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 lift 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.