



Fish held at high density in net pens may experience negative effects on welfare.

SUSTAINABLE AQUACULTURE: A REVIEW OF EXISTING CERTIFICATION PROGRAMS

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Capture fisheries increased fivefold from 60 million t in 1960 to approximately 100 million t in 2000 but has not grown further since then. New and more efficient fishing technologies have led to a dramatic increase and spread of fishing activities and the consequent full to over exploitation of the main commercial fish stocks.

As the global population and consumption grows, aquaculture alone has compensated the consequent increase in demand for seafood. Aquaculture is the fastest growing food sector, having reached and overcome 100 million t in recent years. With 16 kg of farmed fish consumed per person per year, it now accounts for nearly 50 percent of global seafood production (Larson and Roney 2013).

CONSUMERS OF ANIMAL PROTEINS ARE INCREASINGLY CONCERNED WITH ANIMAL WELFARE ISSUES AND SEEM TO BE WILLING TO PAY A CERTAIN PRICE PREMIUM FOR AQUACULTURE PRODUCTS THAT ARE CERTIFIED TO AN ANIMAL WELFARE STANDARD. THIS MEANS THAT INTRODUCING AND ENGAGING IN ADDITIONAL FISH WELFARE REQUIREMENTS CAN MAKE ECONOMIC SENSE FOR THE INDUSTRY.

Farming fish or enclosing them in ponds for ranching dates back to the time agriculture was first developed, around 10,000 years ago. Farming techniques had not improved substantially until the beginning of the 20th century, when a mere four species were raised worldwide. It was only since 1900 that technology developed and new

knowledge on fish biology allowed for raising more species in closed circle. Currently over 400 different species are raised worldwide, although some of them only experimentally.

The increase in the number of farmed species, together with the increase in global demand and more efficient farming methods, has led to a strong growth in aquaculture production: from less

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than 1 million t in the 1950s to more than 100 million t now. This scenario can however be misleading because most of the growth in aquaculture production occurred in China and in other Asian countries and was generated mainly by increases in carp, shrimp, and pangasius, mollusc and seaweed production.

THE ENVIRONMENTAL IMPACT OF AQUACULTURE

In terms of environmental impact, aquaculture production is a good alternative to other ways of producing animal proteins. The feed conversion ratio of farmed fish ranges from around one-third that of farmed cows and one-half that of pigs, depending on farming practices and species. Aquaculture performs well also in terms of CO₂ emissions. Farming salmon, for instance, produces 10.9 kg CO₂ equivalents per kg versus 39.2 for lamb and 27.0 for beef (Brown 2011).

Regarding the use of land, one must differentiate between aquaculture on land from that at sea. The latter usually consists of provisional cages that can be removed and that have also a low impact on the landscape. Land-based aquaculture infrastructure can have a greater impact, but considering the good performance in feed conversion ratio, one can expect a lower impact on agriculture land use when compared to farming terrestrial livestock.

Although aquaculture has potential environmental impacts, the industry has demonstrated that it can reduce them faster and more effectively than fisheries. Fishing vessels are built to function in the same way for years and this rarely allows space for changes to reduce the impacts of a particular gear on the environment or fuel consumption.

Over the years instead, as aquaculture production increased, fishmeal and fish oil use per ton produced has decreased, thanks to improvements in feeding practices and higher efficiency in feed composition and fishmeal harvesting and processing. In the 1990s, the use of antibiotics, a reason for much attention by international environmental NGOs, has been reduced dramatically in many countries as a result of the introduction of new vaccines and better disease management. Escapes too, have been reduced in some countries as stronger nets have been introduced. It is of course against farmers economic interests to experience fish escapes.

INTERNATIONAL SUSTAINABLE AND RESPONSIBLE AQUACULTURE CERTIFICATIONS

Consumer awareness on the potential impact of aquaculture on the environment has grown over the years and companies have started looking for third-party certifications to recognize their sustainability efforts. Over 500 different organic standards have developed since then and a plethora of sustainability and responsibility certifications.

In 2007 the European Union, in an effort to bring some order and standardization to the organic market, introduced a regulation on organic farming that covers production, processing and the control and labelling of organic food (EC 2007). The EU organic aquaculture production accounts for almost 4 percent of the total aquaculture production. The main producer of organic farmed products is Ireland (44 percent), followed by Italy (17 percent), the United Kingdom (7 percent) and France (6 percent).

Four years later, the Food and Agriculture Organization of the



Stocking density has a strong effect on fish welfare.

United Nations (FAO) produced its own Technical Guidelines on Aquaculture Certification (FAO 2011), recognizing the importance of voluntary environmental and social sustainability certification, calling it “a market-based tool for minimizing potential negative impacts and increasing societal and consumer benefits.” These FAO guidelines describe credible aquaculture certification schemes as those consisting of three main components: standards, accreditation and certification. The FAO also listed a minimum number of criteria to be included in the standards: animal health and welfare, food safety, environmental integrity and socio-economic aspects.

The FAO guidelines and the market response trimmed down a long list to a small group of internationally accepted sustainability and responsibility standards: Aquaculture Stewardship Council (ASC), Best Aquaculture Practices (BAP/GAA), Friend of the Sea and GlobalG.A.P.

Among them, Friend of the Sea and GlobalG.A.P are the only aquaculture certification programs recognized by EU national accreditation bodies and the first ranked in terms of number of certified species and tons of production.

BRINGING FISH WELFARE INTO RESPONSIBLE SEAFOOD CERTIFICATION

The market for vegan products is growing at a pace of 3 percent per year globally, with China running at a surprising > 15 percent



Friend of the Sea certified Atlantic salmon. In the future, aquaculture certification standards may include fish welfare as a consideration.

per year. Consumers of animal proteins are increasingly concerned with animal welfare issues and their concern is rapidly focusing also on farmed and wild-caught fish.

Consumers seem to be willing to pay a certain price premium for aquaculture products that are certified to an animal welfare standard (from few cents in the USA to 50 percent more in Norway). This means that introducing and engaging in additional fish welfare requirements can make economic sense for the industry (Binnekamp and Ingebleek, 2006, Frewer *et al.* 2005, Olesen *et al.* 2010, Solgaard and Yang 2011, Grimsrud *et al.* 2013).

Increasing scientific evidence confirms that finfish, crustaceans and molluscs are sentient, can feel pain and joy, have social lives and memory. The Swiss NGO fair-fish has been the precursor of the pro fish welfare movement. Captured fish do not generally die humanely, without pain, and following loss of consciousness. Instead, depending on use of nets or hooks, fish can experience exhaustion and decompression, with swim bladders burst and crushed. The indirect impact of by-catch of non-target fish is well known, as well as potential habitat and seabed impacts. These are factors that likely reduce aquatic species welfare. Suggested improvements include not using live fish as bait, reducing time from hauling nets to the actual death and improving fishing gears.

Wild-catch standards such as MSC and Friend of the Sea focus more on the impacts of a fishery on the environment, rather than on fish welfare, even though they indirectly approach and tackle some of the above mentioned issues that could impact fish welfare. There is space for improvement to both standards in terms of introduction of fish welfare standards.

FISH WELFARE IN AQUACULTURE CERTIFICATION SCHEMES

As far as aquaculture standards, it is interesting to understand if and how the various major standards for sustainable and responsible aquaculture have included fish welfare among their requirements (Cooke 2016).

- The focus of the **Aquaculture Stewardship Council (ASC)** standard is on the environmental and social impacts of aquaculture. Although animal welfare is not included explicitly, it is addressed indirectly in most of the individual ASC species standards.
 - The **GlobalG.A.P.** aquaculture standard covers legal compliance, food safety, worker welfare, environmental care, ecological care and animal welfare.
 - The **Best Aquaculture Practices (BAP)** standard predominantly focuses on environmental responsibility. The animal welfare component is most comprehensively covered in the salmon standard, but it is less well covered in the general Finfish and Crustacean Farms standard, which is applicable to all other species.
 - **RSPCA Assured** (previously Freedom Food) standards stipulate a high level of fish welfare. RSPCA Assured is recognized as the only scheme in Europe dedicated to farm animal welfare.
 - The **EU Organic Aquaculture** regulation covers animal welfare issues to a greater extent compared to other sustainable and responsible certification standards.
 - Although animal welfare is not yet included explicitly in the **Friend of the Sea** standards, it is addressed indirectly in most of the individual FOS species standards through water quality parameters, siting of production facilities, procedures for the treatment of sick fish, and transportation.

LOOKING FORWARD

Recently, Friend of the Sea and the Swiss association fair-fish international have been awarded a grant from the US-based Open Philanthropy Project to promote animal welfare principles among Friend of the Sea's aquaculture certified companies. Findings from these assessments will then be used to develop animal welfare criteria for inclusion in Friend of the Sea's standards in 2019.

The role of seafood certification programs is not only one of providing consumers with an ecolabel to make a more environmentally aware choice. They have the potential to drive major changes in the industry and lead shipowners, fish producers and processing companies to introduce gradually fish welfare rules and procedures in their company policies.

The development of such certification schemes and their harmonization at an international level, with technological improvements in the industry, will contribute to reduce environmental impact, protect marine habitats, and improve welfare of farmed and wild-caught fish worldwide.

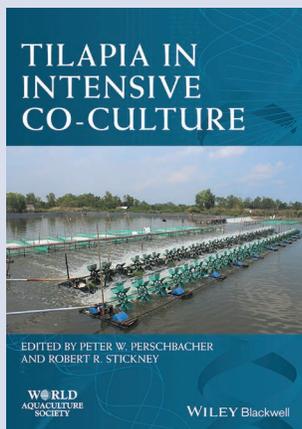
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Notes

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FEATURED BOOK IN THE WAS ONLINE STORE

Intensive tilapia co-culture is the commercial production of various species of tilapia in conjunction with one or more other marketable species. Tilapia are attractive as a co-cultured fish because of their potential to improve water quality, especially in penaeid shrimp ponds, by

consuming plankton and detritus and by altering pathogenic bacterial populations while increasing marketable production.

Following introductory chapters covering ecological aspects of co-culture, tilapia feeding habits, historical use, and new models, *Tilapia in Intensive Co-Culture* is divided into co-culture in freshwater and marine environments. Co-culture core information is presented on *Vibrio* control, high-rate aquaculture processes, aquaponics, tilapia nutrient profile, and tilapia niche economics and marketing in the U.S, and with carp, catfish, freshwater and marine shrimp in the Americas, the Middle East, and Asia.

Tilapia in Intensive Co-Culture was published for WAS by Wiley Blackwell. It will be of great use and interest to researchers, producers, investors and policy makers considering tilapia co-culture in terms of environmental and economic sustainability.

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