

POLICY BACKGROUND

Policy-relevant issues in Aquaculture & Fisheries

Genetics and Genomics



General introduction of the Policy Background of Genetics and Genomics

Introduction¹

Genetics is the branch of biology that deals with heredity, especially the mechanisms of hereditary transmission and the variation of inherited characteristics among similar or related organisms.

An organism's genome is its genetic material (DNA) and 'animal genomics', broadly defined, is the study of animal DNA, its organisation into genes, the roles and interactions of gene products (mostly proteins), the control of gene expression, and ultimately all downstream impacts on animals, their traits, and their interactions with the environment.

While genetics began with the work of Gregor Mendel in the mid-1800s, the sequencing of the human genome was a milestone in the development of modern biotechnology, opening new avenues for understanding the control of complex traits at a molecular level. The genomes of several farm animal species (cattle, pig, rabbit, and aquaculture species) are also being sequenced and analysed. This will facilitate the integrated analysis of biological functions.

The major benefits of genomic approaches are linked to the capability to drive a much broader and systematic analysis of the genome and its expression products. Such perspectives are profoundly modifying our ability to understand complex biological processes and to propose solutions.

Genomic studies provide a bridge to nutrition, health, and more. These are yielding precious knowledge on a wide range of processes related to health and food safety. The application of such knowledge will contribute to improving animal health and food safety, animal welfare, and the biodiversity of breeding populations. In the long run, they will boost the competitiveness of European farm animal breeding practises. As such, many research projects have started to examine the use of genomic approaches to solve industrially-relevant problems.

Contribution to the European policy for aquaculture

Such genomic project work will contribute to European policy for aquaculture in several ways:

Sustainable Development

'Towards a Global Partnership for Sustainable Development' (2002), made it clear that, for the EU, a priority objective is to ensure that the objectives of sustainable development are progressively integrated into European policies, with respect to both their internal and external dimensions. To this end, the process of adapting the Common Fisheries Policy should be continued. Both sustainable management of natural and environmental resources and trade for sustainable development are important.

Sustainable development – to meet the needs of the present generation without compromising those of future generations – is a fundamental objective under the Treaties of the European Community. The European Council has invited industry to take part in the development and wider use of new environmentally-friendly technologies. In this context the European Council stresses the importance of decoupling economic growth from resource use.

The Union's Sustainable Development Strategy is based on the principle that the economic, social and environmental effects of all policies should be examined in a co-ordinated way and taken into account into decision-making (European Council [Gothenburg, 2001]). Among the priorities identified is the management of natural resources in a more responsible way. Strong economic performance must go hand in hand with the sustainable use of natural resources, lowering levels of waste, maintaining biodiversity, preserving ecosystems and avoiding desertification. To meet these challenges, the European Council agrees that the review of the Common Fisheries Policy will take this into account, and that biodiversity decline should be halted. The Council aims to finalise and further develop sector strategies for integrating environmental considerations into all relevant areas of Community policy. At the Brussels summit of 2003, the EU committed itself to maintain its leading role in promoting sustainable development on a global scale by, among other measures, ensuring the protection of the marine environment and natural resources, including biodiversity. Genomics represents both a way and a tool for the aquaculture industry to achieve these goals.

Common Fisheries Policies

In the Green Paper on the Future of CFP (2001), it is stated that European aquaculture needs to confront effectively the challenges arising from environmental requirements.

White Paper on Food Safety and Human Health.

Since the Treaty of Amsterdam, one of the top priorities of Europe has been to assure a high level of human health protection. In Helsinki (1999), it was put forward that healthy and high quality food are important and need to be ensured for all citizens in all European member states.

The use of breeding programmes and genomics can help to optimise the production of healthy fish by, for example, identifying genes in fish that associated with stress and disease resistance so that lower mortality and a reduced use of medicines are attained. In studying these aspects, more research will improve human and animal health, allow for a more sustainable food production and improve the trust of consumers in responsible, safe food production.

Life Sciences

Europe has also expressed a firm desire to emphasise life sciences in R&D, and to allow the exploitation of the potential of biotechnology, taking into account the precautionary principle and in meeting ethical and social concerns. The use of breeding programmes and the application of genomics in aquaculture and their impact on the environment need to be investigated and discussed in a way that is in compliance with European values and standards.

Competitiveness

Another important concern of the European member states is the competitiveness of their industries, especially SMEs, and the determination of Europe to become the most dynamic knowledge-based economy in the world (European Council [Lisbon 2000]). The European Research Area should be a means of attaining this objective. More research for breeding programmes and genomics will make a European scientific contribution to maintaining the license to produce. Research in this area will ensure long-term viability and maximise the socio-economic benefits of the European aquaculture industry. As the major industries have also interests outside Europe, the effects should not be limited to the European continent alone, and will have effects on the global aquaculture industry of the future.

Genetic and genomic projects funded by the European Commission

The strong mobilization and contribution of European research laboratories to the development of genomics in fish and shellfish biology is illustrated by the number of projects funded. It is thus that more than 13 projects contributing to the implementation of the Common Fisheries Policy within the 5th and 6th Framework Programmes have used genomic approaches to answer specific questions/problems in different species under the same general philosophy of improving the sustainability of European aquaculture.

Summaries

- AQUAFIRST
- AQUAFUNC
- AQUAGENOME
- BASSMAP
- REPROFISH

Footnotes

1. This section has been abridged from the vision document created by the working group 'FABRE Technology Platform' February 2006. Sustainable Farm Animal Breeding and Reproduction—A Vision for 2025