA Powerboat training to Levels 1 and 2. Training was also provided for staff from the University of Edinburgh.

*M Sayer, S Thurston and H Brown*

# SAMS HIGHER EDUCATION

## SAMS/UHI Millennium Institute Education Activities

This year has provided noteworthy activity on both the undergraduate and postgraduate fronts.

### BSc (Hons) Marine Science

The sixth cohort of UHI undergraduates arrived in September. In November, our third graduation ceremony was held in conjunction with the SAMS AGM. To mark the occasion, two sponsored awards were made: the SAMS Council Prize for Academic Excellence was awarded to Saul Reynolds, for obtaining the highest ever mark on the degree for his Honours Dissertation; while the SAMS Prize for Overall Achievement went to Kimberley Blackwell, who received a First Class honours degree.

During the year, SAMS was awarded the first Comann na Mara bursary – sponsored by popular Celtic band Runrig – for undergraduates to undertake field studies at the European Special Area of Conservation, Lochmaddy Bay, North Uist.

### Postgraduate Research Activities

In October, a further intake of NERC-funded postgraduate students commenced at SAMS, supporting our vibrant research school community. There have been a number of PhD completions over the year: Rebecca Dean and Pei Sun Loh have since obtained career positions in the UK and Malaysia respectively.

In December, we were delighted to hear that our application for an ERASMUS University Charter had been accepted; enabling both staff and students at SAMS to participate in exchange programmes with Higher Education Institutions across Europe.

Also on the European front, we have been successful in a proposal to form a Marie Curie Training Site for Early Stage Researchers. The ECOSUMMER (Ecosystem Approach to Sustainable Management of the Marine Environment and its Living Resources) site, led by the University of Aberdeen, with partners in Scotland, Greece and Spain, paves the way for collaborative postgraduate projects – including PhD studentships – over a three year period.

Finally, SAMS was invited to join in a Socrates Thematic Network proposal, AQUA-TNET. The network, coordinated by Ghent University, aims to establish a European Higher Education Area in the field of Aquaculture, Fisheries and Aquatic Resource Management. The AQUA-TNET partnership comprises the leading European academic institutions offering aquaculture courses and has representatives from 17 European countries.

*Axel Miller*



Graduands at the third UHI/SAMS BSc (Hons) Marine Science degree congregation. From the left (rear), SAMS Director Professor Graham Shimmiel, SAMS President Professor Sir John Arbuthnott, Donald Bisset, Saul Reynolds and UHI Principal, Professor Robert Cormack; (front) Joanne Brown, Kirsty Donald and Kimberley Blackwell.

# SAMS MEMBERSHIP ACTIVITIES

SAMS is a learned society with a total membership of 451 in four categories. During the reporting year members received SAMS Newsletters 30 (April 2005) and 31 (November 2005) as well as the SAMS Annual Report 2004-05.

## AGM and Newth Lecture

The Association's 91st Annual General Meeting took place on 7 November 2005. The 16th Newth Lecture followed the AGM and SAMS UHI Graduation, and was delivered by Dr Michel Kaiser from the School of Ocean Sciences at the University of Wales, Bangor. Dr Kaiser's well attended and discussed presentation was on 'Can't see the fishermen for the fish: net benefits demand a wider perspective.' A summary of the lecture was published in SAMS Newsletter 32 and on the SAMS website.

## Scottish Marine Group activities

Dr Hamish Mair from Heriot-Watt University convened the Scottish Marine Group for a sixth and final year. The theme for the autumn meeting on 27 October 2005 in Stirling was 'Scottish Marine Science Overseas'. Dr Mair presented work he and a number of his postgraduate students had been conducting at the Las Perlas Archipelago in Panama. At the end of the meeting Dr Mair stood down as convenor, and was given a warm and sincere thank you for his long-standing and successful efforts on behalf of the Scottish marine science community.

Susan Chambers, curator for marine invertebrates at the National Museums of Scotland, agreed to take over as SMG

convenor for 2006.

## SAMS Bursaries

SAMS offers up to four bursaries every year of up to £1000 to support worthy research or scholarship activities of its members. During the year, two bursaries were awarded:

Dr Teresa Fernandes (Napier University): Does turbidity affect how fish use mangrove habitats? Award: £810.

Dr Andrew Brierley and Dr Valery Smith (University of St Andrews): Studies on *Calanus finmarchicus* diapause. Award: SAMS research vessel time.

*Anuschka Miller*



Speakers at the autumn 2005 SMG meeting. From left: Colin Graham (BGS), Dr Hamish Mair (Heriot Watt), Dr Trevor Telford (Stirling), Dr Finlo Cottier (SAMS), Dr Evanthia Karpouzli (Scottish Executive), Dr Martin Biuw (Gatty).



# SAMS OUTREACH ACTIVITIES

SAMS firmly believes in proactive science communication with different sectors of the public, aiming to use the appropriate language, imagery and context to relate to the target group. Although this may be work intensive, we particularly believe in direct two-way communication as one of the most effective means of engagement with the public.

Educational outreach activities target specific groups: schools, the local community, and special interest groups, particularly those interested in marine resource development and protection and/or climate change. We reach out to the general public through engagement with national and international television, radio, newspapers, magazines as well as the internet. The SAMS website ([www.sams.ac.uk](http://www.sams.ac.uk)) is supplemented by a multitude of commercial and project websites based on work carried out or contributed to by SAMS staff.

## School activities

A number of SAMS staff visited local primary and secondary schools, and we hosted school groups from Oban High School and Bowmore Primary School (Islay). Annual school days took place on 4 April 2005 and 15 March 2006, where we welcomed each time around 150 pupils from up to nine local primary schools. An interactive programme demonstrated the diversity of our research activities, and aimed to show the children what marine scientists actually do rather than focussing in detail on research content. With this we aimed to enthuse the children about research as an activity in contrast to the textbook science they may encounter in schools.

To reach an even larger audience of school children throughout Argyll and Bute, SAMS is a regular and active participant in the annual Argyll and Bute Regional Environmental Education Forum (ABREEF) Environment Fairs. SAMS is also represented at the ABREEF planning group. A three day ABREEF fair was organised in September 2005 in Campbeltown, which over 700 primary school children attended. Of these we engaged directly with about 200: In groups of up to 15 children, they learnt about marine food webs by playing a dressing up game, about the extent of the oceans by virtue of a ball game with a globe, and about the life of marine larvae through a card game.

SAMS further sponsored the 'SAMS Cup for Outstanding Achievement in Science' at the annual prize giving event at Oban High School for the second year. This prize is awarded by the team of science teachers to the best Higher or Advanced Higher pupil in any science discipline.

## Open Days – engaging the local community

SAMS annually opens its doors to the local public at an open evening – always held during National Science Week: During the reporting period open evenings were held on 4 April 2005, on the evening prior to the official opening of the European Centre for Marine Biotechnology, and on 15 March 2006. Between 150 and 200 visitors attended the events, at which all departments exhibited some of their research, and at which short overview talks were presented. At these events SAMS staff and students engage visitors in much conversation and discussion, alongside providing as much hands-on experience as a topic allows. A balance of displays ensured interesting visits for both adults and children.

The Argyllshire Gathering took place in Oban on Thursday 25 August 2005, and SAMS, as every year, had a large information and education stand within the Heritage Tent. The display of a selection of live seashore organisms drew crowds of children and parents to our



CCAP staff member Gosia Gaj opens a young visitor's eyes to the world of microscopy

# SAMS OUTREACH ACTIVITIES

stand, while we also showcased more advanced research projects to engage those with already developed interests in the marine environment. Besides locals this event draws in tourists with a particular interest in Scottish culture and environments.

When invited to talk to local community groups, we strive to always oblige. This year Dr Anuschka Miller spoke to the Lorn Lunch Club of the Argyll and Bute Conservative and Unionist Association about the scope of activities and research undertaken by SAMS, and on the latest developments within UHI.

## Special interest groups

A particularly interesting event was an open meeting on what science can contribute to the debate about marine national parks held on 6 February 2006 in the Corran Halls in Oban. Drs Maeve Kelly, David Hughes, David Schoeman, Michael Burrows and Toby Sherwin gave short overview presentations alongside speakers from the Aberdeen Institute for Coastal Science and Management and from the Community of Arran Seabed Trust. About 90 people attended the meeting that was organised and chaired by Sandy Smith from the British Association for the Advancement of Science.

SAMS exhibited work on the many human uses for macro-algae at the 'Innovations in Natural Products in the Highlands and Islands' event on 9 and 10 March 2006 in Inverness.

A variety of staff gave public lectures: Dr Ben Wilson participated in the 2006 IgNobel tour during National Science Week with a talk on the predator-prey relationship between killer whales and herring. Dr Maeve Kelly spoke on 'seaweed, the ultimate natural resource' at an evening event on 'Natural Resources in the Highlands and Islands' on 9 March 2006 at Inverness College. Dr Anuschka Miller reviewed recent advances in Arctic research at the Orkney Science Festival in Kirkwall on 2 September 2005.

Staff with particular engagement in outreach activities included Debra Brennan, Elaine Mitchell and Sharon McNeill.

field classes at SAMS using our research vessels and teaching laboratory facilities. These included Edinburgh University (Geosciences), Heriot Watt (Biology - 2 groups), University of Liverpool (Oceanography) and the University of East Anglia (Oceanography). In addition, several groups with non-marine interests took advantage of our teaching facilities and meeting rooms.

*Anuschka Miller*



Professor Hui Liu, Professor Graham Shimmield and Dr Maeve Kelly, who hosted Professor Liu.

## Visitors to SAMS

This year saw the completion of Professor Hui Liu's stay at SAMS, our first Marie Curie Incoming International Fellow. Hui, from the Yellow Seas Fisheries Research Institute in China, collaborated with our researchers in sea urchin and scallop cultivation and on the impact of ASP, the amnesic shellfish poison. As usual, a number of university groups conducted

# POSTGRADUATE RESEARCH PROJECTS

(Supervisors' names in parentheses;  
SAMS supervisors in blue)

## DEGREES AWARDED DURING THE REPORTING YEAR

**Cousins S**, Ph.D, Aberdeen University. *An Investigation of the processes involved in Pecten maximus contamination by Amnesic Shellfish Poisons*. (Gallagher S, **Kelly MS**, Eddie B and Taylor A)

**Dean R**, Ph.D, The UHI Millennium Institute. *Biogeochemical cycling in fish farm sediments*. (**Shimmiel TM**, **Black KD** and **Gillibrand P**)

**Hughes A**, Ph.D, The UHI Millennium Institute (NERC). *Sea bed biota scrapers and shapers: urchins in control*. (**Kelly MS** and Barnes D)

**Loh P-S**, Ph.D, The UHI Millennium Institute. *Terrigenous organic carbon in Scottish sea loch sediments*. (**Miller AEJ**, Reeves A, and **Harvey SM**)

**Mitra A**, Ph.D, The UHI Millennium Institute. *The Influence of micro-zooplankton on marine productivity*. (**Leakey R** and Tett P)

**Rose C**, Ph.D, Newcastle University. *The role of habitat complexity in determining community development on the Loch Linnhe Artificial Reef*. (**Wilding T**, Downie M and Bentley M)

**Waller RG**, Ph.D, University of Southampton. *Gametogenesis and larval biology of deep-sea corals*. (Tyler PA and **Gage JD**)

**Ware S**, Ph.D, University of London. *Inshore fisheries ecology*. (Atkinson RJA, **Sayer MDJ** and Bailey N)

## ONGOING RESEARCH

**Adey (née Osborne) EA**, Ph.D, The UHI Millennium Institute. *Distinguishing wild from farmed salmon*. (**Black KD** and **Shimmiel TM**)

**Andrew G**, Ph.D, The UHI Millennium Institute. *Biodiversity and ecosystem function: trophic diversity versus species diversity in intertidal grazers*. (**Burrows M**, Hawkins S and McGill R)

**Ashton GV**, Ph.D, The UHI Millennium Institute (NERC). *Biological invasions-quantifying the impact of alien species on marine ecosystems, using the introduction of the amphipod Caprella mutica to the west of Scotland as a case study*. (**Cook EJ**, **Willis K** and **Burrows MT**)

**Batty P**, Ph.D, The UHI Millennium Institute (NERC). *The influence of structural & functional aspects of benthic organisms on bioturbation & ecosystem function*. (**Nickell L**, Solan M, **Nickell T** and **Black KD**)

**Bayley S-A**, Ph.D, The UHI Millennium Institute. *Towards a brighter future for Scottish salmon - new ideas in socio-economic and political dimensions*. (Smith M and **Miller AEJ**)

**Beaumont J**, Ph.D, The UHI Millennium Institute (NERC). *Quantifying biotic interactions with inshore subtidal structures: comparisons between natural and artificial reefs*. (**Sayer MDJ**, **Brown C** and **Shimmiel GB**)

**Corner R**, Ph.D, Stirling University. *Reduction of fish farm impacts using smart automatic feeders*. (**Black KD** and Telfer T)

**Cox (née MacLachlan) SE**, Ph.D, The UHI Millennium Institute. *Geochemical signals of environmental change in the Arctic: from freshwater lake to the deep ocean*. (**Howe J**, **Shimmiel TM**, **Shimmiel GB** and Austin W)

**Cresswell K**, Ph.D, The Open University. *Penguin-krill interactions at South Georgia*. (Tarling GA, Trathen P and **Burrows MT**)

**Darrock L**, Ph.D, The University of East Anglia. *Dimethylsulphoxide: origin, fate and cycling*. (Liss PS, Malin G and **Hatton AD**)

**Dodds L**, Ph.D, The UHI Millennium Institute (NERC). *The physiological ecology of the cold-water coral Lophelia pertusa*. (**Roberts JM**, Taylor A and **Gage JD**)

**Gass S**, Ph.D, The UHI Millennium Institute (AFEN). *The environmental sensitivity of cold water corals*. (**Roberts JM**, **Gage JD** and Tudhope AW)

**Johnson C**, Ph.D, The UHI Millennium Institute. *Tracing water masses in the North Atlantic*. (**Sherwin T**, **Shimmiel TM** and Smyth-Wright D)

**Law GT**, Ph.D, The UHI Millennium Institute (NERC). *Cycling of trace metals of organically-rich sediments off Pakistan and Scotland*. (**Shimmiel TM**, Cowie G, **Shimmiel GB** and Ganeshram R)



# POSTGRADUATE RESEARCH PROJECTS

**MacDonald A**, M.Phil, The UHI Millennium Institute. *Salmonid survival in an upland river.* (**Miller AEJ** and Chisholm N)

**Nebot C**, Ph.D, The UHI Millennium Institute. *Human pharmaceuticals in the Scottish marine environment.* (Gibb S, Boyd K and **Black K**)

**Pete R**, Ph.D, The UHI Millennium Institute. *The influence of organic nutrient perturbation on microbial community dynamics.* (**Davidson K**, **Miller AEJ** and **Leakey R**)

**Pillans J**, Ph.D, Newcastle University. *DMS photochemistry.* (**Hatton AD**, Uher G and Upstill-Goddard R)

**Rodger A**, Ph.D, The UHI Millennium Institute. *Multi-trophic level culture for environmental remediation – active management of aquaculture initiatives for diversification and sustainability.* (**Kelly MS**, **Gillibrand P** and Dring M)

**Sanderson JC**, Ph.D, The UHI Millennium Institute. *Reducing the environmental impact of sea-cage farming through cultivation of seaweeds.* (**Kelly MS** and Dring M)

**Shelmerdine R**, Ph.D, The UHI Millennium Institute (NERC). *Large-scale forcing of coastal communities.* (**Burrows MT** and **Hughes DJ**)

**Shields ME**, Ph.D, The UHI Millennium Institute. *Gradients in benthic community structure and bioturbation along the northern seas continental margins.* (**Hughes DJ** and **Gage JD**)

**Shucksmith R**, Ph.D, The UHI Millennium Institute (NERC). *Biological invasions: The role of biodiversity in determining community susceptibility to invasion.* (**Cook EJ**, **Burrows MT** and **Hughes DJ**)

**Suddick E**, Ph.D, The UHI Millennium Institute. *Impacts of solar UV radiation on freshwater nitrogen biogeochemistry.* (S Gibb, G Uher and **Miller AEJ**)

**Vare LL**, Ph.D, The UHI Millennium Institute (NERC). *An investigation of temporal trends of pollutant inputs within the Arctic environment: from freshwater lake to deep ocean.* (**Shimmield TM**, **Shimmield GB** and **Black K**)

**Wilson L**, Ph.D, The UHI Millennium Institute (NERC). *Gadoid fish sound production & its role in mate selection, the risk of predation & the impacts of noise pollution.* (**Wilson B**, and **Burrows MT**)

**Wilson S**, Ph.D, The UHI Millennium Institute. *Plankton and climate change.* (**Hatton AD**, **Miller AH** and Law C)

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- Brown, CJ**, Mitchell, A, Limpenny, DS, Robertson, M, Service, M and Golding, N, 2005. Mapping seabed habitats in the Firth of Lorn, west coast of Scotland: evaluation and comparison of habitat maps produced using the acoustic ground discrimination system, RoxAnn, and sidescan sonar. *ICES Journal of Marine Science* **62**: 790-802.
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- Cottier, F**, Tverberg, V, **Inall, ME**, Svendsen, H, Nilsen, F and **Griffiths, CR**, 2005. Water mass modification in an Arctic fjord through cross-shelf exchange. The seasonal hydrography of Kongsfjorden, Svalbard. *Journal of Geophysical Research* **110(C12)**: 12005.
- Davenport, J, Berggren, M, Brattegard, T, Brattenborg, N, **Burrows, MT**, Jenkins, SR, McGrath, D, MacNamara, R, Sneli, J, Walker, G and Wilson, S, 2005. Doses of darkness control latitudinal differences in breeding date in the barnacle *Semibalanus balanoides*. *Journal of the Marine Biological Association of the United Kingdom* **85**: 59-63.
- Davidson, K**, **Roberts, E**, **Wilson, A** and **Mitchell, E**, 2005. The role of prey nutritional status in governing protozoan nitrogen regeneration efficiency. *Protist* **156**: 45-62.
- Day, JG**, Benson, EE, Harding, K, Knowles, B, Idowu, M, Santos, L, Santos, F, Friedl, T, Lorenz, M, Lukesova, A, Elster, J, Lukavsky, J, Herdman, M, Rippka, R and Hall, T, 2005. Cryopreservation and conservation of microalgae: the development of a pan-European scientific and biotechnological resource (the COBRA project). *Cryoletters* **26**: 231-238.
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- Gage, JD**, 2005. Deep-sea spiral fantasies. *Nature* **434**: 283-284.
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- Groeneveld, J, Khanyile, J and **Schoeman, D**, 2005. Escapement of the Cape rock lobster (*Jasus lalandii*) through the mesh and entrance of commercial traps. *Fishery Bulletin* **130**: 52-62.
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**Roberts, JM**, 2005. Reef-aggregating behaviour by symbiotic eunicid polychaetes from cold-water corals: do worms assemble reefs? *Journal of the Marine Biological Association of the United Kingdom* **85**: 813-819.

**Roberts, JM, Brown, CJ**, Long, D and Bates, CR, 2005. Acoustic mapping using a multibeam echosounder reveals cold-water coral reefs and surrounding habitats. *Coral Reefs* **24**: 654-669.

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# RESEARCH GRANTS AND CONTRACT INCOME RECEIVED

Project Leader	Title	Funding body	Duration	Award
RS Batty	RNA:DNA Ratio as an estimate of juvenile plaice growth rate	University of Delaware	07/05 - 09/05	£1k
RS Batty	Algal mediated turbidity	Seafish	10/05 - 04/07	£31k
RS Batty	Effect of turbidity on marine fishes	EU FP5	10/02 - 09/05	£204k
K Black	Etive bolt-on	HIE	01/06 - 03/06	£24k
K Black	Risk factors in shellfish harvesting areas	SARF/SEPA/FSA	11/05 - 10/07	£152k
K Black	Bioactive peptides from marine sources - a Nordic network	Icelandic Fisheries Laboratories	06/05 - 09/06	£8k
K Black	OMUR - shellfish submersible	Sea Fish Industry Authority	04/04 - 07/05	£25k
K Black	Synthesis of aquaculture and marine ecosystems interactions	EU FP6	11/05 - 04/07	£30k
K Black	Ecosystem approach for sustainable aquaculture	EU	01/05 - 02/08	£227k
C Brown	Development of a framework for mapping European seabed habitats	QUB (EU Interreg)	04/04 - 03/07	£108k
M Burrows	Sustainable management of deep-water fisheries and their impact on marine biodiversity	Esmee Fairbairn	01/06 - 12/08	£72k
M Burrows	Biodiversity and ecosystem functioning: tests using rockpools as natural mesocosms	NERC	01/06 - 12/08	£65k
M Burrows	Marine biodiversity and climate change	English Nature, SNH plus a consortium of 10 other bodies	04/01 - 04/06	£45k
EJ Cook	Raising awareness of invasive marine species	Esmee Fairbairn Foundation	04/04 - 03/07	£145k
P Gillibrand	The development of modeling techniques to improve predictions of assimilative capacity of water bodies utilized for marine caged fish farming	SARF	07/05 - 06/08	£58k
P Gillibrand	European climate of the last Millennium	EU FP6	01/06 - 12/09	£94k
P Gillibrand	Identifying the risk of deoxygenation in Scottish sea lochs with isolated deep water	SARF	12/05 - 11/06	£20k
P Gillibrand & T Sherwin	Scottish Marine Observatory	FRS	12/04 - 11/06	£5k
SJ Gontarek	Data rescue and archiving project	NERC	06/03 - 10/06	£225k
JDM Gordon	Towards accreditation and certification of age determination of aquatic resources	EU FP5	11/02-03/06	£3k
D Green	The role of algal-bacterial interactions in determining dimethylsulphide fluxes to the atmosphere	Nerc Solas	10/05 - 09/08	£170k
A Hatton	Methanogenesis in oxygenated marine environments	Nuffield Foundation	03/04 - 06/06	£5k
M Inall	Provision of mooring deployment, maintenance and analysis	Norwegian Polar Institute	08/05 - 06/08	£48k
K Jones	Factors determining the magnitude of solar stimulated fluorescence peaks in water-leaving radiance spectra from shelf seas	NERC	01/02 - 07/05	£27k
MS Kelly	Larval invertebrate microalgal interactions	EU FP6 Marie Curie	06/05 - 06/06	£72k
MS Kelly	Alternative marine sources of protein and oil for aquaculture feeds	The Crown Estate	02/06 - 06/06	£23k

# RESEARCH GRANTS AND CONTRACT INCOME RECEIVED

Project Leader	Title	Funding body	Duration	Award
MS Kelly	Atlantic Arc Aquaculture	Interreg IIB	12/03 – 11/06	£559k
MS Kelly	To investigate sustainable biological carrying capacities of key European coastal zones	EU	02/05 – 01/07	£100k
MS Kelly	Reducing the environmental impact of sea-cage fish farming through cultivation of seaweeds	Highland Council and HIE	02/03-01/06	£112k
MS Kelly	Sea urchin production in integrated systems, their nutrition and roe environment	EU	01/05 – 12/07	£193k
MS Kelly	Algal toxins in shellfish	EU FP5	01/03-04/05	£162k
MS Kelly & JG Day	Microalgae as cell factories	EU FP5	01/03-01/06	£30k
F Küpper	Marine algal characterisation and exploitation	NERC	06/04 - 05/05	£21k
F Küpper	The role of bacterial symbiotic metabolites in the development of toxic phytoplankton blooms	California Sea Grant	03/06 - 02/08	£5k
RJG Leakey	Assessment and management of coastal pollution	British Council	04/03 – 03/06	£21k
S Magill	Ribotyping E.Coli in Loch Etive	HIE/The Crown Estate	02/06 – 03/06	£10k
DT Meldrum	Molecularly Imprinted Polymers	SE/RGU	01/05 – 05/05	£7k
DT Meldrum & ME Inall	Prediction of marine mammal aggregations by reference to oceanographic observations	NERC & MOD	07/02 – 06/05	£65k
DT Meldrum & ME Inall	Mitigation of the effects of high power sonars on marine mammals	NERC & MOD	09/02-07/05	£85k
AEJ Miller	Ecosystem approach to sustainable management of the marine environment and its living resources	EU FP6	01/06 – 12/09	£233k
AEJ Miller	Additional skills training	NERC	10/05 - 09/06	£17k
AEJ Miller	US Undergraduate funding	Uni of Dayton	10/05 - 03/06	£3k
AEJ Miller	UHI Capital Resources	UHI	04/05 - 07/05	£7k
AEJ Miller	UHI learning & teaching infrastructure	UHI	08/05 - 07/07	£45k
AH Miller	Runrig Bursary	Commun Na Mara	02/06 - 03/06	0.5k
B Narayanaswamy	EuroCoML core funding	AIE	02/05 – 01/08	£21k
JM Roberts	Deep sea conservation for the UK	Esmée Fairbairn Foundation	03/05 – 02/07	£146k
JM Roberts	Biodiversity and vulnerability of European cold-water reef ecosystems	EU Marie Curie Fellowship	01/05 – 12/06	£106k
JM Roberts	Hotspot ecosystem research on the margins of European seas	EU FP6	04/05 – 03/09	£170k
MDJ Sayer	Enhancing marine biodiversity with artificial reefs	Project Aware (UK)	07/05 – 06/06	£30k
MDJ Sayer	National Facility for Scientific Diving	NERC	04/05 -03/06	£91k
T Sherwin	Meridional overturning exchange with the Nordic seas	EU	12/02 – 11/05	£126k
GB Shimmield	Addressing research capacity	UHI	04/05 - 07/05	£21k
GB Shimmield	EuroCoML core funding	Stavros S Niarchos Foundation	02/05 – 02/08	£241k
GB Shimmield & L Nickell	Coastal ocean benthic observatories	EU FP6	03/04 – 02/07	£163k



# RESEARCH GRANTS AND CONTRACT INCOME RECEIVED

Project Leader	Title	Funding body	Duration	Award
TM Shimmield	El Nino Southern Ocean circulation	NERC	01/04 – 12/06	£17k
TM Shimmield, AEJ Miller & GB Shimmield	Benthic processes in the Arabian Sea	NERC	10/01 – 12/05	£360k
IM Vassie	Arctic-subarctic ocean flux array for European climate	EU FP5	02/03-07/05	£259k
P Wadhams	Cryosat consortium grant	NERC	02/04 – 02/07	£228k
P Wadhams	Greenland Arctic shelf ice and climate experiment	EU FP5	12/02 – 11/05	£385k
P Wadhams	Ice ridging information for decision making in shipping operations	EU FP5	01/03 – 12/05	£184k
P Wadhams	Sea ice thickness observation system	EU FP5	12/02 – 11/05	£175k
J Wilkinson	Developing Arctic modelling and observing capabilities for long-term environmental studies	EU FP6	12/05 – 11/09	£311k

## SAMS Research services limited

Project Leader	Title	Funding body	Duration	Award
K Black	An environmental impact assessment for the proposed salvage operation on the SS Glenlogan	Pere UK Ltd	06/05 - 06/05	Commercial in confidence
K Black	SEA7 sample analysis - macro fauna	Geotek	12/05 - 02/06	
K Black	SEA7 technical report - fish and fishing	Geotek	01/06 - 03/06	
K Black	SEA7 seabed photo analysis	Geotek	12/05 - 02/06	
K Black	Metoc 1	Metoc PLC	09/05 - 10/05	
K Black	The environmental effects of acoustic and electromagnetic fields produced by tidal generators	Synergie Scotland Ltd	01/06 - 03/06	
K Black & L Nickel	SEA6 technical report - benthos	Geotek	02/05 – 04/05	
K Davidson	Toxic algae monitoring programme	Food Standards Agency	09/05 - 08/08	
S Gontarek	Fish Farm Database 2006	SEPA	02/06 - 05/06	
T Gutierrez	BIOBAC II	AIE	09/04 – 08/06	
N Hughes	Additional analysed ice & iceberg data	UKHO	07/05 - 08/05	
M Inall	Marine instrument development at SAMS	NERC	06/03 – 05/06	
M Inall	Hydrographic surveys	Scottish Sea Farms	11/05 - 11/05	
M Inall	Marine survey	Marine Harvest (Scotland) Ltd	03/05 - 05/05	
M Inall	Scottish water solution survey	SWS	03/05 – 04/05	
M Inall	Hydrographic survey and modelling work	C D Campbell Marine Contractors	05/05 – 07/05	
K Jones	Garroch Head survey	Scottish Water	07/05 – 12/05	
F K�pper	CCAP culture collection	Commercial sales	Annually	

# RESEARCH GRANTS AND CONTRACT INCOME RECEIVED

## SAMS Research services limited

Project Leader	Title	Funding body	Duration	Award
DT Meldrum	HOMing Environmental Recorder: A deep water vertical profiling vehicle	NERC	04/03 – 03/06	Commercial in confidence
DT Meldrum	Oceanology International	AIE	03/05 - 04/06	
DT Meldrum	Argos satellite services	Commercial services	04/02- 04/05	
AEJ Miller	DOC analyses	CEFAS	10/04 – 04/06	
B Narayanaswamy	SEA7 Seagoing staff & equipment	Geotek	07/05 – 10/05	
JM Roberts	Norwegian deep water program	Akvamiljo	07/04 – 06/06	
MDJ Sayer	Grampian hyperbaric technical services	Grampian University	Annually	
MDJ Sayer	NHS recompression facility	NHS	Annually	
T Sherwin	LAGRANGE	EA	03/04 – 05/05	
T Sherwin	SEA7 technical report - hydrography	Geotek	01/06 - 03/06	
GB Shimmield	Knowledge Transfer Officer grant	AIE	03/05 – 02/08	
K Black	SEA7 technical report - benthos	Geotek	01/06 - 03/06	
E Walton	Visitor services	Various	04/04 - 03/05	
J Watson	Vessel hire	Various	04/05 - 03/06	
T Wilding	Review of reef effects of offshore windfarm structures and potential for enhancement and mitigation	Plymouth Marine Lab	01/06 - 07/06	
J Wilkinson	Sea Ice Nautical Pilot Revisions	UK Hydrographic Office	10/03 – 08/05	
B Wilson	Support to HSE Tier III lenders audit	RSK ENSR Group	09/05 – 09/05	

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Mrs Irene Partridge (part time)  
Ms Margaret Sime (part time)

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Mrs Patricia Thomson (part time)

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### **Estates/Ship's Husband**

Mr Jim Watson

### **UHI IT**

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Miss Nicola Longman  
Miss Heather MacDougall  
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### **RV Calanus**

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Mr John MacFarlane  
Mr Duncan MacNeill  
Mr Norman Smith

### **RV Seol Mara**

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Mr Steven Douglas

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Mr John Hill

### **Engineering workshop**

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Mr Mark Robertson (Apprentice Engineer)

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