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Evolving legal regimes, market structures and biology affecting access to and protection of aquaculture genetic resources

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ABSTRACT

The maturing aquaculture sector currently faces a number of challenges relating to the objectives of sustainability, conservation, equity and access to and legal protection of genetic resources. The study investigates, through interviews, how actors in the aquaculture sector perceive their options with a view to accessing aquatic genetic material and to protecting innovations in breeding. Moreover, the study analyses how corporate strategies, technological developments, and international regulatory regimes are perceived to affect these options, building also on scientific literature and other legal and policy documents. A methodology of descriptive and explorative case study within the qualitative domain is applied for this. Included are comparisons of findings from Norwegian case studies on Atlantic salmon and Atlantic cod with similar studies on marine shrimp in India and tilapia in South East Asia and Africa.

Aquaculture is increasingly characterised by pressure toward higher production efficiency and short-term profits. Hence, actors in the aquaculture sector face emerging difficulties pertaining to affordable access to improved breeding material and technology, while also securing adequate funding for sustainable breeding programmes. Public ownership or support seems to be important measures to balance these objectives that may otherwise be hard to combine. This is particularly the case during the early phases of implementation and operation of applied aquaculture breeding programmes. An alternative model with cooperative/farmers' ownership is also worth considering in many situations, particularly after the first establishment phase.

1. Introduction

This study aims to examine how evolving legal regimes at international and domestic levels as well as structural and biological factors affect choices and strategies pertaining to access to and legal protection of aquatic genetic resources. Innovation, breeding and aquaculture happen under the jurisdiction of the home country where the activities are going on. Globalisation in the sense of adaptation to global markets is taking place regarding law, policy and biotechnology relevant for aquaculture. The overall topic, to which this manuscript contributes, is how biotechnology, policy and law together affect innovation in aquaculture.

A central socio-economic challenge in fish breeding is how affordable access to genetic diversity and techniques and manners of protecting innovative efforts by exclusive rights to genetic resources can be balanced in a more optimal manner to spur innovation. Fish breeders and breeding companies at all levels in the aquaculture sector need some type of legal or biological protection of their innovations and improvement of genetic material in order to ensure economic returns on their investments in genetic improvements and stimulate innovation. At the same time, breeders and farmers need affordable access to genetic material in order to produce food and to continue upgrading, innovation and breeding. How may a balance be achieved between legal protection and affordable access? The aim here is to identify actors' perceptions of needs for regulating access to aquatic genetic resources and legal protection of the results:

1. How do actors in the aquaculture sector perceive their options with a view to accessing aquatic genetic material and protecting innovations in breeding, and what are the main factors affecting these options?
2. How may a balance be achieved between access to and protection of improved breeding material? More specifically, how to encourage investments in costly breeding programmes while keeping access to breeding material affordable?

These two research questions are explored on the background of several changes happening internationally. The industry's vulnerability to fish disease and epidemics is a central biological factor that will also be discussed in this connection.

Aquaculture is one of the fastest-growing sectors of food production, and there are great expectations that the aquatic Blue Revolution may constitute the next wave for enhanced food security in the world (Greer and Harvey, 2004:25). It is hoped that a Blue Revolution may

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circumvent some of the flaws of its predecessor, the Green Revolution, for instance by basing productivity on a less narrow genetic base, and contributing to equitable benefit sharing. However, less than 10% of total aquaculture production is based on genetically improved material (Gjedrem et al., 2012). This suggests a potential for increased use of improved genetic material and improved efficiency in aquaculture production.

Existing international legal frameworks regarding both affordable access and exclusive rights have been developed for protection of innovation in other areas, notably for plant varieties and for technical non-biological inventions in the patent system. The most important property rights to results of breeding, which establishes exclusive rights to improved plant varieties, are based upon the plant breeders' rights as set out in the various editions of the International Union for the Protection of New Varieties of Plants (UPOV). The UPOV-based national systems for protection of *plant varieties* are based on an assessment of the plant variety being considered as *new*, *distinct*, *uniform*, and *stable*, to be subject to a partly exclusive right to commercial uses.

Beside the system for protection of plant varieties in UPOV-based systems, granting patents to biological inventions has been an important step in making exclusive rights more available. Patent systems are traditionally national in scope and application. However, when negotiating the treaties leading to the establishment of the World Trade Organization (WTO), global standards for harmonisation of various aspects of intellectual property rights were taken to a global level, with increased geographical scope as a result. In addition to the WTO, the World Intellectual Property Organization (WIPO) has a mandate to strive towards cooperation and harmonisation of IPR in all member countries. Harmonised IPR regulations target all technological fields similarly, including biotechnology.

Increased applications for exclusive rights to biological material acquired from the territory of other countries became an important background for the negotiation of the Convention on Biological Diversity (CBD). The CBD has three interrelated objectives: conservation, sustainable use of biodiversity, and access and equitable sharing of benefits from use of genetic resources. The scope of the CBD covers conservation and sustainable use of wild species and improved breeding stocks, as well as equitable sharing of benefits derived from the use of the world's genetic resources.[1] This issue has been the subject of controversial negotiations over the years since the establishment of the CBD. Negotiations resulted in a Protocol on Access and Benefit Sharing (ABS) at the 10th Conference of the Parties to the CBD in Nagoya, in October 2010.[2] The tension between the overlapping and often conflicting objectives of the various international treaties is a controversial North–south issue.

Unlike plants, access to or exchange of fish genetic resources and legal protection of investments and research in aquaculture have not been addressed extensively (Greer and Harvey, 2004:5) until recent years by Rosendal et al. (2006), Olesen et al. (2007), Bartley et al. (2009), and Ramanna Pathak (2012).

These international rules, policies and obligations need to be transferred to the national level for them to become applicable in a direct manner among private and public parties under national jurisdiction. Therefore, when discussing law and aquaculture the main focus needs to be at the national legal level, while keeping an eye at developments in international law and policy. Since law is only one of many, and a relatively new factor driving innovation in aquaculture, it is interesting to follow up with a more detailed understanding of how the actors reflect on the needs for new legislation.

[1] The CBD defines *genetic resources* as genetic material of actual or potential value.

[2] The Nagoya Protocol recognises the interdependence between countries with regard to 'genetic resources for food and agriculture as well as their special nature and importance for achieving food security worldwide … and acknowledging the fundamental role of the International Treaty on Plant Genetic Resources for Food and Agriculture and the FAO Commission on Genetic Resources for Food and Agriculture' UNEP/CBD/COP/10/L.43/Rev.1: p. 6.

2. Methods

This study uses an interdisciplinary approach and research strategy. It includes components of biology/biotechnology, law and policy — and these three areas of research draw from their respective methodological backgrounds. Interdisciplinary research involves an additional challenge in combining different methodologies and contributing to the development of an interdisciplinary method for communicating and discussing the respective findings. We applied the same approach as described and applied by Olesen et al. (2007), and the outline of this paper given below also reflects our approach to this complex and interdisciplinary issue.

Section 3 explores the three main elements or drivers that are suggested to be the most crucial ones for the changes in the perceptions of the actors in relation to affordable access and protection of rights (Rosendal et al., 2006). We apply a methodology of descriptive and explorative case study within the qualitative domain, as this allows more in-depth understanding of factors and mechanisms through multiple observations (King et al., 1994). This implies drawing on written material such as reports from the aquaculture sector and legal and policy documents of relevance to the sector. The authors have monitored developments in the Norwegian aquaculture sector over several years. An important focus is the development of breeding programmes, and for this purpose relevant documentation from key actor interviews is added, both interviews carried out by Olesen et al. (2007) and more recent interviews of external users of Norwegian salmon as well as Norwegian actors in cod breeding. This has provided a thorough description of the various phases of the process, necessary for the detailed case study method (King et al., 1994).

Section 3.1 describes the use of Norwegian salmon genetic resources by foreign breeders and farmers, basically limiting the examination to salmon breeding in Chile and to the sale of the majority of the Norwegian salmon breeding programme to a multinational corporation. The other part of the structural section pertains to the use of Norwegian cod genetic resources by the Norwegian aquaculture sector. This investigation of structural factors includes considerations of various forms of ownership of the genetic resources and breeding programmes (governmental, private, cooperative and multinational) and trends regarding merging and privatisation. Diverging interests in access, benefit sharing and legal protection tend to be based on differences in technological and economical capacity to utilise genetic resources and on differences in holding biological diversity (Raustiala and Victor, 2004; Rosendal, 2000, 2006a).

Section 3.2 explores the biology of fish, as the importance of fish diversity may imply different perceptions of needs and interests in aquaculture compared to the plant and pharmaceutical sectors. This is relevant for the discussion about whether there is a need for a differentiated approach to ABS for various types of genetic resources (Bartley et al., 2009).

In Section 3.3 we rely mostly on the methodology of law. Legal analyses in these fields raise a challenge due to the fact that rules are found at two levels: the international and domestic legislations. In this field, the topic is to explore how these two legal systems interrelate. National law is binding and directly applicable for private parties. The national legal system is heavily influenced by norms at the international level. When exploring this legal area, the challenges of these two levels need to be taken into account.

For the discussion in Section 4, we supplement the empirical data with non-structured and open key-actor interviews. The aim here is not to provide statistical surveys, but to explore the various arguments applied as well as perceived needs and interests among stakeholders in the sector. Applying a similar methodology as used in a previous study of the domestic salmon sector in Norway, we made a selection from individuals that are involved in fish breeding (Olesen et al., 2007). The respondents represent the two cod-breeding companies that provide practically all of the roe for cod farming in Norway, one