Chapter 3

Globalisation in the Aquaculture Sector

Companies in the aquaculture sector have pursued a globalisation strategy based on foreign direct investment in aquaculture installations abroad or through fragmenting parts of the farming process to other companies. Production and transport costs in salmon farming differ considerably across producing countries due to labour costs and distance to markets. Concentration is occurring in the aquaculture sector, both in production and in companies providing inputs, particularly in the feed compound business; there are important economies of scale in aquaculture production as modern aquaculture is capital and knowledge intensive. Access to raw material (fish for reduction to meal and oil) is a key consideration in this respect. However this aspect may be of decreasing importance as research into alternative feed compounds based on vegetable material starts bearing fruit. A key policy implementation issue is the provision of sustainable and responsible aquaculture practices in producing countries. The implementation of national aquaculture plans are in this respect particularly important in outlining a future vision for the sector.

The farming of fish is an ancient activity that has gradually developed from subsistence farming to a large-scale commercial activity. Aquaculture or the farming of aquatic organisms includes fish, molluscs, crustaceans and plants; human intervention ranges from the addition of feed to stocking and protection from predators. A wide range of species are farmed; global aquaculture production reached 66.7 million tonnes in 2006 with an associated value estimated to be USD 86 billion. Summary characteristics of world aquaculture are provided in Tables 3.1 to 3.3.

There are basically two types of aquaculture: artisanal and industrial. Most aquaculture in the developing world is artisanal in nature, producing for local consumption only; it is by far the largest part of overall aquaculture production and the most important species involved are various types of freshwater carps and seaweeds. Aquaculture destined for trade is different as it is subject to stringent sanitary and hygiene rules to be able to enter those markets. The species are also of higher value with a ready consumer appeal; species include shrimps, oysters, mussels, salmon, sea bass and bream, rainbow trout, eels and turbot. More recently, new species farmed on a commercial scale include cod and pangasius and, in the not too distant future, tuna.

Aquaculture production has a number of distinct advantages over wild harvested species. Farmers can provide a more regular flow of products with more regular quality (size, colour, etc.) and farming takes place in relatively controlled conditions (knowledge about what the fish has eaten, quality of aquatic environment, etc.). These are very

Table 3.1. **Aquaculture production in inland and marine waters, 2006**

	Quantity (million tonnes)		Value (USD billion)		Total production	
	Inland	Marine	Inland	Marine	Quantity	Value
Fish, crustaceans and molluscs	31.5	20.2	41.4	37.6	51.7	79.0
Plants	0.1	14.9	–	7.2	15.0	7.2
Total	**31.6**	**35.1**	**41.4**	**44.8**	**66.7**	**86.2**

Source: FAO (2006).

Table 3.2. **World aquaculture production by main species group, 2004**

	Quantity (million tonnes)	Value (billion USD)
Freshwater fish	24.4	25.3
Diadromous fish	2.9	8.3
Marine Fish	1.5	5.0
Crustaceans	3.7	14.2
Molluscs	13.1	9.8
Plants	13.9	6.8

Source: FAO (2006).

Table 3.3. **Farmed species with a value above USD 1 billion, 2006**

	Quantity (million tonnes)	Value (USD billion)
Oysters	4.6	2.9
Silver carp	4.0	3.4
Grass carp	3.7	3.0
Common carp	2.9	2.9
Manila clam	2.9	2.2
Bighead carp	2.1	1.8
Crucian carp	2.0	1.4
Nile tilapia	1.5	1.6
White shrimp	1.3	4.7
Atlantic salmon	1.3	4.1
Yesso scallop	1.1	1.4
Tiger prawn	0.7	3.4
Chinese mitten crab	0.4	2.1
Rainbow trout	0.5	1.7

Source: FAO (2006).

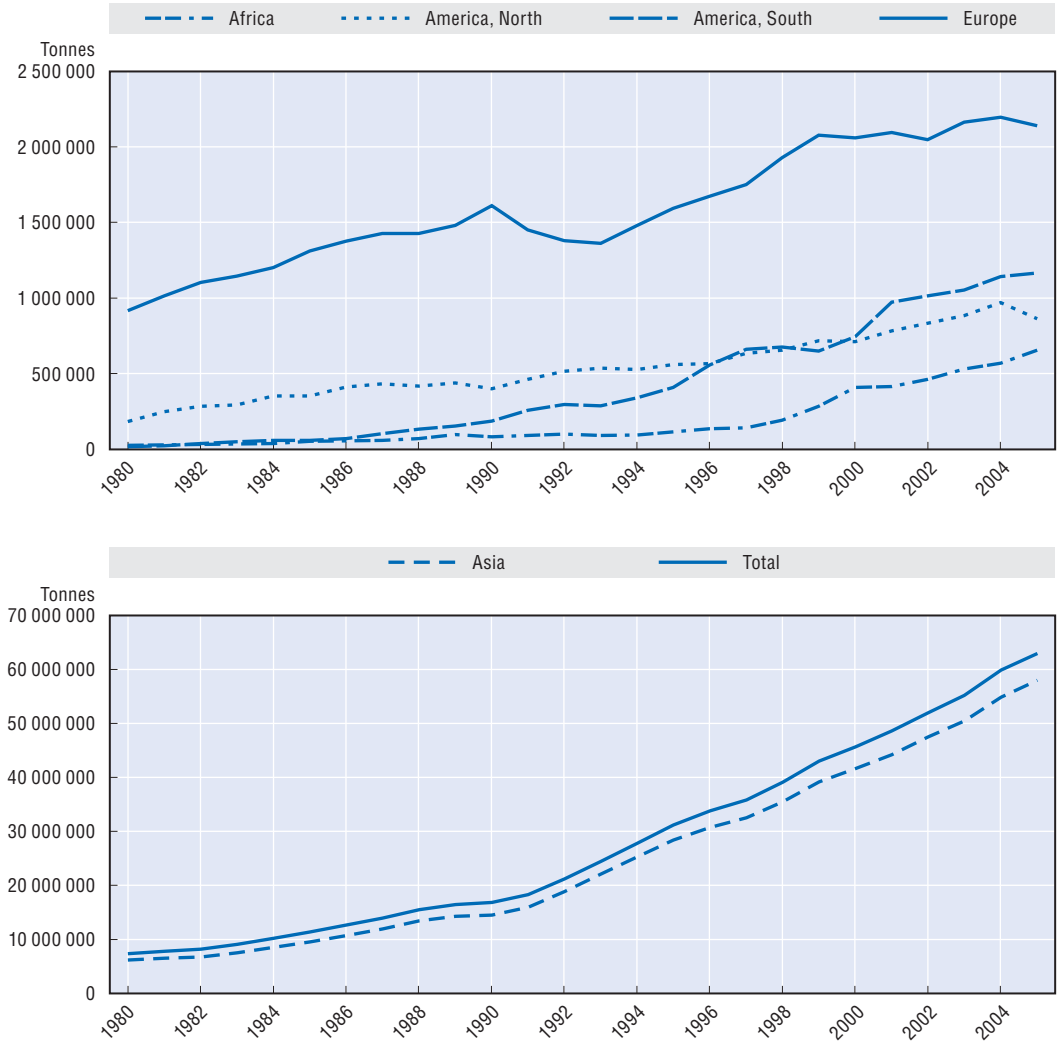
important considerations for retailers and food service industry (catering) in their marketing strategies. It is therefore important for retailers that the consumer image of aquaculture is not tainted but is based on reliable and verifiable sources of information.

Farming in developed countries is generally capital intensive and relatively concentrated; in developing countries, although with some notable exceptions, farming is mostly small scale and extensive. Species differ as well: finfish (salmon, bream, trout and sea bass), oysters and mussels are predominant in developed countries while carp, shrimps and tilapia are a mainstay for developing countries. There is no doubt that aquaculture will continue to grow in importance for fisheries markets, as wild caught fish becomes more difficult to obtain as a result of continued high fishing pressure on fish stocks, in many cases exceeding levels of maximum sustainable yields. According to the FAO, aquaculture production will be an important future source of protein.

As Figure 3.1 shows, Asia as a region is by far the most important aquaculture producer, with China being the single most important country. World aquaculture production in 2006 was 66.7 million tonnes, 70% of which took place in China. 91 per cent of total world production by value comes from Asia with 80% of total world production from China. The combined figures for North and South America plus Europe are 7% by quantity and 17% by value. The principal species produced in China are carps, oysters and various aquatic plants primarily for domestic consumption. However, in the context of globalisation and which is important for international trade and investments, certain countries have played a key role. Chief among these are Norway, UK, Canada and Chile for salmon; China, India, Indonesia, Viet Nam and Brazil for shrimp; and Viet Nam for pangasius.

As observed by Macfarlane[1] trade in farmed fish is undergoing significant change. While Atlantic salmon and shrimps have been the dominant species for decades in recent years, tilapia, catfish, pangasius and barramundi, have been supplied in large quantities to major markets. These fish are all characterised by being white fleshed and a ready substitute for traditional species in many OECD countries (*e.g.* cod). While trade statistics do not split into sources of production (farmed *vs.* capture fish) production statistics may be an indicator of the relative importance in terms of contribution to consumption; in 2006

Figure 3.1. **Aquaculture production 1980-2005 by region**



Source: FIGIS.

total supplies of fish stood at 144 million tonnes, 66.7 million (corresponding to 46%) was from aquaculture. And the share is expanding as catches from wild sources are stagnating or falling due to overfishing.

Internationalisation of aquaculture production

Aquaculture has made an important contribution to the global fisheries sector in particular over the past two decades as farming techniques have been mastered to include salmon, shrimps, sea bass and sea bream as well as the fattening of eels and tuna. These techniques have spread at a fast rate over the world; salmon and trout farming takes place on all continents; tuna fattening has been taken up in the Mediterranean and Australia, etc. showing that such techniques are replicable and provide increased economic opportunities. Companies have extended their business operations abroad, farming in several countries to benefit from location, availability of space, production licences, easier access to raw material (feed and fish stocks), labour costs and proximity to markets (transport costs).

Aquaculture production has become more international in at least two ways: through foreign direct investments (directly by setting up aquaculture installations, or through the purchase of existing production companies) and through subcontracting parts of the aquaculture process to other companies (fragmentation and outsourcing – see Box 3.1).

Box 3.1. **Marine Farms**

Marine Farms is an international aquaculture company with a diversified and integrated seafood portfolio. The Company's current product portfolio can be divided into three main categories:

- Salmon and salmon eggs, parr and smolt and salmon produced in the UK through the wholly owned subsidiary Lakeland primarily are sold to the UK and French markets through wholly owned *Sea Products of Scotland*.
- Seabass and seabream (and juveniles) produced in Spain are sold to the domestic market through the wholly owned subsidiary *Culmarex*.
- New species represented by cobia and cod, initially producing and selling juveniles to other farmers. The on-growing of cobia for sale commenced this year in Belize and Viet Nam.

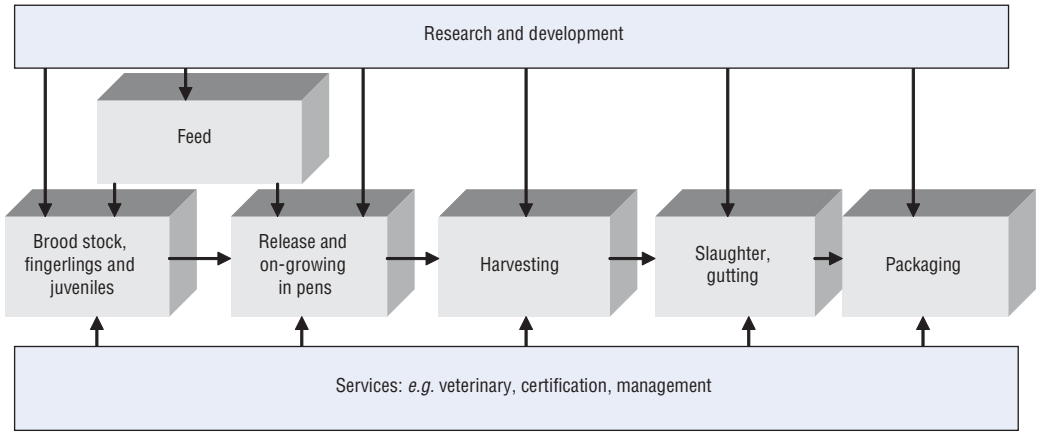
Source: www.marinefarms.no/content/view/64/36/.

Available evidence from the 30 largest companies involved in fisheries and aquaculture suggests that there is substantial foreign direct investment in the sector. Marine Harvest of Norway produces salmon in Norway, Chile, Canada, Scotland, Ireland and the Faroe Islands and has other farming interests (yellowtail) in Asia. Cermaq of Norway has farming interests in Chile, Canada, Scotland and Norway primarily involved in salmon (mainly through acquisition of existing farm facilities). Austevoll Seafood[2] of Norway has salmon production facilities in Norway and Scotland. Nireus of Greece operates sea bream and bass operations in Greece, Turkey and Spain, and has interests in aquaculture companies in Norway, especially Marine Harvest. In Asia, Nippon Suisan Kaisha of Japan has salmon aquaculture installations in Chile, eel farming in China, as well as farm installations in Indonesia. Maruha, also of Japan, owns aquaculture subsidiaries in Spain (tuna farming) and Madagascar (shrimp culture).

In aquaculture there is room for fragmentation and hence possibilities for outsourcing of various elements of the production chain. Generally, "aquaculture" consists of: research; the production of brood stock and juveniles, which is a highly technological venture requiring particular technical skills; on-growth; harvesting; and initial processing (gutting, packaging). When new species are reared, this often takes place in publicly funded research laboratories. Hatcheries are often smaller units specialising in juvenile-stages and initial growth to sizes appropriate for release into on-growing/fattening aquaculture installations. Generally, production in aquaculture follows a process similar to that shown in Figure 3.2.

In the meantime, an analysis of the major companies involved in salmon, sea bream, bass and eel farming reveals that companies that are fully integrated with processing and sales have surprisingly little outsourcing. This may possibly be explained by the fact that the industry is capital, technology and knowledge intensive. The sheer size of such companies is also important: integrating processing, sales and farming results in full control of the supply side, economies of scale and often results in better management of

Figure 3.2. **Schematic aquaculture production system**



Sources: OECD and personal communication with FAO staff.

Box 3.2. **Forward integration as a risk management strategy**

Marine Harvest of Norway operates farming activities in several countries (Norway, Scotland, Ireland, Chile, Canada, Faroe Islands) with processing activities (for both primary, secondary and value added products) in Norway, Chile, Canada, Scotland, Ireland, Belgium, France, the Netherlands and the United States. Spreading activities over many geographical areas may reduce market access constraints as well as certain types of risks including weather, fish diseases and environmental exposure.

Source: www.marineharvest.com.

risks (see Box 3.2). It is also noted in this respect that, at least in salmon farming, there is a high degree of concentration. The ten largest salmon producers are responsible for 60% of world supplies. Some industry leaders expect this to increase to 90% over the next decade.

A guiding principle in aquaculture management is that the time lag (and hence distance and therefore physical possibility for fragmenting into segments) between two segments has to be as short as possible because of time constraint (fish stress management, freshness, food safety concerns). This may also help explain why outsourcing of parts of the farming process is rare.

As for production costs in the salmon industry, calculations by Cermaq (October 2005) suggest that Chile has a competitive advantage. Costs vary according to species but chief among costs are feed and fingerlings/smolt followed by slaughter costs and freight charges.[3] For salmon, Cermaq's figures suggest the following costs of production:

- Chile: NOK 9.90/kg product;
- Norway: NOK 14.40/kg product;
- Canada: NOK 15.90/kg product; and
- Scotland: NOK 19.50/kg product.

Transport costs are an important cost component for the marketing of fresh fish; less so for frozen. Also, according to Cermaq freight costs of salmon are an important element in location decisions. The following Table 3.4 (October 2005) provides costs of freight between main producing and consuming regions.

Table 3.4. **Costs of freight between main producing and consuming regions**

	Fresh (NOK/kg)	Frozen (NOK/kg)
From Norway to USA	15	2
From Chile to USA	12	2
From Canada to USA	1.50	1.50
From Norway to Europe	3	2
From Chile to Europe	15	2

Source: Cermaq.

Such differences in production and transport costs are important elements influencing investor decisions regarding production sites. Combined with the limits that authorities in some countries have imposed on the maximum number of licences and production (biomass)[4] any given aquaculture company may hold, production and transport costs have been the principal elements in the decision to go global (see Box 3.3). However, the fact that production is well managed through regulatory frameworks may also bring very positive elements such as better disease control, which can be a costly risk in aquaculture operations.

Box 3.3. **Grieg Seafood**

Grieg Seafood, a Norwegian company involved in aquaculture, has operations in Canada which have expanded considerably during recent years. The latest acquisition was made in February 2007 when the Group bought Target Aquaculture, including 8 production licenses and one processing plant. The Group has made considerable investments to modernise equipment in Canada over the last few years, among other factors to meet environmental challenges. The Canadian operation has a crucial proximity to the American market. Transport costs are NOK 6-10 lower per kg than for Chilean producers. Furthermore, the temperature conditions (between 7-15 degrees) in the sea off Vancouver Island are ideal for salmon farming.

Source: www.griegseafood.no.

This section has shown that companies in OECD countries play a particularly important role in the globalisation of the aquaculture sector and that foreign direct investment is a key driver. It also shows the importance of market acceptance of species to become a big success; salmon has clearly achieved such status and possibly also catfish and pangasius. While species such as sea bass and bream are important in certain regions (in particular Europe) they have not (yet) achieved the status of global importance. The next species to achieve "global" status could be tuna.

Policy implementation gaps

With some notable exceptions, aquaculture in developing countries is made up of small-scale family holdings that supply the domestic market and produce fish and crustaceans for export. Small-scale producers in developing countries need finance, capacity-building and technology transfer to be able to meet the requirements of the export markets. Domestic action, including through the establishment of co-operatives

and "clustering", can enhance small-scale farmers' ability to participate in the global value chain. Notable exceptions include Viet Nam (pengasius), Thailand and Brazil (shrimp) which all have multinational aquaculture producers producing for the world market.

There are several areas in the aquaculture industry where the public and private sectors intersect. These include government financial assistance, the development of new species and more generally environment-friendly aquaculture, feed compounds, use of space, markets and market access, governance of the industry, food safety and animal health/welfare and research. The following will briefly highlight certain important policy implementation gaps.

Sustainable and responsible aquaculture: The importance of national aquaculture plans that can guide the sustainable development of the industry

In OECD countries, the key challenge for policy makers is to ensure that aquaculture can fulfil its potential taking into account consumer confidence, issues such as competition for space and other environmental constraints in spite of the fact that this may increase production costs. Hence, policy makers need to articulate and develop or further enhance aquaculture strategies and action plans to ensure sustainable production, market acceptance and the ability for products to enter into trade.

Also in aquaculture, sustainability and responsibility is a "*sine qua non*". The image of aquaculture is constantly under pressure, including negative effects on the environment, and the use of medicines, hormones and genetic engineering. Good farming practices are therefore important to introduce and verify, either as part of a government policy or through verification/certification schemes.

Most countries heavily engaged in aquaculture have developed national plans; this has been underpinned by the work of the FAO in developing the Code of Conduct for Responsible Fisheries, which includes a section dealing with aquaculture. Aquaculture in that context is seen as a means to promote diversification of income and diet. The Code furthermore calls for states to "establish, maintain and develop appropriate legal and administrative frameworks which facilitate the development of responsible aquaculture".

The FAO maintains an inventory[5] of national aquaculture legislation. An overview of the inventories across OECD countries suggests that a number of OECD countries have not yet developed national aquaculture plans or not yet submitted their plan to the FAO.[6] Aquaculture plans may specify conditions for aquaculture productions (locality, use of medicine, escapees, cage structure, run off, etc.) that will have an influence of the overall production costs of fish farming. As these aquaculture plans do have a direct impact on the way the aquaculture industry globalises (through the costs of production), it would seem that more effort should be invested into setting up appropriate legislation for the sector and ensuring appropriate implementation.

In terms of the pathways for globalisation in aquaculture, the above overview has attempted to show how farming companies go global. In some cases this is likely to be closely linked to the number of production licenses any given company is allowed to hold and the associated production volume, as well as production costs and costs for delivery to markets (transport). National legislation regarding the distribution of licences and maximum number of licences and/or production any given company may hold may be elements in decision making to go global, although, as noted above, the link with the regulatory framework may not be as obvious due to the positive effects (*e.g.* disease control) of regulations. A review of companies engaged in salmon aquaculture suggests that the

globalisation path nowadays is through acquisitions of companies abroad, rather than by directly investing in start-ups. Traditionally, there has been an important link between salmon farming companies and producers of fish feeds; although most fish feeding companies still own some fish farming interests it is less today than previously.

It is also worth noting that the FAO is in the process of establishing Guidelines for Aquaculture Certification. The purpose of these guidelines is to ensure that certification schemes deliver on their promises with respect to ensuring that certified farms respect certain minimum standards and criteria.

Industry ownership structure

Industry information suggests that the ten largest salmon producers in the world account for roughly 60% of world output of farmed salmon. As an example,[7] and according to IntraFish Media's yearly Industry Report, *The World's 30 Largest Salmon Producers*, global salmon production (tonnes round weight) in 2006 amounted to 1 604 000 tonnes. This was distributed among the ten largest producers as follows:

Table 3.5. **Global salmon production by company**

Company		Tonnes	% world weight
Marine Harvest	Norway	394 900	24.6
Mainstream	Norway	114 900	7.2
AquaChile	Chile	100 000	6.2
Austevoll Seafood	Norway	90 200	5.6
Cooke Aquaculture	Canada	45 000	2.8
Scottish Sea Farms	Norway	43 200	2.7
Grieg Seafood	Norway	42 900	2.7
Salmar	Norway	41 400	2.6
Multiexport Foods	Chile	40 000	2.5
Pesquera Los Fiordes	Chile	40 000	2.5
Total salmon for the world's 30 largest producers		**1 604 000**	**100**

Source: 2007 edition of IntraFish Medias Industry Report, *The World's 30 Largest Salmon Producers*.

As for feed compounds, of the 2 925 000 tonnes[8] of feed compounds produced in 2006, approximately 925 000 tonnes was produced by Skretting (a Nutreco company previously engaged in fish farming through Marine Harvest, but now disinvested), 700 000 tonnes by EWOS (part of Cermaq, see above) and 500 000 tonnes by BioMar (BioMar is involved in salmon farming through the Norwegian company Sjotroll). Thus, 73% of the world output of feed compounds used by aquaculture producers is produced by three companies (which are also involved in aquaculture themselves).

The level of concentration in salmon production may be explained by the fact that companies consolidate and integrate vertically and hence a concentration in ownership exists because aquaculture is highly capital- and knowledge-intensive. The only possible path to further company development and expansion would be through buying up companies or investing abroad. Hence, in terms of globalisation, this also underlines the importance of establishing a solid and forward looking domestic aquaculture legal framework.

Several antidumping actions or investigations of salmon have occurred over the years. The EU and US investigations have concerned the salmon producers of Norway, Chile and the Faroe Islands with the EU and USA, and may have influenced strategic business decisions by the larger companies.

The dependence on fish in feed compounds: The fishmeal trap

Although technological innovations have eased the situation recently, the aquaculture industry continues to be dependent on the production of fishmeal and oil and is in competition with other major users, *i.e.* the production of pigs and hogs. The International Fishmeal and Fish Oil Organisation (IFFO) and the Fishmeal Information Network (FIN)[9] estimate that by 2010 the aquaculture industry will use 50% of the world's fishmeal output and 88% of fish oil. The aquaculture industry's need for more feedstuff may in principle be met by a reduced share of fishmeal and oil use in agriculture production. However, current price trends for fish and plant feedstuffs are on the rise, and in order to meet the future global demand and protein needs of the global market, investments in alternatives to fish meal and oil, and into the development of alternative non-carnivorous species with market appeal are needed.

Box 3.4. **Aquaculture feed**

Feed costs account for a significant proportion of total production costs within the salmon farming sector (more than 50% of total production cost in the cage), and fluctuations in feed prices could therefore have a major impact on profitability within the industry. Feed prices are affected both by the global market for fishmeal and marine/animal/vegetable oils, and the fact that the feed industry is dominated by a small number of large, global producers. Natural limitations in the marine resource base could lead to global shortages of fishmeal and oil for fish feed production. The feed producers have, however, come a long way in their efforts to replace some of the marine-based input factors with vegetable raw materials. Hence, the industry sensitivity to shortage of marine feed stuff has been significantly reduced since 2001.

Source: www.griegseafood.no/docs/080607_GSF_Prospekt.pdf.

In view of the growing dependence on the aquaculture sector across the fisheries market this may be a shared problem that needs co-operative approaches across countries. Assuming that farmed production of carnivorous species continue to grow, it will become increasingly important that aquaculture producers link up with feed processors and are in proximity to fishmeal/oil production. It should however be pointed out that the aquaculture feed industry has made significant progress in substituting the fish based feed with vegetable material and that further development in that direction is likely in the future. In some parts of the world (Asia in particular) the need for fish meal and oil contributes to overfishing and fishing of juveniles. It is important in this regard that fish meal fisheries are sustainably managed.

Box 3.5. **Aquaculture feed and sustainability**

In Marine Harvest we have a clear focus on safety and sustainability of raw materials used in feed. With regard to marine raw materials (fishmeal and fish oil), we are working with our feed suppliers to ensure that the feed comes from controlled and, in the future, possibly also certified sources. We expect marine raw materials to continue to be important feed ingredients in the future, but due to limitations in supply and competition from other industries, *e.g.* producers of omega-3 capsules, pig and chicken production, growth in salmon production will depend on using alternative feed raw materials.

Source: Annual Report 2007 Marine Harvest, *http://hugin.info/209/R/1222038/257419.pdf.*

Environmental issues and pollution from aquaculture: Dealing with the image of fish farming

Aquaculture can potentially have certain environmental effects. Chief among these are:

- The release of nitrogen/phosphorous though faeces and feed not eaten by fish can cause nutrient enrichment and hence eutrophication.
- The use of wild caught stocking material can have significant impacts on wild stocks (*e.g.* tuna and eel) as juveniles are being removed and hence will not be reproducing.
- Escapees from farms may intermingle with wild stocks or invade areas as non-indigenous species. This may have biodiversity impacts and cause changes in genetic diversity.

Such issues need to be addressed in a coherent way to help underpin the image that fish farmers wish to project to the public, *i.e.* that the industry is sound and well managed and can contribute substantially to overall food-fish production. For the free flow of aquaculture produce across borders and for certification schemes it may be necessary to address such issues on a global level. In this regard, it is important to identify the respective roles of governments *versus* producers. It also highlights the importance of sustainable aquaculture planning frameworks. The institutionalisation of a dialogue between producers, public authorities, consumer interests and environmental NGOs may be a particularly useful way forward; appropriate solutions may also help to expand sales from aquaculture abroad. It is recognised that a number of countries already consult widely among stakeholders.

Consideration of environmental issues in aquaculture is a particular challenge for developing countries and may be linked to gaining (or retaining) market access in developed markets – and hence to be able to benefit from globalisation. Certification systems flourish and could limit access to markets while, concurrently, helping producers to improve production and quality. Developed countries should in this regard consider providing development assistance and knowledge transfer. The case of the Swiss SIPPO (Swiss Import Promotion Programme) assisting several developing countries move to organic production (in particular of shrimps) is an example of how such transfer of knowledge may take place.

Particular challenges and opportunities for developing countries

Most aquaculture production in developing countries is fragmented in fairly small family holdings. From this observation at least four issues arise that will help in the articulation of a strategy to allow developing countries to benefit from global aquaculture markets:

- A need to build co-operative marketing centres that can take in produce from small-scale holdings and provide essential marketing services.
- A need to identify and develop appropriate finance mechanisms as most commercial banks will not lend money to small-scale producers.
- Improved access to technical extension/help to improve farming.
- Improved transport and cold storage facilities.

Several case studies presented to the OECD/FAO Workshop on Opportunities and Challenges of Fisheries Globalisation provided evidence on various ways to overcome or address such shortcomings in developing countries. In India, for example, shrimp farming is an important industry with growing exports to OECD countries. However, 90% of shrimp farms are of less than 2 hectares, *i.e.* small-scale and marginal farmers. Concurrently,

since 2000, the farm gate price for shrimp has been constantly falling due to global increases in production and certain marketing difficulties (*e.g.* US antidumping actions). This may require a new approach to institutional and governance structures.

In particular, individual small-scale farmers have little bargaining power and many will not have the necessary installations to provide a product that is acceptable to the international market. Pooling their efforts through the clustering of small-scale farms and the establishment of co-operatives has been successful and may provide an answer in the future for developing countries. Also, as global markets for aquaculture products grow and the requirements for environmental quality control, health and hygiene become more stringent, developing countries need to reassess the role and objectives of their aquaculture sector. While social objectives may be prevalent in today's farming strategy in developing countries, as competition becomes fiercer and prices decrease more emphasis on large scale industrialisation may be warranted.

The availability of finance to small-scale farmers can be an important impediment to further growth in the aquaculture sector in developing countries and therefore on their ability to benefit from globalisation. Microfinance institutions are better equipped in addressing the interests of small-scale farmers and their development should be encouraged. Guidelines to this effect have already been published by the FAO.[10]

NACA (the Network of Aquaculture Centres in Asia-Pacific)[11] is a co-operative effort by a number of countries to share and mutually inform each other of aquaculture research and activities. NACA, an intergovernmental organisation, promotes rural development through sustainable aquaculture, improved rural income, increased food production and foreign exchange earnings and diversified farm production. NACA's activities include: capacity building through education and training; collaborative research across the membership; information and communication networks; policy guidelines and support to institutional capacities; aquatic animal health and disease management; and genetics and biodiversity. NACA has several partners in the donor community and among the specialised international agencies dealing with development or aquaculture. Such centres could have equally positive effects in other parts of the world, in particular in Africa and South America, and their establishment should be encouraged.

Establishing speciality markets (*e.g.* organic shrimp aquaculture) may provide a new orientation and strategy for further growth. One example, presented to the Workshop (the Swiss Import Promotion Programme), provides assistance to farmers in developing countries to convert products to organic, which is popular in OECD countries and consumers, and obtains premium prices. This segment is foreseen to have substantial future growth, particularly as consumers in developing countries are increasingly oriented towards health concerns.

Notes

1. "Globalisation Overview", in *Globalisation and Fisheries: Proceedings of an OECD-FAO Workshop* (OECD/FAO, 2007).
2. Austevoll Seafood has recently bought out the company Leroy Seafood Group.
3. Additional information on the cost structure in Norwegian aquaculture can be found at *www.fiskeridir.no/fiskeridir/english/aquaculture/reduced_profitability_for_the_norwegian_fish_farming_industry*.
4. For example in Norway approval from the authorities must be obtained if a company controls more than 15% of the total allowable biomass (TAB). The maximum limit is control of 25 per cent of the TAB.

5. *www.fao.org/fi/website/FIRetrieveAction.do?dom=collection&xml=nalo.xml*.
6. Countries that have submitted a plan are Australia, Canada, Denmark, France, Germany, Ireland, Italy, United Kingdom, Japan, Mexico, New Zealand, Norway and United States. Among the observers to the Committee, Thailand has submitted a plan.
7. The salmon industry is particularly well surveyed.
8. Information from Cermaq posted at *http://hugin.info/134455/R/1030396/165276.pdf*.
9. See *www.iffo.net/* and *www.gafta.com/fin/fin.html*.
10. U. Tietze and L.V. Villareal (2003), "Microfinance in Fisheries and Aquaculture: Guidelines and Case Studies", FAO Fisheries Technical Paper No. 440, Rome, FAO.
11. *www.enaca.org/modules/tinyd1/*.

Bibliography

Dommen, Caroline (2000), "Fish for Thought: Fisheries, International Trade and Sustainable Development – Initial Issues for Consideration by a Multi-stakeholder Policy Dialogue, Research and Information Exchange Process", *Natural Resources, International Trade and Sustainable Development Series*, No. 1, ICTSD, Geneva.

European Commission (2006), *Proposal for a Council Decision on the Conclusion of the Agreement in the Form of an Exchange of Letters on the Provisional Application of the Fisheries Partnership Agreement between the European Community and the Islamic Republic of Mauritania on Fishing in Mauritanian Fishing Zones and of the Protocol Setting out the Fishing Opportunities and Financial Contribution which Applies from 1 August 2006 to 31 July 2008* [COM(2006)505 final], European Commission, Brussels.

European Parliament (2006), *Report on the Proposal for a Council Decision on the Conclusion of the Agreement in the Form of an Exchange of Letters on the Provisional Application of the Fisheries Partnership Agreement between the European Community and the Islamic Republic of Mauritania on Fishing in Mauritanian Fishing Zones and of the Protocol Setting out the Fishing Opportunities and Financial Contribution which Applies from 1 August 2006 to 31 July 2008*, PE v04-00, European Parliament, Brussels.

FAO (2004), *State of the World's Fisheries and Aquaculture Resources*, FAO, Rome.

Garibaldi, Luca and Luca Limongelli (2003), "Trends in Oceanic Captures and Clustering of Large Marine Ecosystems – Two Studies Based on the FAO Capture Database", *Fisheries Technical Paper 435*, FAO.

Gorez, Beatrice (2005), *Policy Study: EU-ACP Fisheries Agreements*, Coalition for Fair Fisheries Arrangements, Brussels, Belgium.

Institute for European Environmental Policy, *Fisheries Agreements with Third Countries – Is the EU Moving towards Sustainable Development?*, WWF, UK.

ICTSD (2006), "Fishing, International Trade and Sustainable Development: Policy Discussion Paper", *Natural Resources, International Trade and Sustainable Development Series*, ICTSD, Geneva.

Lange, Glenn-Marie (2003), "The Value of Namibia's Commercial Fisheries", *Directorate of Environmental Affairs Research Discussion Paper*, No. 55, Ministry of Environment and Tourism, Namibia.

Maggi, Bernard (2005), "Namibian Fishing Industry: An Overview", *The Namibian*, Namibia, 8 April, *www.namibian.com.na/2005/April/national/05A709D78B*.

Mwikya, Mbithi S. (2006), "Fisheries Access Agreements: Trade and Development Issues", *ICTSD Natural Resources, International Trade and Sustainable Development Series Issue Paper*, No. 2, International Centre for Trade and Sustainable Development, Geneva, Switzerland.

Norsk Hydro (2006), Norsk Hydro ASA (Norsk Hydro) or *www.competition-commission.org.uk/rep_pub/reports/2006/fulltext/520.pdf*, final report on the "Pan Fish and Marine Harvest NV Merger Inquiry".

OECD (2007), *Globalisation and Fisheries: Proceedings of an OECD-FAO Workshop*, OECD/FAO, 2007, Paris.

Grafton, Quentin R., James Kirkley, Tom Kompas and Dale Squires (2006), "Economics for Fisheries Management", Ashgate Pub. Co., Ireland.

Swartz, Wilfram Ken (2004), "Global Maps of the Growth of Japanese Marine Fisheries and Consumption", University of British Columbia, Canada.

Tietze, U. and L.V. Villareal (2003), "Microfinance in Fisheries and Aquaculture: Guidelines and Case Studies", FAO Fisheries Technical Paper, No. 440, FAO, Rome.

Toueilib, Chérif Ould (2007), *Globalisation and Fisheries: Proceedings of an OECD-FAO Workshop*, OECD/FAO, 2007, Paris.