A strategy for UK marine science for the next 20 years

Fifty years ago, there was ‘A discussion on progress and needs of marine science’ at the Royal Society [1]. George Deacon wrote in the Introduction (p. 286): ‘A hundred years ago the Society often listened to papers about the ocean, but the rapid growth of science … has led to some neglect of large-scale natural processes’. Today, marine science is at the core of many of the most substantial challenges and opportunities facing society. The large-scale natural processes referred to by Deacon, encompassing physics, chemistry and biology, are being perturbed by anthropogenic inputs to the atmosphere, most notably carbon dioxide, and directly and indirectly into the ocean, with substances ranging from radioactive elements to nutrients to endocrine disrupters. Ocean resources are increasingly being exploited. Offshore oil and gas are resources of growing importance to many developing nations, while marine renewable energy is a small but likely to be significant aspect for many coastal communities. Questions over the exploitation of the ocean’s living resources can lead to clashes between science and politics. In terms of climate change, we are presently performing a global experiment by putting large amounts of carbon dioxide into the atmosphere. How the turbulent ocean and atmosphere will react to the resulting changes in radiative forcing and interact with land and ice forms are fascinating scientific problems of intrinsic interest but also with serious ramifications for mankind. Marine science is at the base of addressing these issues. Fundamental research is needed to deepen understanding of ocean processes, understanding that may enlarge or constrain the options for addressing the challenges facing society. What are the critical marine science issues that should be addressed in the next 20 years?

The Challenger Society for Marine Science and the UK Scientific Committee for Oceanic Research decided that the first step towards developing a marine science strategy was to ask scientists what they considered to be the principal marine science issues that could and should be addressed over the next 20 years. We convened a one-day meeting at the Royal Society in September 2011 with sponsorship from the Royal Society’s Global Environment Research Committee, from national centres (National Oceanography Centre and British Antarctic Survey) and from marine industries (Planet Ocean, Horiba, Ocean Optics, RBR, Valeport, Ocean Scientific International and RS Aqua). Because the Challenger Society considers that its primary remit is to encourage young scientists to tackle serious marine science topics, we invited nine young to mid-career marine scientists to reflect on the progress that marine science had made over the past 20 years and to suggest where marine science should achieve...
most progress over the next 20 years. All presentations were recorded, and are available in audio with accompanying slides at the Challenger Society website (http://www.challenger-society.org.uk/meetings/prospectus2011).

The papers in this Theme Issue represent the speakers’ visions for the future of marine science in their research areas encompassing physical oceanography, ocean–ice sheet interactions, palaeoceanography, marine geoscience, biogeochemistry, biological oceanography, climate modelling and marine policy. Unfortunately, the presentation on marine technology could not be prepared within the time scale for publication of this issue due to concentrated development and production of sensors to sample the properties of Lake Ellsworth deep under the Antarctic ice sheet. As the organizers of the meeting and the guest editors of this issue, we decided shortly after the one-day meeting that there should be an additional contribution outlining a strategy for research on changing ocean circulation, for the ocean circulation affects all aspects of marine science covered by the speakers in their presentations and contributions to this issue.

Each of the individual contributions has strong merit as a foundation for building a dedicated marine science strategy in its particular field. We will not attempt here to abstract their arguments or their future research initiatives. The views expressed in the individual contributions on an overall strategy for marine science research over the next 20 years parallel those summarized in our contribution: sustained systematic observations of the ocean, careful analysis of the sustained observation datasets to develop an understanding of how the ocean environment works in an evolving climate, and a succession of carefully designed field experiments on key oceanic processes that are not resolved in models so that these processes can be understood well enough to embed them within models used for predicting the course of climate change.

Owing to the constraint of a one-day meeting, we could not cover all topics in marine science. It is the intention of the Challenger Society for Marine Science and the UK Scientific Committee for Oceanic Research to organize similar meetings on a biennial basis to cover important topics that are not covered in this issue, such as coastal physical oceanography and biogeochemistry, fisheries, etc. In our view, regular review of UK marine science strategy by young to mid-career scientists on a 2–4 year time scale is essential to maintain the health of UK marine science.

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