Organic aquaculture: the future of expanding niche markets

Expert Panel Review 4.3

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Abstract

The past 15 years have seen a rise in demand for seafood that has been farmed according to certified organic standards, notably in European countries, led by Germany, the United Kingdom, France and Switzerland. Budding demand is also noticeable among emerging middle classes of transition economies. Part of

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this demand is met domestically or regionally. However, a large proportion of organically certified aquaculture products is produced in developing countries where it is processed and then shipped to their markets overseas. In 2008, total organic aquaculture production globally was around 53 500 tonnes with a total market value of 300 million USD. This was produced by 240 certified operations, of which 72 are situated in China. There were 30 species in certified organic aquaculture production in 29 countries. To date, around 80 different organic aquaculture standards exist, of which there are 18 in the countries of the European Union. Organic aquaculture products usually fetch a price premium over the conventionally produced products, yet with varying dimensions and durability. The trend is for continued steady growth of the organic aquaculture sector accompanied by the establishment of more national standards and labels, in addition to existing global standards.

KEY WORDS: *Aquaculture, Current status and issues, Organic aquaculture.*

Introduction

There is unprecedented growth in the demand for certified organic food, and new areas of organic food production, such as seafood, are proving increasingly popular. In reference to the Codex Alimentarius Commission (2011), organic aquaculture refers to the production processes and practices of ecological production management systems that promote and enhance biodiversity, biological cycles and biological activity (Bergleiter 2003; Bergleiter *et al*., 2009). It is based on minimal use of off-farm inputs and on holistic management practices that restore, maintain and enhance species diversity and ecological harmony (IFOAM EU Group, 2010; Costa-Pierce, 2010). More generally, the primary goal of organic agriculture is to optimize the health and productivity of interdependent communities of soil life, plants, animals and people. However, details are often unclear to the consumer, e.g. the exclusion of synthetic fertilizers and genetically modified organisms (GMOs) in the production process (Mansfield, 2003, 2004; Hatanaka, 2010). This contribution presents the current status and issues in organic aquaculture production and markets.

History of organic aquaculture

A detailed account of the history of organic aquaculture and its certification standards is given in Bergleiter *et al.* (2009). The earliest standard was established in 1994 in Austria for common carp (*Cyprinus carpio*) (Table 1). The first national general standards for organic aquaculture were established by France and the United Kingdom in 2000. The first global organic aquaculture criteria were established by the International Federation of Organic Agriculture Movements (IFOAM) in 2000. In the United States of America, the State of California in 2005 banned the labelling of organic aquaculture products pending the establishment of state regulations for such products. Numerous conferences

and workshops enabled practitioners, traders, certifiers and other stakeholders to continually progress the approach.

TABLE 1
History of organic aquaculture*

Year	Species/Issue	Country	Certifying Organization
1994	Common carp (Cyprinus carpio)	Austria, Germany	
1995	Atlantic salmon (*Salmo salar*)	Ireland	Naturland
1997	Organic aquaculture standard	Australia	National Association for Sustainable Agriculture, Australia
1998	Atlantic salmon	United Kingdom	Soil Association
1999	Shrimp (Penaeidae)	Ecuador	Naturland and GTZ
1999	Blue mussel (*Mytilus edulis*)	Ireland	
2000	Organic aquaculture standard	United Kingdom	
2000	Organic aquaculture standard	France	Agriculture Biologique
2000	Giant tiger prawn (*Penaeus monodon*) small-scale farmer groups	Viet Nam	Naturland and SIPPO
2001	Basic organic aquaculture standards	Global	IFOAM
2001	Organic aquaculture standard	Australia	
2002	Tilapia (not species specific)	Israel	Naturland
2003	Aquaculture Group formed	Global	IFOAM
2004	Organic aquaculture standard	Denmark	Økologisk
2005	Organic aquaculture standard	China	
2005	Gilthead seabream (*Sparus aurata*)	France	
2005	Microalgae	Taiwan POC	
2005	Atlantic cod (*Gadus morhua*)	United Kingdom	
2005	Ban on labelling of organic seafood	California, USA	State
2006	"Pangasius" (striped catfish, *Pangasianodon hypophthalmus*)	Viet Nam	Naturland and GTZ
2009	Organic aquaculture legislation	EU	CEC

* CEC = Commission of the European Communities, GTZ = Deutsche Gesellschaft für Technische Zusammenarbeit[1], IFOAM = International Federation of Organic Aquaculture Movements, SIPPO = Swiss Import Promotion Programme.

Source: adapted from Bergleiter *et al.* (2009).

Status of organic aquaculture

The past decade has seen a rise in demand for organic seafood, notably in Europe, North America and Japan. Budding demand is also noticeable among emerging middle classes of emerging economies. Part of this demand is met domestically (e.g. carp, brook trout (*Salvelinus fontinalis*) or rainbow trout (Oncorhynchus mykiss) in Austria and Germany) or regionally (e.g. salmon, cod and molluscs in northern and western Europe, or seabream, seabass, or even tilapia in countries around the Mediterranean Sea). A large proportion of organically certified aquaculture products are produced in developing countries and processed and shipped to their markets. In 2008, total organic aquaculture

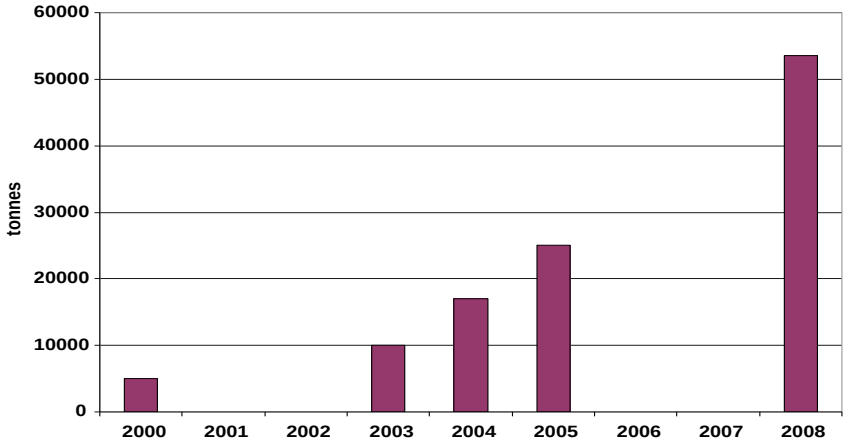
[1] Now changed to GIZ = Deutsche Gesellschaft fuer Internationale Zusammenarbeit.

production globally was around 53 500 tonnes with a total market value of 300 million USD (Bergleiter *et al*., 2009). This was produced by 240 certified operations, of which 72 are situated in China. There were 30 species in certified organic aquaculture production in 29 countries. To date, around 80 different organic aquaculture standards exist, of which there are 18 in the countries of the European Union (EU) (Bergleiter *et al*., 2009).

Production

The total global production from organic aquaculture increased by 950 percent, from 5 000 tonnes/year in 2000 to 53 500 tonnes per year in 2008 (Figure 1), produced by 240 certified organic aquaculture operations in 29 different countries (IFOAM EU Group, 2010). In China alone, 72 operations have received organic aquaculture certification. Some projections expect total global production to reach 100 000 tonnes by 2011 (IFOAM EU Group, 2010).

FIGURE 1
Trend in global organic aquaculture production, 2000–2008



Source: Adapted from Bergleiter *et al.* (2009).

Geographic distribution of organic aquaculture production

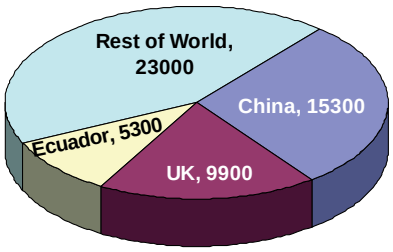
Based on data from 2008, the majority (25 000 tonnes/year) of organic aquaculture production is farmed in Europe, followed by Asia (19 000 tonnes/year) and Latin America (7 000 tonnes/year). By individual countries, China leads with 15 300 tonnes/year, followed by the UK (9 900 tonnes/year) and Ecuador (5 800 tonnes/year) (Figure 2).

Species in organic aquaculture production

The number of species from organic aquaculture has increased from four species in 2000 to around 30 species in 2009, including at least 15 finfish species, six crustacean species, at least one molluscan species, one holothurian,

one turtle, and at least four species of microalgae (IFOAM EU Group, 2010). For some species of which conventional (i.e. not certified organic) products are sold in large volumes, such as Atlantic salmon (*Salmo salar*) and striped catfish (*Pangasianodon hypophthalmus*, "pangasius"), supply growth of organically produced products has reportedly not been keeping up with demand growth. By species, salmon had the highest production of 16 000 tonnes/year in 2008, followed by "shrimp" (combining Litopenaeus vannamei and *Penaeus monodon*) with 8 800 tonnes/year and common carp with 7,200 tonnes/year (Bergleiter *et al.*, 2009).

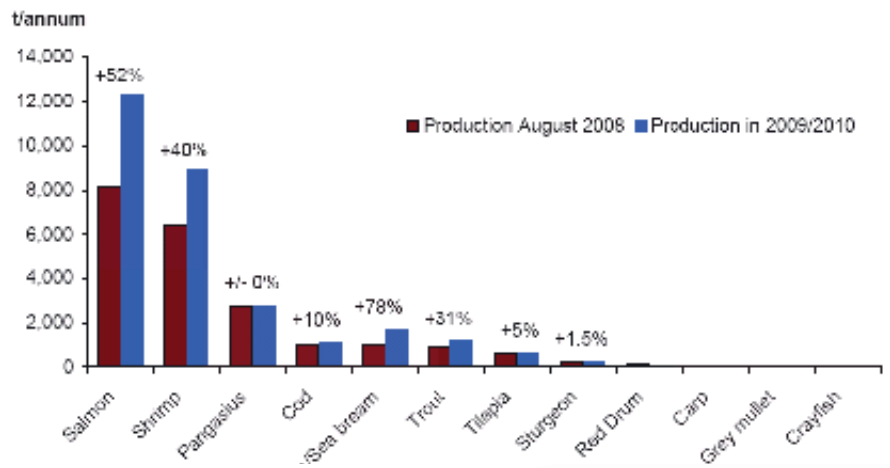
FIGURE 2
Organic aquaculture production by country in 2008



Source: Bergleiter *et al.* (2009).

The main fish species in organic aquaculture are "carp", "trout", Atlantic salmon (Tveterås, 2000), "pangasius", "tilapia", "seabream", European seabass (*Dicentrarchus labrax*), meagre (*Argyrosomus regius*) and red drum (*Sciaenops ocellatus*). The main species of shellfish are whiteleg shrimp (*L. vannamei*), giant tiger prawn (*P. monodon*), pink shrimp (*Metapenaeus ensis*), giant river prawn (*Macrobrachium rosenbergii*), blue mussel (*Mytilus edulis*) and Chilean mussel (*M. chilensis*). The three species with the largest production volumes are Atlantic salmon, "shrimp", and "pangasius" (Figure 3).

FIGURE 3
Organic aquaculture production by major species in 2008, with estimates of increase by 2009/2010



Source: Bergleiter *et al.* (2009).

Production issues

General

One of the main requirements for species to be eligible for certification under organic aquaculture standards is the requirement for a closed life cycle in captivity, i.e. the prohibition of catching larvae for stocking from the wild. The present acceptance of the giant tiger prawn is due to the consideration that the life cycle has been closed in experimental systems and is gradually in the process of being introduced to the industry, despite technical hurdles.

Further, it is not permitted to commit a new introduction of a species into a country or location in which it previously did not exist specifically for the purpose of organic aquaculture. However, if the introduction occurred at least several years prior to the certification of the farm and the species is considered to be established naturally in the environment and is environmentally benign, then organic certification is permitted.

The maintenance of biodiversity on the aquaculture site is a key aspect of most organic aquaculture standards. Non-destruction of, or even replanting of mangroves in brackishwater coastal locations is a key element of system design and management. The planting of pond dikes with local plant species, particularly for control of dike erosion (avoiding siltation, pond turbidity and subsequently maintaining natural productivity), is a common goal that is not yet met satisfactorily.

Generally, polyculture is the recommended system for organic aquaculture, where several species occupy distinctly separate feeding niches within the aquaculture ecosystem, additively enhancing production per unit area, ideally without additional inputs. This is mostly the case in pond systems in Europe farming common carp (*Cyprinus carpio*) and tench (*Tinca tinca*), but also in extensive and semi-intensive brackishwater systems in tropical locations.

Ponds and cages are recommended rearing systems for organic aquaculture. Tank systems are permitted only for hatcheries and nurseries but not for grow-out operations on farms. A major aspect in the granting of certificates of organic aquaculture is that clusters of net cages as well as the farms themselves should not be spaced too closely together.

The stocking density of cultured species is limited (e.g. by limiting the number of individuals per unit area or per volume of water) in order to approximate conditions as they would occur in the wild and to avoid stress as well as the tendency towards intensification.

The use of mechanical aeration is usually banned, while an exception is made only for mechanical mixing and destratification of the water column for a limited

number of hours per day with a small number of devices. At present, there are no detailed regulations on the required energy efficiency (e.g. the maximum kWh/kg of product from the farming process). Similarly, no requirements are stated for maximum levels of carbon equivalents per harvested product (CO_2/kg), although several standard-setting bodies are evaluating the feasibility of such criteria and even product labels.

Several organic aquaculture standards require the monitoring of effluent quality, with the stated goal of avoiding negative impacts on the surrounding environment. The improvement of the ecological status of the ponds themselves, notably the benthos, is a requirement of some standards. Recent studies have shown that the biodiversity within and around aquaculture farms (notably shrimp farms) increased significantly after organic certification in comparison to the prior situation when operated under conventional methods, or in comparison to conventionally operated farms in the vicinity.

Several organizations have expanded their standards that were originally more focussed on ecological criteria to include social criteria. In the future, the addition of aspects of animal welfare is expected.

Reproduction, fingerlings and larvae

As the provision of juveniles for stocking through controlled conditions is of major concern, most standards place a major emphasis on criteria for hatchery operations. The aim is to achieve a closed cycle and to avoid the collection of seed from the wild. In certain countries or locations with newly established, pioneering organic aquaculture operations, the volumes of hatchery production according to organic criteria have been limited. The additional sourcing of juveniles from conventional hatcheries is therefore permitted under certain conditions. By some definitions, for operations having to rely on such bought-in juveniles, a minimum of two-thirds of an animal's life span should have been under conditions certified as organic by the time of harvest.

Restrictions also exist for methods to induce spawning, for example, on the use of hypophysation in fish and the manipulation or ablation of eyestalks in crustaceans. Hormonal sex-inversion is not permitted. The induction of polyploidy in the reproduction process as well as the use of polyploid animals in organic aquaculture is not permitted. The farming of GMOs is also not permitted.

For farmers, the fluctuations of prices of juveniles from certified organic sources has been a challenge. Premiums of between 0 and 24 percent annually pose risks in cost calculations.

Health

Organic aquaculture principles aim at reduced instances of disease. Likewise, if disease does occur, the costs for treatment are expected to be reduced due

to the extensive nature of the operations and the expected hardiness of the less-stressed fish.

In net cages, the use of chemicals for sea-lice treatment is not permitted. As a successful remedial measure to treat sea lice, cleaner fish (wrasse) are promoted and have induced the development of own wrasse farming operations to supply these to the net cage farms.

According to most private organic aquaculture standards (e.g. Naturland e.V.), antibiotics are not permitted in invertebrates (e.g. shrimp), whereas the 2009 EU regulation is less stringent in this regard. The use of antibiotics is not prohibited in fish, but after use the treated fish cannot be sold with a label as organically certified. The use of vaccines as well as probiotics is permitted.

For predator control, measures should not harm the predators. Nets over ponds or cages are recommended for control of birds, while for the control of otters and seals non-harmful repellents should be used.

To control unwanted fish fry in ponds, such as those of predators or non-target competitors, natural plant extracts are permitted. However, the use of detergents or antifouling chemicals to treat nets of cages is not permitted, as these are considered harmful to the environment as well as to the cultured organisms.

Feed

The most salient issue in organic aquaculture production is the existing bottleneck in supply of certified organic feed. Even if organic carp farmers in Europe and extensive giant tiger prawn producers in Southeast Asia have little difficulties to satisfy their modest requirements for external feed, organic net-cage and semi-intensive pond farms are facing a drastic increase in feed prices, particularly if organic vegetable feed ingredients (e.g. soy, cereals) have to be sourced from global markets. Global demand for certified organic feed ingredients for aquaculture and agriculture far outstrips supply, resulting in very high prices and consequently, high production costs. Furthermore, organic principles should aim at reducing environmental costs of long-distance shipment (Pelletier and Tyedmers, 2007). However, in a country with only one or a few organic aquaculture farms, the initiation of organic agriculture feed projects and the establishment of the first local organic aquaculture feed mill is a challenging process, requiring high levels of commitment by, and cooperation between different sectors (e.g. aquaculture, agriculture, feed production). First promising projects of this kind have developed in Brazil, India and Bangladesh.

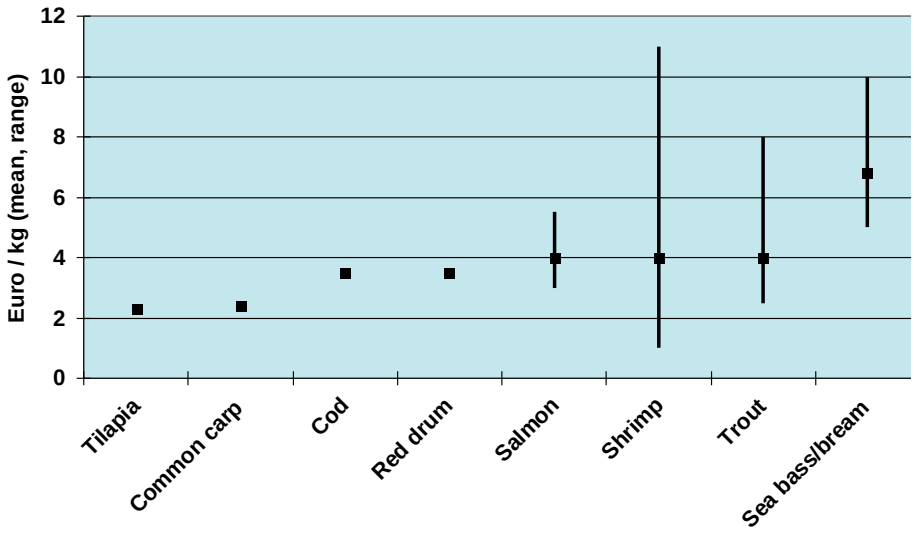
In many countries, existing feed mill operators hesitate to undertake the part-time production of relatively low amounts of feed due to the stringent requirements in preparing machines between runs of organic and non-organic feed to avoid contamination. Additionally, the sourcing of agricultural ingredients

at the national or local level which satisfy the requirements of organic labels can pose serious obstacles for start-ups, notably in developing countries.

Production costs

Costs of production are higher where feed costs are higher and the volume of production is relatively small yet the area of the operation is larger due to the more extensive nature of the organic farming system. Examples of economic feasibility studies have been conducted for organic shrimp, freshwater prawn and freshwater fish (INFOFISH, 2011). Figure 4 shows the production costs of organic aquaculture for major species in 2008.

FIGURE 4
Production costs of organic aquaculture by major species in 2008



Source: Bergleiter *et al.* (2009).

Certification of smallholder farmer groups

Certification of smallholder farmer groups has a long history in organic agriculture, such as in coffee and tea farmer cooperatives. Today there are certified organic shrimp farmer groups in Bangladesh, Costa Rica, India (Phillips *et al.*, 2008; NACA, 2010), Indonesia and Viet Nam (Camillo, Poisson and Serene, 2004; Mueller, 2004). This can be communicated to consumers who find additional appeal in equitable remuneration arrangements (e.g. "fair trade").

These arrangements are usually initiated by seafood processors or by seafood traders or importers in developed countries. They take a long-term perspective to such linkages. Contract farming arrangements with price guarantees and production specifications are a common feature. Smallholder farmers require considerable effort to become organized. In some countries (e.g. Viet Nam), the registration of groups forms the legal basis for joint operations.

For adaptation of farms to the criteria of the organic standards, as well as to cover the costs of the advisory services that guide the transition, farmers often need to make investments which are difficult if not impossible for smallholders. In such group formations and collective arrangements, the processing or exporting partners often cover the costs. These also arrange for the provision of better quality inputs such as disease-free larvae or fingerlings, as well as good quality feed. They arrange for training of the farmers on the necessary organic farming criteria. The viability of smallholder group arrangements growing a highly perishable product that also has such stringent criteria as organic aquaculture is highly dependent upon a functioning internal control system (ICS). These are tedious, time consuming and costly to establish and successfully operate, but experience has shown that farmers appreciate the benefits of equitable arrangements and adjust their management systems accordingly. The groups also constitute nuclei for further up-scaling (Umesh *et al.*, 2010; Subasinghe and Phillips, 2010).

Processing of organic aquaculture products

Farmed organic aquaculture products are usually sold to local processors who have contracts with traders and/or importers. Farms usually grow products according to specific criteria (e.g. individual fish size, harvest schedule) demanded by the market and conveyed by processors. Processing is also conducted according to market demands and local capacity. For example, in shrimp processing, these demands can range from whole freezing over peeling, deveining and blanching to breading, saucing and packing as ready meals. In some cases, where local processing capacity is not well developed, raw products are frozen, shipped and final-processed in another continent. There the final product can range from repackaged individually quick-frozen shrimp or fish, to marinated products, to ready meals, including organic pizzas with a few shrimp or bits of salmon sprinkled on them. Some producers have established their own processing facilities, given unwillingness by local processors to interrupt their processing lines of conventional product and clean the entire system in order to process a batch of organically certified product. For processing, an own set of standards and criteria exist, and processors also need to undergo a certification process, with ensuing regular audits. Ideally, with adequate volumes of production and marketing, processors maintain separate lines for organic products as well as conventional products in their facilities.

The entire production chain requires documentation to ensure full traceability. In the processing facilities, the organic standards have specific criteria on the use of detergents and for pest control substances. Anesthetization of vertebrates before slaughter is mandatory. Certain additives are either restricted in use or prohibited (e.g. metabisulphites, phosphates, and anticaking agents). The ingredients used in the processing, such as breading and spices, must also be organically certified.

Organic aquaculture products

Today, organically certified aquaculture products are marketed in a wide range of processed forms, e.g. fresh (chilled, on ice), frozen, smoked, marinated, modified atmosphere packed (MAP), all the way to value-added products. By far the most common form is frozen product (with fresh-thawed product displayed on ice in the shops), but the further-processed value-added forms (all the way to ready meals) are gaining market share.

Marketing of organic aquaculture products

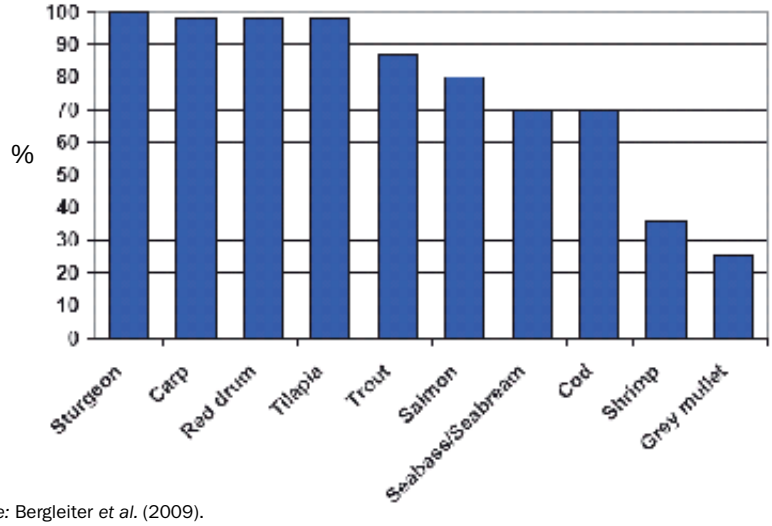
The total market value of organic aquaculture products was estimated300 million USD in 2009. The major markets are European countries, led by Germany, the UK, France and Switzerland. Here features of an evolving market are observed, such as increasing sales volumes, growing competition in increasing numbers of new outlets and market channels, and increasing pressure to decrease prices. The United States of America is considered to have a large potential once regulations are passed by the USDA. Other countries, particularly in East and Southeast Asia, are showing gradual expansion of organic aquaculture markets; however, these are characterized by high prices, low sales volumes, little or almost no competition and the need to invest in marketing and create consumer awareness of organic aquaculture products.

Marketing channels are species dependent and also reflect characteristics of the respective region of production and consumption. Marketing of seafood in general and of organically certified seafood in particular is characterized by a diverse web of products and markets. These can range from sales at the farm gate or in small specialized organic food shops to supermarkets and discounters. A recent trend has been the strong increase in market share by the latter, at somewhat discounted prices, where a large share of the volume growth of the past decade has taken place.

There are numerous intermediaries in the seafood sector in general, and more so in the organic seafood sector. Due to greater agility, all intermediary players can appear at the processors' or even farmers' doors: buyers, agents, reprocessors, wholesalers and retailers. Here various criteria influence the decisions as to the sale of products, either as organically labelled or, despite its organic origin, as conventional product, which includes the novelty of an organically certified seafood species on the market (Figure 5).

There is a large volume of onward product trade, e.g. within the EU, where some countries traditionally have strengths due to a previous engagement in the seafood sector. Own-branding by retailer chains is steadily expanding by volume, all the way to whole purchases of processing facilities. In this respect Asian countries are emerging strongly, notably China, Hong Kong SAR, Republic of Korea and Taiwan POC.

FIGURE 5
Results from a survey of the proportion of organic aquaculture production (by species) sold to end-consumers as such, versus being sold and not specifically labelled as originating from certified organic aquaculture



Source: Bergleiter *et al.* (2009).

Consumer perspective

In the sustainability, as well as the expansion of the organic seafood sector, the perception of the consumer is the driving factor (O'Dierno *et al.* 2006; Stern 2007). The continuous evolution of the standards as well as products and their diversification are important aspects. A suite of attributes characterize organic products in the eyes of the consumer. These can be grouped into categories of environment ("naturally grown", "sustainable"), health ("healthy", "pure", "no additives", "good for my young children"), consumption ("taste", "texture"), social ("fair") and lifestyle ("special treat"). These have been summarized by some under the descriptor of LOHAS, or Lifestyle of Health and Sustainability, as is currently pervasive.

It is important to consider that this trust in organic products in general, and in organic aquaculture products in particular, is fragile. Much depends on the credibility of the sector and its variety of products and farming systems, as the consumer is highly sensitive to scandals. Still, consumer surveys show that doubts persist about the true origins of products, and whether all of the products on the market are truly from certified organic farms.

To date, the sector has maintained a perception of "honesty" and "credibility" among consumers. The sector relies on specific communication avenues and messages to maintain a perception of realistic, moral, ethical business, with high regard for environmental, health and social criteria. The sector maintains constant communication with the consumer through a wide variety of channels

and media to maintain this perception, yet there is general understanding that much more should be done by the organic aquaculture sector.

Across the organic agriculture sector, a clear distinction should be made between categories, i.e. grains and cereals, dairy products, fruit and vegetables, meats and fish (or "seafood") in the order of purchased volume by consumers, with the first being the highest. Meats and seafood are presently, and for the foreseeable future, the categories with proportionally lesser sales and consumption volumes for organically certified products. However, across all categories a price premium usually exists, which reflects a "willingness to pay" by consumers.

Organic certification standards and labels

Around 80 different organic aquaculture certification standards exist, both public as well as private, of which those with the greatest number of certified farms are Naturland, AB France and Bio Suisse. Favoured by broad (general) compatibility among standards, farms may obtain certification according to more than one label, in order to access a greater variety of markets. However, the greater majority are certified according to one label only. As of 1 July 2010, the new EU organic aquaculture implementing rules are applicable. These constitute a consensus "minimum" standard, while other existing standards are stricter in their requirements. One of the issues of debate is that there is no limit to the percentage of fishmeal in feeds for coldwater species such as trout, Atlantic salmon and cod, whereas for warmwater species such as shrimp, tilapia and pangasius there is a permissible fishmeal limit of 10 percent in their organic feeds, while for tilapia, fishmeal in the feed is even completely forbidden (CEC, 2009; IFOAM EU Group, 2010; Klinkhard, 2010).

Today, several specific and relatively precise certification standards for organic aquaculture production (i.e. hatchery, feed, grow out) and processing exist which aim at achieving optimal, sustainable agro-ecosystems. A number of private organic aquaculture standards (e.g. Naturland, Soil Association) also include obligatory social criteria, some of them even including the option for a "Fair Trade" certification (e.g. the Naturland "Organic plus Fair" scheme). Impartial organizations take part in the inspection and certification process to ensure adherence to the relevant production and processing standards.

The role of IFOAM

The International Federation of Organic Agriculture Movements (IFOAM) is the world umbrella organization of the organic farming movement. IFOAM runs the International Organic Accreditation System (ISOAS) and the International Basic Standards (IBS) criteria. IFOAM is further represented in policy-setting procedures, e.g. the EU and the USDA. IFOAM is a member of the International Social and Environmental Accreditation and Labelling Alliance (ISEAL), the global association for social and environmental standards. IFOAM has a fostering and harmonizing role, for example regarding the mutual recognition of certifications.

Inspection and certification bodies

Although standards are set by private, national or intergovernmental organizations or institutions, the inspections or audits of the farms are conducted by independent "third party" inspection bodies (IBs) who are hired to provide the service, usually at the recommendation of the standard-setting body. The actual certification is conducted by certification bodies, i.e. the institutions setting and maintaining the standards. These are normally accredited according to ISO 65 according to their operational procedures of standard setting, commissioning third-party IBs to conduct independent audits and annual inspections. A suite of audit rules, manuals for interpretation of the standards and conduct of inspections and audits, as well as checklists for the inspections and audits need to be prepared for each standard. Inspectors need to be trained in the specifics of the respective standards and their interpretation, so that they meet necessary qualifications. Certification bodies as well as IBs maintain outreach offices and liaison offices through partner organizations. In the implementation of the inspection, auditing and certification process, cost efficiency is a major factor for consideration in the design of these services. Several countries have formulated national standards and strategies for up-scaling of organic aquaculture, for example, Thailand (Ruangpan, 2007), which reflects government commitment and support to the growth of the sector.

Organic aquaculture as rural development

The recently completed project financed by the Common Fund for Commodities involved organic farms in Thailand (shrimp), Myanmar (shrimp) and Malaysia (tilapia and shrimp). In Thailand, the project was successful in obtaining organic certification for the involved stakeholders and in establishing contacts with buyers in international markets. In Malaysia and Myanmar, good potential was identified for the relevant parties. The main obstacle encountered was the difficulty in obtaining organic feed at a reasonable cost. On the plus side, domestic and regional demand for organic aquaculture products was much stronger than anticipated[2].

Despite the characteristic of a niche market, organic aquaculture is considered to have opportunities for food security and poverty alleviation when implemented by rural farmers (Funge-Smith and Halwart, 2004). In terms of small and medium-sized rural businesses, successful bilateral development initiatives in Latin America and Asia with shrimp and pangasius prove that certification (and organic certification in particular) has had positive effects on aquaculture industries. These in turn have led to improvements by other players and stakeholders in the local industries, and have been either locally expanded,

[2] Presentation by T. Singh on *Farming and certification of organic and "chemical-free" fishery products under the CFC/FAO/INFOFISH Organic Aquaculture Project* presented at the Asia-Pacific Regional Workshop on "Organic Aquaculture Development in Myanmar, Thailand and Malaysia", 3–6 March 2011, Bangkok, Thailand.

nationally up-scaled or even transferred to neighbouring countries, with resulting viable small and medium-scale businesses supplying local and export markets (Nolting and Prein, 2008).

Future outlook

A census of organic aquaculture conducted in 2009 (Bergleiter *et al.*, 2009) showed global organic seafood production to be approximately 55 000 tonnes. Since then, new products have been certified and in 2011, there may be about 80 000 tonnes of certified organic seafood, altogether. World aquaculture production (excluding aquatic plants), is 52.5 million tonnes (FAO, 2010); thus, only 0.1 percent of total production is currently certified and marketed as organic. However, the prospects for strongly expanding this tiny niche are good (see also Bergleiter, 2011):

– A considerable portion of the world aquaculture industry is already producing very close to, or even in congruence with, organic principles. However, this has not translated into formal certification. This is particularly true for bivalve shellfish and seaweed culture, which in general are "no input" systems. The areas where the industry does not yet meet organic standards are mostly related to the recycling or re-use of ropes and other disposable culture materials and to appropriate siting of farms in areas with the best water quality. Both these issues are increasingly being tackled by national and international legislation so that organic group certification of large areas seems within reach.
– Cyprinids (carps) are by far the largest family of farmed finfish. These are mostly produced by Asian family enterprises and consumed locally. Typically, they apply organic production principles, often using polyculture systems that include rice, ducks or pigs, and give a general priority to fertilizing rather than feeding. Nevertheless, these systems would still face several obstacles if they were to seek organic certification, mainly due to gaps in quality management and the traceability of the different inputs. Ongoing urbanization and increased domestic exports to the big cities are likely to lead to much more attention being paid to food quality and safety, which will result in moves towards standardization and reliable certification.
– Shrimp and prawns are the most important aquaculture export items from many southern countries. In Southeast Asian countries, a large proportion of these are farmed in extensive, low or no-input systems that are very suitable to be converted into certified organic operations. The major challenge here is to establish internal control systems enabling large numbers of small-scale farmers to run their operations in accordance with agreed standards (e.g. regarding mangrove protection and reforestation). At the moment, there are certified organic shrimp farms in Viet Nam, Bangladesh, India, Indonesia and Thailand, which volume-wise represent only a fraction of the organic potential in these countries. In South America and Madagascar, shrimp companies are usually large, integrated enterprises which have the ability

to implement organic standard requirements directly and to take immediate action along the whole production chain. The farms operate using a semi-intensive model (i.e. feeding the shrimp, with additional fertilization of the pond). The main challenge for organic candidates here will be to source certified organic vegetable feedstuff at a reasonable cost. This is being tackled by initiating pilot organic projects producing certified organic manioc, rice, soy and corn as feed ingredients in these countries.

– Salmon is a very sought-after aquaculture product and, due to feed and energy costs, prices are steadily increasing. Over the past 15 years, organic salmon has become well established in European markets. In Ireland, certified organic production already makes up more than half of the total salmon volume, and strong market demand is currently pushing other countries to follow this example. The requirements for farming organic salmon are clear and widely accepted, with the goals of increasing product quality and environmental performance. Yet these standards are also demanding and expensive to meet. As long as there is a demand for salmon that are grown under less strict environmental conditions, the two major salmon-producing countries, Chile and Norway, will be reluctant to contribute to the organic momentum.
– The other main organic aquaculture species can be located somewhere between the scenarios given in this overview: The Mediterranean species (seabream, seabass and meagre) can be compared to organic salmon, but have not yet had the same duration of mainstreaming. Organic trout and char producers in Austria, Germany, the UK and Switzerland are usually smaller farms who still mainly focus on local markets. Delivering to large retail markets remains a challenge to them. Organic tilapia and pangasius production can be compared to semi-intensive shrimp farms; the critical factor in organic conversion is obtaining a supply of certified organic feed from, as far as possible, domestic organic agriculture.

In the future, the largest increases in production volume of organic aquaculture products are projected for Atlantic salmon and “shrimp”, as well as certain finfish species that are presently in undersupply (e.g. tilapia). The global market value of organic aquaculture is expected to increase by 40 to 60 percent over the three years between 2009 and 2012, surpassing a total value of 640 million USD in 2011, focussed, however, on a few highly developed markets, notably Organisation for Economic Co-operation and Development (OECD) countries. Although considerable scope exists for development of organic agriculture markets in developing countries due to the increasing numbers of middle-class consumers, experience has shown that the initial growth and expansion is in other organic food categories, such as grains, dairy products, fruit and vegetables, and only in a secondary phase in meats and aquatic products. Raising consumers’ information level on aquaculture issues in general and creating awareness of the organic initiatives seem critical for stable market development. Numerous successful examples show that joint ventures or

long-term contractual arrangements between retailers and producers contain supporting arrangements and create incentives.

For stabilizing global growth of this initiative, better strategies will have to be developed to avoid the bottleneck of insufficient organic aquaculture feed supply, notably in the budding semi-intensive organic aquaculture sector in developing countries.

At the same time, the organic market presents an attractive option for extensive aquaculture producers, particularly in the case of extensive and integrated shrimp production in Southeast Asia, where farmers operations are already working very close to organic principles. The challenge here is the vertical integration of supply chains (hatchery-feed-farm-processor-exporter), granting full traceability as a prerequisite for a valid certification.

Benchmarking of existing (and also conventional) labels and standards and cross-accreditation should be progressed in order to enable farms to access additional market channels without the need for new and costly inspection and certification procedures.

By 2015, a total value of 1.25 billion USD for organic aquaculture products has been forecast (Bergleiter *et al.*, 2009). For some finfish such as tilapia, there is presently an undersupply of organically certified product. Such phenomena occur when new standards are created and markets as well as producers have not established a balance of demand and supply. However, further diversification of species under organic aquaculture certification is needed and even expected. In the future, the feed bottleneck will need to be solved. Harmonization of organic aquaculture standards will occur. However, given that standards are a competitive business that is partly governed by national perspectives, it is expected that a diverse array of standards and certification bodies will continue to exist. The United States Department of Agriculture (USDA) is lagging behind international developments in the establishment of regulations for organic aquaculture. Considerable expansion of organic aquaculture markets is projected for China, Repubic of Korea and the Russian Federation.

Conclusions

Organic aquaculture and markets have met the expectations and commitments expressed in the Bangkok Declaration and Strategy for Aquaculture Development Beyond 2000. (NACA/FAO, 2001), including: improved environmental sustainability, strengthening of institutional support to implement transparent and enforceable policy and regulatory frameworks, application of rules and procedures, application of innovations in aquaculture, better management of aquatic animal health, improved nutrition in aquaculture, improved food quality and safety, and the promotion of market development and trade.

In the future, the efficiency of organic aquaculture value chains needs to be increased. The presently existing feed bottleneck needs to be removed. One option is through contract farming of certified feed ingredients. A workshop with all relevant stakeholders could be conducted to address the feed bottleneck problem. In the future, joint ventures will be established between retailers and producers, and these will result in greater efficiencies and market-aligned production, as well as ensured and sustainable returns for farmers. Micro-insurance schemes for organic aquaculture farmers will need to spread and become a mainstay, as has happened in other agriculture production sectors.

Consumers will need to be educated about the criteria of organic aquaculture, notably in new and hitherto untapped markets, but also in traditional markets consumers need to be continuously informed. Policy support needs to be provided by national programmes for the expansion and upgrading of national standards and their harmonization with existing global labels. In this vein, the benchmarking of existing standards needs to be conducted, which can lead to their harmonization. On the other hand, the addition of "fair trade" criteria to organic aquaculture standards poses a considerable market opportunity already voiced by importers and traders. Finally, there are no research and development facilities for the conduct of applied organic aquaculture research and demonstration of systems. The establishment of such facilities in key environments would further the scientific basis, credibility and expansion of the sector.

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