



Department of Communications, Marine and Natural Resources
Roinn Cumarsáide, Mara agus Acmhainní Náúúrtha

Beaufort Marine Research Awards

Terms of Reference



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**Beaufort Award in Economic and Social Research
related to the Development Dynamics of the Marine
Sector in Ireland**

Terms of Reference

OVERALL OBJECTIVE

To develop research capacity in the priority area of economic and social research related to the development dynamics of the marine sector in Ireland through the funding of a research team. This will inform the development of the marine sector through the use of knowledge derived from marine related economic and social research and analysis.

STRATEGIC CONTEXT

The marine sector in Ireland has received increasing attention in recent years. Its development as an economically active, commercially viable, environmentally and socially sustainable sector is in keeping with some of the most important European and Irish economic, social and environment policies. The government has recently endorsed the drive to develop the marine sector as a dynamic element of Ireland's knowledge economy via the approval of the *Sea Change: A Marine Knowledge, Research & Innovation Strategy for Ireland 2007-2013*¹.

The *Sea Change Strategy* is aimed at supporting the transformation of the marine sector so that: *by 2020 the marine sector will sell into specialized global and local markets in a dynamic, innovative and technologically driver manner, by means of strong industry research partnerships, a skilled workforce and a strategic capability that responds to markets and technology. It will be internationally recognized for its high quality marine environment and characterized by coherent policy and regulation.*

In order to support the achievement of this transition, dedicated economic and social research and related analysis will be required to support 'evidence based' policy development within the sector.

SPECIFIC OBJECTIVES

Specifically, the research team/consortia will deliver new research capacity to address key aspects of the development dynamics of the marine sector in Ireland as follows:

- i. Size and composition of the marine sector in Ireland.
- ii. Competitiveness and growth issues for an evolving marine sector and maritime economy.
- iii. Contribution of existing and new marine activities to regional/rural development in Ireland
- iv. Development of an economic model for the marine sector in Ireland (in line with the vision and objectives in *Sea Change*)
- v. Impact of marine activities on social inclusion and cultural diversity in rural areas.

¹ www.marine.ie/home/seachange

- vi. Quantification of the non-market benefits of marine resources to Ireland.
- vii. Achieving a balance between regulation and development to support sustainable development of marine activities.

In respect of the above it is envisaged that research activities will focus on:

- Identification of the data sets required.
- Development of new standard data collection and collation mechanisms in conjunction with relevant partners.
- Development and application of new analysis techniques to deliver outputs in each of the areas outlined above.
- Application of data and analysis to support the development and monitoring of relevant socio-economic and regional development performance and impact indicators for the *Sea Change* Strategy.

DELIVERABLES/KEY OUTPUTS

- Contribution to the development of a research team/consortia and associated research capacity to address key aspects of the development dynamics of the marine sector in Ireland;
- New data collection and analysis techniques and the application of these techniques to address specific aspects of the development dynamics of the marine sector;
- Appropriate performance and impact indicators to underpin an analysis and evolution of the *Sea Change* Strategy;
- Establishment of working relationships with relevant government departments, national organisations and agencies;
- Establishment of working relationships with the marine sector;
- Development of new international partnerships and projects in areas that add value to the objectives of the Beaufort Award; and
- Development of a close working relationship with the *Sea Change* Management Unit in the Marine Institute.

ACCESS TO MARINE INSTITUTE DATA

The Marine Institute has data which may be applicable to this research programme. This data will be made available to anyone who wishes to compete for this award. Candidates should contact Aengus Parsons (aengus.parsons@marine.ie) to discuss further details on access.

KEY ADDITIONAL INFORMATION

Further information is available in *Sea Change: A Marine Knowledge, Research & -Innovation Strategy for Ireland 2007-2013* and the associated supporting document: *Sea Change (2007-2013) Part II: Marine Foresight Exercise for Ireland* (which provides further details on the Policy, Socio-Economic & Legal Research Programme). Both documents are available to download from www.marine.ie/home/seachange or alternatively by requesting hard copies from the Marine Institute.

Beaufort Award in Fish Population Genetics

Terms of Reference

OVERALL OBJECTIVE

To develop research capacity in the priority area of fish population genetics through the funding of a research team that will develop a suite of Genetic Stock Identification (GSI) tools to monitor and predict fish population changes resulting from climate change impacts.

STRATEGIC CONTEXT

The Beaufort Award in fish population genetics addresses the vision and challenge in the Government's *Strategy for Science Technology and Innovation 2006-2013* (SSTI). In addition, this award directly addresses a number of key objectives of *Sea Change: A Marine Knowledge, Research & Innovation Strategy for Ireland 2007-2013* (www.marine.ie). Specifically, it addresses objectives within the Rapid Climate Change (RCC) and Fisheries Resources (FR) Research Programmes, as follows:

- *Develop and use real (e.g. temperate / salinity) and proxy (e.g. biogeographic species shifts, phenology, etc) climate change indicators (Obj. 3 RCC Research Programme); and*
- *Increase our understanding of the life history, ecology, socio-economics, dynamics and ecosystem role of fish stocks (Obj. 2 FR Research Programme).*

The Award will also address fundamental migratory stock management issues arising from the recent Government decision (November 2006) to manage salmon on a stock by stock basis and increasing pressure from the EU for member states to address the underlying climate and environmental issues relating to the increasingly poor marine survival of eel and salmon stocks.

DELIVERABLES/KEY OUTPUTS

- Techniques for parental assignment (genetic tagging);
- Methods to identify and map the extent of evolutionary significant units (populations/stocks);
- Methodologies to assess the proportions of individual populations in mixed assemblages;
- Assignment of individual fish to population/stock of origin;
- The provision of estimates of effective population size, particularly in declining stocks in marine species;
- The monitoring of climate mediated population shifts; and
- Genome mapping and Quantitative Trait Loci identification.

ACCESS TO MARINE INSTITUTE DATA/FACILITIES

The Marine Institute has facilities and data which may be applicable to this research programme. This national infrastructure will be made available to anyone who wishes to compete for this award. Candidates should contact Aengus Parsons (aengus.parsons@marine.ie) to discuss further details on access.

KEY ADDITIONAL INFORMATION

Along the coasts of Western Europe it is the Gulf Stream, or the North Atlantic Drift, that most influences our weather patterns. Geographically the North Atlantic drift comes closer to Ireland than any other country in Europe. Off the coasts of Galway and Mayo the great ocean currents merge as they push northwards towards Scotland and finally the Norwegian coast. In this zone the diversity of life that characterises the southern and northern basins of the Atlantic Ocean meet and it is here that the predicted biological shifts in marine species diversity or abundance are most likely to occur. Ireland is ideally placed to play a key role in monitoring vital dimensions of climate change, particularly as these relate to the ocean and to ocean mediated changes in our climate and in our environment. Research across a broad range of disciplines is urgently required to inform appropriate international mitigation policies and perhaps even more importantly improve the predictive nature of the current climate change models so as to facilitate the formulation of integrated multidisciplinary strategies to deal with the economic, social, political and environmental consequences of the predicted changes in the global climate.

Current ecosystem models predict that climate change will result in rapidly changing ecological conditions and major alterations in the abundance, distribution and genetic composition of major fish populations. This is particularly true of long distant migrants such as tuna, shark, eels and salmon. Over the past five years DNA profiling methods for the identification of the region, or river/tributary origin of individual salmon populations, have shown very significant advances. Ongoing research has clearly shown the potential application of mixed stock analysis (MSA) and individual assignment (IA) methodologies to the management of salmon stocks in the changing marine environment. These studies have shown that genetic MSA and IA can be successfully applied to the elucidation of Atlantic salmon migration and distribution patterns. This is further supported by work carried out on the migration and distribution of a number of species of Pacific salmon.

These advances are based on the use of microsatellite DNA probes but following the completion of the human genome project intensification of the search for novel genetic data of medical and biological value is underway. The study and exploitation of single nucleotide polymorphisms or SNPs, the most abundant type of genetic variation yet discovered, currently offers the greatest potential to yield substantial advances. Modest numbers of SNPs are currently available from migratory fish species but it is likely that in the very near future additional markers will be discovered, offering the possibility to automate the screening of very large numbers of individuals at a much reduced cost. As panels of SNPs for marine fish stocks and other key marine organism become available it should prove possible to monitor and assess at a very precise level population changes in a range of key indicator species.

This Beaufort award will be granted to the research group or research consortium who can best illustrate their ability to build urgently required research capacity in the area of Genetic Stock Identification. Applicants for this award are required to demonstrate how they would build on existing technologies to provide a suite of novel gene probe technologies to identify and monitor population changes in key anadromous and catadromous species. They

will also be required to demonstrate how these technologies could be applied to the monitoring of population changes in key marine fish species and other marine organisms and how such assessments might be used as proxy indicators of climate change in global scale or down-scaled predictive models.

Beaufort Award in Marine Biodiscovery

Terms of Reference

OVERALL OBJECTIVE

To develop research capacity in the priority area of marine biodiscovery through the funding of a research team that will contribute to the development of a distributed national centre of excellence in Ireland in Marine Biodiscovery.

STRATEGIC CONTEXT

The Beaufort Award in marine biodiscovery addresses the vision and challenge in the Government's *Strategy for Science Technology and Innovation 2006-2013* (SSTI). In addition, this award directly addresses a number of key objectives of *Sea Change: A Marine Knowledge, Research & Innovation Strategy for Ireland 2007-2013* (www.marine.ie). Specifically, it addresses objectives within the Marine Biodiscovery/Biotechnology Research Programme, as follows:

- *Create a strong interdisciplinary capability in the utilisation of marine biodiversity, using novel high-throughput techniques, for the development of drugs, therapies, bio and nano-bio materials;*
- *Develop core research capabilities and teams in taxonomy, natural products chemistry, chemogenomics and bioinformatics and*
- *Develop capabilities for the isolation and identification of novel chemical compounds or proteins for use by the medical device industry (e.g adhesives, biofilms and sensors).*

The Marine Institute, in partnership with a range of national and international centres of expertise, has been establishing the scope and content of a national Marine Biodiscovery programme. Initiatives are planned and underway to strengthen the MI's capabilities in respect to sample collection and processing, and the Marine Institute will play a central role in facilitating and co-ordinating the ongoing evolution and development of a national programme in this field.

DELIVERABLES/KEY OUTPUTS

The areas in which proposals should demonstrate capability to generate deliverables and outputs include some or all of the following:

- Mapping and genetic characterisation of Ireland's marine biodiversity;
- Creation of a strong, networked research capability in taxonomy, screening and characterisation of algae, sponges and other marine invertebrate fauna;
- Metagenomic cloning and screening of unculturable marine microbes;
- Establishment of capability in the isolation and identification of novel chemical compounds, proteins and enzymes, and microorganisms;
- Development of new synthetic production methodologies;
- Contribution to unique databases linking marine, biological and chemical information;
- Development of national and international scientific collaborations;
- Possible identification and demonstration of candidate marine materials as components in functional foods, pharmaceuticals and nanotechnology, (including nano-bio applications).

ACCESS TO MARINE INSTITUTE DATA / FACILITIES

The Marine Institute has facilities and data which may be applicable to this research programme. This national infrastructure will be made available to anyone who wishes to compete for this award. Candidates should contact Aengus Parsons (aengus.parsons@marine.ie) to discuss further details on access.

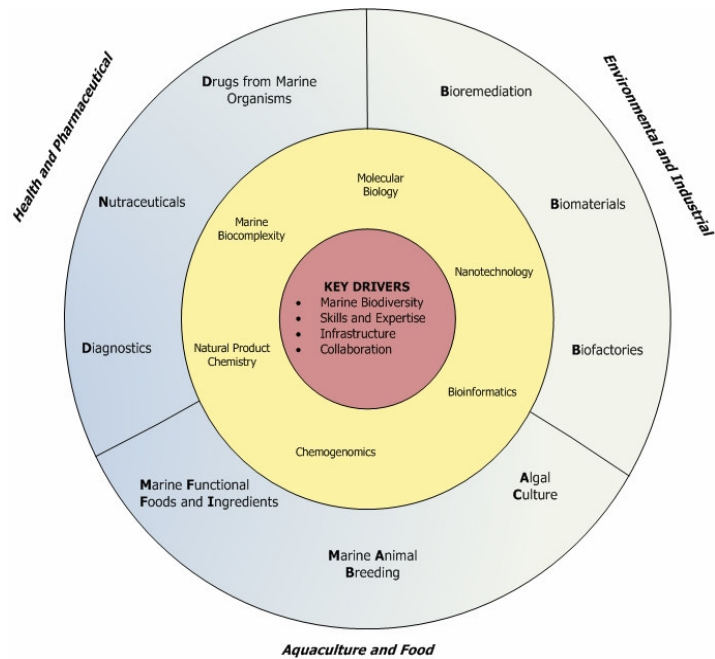
KEY ADDITIONAL INFORMATION

Marine Biodiscovery is fundamentally directed towards using nature's own technology for the production of goods and services. The seas are a major source of organisms with unique metabolic mechanisms, and novel biological materials. There is an international resurgence of interest in natural products as a source of novel bioactive substances for the development of novel drugs, therapies, functional food ingredients and biomaterials.

Ireland has developed much of the marine research, biotechnology, food and medical research infrastructure and capability that is necessary to establish an integrated chain of marine biodiscovery activities. In addition to creating a significant "value-added" aspect to a wide range of research investments, specific opportunities and synergies that will arise from exploring Ireland's marine resources from an entirely different perspective include:

1. Novel business opportunities for Ireland in the areas of:
 - drugs, industrial enzymes and biomaterials and processes as discoveries are made and optimized;
 - provision of chemical and protein drugs for disease targets identified as part of the State's research programmes in biotechnology; and
 - Biomaterials for the Medical Device and Diagnostics Sectors.
2. Functional foods/nutraceuticals, including prebiotic and probiotic products based on fish oils, algae or other marine sources.

The aim of this Award is to develop the core capability, as illustrated in the figure below, in order to enable Ireland to realise the opportunities outlined.



The implementation of an effective national effort in Marine Biodiscovery will entail the participation of a wide range of disciplines across a range of institutions. The Beaufort Award will not be able to address the entire chain of competencies and activities involved in Biodiscovery; but it is intended to build core capacity and knowledge that will contribute to the development of a wide-ranging programme.

Beaufort Award in Ecosystem Approach to Fisheries Management (EAF)

Terms of Reference

OVERALL OBJECTIVE

To develop research capacity focused on the field of the Ecosystem Approach to Fisheries Management (EAF). The research team will turn the available concepts and principles into pragmatic action plans that can be used for the sustainable management of fisheries in the waters around Ireland.

STRATEGIC CONTEXT

The Beaufort Award in EAF will be a key component in the delivery of national Strategies. The Award addresses the vision and challenge in the Government's *Strategy for Science Technology and Innovation 2006-2013* (SSTI). In addition, this award directly addresses a number of key objectives of *Sea Change: A Marine Knowledge, Research & Innovation Strategy for Ireland 2007-2013* (www.marine.ie). Specifically, it addresses key objectives within the Fisheries Resources Research Programme, as follows:

- Improve scientific advice for stakeholders—to deliver clear, reliable and impartial advice on the fish stocks of economic importance to Ireland;
- Contribute to the rebuilding of depleted fish stocks; and
- Build integrated data capacity and knowledge management.

Finally, the award will address the *Strategy for a Restructured, Sustainable and Profitable Irish Seafood Industry 2007-2013* (Cawley *et al.*, 2007). In launching the Cawley Report in January 2007, the Taoiseach stated that "*the bedrock of the fishing industry is the state of the fish stocks in our waters and the Government is committed to working nationally and at EU level to seek to ensure that the stocks are managed sustainably and re-built. Beyond that, we need to restructure the Sector to put it on a sustainable development path where it can maximise its potential into the future*".

DELIVERABLES/KEY OUTPUTS

- Centre of excellence in Ireland focused on the Ecosystem Approach to Fisheries Management (EAF);
- Review practical worked examples of the successes and failures of EAF in a global context;
- Turn available concepts and principles into pragmatic EAF actions plans relevant to Ireland;
- Develop Area Based, EAF Management Plans for waters around Ireland (both inshore and offshore);
- Establish close working relationship and regular contacts with scientists, industry and other stakeholders on the island of Ireland, principally through the Regional Advisory Councils (RAC's);
- Develop international partnerships and attract external funding;
- Develop a close working relationship with MI scientists that adds value to the knowledge derived from their extensive research and monitoring programmes; and

- Ensure Ireland is internationally recognised as providing research leadership in the emerging integrated marine science required for the application of EAF.

ACCESS TO MARINE INSTITUTE DATA/FACILITIES

The Marine Institute has facilities and data which may be applicable to this research programme. This national infrastructure will be made available to anyone who wishes to compete for this award. Candidates should contact Aengus Parsons (aengus.parsons@marine.ie) to discuss further details on access.

KEY ADDITIONAL INFORMATION

The waters around Ireland contain some of the most productive fishing grounds and biologically sensitive areas in the EU. There are major spawning areas for mackerel, horse mackerel, blue whiting, hake and cod in Ireland's Exclusive Economic Zone (EEZ) and the biological sensitivity of Irish waters has been recognized in the establishment of the 'Biologically Sensitive Area' by the EU (Anon. 2006). The fishing sector makes a significant contribution to the social and economic fabric of peripheral coastal regions. However, against a background of resource depletion, fleet overcapacity, misreporting of catch, discarding, poor scientific data and degradation of ecosystem processes, scientists, managers and the fishing sector face great challenges (Cawley et al., 2007). Furthermore, the impending European Marine Directive (MFD) seeks to ensure that all human activities are sustainable and embraces the ecosystem approach. Managing the environment in an ecologically sustainable manner has now shifted from being an option, to being a legal necessity: sustainability is now the overarching goal of environmental management policy (Frid et al., 2006). The European marine Directive will have a profound impact on the fishing sector in the coming years.

Ecosystems are complex and dynamic natural units that produce goods and services beyond those of benefit to fisheries. Because fisheries have a direct impact on the ecosystem, which is also impacted by other human activities, they need to be managed in an ecosystem context. Humans have affected marine ecosystems for hundreds of years. Some of these effects have been sustainable and have not compromised the options of future generations to benefit from the full range of goods and services that ecosystems supply or the capacity of the ecosystems to respond to environmental change. Conversely, some impacts have not been sustainable and have led to species depletion, fish stock collapse and the degradation of ecosystem processes (Rice et al., 2005).

Ecosystem Management (EM) has been defined as "*a management philosophy which focuses on desired states rather than system outputs and which recognizes the need to protect or restore critical ecological components, functions and structures in order to sustain resources in perpetuity*" (Cortner et al., 1994).

The 1992 UN Convention on Biological Diversity defines the **Ecosystem Approach (EA)** as "*ecosystem and natural habitats management.....to meet human requirements to use natural resources, whilst maintaining the biological richness and ecological processes necessary to sustain the composition,*

structure and function of the habitats or ecosystems concerned. Important within this process is the setting of explicit goals and practices, regularly updated in the light of the results of monitoring and research activities." The EA is embedded in the concept of sustainable development and defined by the twelve Malawi Principles (see Garcia et al., 2003).

Ward et al. (2002) define the **Ecosystem approach to fisheries management (EAF)** as "*an extension of conventional fisheries management recognizing more explicitly the interdependence between human well being and ecosystem health and the need to maintain ecosystems productivity for present and future generations*". The EAF embraces the conservation of critical habitats, the reduction of pollution and degradation, the minimizing of waste, and the protection of endangered species.

Garcia et al. (2003) state that EAF is recognized as a form of fisheries governance framework, taking its conceptual principles and operational instruments from conventional fisheries management on one hand and ecosystem management on the other. EAF is an evolution of the fisheries management paradigm which borrows some central principles of ecosystem management and gives to them a practical operational meaning. However, both paradigms are evolving and the interaction between their respective trajectories is not immediately obvious. The future of EAF and fisheries depends on the way in which the two fundamental concepts of fisheries management and ecosystem management, and their respective stakeholders, will join efforts or collide. This programme will seek to ensure they join efforts.

Global societal concerns regarding the human use of the natural resources of the planet have been translated into marine policy since 1945. Global ocean governance policy drivers have evolved and led to a cloud of ideas, concepts and tools which represent the present form of the EAF. National and regional governments, government institutes and other stakeholders are presently trying to disentangle or unpack these concepts in order to arrive at a realistic, pragmatic and workable way forward towards a new approach to operational management which will replace or augment the present single species, fish stock orientated methods (Turrell, 2004).

The wide ranging set of international agreements of relevance to EAF encompass a large number of principles and conceptual objectives. These provide fundamental guidance and a significant challenge for the implementation of EAF. One of the major difficulties in defining EAF lies precisely in turning the available concepts and principles into pragmatic operational objectives, from which an EAF management plan can be more easily developed. The EAF programme will specifically address this issue.

Garcia et al. (2003) have stated that an outright elimination of fisheries as the main user of the marine ecosystem is unlikely. He also states that the ecological footprint of an alternative solution to production of the 150 million tonnes of food now coming from the seas would probably be worse. Furthermore, the socio-economic impact resulting from the demise of world fisheries would be unacceptable to society.

Guided by the twelve Malawi principles, the EU Common Fisheries Policy (CFP), the MFD, and the new EU Maritime Policy, this Beaufort programme will explore the type of actions needed to achieve EAF for the waters around Ireland.

REFERENCES

- Anon. (2006) *The Stock Book*. Annual Review of Fish Stocks in 2006 with Management Advice for 2007. The Marine Institute. 422 pp.
- Cawley, N., Murrin, J. & O'Bric, R., (2007) *Steering a New Course. Strategy for a Restructured, Sustainable and Profitable Irish Seafood Industry 2007–2013. Report of the Seafood Industry Strategy Review Group*. 196 pp.
- Cortner, H.J., Shannon, M.A., Wallace, M.G., Burke, S. & Moote, M.A. (1994) Institutional barriers and incentives for ecosystem management. Issue Paper no. 16. Tucson, University of Arizona, Water Resource Research Centre. 51pp.
- Frid, C.L.J., Paramor, O.A. and Scott, C.L.S., (2006) Ecosystem based management of fisheries: is science limiting? *ICES Journal of Marine Science*, **63**, 1567-1572.
- Garcia, S.M., Zerbi, A., Aliaume, C., Do Chi, T. & Lasserre, G. (2003). The ecosystem approach to fisheries; issues, terminology, principles, institutional foundations, implementation and outlook. *FAO Technical Paper*. No. **443**. Rome. 2003. 71pp.
- Turrell, W.R. (2004) *The Policy Basis of the Ecosystem Approach to Fisheries Management*. EuroGOOS Publication No. 21.
- Rice, J., Trujillo, V., Jennings, S., Hylland, K., Hagstrom, O., Astudillo, A. & Jensen, (2005). Guidance on the application of the Ecosystem Approach to Management of Human Activities in the European Marine Environment. *ICES Cooperative Research Report* No. **273**.
- Ward, T., Tarde, D., Hegerl, E. & Short, K. (2002) *Ecosystem based management of marine capture fisheries*. World Wide Fund for Nature Australia. 80 pp.

Beaufort Award in Sensors and Communications Systems for the Marine Environment

Terms of Reference

OVERALL OBJECTIVE

To develop research capacity in the priority area of Sensors and Communications Systems for the Marine Environment through the funding of a research team focused on the field of Sensors, Sensor Systems and related Telemetry, Communications and Data Management, in the area of monitoring water quality and the marine environment.

STRATEGIC CONTEXT

The Beaufort Award in sensors and communications systems for the marine environment addresses the vision and challenge in the Government's *Strategy for Science Technology and Innovation 2006-2013* (SSTI). In addition, this award directly addresses a number of key objectives of *Sea Change: A Marine Knowledge, Research & Innovation Strategy for Ireland 2007-2013* (www.marine.ie). Specifically, it addresses objectives within the Marine Technology Research Programme, as follows:

- *Create a critical mass, multi-disciplinary and industry-oriented research grouping in the field of sensors, intelligent systems and sensor platforms;*
- *Create a focused capability in the application of information and communication technologies to the marine sector; and*
- *Harness the synergies between the above to deliver innovative technology solutions to targeted sectors (aquaculture, seafood processing, environmental monitoring, and ocean energy).*

The Award will build on emerging concepts and principles to support pragmatic actions and plans that can be used for the sustainable management of Ireland's aquatic resources.

DELIVERABLES/KEY OUTPUTS

- Strengthening of existing multi-disciplinary, industry-oriented research capability in the field of sensors, intelligent systems and sensor platforms for monitoring water quality and the marine environment;
- Supporting the development and deployment of advanced Sensor and Communications technologies in the marine environment;
- Enhancement of capability to apply information and communication technologies to the marine sector;
- Support the development of Irish knowledge-based economic activity in marine Sensors and Communications Systems;
- Review of current and emerging state-of-the-art developments in the field;
- Establishment of close working relationships with other relevant institutions on the island of Ireland;
- Development of an internationally recognised Sensor and Communications research capacity in Ireland;
- Active participation in internationally funded programmes and bilateral international collaborations.

ACCESS TO MARINE INSTITUTE DATA/FACILITIES

The Marine Institute has facilities and data which may be applicable to this research programme. This national infrastructure will be made available to anyone who wishes to compete for this award. Candidates should contact Aengus Parsons (aengus.parsons@marine.ie) to discuss further details on access.

KEY ADDITIONAL INFORMATION

The Marine Institute, in partnership with the EPA and others, has been working to develop national RTDI capacity in the field of sensors, sensor systems and related ICT in the area of freshwater and marine environmental monitoring, in order to:

- a. provide technological support for the sustainable development of aquatic/marine resources; and
- b. support the creation of new industrial capabilities in these areas.

Projects and studies supported to date include:

- SMART Water Quality Monitoring System (SmartCoast)
- Demonstration of a Miniaturised Multi-Channel Cytometry System & its suitability for Autonomous Deployment (Cytometry)
- Marine Monitoring System Based on Optical Oxygen Sensing and Respirometry (Oxygen Sensing)
- Instrumentation Interface, Communication & Data Management Architecture Issues for Marine Sensor Systems, including Sea-floor Observatories
- Platforms for Marine Monitoring

Other related developments include:

- *SmartBay* - a planned initiative to develop a national test and demonstration site for a wide range of new and emerging marine technologies, and
- *CeltNet* - a developing concept for a large, long-term cabled observatory in the Porcupine area, west/south-west of Ireland

The overall goal of the Advanced Technologies programme, initiated by the Marine Institute in 2005, is to increase the contribution of the marine sector to the Irish economy by developing a new technology-driven dimension in areas with emerging industrial potential.

The medium-term objectives that underlay the suite of projects, listed above, are:

- To create strong national partnerships around agreed objectives and strategies for the development of new marine technology capabilities in Ireland, in the area of Advanced Technologies; and
- Develop strongly networked centres of research expertise in these areas, with sufficient critical mass to support existing and new industrial capabilities in these market sectors.

Among the new research and technological challenges in these areas and in which proposals should demonstrate current or potential capabilities are:

Sensors and Sensor Systems

- Sensitivity for low levels of trace chemical concentrations;
- Fouling of sensors;
- Selectivity limitations;
- Limited stability of sensor chemistry and material;
- Correlation of pressure and depth sensors data to allow *in-situ* instruments to match satellite altimeter data;
- Interfacing of sensor systems with networks and communication and data infrastructure mechanisms;
- Instrument capabilities and functions in respect to data acquisition and analysis;
- Design and operation of sensor platforms; and
- Integration of fibre-optic technology with sensors, communication and power sources.

Information and Communications

- Automatic identification and tagging of events in sensor data streams;
- Wireless technologies for use offshore and their integration with inshore communications networks;
- Underwater communications inc. acoustics, distance, reliability, speed, power and their integration with onshore communications networks;
- Web service workflow tools allowing users to bind processes together for particular applications;
- Integration of instruments and sensors into a grid computing environment with web services interfaces;
- Techniques for simulation and visualization of complex data sets;
- Automatic linking of instruments and metadata production; and
- Development of methodology for grid enabling instruments.