SCOTTISH ASSOCIATION *for* MARINE SCIENCE

ANNUAL REPORT 07-08

Front cover photograph: The nudibranch *Facelina* photographed by the SAMS dive team at 30m on the mooring line of a subtidal temperature logger array maintained in Ardmucknish Bay, near Oban.

CONTENTS

ACTING DIRECTOR'S INTRODUCTION

Acting Director Dr Ken Jones

Accommodating change has become a familiar process at SAMS. During 2007 the winds of change continued to blow with the announcement in October that our Director of 12 years, Professor Graham Shimmield, was to leave SAMS to move to the Bigelow Laboratory for Ocean Sciences in Maine, USA, as Executive Director.

Graham's contribution to SAMS has been immense. When he arrived at Dunstaffnage in February 1996, Graham became director of two organisations: SAMS with 16 staff, which had recently

formed a partnership with the University of the Highlands and Islands Project, and a weakened NERC centre (Dunstaffnage Marine Laboratory, DML) with 46 employees. In 1997 DML joined forces with the Proudman and Plymouth Marine Laboratories under the banner of the NERC Centre for Coastal and Marine Sciences (CCMS), for which Graham acted as Deputy Director in addition to his SAMS role. CCMS was dissolved in 2001, when the operation and management of the Dunstaffnage laboratory and its staff were reunited under the SAMS banner. From there, Graham led SAMS to its present position: a vibrant laboratory with 140 staff; a research programme held in high esteem nationally and internationally, and contributing significantly to the delivery of the new NERC Strategy as a Collaborative Centre partner in Oceans 2025. Furthermore, SAMS has established a highly regarded Marine Science honours degree course, contributing to the achievement of taught degree awarding powers for the UHI Millennium Institute. Graham's most tangible legacy at SAMS is the state-of -the-art marine science facility and biotechnology incubator (ECMB) at Dunstaffnage. This now enables SAMS to attract world-class staff to compete at the highest scientific level and to host some of the most successful new marine biotechnology companies, thus benefitting the economy of Argyll and the Northwest Highlands. Particularly important for the future, however, is the intangible benefit, delivered through Graham's leadership, of a young, enthusiastic and confident organisation capable of meeting SAMS' future challenges and those of its stakeholders. Council and staff wish Graham success in his new position.

Another significant change this year has been the review and revision of the governance of SAMS. Recognising the working pressures that the unprecedented growth of SAMS placed upon the Director and the increasing responsibilities facing the SAMS trustees for managing a business with a turnover approaching £10m, Council sought to strengthen the support to Director and Executive through the formation of a Board of Council, which has delegated authority of Council, to oversee the business management of SAMS. Under the Chairmanship of Michael Gibson, who is Chair of the Board of the Macaulay Institute, a Shadow Board has worked closely with the Director and Acting Director to formulate the new structure to implement these changes. The governance changes were approved by the Annual General Meeting in November 2007 and necessary changes to the Memoranda and Articles of Association to allow its implementation were approved at an Extraordinary General Meeting in May 2008. The new Board of Council and its supporting committees will be in operation from the autumn.

SAMS Council moved swiftly to fill the vacant Director's post and, after considering a strong field of candidates, appointed Professor Laurence Mee as the new Director of SAMS. Laurence, who will take up his post in September, is currently the Director of the Marine Institute at the University of Plymouth. Although his training is in chemical oceanography, Laurence has led the Marine and Coastal Policy Research Group at Plymouth. His skills will thus strengthen emerging research capabilities at SAMS in marine policy and the socioeconomic aspects of marine management.

The establishment of a marine policy research portfolio at SAMS - initially through strategic capacity building through UHI's Addressing Research Capacity project - could not have been more timely. We are in a period of unprecedented changes in marine legislation and increasing public awareness and debate on issues of living with climate change, marine spatial planning and the sustainable management of our seas. These issues are encapsulated within the Marine Bills passing through parliaments north and south of the border and within the EU. SAMS scientists have actively contributed to the work of the Sustainable Seas Task Force though case study input to the Scottish Government publication "Scotland's Seas: Towards understanding their state" and participation in the formative discussions and workshops supporting the release of the Scottish Marine Bill consultation "Sustainable Seas for All". SAMS has also contributed to the consultation on the UK Marine Bill through written response and verbal evidence to the UK Parliament Joint Committee on the draft Marine Bill, amongst other consultations.

The effectiveness of new legislation critically depends upon the existence of a strong and well coordinated Scottish and UK interdisciplinary science base, with the ability to respond scientifically to deliver new independent research, to inform and advise on policy development and management action, and the availability of appropriately trained scientists and managers. SAMS believes that it is well placed to contribute to the needs of government and other stakeholders through its focussed research and the development of new innovative training programmes.

Over the past five years SAMS has established itself as a UK leader in Arctic research through its work on the NERC-funded Northern Seas programme, involvement in EU programmes on sea ice physics and through strong international collaboration with the Arctic nations and leadership within the programmes of the International Polar Year. There is increasing interest in the Arctic in the areas of geopolitics, climate change research, energy, defence, shipping, fisheries and tourism as the potential for improved access increases with significant ice melt associated with incipient climate change.

In March 2008, SAMS hosted an Arctic Stakeholder Meeting, sponsored by the UK Foreign and Commonwealth Office, which was attended by SAMS Arctic scientists and 40 representatives of these sectors. The meeting explored the need for coordination of UK Arctic policy across the stakeholders interests, the UK's role in Arctic governance and the priorities for research to address the key uncertainties for stakeholders. SAMS scientists have also contributed to the NERC Polar Science Working Group and continue to engage with other UK and international fora discussing a future science strategy for the Arctic. SAMS' Arctic research focus continues within the NERC-funded Oceans 2025 programme. Work is underway i) to understand past and present changes in the Meridional Overturning Circulation (MOC) using palaeo-geochemical proxies within sediment cores, ii) to continue long-term oceanographic observations within the

ACTING DIRECTOR'S INTRODUCTION

The UNIS Research Centre in Svalbard. Photo: Nils Petter Dale

Arctic and in the North Atlantic as an important gateway for Atlantic-Arctic exchange and iii) to investigate the consequences of an ice-free Arctic on the microbial ecosystem and ecosystem energy transfer through modelling and ship-borne process studies. The first cruise supporting this work will leave for the Arctic in July 2008. The appointment of Professor Ronnie Glud, from the University of Copenhagen, as part of the ARC project, will further strengthen our Arctic and biogeochemical capability to complement Oceans 2025 work and address key themes in the emerging NERC strategy. Our undergraduate teaching has also embraced the Arctic theme, through collaboration with The University Centre in Svalbard (UNIS) to develop a course component in Arctic Studies within the Marine Science honours degree. During the coming year, two third-year students will be our first students to take up the opportunity to study for one year at UNIS in Longyearbyen, Svalbard.

The highlighted science and related activities presented in this report demonstrate the continuing development of the quality of SAMS' facilities and staff, the diversity and international relevance of its academic and applied research and education portfolios and the commitment to work in partnership with Highlands and Islands Enterprise and UHI Millennium Institute to benefit the economies and communities of Argyll, the Highlands and Scotland. I believe that these elements will make SAMS strategically well placed to respond to the challenges of the future.

Dr Ken Jones
Acting Director

OCEANS 2025

"Our vision for the marine environment is clean, healthy, safe, productive and biologically diverse oceans and seas. Within one generation, we want to have made a real difference."

(UK government, Safeguarding our seas, 2007)

Oceans 2025 is NERC's major strategic marine science programme that started in 2007 and is scheduled to run for five years. Over that period NERC is investing £120 million in marine research that focuses on how climate change and increasing resource demands will affect the marine environment within the next generation. It aims to deepen and widen our understanding of how the ocean behaves and is changing, thereby improving our predictive capabilities, and to find creative and adaptive solutions for society to deal with the changing marine environment. Oceans 2025 provides the science necessary to achieve the UK government's vision for the marine environment as set out in 'Safeguarding our Seas' (2007).

The programme is organised into nine major themes:

Theme 1: Climate, ocean circulation and sea level
Theme 2: Marine biogeochemical cycles
Theme 3: Shelf and coastal processes
Theme 4: Biodiversity and ecosystem functioning
Theme 5: Continental margins and the deep ocean
Theme 6: Sustainable marine resources
Theme 7: Technology development
Theme 8: Next generation ocean prediction
Theme 9: Sustainable observations in the marine environment
It also funds key national capabilities, including the Culture Collection of Algae and Protozoa at SAMS.

In contrast to the Northern Seas Programme (SAMS' previous core programme), Oceans 2025 is not a SAMS-only project but has been planned and will be delivered in partnership with six other UK marine research centres, namely the Marine Biological Association of the UK, the National Oceanography Centre, Southampton, the Plymouth Marine Laboratory, the Proudman Oceanographic Laboratory, the Sir Alister Hardy Foundation for Ocean Science and the Sea Mammal Research Unit. A new, competitive Strategic Ocean Funding Initiative allows for university and industry involvement to bring in additional expertise and training opportunities.

SAMS researchers from all departments are involved in Oceans 2025, in particular in themes 1, 3, 4, 8 and 9.

Over 40 UK marine scientists attended the Oceans 2025 inaugural meeting at SAMS in July 2007, and SAMS also hosted a successful Theme 3 workshop in November 2007, exploring the interactions between fluid dynamics and seabed roughness.

Several cruises have been taking place, funded or part-funded by Oceans 2025 including to the Fram Strait and Summer Isles. The 2007 Ellett line cruise found that sea surface temperatures in the Rockall Trough continue to rise while the salinity peak of 2000 has since been reversed. Other Oceans 2025 activities in this first year revolved around the planning and organising of field campaigns, the setting up of experiments, and the analysis of collected samples.

For more information on Oceans 2025, please visit the www.sams.ac.uk and / or the Oceans 2025 websites (www.Oceans2025.org) or contact the Oceans 2025 science coordinator:

Dr Phil Williamson
E: p.williamson@uea.ac.uk,

Anuschka Miller

PHYSICS, SEA ICE AND TECHNOLOGY DEPARTMENT

Department members: Dr Mark Inall (Head), Mr David Meldrum (Deputy), Mr John Bass, Mr John Beaton, Dr Tim Boyd, Dr Finlo Cottier Dr Andrew Dale, Miss Estelle Dumont, Mr Colin Griffiths, Dr Keith Jackson, Mr Alistair James, Dr Toby Sherwin, Dr Ian Sillitoe, Dr Pushkar Wadke, Dr Jeremy Wilkinson

PHYSICS, SEA ICE AND TECHNOLOGY DEPARTMENT

The Oceans 2025 programme has heralded a period of major capital investment within the Department. A total of £978k was awarded to SAMS under Oceans 2025 capital, of which about £700k is allocated to Physics, Sea ice and Technology. Add to this the final phase of ARC capital investment, and the total capital investment is over £900k. The major new big-ticket items will be an AUV (Autonomous Underwater Vehicle), a Sea Glider and a cold-environment test facility.

There have been several staff changes during the last year. We have recruited strongly in both Physics and Technology, bringing the Department back up to full complement, following a difficult 12 month period of under-manning. The Physics Group is now at its strongest ever, with two new technical appointments and the Department is fully capable of delivering the huge capital investment programme. Overall, it has been a good year and a small selection from our research projects appears below.

ARCTIC SHELF ECOSYSTEMS

SAMS has continued to operate its multi-parameter moored observatory in Kongsfjorden, NW Spitsbergen. Now entering its sixth year of operation, it constitutes an important contribution to the international research community that operates out of the Svalbard Archipelago. Since 2006, SAMS has also operated an identical observatory in Rijpfjorden, in Nordaustlandet, in the north east of the archipelago supporting a project funded by the Research Council of Norway to investigate the fate of arctic ecosystems under conditions of reduced sea ice cover. The leader of the Rijpfjorden project is Prof Jørgen Berge of the University Centre in Svalbard and he has spent 2007-08 at SAMS on sabbatical. During this period he has been investigating the wintertime behaviour of zooplankton. The classical view of arctic ecosystems is that biological processes slow down or stop during the continual darkness of winter to conserve energy – only resuming once the sun reappears. Acoustic data have shown that zooplankton sustain a vertical migration behaviour through the winter with a strictly 24 hour period. This behaviour is occurring in both Kongsfjorden (ice free) and Rijpfjorden (ice covered) and is a response to almost imperceptible changes in light intensity. Further investigation of arctic ecosystems will continue with a NERC grant between SAMS, St Andrews and the British Antarctic Survey.

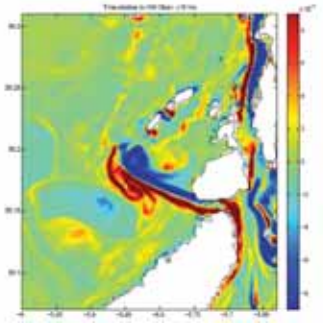
Finlo Cottier, Mark Inall & Colin Griffiths

TIDAL MODELLING OF THE FIRTH OF LORN

A high resolution tidal model of the Firth of Lorn has been developed, with particular interest focussed on the area surrounding the Garvellach islands, including the Great Race the westward extension of tidal flow through the Gulf of Corryvreckan. This area has a complex bathymetry and often intense tidal flows. The model is implemented using POLCOMS, a UK-developed ocean modelling system, and exploits the parallel computing power of the SAMS Linux cluster.

The initial impetus for the development of this model was an SNH contract aimed at understanding the impact of scallop dredging in the region, by interfacing current predictions with a particle-tracking model to predict the fate of sediment stirred into the water column. Beyond this initial goal, however, the model offers insights into the fascinating physics of the region. In particular, the regular production of eddies by the Great Race makes this site perfect for investigating the stirring of the ocean by eddies and how this is represented in models.

Andy Dale & Toby Sherwin



A pair of opposite-rotating eddies generated by tidal flow through the Gulf of Corryvreckan. Colours represent vorticity (eddying activity).

INTERNATIONAL SPACE SCIENCE INSTITUTE

The International Space Science Institute (ISSI) was established to further interdisciplinary, international studies and interpretation of experimental data, which originate from multi-experiment satellites, already launched or due to be launched in the near future by different space agencies. During the International Polar Year 2008, the ISSI widened its remit to encompass Earth Science. The first Earth Science meeting ever held at ISSI was co-ordinated by Jeremy Wilkinson, SAMS. It is the first in a series of meetings and workshops, funded by the European Space Agency and ISSI, concentrating on the changing nature of Arctic Polynyas – areas of open sea water bounded by ice or ice/land. Two polynya systems were

PHYSICS, SEA ICE AND TECHNOLOGY DEPARTMENT

identified for further study; the Northeast Water Polynya system which is situated over the continental shelf region of NE Greenland and the North Water Polynya/Nares Strait system which is located between Ellesmere Island (Canada) and Greenland. The functioning of both these systems has undergone change in recent years. The first meeting was held in March and involved scientists from half a dozen countries who have been studying the North Water Polynya/Nares Strait region. One output from this meeting was the establishment of a special issue journal encompassing the present state of our knowledge of this region. A second international meeting on the region is scheduled for November 2008.

Jeremy Wilkinson

MARINE TECHNOLOGY GROUP

After being significantly under strength for most of the year, the recruitment of two excellent new engineers in January (Keith Jackson and John Bass) has returned the group to full strength. Together with technology teams at NOCS and POL, we submitted a successful proposal for technology development (Theme 8) within the context of Oceans 2025. Theme 8 will underpin much of the work of the group over the next few years, and will see us addressing the overall objective of developing an optimal marine observing network. Specific work packages are focussing on sensor optimisation, smart *in situ* data processing, platforms and communications. The work will complement other Oceans 2025 work, both at SAMS (notably with the physics and geochemistry groups) and at other NERC-supported institutes, such as the Sea Mammal Research Unit at St Andrews.

Below are just some of the highlights from 2007-8.

ICE PLATFORMS

It is now evident that the sea ice cover of the Arctic Ocean is under threat from increasing heat and fresh water inputs and SAMS is playing an important role in the international effort to monitor these changes. The group continues to work closely with sea ice specialists at SAMS and elsewhere in the development, construction and testing of novel instrumentation for sea ice observations combined with state of the art satellite communications technologies such as Iridium 9601 and a new 2-way ARGOS system. These efforts are being co-ordinated within the context of the International Polar Year, and the SAMS technology group has been supported both by substantial NERC grants, and by European funding under the RECARO and DAMOCLES programmes. Recent deployments have included tiltmeter and GPS suitcase buoys, both designed to monitor ice movements and the changing pattern of the ice cover. This year we have also developed a novel clear-hulled GPS buoy, which will use solar panels, a rechargeable battery and satellite communications to study year-round ice dynamics.

John Bass, Keith Jackson, Alistair James, David Meldrum, Ian Sillitoe & Pushkar Wadke

Clear-hulled GPS buoys being prepared at Alert station in northern Ellesmere Island. The buoys all report their position via satellite in support of studies of the movement of sea ice in the Arctic Ocean and the adjacent Nares Strait. Two buoys also report barometric pressure for use by the global weather forecasting community.

An Iridium 9601 satellite modem and antenna. This device is transforming our ability to interact with and receive data from remote instruments anywhere in the world.

The Iridium Pilot Project has deployed more than 50 Iridium-equipped drifters in a variety of challenging ocean environments with the aim of seeing how well Iridium performs in tough conditions. The environmental data from these drifters is used by the weather forecasting community and by ocean modellers.

BIOGEOCHEMISTRY AND EARTH SCIENCES DEPARTMENT

Department members: Dr Tracy Shimmield (Head), Dr John Howe (Deputy), Dr Tim Brand, Miss Susan Fitzer, Mrs Anni Glud, Prof Ronnie Glud, Miss Cheryl Haidon
Mr S Martyn Harvey, Dr Angela Hatton, Miss Helen Kinninmonth, Miss Pauline Learmonth, Miss Susan McKinlay, Dr Axel Miller, Mrs Joyce Moore (Part time)
Dr Arlene Rowan, Dr Dan Sinclair, Dr Henrik Stahl, Dr Robert Turnewitsch

BIOGEOCHEMISTRY AND EARTH SCIENCES DEPARTMENT

This Department unites the disciplines of biogeochemistry, geochemistry, sedimentology and radiochemistry. Our fundamental research aims to encompass the investigation of rates and frequencies of natural and anthropogenic change in the marine environment at temporal scales from longer term (100ka) to short term (annual, seasonal, diurnal, tidal). Over the last year we have seen the addition of a number of new members of staff, increasing the research skills and capability of the department. A major new applied project also commenced. The activities reported below provide a cross section of our research themes.

AN INDEPENDENT EVALUATION OF DEEP-SEA MINE TAILINGS PLACEMENT (DSTP) IN PAPUA NEW GUINEA (PNG).

The Lihir gold mine, Papua New Guinea

The main aim of this applied project, which is funded through the EU, is to investigate the effects of the discharge of mine tailings into the deep oceans and provide the PNG government with guidelines on the placement of tailings. Within the study we are investigating 3 sites, Lihir Gold mine located on Lihir Island (operational), Misima Gold mine located on Misima Island (tailings discharge stopped 4 years ago) and finally a site at Basamuk which is a proposed tailings discharge site for Ramu Nickel mine. A review of all data available for both Lihir and Misima mines was completed in August 2007 and a cruise to the Solomon Sea and Milne Bay, southwestern Pacific was carried out from October to December, 2007. During the 7 week cruise, the first ever photographs

Deploying the SAMS megacorer onboard the *Miss Rankin*, Papua New Guinea.

and undisturbed sediment cores of both Lihir and Misima seabeds were obtained. The data gathered during the cruise and from analysed samples will provide the information on which the guidelines will be based. These sediment cores will provide the first geochemical and biological data in this region. In addition, SAMS is organising an international conference on DSTP, which will be held in Madang, PNG, to discuss the recent work and draft guidelines which SAMS is producing for the PNG Government.

Tracy Shimmield & John Howe

OCEAN CIRCULATION SINCE THE LAST GLACIATION

Two sediment cores collected from north and south of the Wyville-Thomson Ridge provide a detailed history of bottom-currents and ice-sheets since the last glaciation. The Wyville-Thomson Ridge is the southerly continuation of the Greenland-Iceland-Scotland Ridge and hence a barrier to the flow of deep water in the north Atlantic. In the northern Rockall Trough a long core and associated short multicore were obtained from the flank of an elongate sediment drift. In the Faeroe Bank Channel, a long core was located in a region of sheeted sediment drifts. Radiocarbon dating of the cores reveals that they span the last 40,000 years, a period that includes the last cold-warm climatic cycle after the full glaciation. All cores were analysed for magnetic susceptibility, wet bulk density, fractional porosity and P-wave velocity, further to detailed (1 cm interval) grain-size analyses. The grain size data are used to reconstruct the ancestral flow of two different water masses; Norwegian Sea Deep Water (NSDW) in the Faeroe Bank Channel and North Atlantic Deep Water (NADW) in the northern Rockall Trough since glaciation. During glaciation, the flow of both was weaker, although still active. Both sites also display intervals of abundant ice-rafted debris from glacial ice. Ocean circulation during climate warming produced a steady increase in flow. This response is noted at both sites suggesting basinal connectivity between the northern Rockall Trough and the Faeroe Bank Channel i.e. between both the NADW and NSDW.

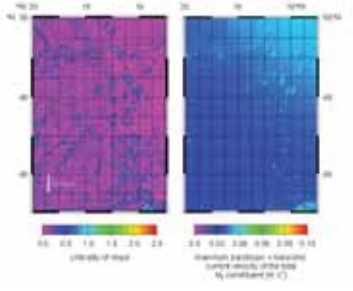
Kate McIntyre & John Howe

TIDES AND SEDIMENT DYNAMICS IN THE DEEP SEA

There is growing evidence that by interacting with kilometer-scale seafloor features such as deep-sea hills and seamounts, tides play an important role in vertical mixing of the global ocean, thereby maintaining the observed density stratification. Model studies suggest that due to ice-age / inter-ice-age sea level changes, tidal dynamics in the deep open ocean also changed, with potential consequences for vertical mixing, density stratification, ocean overturning, and

hence, biogeochemical cycles and climate.

Reconstructing these changes would help predict future variability of tidal dynamics and possible feedbacks. Any fluid-dynamical changes in the interior ocean are amplified near seafloor features that protrude into the interior ocean (such as seamounts) and sedimentary records from these features are most likely to archive the sought after signals. By looking at flow/seamount interactions, and their reflection in the distribution of particulate-matter tracers and the sedimentary record of the modern ocean, we are working towards establishing a sediment-based



Maps of the criticality of seafloor slopes (left) and of total maximum current velocities near the seafloor (right) for the tidal M2 constituent (the strongest of the tidal constituents) in a part of the deep Northeast Atlantic off the western coast of France.

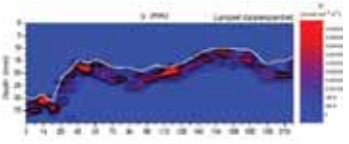
proxy for past changes of tidal dynamics. Progress during the last year resulted from two projects. First, for study sites in the Northeast Atlantic, we combined the tidal model of Jonas Nycander with field data of the naturally occurring particulate-matter tracer ^{234}Th. We were able to show that the formation of internal tides and the resulting locally increased current velocities on critical or near-critical seamount slopes (slopes where the criticality equals or is close to 1) are associated with intensified sediment resuspension. Second, a comparison of the behaviour of the particulate matter tracer ^{234}Th in a deep-sea environment with typical open-ocean tides (the Northeast Atlantic study), with its behaviour in a deep-sea environment with very weak tides (Eastern Mediterranean), suggests that tides are of key importance for topographically-controlled sediment dynamics in the deep open ocean. Future work will use these results to establish a sediment-based proxy for past changes of tidal dynamics in the deep open ocean.

Robert Turnewitsch (SAMS) and colleagues at the universities of Rostock, Stockholm, NOC Southampton and the Laboratoire des Sciences du Climat et l'Environnement, Gif-sur-Yvette.

CARBON TURN-OVER FROM SEA ICE TO THE DEEP SHELF

It is of the utmost importance to constrain and investigate the efficiency by which organic material is produced and degraded within the marine environment. Local, regional and global carbon cycling strongly interrelates to the chemical and biological marine environment and has a profound effect on climatic forcing. A combination of laboratory-based investigations and field observations has shown that the formation and thawing of sea ice has important implications for the gas dynamics (i.e. O_2 and CO_2) within and around sea ice. As sea ice forms, the hypersaline brine-channels of the ice become supersaturated with O_2 and CO_2, which has strong implications for the inorganic carbon chemistry and the microbiology of the sea ice. The work is a part of an ongoing, integrated, multi-disciplinary study resolving the carbon cycling of a High-arctic ecosystem. The current status of the research was compiled in a book that was published in 2007.

70% of our coastal ocean seabed is covered by relict sand and 50% of this is believed to be permeable sand. It has generally been considered that as sand holds little organic material, such sediments were of minor importance for regional carbon cycling. In reality, however, the organic carbon held by such sediments is of a very high "quality" and is turned over at a very rapid pace. It has been documented that permeable sands hold a great potential for carbon and nutrient turn-over in the Waden Sea, Baltic Sea and at the Great Barrier Reef. Studies on the interrelation between advective porewater transport and conspicuous infauna, e.g. lugworms *Arenicola* spp. and sand eel *Ammodytes tobianus* demonstrated a very dynamic microenvironment around buried animals. The infauna clearly affected the patterns of porewater transport and stimulated benthic exchange rates and overall carbon turn-over.



In situ volume specific O_2 consumption rates at 1500m water depth derived from a 218 mm long transect of 33 microprofiles measured at an equidistant interval of 7 mm. The white line indicates the estimated sediment surface.

Athough early investigations have suggested that ocean margins represent areas of intensified benthic carbon mineralization, deep slope sediments remain an understudied area of the ocean floor. During a close collaboration with the Japan Agency for Marine Earth Science and Technology (JAMSTEC) we have conducted a number of detailed investigations of carbon and nutrient cycling at 1500m water depth in central Sagami bay, Japan. Measurements show that most carbon reaching the seabed in

BIOGEOCHEMISTRY AND EARTH SCIENCES DEPARTMENT

the area is degraded by iron-respiring bacteria. In order to perform the studies a number of new technological developments were realized in collaboration with other institutions. These developments include a transecting microprofiling instrument, deep-sea O_2 eddy-correlation measurements and *in situ* nitrate microsensor measurements.

Ronnie N Glud & Henrik Stahl

OCEAN SCIENCE ON TALL SHIPS INTIATIVE

'University of the Oceans' is the unofficial term for a new tall ship being built specifically for scientific research and education by the Future Ship Project for the 21st Century (http://www.fsp21.com) In order to test the feasibility of conducting marine science on a tall ship, the Future Ship Project, Jubilee Sailing Trust (JST) and Challenger Society proposed the Ocean Science on Tall Ships Initiative. Scientists and members of the general public were invited to take part in a cruise around the Canaries onboard the *Lord Nelson*. The JST is a registered charity that enables participants whatever their physical ability to integrate and challenge themselves through the adventure of tall ship sailing. All cruise participants were encouraged to take part in the ships activities including sailing, scrubbing the decks and marine science research. The aim for the scientists was not only to conduct their research but to integrate and educate the non-scientists. Highlights included sightings of several minke whales, glowing phytoplankton, sailing through patches of Portuguese Man o' War and the excitement of an anti-piracy drill. SAMS participation in the cruise was not only to promote science, but to research the 'oceanic methane paradox' and its effect on climate. This paradox relates to the observed supersaturation of methane in the upper oceans, despite the fact that the organisms responsible, methanogens, are strict anaerobes and the upper oceans are highly oxygenated. Anaerobic microsites within zooplankton, their faecal pellets and sedimentary material may provide sites for this methane production, and the cruise provided an ideal opportunity to gain a better understanding of the natural diversity of methanogens and the processes involved in methane production by collecting zooplankton samples from tropical localities. Furthermore, it was a fantastic opportunity to study science related to climate change on a low carbon footprint sailing ship.

Arlene Rowan

ECOLOGY DEPARTMENT

Department members: Dr Kenny Black (Head), Dr Michael Burrows (Deputy), Dr Robert Batty, Mrs Christine Beveridge, Mr Lars Brunner, Mrs Caroline Carter (part-time) Dr Elizabeth Cook, Mrs Janet Duncan (part-time), Dr Clive Fox, Dr Vicki Hendrick (part-time), Dr Sheila Heymans, Mr Robin Harvey, Dr David Hughes, Dr Maeve S Kelly Dr Kim Last, Mr Peter Lamont, Miss Shona Magill (part-time), Dr Lois Nickell , Dr Thomas Nickell, Mrs Heather Orr, Dr Tavis Potts, Mrs Linda Robb, Dr Murray Roberts Miss Coleen Suckling, Dr Tom Wilding, Ms Averil Wilson, Dr Ben Wilson

ECOLOGY DEPARTMENT

Ecological research at SAMS extends from the shore to the greatest ocean depths and includes studies on benthic macro-algae, invertebrates and vertebrates of all major groups, including marine mammals. A mix of fundamental and applied studies allows us to capture income from disparate sources. As the largest research department at SAMS, the following can only be a glimpse of the breadth of our research. For details of other projects, the reader is directed to the SAMS website.

DEEP-WATER OASES

The biology of the northeast Atlantic deep water area to the North and West of the UK mainland has been investigated since the 19th Century and this region is sometimes described as the birthplace of deep-sea research. Within the region lie several submerged mountains and ridges, but only recently has interest in these features grown sufficiently, and technology become available, to allow researchers to explore their steep and rocky terrain and capture high quality images of the seafloor. Researchers at SAMS, in conjunction with the University of Plymouth and the National Oceanography Centre, Southampton, have discovered that the UK's seamounts and ridges are teeming with exotic-looking animals that thrive on the plankton brought to them by persistent deep water currents.

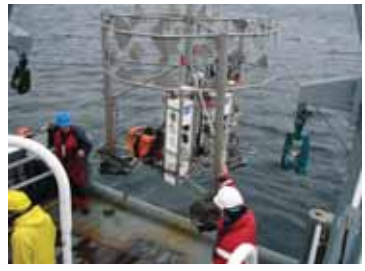
The surveys to undertake this research were funded by the Department for Business, Enterprise and Regulatory Reform (formerly the Department of Trade and Industry) through the Strategic Environmental Assessment programme of Area 7. Thousands of photographs and many hours of video tape were collected and analysed allowing researchers to study previously unexplored fields of feather stars, sweeping expanses of sponges and coral-like meadows. The data collected will allow comparisons to be made with research being undertaken internationally through other programmes such as the Census of Seamounts.

Bhavani Narayanaswamy & David Hughes

Dense beds of feather stars, with hydroids and anemones at 475 m depth on the northern flank of the Wyville Thomson Ridge

UNDERSTANDING COASTAL BENTHIC SYSTEMS - HOW DO WE KNOW WHEN THINGS ARE GOING WRONG?

Coastal ecosystems are highly productive environments from which humans derive much benefit. Many are already substantially altered and exploited but in order to achieve sustainable resource use, knowledge is required of how these systems function. Interactions between benthic biodiversity, ecosystem function and the effects of man-made impacts are still poorly understood, however, the oceans now face global environmental changes, such as acidification, rising temperatures and UV intensity. To protect, preserve or enhance resources, our actions must be underpinned by sound knowledge of the system and its responses. Bringing together the skills and expertise of 13 partners across Europe, the EU FP6 funded COBO project developed and integrated *in situ* technologies for observation and measurement of organisms and sediment processes in order to examine the complex relationships between animals and their chemical environment.



A multi-chambered benthic lander being recovered by *RV Calanus*

Collaborative *in situ* experiments with the University of Aberdeen, Ocean Lab, using a moored multi-chambered benthic lander, have compared sediment and solute

mixing processes in sediments along a gradient of organic enrichment provided by the presence of an Atlantic salmon farm. On the sea bed, luminescent tracer particles were added to benthic incubation chambers to determine rates of bioturbation - the mixing of sediment particles caused by animal activity. A second tracer, sodium bromide, was used to measure bioirrigation - the water movement caused by the pumping activity of organisms living beneath the sediment surface. Both of these processes can have significant influences upon the supply of oxygen and the rates of many chemical processes occurring in sediments.

Organically enriched stations showed much lower rates of bioturbation and bioirrigation. Where sediment organic carbon load was very high, oxygen became limiting, leading to a lower diversity of organisms living only in the top centimetres or millimetres of the sediment. At less organically enriched stations, organism diversity increased, as did burrow depth. Here, animal activity contributed to rapid incorporation of particles and solutes to much greater depths, leading to a 3-dimensional mosaic of chemical processes. The influence of animals on their environment varied greatly under conditions of varying organic enrichment and we are continuing to explore the potential of integrated measures of organism activity, such as these, to provide indicators of ecosystem function and health.

Lois Nickell

CAN MARINE RENEWABLE ENERGY TECHNOLOGIES BE GREEN?

With wind turbine technologies now an established weapon in the energy generation armoury, political, financial and engineering interests are eyeing wave and tidal technologies as the next big renewable energy opportunity. Ensnaring the sea's bountiful supply of kinetic energy is a colossal challenge and unlike wind turbine designs, which all look much like each other, the new legion of marine machines range hugely in design. There is a palpable buzz of excitement in a marine renewables industry eager to get these devices into the sea and find out which will triumph in an intense development race.

In addition to the challenges faced by the designs in delivering power and surviving the sea's punishment, there are potential risks and benefits to marine life. At SAMS we are looking into how renewable energy devices and living organisms will interact. Most of our work has focused on interactions with marine vertebrates – fish, marine mammals and diving birds. There may be potential benefits: inadvertent fishery exclusion zones around device farms, artificial at-sea rest stops for birds and seals and artificial reef effects for fish. Conversely, there are conservation concerns such as the risk of fish, marine mammals and birds colliding with underwater turbines in strong tidal flows. Dr Bob Batty's ongoing modelling work is looking at how frequently fish and mammals will run the risk of colliding with these devices. Caroline Carter's MSc project has looked at how far upstream animals will be able to hear and potentially avoid them and my latest work has been developing new techniques to measure background and device-generated sound in strong tidal flows, to provide real numbers for the models. We have a responsibility as researchers not only to highlight potential areas of conflict but to help point the way to solutions. After all, what better cause is there for today's marine ecologists than helping these new and worthy industries to reduce global carbon emissions without causing undue harm to marine life?

Ben Wilson

ECO-LABELLING AND CERTIFICATION – EFFECTIVE AIDS TO SUSTAINABILITY?

The human population continues to expand, creating increasing demand for environmental services and goods from ocean resources. Overfishing affects all but four of the world's 16 fishing regions, with 76 percent of global stocks fully exploited, overexploited, or depleted. In parallel to this, global aquaculture production is expanding rapidly, raising concerns about the sustainability of both

The dynamic feedback systems present in the seafood marketplace.

industries. The traditional approach to regulation has involved a top-down approach by central governments; limiting fishing effort, catch size or both. The effectiveness of this management approach is increasingly being called into question. Recently, policy makers have started to explore new tools for

environmental protection, including Market Based Instruments (MBIs). Certification and eco-labelling are incentive based MBIs, which promote products and production processes that have fewer impacts on the environment than similar products. They aim to improve management by providing market incentives for producers who meet 'sustainability' criteria and are a signal for consumers who prefer sustainable products. Eco-labelling refers to the awarding of a visual label to a product that passes a set of defined criteria, usually along the lines of environmental best practice.

The first problem concerns the structure of the certification system; standard complexity, benchmarking, cost, credibility and governance. Minimal research exists on the comparison of different schemes, their strengths and weaknesses and their effectiveness. The EECSAF project, funded by the Economic and Social Research Council, aims to examine the issues surrounding the eco-labelling of fisheries and aquaculture products at a time when it is becoming a tool with significant public interest and investment of resources. Competition is also emerging between fishery and farming sectors in capturing the 'sustainable' or 'organic' market. Drawing on methodology from the field of environmental policy, this research is directed towards understanding complex problems that affect society, industry and markets. It also responds to information gaps identified in the literature and in discussion with organisations such as the Marine Stewardship Council and the Soil Association. These include a lack of analysis of integrated fishery and aquaculture certification systems; comparison and benchmarking of certification processes; the need for analysis on consumer preference for eco-labelled products and the impact of certification on producer behaviour.

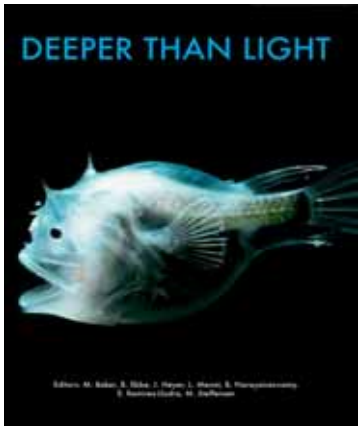
Tavis Potts & Averil Wilson

THE EUROPEAN CENSUS OF MARINE LIFE (EUROCOML)

EuroCoML has continued to develop during the past 12 months. There have been several high profile meetings where keynote talks have raised the awareness of CoML in Europe e.g. presentations made at the joint Italian Association for Limnology and Oceanography and Italian Society of Ecology Congress. EuroCoML has continued to fund international workshops in key areas of systematics e.g. Ribosomal RNA technology and Novel modelling approaches to relate biodiversity of marine sediments to ecosystem functioning, as well as strengthening the links with a number of CoML projects.

A new development has been the affiliation of different projects from several regions to EuroCoML. These comprise (i) the Ecosystem of the Mid-Atlantic Ridge at the Sub-Polar Front and Charlie Gibbs Fracture Zone (UK), (ii) Southern European Seas: Assessing and Modelling Ecosystem Changes (Greece), (iii) BIOdiversity and ecosystem FUNctioning in contrasting southern European deep-sea environments: from viruses to megafauna (Spain) and (iv) Monitoring the marine biodiversity along Calabrian coasts (Italy).

Education and outreach activities featured a collaboration between the four European led deep-water CoML projects, to publish a book entitled Deeper than Light in English and German, and soon to



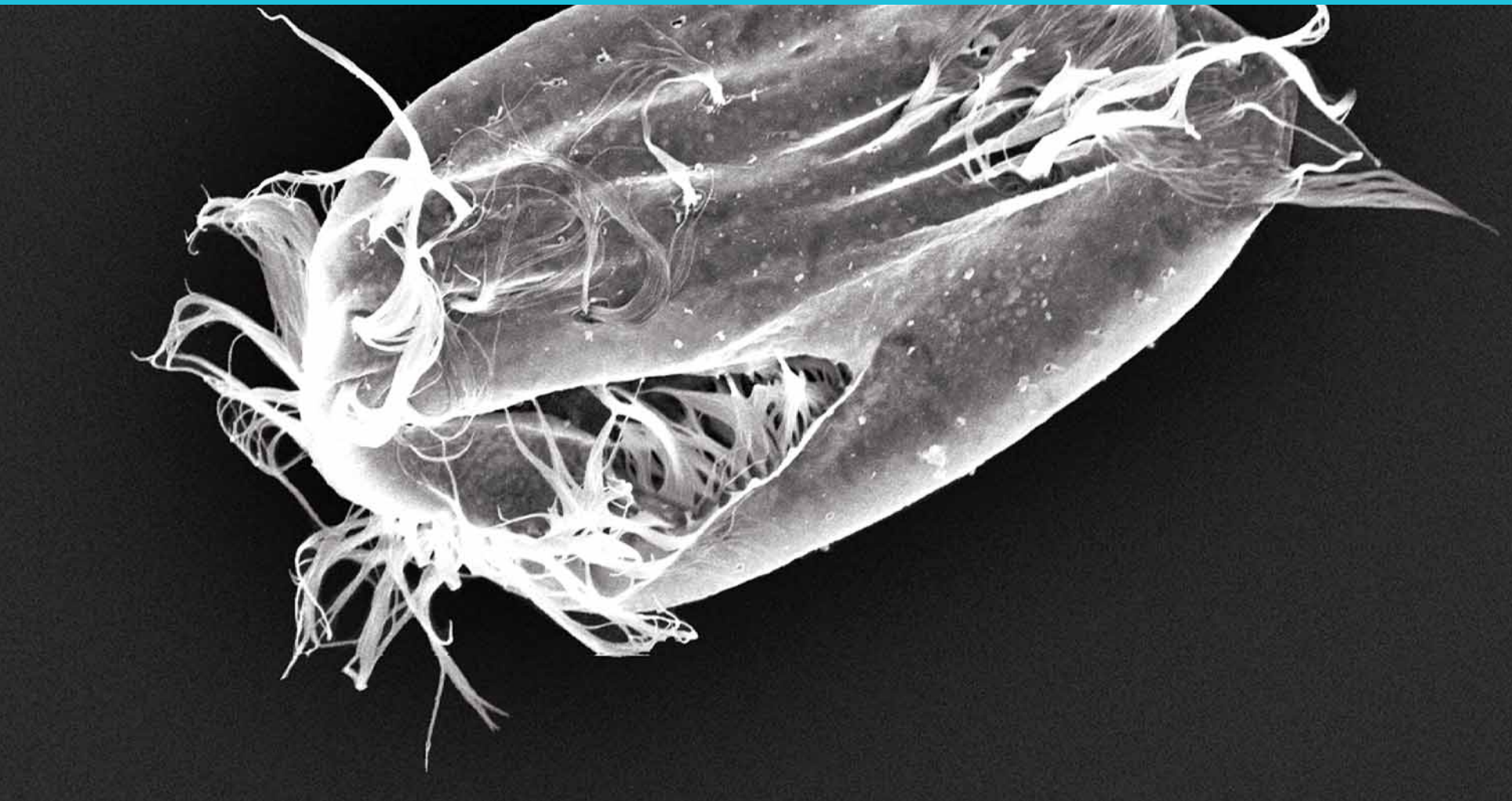
be available in French, Norwegian and Spanish (available from www.eurocoml.org). The book, written for the general public, includes many stunning underwater photographs, pen and ink drawings from the Michael Sars expedition and paintings by a Norwegian artist.

EuroCoML was delighted to receive the Census of Marine Life Outstanding Achievement Award for building community within the Census at the CoML All Programme meeting in New Zealand. The award was given as a result of the work that has gone into building up the profile of CoML within Europe.

Bhavani E Narayanaswamy

MICROBIAL AND MOLECULAR BIOLOGY DEPARTMENT

Department members: Dr Ray Leakey (Head), Dr Frithjof Küpper (Deputy), Dr Elanor Bell, Mrs Undine Achilles-Day (part-time), Mrs Debra Brennan, Mrs Christine Campbell (part-time), Mrs Alison Clarke, Dr Keith Davidson, Dr John Day, Ms Joanne Field, Dr Claire Gachon, Dr Tony Gutierrez, Dr David H Green Dr Mark Hart, Dr Vincent Le Fouest, Mr Christian Loenborg, Mrs Eleanor Martin, Miss Sharon McNeill, Ms Elaine Mitchell, Mr Romain Pete, Dr Thomas Pröschold Miss Cecilia Rad Menendez, Miss Rachel Saxon, Dr Damodar Shenoy, Dr Michele Stanley, Miss Martina Strittmatter, Ms Sarah Swan, Mr Tim Wilkinson



MICROBIAL AND MOLECULAR BIOLOGY DEPARTMENT

BIOGEOCHEMICAL INSIGHTS FROM BIOTECHNOLOGY

Emulsifiers are chemical compounds that are used extensively in all sectors of modern industry to mix substances that are not generally miscible, such as oil and water. There is currently a demand for 'natural' emulsifiers ('bio-emulsifiers') to replace synthetic emulsifiers in such products as cosmetics. In 2003, we commenced biotechnological research aimed at producing new types of bio-emulsifiers to hopefully meet markets requirements. This work has been generously funded by the Highlands & Islands and Argyll and the Islands Enterprise and, through 2007, by NERC.

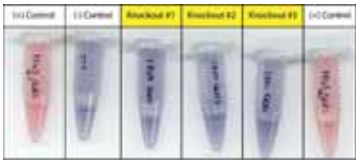
This search has been successful, with a number of high molecular-weight (polymeric) bio-emulsifiers, which show excellent potential for the food and healthcare markets. However, in the course of analysing the chemical composition of these polymers, we found them to contain unusually high levels of a sugar called uronic acid. This sugar is negatively charged and we believed this might enable these bio-emulsifiers to complex metal ions. In collaboration with Dr. Tracy Shimmield (Biogeochemistry and Earth Sciences Dept.), we found that these polymers exhibited a remarkable ability to bind a variety of metals. In particular, iron was bound at high concentrations, and surprisingly, so were a number of toxic heavy metals, like lead and uranium. Clearly, these bio-emulsifiers are more than useful for mixing just oil and water; they show clear promise for scavenging various metals or pollutants from water or sediments as well.

While our original aim was to search for biotechnologically interesting natural and polymeric bio-emulsifiers, the finding that a number of marine bacteria produce polymers with significant emulsifying and metal-binding properties begs the question: Why are they doing this? One answer is that these bacteria use these polymers to scavenge iron, which all living things need to grow and divide. To-date, our results demonstrate the strongest evidence supporting the hypothesis that marine bacterial exopolymers can contribute to maintaining a pool of iron in the water column, where it may be used by phytoplankton for their growth and the development of primary production.

Tony Gutierrez, David Green & Tracy Shimmield

IT'S A [GENE] KNOCKOUT

As a part of a collaborative project with the San Diego State University to look at "The Role of Symbiotic Bacterial Metabolites in the Development of Toxic Phytoplankton Blooms" funded by the California Sea Grant, we set out to knock out a key biosynthetic gene involved with iron scavenging, that encodes for the synthesis of a siderophore (Greek for 'iron carrier') – see previous section. Discovering the mechanism by which scavenging occurs is our aim, but the current possibilities include: algae hijack the bacteria's siderophores stealing the bound iron (i.e. competition); the bacterial siderophore rapidly associates with the algal cell surface and then delivers iron (i.e. altruism/symbiosis); normal bacterial activity in and around the algal cell alters the iron bioavailability in some other manner. Knocking out siderophore production by the bacteria would show whether algae living with bacteria that do not produce siderophores fail to grow as well as when they are growing with a positive control (bacteria that produce siderophore), thus providing good evidence for the importance of siderophores. Having the complete genome sequence of the target bacteria (*Marinobacter algicola* DG893) sequenced for us by the Gordon and Betty Moore Foundation (USA) made de-activation of the siderophore biosynthesis gene a relatively straightforward process. We have now completed this first stage of knocking out the gene and future work will look at the effects of this on algal growth.



Results of a biochemical assay showing that the bacteria in the 'pink' tubes produce siderophore, while those in the 'blue' tubes have had their siderophore biosynthesis gene inactivated.

(+) Control = Wild type bacteria producing siderophore
(-) Control = No bacteria
Knockout #1, #2, #3 = Successful gene knockout; bacteria fail to produce siderophore

David Green, Mark Hart & Frithjof Küpper (SAMS); Shady Amin & Carl Carrano (SDSU)

THE ANTIOXIDANT FUNCTION OF IODIDE IN KELP IMPACTS COASTAL CLIMATE

The large brown kelps of the genus *Laminaria* are known as the world's most effective bio-accumulators of iodine, an important element for thyroid function in humans. The chemical speciation and biological role of iodine in kelp had, however, remained enigmatic until now.
A new study found that large brown seaweeds, when under stress, release

large quantities of inorganic iodine into the coastal atmosphere, where it becomes oxidised and can contribute to cloud formation, thus influencing climate. Iodine is stored in the form of iodide - single, negatively charged ions - which acts as the first known inorganic (and, in fact, the most simple) antioxidant in any living system.

When kelps experience stress, for example when they are exposed to intense light, desiccation or atmospheric ozone during low tides, they very quickly begin to release large quantities of iodide from stores inside the tissues. These ions detoxify ozone and other oxidants that could otherwise damage kelp, and, in the process, produce molecular iodine. Our new data provide a biological explanation for why we can measure large amounts of iodine oxide in the atmosphere above kelp forests. These chemicals act as condensation nuclei around which clouds may form. Similarly, large amounts of iodide are released from kelp tissues into sea water as a consequence of oxidative stress during a defence response against pathogen attack.

Iodide, the accumulated form of the biologically essential element iodine in *Laminaria* (kelp), constitutes the first identified case of an inorganic antioxidant in life, impacting atmospheric and marine chemistry. Iodide scavenges both aqueous and airborne oxidants at the surface of kelp tissues. In the case of ozone, this results in the formation of aerosol particles, contributing to coastal cloud formation.

Localities: (left) Roscoff, Brittany, France; (right) Dunstaffnage, Argyll

Kelps thus play an important role in the global biogeochemical cycle of iodine and in the removal of ozone close to the Earth's surface. This interdisciplinary and international study - with contributions from the United Kingdom, the Netherlands, Germany, France, Switzerland, the European Molecular Biology Laboratory (EMBL) and the USA - comes almost 200 years after the discovery of iodine as a novel element - in kelp ashes.

Frithjof Küpper

RISK ASSESSMENT - BASED MODELLING OF THE APPEARANCE OF HARMFUL ALGAL BLOOMS

Harmful algal blooms (HABs) are common in UK and other North West European marine waters. In particular, naturally occurring bio-toxins from certain harmful phytoplankton are problematic for the shellfish industry. By feeding on the phytoplankton, shellfish accumulate the toxins within their biomass. Subsequent ingestion of contaminated shellfish by humans or other mammals can have serious heath consequences.

In Scottish waters, human health is safeguarded by a comprehensive program of monitoring of both harmful phytoplankton in the sea and biotoxins within shellfish flesh, the phytoplankton component of which is operated by SAMS on behalf of the Food Standards Agency. Such monitoring has been very successful in preventing shellfish poisoning events.

Currently the response to HABs is conducted on a reactive basis based on the results of these monitoring programs, with little understanding of the factors that govern the temporal or spatial appearance of harmful blooms. Within the EU Interreg IIIB project "FINAL", along with collaborators at IFREMER in France and the Martin Ryan Institute of the National University of Ireland, Galway, we are seeking to derive simple risk assessment criteria and models in which the development of HABs are related to easily measured water chemistry or meteorological parameters. Such analysis is intended to better understand and predict the appearance of blooms of two toxin producing genera: *Alexandrium* and *Pseudo-nitzschia* responsible for paralytic and amnesic shellfish poisoning respectively.

Initial results, based on time series data sets collected over a number of years in Loch Creran near Oban, suggest that the appearance of blooms of *Pseudo-nitzschia*, of sufficient size to be harmful, can often be related to a set of criteria based on easily collected water chemistry and meteorology. This suggests that local risk assessment criteria may be achievable at individual shellfish harvesting locations.

Keith Davidson, Romain Pete, Sharon McNeil & Joyce Moore

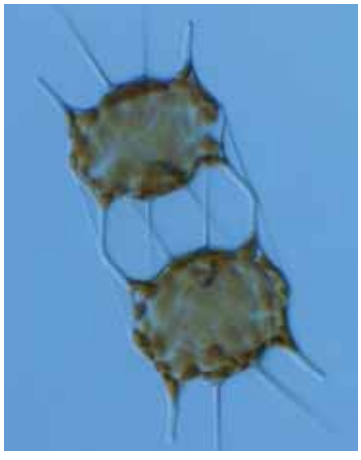
CULTURE COLLECTION OF ALGAE AND PROTOZOA (CCAP)

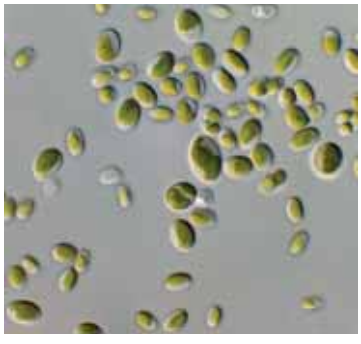
The CCAP currently maintains in excess of 3000 strains of algae, cyanobacteria and free-living, non-pathogenic protozoa, with more than 2900 of these being held in the publicly accessible collection. In 2007, 520 new strains were added to the Collection, including 11 authentic strains derived from original type material (details of new accessions are listed on the CCAP website www.ccap.ac.uk). The CCAP acts as the UK Service Collection for the provision of cultures and their associated data to the UK and world-wide scientific communities. The demand for CCAP strains and services has continued to increase over the past 12 months with the servicing of >500 orders from customers. This included the provision of approximately 1300 cultures, as well as the provision of patent services, extracted DNA, training courses and algal identifications. Recently, a new website for CCAP strain-related data was launched, providing a format to include still images and video clips, bibliographic references, biogeographical and chemical information and nucleotide sequence accession numbers, with the aim of developing this into a comprehensive protistan knowledgebase over the next few years. CCAP has also initiated a pioneering collaboration with the European Bioinformatics Institute (EBI) by providing 2-way live hyperlinks between nucleotide sequence records in the EBI database and strain records in the CCAP database.

The Collection remains active in algal research and over the last year, it has continued to host and support a range of "in-house" and collaborative research projects. In addition to underpinning SAMS environmental and ecophysiological work, research was focused on algal defence, protistan taxonomy, barcoding, siderophores and cryobiology. One of the objectives of the CCAP is to increase the number of strains maintained by cryopreservation (ultra-low temperature storage). This approach is particularly problematic for larger (>20 µm), or structurally complex organisms. Pioneering collaborative research with Dr Helga Müller (Konstanz) has resulted in the development of a simple "vitrification" method, which avoids the formation of potentially damaging ice crystals during cooling. Cysts of the large (50 µm) freshwater ciliate *Meseres corlissi* CCAP 1647/1 were dried with soil to a residual moisture content of <14%. On subsequent plunging of samples into liquid nitrogen (-196^{0}C) a stable glass is formed and the ciliate was successfully (>50% survival) cryopreserved.

CCAP currently participates in an international initiative to develop suitable molecular barcodes for protistan diversity by providing DNA extracts from across the entire phylogenetic breadth of its strain holdings. Within the framework of a long-term effort to provide a state-of-the art identification of its strain holdings, CCAP is also collaborating with taxonomists with expertise in a range of different groups of protists and the data generated by these studies along with images and bibliographic information are being used to populate the CCAP knowledgebase that will enhance services and value to the scientific community.

Frithjof Küpper, John Day & Christine Campbell





Algae from the CCAP collection.

Upper: *Odontella mobiliensis* CCAP 1054/4 (Bacillariophyta)

Lower: *Chlorella ellipsoidea* CCAP 211/34 (Chlorophyta)

NERC FACILITY FOR SCIENTIFIC DIVING (NFSD)

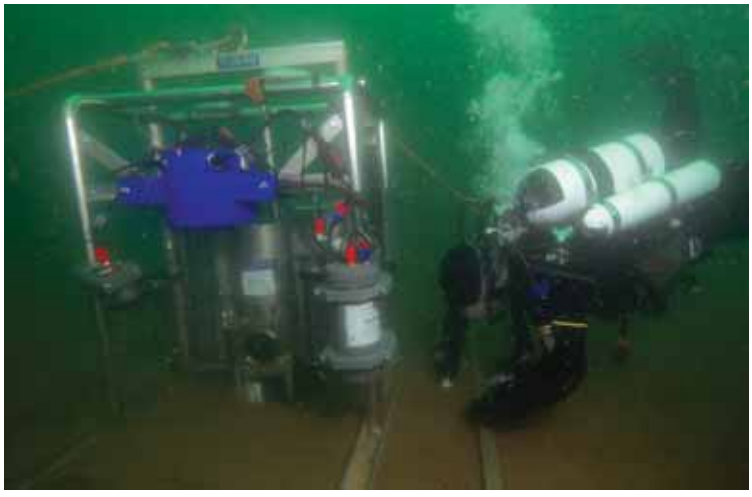
DIVING AND SMALL BOATS

The Diving Unit continues to deliver a range of services both in support of SAMS underwater science activities and at the national level. It 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 Health and Safety Executive for the provision of professional diver training and by the Royal Yachting Association for small boat training.

The unit provided support that underpinned four peer-reviewed publications in 2007. In addition, we contributed to five edited works, 12 proceedings papers / published abstracts, gave seven conference / workshop presentations, contributed to three contract reports and wrote one popular article.

NERC FACILITY FOR SCIENTIFIC DIVING (NFSD)

The NERC Facility for Scientific Diving (NFSD) at SAMS provides divers, equipment, training and scientific/technical support that underpin a wide range of high-class interdisciplinary research in the underwater environment. Services range from providing additional manpower for groups with limited diving experience, to total project management for scientists with no diving experience and/or specialist equipment loans for groups with diving experience but limited resources. On a secondary level, the Facility



undertakes to ensure proper adherence to Health and Safety legislation as applied to diving at work activities. This can be through targeted training programmes, communicating advice and guidance for senior management with legal responsibilities for diving at work, undertaking safety audits on behalf of the NERC Health and Safety management structure and facilitating a wider interactive dialogue with others in the higher education field and the Health and Safety Executive. The NFSD is the main service provider and the major supporter of research within the UK that involves scientific diving. This is achieved through its support and maintenance of an extensive underwater research programme, its support for the UK Scientific Diving Supervisory Committee, its interactions with other diving industry bodies, its ongoing diving research and evaluation programme, and its focussed training programme for scientists and technicians involved with working underwater. In addition to diving services per se, the NFSD also provides support and training in associated small boat operations and in emergency diving medicine.

The NFSD was reviewed by the NERC Services Review Group in 2008 through a competitive bidding process. The SAMS bid received an overall average rating of 4.75 out of 5.00 and retained hosting the NERC facility for the next five-year period (2009-2014).

DIVING SUPPORT

In 2007, the diving unit supported 546 person dives (263 separate diving operations) in support of numerous science programmes. A total of 39 divers were either employed on diving operations or attended some of the NFSD training courses and workshops. Diving operations 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 7568 minutes for 2007 at an average of 29.7 minutes per diving operation. On

NATIONAL FACILITIES

average this was a slight decrease in average bottom time. This was caused, in part, through the support of new diving projects that had an operational requirement to work at greater than normal depths. Nearly 20% of diving occurred at depths of 30 metres or deeper. This compares with an overall average for all SAMS diving operations at those depths of under 3%.

DUNSTAFFNAGE HYPERBARIC UNIT (DHU)

2007 saw the Dunstaffnage unit treat its 300th patient since SAMS began treating divers in 1972. Throughout the year, 27 divers suffering from symptoms of suspected decompression sickness were examined at the hyperbaric unit and 18 received treatment. The divers received, in total, 142 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. DHU is part of the National Registration Scheme for Scotland and DHU staff continue to act as technical advisers for the scheme. In 2007, we hosted the annual scientific meeting of the British Hyperbaric Association.

DIVING SCIENCE DEGREE MODULE

2007 was the initial year of the Diving Science module for the UHI Marine Science degree course. Given in the third year of the course, the module combines a series of lectures and assignments examining the ways in which diving is employed as a scientific research tool with a programme of practical lessons in occupational scientific diving. At the end of the course, the students should have vocational qualifications in professional diving, boat handling and emergency recompression.

RYA SCHOOL

The small boat facility continues to provide RYA accredited training programmes. 2007 again saw the provision of a seamanship module for students on the UHI Marine Science degree and all students successfully completed their RYA Powerboat training to Levels 1 and 2. Training was also provided for staff from the University of Edinburgh.

MDJ Sayer, SR Thurston, H Brown, J Beaumont & E Azzopardi

KNOWLEDGE EXCHANGE

SAMS long history in knowledge exchange can be traced back to its origins as one of the worlds oldest marine research organisations. The knowledge exchange goals of a modern research organisation go beyond the traditional forms of research publication and academic teaching. SAMS knowledge exchange covers a broad range of activities from the non-commercial, involving advice for policy makers, regulators and continued professional development training, to commercial activities involving contract research, analytical services, and the licensing of intellectual property. SAMS seeks to maximise the organisational knowledge exchange and income generation opportunities while maintaining a balance with the priority of excellence in research output. Research and research exploitation are considered to be complimentary activities.

In the past year there has been a clear move towards the development of an established knowledge exchange and commercialisation office at SAMS. In the summer of 2007 a new Director of Knowledge Exchange and Commercialisation was appointed when Dave Gunn joined SAMS from NERC. Proposals to attract capacity building funding have progressed well, in parallel with a developing research exploitation strategy aimed at identifying and addressing the internal organisational and external market place needs.

SAMS continues to provide contract research and services to a variety of customers. Significant among these are the commissioned research into deep-sea mining tailings placement practice in Papua New Guinea, the toxic phytoplankton monitoring service contract with the Food Standards Agency, the sale of material by the Culture Collection of Protozoa and Algae and the services provided by the National Facility for Scientific Diving.

Jim Mather (right), our local MSP and Scottish Minister for Enterprise, Energy and Tourism, visited SAMS on 7 December 2007 to find out about a research proposal on biofuels from algal biomass.

There has been a progressive increase in awareness raising and marketing activities, with the move towards a more strategic approach to targeting SAMS stakeholders and the potential emerging market opportunities. Renewable energy was identified as an area where SAMS would benefit from improved awareness of the organisational expertise and resources. This campaign was highlighted by Jim Mather's visit to SAMS in his capacity as both a local MSP and the Scottish Minister for Enterprise, Energy and Tourism. SAMS research staff gave presentations describing their work in the renewable energy sector and later in the year, staff were invited to the Scottish Parliament to give a presentation on their marine biomass research at a specially organised meeting of the Scottish Parliamentary Renewable Energy Group. This year SAMS had a prominent stand at the biannual Oceanology 2008 exhibition and conference in London. The new SAMS promotional DVD proved very popular and the SAMS stand was well attended.

SAMS will continue to build on the knowledge exchange processes and resources developed over the last year. Knowledge exchange and commercialisation are key activities within the SAMS mission and the development of capacity to serve these needs remains a priority.

Dave Gunn

SAMS HIGHER EDUCATION

This year has, once again, proved noteworthy in terms of our higher education activities. In addition to the undergraduate and postgraduate outcomes reported below, SAMS was subjected to a quinquennial Academic Partner Review by the UHI Millennium Institute. The outcome was extremely positive, with nine commendations, including SAMS international engagement, the quality of our research administration processes and the integration of both undergraduate and postgraduate students into the broader SAMS community.

BSC (HONS) MARINE SCIENCE

The eighth cohort of UHI undergraduates arrived in September. In November, our fifth 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 Charlie Wilson, whose first class degree was based upon the highest ever mean mark over the honours year (81%); while the SAMS Prize for Overall Achievement

Kate McIntyre receives her certificate from Prof. Bob Cormack, Chair of UHI Academic Council, at the fifth SAMS-UHI BSc (Hons) Marine Science degree congregation at the SAMS Annual General Meeting.

went to Kate McIntyre, for her sustained performance over the programme. Both have moved on to PhD programmes, with a third student – Ander Martinez de Lecea – taking an MSc place at Heriot-Watt University.

The other highlight of the undergraduate year was the revalidation of the programme by the Open University Validation Service. The outcome was extremely positive, with the degree being described as "a great course with interesting and important modules". Among the eight commendations, the panel highlighted the close link to high level research activities and facilities, the accessibility of staff, and our consequent ability to attract a distinctive community of well motivated, committed and enthusiastic students.

As part of the revalidation process, a BSc (Hons) Marine Science with Arctic Studies was established, enabling students to spend their third year studying in the Arctic, based at the University Centre in Svalbard (UNIS). Participants will be able to follow courses in Arctic biology, geology or technology, returning to SAMS for their fourth year and completing a dissertation in a field of Arctic research. This opportunity is unique in Scotland and is the only marine science course in the UK to offer this placement.

The UNIS Research Centre in Svalbard. Photo: Nils Petter Dale

POSTGRADUATE RESEARCH ACTIVITIES

Over the year a further intake of NERC and EU-funded postgraduate students commenced at SAMS, adding to our vibrant research school community. There have been a number of PhD completions: Elizabeth Adey, Sam Wilson, Mark Shields, Lindsay Vare and Richard Shucksmith. Our first UHI MSc (by research) student, Caroline Carter, also passed her viva voce examination, being recommended for an award with Distinction.

At the invitation of the British Council, a group of staff and postgraduates travelled to Tromsø, Norway, to participate in an International Networking of Young Scientists event, themed around 'Arctic Frontiers: Balancing Human Use and Ecosystem Protection'. Ten UK participants were paired with colleagues from Arctic Europe for a week of intensive networking activities.

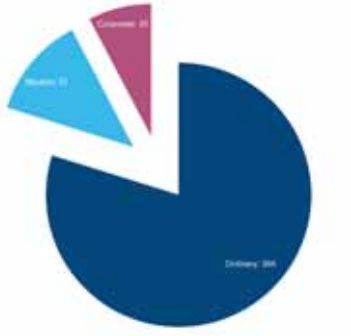
Richard Shucksmith – UHI Research Student of the Year

Finally, one of our research students, Richard Shucksmith, was named UHI Research student of the Year, for his high quality work on the threat to marine communities of invasion by non-native species; matched by intellectual ability, enthusiasm, commitment, and his contribution to the student community.

Axel EJ Miller

SAMS MEMBERSHIP ACTIVITIES

As a learned society SAMS has 456 members from three categories (see figure), which is an increase of 29 over the past year. Subscription rates have not changed in the last decade and currently stand at £12 for ordinary members, £5 for students and unwaged ordinary members, and at £60 for corporate members.



For their subscriptions, members receive SAMS newsletters, the annual report, may apply for the SAMS research bursary, may access the SAMS reference library, are invited to attend the AGM, and if appropriate an EGM, the annual Newth Lecture and two meetings of the Scottish Marine Group per year.

SCOTTISH MARINE GROUP

The Scottish Marine Group continues to be organised by Susan Chambers from the National Museums of Scotland. The annual postgraduate research presentations prize meeting was held on 17 May 2007 at Napier University in Edinburgh. Nine postgraduate students from seven Scottish universities presented their research. The SAMS £100 prize for the best overall presentation was awarded to Julian Augley from Napier for his talk on the growth of juvenile plaice in the Firth of Forth. The £100 SEPA prize for the best visual presentation went to Gill Andrew from SAMS UHI. Attendance at the spring meetings continues to fall irrespective of location or timing.

The autumn SMG meeting followed the theme of 'Recent Advances in Marine Biology' and was held on 25 October 2007 at the University of Stirling with several invited speakers: Hector Guzman (Heriot-Watt), Steve Simpson (Edinburgh University), Dan Edwards (Heriot-Watt), Jorgen Berge (University Centre in Svalbard), Kim Last (SAMS), Alastair Lyndon (Heriot-Watt) and Susan Manson (Forth Estuary Forum). Attendance at the autumn meetings has been stable over the last years varying between 50 and 70 participants.

RESEARCH BURSARIES

Four SAMS bursaries were awarded during the past year:

BJ Ciotti & Dr T Targett	University of Delaware	How do beach productivity and density control the spatial and temporal dynamics of growth of juvenile plaice?	£1,087
K Burke with B Narayanaswamy & U Witte	University of Aberdeen	The role of benthic polychaetes in fjordic ecosystem functioning	£1,050
K Munro & E O'Donnelly	Freelance artists	Plankton and Us	£1,000
L Teal	University of Aberdeen	Linking macrofaunal activity and sediment function at two sites in Loch Creran	£1,000

ANNUAL GENERAL MEETING AND 18TH ANNUAL NEWTH LECTURE

The 2007 AGM took place on 7 November in the William Speirs Bruce Conference Room at SAMS, and was followed by the SAMS UHI student graduation and the Newth lecture. This year Professor Tom Crowley, the director of the Scottish Alliance for Geoscience, Environment and Society (SAGES) based at the University of Edinburgh, delivered the lecture entitled "A geologist's perspective on global warming and energy options."

Anuschka Miller

SAMS OUTREACH ACTIVITIES

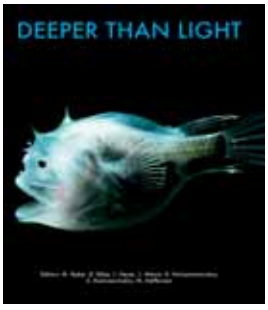
ENGAGING THE PUBLIC

SAMS is always seeking good opportunities to engage the public in dialogue about the science we do, the state of the marine environment, and about the role of science in society.

Although it is a time of intensive activity, we particularly value face-to-face contact with the public as the most powerful form of science communication. For that reason we extended our usual open evening into a full open day on Saturday 1 March. The Sharing Science project funded by the Scottish Government allowed us to invite colleagues from the Universities of Edinburgh and Dundee to our open day to explain some of their environmental and life sciences research to the local community. One of the highlights of the day was a live link to Dr Elanor Bell in Antarctica. The open day saw record visitor numbers approaching 400, approximately double the usual turnout.

We also had a large stand at the UHI open day on 28 July in Inverness, at the Oban Games on 23 August and at the Dunbeg fun day on 22 September.

SAMS staff have provided numerous public lectures throughout the UK, and we are making our research available to the world via our growing website. Dr Bhavani Narayanaswamy co-edited a book on life in the deep sea for general audiences, as part of the European Census of Marine Life project.



'Deeper than light' has been produced by the European Census for Marine Life DESEO project and is available in a number of languages.

WORKING WITH SCHOOLS AND TEACHERS

Over recent years much of the SAMS schools education portfolio has focused on marine environmental research. However, with the increase in provision in environmental education, SAMS took the decision to focus its schools programme more at the science angle. This allowed us to support the government's STEM (science, technology, engineering and mathematics) initiative which is aimed at bringing more students into these wealth creating industries. For example we contributed to a STEM activity day at Aviemore in August organised by Highlands and Islands Enterprise

Our engagement with primary schools is significantly defined by our contribution to the three day long annual environment fair organised by the Argyll and Bute Regional Environmental Education Forum (ABREEF). In 2007 the fair was at Lomond Shores in Balloch and SAMS, beyond its role on the steering committee, contributed a teaching activity on marine food webs. We also continued to accept invitations to local primary schools and have hosted primary school visits to the laboratory.

Our engagement with secondary schools is growing and we are actively supporting the new curriculum for excellence. Increasingly, SAMS contributes to updating the knowledge and enthusiasm of science teachers and to that end delivered a CPD weekend course on the topic of climate change and the oceans. We also hosted Highland science teachers on a Career Scotland programme to develop information for pupils on exciting careers in science and lesson plans on curriculum relevant topics. SAMS also contributes to school based career fairs. For the first time we invited all Oban High School pupils studying an Advanced Higher in science to SAMS to learn about 'how to do research'. The SAMS technology team hosted an Oban High school pupil for a year's work experience. We also continue to offer work experience to school pupils - this year we had our first pupil from Germany. Finally, we hosted two Scottish pupils in receipt of a Nuffield School Bursary for five-week research placements.

SAMS IN THE NEWS

We engage proactively and reactively with the media, and in the last year have contributed many items to radio programmes and press reports both in the UK and abroad. We issued our first press release in languages other than English to reach appropriate audiences.

INFORMING POLITICIANS

SAMS is both proactive and reactive in our engagement with politicians. We have been responding to an increasing number of public consultations about the marine environment e.g. the UK marine bill,

SAMS OUTREACH ACTIVITIES

From left: Congressman Roger Wicker, Congressman Mike McIntyre, Congressman Robert Alderhold, SAMS President Sir John Arbuthnott, Argyll and Bute Councillor Isobel Strong, Lady Elanor Arbuthnott, Dr Ken Jones (SAMS Deputy Director) and Congressman Joe Wilson toured SAMS and discussed our research on climate change, renewable energy and the Arctic.

Scottish Marine Bill, Scottish Parliament marine environment inquiry, and the Scottish Executive Strategic Environmental Assessment. SAMS has further been involved with giving evidence in parliamentary meetings.

We also displayed information on SAMS and participated in discussions about climate change research at the Royal Society of Chemistry 'Science in Parliament' event in Edinburgh on 29 November.

We have been welcoming a number of politicians to the laboratory, including four US congressmen as well as Scottish and UK parliamentarians. These visits are a very productive and targeted way of providing scientific information to decision makers on relevant topics, and to contribute missing facets to a debate.

SAMS also hosted and contributed to a workshop for Arctic stakeholders organised by the Foreign and Commonwealth Office.

Anuschka Miller

ESTATES AND FACILITIES

Annual reports over the past 3 years have documented the unprecedented investment that SAMS has made in its built infrastructure to accommodate the significant increase in staff and the new demands made by its expanding science base. David Mathias joined us in September 2007 as Estates and Facilities Manager, bringing the professional expertise necessary to manage the increased capacity and complexity in buildings and their control systems. One of David's first tasks has been to implement energy saving measures within the new building's heating and ventilation plant, addressing energy saving targets set by the laboratory's Energy and Environment Advisory Panel (EEAP) based on recommendations from an energy audit by the Carbon Trust. As a consequence there has been a significant reduction in base-load electricity usage and an ongoing programme of energy saving measures has been established.

Between October 2007 and March 2008, Phase 1 of a significant refurbishment programme was carried out in the Research Aquarium and associated laboratories under the supervision of John Kershaw, our new Aquarium Manager, and David Mathias. This has involved replacement of internal pipework, installation of a new low voltage electrical power supply and lighting, installation of a new resin floor throughout the aquarium hall and covering the internal bare brick walls with a hygienic plastic cladding. Two new controlled environment laboratories have been provided which allow experiments to be carried out at low temperatures (~0°C) with controlled illumination and a further 4 laboratories offering photoperiod control at ambient temperatures have also been provided. Wet laboratory space adjacent to the aquarium has been refurbished and extended. Phase 2 of the aquarium refurbishment project will begin in October with the refitting of a further three of the existing controlled environment rooms. The total cost of the project including Phase 2 will be £370k which has been secured through the Strategic Research Investment Fund (SRIF) and European Regional Development Fund (ERDF) administered through the UHI Strategic Delivery Body.

KJ Jones

IT & DATA SERVICES

The past year has seen a number of upgrades, both in software and hardware, to cope with the increasing demands of an expanding organisation. The Novell Netware was upgraded to the latest version 6.5; the Intranet was upgraded to use Plone v3.0.1; several network switches were upgraded and the wireless network was expanded to include the resident's hostel. The rollout of Zenworks has also continued.

Towards the end of 2007 a strategy for the future of IT at SAMS was developed, and though not finalised, most of the points were agreed in principle. This enabled us to start implementing some of the changes in the first quarter of 2008. One of the main proposed changes was the utilisation of file server virtualisation and in this we were able to make a start by purchasing a high specification server to allow us to consolidate some of the minor servers we had running. Another change we were able to make was to upgrade the Tivoli Backup system from its previous capacity of 2TB to approximately 20TB: this increase was achieved through a combination of purchasing the latest tape drive hardware (which utilizes tapes quadruple the capacity of our current drives) and a reconfiguration of the system.

One of the main advantages of server virtualisation is that it makes it easier to implement new systems very quickly, without the requirement to purchase new hardware, install it in the server room and then integrate it into the existing network. This feature enabled us to quickly set up virtual servers on the new server to host two new software systems that were acquired in the first quarter of 2008: a document management system (Docuware) and a HR\Personnel management system (Ciphr). In addition we connected an additional 7.5 TB of new disk storage to the new virtual host server. This additional storage is intended to host the SAMS data archive, data generated from the new Sonar equipment and finally, to host a Digital Asset Management system for images and videos - not least, the National Facility for Scientific Diving's growing collection of underwater imagery and video.

It is expected that we will be able to consolidate most of our remaining servers, with the exception of the backup server, through virtualisation, reducing the current requirement of 18 physical servers to 3 or 4. This will further the aims of SAMS environmental policy; the savings in power consumption, with fewer machines and therefore a reduced cooling requirement, should be considerable. The strategy for implementing this fully will be formulated and assessed in the coming year. The other aspects of the proposed IT strategy will involve reassessing our current network software: e.g. whether we stay with Netware eDirectory or move towards Microsoft's Active Directory.

The new SAMS Data Tracking website went live this year. This enables staff to submit their NERC funded data to a website, which is then downloaded by the British Oceanographic Data Centre at Liverpool. The old SAMS Data Archive software was ported to a web interface to create the SAMS Data Archive website which is intended for long term data security of all SAMS data sets. Both of these sites are only accessible via the SAMS Intranet.

This was the last year of the NERC funded Data archiving Project. Martyn Harvey replaced Susan Drain, who left SAMS at the beginning of the year, as the main archiving assistant on the project. The year was mostly taken up with scanning activities: Over 20,000 70mm aerial frames of sea ice were scanned and catalogued on the specialist Kodak & Durst AFA equipment. A summer student was also hired to scan several thousand pages of documents and computer printouts from the Sea Ice collection. Another 6,000 35mm slides were scanned near the end of the project. These were part of a time series recording the changing states of various Scottish coastal sites over the past 4 decades. In addition a number of other items were digitised, including a set of 10 VHS video tapes which represent the first seabed pictures of the cold water coral *Lophelia* from the Minch.

Steve Gontarek

POSTGRADUATE RESEARCH PROJECTS

(Funding body and supervisors' names in parentheses; SAMS supervisors in blue)

DEGREES AWARDED DURING THE REPORTING YEAR

Adey (née Osborne) EA, Ph.D, The UHI Millennium Institute (UHI/HIE). *Distinguishing wild from farmed salmon.* (**Black KD, Shimmield TM, Shimmield GB** and Hawksworth C)

Carter C, M.Sc, The UHI Millennium Institute (European Social Fund). *Do marine renewable energy devices give sufficient warning to marine mammals to avoid harmful collisions?* (**Black KD and Wilson B**)

Kumar A, M.Sc, IT-University Sweden (self-funded). *A feasibility study for underwater structured light systems.* (**Sillitoe I**)

MacLachlan S, Ph.D, The UHI Millennium Institute (UHI/HIE). *Fjordic and shelf sea paleo-records of arctic climate change.* (**Howe J, Shimmield TM** and Austin W)

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

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, Hughes DJ** and Dodd J)

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

Thomalla SJ, PhD, University of Cape Town (University of Cape Town/Bursaries). *Particulate organic carbon export from the north and south Atlantic: the* $^{234}Th/^{238}U$ *disequilibrium approach.* (Waldron H, Lucas M and **Turnewitsch R**)

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**)

Vincent L, M.Sc, University of Abertay, Dundee (University of Abertay). *Screening of emulsifiers from marine bacterial strains for potential biotechnological applications.* (Walker G and **Gutierrez T**)

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

ONGOING RESEARCH

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

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

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

Blicker M, Ph.D, University of Copenhagen (Royal Scientic Investigations Greenland). *Arctic macrofauna.* (**Glud RN**, Sejr M and Rysgaard S)

Boos K, Ph.D, Alfred Wegner Institute (AWI). *Mechanisms of a successful immigration from north-east Asia: settlement dynamics, competitive ability and anti-predatory strategies of* Caprella mutica *Schurin 1935 in European coastal waters.* (Gutlow L, Franke R and **Cook E**)

Burke K, Ph.D, University of Aberdeen (University of Aberdeen). *The fate of organic matter in marine sediments: The role of macrofauna.* (Witte U and **Narayanaswamy B**)

Kristensen M, M.Sc, University of Copenhagen (self-funded). *Oxygen and DIC dynamics of sea-ice.* (**Glud RN** and Rysgaard S)

Davies J, Ph.D, University of Plymouth (JNCC). *Identification of areas of nature conservation importance in deep waters of the UK continental shelf, to contribute towards spatial planning and the development of an ecologically coherent network of MPAs in the North-East Atlantic.* (Howell K, **Narayanaswamy B**, Stewart H, Jacobs C and Johnstone C)

POSTGRADUATE RESEARCH PROJECTS

Gontikaki E, Ph.D, University of Aberdeen (Marie Curie-Ecosummer/University of Aberdeen). *Deep sea benthic community response to simulated sedimentation events in contrasting environments.* (Witte U, **Narayanaswamy B** and Tselepides T)

Hughes S, Ph.D, The UHI Millennium Institute (FRS). *Inflow of Atlantic Water to the North Sea: Variability and influence on North Sea climate.* (**Dale A** and Gallego A)

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

Larsen M, M.Sc, University of Copenhagen (self-funded). Amphiura filiformis *and benthic nitrogen cycling.* (**Glud RN** and B Vismann B)

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

Lonborg C, Ph.D, The UHI Millennium Institute (Marie Curie – Ecosummer). *The importance of dissolved organic matter in two contrasting marine waters.* (**Davidson K, Miller AEJ** and Alvarez-Salgado A)

MacIntyre K, Ph.D, The UHI Millennium Institute (NERC). *Post-glacial fjordic landscape evolution; the onshore and offshore limits of the Younger Dryas ice-sheet Western Scotland.* (**Howe J, Shimmield T**, Bradwell T and Stoker M)

Mogg A, Ph.D, The UHI Millennium Institute (NERC). *The role of bacterial associates in the production of dimethylsulphoxide by marine phytoplankton: Significance for the biogeochemical cycle of the climatic feedback gas dimethylsulphide.* (**Hatton A, Hart M, Green D** and Bavington C)

Morris P, Ph.D, University of Southampton (NOC). *Carbon export from iron-induced southern ocean phytoplankton blooms.* (Sanders R, Mills R and **Turnewitsch R**)

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

Nordi G, Ph.D, Fiskerrihoejskolen I Torshavn (self funded). *Aquaculture and benthic biogeochemistry.* (Fiskerrihoejskolen and **Glud RN**)

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

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

Soegaard D, M.Sc, University of Copenhagen (self-funded). *Autotrophy versus heterotrophy of sea-ice.* (**Glud RN** and Rysgaard S)

Strittmater M, Ph.D, The UHI Millennium Institute (Marie Curie – Ecosummer). *Molecular biology of the* Ectocarpus/Eurychasma *host-pathogen interaction.* (**Kupper F**, van West P and Gachon CMM)

Venables E, Ph.D, The UHI Millennium Institute (NERC CASE). *An investigation of mixing in the Faroe-Shetland Channel.* (**M Inall, T Sherwin** and W Turrell)

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

PUBLICATIONS

JOURNAL: ISI LISTED

Amato A, Kooistra WHCF, Ghiron JHL, Mann DG, **Pröschold T** and Montresor M, 2007. Reproductive isolation among sympatric cryptic species in marine diatoms. *Protist* **158**: 193-207.

Amin SA, **Küpper FC**, **Green DH**, Harris W and Carrano CJ, 2007. Boron binding by a siderophore isolated from marine bacteria associated with the toxic dinoflagellate *G. catenatum*. *Journal of the American Chemical Society* **129**: 478-479.

Ashton G, **Willis KJ**, **Burrows MT** and **Cook EJ**, 2007. Environmental tolerance of *Caprella mutica*: Implications for its distribution as a marine non-native species. *Marine Environmental Research* **64**: 305-312.

Ashton G, **Willis KJ**, **Cook EJ** and **Burrows MT**, 2007. Distribution of the introduced amphipod, *Caprella mutica* Schurin, 1935, on the west coast of Scotland and a review of its global distribution. *Hydrobiologia* **590**: 31-41.

Beaumont JC, **Brown CJ** and **Sayer MDJ**, 2007. Evaluation of techniques used in the assessment of subtidal epibiotic assemblage structure. *Biofouling* **23**: 343-356.

Behrens J, **Stahl H**, Steffensen JF and **Glud RN**, 2007. Oxygen dynamics around buried lesser sandeel, *Ammodytes tobianus* (Linnaeus, 1785): Mode of ventilation and metabolic requirements. *Journal of Experimental Biology* **210**: 1006-1014.

Brandt A, Gooday A, Brix S, Brandao S, Brokeland W, Cedhagen T, Chowdhury M, Cornelius N, Danis B, de Mesel I, Diaz R, Gillan D, Ebbe B, **Howe JA** , Janussen D, Kaiser S, Linse K, Malyutina M, Pawlowski J, Raupach M and Vanreusel A, 2007. First Insights into biodiversity and biogeography of the Southern Ocean deep sea. *Nature* **447**: 307-311.

Cook EJ and Clark P, 2007. Invasive Crustacea Symposium 7 at the 6th International Crustacean Congress (ICC6), held at the University of Glasgow, UK, 18-22 July 2005 - Preface. *Hydrobiologia* **590**: 1-2.

Cook EJ and **Kelly MS**, 2007. Effect of variation in the protein value of the red macroalga *Palmaria palmata* on the feeding, growth and gonad composition of the sea urchins *Psammechinus miliaris* and *Paracentrotus lividus* (Echinodermata). *Aquaculture* **270**: 207-217.

Cook EJ and **Kelly MS**, 2007. Enhanced production of the sea urchin *Paracentrotus lividus* in integrated open-water cultivation with Atlantic salmon *Salmo salar*. *Aquaculture* **273**: 573-585.

Cook EJ, **Hughes A**, **Orr H**, **Kelly MS** and **Black KD**, 2007. Influence of dietary protein on essential fatty acids in the gonadal tissue of the sea urchins *Psammechinus miliaris* and *Paracentrotus lividus* (Echinodermata). *Aquaculture* **273**: 586-594.

Cook EJ, **Willis KJ** and **Lozano Fernandez M**, 2007. Survivorship, growth and reproduction of the invasive *Caprella mutica* Schurin (Crustacea: Amphipoda). *Hydrobiologia* **590**: 55-64.

Cook PLM, Wenzhofer F, **Glud RN**, Janssen F and Huettel M, 2007. Benthic solute exchange and carbon mineralization in two shallow subtidal sandy sediments: Effect of advective pore-water exchange. *Limnology and Oceanography* **52**: 1943-1963.

Cottier F and **Venables E**, 2007. On the double-diffusive and cabbeling environments of the Arctic Front, West Spitsbergen. *Polar Research* **26**: 152-159.

Cottier F, Nilsen F, **Inall ME**, Gerland S, Tverberg V and Svendsen H, 2007. Wintertime warming of Arctic shelves in response to large-scale atmospheric circulation. *Geophysical Research Letters* **34**: L10607.

Cox (MacLachlan) S, **Cottier F**, Austin WEN and **Howe JA**, 2007. The salinity: ^{18}O water relationship in Kongsfjorden, western Spitsbergen. *Polar Research* **26**: 160-167.

Cresswell K, Tarling GA and **Burrows MT**, 2007. Behaviour affects local-scale distributions of Antarctic krill around South Georgia. *Marine Ecology-progress Series* **343**: 193-206.

Cumashi A, Ushakova N, Preobrazhenskaya MD, Incecco A, Piccoli A, Totani L, Tinari N, Morozevich G, Berman A, Bilan M, Usov A, Ustyuzhanina N, Grachev A, **Sanderson JC**, **Kelly**

PUBLICATIONS

MS *et al.*, 2007. A comparative study of the anti-inflammatory, anticoagulant, antiangiogenic, and antiadhesive activities of nine different fucoidans from brown seaweeds. *Glycobiology* **17**: 541-552.

Davidson K, Gilpin L, **Fouilland E**, **Hart M**, **Mitchell E**, Alvarez-Calleja I, Laurent C, **Miller AEJ** and **Leakey RJG**, 2007. The influence of the balance of inorganic and organic nitrogen on microbial food web trophic dynamics. *Limnology and Oceanography* **52**: 2147-2163.

Davies AJ, Johnson MP and Maggs C, 2007. Limpet grazing and loss of *Ascophyllum nodosum* canopies on decadal time scales. *Marine Ecology-progress Series* **339**: 131-141.

Davies AJ, **Roberts JM** and Hall-Spencer J, 2007. Preserving deep-sea natural heritage: Emerging issues in offshore conservation and management. *Biological Conservation* **138**: 299-312.

Day JG, Lorenz M, **Wilding TA**, Friedl T, Harding K, **Pröschold T**, **Brennan D**, Müller J, Santos L, Santos F, Osorio U, Amaral R, Elster J, Lukavský J, Lukesova A, Hrouzek P, Lukes M, Probert I, Ryan M and Benson EE, 2007. The use of physical and virtual infrastructures for the validation of algal cryopreservation methods in international culture collections. *Cryoletters* **28**: 359-376.

Dean RJ, **Shimmield TM** and **Black KD**, 2007. Copper, zinc and cadmium in marine cage fish farm sediments: An extensive survey. *Environmental Pollution* **145**: 84-95.

Dodds L, **Roberts JM**, Taylor AC and Marubini F, 2007. Metabolic tolerance of the cold-water coral *Lophelia pertusa* (Scleractinia) to temperature and dissolved oxygen change. *Journal of Experimental Marine Biology and Ecology* **349**: 205-214.

Droop MR, 2007. Vitamins, phytoplankton and bacteria: Symbiosis or scavenging? *Journal of Plankton Research* **29**: 107-113.

Fouilland E, **Leakey RJG**, **Jones KJ**, Slater J and Alvarez-Calleja I, 2007. The response of a planktonic community to sudden mixing conditions in temperate coastal waters: Importance of light regime and nutrient enrichment. *Journal of Experimental Marine Biology and Ecology* **351**: 211-225.

Fox CJ, Geffen AJ, Bunn N, Davison P, McCloghrie P, Nash RDM and Rosseti H, 2007. Birth-date-selection in early life stages of plaice (*Pleuronectes platessa* L.) in the eastern Irish Sea (British Isles). *Marine Ecology-progress Series* **345**: 255-269.

Gachon CM, **Day JG**, **Campbell CN**, **Pröschold T**, **Saxon R** and **Küpper FC**, 2007. The Culture Collection of Algae and Protozoa (CCAP): a biological resource for protistan genomics. *Gene* **406**: 51-57.

Gillibrand P and Amundrud T, 2007. A numerical study of the tidal circulation and buoyancy effects in a Scottish fjord: Loch Torridon. *Journal of Geophysical Research* **112**: C05030.

Gillibrand P and **Willis KJ**, 2007. Dispersal of sea louse larvae from salmon farms: Modelling the influence of environmental conditions and larval behaviour. *Aquatic Sciences* **1**: 63-75.

Glud RN and Rysgaard S, 2007. The annual organic carbon budget of Young Sound, NE Greenland. In: Rysgaard S and Glud RN (Eds) *Carbon cycling in Arctic marine Ecosystems: Case study Young Sound. Meddelelser om Gronland-Bioscience* **58** (Special issue): 194-203.

Glud RN, Berg P, Fossing H and Jorgensen B, 2007. Effect of the diffusive boundary layer on benthic mineralization and O^2 distribution: A theoretical model analysis. *Limnology and Oceanography* **52**: 547-557.

Glud RN, Rysgaard S, Kühl, RK and Hansen JW, 2007. The sea-ice in Young Sound: Implications for C cycling. In: Rysgaard S and Glud RN (Eds) *Carbon cycling in Arctic marine ecosystems: Case study Young Sound. Meddelelser om Gronland-Bioscience* **58** (Special issue): 62-85.

Gutierrez T, Mulloy B, Bavington C, **Black KD** and **Green DH**, 2007. Partial purification and chemical characterization of a glycoprotein (putative hydrocolloid) emulsifier produced by a marine bacterium *Antarctobacter*. *Applied Microbiology and Biotechnology* **76**: 1017-1026.

Gutierrez T, Mulloy B, **Black KD** and **Green DH**, 2007. Glycoprotein emulsifiers from two marine *Halomonas* species: chemical and physical characterisation. *Journal of Applied Microbiology* **103**: 1716-1727.

PUBLICATIONS

Hall POJ, Brunnegard J, Hulthe G, Martin WR, **Stahl H** and Tengberg A, 2007. Dissolved organic matter in abyssal sediments: Core recovery artefacts. *Limnology and Oceanography* **52**: 19-31.

Harris W, Amin SA, **Küpper FC**, **Green DH** and Carrano CJ, 2007. Borate-binding to siderophores: Structure and stability. *Journal of the American Chemical Society* **129**: 12263-12271.

Hart M, **Green DH**, Bresnan E and Bolch CJS, 2007. Large subunit ribosomal RNA gene variation and sequence heterogeneity of *Dinophysis* (Dinophyceae) species from Scottish coastal waters. *Harmful Algae* **6**: 271-287.

Hatton AD and **Wilson S**, 2007. Particulate dimethylsulphoxide and dimethylsulphoniopropionate in phytoplankton cultures and Scottish coastal waters. *Aquatic Sciences* **69**: 330-340.

Henry L and **Roberts JM**, 2007. Biodiversity and ecological composition of macrobenthos on cold-water coral mounds and adjacent off-mound habitat in the bathyal Porcupine Seabight, NE Atlantic. *Deep-sea Research Part I - Oceanographic Research Papers* **54**: 654-672.

Heymans JJ, Christensen V and Guénette S, 2007. Evaluating network analysis indicators of ecosystem status in the Gulf of Alaska. *Ecosystems* **10**: 488-502.

Howe JA, **Wilson CR**, **Shimmield TM**, Diaz R and Carpenter L, 2007. Recent deep-water sedimentation, trace metal and radioisotope geochemistry across the Southern Ocean and northern Weddell Sea, Antarctica. *Deep-sea Research Part II - Topical Studies in Oceanography* **54**: 1652-1681.

Jackson D, Stone D, Smith K, Morgan G and **Shimmield TM**, 2007. Assessing the environmental risk from hot particles in the vicinity of Dounreay - a case for inaction? *Journal of Radiological Protection* **27** (Special Issue): A111-A118.

Kenchington E, Kenchington T, **Henry L**, Fuller S and Gonzalez P, 2007. Multi-decadal changes in the megabenthos of the Bay of Fundy: The effects of fishing. *Journal of Sea Research* **58**: 220-240.

Liu H, **Kelly MS**, **Campbell DA**, Dong SL, Zhu JX and Wang SF, 2007. Exposure to domoic acid affects larval development of the king scallop *Pecten maximus*. *Aquatic Toxicology* **81**: 152-158.

Liu H, **Kelly MS**, **Cook EJ**, **Black KD**, **Orr H**, Zhu JX and Dong SL, 2007. The effect of diet type on growth and fatty-acid composition of sea urchin larvae, I. *Paracentrotus lividus* (Lamarck, 1816) (Echinodermata). *Aquaculture* **264**: 247-262.

Liu H, **Kelly MS**, **Cook EJ**, **Black KD**, **Orr H**, Zhu JX and Dong SL, 2007. The effect of diet type on growth and fatty acid composition of sea urchin larvae, II. *Psammechinus miliaris* (Gmelin). *Aquaculture* **264**: 263-278.

Meager JJ and **Batty RS**, 2007. Effects of turbidity on the spontaneous and prey searching activity of juvenile Atlantic cod (*Gadus morhua*). *Philosophical Transactions of the Royal Society of London Series B - Biological Sciences* **362**: 2123-2130.

Mieszkowska N, Hawkins SJ, **Burrows MT** and Kendall MA, 2007. Long-term changes in the geographic distribution and population structures of *Osilinus lineatus* (Gastropoda: Trochidae) in Britain and Ireland. *Journal of the Marine Biological Association of the United Kingdom* **87**: 537-545.

Moranta J, Massutí E, Palmer M and **Gordon JDM**, 2007. Geographic and bathymetric trends in abundance, biomass and body size of four grenadier fishes along the Iberian coast in the western Mediterranean. *Progress in Oceanography* **72**: 63-83.

Morris P, Sanders R, **Turnewitsch R** and Thomalla SJ, 2007. 234_{Th}-derived particulate organic carbon export from an island-induced phytoplankton bloom in the Southern Ocean. *Deep-sea Research Part II - Topical Studies in Oceanography* **54**: 2208-2232.

Müller J, **Day JG**, Harding K, Hepperle D, Lorenz M and Friedl T, 2007. Assessing genetic stability of a range of terrestrial microalgae after cryopreservation using amplified fragment length polymorphism (AFLP). *American Journal of Botany* **94**: 799-808.

Nash RDM, Geffen AJ, **Burrows MT** and **Gibson RN**, 2007. Dynamics of shallow-water juvenile flatfish nursery grounds: application of the self-thinning rule and carrying capacities. *Marine Ecology-progress Series* **344**: 231-244.

Negri AP, Bolch CJS, Greier S, **Green DH**, Park TG and Blackburn S, 2007. Widespread presence of hydrophobic paralytic shellfish toxins in *Gymnodinium catenatum*. *Harmful Algae* **6**: 774-780.

PUBLICATIONS

Obajimi O, **Black KD**, Glen I and Ross B, 2007. Antioxidant modulation of oxidant-stimulated uptake and release of arachidonic acid in eicosapentaenoic acid supplemented human lymphoma U937 cells. *Prostaglandins Leukotrienes and Essential Fatty Acids* **76**: 65-71.

Palomares MLD, **Heymans JJ** and Pauly D, 2007. Historical ecology of the Raja Ampat archipelago, Papua Province, Indonesia. *History and Philosophy of the Life Sciences* **29**: 33-56.

Park TG, **Bell EM**, Pearce I, Rublee PA, Bolch CJS and Hallegraeff GM, 2007. Detection of a novel ecotype of *Pfiesteria piscicida* (Dinophyceae) in an Antarctic saline lake by real time PCR. *Polar Biology* **30**: 843-848.

Pearce I, Davidson A, **Bell EM** and Wright S, 2007. Seasonal changes in the concentration and metabolic activity of bacteria and viruses at an Antarctic coastal site. *Aquatic Microbial Ecology* **47**: 11-23.

Perlin A, Moum J, Klymak J, Levine MD, **Boyd TJ** and Kosro M, 2007. Organization of stratification, turbulence, and veering in bottom Ekman layers. *Journal of Geophysical Research* **112**: C05S90.

Rampen S, Schouten S, Abbas B, Panoto FE, Muyzer G, **Campbell CN** , **Fehling J** and Sinninghe Damste JS, 2007. On the origin of 24-norcholestanes and their use as age-diagnostic biomarkers. *Geology* **5**: 419-422.

Robson AA, **Kelly MS** and Latchford JW, 2007. Effect of temperature on the spoilage rate of whole, unprocessed crabs: *Carcinas maenas*, *Necora puber* and *Cancer pagurus*. *Food Microbiology* **24**: 419-424.

Roeselers G, Norris TB, Castenholz RW, Rysgaard S, **Glud RN**, Kuhl M and Muyzer G, 2007. Diversity of phototrophic bacteria in microbial mats from Arctic hot springs (Greenland). *Environmental Microbiology* **9**: 26-38.

Rysgaard S and **Glud RN**, 2007. Carbon cycling and climate change: Predictions for a high-Arctic marine ecosystem (Young Sound, NE Greenland). In: Rysgaard S and Glud RN (Eds) *Carbon cycling in Arctic marine Ecosystems: Case study Young Sound. Meddelelser om Gronland-Bioscience* **58** (Special issue): 206-213.

Rysgaard S, **Glud RN**, Sejr M, Bendtsen J and Christensen P, 2007. Inorganic carbon transport during sea ice growth and decay: A carbon pump in polar seas. *Journal of Geophysical Research*. **112**: C03016.

Shenoy DM and Kumar MD, 2007. Variability in abundance and fluxes of dimethyl sulphide in the Indian Ocean. *Biogeochemistry* **83**: 277-292.

Stanley MS and Callow JA, 2007. Whole cell adhesion strength of morphotypes and isolates of *Phaeodactylum tricornutum* (Bacillariophyceae). *European Journal of Phycology* **42**: 191-197.

Stashchuk N, **Inall ME** and Vlasenko V, 2007. Analysis of supercritical stratified tidal flow in a Scottish fjord. *Journal of Physical Oceanography* **37**: 1793-1810.

Symonds RC, **Kelly MS**, Caris-Veyrat C and Young A, 2007. Carotenoids in the sea urchin *Paracentrotus lividus*: Occurrence of 9 '-cis-echinenone as the dominant carotenoid in gonad colour determination. *Comparative Biochemistry and Physiology B - Biochemistry and Molecular Biology* **148**: 432-444.

Tankere-Muller S, Zhang H, Davison W, Finke N, Larsen O, **Stahl H** and **Glud RN**, 2007. Fine scale remobilization of Fe, Mn, Co, Ni, Cu and Cd in contaminated marine sediment. *Marine Chemistry* **106**: 192-207.

Thamdrup B, **Glud RN** and Hansen JW, 2007. Benthic carbon cycling in Young Sound, NE Greenland. In: Rysgaard S and Glud RN (Eds) *Carbon cycling in Arctic marine Ecosystems: Case study Young Sound. Meddelelser om Gronland-Bioscience* **58** (Special Issue):138-157.

Thompson PM, Ingram S, Lonergan M, Northridge S, Hall A and **Wilson B**, 2007. Climate change causing starvation in harbour porpoises? *Biology Letters-UK* **3**: 533-534.

Turley CM, **Roberts JM** and Guinotte JM, 2007. Corals in deep-water: Will the unseen hand of ocean acidification destroy cold-water ecosystems? *Coral Reefs* **26**: 445-448.

Turnewitsch R, Domeyer B and Graf G, 2007. Experimental evidence for an effect of early-diagenetic interaction between labile and refractory marine sedimentary organic matter on nitrogen dynamics. *Journal of Sea Research* **57**: 270-280.

Turnewitsch R, Springer BM, Kiriakoulakis K, Vilas JC, Aristegui J, Wolff GA, Peine F, Werk S, Graf G and Waniek JJ, 2007. Determination of the concentration of particulate organic

PUBLICATIONS

carbon (POC) in seawater: the relative methodological importance of artificial organic carbon gains and losses in two glass-fiber-filter-based techniques. *Marine Chemistry* **105**: 208-228.

van der Molen J, Rogers SI, Ellis JR, **Fox CJ** and McCloghrie P, 2007. Modelled egg and larvae dispersal patterns of spring-spawning fish in the Irish Sea, UK. *Journal of Sea Research* **58**: 313-330.

White M, **Roberts JM** and van Weering T, 2007. Do bottom-intensified diurnal tidal currents shape the alignment of carbonate mounds in the NE Atlantic? *Geo-marine Letters* **27**: 391-397.

Wilding TA, Rose C and **Downie M**, 2007. A novel approach to measuring subtidal habitat complexity. *Journal of Experimental Marine Biology and Ecology* **353**: 279-286.

Wilkinson JP, Wadhams P and **Hughes N**, 2007. Modelling the spread of oil under fast sea ice using three-dimensional multibeam sonar data. *Geophysical Research Letters* **34**: L22506.

Woulds C, Cowie G, Levin LA, Andersson JH, Middelburg J, Vandewiele S, **Lamont PA**, Larkin K, Gooday A, Schumacher S, Whitcraft C, Jeffreys R and Schwartz M, 2007. Oxygen as a control on seafloor biological communities and their roles in sedimentary carbon cycling. *Limnology and Oceanography* **52**: 1698-1709.

JOURNAL: OTHER REFEREED

Liu H, **Kelly MS**, **Campbell DA**, Dong SL, Zhu JX and Wang SF, 2007. Ingestion of domoic acid and its impact on king scallop *Pecten maximus* (Linnaeus, 1758). *Journal of Ocean University of China* **6**: 133-139.

Mulvaney DJ, **Sillitoe IP**, Swere E, Wang Y and Zhu Z, 2007. Real-time machine learning in embedded software and hardware platforms. *International Journal of Intelligent Systems Technologies and Application* **2007**: 187-204.

Narayanaswamy BE, 2007. The European Census of Marine Life (EuroCoML). *Ocean Challenge* **15**: 8-9.

Potts TW and Haward M, 2007. Fisheries Certification and Trade: Recent Developments. *Environment, Development & Sustainability* **9**: 91-106.

Rippeth TP and **Inall ME**, 2007. Turbulent dissipation of coastal seas, a response to "Observations of biologically generated turbulence in a coastal inlet". *Science Electronic Letters.*

Sayer MDJ, 2007. Personal view: The past, present and future for scientific diving. *Underwater Technology* **27**: 73-74.

Sayer MDJ, 2007. Scientific diving: a bibliographic analysis of underwater research supported by SCUBA diving, 1995-2006. *Underwater Technology* **27**: 75-94.

Sayer MDJ and Poonian C, 2007. The influences of census technique on estimating indices of macrofaunal population density in the temperate rocky subtidal zone. *Underwater Technology* **27**: 119-139.

Wilson C M, **Sayer MDJ** and Murchison AG, 2007. Case report: Transient prosopagnosia resulting from a cerebral gas embolism while diving. *Diving and Hyperbaric Medicine* **37**: 139-142.

BOOKS AND BOOK CHAPTERS

Benson EE, Harding K and **Day JG**. 2007. Algae at extreme low temperatures: the cryobank. In: Seckbach, A (Ed.) *Algae and cyanobacteria in extreme environments*, pp. 365-383. Springer.

Clark MR, Vinnichenko VI, **Gordon JDM**, Beck-Bulat GZ, Kukharev NN and Kakora AF, 2007. Large-scale distant-water trawl fisheries on seamounts. In: Pitcher, TJ, Morato, T, Hart, PJB, Clark, MR, Haggan, N and Santos, RS (Eds) *Seamounts: Ecology, conservation and management.* Fish and Aquatic Resources Series, pp. 361-399. Oxford: Blackwell.

Day JG, 2007. Cryopreservation of microalgae and cyanobacteria. In: Day JG and Stacey G (Eds) *Cryopreservation and freeze-drying protocols*, pp.141-152. Humana Press.

Day JG, **Achilles-Day UEM**, Brown S and Warren A, 2007. Cultivation of algae and protozoa. In: Hurst C, Crawford R, Garland J, Lipson D, Mills A and Stetzenbach L (Eds) *Manual of environmental microbiology*, pp. 77-92. Washington: ASM Press.

Haggan N, Ainsworth C, Pitcher T, Sumaila UR and **Heymans JJ**, 2007. Life in the fast food chain: Oú sont les poissons d'Qntan? In: Parrish CC, Turner NJ and Solberg SM (Eds) *Resetting the kitchen table: Food security, culture, health and resilience in coastal communities*, pp. 51-74. Nova Science Publishers, Inc.

PUBLICATIONS

Kelly MS, **Hughes A** and **Cook EJ**, 2007. The ecology of *Psammechinus miliaris*. In: Lawrence, J (Ed.) *Edible sea urchins: Biology and ecology (Developments in Aquaculture and Fisheries Science 37, 2nd edition)*, pp. 287-295. Amsterdam: Elsevier.

Potts T, Merson J and Kachka M, 2007. Local multi-stakeholder partnerships for sustainability. In: Nelson, A (Ed.) Steering sustainability in an urbanising world: *Policy, practice and performance*, pp. 175-185. London: Ashgate.

Potts T, 2007. Using indicator systems as tools to progress fisheries sustainability: An analysis of recent policy approaches. In: Chircop A, Coffen-Smout S and McConnell M (Eds) *Ocean yearbook* **21**, pp. 237-264. International Oceans Institute. Boston: Martinus Nijhoff.

Pröschold T and Leliaert F, 2007. Systematics of the green algae: Conflict of classic and modern approaches. In: Brodie J and Lewis J (Eds) *Unravelling the Algae: The past, present, and future of algal systematics*, pp. 123-153. Systematics Association Special Volume **75**. Taylor and Francis.

Sayer MDJ, Fraser KPP, **Shimmield TM** and **Wilkinson JP**, 2007. Under ice diving operations carried out by UK organisations in support of scientific research. In: Lang MA and Sayer MDJ (Eds) *Scientific diving under ice: Proceedings of the international polar diving workshop, Svalbard*, pp. 95-110. Washington: Smithsonian Institution.

Sayer MDJ, Lang MA and Mercer S, 2007. The comparative incidence of decompression illness in Antarctic scientific divers. In: Lang MA and Sayer MDJ (Eds) *Scientific diving under ice: Proceedings of the international polar diving workshop, Svalbard*, pp. 191-195. Washington: Smithsonian Institution.

Stacey GN and **Day JG**, 2007. Long-term *ex situ* conservation of biological resources and the role of biological resource centres. In: Day JG and Stacey GN (Eds) *Cryopreservation and freeze-drying protocols* (2nd Edition), pp. 1-14. Humana Press.

EDITED WORKS

Baker M, Ebbe B, Hoyer J, Menot L, **Narayanaswamy BE**, Ramirez-Llodra E and Steffensen M (Eds) 2007. *Deeper than light*. 85 pp. Bergen Museum.

Day JG and Stacey GN (Eds), 2007. *Cryopreservation and freeze-drying protocols* (*2nd Edition*). 345 pp. Humana Press.

Gibson RN, Atkinson RJA and **Gordon JDM** (Eds), 2007. *Oceanography and Marine Biology: An Annual Review* **45**: 547 pp. Boca Raton, USA: CRC Press.

Harvey R and **MacKinnon R** (Eds), 2007. *SAMS Annual Report* 2005-6. 63 pp. Oban: SAMS.

Le Quesne WJ, Arreguín-Sánchez F and **Heymans JJ** (Eds), 2007. *INCOFISH ecosystem models: Transiting from Ecopath to Ecospace. Fisheries Centre Research Reports* **15**. 188 pp.

Lang MA and **Sayer MDJ** (Eds), 2007. Scientific diving under ice: *Proceedings of the international polar diving workshop, Svalbard*. 213 pp. Washington: Smithsonian Institution.

Narayanaswamy BE (Ed), 2007. *The European Census of Marine Life Newsletter* **2**. 6 pp.

Narayanaswamy BE (Ed), 2007. *The European Census of Marine Life Newsletter* **3**. 8 pp.

Rysgaard S and **Glud RN** (Eds), 2007. *Carbon cycling in Arctic marine Ecosystems: Case study Young Sound. Meddelelser om Gronland-Bioscience* **58** (Special issue). 214 pp.

Sayer MDJ (Ed), 2007. *Underwater Technology* **27(1)**, 40 pp.

Sayer MDJ (Ed), 2007. *Underwater Technology* **27(2)**, 30 pp.

Sayer MDJ (Ed), 2007. Diving for Science and Archaeology. *Underwater Technology (Special Issue)* **27(3)**. 75 pp.

NON-REFEREED PAPERS AND REPORTS

Black K, 2007. The future of seafood and aquaculture. *SAMS Newsletter* **33**: 7.

Bundy A, **Heymans SJJ**, Morissette L and Savenkoff C, 2007. Seals, cod and forage fish: a comparative exploration of variations in the theme of stock collapse and ecosystem change in NW Atlantic ecosystems. *ICES CM* **2007/D**: 15.

Burrows MT, **Davies AJ**, **Meldrum DT** and **Wadke PM**, 2007. Using magneto-resistive sensors to monitor animal behaviour: A case study using limpets. *On the edge of tomorrow - Oceans 2007, Vancouver, September 2007*. MTS/IEEE.

PUBLICATIONS

Campbell CN, **Gachon CM**, **Day JG**, **Pröschold T**, **Saxon R** and **Küpper FC**, 2007. Bioinformatics, genomics and the Culture Collection of Algae and Protozoa. Connections between Collections 1: 34-35. DSMZ Braunschweig Germany. *11th International Conference on Culture Collections, Goslar, Germany 7-11 October 2007*. World Federation for Culture Collections.

Doble M, **Meldrum DT**, **Mercer DJL**, Wadhams P, **Wadke PM** and **Wilkinson JP**, 2007. The autonomous measurement of waves propagating across the Arctic Ocean. *On the edge of tomorrow - Oceans 2007, Vancouver, September 2007*. MTS/IEEE.

Gillibrand P and **Willis K**, 2007. Where do larval sea lice go? Modelling sea lice dispersal in sea lochs. *SAMS Newsletter* **33**: 6.

Guénette S, **Heymans JJ**, Christensen V and Trites A, 2007. Ecosystem models of the Aleutian Islands and Southeast Alaska show that Steller sea lions are impacted by killer whale predation when sea lion numbers are low. *US Geological Survey Scientific Investigations Report 2007-5047. Proceedings of the Fourth Glacier Bay Science Symposium, October 26-28, 2004*: 150-154. US Geological Survey.

Heymans S, Guenette S, Christensen V and Trites A, 2007. Steller sea lions in the Gulf of Alaska: Modelling effects of environmental variation and fishing. *SAMS Newsletter* **33**: 14.

Heymans SJJ and Sumaila UR, 2007. Updated ecosystem model for the Northern Benguela ecosystem, Namibia. In: Le Quesne WJF, Arreguín-Sánchez F and Heymans SJJ (Eds) *INCOFISH Ecosystem Models: Transiting from Ecopath to Ecospace. Fisheries Centre Research Reports* **15**: 25-70.

Howell K, Davies JS, **Hughes DJ** and **Narayanaswamy BE**, 2007. Strategic Environmental Assessment / Special Area for Conservation. Report to the DTI and JNCC. 82 pp.

Howe JA, **Shimmield TM**, Harland R, **MacLachlan S**, **Cottier F** and Austin WEN, 2007. Late Quaternary palaeorecords of ocean circulation and climate: Multi-proxy evidence from western Svalbard and the Fram Strait. *Arctic Palaeoclimate and Extremes, Stockholm, 2007* **1**: 25-26. Royal Swedish Academy of Sciences.

Kelly MS and **Dworjanyn S**, 2007. Seaweed: The blue biofuel? *SAMS Newsletter* **33**: 16.

Linley EAS, **Wilding TA**, **Black KD**, Hawkins AJS and Mangi S, 2007. Review of the reef effects of offshore windfarm structures and potential for enhancement and mitigation. Report from PML Applications Ltd and the Scottish Association for Marine Science to the Department for Business, Enterprise and Regulatory Reform (BERR). 132 pp.

Oguri K, Kitazato H, **Glud RN**, **Stahl H**, Wenzhofer F, Asakawa K, Iwase R, Sakai S, Nomaki H and Fujikura K, 2007. In situ measurement of time-series two dimensional O_2 distributions at sediment-water interface using a planar O_2 optode system connected with a submarine cable. *Symposium on underwater technology and workshop on scientific use of submarine cables and related technologies, Tokyo, April 2007*, pp. 367-370. IEEE Press.

Swan SC and **Davidson K**, 2007. Monitoring programme for the presence of toxin producing plankton in shellfish production areas in Scotland: April 2006 - March 2007. Report to the Food Standards Agency Scotland. 25 pp. + appendices.

Potts T, 2007. Marine policy in the UK: Moving towards integrated management? *SAMS Newsletter* **33**: 8.

Sayer M, 2007. Recompression and the occupational diver. *Underwater Contractor International* **11(6)**: 14.

Stahl H, 2007. Landing on the Sea Floor - using advanced in situ technologies to investigate benthic carbon cycling. *SAMS Newsletter* **33**: 11.

Wang Y, **Sillitoe IP** and Mulvaney DJ, 2007. Mobile robot path planning in dynamic enviroments. *IEEE International conference on robotics and automation, Rome, April 2007*, pp. 71-76. IEEE Press.

Williamson P and **Day JG**, 2007. The problem with protists: is barcoding the answer? *The Biologist* **54**: 86-90.

Williamson P, Andersen R and **Küpper FC**, 2007. Why every protist needs a barcode. *Microbiology Today* **34**: 46-47.

Wilson B, 2007. Scottish renewable energy: green gold from the sea? *Parliamentary Monitor* June 07: 31.

RESEARCH GRANTS AND CONTRACT INCOME RECEIVED

Project Leader	Title	Funding body	Duration	Award
G Andrew	Stable isotope analysis	British Council	09/07 - 10/07	£5k
R Batty	Algal mediated turbidity	Seafish	10/05 - 04/07	£31k
K Black	Risk factors in shellfish harvesting areas	SARF/SEPA/FSA	11/05 - 10/07	£152k
K Black	Ecosystem approach for sustainable aquaculture	EU	01/05 - 02/08	£227k
K Black	Synthesis of aquaculture and marine ecosystems interactions	EU FP6	11/05 - 04/07	£30k
K Black	Environmental management reform for sustainable farming, fisheries and aquaculture	EU FP6	01/07 - 12/09	£18k
K Black	Science and Policy Integration for Coastal Systems Assessment (SPICOSA)	EU FP6	02/07 - 01/11	£65k
K Black	Consultancy work	World Wildlife Fund	03/06 - 12/07	£10k
K Black	Benthic Recovery Processes	SARF	01/07 - 12/10	£113k
K Black	Non native Risk Analysis Panel	DEFRA	12/06 - 01/08	£5k
K Black	Enivonmental impact of salmon aquaculture	FAO	04/07 - 11/07	£4k
K Black & P Batty	The influence of structural and functional aspects of benthic organisms on bioturbation and ecosystem function (PhD Project)	NERC	10/05 - 09/08	£18k
K Black & R Shucksmith	Biological invasions: The role of biodiversity in determining community susceptibility to invasion (PhD Project)	NERC	10/04 - 09/07	£12k
M Burrows	Biodiversity and ecosystem functioning: tests using rockpools as natural mesocosms	NERC	01/06 - 12/08	£65k
M Burrows & G Andrew	Trophic diversity versus species diversity in intertidal grazers and filter feeders (PhD Project)	NERC	10/04 - 09/07	£15k
M Burrows	Sustainable management of deep-water fisheries and their impact on marine biodiversity	Esmee Fairbairn	01/06 - 12/08	£72k
M Burrows	Oceans2025 Theme 4 WP 4.4 Predators and prey	NERC	04/07 - 03/12	£818k
M Burrows	Oceans2025 Theme 4 WP 4.6 Ecosystem services	NERC	04/07 - 03/12	£254k
CN Campbell	Diatoms	Unilever	01/07 - 12/07	£20k
E Cook	Invasive Alga: Controlling the spread of *Sargassum muticum*	Scottish Executive	01/07 - 12/07	£5k
E Cook	Biological Invasions: The role of biodiversity in determining community susceptibility to invasion	NERC	10/04 - 09/07	£13k
F Cottier	Ecosystem of the mid-atlantic ridge at the sub polar front and Charlie Gibbs Fracture Zone	NERC	10/06 - 09/10	£191k
F Cottier	International Networking for Young Scientists	British Council	09/06 - 08/07	£10k
F Cottier	Provision of mooring deployment, maintenance and analysis	Norwegian Polar Institute	08/05 - 07/08	£48k
F Cottier	Arctic Oceanography: the Atlantic Influence of Polar Climates	The Royal Society	01/07	£2k
F Cottier	Climate effects on planktonic food quality & trophic transfer in Arctic Marginal Ice Zones	Norwegian Research Council	01/07 - 12/07	£45k
F Cottier	Oceans2025 Theme 10 SO13 Kongsfjord	NERC	04/07 - 03/12	£125k
F Cottier	Oceans2025 Theme 10 SO13 Arctic mooring	NERC	04/07 - 03/12	£106k
F Cottier	UHI BERGE	UHI	08/07 - 07/08	£4k
I Crawford	Human Resources Modernisation	UHI	Ongoing	£25k
C Cromey	Mitigating impact from aquaculture in the Philippines	EU FP6	08/06 - 01/08	£50k
C Cromey	Validation & Provision of Cryosat Measurements of fluctuations of the earth's land and marine ice fluxes	NERC	02/04 - 02/09	£310k
C Cromey	Convection & Cascading on Arctic Shelves: a tracer study	NERC	04/07 - 03/09	£69k
J Day	International Incoming Short Visits 2007/R2	The Royal Society	09/07 - 11/07	£5k

RESEARCH GRANTS AND CONTRACT INCOME RECEIVED

Project Leader	Title	Funding body	Duration	Award
J Day	CCAP National Facility	NERC	04/07 - 03/12	£3,044k
K Davidson	Predicting the progression of the harmful dinoflagellate *K. mikimotoi* along the Scottish coast	The Crown Estate	02/07 - 06/07	£58k
K Davidson	Relating harmful phytoplankton to shellfish toxicity & human health	NERC	03/07 - 02/08	£28k
K Davidson	Forecasting initiation of blooms of toxic algae	EU Interreg IIIB	04/06 - 06/08	£153k
K Davidson	Oceans2025 Theme 3 WP 3.8 Pelagic mixing	NERC	04/07 - 03/12	£566k
C Gachon	Structuring the European Research Area - human resources & mobility	Marie Curie Intra European Fellowships	09/06 - 08/08	£109k
C Gachon	British Phycological Society bursary	British Phycological Society	07/07	£580
C Gachon	Travel grant to visit collaborator in Germany	Marine Genomics Europe	06/07	£1k
C Fox	Eur-Oceans	EU	04/07 - 03/09	£13k
C Fox/L Robb/L Nickell	UHI Travel	UHI	10/07 - 02/08	£1k
P Gillibrand	European climate of the last Millennium	EU FP6	01/06 - 12/09	£94k
P Gillibrand	The development of modeling techniques to improve predictions at marine cage farms	SARF	07/05 - 06/08	£58k
P Gillibrand	Scallop fishing in the Firth of Lorn Marine SAC: Modelling of indirect environmental impacts	SNH	10/07 - 06/08	£46k
P Gillibrand & S Hughes	Research Degree Part Time ARC/UHI	Fisheries Research Services	04/07 - 03/12	£9k
S Gontarek	Data Management	NERC	06/06 - 11/10	£225k
D Green	Algal-bacterial interactions in determining dimethylsulphide fluxes to the atmosphere	NERC Solas	10/05 - 09/08	£170k
D Green	Characteristics of organic microlayer produced aerosols	NERC	06/06 - 05/08	£16k
D Green	Development of bioemulsifier production to advance commercial exploitation opportunites.	NERC	04/07 - 03/08	£81k
A Hatton	Unravelling the ocean methane paradox	NERC	08/07 - 07/10	£454k
A Hatton & A Mogg	The role of bacterial associates in the production of dimethylsulphoxide by marine phytoplankton (PhD Project)	NERC	10/07 - 09/10	£10k
A Hatton	Sequencing the Sea Sulphur cycle	NERC	01/08 - 12/10	£14k
J Howe	Collaborative paper on inner shelf of the Amundsen Sea	British Antarctic Survey	01/07 - 05/07	£650
J Howe & K McIntyre	Limits of the Younger Dryas ice sheet in West Scotland (PhD Project)	NERC	10/07 - 09/10	£10k
J Howe	Oceans2025 Theme 3 WP 3.8 Multibeam system	NERC	04/07 - 03/12	£161k
J Howe	Oceans2025 Theme 1 WP 1.5B MOC activity	NERC	04/07 - 03/12	£288k
J Howe	Oceans2025 Theme 3 WP 3.9 Sediment transport	NERC	04/07 - 03/12	£265k
D Hughes	PHD extension	NERC	09/06 - 08/07	£18k
D Hughes	Gradients in macrofaunal community structure and bioturbation in the Northern Seas Region	NERC	09/06 - 08/07	£12k
N Hughes	Polar View	University of Cambridge	09/05 - 05/08	£5k
M Inall	UK Marine Environmental Change	MBA	07/05 - 04/07	£1k
M Inall	Ice Edge	Individual	08/07 - 07/08	£10k
M Inall	Oceans2025 Theme 3 WP 3.7 AUV	NERC	04/07 - 03/12	£90k
M Inall	Oceans2025 Theme 10 SO13 Tiree mooring	NERC	04/07 - 03/12	£111k
M Inall	Oceans2025 Theme 3 WP 3.7 Topography	NERC	04/07 - 03/12	£492k
M Inall	Oceans2025 Theme 10 SO1 Tiree mooring	NERC	04/07 - 03/12	£312k
M Kelly	Toxins in aquaculture ecosystems and shellfish	EU Collective Research Projects	07/06 - 06/09	£105k
M Kelly	Reducing the environmental impact of sea cage farming through cultivation of seaweeds	HIE	08/06 - 07/08	£147k

RESEARCH GRANTS AND CONTRACT INCOME RECEIVED

Project Leader	Title	Funding body	Duration	Award
M Kelly	The Potential of marine biomass for biofuel	The Crown Estate	01/07 - 06/07	£30k
M Kelly	Sea urchin production in integrated systems, their nutrition and roe environment	EU	01/05 – 12/07	£193k
M Kelly & A Rodger	Multi-trophic level culture for environmental remediation - active management of aquaculture initiatives for diversification and sustainability (PhD Project)	AIE	10/04 – 09/07	£36k
M Kelly	Atlantic Arc Aquaculture Group 2	EU Interreg IIIB	01/07 -06/08	£160k
M Kelly	Supergen Biomass Biofuels & Energy Crops	ESPRC	06/07 - 05/11	£79k
M Kelly	PSP in King Scallops	Food Standards Agency	04/07 - 04/08	£26k
F Küpper	The role of bacterial symbiotic metabolites in the development of toxic phytoplankton blooms	California Sea Grant	03/06 - 02/08	£5k
F Küpper	Pioneering post genomics approaches for studying algal host-pathogen interactions, using the *Ectocarpus/Eurychasma* model	NERC	05/06 - 05/09	£25k
F Küpper	Transformations, volatilisation & speciation of organic and inorganic iodine in the marine environment	NERC	10/06 - 09/09	£15k
F Küpper	International Exchange Programme IEP Poland - incoming	The Royal Society	08/07	£2k
F Küpper	Oceans2025 Theme 4 WP 4.5 Microbial media	NERC	04/07 - 03/12	£272k
K Last	Guest Lecturing	University of Newcastle	04/07 - 02/08	£500
R Leakey	UK-Arctic Stakeholders Conference	Foreign & Commonwealth Office	02/08	£2k
I Macfarlane	Blue Energy - Sustainable fuels from marine biomass	EU Interreg	07/07	£18k
D Meldrum	Arctic Synoptic Basin-wide oceanography	NERC	01/07 - 12/09	£220k
D Meldrum	Synoptic Antarctic Shelf-Slope Interactions Study	NERC	06/07 - 11/10	£171k
D Meldrum	NERC Technology Forum	NERC	03/08 - 06/08	£15k
D Meldrum	Oceans2025 Theme 8 WP 8.9 Satellite comms	NERC	04/07 - 03/12	£422k
A Miller	Sharing Science	Scottish Executive	11/07 -03/08	£4k
AEJ Miller	UHI learning & teaching infrastructure	UHI	08/05 - 07/07	£45k
AEJ Miller	Ecosystem approach to sustainable management	EU FP6	01/06 – 12/09	£233k
AEJ Miller	Socrates-Erasmus mobility grants 2006/2007	UK Socrates-Erasmus Council	07/06 - 09/08	£3k
AEJ Miller	Ecosummer	EU Marie Curie	01/06 -12/09	£234k
AEJ Miller	Erasmus	Socrates-Erasmus	ongoing	£1k
AEJ Miller & M Strittmatter	Ecosummer (PhD project)	EU Marie Curie	06/07 - 11/09	£94k
AEJ Miller & C Lonborg	Ecosummer (PhD project)	EU Marie Curie	06/06 - 05/08	£75k
AEJ Miller	Addressing Research Capacity	Scottish Funding council, ERDF	03/06 - 06/09	£5,636k
AEJ Miller	Additional Skills Training	NERC	ongoing	£5k
AEJ Miller	UHI Course Management and Exam Board Fees	Scottish Funding Council via UHI	08/06 - 07/07	£6k
AEJ Miller	FE/HE Articulation	Scottish Funding Council via UHI	ongoing	£28k
AEJ Miller	UHI Learning & teaching infrastructure	UHI	ongoing	£26k
AEJ Miller	UHI Additional resources	Scottish Funding Council via UHI	08/06 - 07/07	£4k
AEJ Miller	Statistics course	Individual	06/07	£500
AEJ Miller	Secondment to role of UHI Dean	UHI	06/07 - 12/07	£18k
AEJ Miller	Wider access retention premium (WARP)	UHI	ongoing	£2k
B Narayanaswamy	EuroCoML core funding	AIE	02/05 – 05/08	£21k
B Narayanaswamy & G Shimmield	The Census of Marine Life	Stavros Niarchos Foundation	02/05 - 02/09	£241k
B Narayanaswamy	Deep sea Education & Outreach Group	DESEO	ongoing	£79k

RESEARCH GRANTS AND CONTRACT INCOME RECEIVED

Project Leader	Title	Funding body	Duration	Award
L Nickell & P Batty	Bioturbation and ecosystem functioning (PhD project)	NERC	10/05 - 09/08	£9k
T Potts	Role of Certification and Ecolabelling in Sustainability	ESRC	09/07 - 08/09	£99k
T Proeschold	International Incoming Short Visits 2007/R2	The Royal Society	04/08 - 06/08	£4k
JM Roberts	Hotspot ecosystem research on the margins of European seas	EU FP6	04/05 - 03/09	£170k
JM Roberts	Biodiversity & Vulnerability of European Coldwater Coral Reef Ecosystems	EU	01/05 - 05/08	£43k
JM Roberts	Trans-Atlantic Coral Ecosystem Studies	EU Marie Curie	05/07 - 04/09	£49k
JM Roberts	Deep sea conservation for the UK	Porcupine Marine Natural History Society	07/07 - 06/09	£37k
JM Roberts	TRACES European Workshop and meetings	NERC	03/08	£7k
M Sayer	NFSD	NERC	2001 - 9	£1,194k
M Sayer	NFSD support work	NERC	03/07 - 09/07	£22k
M Sayer	Development of a framework for Marine European Seabed Habitats	EU Interreg	05/04 - 04/07	£114k
M Sayer	Lyme Bay Urgency Grant	NERC	05/07 - 10/07	£20k
M Sayer	Grampian Technical Support	Grampian University Hospitals Trust	ongoing	£12k
M Sayer	Foster Yeoman Survey	Foster Yeoman Ltd	04/06 - 03/08	£25k
T Sherwin	Internal tides over oceanic topography & their influence on mixing	NERC	10/06 - 09/09	£15k
T Sherwin	12 month PHD extension	NERC	09/06 - 08/07	£18k
T Sherwin	Tracing overflow water in the Rockall Trough	NERC	09/06 - 08/07	£12k
T Sherwin	Oceans2025 Theme 10 SO4 Sea glider	NERC	04/07 - 03/12	£120k
T Sherwin	Oceans2025 Theme 10 SO4 ADCP mooring	NERC	04/07 - 03/12	£75k
T Sherwin	Oceans2025 Theme 1 WP 1.5A Mining instrument	NERC	04/07 - 03/12	£127k
T Sherwin	Oceans2025 Theme 10 S04 Extended Ellett Line	NERC	04/07 - 03/12	£805k
T Shimmield	Scottish Alliance for Geoscience, Environment & Society (SAGES)	Scottish Funding Council	10/06 - 10/10	£293k
T Shimmield	Scottish Alliance for Geoscience, Environment and Society	Scottish Funding Council	10/06 - 09/11	£293k
T Shimmield	Oceans2025 Theme 1 WP 1.6 Mooring	NERC	04/07 - 03/12	£130k
T Shimmield	Oceans2025 Theme 1 WP 1.6 Alpha/Gamma	NERC	04/07 - 03/12	£68k
T Shimmield	Oceans2025 Theme 1 WP 1.6 Climate change	NERC	04/07 - 03/12	£2,417k
T Shimmield	Carbon and radioisotope analysis	NERC	04/07 - 03/12	£447k
T Shimmield	Cruise costs	NERC	04/07 - 03/12	£415k
I Sillitoe	Oceans2025 Theme 8 WP 8.7 Sensor optimisation	NERC	04/07 - 03/12	£258k
I Sillitoe	Oceans2025 WP 8.8 Water column	NERC	04/07 - 03/12	£466k
M Stanley	Algal Biofuels Phase 1 & 2	ITI Energy	01/08 - 02/08	£25k
E Walton	UHI Hardship Fund	UHI	08/07 - 07/08	£500
T Wilding	Krill as a source of Aquafeeds	The Crown Estate	03/07 - 07/07	£18k
T Wilding	A Review & Assessment of the effects of marine fish farm discharges on Biodiversity Action Plans	SARF	05/07 - 04/09	£83k
J Wilkinson	Developing Arctic modelling and observing capabilities for long-term environmental studies	EU FP6	12/05 - 11/09	£311k
K Willis	Arcfac V	Ny-Alesund RI - Arcfac V	06/07	£4k

RESEARCH GRANTS AND CONTRACT INCOME RECEIVED

Project Leader	Title	Funding body	Duration	Award
B Wilson	Distribution, abundance & population structure of bottlenose dolphins in Scottish waters	University of Aberdeen	05/06 - 09/07	£68k
B Wilson & L Wilson	Gadoid fish sound production and its role in mate selection, the risk of predation and impacts of noise pollution (PhD Project)	NERC	10/05 - 09/08	£29k
B Wilson	European Marine Energy Centre, Falls of Warness, Acoustic monitoring	HIE	12/06 - 04/08	£65k
B Wilson	MSc Supervision	European Social Fund via North Highland College	08/06 - 07/08	£7k

SAMS RESEARCH SERVICES LIMITED

Project Leader	Title	Funding body	Duration	Award
R Batty	Peer review role in connection with Feed and sustainability trial (FAST) project	The Crown Estate	11/06 - 04/08	Commercial in confidance
K Black	Non-native Risk Analysis Panel sub contract	DEFRA via Central Science Laboratory	12/06 - 03/09	
K Black	Analyses	Glycomar	ongoing	
T Brand	Carbon analysis of algal suspensions	CEFAS	01/08	
C Campbell	Produce and despatch cell concentrates to test their efficacy in food manufacturing process	Unilever	01/07 - 12/07	
C Cromey	Depomod III software	Commercial sales	ongoing	
C Cromey	Modelling benthic effects of large salmon cage farms in Scotland.	SSPO	01/08 - 09/08	
K Davidson	Provision of an official control monitoring programme for the presence of toxin producing plankton in shellfish production areas in Scotland	Food Standards Agency	09/05 - 08/08	
C Griffiths	Invergordon Survey	CD Campbell Marine Contracts	07/07	
D Gunn	Commercial Marketing & Promotion	AIE	04/06 - 03/08	
F Kuepper	CCAP culture collection	Commercial sales	Annually	
B Narayanaswamy	Photographic and video analysis of SEA/SAC survey data obtained in 2006	Geotek Ltd	01/07 - 04/07	
M Sayer	NHS recompression facility	NHS	Annually	
M Sayer	Grampian hyperbaric technical services	Grampian University Hospitals Trust	Annually	
M Sayer	Cranfield/Ardtoe Diving	CRANFIELD	04/07	
G Shimmield	Knowledge Transfer Officer grant	AIE	03/05 - 02/08	
T Shimmield	Investigation of the environment effects of the placement of metal mine processing tailings into the deep sea	EU & Government of PNG	02/07 - 11/09	
B Wilson	A study for EMEC and Synergie Scotland: Measuring the environmental effects of the acoustic impact of tidal generators	HIE	12/06 - 11/07	

SAMS STAFF AT 31 MARCH 2008

Director
Professor Graham Shimmield

Deputy Director
Dr Ken Jones

Physics, Sea Ice and Technology
Dr Mark Inall (Head)
Mr David Meldrum (Deputy)
Mr John Bass
Mr John Beaton
Dr Tim Boyd
Dr Finlo Cottier
Dr Andrew Dale
Miss Estelle Dumont
Mr Colin Griffiths
Dr Keith Jackson
Mr Alistair James
Dr Toby Sherwin
Dr Ian Sillitoe
Dr Pushkar Wadke
Dr Jeremy Wilkinson

Biogeochemistry and Earth Sciences
Dr Tracy Shimmield (Head)
Dr John Howe (Deputy)
Dr Tim Brand
Miss Susan Fitzer
Mrs Anni Glud
Prof Ronnie Glud
Miss Cheryl Haidon
Mr S Martyn Harvey
Dr Angela Hatton
Miss Helen Kinninmonth
Miss Pauline Learmonth
Miss Susan McKinlay
Dr Axel Miller
Mrs Joyce Moore (Part time)
Dr Arlene Rowan
Dr Dan Sinclair
Dr Henrik Stahl
Dr Robert Turnewitsch

Ecology
Dr Kenny Black (Head)
Dr Michael Burrows (Deputy)
Dr Robert Batty
Mrs Christine Beveridge
Mr Lars Brunner
Mrs Caroline Carter (part-time)
Dr Elizabeth Cook
Mrs Janet Duncan (part-time)
Dr Clive Fox
Dr Vicki Hendrick (part-time)
Dr Sheila Heymans
Mr Robin Harvey
Dr David Hughes
Dr Maeve S Kelly
Dr Kim Last
Mr Peter Lamont
Miss Shona Magill (part-time)
Dr Lois Nickell
Dr Thomas Nickell
Mrs Heather Orr
Dr Tavis Potts
Mrs Linda Robb
Dr Murray Roberts
Miss Coleen Suckling
Dr Tom Wilding
Ms Averil Wilson
Dr Ben Wilson

Microbial and Molecular Biology
Dr Ray Leakey (Head)
Dr Frithjof Küpper (Deputy)
Dr Elanor Bell
Mrs Undine Achilles-Day (part-time)
Mrs Debra Brennan
Mrs Christine Campbell (part-time)
Mrs Alison Clarke
Dr Keith Davidson
Dr John Day
Ms Joanne Field
Dr Claire Gachon
Dr Tony Gutierrez
Dr David H Green
Dr Mark Hart
Dr Vincent Le Fouest
Mr Christian Loenborg
Mrs Eleanor Martin
Miss Sharon McNeill
Ms Elaine Mitchell
Mr Romain Pete
Dr Thomas Pröschold
Miss Cecilia Rad Menendez
Miss Rachel Saxon
Dr Damodar Shenoy
Dr Michele Stanley
Miss Martina Strittmatter
Ms Sarah Swan
Mr Tim Wilkinson

SAMS Honorary Research Fellows
Prof Peter Boyle
Dr Clive Craik
Dr Robin Gibson
Dr John Gordon
Professor Jack Matthews
Dr Julian Overnell
Dr Tom Pearson

European Census of Marine Life Office
Dr Bhavani Narayanaswamy

IT & Data Services
Mr Steven Gontarek (Head)
Ms Nicola Longman
Mr Rory MacKinnon
Mr Nigel MacLucas
Mrs Katrine Smalley

Activities Manager
Dr Anuschka Miller

Company Secretary
Mrs Elaine Walton

Directors Secretariat
Miss Jane E McLoughlin
Mrs Allison Dawson (part time)

Finance Accountant

SAMS STAFF AT 31 MARCH 2008

Mr Gordon McAllister
Ms Frances McCloskey

Accounts
Mrs Elizabeth Campbell
Miss Sharyn Farmer (part time)
Mrs Lindy Lamb (part time)
Ms Emma Morgan
Mrs Lorna Watt

Contracts Accountant
Mr Derek Black

Contracts
Miss Angela Anderson
Mrs Fiona Hart
Mrs Yvonne Lindesay

Knowledge Transfer
Mr David Gunn (Head)
Miss Karen Alexander

Health & Safety Adviser
Mr Ivan Ezzi

Human Resources & Student Registry
Mr Ian Crawford (Head)
Ms Karen Campbell
Mrs Ellie Cooper
Miss Jennifer Love

ARC Administration
Mrs Helen McNeill

Reception
Mrs Shirley Kersley (part time)
Mrs Irene Partridge (part time)
Ms Margaret Sime (part time)

Assistant Librarian
Ms Olga Kimmins

Aquarium Manager
Mr John Kershaw

Estates & Facilities
Mr David Mathias

Estates/Ship' s Husband
Mr Ivan Ezzi

NERC National Diving Facility
Dr Martin Sayer
Mr Hugh Brown
Dr Simon Thurston

RV Calanus
Mr Roderick MacNeil (Master)
Miss Kirsty Dalby
Mr John MacFarlane
Mr Duncan MacNeill
Mr Norman Smith

RV Seol Mara
Mr Douglas McAlpine
Mr Steven Douglas

Electrical Maintenance
Mr Brian Clark
Mr John Hill

Engineering workshop
Mr Andrew Connelly
Mr Mark Robertson (Apprentice Engineer)

Building Maintenance
Mr Duncan MacKinnon

Storeman
Mr Alasdair Black

SAMS FINANCE 2007 - 2008

SAMS is an Academic Partner in the UHI Millennium Institute and a Collaborative Research Centre of the Natural Environment Research Council

THE SCOTTISH ASSOCIATION FOR MARINE SCIENCE

DUNSTAFFNAGE MARINE LABORATORY

OBAN • ARGYLL • PA37 1QA • SCOTLAND

T: (+44) (0)1631 559000 F: (+44) (0)1631 559001

E: info@sams.ac.uk W: www.sams.ac.uk

We acknowledge support from the following sponsors: