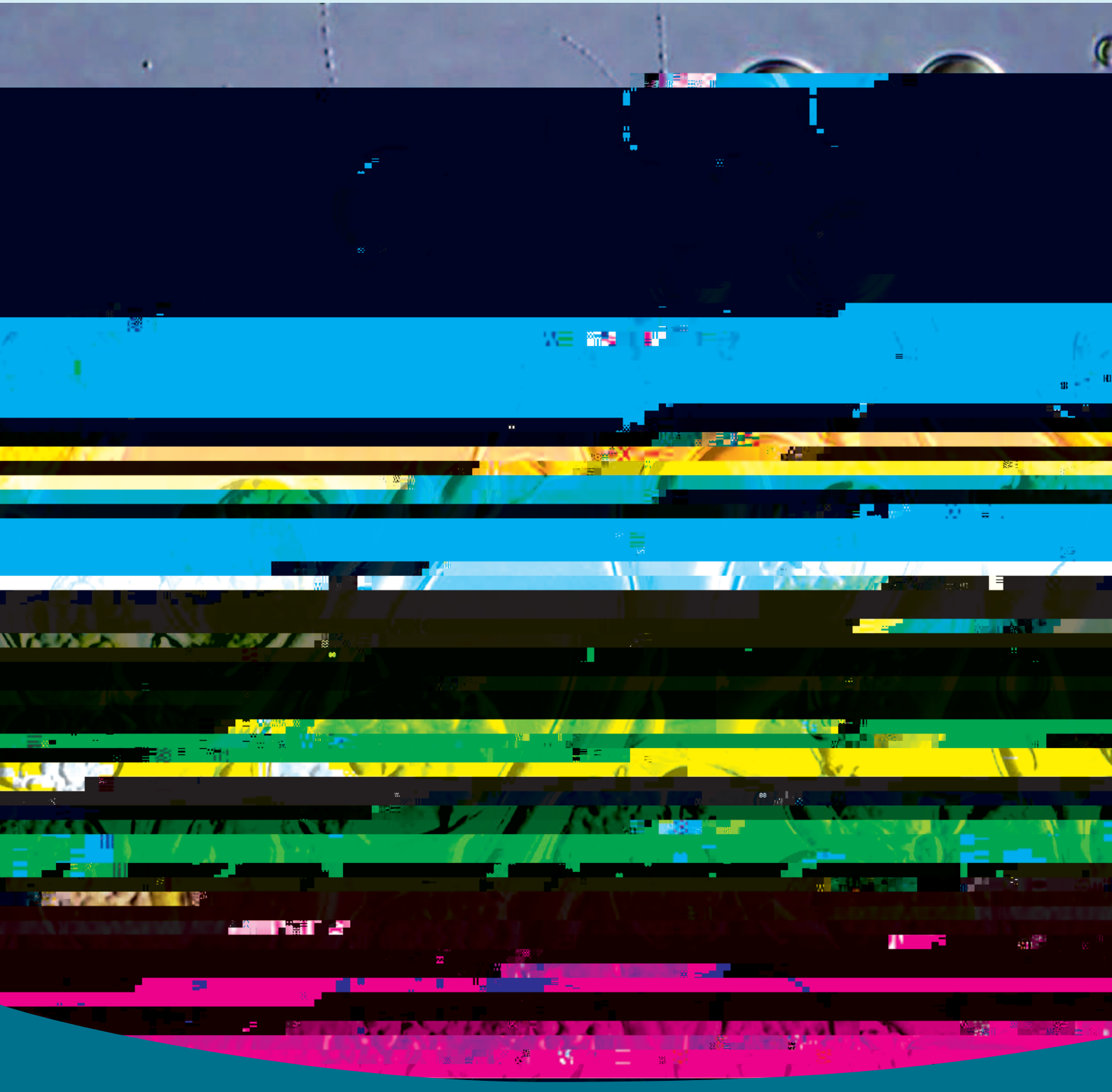
Newsletter of th

SAMS

SCIENCE

ISBN 1475-7214



Marine renewable energy research

Spring / Summer 2009

Dr Anuschka Miller, EDITOR

Alongside food and freshwater, energy is perhaps the most important commodity for our civilisation underpinning every component of the world economy and modern living. As the era of fossil fuels is on the decline we are searching for the power technology of the future, which will have to be abundant, reliable, and cheap. Renewable energy both from terrestrial and marine sources are attractive options, and Scotland is currently competing for pole position in the development of marine renewable energy technologies, particularly for wave and tim-gy:>:vd[w…hly;J[i…hly;J[4y;5q)49;J9e)…hly;Jh4v;Jhkmly;J[i…hly;p>‘[s…hly;J[o…hly;8i…hly;J[l…hly;J[

Offshore wind farms:

The common answer to mitigating climate change is a now ubiquitous call to reduce carbon dioxide emissions. Scotland is charact

Recent years have seen a surging demand for fuel crops like corn, rapeseed, soya, wheat and sugarcane.soya,

UNDERWATER SOUND POLLUTION

Marine wave and tidal energy technologies
are new and t

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COST AND TECHNOLOGY

The cost of producing energy from Renewable Marine Energy (RME) is still significantly higher than energy that comes from mature technologies, both renewable and otherwise. Whilst RME should become more competitive over time through technological consolidation and economies of scale, the Scottish Government is taking steps at this time to ensure developers have an incentive to invest in wave and tidal power where Scotland has a perceived technological lead. That lead must be maintained and prototype technologies need to show that they can be developed on a larger scale to commercially viable projects. Perhaps more column inches should be devoted to the Scottish Government's bold plan to award five Renewables Obligation Certificates (ROCs) for every megawatt hour of wave power generated and three ROCs for every megawatt hour of tidal power. This compares to offshore wind, which currently receives two ROCs for each megawatt hour.

GRID CAPACITY

One of the difficulties facing any developer in Scotland is the limited capacity of existing grid infrastructure. Without significant upgrading of the grid, the attractiveness of the remoter areas of Scotland (where the best wave energy resources are located) as places to develop RME will be hampered. This problem is not going unattended, however, and at this year's SRF Conference the National Grid outlined its plans for a major upgrade of the grid in Scotland. National Grid called upon developers to apply for grid connections now in order that a co-ordinated plan could be in place to ensure that the necJβet..-lỷ;Jβv…-lỷ;Jβe…-lỷJβv…-lỷ;Jβe…-lỷ48m…-lỷ;JF̱ỷ;Jβo…-lỷ;Jβi…-lỷ;Jβn…-lỷ;n

A 2008 SAMS bursary supported the formulation of the 'Plankton Power' SciArt project that generates aesthetically striking images of plankton to raise community awareness about the relevance of plankton to life and human activities.

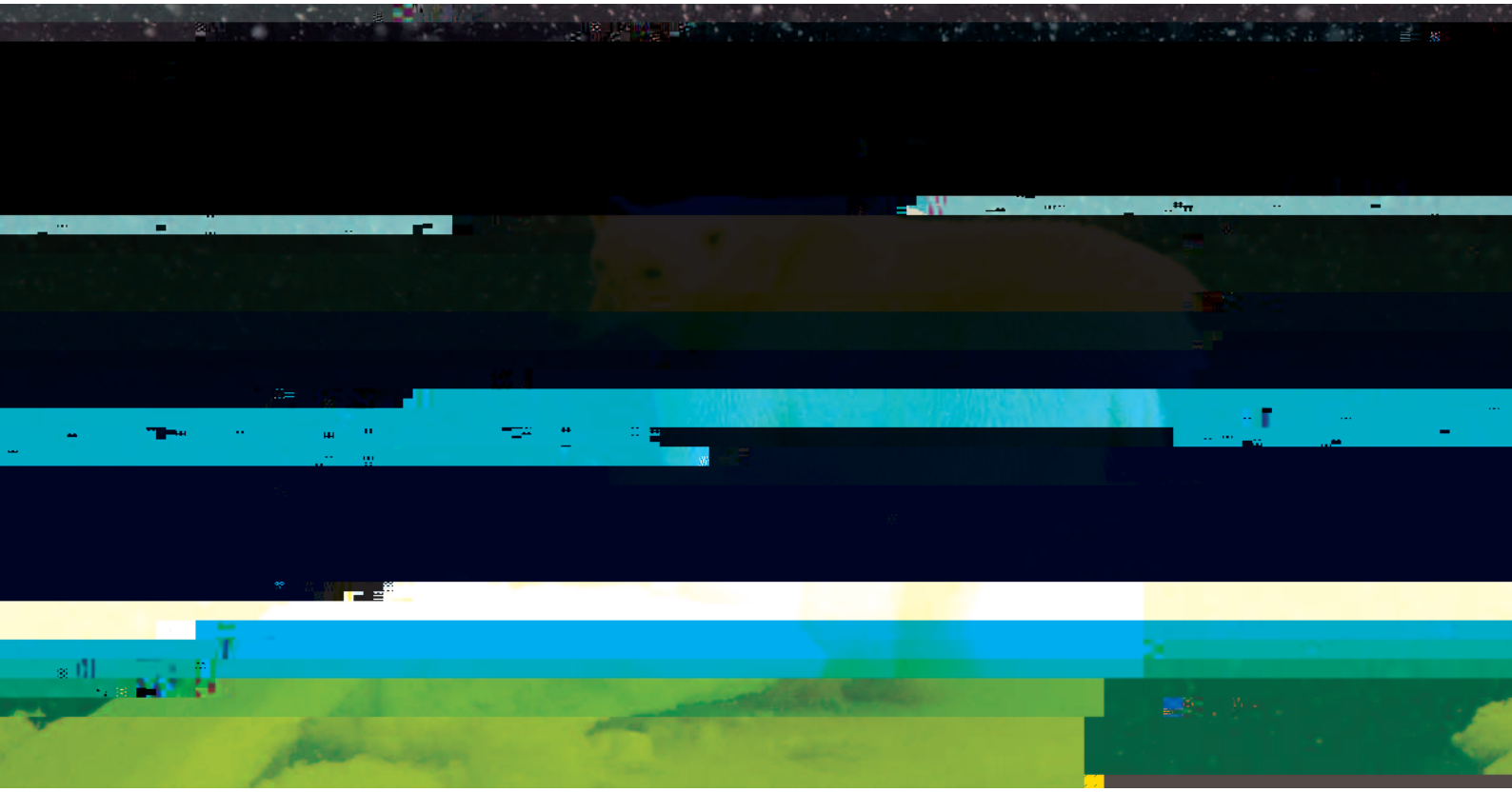
LIVING LIQUID LIFE

The initial working relationship between us and SAMS was established in 2000 when we examined bioluminescence in plankton for a project entitled 'Living Liquid Light' funded by the Arts Council Lottery, SNH, Hi-Arts and Highland and Islands Enterprise. This took the form of a residency with schools on the Isle of Skye and included a touring event to reach out to communities on the west coast like the school on the island of Canna. After a brief introduction to the significance of plankton, we exposed the children to large-scale scanning electron micrograph images of dinoflagellates to stimulate ideas for creating artworks and sculptural lanterns. The project was literally 'highlighted" with an evening voyage in the glass-bottomed boat from Kyle of Lochalsh which revealed plenty of phosphorescence like an underwater firework display.

Local and international exchanges brought us together with David Mann of the Botanic Garden in Edinburgh, Mike Latz of the Scripps Institute in San Diego, and Chris Bolsch from Tasmania. Further meetings with staff at Dunstaffnage provided the project with continuity and momentum.

Since 2003 the video collaboration with Edward O'Donnelly has enabled us to explore several environmental themes in Scotland, Australia and India.

BRINGING DIGITAL VIDEO TO BEAR ON PLANKTON: 2007----



The 2008 ICE CHASER (CHAnging Sea-ice and Ecosystem Response) expedition was funded by the UK National Environment Research Council's *OCEANS 2025* strategic marine research programme, and was part of the International Polar Year PAN-AME and PAME research clusters. Led by Dr Ray Leakey, Head of Microbial and Molecular Biology at SAMS, the aim of the cruise was to improve our understanding of the ecology and biogeochemistry of the region, thereby helping to refine models of ecosystem response to environmental change. The dynamics of the marine microbial comunityy

much carbon and energy is available for all other organisms. They found that that an increase in water temperature may lead to a decrease in phytoplankton growth, a critical finding with regard to global warming.

The sea is teaming with viruses, bacteria and protozoans. These organisms carry out three critical roles: they infect, they degrade and they eat. Dr Elanor Bell was interested in all three processes because they lead to the rapid release of carbon back into the environment, stalling the transfer of carbon up the food web. By identifying and measuring microbial activity, her aim was to calculate how much carbon was being liberated at this early stage. She found an abundant and active bacterial community in the water column suggesting that considerable amounts of energy, carbon and nutrients are recycled by the microbial community rather than being transferred uplyThJi4ij-aarbavdBi…y;JmdBu…y9kh

THE SCIENCE

The scientific programme aimed to generate a detailed picture of the arctic environment: what organisms are there? how well are they growing? how susceptible are they to changes in temperature or light intensity; and how much carbon are they storing – or releasing?

Joining the expedition from France, Dr Eric Fouilland and Emilie Le Floch were focusing on phytoplankton: This microscopic plant life grows in surface waters using the sun's energy to photosynthesise. The process absorbs carbon from the environment and turns it into biomass – the first step in the organic carbon cycle. By measuring phytoplankton biomass and primary production Eric and Emilie studied how

Scottish squid: developing a sustainable fishery

With the present state of decline that surrounds most of the world's finfish fisheries, cephalopod fisheries have almost exclusiv

In contrast to the turbulent, energetic ocean surface, the deep ocean is often seen as a sluggish place, far removed from the heating, cooling and winds that drive ocean circulation. Ne

To this date, approximately one half of the anthropogenic emissions of carbon dioxide have been taken up by the oceans. This may cause concern about ocean acidification, but fears are probably even greater that the uptake of carbon dioxide by the ocean might be slowing down. If this was the case, atmospheric levels of CO_2 would rise increasingly, giving our society even less time to adapt to climate change than current models assume. Our strategies to adapt to global change strongly rely on the capability of Earth system models to predict future conditions. But how can we be sure that the models do a good job?

Considerable progress has been made in the predictive capabilities of models, narrowing the range of uncertainties. Part of the improvement is due to the impressive computational power that is now available to solve the relevant equations. However, the processes that are expressed in a model's equations remain to be identified by other means, and models have to be validated by measurements. Ideally, modelling and observations go hand in hand. Models can help to identify promising sampling locations, and observations that deviate from current models can be used to improve our understanding of the Earth system.

There is, however, often a fundamental gap between the type of information that marine records can provide, and the type of input that models require. Biologists, chemists and geologists studying aspects of the ocean will often find qualitative connections

LINDA ROBB, marine ecologist & trade union representative

Graham arrived at SAMS with enthusiasm and charisma to lead a rather disenchanted staff of 66 who had b

CHARLIE WILSON, former undergraduate student

I feel I owe a great deal to Professor Graham Shimmield for two reasons: the first is his unwavering support of the marine science degree, even when student numbers were falling and pressure was increasing from other stakeholders to compromise the quality of the programme. Graham's involvement in the lectures themselves was invaluable, and his input during the final year palaeoceanography module was really informative and enjoyable. The ongoing success and high quality of the UHI Millennium Institute's Marine Science degree on its own provides an excellent testimony regarding Professor Shimmield's tenure as Director of SAMS.

My second reason for gratitude to Graham is that he intervened to allow me as an undergraduate to take part in a SAMS research cruise to the Arctic in 2005, an experience which led to a summer internship at a major Norwegian oil company.

During the cruise I had the opportunity to get to know Graham. I was struck not only by his drive and determination, but also by his patience and forbearance when confronted by ofh>>k:>:vdpu.heavy>>vely blaring constantly through the science bridge. His tendency to spend long hours in the ship's sauna was completely understandable under the circumstances…

GARETH LAW, PhD student

Graham's work-load was always full. However, he somehow always found time to discuss new findings over a seemingly endless supply of

A "cnidarian orgy" is how Elizabeth Pennisi, reporter for the journal Science, describes coral mass spawning. While many scientists scramble to unlock the biology of this reproductive exuberance, researchers like Professor Ronnie Glud use the natural fertilisation event to study element cycling in an otherwise extremely oligotrophic tropical environment.

In 2005, Ronnie Glud and a team of biologists, microbiologists and chemists visited Australia's Great Barrier Reef on the few nights of the year when it all happens: In mid October, synchronised by the light of the full moon, cou-βi…ɣhp