How did the World Fare in Fisheries and Aquaculture in 2004? Let's take a look at SOFIA 2006

The State of World Fisheries and Aquaculture, 2006 (SOFIA 2006) is out – FAO's authoritative wide-ranging macro-analysis of global fisheries and aquaculture for 2004.

SOFIA is perhaps the best-known five-letter word in fisheries! It is the product of a regular exercise carried out by FAO staff and consultants, based on data worldwide. Because of the time taken to collect, compile, assemble and analyse data globally, arrive at conclusions, then present and disseminate it, SOFIA 2006 deals with 2004.

SOFIA 2006 takes up about 175 pages. Like its predecessors, it is in four parts. Part I is a review of world fisheries and aquaculture. Part 2 discusses select issues facing fisheries and aquaculture. Part 3

highlights special FAO studies. Part 4 is an "outlook" for the future. The book comes with a CD-ROM containing a "World fisheries and aquaculture atlas",

This article provides glimpses into the 175-page publication – facts, insights, revelations. (For a copy of this important publication, you may write to the Sales and Marketing Group, Electronic Publishing Policy and Support Branch, FAO, Via delle Terme di Caracalla, 00153 Rome, Italy.)

Part 1: World Review of Fisheries and Aquaculture

Part 1, containing 60 pages, is the biggest part of SOFIA 2006. It is devoted to "Fisheries resources: trends in production, utilization and trade". What appears below is a summary of the 6-page "Overview" of trends in fish production, utilization and trade worldwide, with which Part 1 begins.

Capture fisheries and aquaculture supplied the world with about 106 million tonnes of food fish in 2004. Of this total, aquaculture accounted for 43 percent. Per capita supply works out to 16.6 kg, the highest on record, but to 13.5 kg if China is excluded. Overall, fish provided more than 2.6 billion people with at least 20 percent of their average per capita animal protein intake.

Outside China, per capita supply has shown a modest growth rate of about 0.4 percent per year since 1992 (following a decline from 1987). The rising numbers in aquaculture supply more than offset the effects of static capture fishery production and a rising population.

Preliminary estimates for 2005 indicate that total world fishery production reached almost 142 million tonnes, an increase of over 1 million tonnes compared with 2004. Although the total amount of fish available for human consumption is estimated to have increased to 107 million tonnes, the global per capita supply remained at about the same level as in 2004 because of population growth.

China remains by far the largest producer, with a reported fisheries production of 47.5 million tonnes in 2004 (16.9 and 30.6 million tonnes from capture fisheries and aquaculture, respectively). But as in earlier years, there are indications that statistics for capture fisheries and aquaculture production for China may be too high. This problem has existed since the early 1990s.

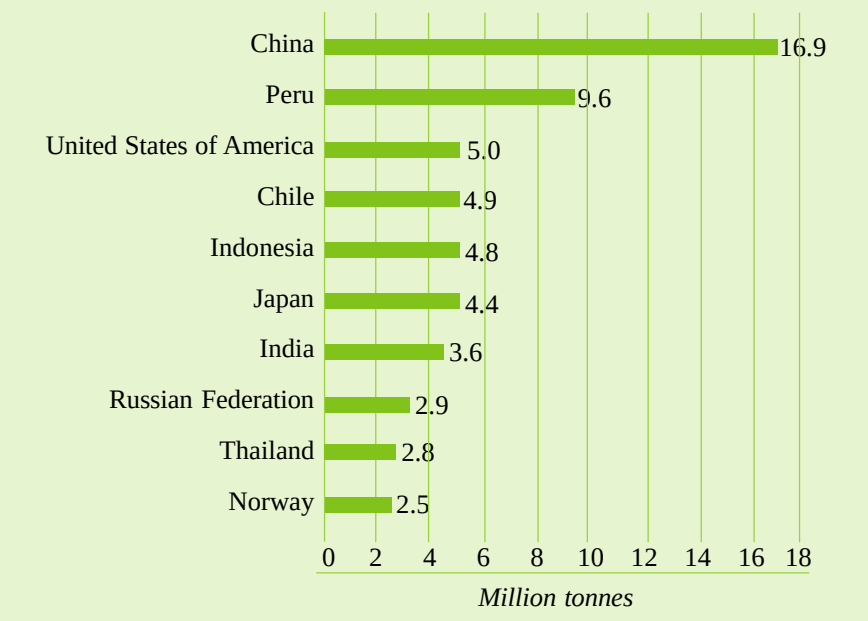
Because of the importance of China and the uncertainty about its production statistics, China is generally discussed separately from the rest of the world.

Global capture fisheries production reached 95 million tonnes in 2004, with an estimated first-sale value of US $ 84.9 billion. China, Peru and the United States remained the top producing countries.

World capture fisheries production has been relatively stable in the past decade. The exception relates to marked fluctuations in catches of Peruvian anchoveta in the Southeast Pacific. Total marine catches accounted for 85.8 million tonnes in 2004.

The Mediterranean Sea and the Black Sea remained the most stable marine areas in terms of capture production. Catches from inland waters, about 90 percent of which occur in Africa and Asia, have shown a slowly but steadily increasing trend since 1950, owing in part to stock enhancement practices, and reached a record 9.2 million tonnes in 2004.

Marine and inland capture fisheries: top ten producer countries in 2004



Aquaculture continues to grow more rapidly than all other animal food-producing sectors, with an average annual growth rate of 8.8 percent per year since 1970, compared with only 1.2 percent for capture fisheries and 2.8 percent for terrestrial farmed meat production systems. However, there are signs that the rate of growth for global aquaculture may have peaked, although high growth rates may continue for some regions and species.

Aquaculture production in 2004 was reported to be 45.5 million tonnes with a value of US $ 63.3 billion. Of

World fisheries and aquaculture production and utilization

	2000	2001	2002	2003	2004	2005[1]
	(million tonnes)					
Production						
Inland						
Capture	8.8	8.9	8.8	9.0	9.2	9.6
Aquaculture	21.2	22.5	23.9	25.4	27.2	28.9
Total inland	**33.0**	**31.4**	**32.7**	**34.4**	**36.4**	**38.5**
Marine						
Capture	86.8	84.2	84.5	81.5	85.8	84.2
Aquaculture	14.3	15.4	16.5	17.3	18.3	18.9
Total Marine	**101.1**	**99.6**	**101.0**	**98.8**	**104.1**	**103.1**
Total Capture	95.6	93.1	93.3	90.5	95.0	93.8
Total Aquaculture	35.5	37.9	40.4	42.7	45.5	47.8
Total World Fisheries	**131.1**	**131.0**	**133.7**	**133.2**	**140.5**	**141.6**
Utilization						
Human consumption	96.9	99.7	100.2	102.7	105.6	107.2
Non-food uses	34.2	31.3	33.5	30.5	34.8	34.4
Population (billions)	6.1	6.1	6.2	6.3	6.4	6.5
Per capita food fish supply (kg)	16.0	16.2	16.1	16.3	16.6	16.6

Note: Excluding aquatic plants
[1] *Preliminary estimate*

the world total, China is reported to have accounted for nearly 70 percent of the quantity and over half the global value of aquaculture production. All regions showed increases in production from 2002 to 2004.

Freshwater culture continued to dominate, followed by mariculture and brackishwater culture. Carps accounted for 40 percent of all production of fish, crustaceans and molluscs. The period 2000-04 saw strong growth in production of crustaceans, in particular, and of marine fish.

In the same period, production in developing countries other than China increased at an annual rate of 11 percent, compared with 5 percent for China and about 2 percent for the developed countries. With the exception of marine shrimp, the bulk of aquaculture production within developing countries in 2004 comprised omnivorous/ herbivorous fish or filter-feeding species. In contrast, carnivorous species accounted for approximately three-quarters of finfish culture production in developed countries.

During the past three decades, the number of fishers and aquaculturists has grown faster than the world's population. In 2004, an estimated 41 million people worked as fishers and fish farmers, the great majority of these in developing countries, principally in Asia. The significant increase in numbers in recent decades is because of a strong expansion of aquaculture activities.

In 2004, fish farmers accounted for a quarter of the total number of fish workers in the primary sector. China has the highest number of fishers and fish farmers, reportedly 13 million in 2004, representing about 30 percent of the world total.

In China, fleet-size reduction programmes to tackle overcapacity are reducing the number of people engaged in capture fisheries. This number declined by 13 percent during the period 2001-04. In most industrialized countries, too, the numbers engaged in fishing and aquaculture are either declining or stationary.

The world fishing fleet comprised about 4 million units at the end of 2004, of which 1.3 million were decked vessels of various types, and 2.7 million undecked (open) boats. While virtually all decked vessels were mechanized, only about one-third of the undecked fishing boats were powered, generally with outboard engines. The remaining two-thirds were traditional craft of various types operated by sail and oars. About 86 percent of the decked vessels were concentrated in Asia.

Many countries are limiting the growth of national fishing capacity or reducing it – both to protect fishery resources, and to make fishing economically viable for harvesting enterprises. Overall, the number of fishing vessels worldwide did not change significantly in either 2003 or 2004.

Just as the world fishing fleet appears to have stabilized, the state of exploitation of the world's marine fishery resources has tended to remain relatively stable.

Over the past 10 to 15 years, the proportion of overexploited and depleted stocks has remained unchanged, after showing a marked increase during the 1970s and 1980s. It is estimated that in 2005, as in recent years, around one-quarter of the stock groups monitored by FA0 were under-exploited or moderately exploited. About half of the stocks were fully exploited, with no room for further expansion. The remaining stocks were either overexploited, depleted or recovering from depletion.

This confirms earlier observations that the maximum wild capture fishery potential from the world's oceans has probably been reached. Fisheries management is necessary to rebuild depleted stocks and prevent the decline of those being exploited close to their maximum potential.

In the case of inland fishery resources, there is widespread overfishing, arising from either intensive targeting of individual large-size species in major river systems or overexploitation of highly diverse species assemblages or ecosystems in the tropics.

Total world trade in fish and fishery products reached a record value of US$71.5 billion (export value) in 2004, representing a 23 percent growth relative to 2000.

In real terms (adjusted for inflation), exports of fish and fishery products increased by 17.3 percent during 2000-04.

China has been the world's main exporter since 2002, and in 2004 its fish exports were valued at US$ 6.6 billion. (China has recorded a remarkable average annual growth of 12 percent in the period 1992-2004.)

The fishery net exports of developing countries (*i.e.* the total value of their exports less the total value of their imports) have shown a continuing rising trend over the past two decades, growing from US $4.6 billion in 1984 to US $16 billion in 1994 to US $20.4 billion in 2004. These figures are significantly higher than those for other agricultural commodities such as rice, coffee and tea.

Shrimp continues to be the most important commodity traded in value terms, (16.5 % of the total value of internationally traded fishery products in 2004) followed by groundfish (10.2 %), tuna (8.7 %) and salmon (8.5%).

Marine fisheries governance: Regional fisheries management organizations (RFMOs) play a unique role in facilitating international co-operation for the conservation and management of fish stocks. These organizations are the only realistic means of governing fish stocks that occur either as straddling or shared stocks between zones of national jurisdiction, between these zones and the high seas, or exclusively on the high seas.

Strengthening RFMOs in order to conserve and manage fish stocks more effectively remains the major challenge facing international fisheries governance. (see pages 9-10)

Despite efforts over the past decade to improve their management capacity, some RFMOs have failed to achieve their fundamental goal of sustainable management of stocks.

For inland fisheries too, a system of governance is needed for transboundary fisheries and fishery resources. Many of the world's large river basins cross one or several international borders, and many riverine fish species migrate across boundaries. Result: activities in one country may affect fish stocks and communities exploiting the fish stocks in another country.

Unlike capture fisheries, aquaculture activities are generally located within national jurisdictions; governance in aquaculture is therefore a national responsibility. There is growing understanding that sustainable development of the aquaculture sector requires an enabling environment, with appropriate institutional, legal and management frameworks guided by an overall policy.

Notable progress has been made in a number of institutional, legal and management development areas, including the use of various public sector- private-sector partnership arrangements.

In recent years, issues relevant to international trade in fishery products have been prominent. They include labelling and traceability requirements; ecolabelling; illegal, unreported and unregulated (IUU) fishing; the sustainable development of aquaculture; subsidies in production and trade agreements. Some of these issues form a part of the agenda for the multilateral trade negotiations in the World Trade Organization (WTO).

Part 2: Selected Issues in Fisheries and Aquaculture

Part 2 of SOFIA 2006 contains a valuable discussion of select issues

in fisheries and aquaculture. These take up 36 pages. Only a listing of these issues is possible in this article.

- The Code of Conduct for Responsible Fisheries: Moving into the Second Decade of Implementation.
- Sustainable growth and expansion of aquaculture: an ecosystem approach.
- The allocation of fishing rights: an evolving issue.
- Impact of market-based standards and labels on international fish trade.
- HIV and AIDS in fishing communities: a public health issue but also a fisheries development and management concern.

Part 3: Highlights of Special Studies

This 40-page section highlights some special studies conducted by the FAO.

These are listed below:

- Rehabilitation of riverine habitat for fisheries.
- Responsible fish trade and food security.
- Trash or treasure? Low-value/ trash fish from marine fisheries in the Asia-Pacific region.
- Conservation and management of shared fish stocks: legal and economic aspects.
- Marine capture fisheries management in the Indian Ocean: status and trends.
- Refuelling the fishing fleet.
- Causes of detentions and rejections in international fish trade.

Fish production in 2004 and projections for 2010 and later

	Simulation target year						
	2000	2004	2010	2015	2020	2020	2030
Information Source	FAO statistics[1]	FAO statistics[2]	SOFICA 2002[3]	FAO Study[4]	SOFIA 2002[3]	IFPRI study[5]	SOFIA 2002[3]
Marine capture	86.8	85.8	86		87		87
Inland capture	8.8	9.2	6		6		6
Total capture	95.6	95.0	93	105	93	116	93
Aquaculture	35.5	45.5	53	74	70	54	83
Total production	131.1	140.5	146	179	163	170	176
Food fish production	96.9	105.6	120		138	130	150
Percentage used for food fish	74%	75%	82%		85%	77%	85%
Non-food use	34.2	34.8	26		26	40	26

Note:All figures - other then percentages - are in million tonnes.

[1] Based on the statistics available to the FAO fishery information, Data and Statistics Unit in 2000.

[2] Based on latest statistics of the FAO Fishery Information, Data and Statistics Unit.

[3] FAO. 2002. The State of World Fisheries and Aquaculture 2002. Rome.

[4] FAO. 2004. Future prospects for fish and fishery products: medium-term projections to the years 2010 and 2015. FAO Fisheries Circular FIDI/972-1. Rome.

[5] International Food Policy Research Institute. 2003. Fish to 2020: supply and demand in changing global markets, by C. Delgado, N. Wada, M. Rosegrant, S. Meijer and M. Ahmed. Washington. DC.

Part 4: Outlook

The 11-page Part 4 of SOFIA 2006 describes the outlook for the future for fisheries and aquaculture, and does so in two parts. The first part revisits global projections for 2010 in fisheries and aquaculture contained in SOFIA 2004, in the light of what has happened since the projections were made. The second part summarizes important findings of a comprehensive FAO study on aquaculture.

What appears below provides a peek into both parts.

a) Revisiting global projections

World fisheries and aquaculture production have moved towards the figures predicted for 2010. Marine fisheries have reached a ceiling in terms of output. But a growing aquaculture sector is enabling per capita supplies of fish to remain almost constant.

Marine capture fisheries: The image of stagnation provided by marine capture fisheries is false. The stagnation in terms of output in no way reflects a stagnating sector. Not only are landings increasing in some fisheries (exemplified by the fisheries in the Northwest Atlantic) and decreasing in others, but the sector is continuously adjusting to changing political, economic and social environments.

While some stocks are recovering, there is no indication that landings for these stocks will expand to exceed the historical maximum sustainable yield levels.

It seems reasonable to expect that marine capture fisheries production will remain between 80 and 90 million tonnes per year, with an average somewhere in the middle of this range.

Freshwater capture fisheries: Contrary to projections, landings from inland fisheries have remained high and even increased somewhat. The projection for 2010 was that landings would have fallen to two-thirds of the 2000 level. However, the projection was based mainly on records from the organized commercial sector, and failed to take note of the larger subsistence sub-sector. Efforts are now under way by both FA0 and others to improve the official records for both commercial and non-commercial inland fisheries.

Aquaculture : Aquaculture (excluding aquatic plants) production continues to grow both in China and in the rest of the world. It is noteworthy that aquaculture production over the past four years has grown faster outside China (37 per cent) than in China (24 percent). It looks as if the prediction of 53 million tonnes of aquaculture production for 2010 will be met**.**

A first impression is that, at least during the rest of the current decade, aquaculture will contribute to future world fish supplies as was expected in 2000.

Fish utilization: Projections for 2010 were that the quantities of fish used for non-food purposes would decline from about 35 million tonnes per year to 26 million tonnes per year. This does not seem to be happening. In 2004, the quantities used for non-food uses were as high as four years earlier. The main reason seems to be increases in anchoveta landings in Chile and Peru.

b) Medium-term challenges and constraints for aquaculture

FA0 recently concluded a prospective analysis intended to provide insights into the future of aquaculture globally.

The process was complex. The analysis encompassed the preparation of national aquaculture sector overviews for more than 100 countries, five regional workshops, seven reports on regional aquaculture development status and trends, and a global expert survey on aquaculture development using the Delphi Technique.

The material developed in this way was synthesized to form a draft global review of the status and trends in aquaculture development. Subsequently, this document was submitted to a group of experts, who were requested to craft a 'prospective analysis of future aquaculture development.' Here are some highlights from the prospective analysis.

Of the many factors that determine the supply of aquaculture products, those outlined below are expected to play a lead role in the coming decades.

Access to land and water resources, and intensification

There is little new land available for fish farming in most countries

around the world, especially in Asia, the leading aquaculture producer. Land shortage is likely to remain one of the major constraints to aquaculture expansion globally.

Governments have taken various measures to address the issue, such as conversion of agriculture to aquaculture land, and integration of aquaculture into existing farming systems.

In the case of shrimp farming, most existing mangroves are protected against encroachment. Because there is no possibility of increasing land area, one solution is to intensify landbased production. In fact, intensification is becoming a growing trend in aquaculture worldwide. But costs go up with the level of intensification; not all farmers are expected to intensify.

The unavailability of freshwater could also limit future aquaculture development. Its use in aquaculture is frequently regarded as a loss for agriculture. In many cases, agriculture has been given priority in the allocation of water.

Access to adequate feed: fishmeal, fish oil and "low-value/ trash fish"

The use of aquafeeds will continue to play an important role in aquaculture development and production. Their availability and the cost of feed can be critical constraints to aquaculture.

With the predicted global increase in aquaculture production, the demand for aquafeed will continue to grow. One tends to be optimistic about the supply of fishmeal and fish oil for aquaculture feed. But demand from developing economies such as China may have a profound impact on overall supply and demand.

The use of low-value trash fish in aquaculture is also an important factor for future development. It is projected that, by 2013, China alone would require 4 million tonnes of low-value trash fish to sustain its marine cage culture. It seems the use of low-value trash fish in aquaculture feed is unlikely to be sustainable. There are also concerns that the continued use of low-value trash fish will generate environmental effects and biosecurity risks.

Greater capitalization and diversification of production systems and species: In spite of limited land and water resources, aquaculture entrepreneurs, attracted by high prices, are likely to find new ways of producing sufficient fish to meet demand.

Greater production requires greater capitalization. In the long run, aquaculture employers will have to use less labour and more capital to maintain the profit margins needed to stay in business. Therefore, an allocation of productive resources towards the production of high-commercial-value species, away from low-value species, can be expected.

Aquaculture of non-food species such as ornamental fish farming is an industry full of promise. Because of its growing potential for increasing rural employment and income and generating foreign exchange earnings, governments are increasingly promoting the culture and trade of ornamental fish. However, the outbreak of diseases is a threat to the development of this industry.

Ecotourism is an emerging industry and has the potential to spread throughout the world. A number of countries are promoting aquaculture-related ecotourism. Recreational fisheries in lakes and reservoirs play a significant role in Central and Eastern Europe.

In Malaysia, there is a growing interest in integrating aquaculture operations with tourism, such as marine cage culture and "put and take" fishing ponds. Offshore sites are a potential area where aquaculture-related ecotourism could be further developed.

The farming of seaweed has expanded rapidly. The seaweed industry provides a range of products generating an annual production value of US $ 5.5-6 billion. There are indications that the seaweed industry is likely to expand in the coming decades.

Access to capital: With progressive intensification and diversification of aquaculture to systems and species requiring sophisticated technologies, access to capital will be a key factor for development. Capital will be needed not only for investment and operating costs, but also for aquaculture insurance.

While access to capital might not be an issue in developed countries, it is certainly a stumbling block to aquaculture development in the developing world.

Environmental management: Intensification may sustain the profitability of farming operations, but it does so at a cost.

Farmer and consumer associations, civil society and institutional buyers such as supermarket chains and other key stakeholder groups are actively promoting the development of standards and codes aimed at ensuring an environmentally and socially responsible aquaculture. Such improvements have been noticeable worldwide for a number of commodities, particularly salmon.

Rising energy costs: Even before the current global energy crisis, energy costs represented an important share of the production costs in many commercial aquaculture operations. With further intensification and the use of more sophisticated technologies, it is likely that more energy will be needed, thereby exacerbating the energy cost problem.

As for land and water, aquaculture must compete with other activities for energy. To alleviate this problem, researchers around the world are seeking low-cost energy sources. More efficient pumps have been suggested as one of the options. Another is the use of recirculating systems. Wind-powered pumps are being used on a limited scale in freshwater

aquaculture in many countries, but their capital cost is high.

Human resources development: Human resources development is pivotal to the future of aquaculture. Can progress in building the human capacity of the public and private sectors keep pace with new developments in technology, international trade and legislation?

Related issues, many of which are beyond the control of the aquaculture sector, include the so-called "brain drain", or migration of trained personnel from developing to developed countries, and the loss of human and social capital because of the effects of HIV and AIDS in many parts of the world, particularly in Africa, and natural disasters, such as the 2004 tsunami.

Research and development: As aquaculture continues to feel the pressure to expand, research and development will be a key. Research faces the challenge of providing policy-makers and practitioners with cutting-edge knowledge and innovations.

Aquaculture development has been hampered, however, by three factors relating to the fundamental requirements of research and development: insufficient funds, lack of core research staff and weak research infrastructure.

lnformation and communication technologies and networking :

Continuous dramatic advances in information and communications technologies are creating new opportunities for communication. Governments and other stakeholders in aquaculture development need to tap these opportunities. lnformation exchange through networking is likely to play an important role in the development of the sector.

Access to markets: Growing national and international markets and the ability to trade in these markets will strongly influence the growth of aquaculture. International trade of farmed fish has been going up.Trade expansion has also induced some countries to apply high import tariffs on fish and fishery products, to protect domestic aquaculture industries.

With the progressive liberalization of trade, tariffs have been lowered in many instances. However, non-tariff barriers have emerged as the main obstacle to trade and market access for exports to developed countries. Exporters are accused of dumping their products, or of benefiting from subsidies. These have led to import curbs and duties. Such disputes are increasingly being brought to the WTO for resolution.

As the industry grows and more aquaculture products move into international trade, the competition for market shares will become stiffer. More disputes can be expected. Access to export markets has also been complicated by regulations concerning product quality and safety requirements introduced by importing countries.

Given the significant contribution of developing countries to global aquaculture production, growing protectionism in developed countries would, of course, reduce aquaculture production in the developing world, and the per capita supply of fish.

The impact of increased protectionism will be felt most keenly by small producers. They may not be able to bear the high costs of compliance and may get pushed out of business. Market diversification may therefore play an important role. One outcome would be the development of niche markets, such as for organic aquaculture products or aquaculture ecolabels.

Further liberalization of fish trade under new agreements could provide new opportunities for expansion of aquaculture. Additionally, in many developing countries, domestic aquaculture industries compete with imports for domestic market shares. To overcome this problem, aquaculture producers and processors are slowly moving towards the development of processed products for both national and export markets.

This value-addition strategy is an avenue for improving the profitability of aquaculture enterprises. There is also a trend towards targeting local urban markets with standardized, value-added "easy-to-cook" or "super-market type" products. As competition for markets increases, these trends are likely to grow and intensify.

Sound policies and governance

Good governance, including political stability, has a major influence on aquaculture development. It reduces the costs of doing business, attracts investment into the sector and enhances the industry's competitiveness.

Greater aquaculture sustainability will be achieved by strengthening farmer associations and by encouraging self-regulation in the aquaculture industry. In many countries, there is no legislation specifically for aquaculture. Instead the sector is governed by a multiplicity of ad hoc laws.

In countries with incipient aquaculture industries, governments may invest substantial sums in building institutions and establishing governance arrangements for aquaculture. As law enforcement is a constraint in many countries, strong emphasis will be placed on increasing self-regulation through farmer associations. Self-regulation is likely to grow and become a norm.

Government support

Generally, a government's commitment to strong support for the aquaculture sector is a prerequisite for the sector's sustainable development.

The level of commitment will vary within and among regions. But it is expected that in countries where aquaculture contributes substantially to growth, poverty alleviation and food security, the commitment will hold, and that the level of support will increase.