PML | Plymouth Marine Laboratory

Science for society

January 2010

Plymouth Marine Laboratory Strategy
2010-2014


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research
pml
environment
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biogeochemical

PML Strategic Plan: Science for Society

Contents

1. A new strategy

Oceans are vital to human existence and have a critical role in:

- Controlling climate and influencing weather
- Ensuring global food security
- Providing a source of abundant renewable energy

... but they are under threat from global change due to:

- Demographic trends
- Climate effects
- Habitat degradation

The **mission of PML** is to develop and apply world-leading integrated **scientific understanding of interactions between the marine environment and society** in order to sustain coastal and upper ocean ecosystems and their services under conditions of global change.

PML is focused on key strategic areas:

- Socio-economics and marine planning
- Science and application of remote sensing
- Biogeochemical cycling of life-sustaining elements and climatically active gases
- Marine ecology and molecular science
- Ecosystem modelling

... and is achieving significant successes in:

- Linking scientific understanding to socio-economic consequences
- Interpretation of satellite imagery to quantify biological activity in the upper ocean
- Understanding ocean acidification
- Developing new tools for measuring biodiversity
- Formulating models to understand better and predict the behaviour of marine ecosystems
- Communicating to stakeholders and the public supported by an outstanding international publication record

The complexity of the marine environment demands an interdisciplinary approach and partnerships:

- PML conducts research in association with a wide range of national and international partners
- PML will contribute to the implementation of the Natural Environment Research Council (NERC) and the United Kingdom Marine Strategies

2. Introduction

The purpose of this document is to present a five year strategic plan for Plymouth Marine Laboratory (PML). The strategy aims to demonstrate the leadership of PML through stimulating growth in key scientific competences, promoting excellence and ensuring the relevance of its marine research, and advocating an interdisciplinary approach both to improve understanding of the sunlit ocean and to solve problems in the marine environment. The sunlit ocean refers to the upper waters of near-shore seas and the global ocean where light penetration drives biological and chemical processes. Interdisciplinary research depends upon bringing a range of different specialties to work together in an integrated manner to achieve successes that could not be attained on an individual basis.

This strategic plan is meant firstly for the Board of Trustees as a means to signal aspirations for development at PML and to present a framework mechanism for reporting progress. Secondly, the strategic plan is for the benefit of all staff working at PML. Inspirational in intent, it provides a clear picture of future scientific priorities and will help staff members understand their role in the implementation of the strategy. Thirdly, this document can be used to inform collaborators and stakeholders of the strategy, strengths and unique capabilities of PML.

As a living document, the strategy will be reviewed annually and will evolve to take into account, as appropriate, scientific developments and emerging environmental priorities.

3. Foundations

PML is a company limited by guarantee (company no. 4178503) with charitable status (charity no. 1091222). The **charitable aims** of PML are laid out in its Memorandum and Articles of Association which also define the Objects of the Charity:

- To carry out research in environmental science and technology including marine and estuarine environmental science and technology, and disseminate results of such research and data and ideas generated in the course of or in connection with such **research for the benefit of the public and to advance public education** in the principles and practice of such science and technology.

The **vision** of PML is:

- To enhance the impact of PML activities as a **world-leading**, marine research organization.

The **mission** of PML is:

- To develop and apply world-leading integrated **scientific understanding of interactions between the marine environment and society** in order to sustain coastal and upper ocean ecosystems and their services under conditions of global change.

PML's charitable objects, vision and mission embody a commitment to excellence in research, a global perspective and the acknowledgement of social responsibilities. Such ideals can be encapsulated in the **strategic objective:**

- To undertake cutting-edge, interdisciplinary research in anticipation of societal needs and to promote stewardship of marine ecosystems.

Vision:

To enhance the impact of PML activities as a world-leading, marine research organization.

Mission:

To develop and apply world-leading integrated scientific understanding of interactions between the marine environment and society in order to sustain coastal and upper ocean ecosystems and their services under conditions of global change.

To realise the charitable objects and vision of PML the strategic plan comprises three main components that outline sequentially the strategic aims, the strategic science areas and the enabling strategies.

PML Strategic Plan

Strategic aims	Quality Competitiveness Responsibility
Strategic science areas	Sea and society Sea from space Cycling in the sunlit ocean Marine life support system Today's models, tomorrow's futures
Enabling strategies	Research and development Workforce and workplace Organization and systems Commercialisation and exploitation Knowledge exchange Partners

PML conducts research in association with a wide range of international and national partners. The complexity of the marine environmental and scope of big research questions demands an interdisciplinary approach. External partnerships are essential when PML lacks specific expertise in a given discipline. Marine scientific studies increasingly requires, and benefits from, collaborations ranging from one-to-one links between individual scientists, to national and international institutional affiliations and formal partnerships. Such endeavours will continue to be encouraged and developed. Whilst PML is a research centre with a 'global footprint', its location in Plymouth provides exciting regional initiatives that will help develop its national and international performance.

4. Strategic aims

Quality

To undertake research in environmental science and technology of outstanding quality and relevance for the benefit of the society.

The vision of PML embodies a clear aspiration to be world-class in everything that it does, which invokes the requirement to be international in reputation and outlook, while not losing sight of local and national priorities. This vision influences the nature of the problems and issues that PML will tackle, the partners with whom it will collaborate, and the roles that it will play. PML will demonstrate quality by:

- Delivering world-leading research
- Addressing marine issues from local to global scales
- Leading major programmes, particularly with relevance to the sustainable use of the marine environment
- Managing international project offices
- Organizing and hosting national and international workshops and conferences
- Collaborating with world-leading researchers wherever they are based
- Contributing to science delivery and provision of policy advice through membership of prestigious panels, boards of organizations and institutes, and by publishing in high profile journals
- Seeking and gaining accreditation as appropriate in science, business and management activities.

Competitiveness

To conduct research in a focused, effective and cost-effective manner in acknowledgement of the contributions received from public, private and charitable sources of funding.

Attracting financial support for conducting marine research is challenging. Success depends upon promoting unique capabilities and being able to deliver outputs in the most cost-effective manner possible. To ensure PML remains competitive, it will:

- Focus on the sunlit ocean, including the coastal environment
- Concentrate on investigations at the interface of biology and chemistry and interactions between sea and society
- Promote an interdisciplinary approach to tackling environmental problems
- Respond rapidly to current marine issues and evolve to handle future challenges
- Seek funding for research, infrastructure and operations from diverse sources
- Exploit the uniqueness of having expertise in socio-economics embedded in a marine institute
- Educate and motivate staff through leadership development and skill training
- Nurture innovation, and optimise and protect the Intellectual Property (IP) arising from its research
- Review and update operational procedures in order to deliver science as efficiently as possible
- Maximise the use of available human and physical resources.

Responsibility

To behave responsibly towards staff and society, and to disseminate the results of PML's research, data and ideas as widely as possible in order to advance public well-being and education.

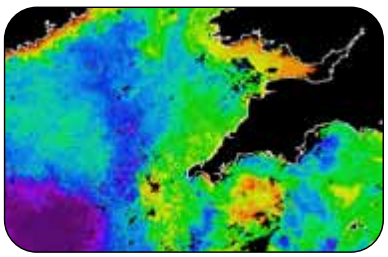
Significant responsibilities emanate from being a world-class marine facility. The constituency of PML spans local civil society, United Kingdom authorities through the provision of national capability and the international community through knowledge exchange. Thus, duties encompass communication and education in the broadest sense. PML is committed to:

- Acting ethically and in accordance with best practice in the governance and conduct of research
- Providing staff with a safe, well-equipped and learning environment
- Disseminating its science to the widest possible audience
- Providing advice based on sound science to environmental managers, policy makers and stakeholders
- Fostering knowledge exchange nationally and internationally
- Contributing to the education and training of the next generation of marine scientists in the United Kingdom and elsewhere
- Promoting global stewardship of the oceans by working with developing countries.

5. Strategic science areas

Scientific research is the core business of PML. PML's science is concerned with increasing knowledge and understanding of the marine environment, and to design tools and solutions for its practical management. An interdisciplinary approach to tackling complex questions is a key strength and feature of PML's activities. The working environment and culture of PML underpins such a philosophy, that in turn forms the backbone of this strategic plan.

The fundamental objective for PML is to strive for excellence in its research. PML's aspiration is to build on the core scientific competences that it has, but be able to adapt and respond to emerging issues and opportunities. PML already demonstrates international leadership in several fields, in which it intends to maintain pre-eminence. PML has also gained a notable national reputation in other areas. PML's aim is to raise the worldwide visibility of its research in these fields through inward investment and encouraging strategic partnerships with renowned researchers and organizations. Finally, PML intends to strengthen core areas of science and technology. PML's ambitions to gain national recognition in these fields rely on supporting the development of new research and increasing research activity overall.



Based on core competences and the ability to work in an integrated manner, there are a number of important marine environmental issues that PML will address. In order to investigate such issues, PML will focus and prioritise its research through a set of high level, overarching research areas. The five cross-cutting and interdisciplinary research areas, presented below, underpin the key scientific requirements to ensure the sustainability of marine ecosystems. These priorities build on the background and experience of staff, and PML's involvement at the cutting-edge of marine environmental research over several decades. PML is positioned to continue making world-leading advances through an established interdisciplinary approach. In this vein, it is to be noted that the five scientific areas to be formed are defined thematically, rather than strictly by scientific discipline.

Key scientific issues that require an interdisciplinary approach

- How will climatic and anthropogenic change affect the physical, chemical and biological functioning of the marine ecosystem, from individual organisms to the ecosystem level? How will such changes feed back to the Earth system?

- What is the sensitivity and adaptability of marine ecosystems to biodiversity loss? How does such loss affect ecosystem processes and services, and at what temporal and spatial scales?

- How will ecosystem health be altered by human behaviour and changes to the climate, and what are the feedbacks for human health?

- In what way can the oceans and their ecosystems be a sustainable part of the solution to society's needs for food, energy and livelihoods?

- How will marine ecosystems respond to our growing demand to utilise and exploit the marine environment in the era of climate change? How do we secure intergenerational equity in the exploitation of marine ecosystem services, resources and space?

- What is the role of ocean observatories and other monitoring tools in a global strategy towards the sustainable use of the marine commons?

- How can we build on the above questions to improve our capability to predict future ecosystem states?

Sea and society

Environment, human health and socio-economics

Aim

To link social science and natural marine science to understand the consequences of the interactions between society and the marine environment in order to improve the outcomes and benefits and to support sustainable and responsible stewardship.

Scope

- Integrated marine ecosystem and socio-economics research to develop understanding of the social and economic value of human use of the marine environment, including human health benefits, focusing particularly on sustainable provision of all marine ecosystem services through understanding of global change and human impacts upon them.
- Environment and human health research to investigate the source, distribution, behaviour and fate of novel and emerging pollutants in the marine environment and to address their feedbacks on human health.
- Biodiscovery research to seek new compounds from the marine environment which have potential benefits to humankind as pharmaceuticals, enzymes or biofuels.

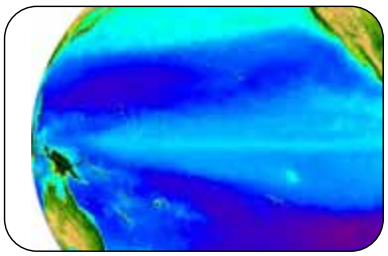
Importance

- Humans are making increasing use of the marine environment and through their interventions, activities and resource use are becoming a central part of marine ecosystems, analogous to their role in terrestrial ecosystems. Within a context of global change the ecological and socio-economic consequences of these activities need to be understood to develop and support science-based marine planning in order to ensure sustainable use of the marine environment.
- To achieve sustainable management and use of marine ecosystems trade-offs will be required between ecosystem services and the biodiversity components that deliver them and between different human activities and resource extractions in the marine environment.
- To understand the trade-offs the underpinning role of biodiversity and ecosystem functioning in the delivery of marine ecosystem services needs to be quantified. The developing role of market forces and demographic change in relation to human activity in the marine environment needs to be elucidated.
- The rapidly growing biotechnology market has hardly begun to explore the molecular and biochemical potential of marine organisms.

Future directions

- Establish PML as a leading organization for marine ecosystem socio-economic research.
- Develop comprehensive understanding of the relationships between marine biodiversity, ecosystem functioning and the socially and economically important human benefits that arise, and how these are impacted by human activity and global change.
- Understand how society values market and non-market marine ecosystem services .
- Produce management support tools for marine planning which incorporate present and future drivers of change, based on fundamental marine ecology, marine ecosystem modelling and bioeconomic modelling.
- Identify and target marine organisms, natural chemicals, enzymes and genes with blue biotechnology potential which can then be developed and marketed through PML Applications Ltd.

Sea from space



Earth observation science and applications

Aim

To exploit Earth Observation (EO) data for fundamental research into marine ecosystems, for support of interdisciplinary science and for operational monitoring, within PML, nationally and globally.

Scope

- Development of methods to understand marine processes, such as estimating global marine carbon production rates or monitoring harmful algal blooms.
- Understanding of processes which impact upon interannual variability of natural resources, such as fisheries.
- Data processing of satellite and aircraft remote sensing data to support scientists in the United Kingdom, Europe and globally.

Importance

- EO by satellite provides the only practical mechanism to observe global surface properties on a regular basis (every 1-2 days) and provides the most comprehensive coverage to initialise, update or validate numerical models.
- Aircraft EO provides a cost effective mechanism for repeated (< hourly) and/or high resolution (sub-metre) observations at medium scale (1-100 kilometre) and for trialling methods and techniques prior to deployment in space.

Future directions

- Lead or contribute to international projects engaged in capacity and partnership building in developing countries, with a focus on Africa.
- Increase visualisation, integration and intercomparison of EO data with *in situ* data and numerical models for improved monitoring or forecasting of the marine environment.

Cycling in the sunlit ocean

Biogeochemical cycling in the upper ocean and near-shore seas

Aim

To quantify key processes in the cycling of the major elements in the surface oceans and coastal seas in order to predict how marine productivity and climate feedbacks between the oceans and atmosphere might alter in a changing world.

Scope

- Identification and quantification of key mechanisms in the microbially- and photochemically-mediated cycling of carbon, nitrogen, sulphur and iodine in surface seawater.
- Maintenance of the Atlantic Meridional Transect to understand ocean plankton communities and improve PML's ability to predict the role of the open ocean in the global carbon cycle.
- Acquisition of data during targeted oceanographic missions as well as from "ships of opportunity" in order to test biogeochemical models.

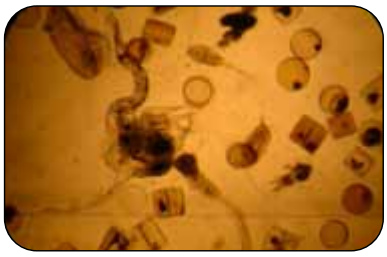
Importance

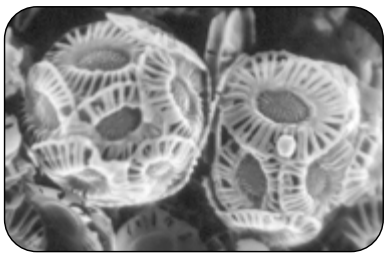
- The oceans are thought to play a major role in atmospheric chemistry and climate via the uptake and release of climate-active gases, but this role is not well quantified nor well understood.
- The cycling of nutrients in the oceans and coastal seas is key for marine productivity, but is likely to be sensitive to global change.

Future directions

- Re-establish the Atlantic Meridional Transect as both a focal point for PML biogeochemical research and as an international standard bearer for PML's profile.
- Enhance the national and international leadership of science within this research area.
- Foster closer integration of research groupings within the science area and better links with the modelling and remote sensing science areas in order to solve complex problems and develop and improve predictive capabilities.
- Assess the sensitivity of atmosphere-ocean interactions to global change.

Marine life support system





Biodiversity, marine ecology, and molecular science

Aim

To study the biodiversity of marine systems, from the basic building blocks of life (DNA, RNA and protein) through individuals, populations and communities to give a unique insight into the role played by biodiversity in controlling ecosystem functioning and to help predict the impacts caused by human exploitation of the marine environment.

Scope

- Develop novel tools and techniques for measuring biodiversity and interpreting complex biodiversity data.
- Investigate the natural and anthropogenic processes which drive spatial and temporal patterns in biodiversity.
- Quantify the role played by biodiversity in supporting ecosystem function.
- Predict the impacts of human activities and marine resource exploitation on biodiversity and the consequences for ecosystem resilience and functioning.

Importance

- The oceans harbour tremendous biological diversity.
- The United Kingdom has a moral and legal obligation to prevent biodiversity loss and meet international commitments, such as the Convention on Biological Diversity.
- Biodiversity is under threat from a multitude of stressors, such as fishing, pollution, anoxia and climate change.

Future directions

- Establish PML as a centre of excellence for predicting the impact of human activities on biodiversity and assessing the benefits of conservation or management strategies, such as marine protected areas and geoengineering solutions for reducing CO_2 emissions.
- Generate fundamental understanding of marine biodiversity and ecosystems needed to underpin activities within “Sea and Society”.
- Support greater collaboration between ecologists and modellers to increase the integration of functional ecology and diversity into process based models.
- Develop biodiversity research in polar (particularly Arctic) and tropical (particularly South East Asia and Australia) systems.

Today's models, tomorrow's futures

Ocean Observations and ecosystem models

Aim

To improve understanding of variability, potential impacts and feedbacks of global change and anthropogenic forcing on the structure, function and dynamics of the ecosystems of the global ocean and its associated shelf seas, and on their capacity to provide ecosystem goods and services.

Scope

- Development of coupled hydrodynamic ecosystem models to understand marine processes, such as marine carbon budgets, impacts of ocean acidification, biogas production and nutrient cycling.
- Maintenance of multidisciplinary observations for the coastal seas of the Western Channel to provide real-time physical, chemical and biological measurements and, coupled with real-time modelling systems, aim to provide information on the functioning of shelf seas.
- Develop error quantified simulations of past, present and future ecosystem states.

Importance

- Sustained measurements are critical to understanding Earth System behaviour and identifying change. They do not just provide long-term data sets, but also capture extreme or episodic events and play a key role in the initialisation and validation of models.
- Knowledge of driver impacts is currently limited by the period over which measurements have been made; the use of dynamic simulation models with feedbacks will allow PML to assess driver impacts outside of the period of observations.

Future directions

- Maintenance and expansion of the Western Channel Observing Systems and linking to other United Kingdom and European observatories.
- Suite of model validation data sets and metrics derived from observatories and linked to Earth Observations.
- Bridging the gaps between plankton models and those of higher trophic levels and between ecosystem and socio economics; PML is increasingly leading or contributing to international projects engaged in this area.
- Attribution of climatic and anthropogenic drivers responsible for change to ascertain mechanisms involved for the simulated ecosystem.

6. Enabling strategies

Research and development

To provide a **national and international strategic research capability** through sustained delivery of innovative, leading edge and relevant marine science and technology to customers and beneficiaries.

Workforce and workplace

To recruit, retain, develop and **motivate highly skilled and committed staff** with the intellectual and practical qualities to work flexibly within **an ethical, safe, well-equipped and learning environment.**

Organization and systems

To develop and maintain excellent operational systems in order to maximise the effectiveness of PML's activities and to **provide first-class services and products at best value for PML's customers.**

Commercialisation and exploitation

To work with PML Applications Ltd, and related commercial partners, in the development and **support of a business strategy** and activities that benefit PML.

Knowledge exchange

To maintain an **active communications** profile in order to disseminate the outputs of scientific research, **raise public awareness of marine sciences**, and inform key stakeholders, beneficiaries, and decision makers.

Partners

To nurture and develop key **international, national, regional and local partnerships** for mutual benefit.

7. A future look

The PML Strategy for 2010-14 is a living document which will be reviewed annually by the Board of Trustees and Senior Management. Modifications will be incorporated in line with current and future developments, opportunities and achievements. The Strategy will be supported by more detailed business and operational plans with SMART (Specific, Measurable, Achievable, Realistic and Timely) objectives and targets, to ensure successful delivery of the Strategic Aims and Science Areas. Progress with the implementation of the Strategy will be reported regularly to the Board and staff, and externally through appropriate knowledge exchange channels.

This Strategy seeks to present a forward look for PML with optimism in the face of economic uncertainties. Major improvements to infrastructure and instrumentation, as well as growth in human resources, will depend upon seeking new avenues of financial support, notably from charitable organizations and international foundations.

In summary, the main strategic aims are to ensure that the marine science is of outstanding quality; that the laboratory, from individual to corporate level, remains competitive to deliver cost-effective outputs; and that the activities, from local to global scales, fulfil charitable objectives and contribute to the public good. Scientific research at PML has always been undertaken within a cultural framework of close collaboration and integration. This ethos of interdisciplinary research, a fundamental strength of PML, will continue internally and be promoted externally as the best approach to conducting marine environmental research. Science delivery will be restructured into five areas of strategic importance. Finally, this strategy looks to build on the key strengths of the laboratory. PML will maintain world-wide leadership where it now has such recognition, and enhance other competences to gain better **national and international visibility.**

Notes

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PML | Plymouth Marine Laboratory

Plymouth Marine Laboratory
Prospect Place
Plymouth
Devon
PL1 3DH

www.pml.ac.uk | forinfo@pml.ac.uk | T: +44 (0)1752 633100 | F: +44 (0)1752 633101