Sustainable aquaculture: the issues in term of reproduction

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SUSTAINABLE AQUACULTURE: THE ISSUES IN TERM OF REPRODUCTION

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What could mean 'sustainability' for fish farming?

The sustainability concept emerged with the report of the World Commission on Environment and Development convened by the United Nation in 1983, and known by the name of its chair G.H. Brundtland. This report, 'Our Common Future' (http://en.wikisource.org/wiki/Brundtland_ Report), provided a key statement on , defining it as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs'. It was primarily concerned with securing a global equity, redistributing resources towards poorer nations whilst encouraging their economic growth, and it highlighted three fundamental components to sustainable development: environmental protection, economic growth and social equity. The sustainability concept was developed with the Conference on Environment and Development held in Rio de Janeiro (1992) still focusing on the developing countries, 'particularly the least developed and those most environmentally vulnerable, shall be given special priority' (http://www.un.org/documents/ga/conf151/aconf15126-1annex1.htm). A comprehensive plan of action, called Agenda 21, has been proposed to be taken globally, nationally and locally by organizations of the United Nations System, Governments, and Major Groups in every area in which human impacts on the environment.

However, the sustainability concept with its three components (environmental, economic and social) has been declined in many various ways to adapt to specific activities, including those of companies belonging to developed countries for solvable markets and rich consumers. It means that, especially for economic and social notions, the goals may be different (Anderson, 2007). Besides, it should be recalled also the opinion of some ecologists for who a 'sustainable development' is an antinomy because economic growth would be possible only at the expense of the environment. Thus, definition of sustainability indicators for each of its three components is probably one of the most interesting way to clarify what is underlying the application of the 'sustainable' concept to a particular human activity. Besides these indicators are useful tools to evaluate rationally the progress due to specific actions towards the type of 'sustainability' which has been identified by the actors. However, these indicators would be useable and reliable only if the frontiers of the studied system are well defined and if they can be measured on the base of unbiased and realistic data collection. By instance, there is a lot of methods to define and measure indicators for the evaluation of the environmental impact of agriculture at the farm level (Werf and Petit, 2002). Some of them, like the life cycle assessment (Papatryphon et al., 2004), have been already experienced in aquaculture but, to our knowledge, methods to control fish reproduction have not been involved in these evaluations.

In the field of European aquaculture, we may refer to the European Coordination Action 'Consensus' which aims to promote sustainable aquaculture in Europe (http://www.euraquaculture.info/index.php) and stated that 'various definitions of sustainability exist, but European aquaculture is so varied and diverse, that European fish and shellfish farmers (are asked) to provide their own definitions.' In this case, the frontiers of the studied system are those of the European aquaculture and results are supposed to be a consensus between the principal European stakeholders of the field. Sustainability indicators themes have been defined within following ones: Economic Viability, Public Image, Use of Resources, Health Management and Welfare Issues, Environmental Standards, Human Resources, Biodiversity,

Post-harvest operations, Sector Issues. Another European initiative, the Farm Animal Breeding and Reproduction Technology Platform (http://www.fabretp.org/), was covering all animal productions, including fish, but focusing on breeding and reproduction to support stakeholders involvement in the set up of partnership by industry. This platform was aiming to tackle 'major issues concerning sustainability (Fabre-TP), animal breeding and reproduction in Europe'. For that initiative, it is also stated that 'what is happening in the developing world' will be taken into account.

What could mean 'sustainability' for technologies aiming to control fish reproduction?

From an European point of view, it seems reasonable to take into account the pioneer 'Consensus' and 'Fabre-TP' works for trying to identify what could be 'sustainable' inputs of fish reproductive biology in fish farming practices. Beyond that approach and closer to Brundtland report spirit, developing countries constraints may also be specifically considered (Jana and Santana Jana, 2003). By instance, the price of some technologies, including the cost of intellectual property rights, could be prohibitive for some developing countries.

Two types of questions may be examined in relation to fish reproductive biology: (1) How knowledge and technologies issued from this field of research may help to improve some aquaculture sustainability indicators? (2) How practices developed to control fish reproduction may be improved or changed to fit better with such indicators?

Domestication of new species is an example for the first type of questions, especially when new marketable species have to be chosen for their low environmental impact risk and not because they are the easiest to reproduce (Duarte et al., 2007). This can be the case for local species. Another example is the usefulness of methods to prevent reproduction of escaped farmed fish which may have a negative impact on the natural environment and/or on natural fish populations by genetic introgression. Finally, from an economical point of view, genetic selection methods rely on a good control of reproduction, reliable gametes preservation and efficient fertilisation.

As far as farming practices are concerned, technologies for fish reproduction control should be examined especially for its public image (i.e. use of hormones) and welfare issues (i.e. genitors management). However, the economic viability of methods has also to be attentively considered taking into account each type of fish farming system.

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