

Responsible Aquaculture Development for the Next Millennium

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Abstract

With the world population doubling in size from 3 to 6 billion people from 1960 to 1999 and currently growing at 1.33% per year (or an annual net addition of 78 million people), and expected to reach 7.3 to 10.7 billion by 2050 (with 8.9 billion considered most likely), there are growing doubts as to the long term sustainability of many traditional agricultural food production systems in being able to meet the increasing global demand for food. Nowhere is this more critical than within many of the world's developing countries, and in particular within those Low-income Food-deficit countries (LIFDC; currently representing over 62% of the world's population), which are net importers of food and lack sufficient earnings to purchase food to cover their basic dietary needs. Of the multitude of agricultural food production systems, aquaculture is widely viewed as being an important potential candidate capable of contributing to reductions in the shortfall in the terrestrial food basket. Aquaculture, the farming of aquatic plants and animals, has been the fastest growing food production sector for over a decade. Total global production from aquaculture more than tripled from 10 million metric tons (mmt) in 1984 to over 36 mmt in 1997, and production grew at an average compound rate of 11% per year since 1984. In contrast to traditional livestock food production systems, the bulk of global aquaculture is realised within developing countries (89.6% total) and LIFDCs (80.6% total).

Despite its good prospects and apparent potential for continued growth, the aquaculture sector has not been without its problems and critics. In particular, there have been concerns raised related to deficiencies in existing aquaculture legislation and planning methods, the use of certain farming practices, issues of resource use efficiency, disease treatment and control, environmental degradation, social welfare, and employment opportunities, etc. Although the majority of these are not unique to the aquaculture sector, it is imperative that these issues be addressed and resolved if the sector is to emerge into a major global food production sector in the next millennium.

In addition, the present paper reviews the origins and salient features of the FAO Code of Conduct for Responsible Fisheries (CCRF), and in particular of Article 9 of CCRF concerning aquaculture development. An overview is also presented of ongoing and planned initiatives concerning the implementation of the code. In particular, the paper attempts to consider the existing socioeconomic conditions of the majority of aquaculture producing countries within the Asian region, and the real basic need of identifying affordable and practical solutions to aid the development of the sector. Particular emphasis is placed on the need of government to provide an enabling economic and legislative environment and umbrella for the *sustainable* and *responsible* development of the sector, and the need for increased collaboration between the private and public sector organizations, and government engaged in all stages of the aquaculture development process.

Introduction

With the world population doubling from 3 billion people in 1960 to 6 billion in 1999, and currently growing at 1.33% per year (or an annual net addition of 78 million people), and expected to reach 7.3 to 10.7 billion by 2050 (with 8.9 billion considered most likely; UN Population Information Network, 1998 Revision of the World Population Estimates and Projections, <http://www.popin.org/pop1998>), there are growing concerns on the ability of many countries to meet their basic dietary needs. This is particularly so within many of the world's developing countries, and in particular within those Low-income Food-deficit countries (LIFDCs¹; currently representing over 62% of the world's population; Table 1) which are net importers of food. In many cases, particularly in Africa, these countries cannot produce enough food to meet all their needs and lack sufficient foreign exchange to fill the gap by purchasing food on the international market. Unless concerted action is taken, the situation could deteriorate for many LIFDC's, where population growth is projected to outstrip gains in food production. In addition, the liberalization of the grain trade, under the Uruguay Round Agreement, is likely to increase food prices in the short term (FAO, 1999a).

Food Security, Malnutrition, and Poverty

For the purposes of this paper 'food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food

Table 1. List of of Low-income Food Deficit Countries (LIFDCs) as of May 1998

| | | | |
|-----------------|--------------------|-------------------|--------------------------|
| Afghanistan | Albania | Angola | Armenia |
| Azerbaijan | Bangladesh | Benin | Bhutan |
| Bolivia | Bosnia Herzegovina | Burkina Faso | Burundi |
| Cambodia | Cameroon | Cape Verde | Central African Republic |
| Chad | China | Comoros | Congo Dem Republic |
| Congo Republic | Cote d'Ivoire | Cuba | Djibouti |
| Ecuador | Egypt | Equatorial Guinea | Eritrea |
| Ethiopia | Ethiopia PDR | Gambia | Georgia |
| Ghana | Guatemala | Guinea | Guinea Bissau |
| Haiti | Honduras | India | Indonesia |
| Kenya | Kiribati | Korea DPR | Kyrgyzstan |
| Laos | Lesotho | Liberia | Macedonia |
| Madagascar | Malawi | Maldives | Mali |
| Mautania | Mongolia | Morocco | Mozambique |
| Nepal | Nicaragua | Niger | Nigeria |
| Pakistan | Papua New Guinea | Philippines | Rwanda |
| Samoa | Sao Tome Pm | Senegal | Sierra Leone |
| Solomon Islands | Somalia | Sri Lanka | Sudan |
| Swaziland | Syria | Tajikistan | Tanzania |
| Togo | Tokelau | Turkmenistan | Tuvalu |
| Uzbekistan | Vanuatu | Yemen | Zambia |

¹ Low-income Food-deficit countries, currently defined by FAO as nations that are 1) poor, with a net income per person that falls below the level used by the World Bank to determine eligibility for IDA assistance, which at present means that their net income amounts to less than US\$1,505 per person, and 2) are net importers of food, with imports of basic foodstuffs outweighing exports over the past three years.

preferences for an active and healthy life' (World Food Summit, 1996). However, in the context of food security, it is also important to realize within individual countries and households that food is not always equally distributed. It follows, therefore, that to ensure nutritional well-being, every individual must have access at all times to sufficient supplies of a variety of safe, good quality foods. According to FAO (1999b), there are 790 million chronically undernourished people in the developing world who do not have sufficient food to eat (this being equivalent to more than the combined populations of North America and Europe). Moreover, it is also generally recognized that in those societies at peace, that poverty and marginalization are the root causes of hunger. Chronic food insecurity is the most prevalent in very poor countries whose populations are predominantly rural and largely dependent on agriculture for a living. In this context, it is important to remember that developing countries currently account for 4.4 billion of the total world's population of which one-third survive on less than US\$ 1 a day (FAO, 1999b)

Overview of Global Aquaculture Production and Food supply

Of the different agricultural food production systems, aquaculture (the farming of aquatic plants and animals) is widely viewed as being an important domestic provider of much needed high quality animal protein and other essential nutrients (including n-3 fatty acids, vitamins, minerals and energy), particularly within China and many other Asian countries. Moreover, within many countries, aquaculture is also seen as an important provider of cash income and valuable foreign exchange earnings through the production of higher value cash crops for export, such as marine shrimp (Thailand, Ecuador, China), salmonids (Norway, Chile), eels (China, European Union or EU), carnivorous marine fish (China, Greece, Malaysia), turtles (China), molluscs (China, EU), and seaweeds (China, Philippines). In view of these positive characteristics, it is perhaps not surprising that aquaculture has been the world's fastest growing food production sector within agriculture for nearly two decades, exhibiting an overall annual growth rate of over 11.1% per year since 1984 (Fig. 1), compared with 3% for terrestrial farm animal meat production (Fig. 2), and 1.5% for landings from capture fisheries (Fig. 1). It is also important to mention here that aquaculture is similar to agriculture in the large diversity of animal and plant species cultured. For example, total aquaculture production in 1997 consisted of 121 finfish species, 45 mollusc species, 29 crustacean species, 13 aquatic plant species, and 4 miscellaneous species (FAO Fishstat Plus (AQUASTAT) Database, 1999).

Total global aquaculture production in 1997 (the latest year for which global information is available from FAO) was reported as 36 million metric tons (mmt; live weight equivalent; Figure 3) and valued at \$ 50 billion, with production up by 6.2% since 1996 and more than doubling by weight since 1990 (Fig. 1). Moreover, aquaculture's contribution to total world fisheries landings has also more than doubled since 1984, with aquaculture increasing its share of total fisheries landings (includes both capture fisheries and aquaculture) from 11.4% by weight in 1984 to 27.6% in 1997 (Fig. 1).

At a species group level finfish contributed over half of total aquaculture production by weight in 1997 (18.8 mmt or 52.3%; Fig. 3), followed by molluscs (8.6 mmt or 23.8%) and aquatic plants (7.2 mmt or 20.1%). However, although crustaceans constituted only 3.6% of total aquaculture production by weight in 1997 (1.3 mmt), they represented 15.8% of total aquaculture production by value, with marine shrimp being the top aquaculture species group by value at \$ 6.1 billion. The annual growth rates of the different major specific groups over the past decade is shown in Fig. 4, with most groups exhibiting double-digit growth rates over the period 1984 to 1997: finfish (12.8%, with production up by 11.6% since 1996), molluscs (11.9%, with production up by only 0.9% since 1996), aquatic plants (6.9%, with production up by only 1.0% since 1996), and crustaceans (15.7%, with production up by 6.7% since 1996).

In terms of per caput 'food fish' supply from aquaculture (i.e., the production of farmed aquatic

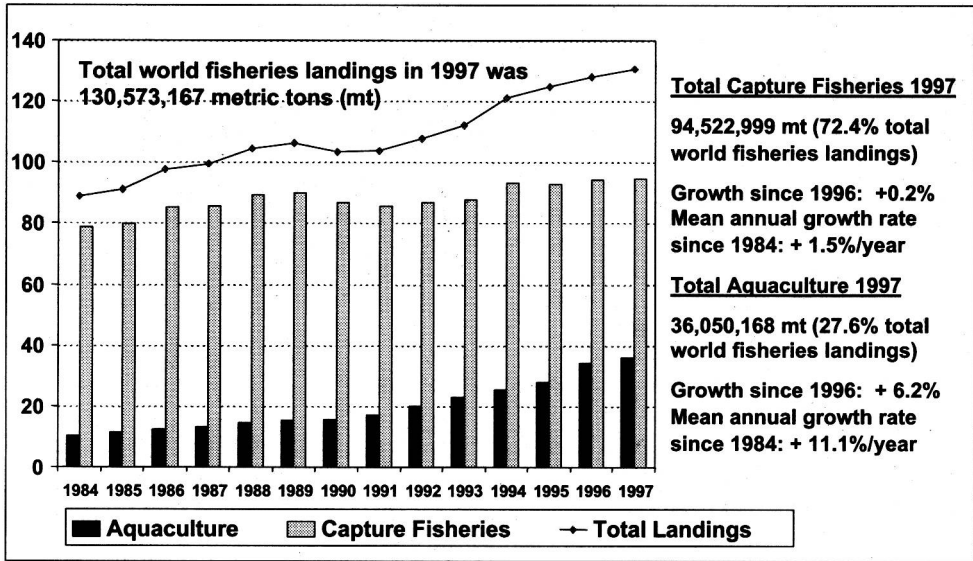


Figure 1. Contribution of aquaculture to total world fisheries landings 1984 - 1997(FAO ,1999a)

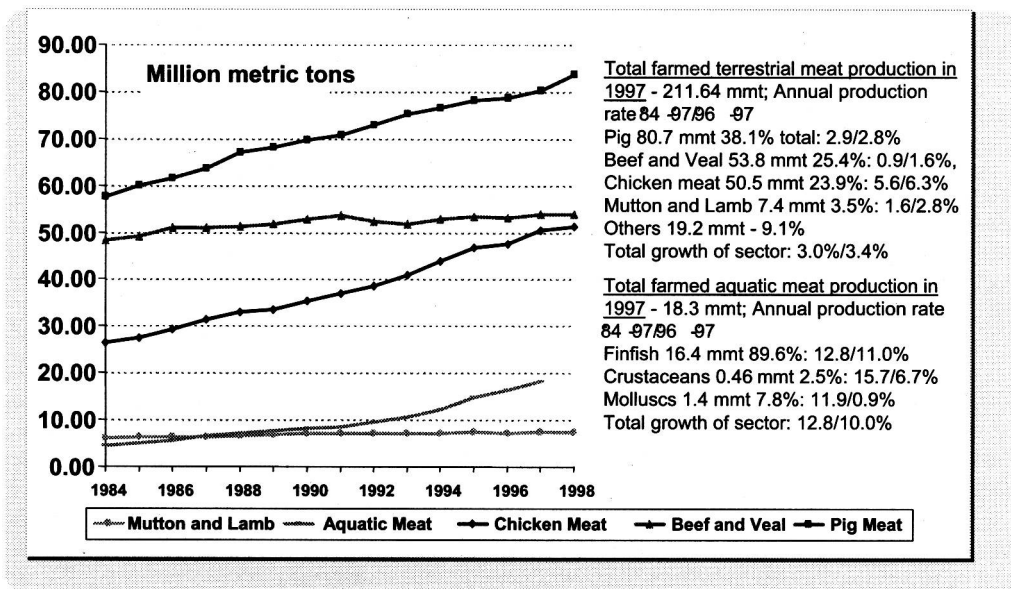


Figure 2. Total global farmed terrestrial and aquatic meat production 1984-1998. FAOSTTAT Database (March 1999) / AQUACULT-PC Database (March 1999)

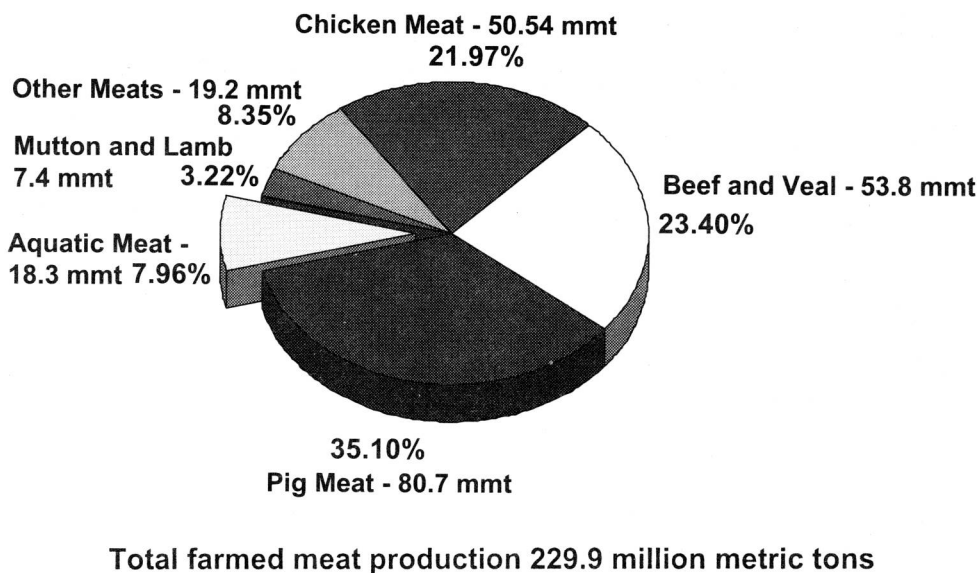


Figure 3. Total world farmed aquatic and terrestrial meat production in 1997. (FAOSTAT/AQUASTAT-PC Database, 1999)

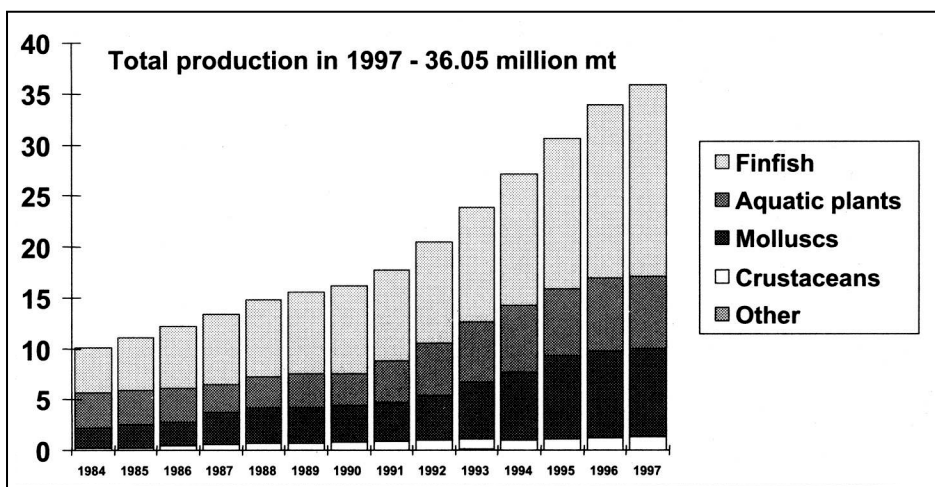


Figure 4. Total world aquaculture production by major species groups 1984-1997. Growth of major species groups (expressed as % increase since 1984 and compound growth rate for period 1984-1997): finfish 4.4 to 18.8mmt, 11.6% and 12.8 %/year; crustaceans 0.22 to 1.30 mmt, 6.7% and 15.7 %/year; molluscs 2.2 to 8.6 mmt, 0.9% and 11.9 %/year; aquatic plants 3.2 to 7.2 mmt, 1.0% and 6.9%/year; World total 10.1 to 36.0 mmt, 6.2% and 11.1 %/year (FAO, 1999a)

finfish and shellfish on a whole live weight basis, and excluding farmed aquatic plants), global production has increased by 239% since 1984 from 1.45 kg to 4.92 kg in 1997, with supply growing at an average rate of 12.6% per year. By contrast, per caput food fish supply from capture fisheries has remained relatively static, increasing from 10.88 kg in 1984 to only 10.91 kg in 1997 and growing at an average rate of 1.75% per year or equivalent to the growth of the human population (1.75%) over the same period. On the basis of the above data, over 30% (31.1% in 1997) of 'food fish' consumed by humans in 1997, from a total average per caput food fish supply of 15.84 kg (up from 12.33 kg in 1984), is currently being supplied by aquaculture.

In terms of global animal protein supply, more 'food fish' is consumed on a per caput basis than any other type of meat, with food fish representing 15.4% of global animal protein supply in 1996 (total global animal protein supply was 26.6g per caput in 1996), followed by pig meat (14.7%), beef and veal (13.5%), and poultry meat (12.8%). In general, people living within Asia and Africa (including LIFDCs) are much more dependent on fish as part of their daily diets than those people living in most developed countries and other regions of the world. For example, figures for 1996 show that while fish represent only 6.1% of total animal protein supplies in South America (Chile 10.3%, Ecuador 7.5%), 7.1% in North and Central America (USA 6.8%), 9% in Oceania (Australia 6.4%), and 9.8% in Europe (Norway 29.2%, Spain 17.0%), they provide 17.2% in Africa (Sierra Leone 63.4%, Ghana 59.1%, Gambia 53.4%, Guinea 47.4%, Congo Rep. 43.1%, Malawi 44.4%, Togo 43.5%, Senegal 38.3%, Cote d'Ivoire 34.6%, Egypt 14.4%), over 27.1% in Asia (Maldives 80.5%, Korea DPR 68.3%, Indonesia 49.6%, Philippines 47.3%, Japan 47.2%, Sri Lanka 46.8%, Bangladesh 45.9%, Myanmar 43.7%, Korea Rep 40.2%, Thailand 36.1%, Malaysia 35.1%, Viet Nam 30.4%, Cambodia 28.4%, China 23.9%), and 23.0% within LIFDCs.

By economic country grouping, approximately 89.6% and 80.6% of total world aquaculture production in 1997 was produced within developing countries (32.3 mmt) and in particular within LIFDCs (29.02 mmt; Fig. 5). Whereas the developing countries' share of global aquaculture production has increased from 72.6% (7.37 mmt) in 1984 to 89.6% (32.3 mmt) in 1997, the share of production from developed countries has decreased from 27.4% (2.78 mmt) in 1984 to 10.4% (3.75 mmt) in 1997 (Fig. 5). Furthermore, aquaculture production within LIFDCs has been growing over 5 times faster (13.9% per year since 1984) than within developed countries (2.5% per year since 1984), with aquaculture production within developing countries displaying an average annual growth rate of 13.1% between 1984 and 1997.

By region, Asia produced over 90.9% of total aquaculture production by weight in 1997 (83.5% by value; production up 6.0% since 1996), followed by Europe (4.6%; production up 4.0% since 1996), North America (1.8%; production up 15.2% since 1996), South America (1.8%; production up 19.2% since 1996), Africa (0.3%; production up 0.9% since 1996), the former USSR area (0.3%; production up 5.4% since 1996), and Oceania (0.3%; production down 0.14% since 1996; FAO, 1999a). By country the top ten aquaculture producers in the world in 1997 were China (24.0 mmt, 66.6% world total), India (1.78 mmt), Japan (1.34 mmt), Korea Republic (1.0 mmt), Philippines (0.96 mmt), Indonesia (0.91 mmt), Thailand (0.57 mmt), Bangladesh (0.51 mmt), Viet Nam (0.49 mmt), and Korea DPR (0.49%). These top ten countries account for about 89.1% of total global aquaculture production (Table 2).

By environment, approximately 47.3% of aquaculture production was produced from inland waters in 1997, increasing from 3.6 mmt in 1984 to 17.0 mmt in 1997 at an average annual rate of 13.8% since 1984 (Fig. 6). The bulk of production from inland waters were from freshwater finfish species (86.5% in 1997; Fig. 7). By contrast, approximately 48.2% of aquaculture production was produced within marine waters in 1997, increasing from 5.9 mmt in 1984 to 17.4 mmt in 1997 at an average annual rate of 9.4% since 1984. The bulk of production from marine waters were in the form

Table 2. Top twenty aquaculture producers in 1997

| Country | Production (metric tons) ^a | Production (% total world S) ^b | Growth (APGR 84-97, %/yr) ^d | Growth (increase 96-97, %) ^e | Total value (US \$ 1,000) | Unit value (US \$/kg) |
|--------------------|--|---|--|---|------------------------------|--------------------------|
| 1. China, mainland | 24 030 313 | 66.6 | + 16.5 | +8.2 | 23 549 193 | 0.98 |
| 2. India | 1 776 450 | 71.6 | +11.0 | -0.4 | 1 975 418 | 1.11 |
| 3. Japan | 1 339 861 | 75.3 | +0.9 | -0.7 | 4 706 068 | 3.51 |
| 4. Korea, Rep | 1 040 280 | 78.2 | +3.6 | +16.0 | 1 204 957 | 1.16 |
| 5. Philippines | 957 548 | 80.8 | +5.9 | -2.4 | 950316 | 0.99 |
| 6. Indonesia | 911 610 | 83.4 | +8.8 | +3.5 | 2 240 482 | 2.46 |
| 7. Thailand | 575 901 | 85.0 | + 14.3 | +4.4 | 1 783 038 | 3.10 |
| 8. Bangladesh | 512 738 | 86.4 | +12.6 | +14.0 | 1 370 199 | 2.67 |
| 9. Vietnam | 492 000 | 87.8 | +12.5 | + 19.7 | 1 118 040 | 2.27 |
| 10. Korea, DPR | 489 321 | 89.1 | -3.0 | -37.5 | 307 745 | 0.63 |
| 11. USA | 438 331 | 90.3 | +2.5 | + 11.4 | 771 183 | 1.76 |
| 12. Chile | 375 113 | 91.4 | +37.0 | +16.1 | 959 759 | 2.56 |
| 13. Norway | 366 281 | 92.4 | +24.7 | +13.9 | 1 043 824 | 2.85 |
| 14. France | 287 609 | 93.2 | +3.4 | +0.7 | 634 100 | 2.20 |
| 15. Taiwan, ROC | 270 112 | 93.9 | +0.8 | -0.8 | 949 837 | 3.52 |
| 16. Spain | 239 236 | 94.6 | -0.3 | +3.3 | 252 765 | 1.06 |
| 17. Italy | 217 519 | 95.2 | +7.0 | +2.4 | 409 155 | 1.88 |
| 18. Ecuador | 135 297 | 95.6 | + 12.3 | +24.4 | 680 624 | 5.03 |
| 19. United Kingdom | 129 715 | 95.9 | + 18.1 | +18.0 | 426 829 | 3.29 |
| 20. Malaysia | 103 360 | 96.2 | +3.6 | -5.6 | 215 226 | 2.08 |

^aTotal aquaculture production (includes finfish, crustaceans, molluscs, miscellaneous aquatic animals/products, aquatic plants); ^b Accumulative total as % total world aquaculture production; ^cPer caput total aquaculture production; ^d Annual Percent Growth Rate (APGR) in production by weight between 1984 and 1997; ^e Percent change in production by weight between 1996 and 1997. FAO (1999a).

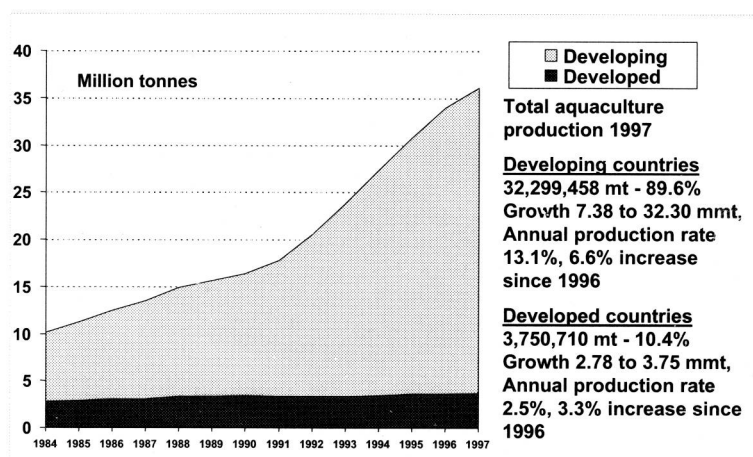


Figure 5. Total world aquaculture production by major economic country groupings. FAO AQUASTAT-PC, FAO (1999a)

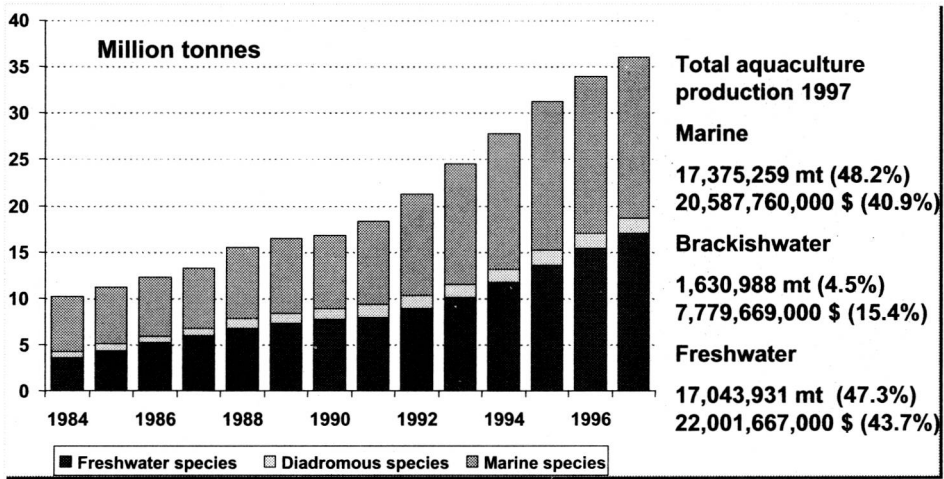


Figure 6. Total world aquaculture production by aquatic environment. Growth expressed as % increase since 1996 and annual production rate for 1984-1997: freshwater 3.59 to 17.04 mmt, 10.7% and 13.8%; brackishwater 0.69 to 1.63 mmt. 0.4% and 7.4%; marine 5.88 to 17.37 mmt, 2.5% and 9.4%/year. (FAO, 1999a)

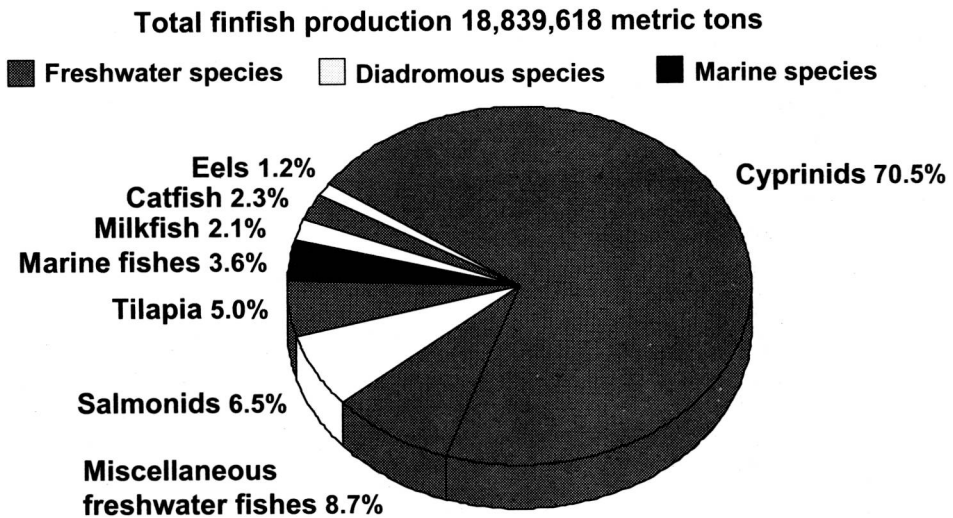


Figure 7. Total finfish aquaculture production by major species groups in 1997. Values expressed as % by weight. (FAO, 1999a)

of marine molluscs, aquatic plants (seaweeds), and marine crustaceans (FAO Fishstat Plus (AQUASTAT) Database, 1999).

Aquaculture, Food Security, and “Erap”

It is apparent from the above discussion that aquaculture currently makes an important contribution to the world's food supply, particularly within developing countries (including LIFDCs) and the Asian region. In this respect, it is extremely important to point out that the main factor driving the apparent high demand for fishery/aquaculture products within most developing countries and LIFDCs is their greater affordability to the poorer segments of the community, including the rural poor, compared with other animal protein sources. For example, the unit price of animal protein sources in Western Visayas (Philippines; the location of the current SEAFDEC meeting) was reported as beef 100 pesos/kg, pork 85 pesos/kg, chicken 70 pesos/kg, fish 60 pesos/kg, dried fish 120 pesos/kg, eggs 36 pesos/dozen, sardines 8.50 pesos/can, milk 35.5 pesos/pack (Cost of Living in Western Visayas for a family of six, Western Visayas Daily Informer, 15 October 1999; 40 Philippines pesos equivalent to 1 US \$ at the time of this cost of living survey). Moreover, aquaculture can also effect food security by increasing income and thus enlarging the capacity to purchase food on the market place.

According to Kent (1995) if aquaculture products are to be used to strengthen the food security of the poor, the following guidelines should be considered;

- Funding for aquaculture for the poor should be increased;
- Aquaculture projects should do no harm to the food supplies of the poor;
- Existing aquaculture activities of the poor should be strengthened;
- The focus should be on low cost products favored by the poor;
- Production should be for local consumers;
- Community production should be encouraged; and
- Food security impacts should be monitored.

In addition to the above general guidelines, there is also an urgent need (in the opinion of the authors) for the further development and promotion of ‘Environmentally Responsible Aquaculture Practices’ (ERAP) to ensure the continued growth and sustainable development of the aquaculture sector, and its contribution to global food supply and food security in the next millennium.

Issues and Challenges to Sustainable Aquaculture Development

There is significant potential for continued expansion and growth of aquaculture and culture-based fisheries. Even in Asia, the full potential for further development has not yet been realized. Discussions during the recent Sessions of the FAO Committee on Fisheries stressed the increasingly important role of inland capture fisheries and aquaculture in fish production and in human nutrition and poverty alleviation in many rural areas, and emphasized enhancement of inland fish production through integrated aquaculture-agriculture farming systems and integrated utilization of small and medium size water bodies. Additional opportunities/strategies for further development and increased food production include, for example:

- intensification of production;
- specialization of production;
- rehabilitation of existing production facilities;
- improved fisheries enhancement methods;
- diversification of production;
- combining on-farm and off-farm activities.

Despite aquaculture's successes and considerable potential for continued growth and expansion, the sector has not been without its problems and critics. Although the majority of these issues are not unique to the aquaculture sector, and relate to the development of more environmentally sound and *responsible* farming practices, it is essential that these issues be addressed and resolved in a timely manner if the sector is to mature and sustain its rapid growth and to provide a positive image with the public and community at large into the next millennium.

As recalled by Dar (1999) on the occasion of the 1999 Ministerial Meeting on Fisheries, the major issues and challenges to aquaculture development that need to be addressed (although these may vary in severity from country to country) can be summarized as follows :

Weak institutional support and insufficient political recognition. At present, many of the decisions over developments affecting fisheries, aquaculture and aquatic environments are often made with little or no consideration of these sectors. Moreover, most fish producers suffer from the absence or inadequacy of defined rights to their specific practices, and institutional support, whether public or private. To address the issue of weak institutional support and insufficient political recognition, there is therefore a need to:

- develop comprehensive policies and associated institutional and legal frameworks in support of the sustainable development of aquaculture and culture-based fisheries;
- improve communication, cooperation and coordination among institutions, agencies and major stakeholders concerned with aquaculture and culture-based fisheries;
- strengthen institutional capacity to manage the sector and to expand the knowledge base in order to enable implementation of sustainable development policies and plans;
- enhance participation and consultation of all stakeholders (public and private) in the planning, development and management of aquaculture and culture-based fisheries, including the strengthening of community-based management of resources, support to non-governmental organizations and private sector associations (eg., groups of farmers, breeders, processors, traders, etc.), and the promotion among private sector groups of voluntary self-regulatory management schemes (eg., codes of practice, best management practices etc.); and
- promote 'enabling environments' in support of aquaculture development, including provisions for fair access to resources, mechanisms for conflict resolution, and ready access to information, credit and markets.

Need to enhance efficiency in the utilization of resources. At present, there is a global trend toward increasing competition between users or stakeholders, including both agricultural and non-agricultural sectors, for available resources, including land, energy/fossil fuels, water, and nutrient sources. Moreover, there is also a global trend within animal husbandry, including aquaculture production, toward intensification of farming systems and increased livestock/aquaculture production per unit area/time, as well as an increasing trend toward the vertical integration of animal and feed production systems so as to reduce risks and minimise production costs. To address these issues and enhance efficiency in the utilization of resources, there is therefore a need to:

- promote the further development of more environment friendly animal production systems and dietary feeding regimes;
- improve the efficiency of resource-use within animal production systems through the development of improved feed formulation techniques and/or through the selection of animal species feeding low on the food chain;
- reduce the dependence of animal production systems upon the use of potentially food-grade feed resources as nutrient inputs through the development and use of more sustainable non-food grade feed resources whose production can keep pace with the growth of the sector;

- improve efficiency in the use of water resources;
- improve site selection and allocation of land/space;
- improve selection and use of seed, broodstock, and feed/fertilizer and other inputs (chemicals, drugs, equipment);
- improve integration with other agricultural activities (e.g., irrigation, rice production, animal husbandry);
- promote the use of appropriate fish health management programs;
- promote the appropriate use of genetic resources and biotechnology;
- reduce the environmental impacts of aquaculture;
- avoid impacts on aquaculture resulting from aquatic pollution by non-aquaculture activities; and prevent impacts of aquaculture on aquaculture.

Responding to the demands by retailers, consumers and producers. With increasing global awareness and concern for the environment, the efficiency of resource use, the sustainability of different food production systems, and food safety, there are increasing demands of retailers and consumers for the production of greener, healthier and safer animal food sources for human consumption and consequently increasing demands by farmers and consumers for the development of national/internationally agreed standards and/or codes/guidelines for animal food production, including aquaculture production. To address these demands by retailers, consumers and producers, there is a need to promote human resource development and capacity building through:

- training, extension, education, and the transfer of appropriate technology;
- improved provision of and access to information;
- promotion of human resource development

The Code of Conduct for Responsible Fisheries (CCRF) and Aquaculture Development

Origins and basic contents of the CCRF

The FAO Code of Conduct for Responsible Fisheries originated at the International Conference on Responsible Fishing, held in May 1992 in Cancun, Mexico. Following this Conference and the 1992 United Nations Conference on Environment and Development (UNCED), FAO was requested by its member countries to draft an International Code of Conduct for Responsible Fisheries. Subsequently, many experts and representatives from governments, intergovernmental and non-governmental organizations participated in several FAO technical consultations and in the 1993 and 1995 Sessions of the FAO Committee on Fisheries for the purpose of the formulation of the Code.

The code draft documents received a broad consensus from the Member States of FAO and the final text was adopted by government representatives attending the 28th Session of the FAO Conference on October 31, 1995 (FAO, 1995).

The Code sets out principles and international standards of behaviour for responsible practices with a view to ensuring the effective conservation, management and development of living aquatic resources, while recognizing the nutritional, economic, social, environmental and cultural importance of fisheries, and the interests of all those concerned with the fishery sector.

The Code is based on relevant rules of international law, including those reflected in the 1982 United Nations Convention on the Law of the Sea, and incorporates the spirit of Agenda 21 and the 1992 Rio Declaration of the UN Conference on Environment and Development as well as the 1992 Convention on Biological Diversity.

The Code is non-binding in nature and will be implemented on a voluntary basis, although it contains certain provisions, which may be given or have already been given binding effect. An example of provisions which are already binding is the Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas, 1993.

The Code consists of five introductory articles, one article on General Principles, and six thematic articles (see Box 1).

Box 1. Contents of the Code of Conduct for Responsible Fisheries

1. Nature and Scope
2. Objectives
3. Relationship with Other International Instruments
4. Implementation, Monitoring and Updating
5. Special Requirements of Developing Countries.
6. General Principles
7. Fisheries Management
8. Fishing Operations
9. Aquaculture Development
10. Integration of Fisheries into Coastal Area Management
11. Post-Harvest Practices and Trade
12. Fisheries Research

<http://www.fao.org/fi/agreem/codecond/codecon.asp>

The Code is addressed primarily at *States*, that is, the Code stipulates actions to be taken by States, and their government authorities and institutions. However, it is also meant to address persons, interest groups or institutions, public or private, who are involved in or concerned with fisheries and aquaculture. In fact, in the case of aquaculture development, it is evident that responsibilities beyond the local farm level need to be shared by many players (FAO Fisheries Department, 1997). Providing an “*enabling environment*” for sustainable development in aquaculture, as in agriculture, is the responsibility of people in governments and their institutions, the media, financial institutions, pressure groups, associations, non-governmental organizations, as well as of social and natural scientists, manufacturers and suppliers of inputs, processors and traders of aquaculture products (Box 2.; see also FAO, 1999).

Box 2. Participants in the implementation of the Code of Conduct for Responsible Fisheries

- Government authorities/officials, policy-makers, planners and regulators
- Aquafarmers, producers, farm operators/workers, “aquaculture experts”
- Manufacturers and suppliers of aquaculture inputs
- Processors and traders of aquaculture products
- Consumers
- Banks and other financing institutions, investors, insurance companies
- Special interest and advocacy groups (professional associations, NGOs, others)
- Researchers, social and natural scientists
- International organizations (regional, global)
- Media
- others

Many aquafarmers, like most of their terrestrial counterparts, continue however to attempt solving problems on their farms while struggling with constraints such as inadequate access to resources, natural and financial, lack of institutional and legal support, or unavailability of appropriate information

(Barg *et al.*, 1997). In many cases, it is very difficult for aquaculture farmers to adapt their farming practices to new requirements. Nonetheless, in many cases there are obvious and significant advantages for the producers to improve their practices, most often in terms of increased productivity and efficiency, resulting in sustained profits, as well as in terms of environmental performance and public image. Most significantly, however, there are advantages which arise from recognized product quality and acknowledged “good practice”. Most producers recognize consumer demands as well as the requirements by retailers. It is therefore important that appropriate information on aquaculture is provided to consumers and to the public in general. Those trading aquaculture products as well as those supplying inputs required for aquaculture also have a role to play in providing such information to civil society.

Salient Provisions of the CCRF as Relevant to Aquaculture Development

The Code provides a range of provisions addressing important issues relevant to aquaculture. In addition to Article 9 “Aquaculture Development, which explicitly covers major aspects of aquaculture, there are also significant provisions in other sections of the Code having an important bearing on aquaculture and its general development context.

The following are a number of salient provisions, which are highlighted to provide examples of basic recommendations for possible important policies and actions which may be derived from the provisions of the Code.

Co-operation in implementation

The Code calls all those concerned and interested to collaborate in the fulfilment and implementation of the objectives and principles contained in this Code. Article 4 clearly highlights that not only States and their authorities should promote the Code but also all non-governmental organizations, which per definition also include private sector associations. Co-operation is sought and encouraged to facilitate the implementation of the Code, for example, as stated in following provisions:

CCRF 4.2. FAO, in accordance with its role within the United Nations system, will monitor the application and implementation of the Code and its effects on fisheries and the Secretariat will report accordingly to the Committee on Fisheries (COFI). All States, whether members or non-members of FAO, as well as relevant international organizations, whether governmental or non-governmental should actively cooperate with FAO in this work.

CCRF 4.4. States and international organizations, whether governmental or non-governmental, should promote the understanding of the Code among those involved in fisheries, including, where practicable, by the introduction of schemes which would promote voluntary acceptance of the Code and its effective application.

Special requirements of developing countries

In formulating and negotiating the Code it was recognized that many developing countries continue to face significant development problems, and that the special economic and social circumstances prevailing in these countries would need to be given due consideration. The Code therefore calls - in Article 5 - for efforts and measures to address the needs of developing countries, especially in the areas of financial and technical assistance, technology transfer, training and scientific co-operation. Special efforts should be undertaken particularly in the areas of human resource development.

General principles

There are six provisions under the *General Principles (CCRF Article 6)* that are of major significance for aquaculture matters:

The requirement to respect the environment, its goods and services, applies to both States as well as to all users of living aquatic resources. Special emphasis is given to the protection of critical fisheries habitats, and to the need to prevent impacts resulting from human activities.

CCRF 6.1. States and users of living aquatic resources should conserve aquatic ecosystems.

CCRF 6.8. All critical fisheries habitats in marine and fresh water ecosystems, such as wetlands, mangroves, reefs, lagoons, nursery and spawning areas, should be protected and rehabilitated as far as possible and where necessary. Particular effort should be made to protect such habitats from destruction, degradation, pollution and other significant impacts resulting from human activities that threaten the health and viability of the fishery resources.

The Code emphasizes not only all aspects of production of fish and fishery products, but also covers the requirement for responsible action in harvesting and post-harvest practices:

CCRF 6.7. The harvesting, handling, processing and distribution of fish and fishery products should be carried out in a manner which will maintain the nutritional value, quality and safety of the products, reduce waste and minimize negative impacts on the environment.

High priority is given in the Code to consultation and effective participation of all interested stakeholders in decision-making, development of laws and policies and their implementation. Emphasis is also given to awareness raising, education and training.

CCRF 6.13. States should, to the extent permitted by national laws and regulations, ensure that decision making processes are transparent and achieve timely solutions to urgent matters. States, in accordance with appropriate procedures, should facilitate consultation and the effective participation of industry, fish-workers, environmental and other interested organizations in decision making with respect to the development of laws and policies related to fisheries management, development, international lending and aid.

CCRF 6.16. States, recognising the paramount importance to fishers and fish-farmers of understanding the conservation and management of the fishery resources on which they depend, should promote awareness of responsible fisheries through education and training. They should ensure that fishers and fish-farmers are involved in the policy formulation and implementation process, also with a view to facilitating the implementation of the Code.

International trade of aquaculture products continues to grow in importance. The Code clearly emphasizes the role of existing international trade agreements and highlights the important requirements for States to prevent the occurrence of negative impacts on trade, environment and societal demands.

CCRF 6.14. International trade in fish and fishery products should be conducted in accordance with the principles, rights and obligations established in the World Trade Organization (WTO) Agreement and other relevant international agreements. States should ensure that their policies, programmes and practices related to trade in fish and fishery products do not result in obstacles to this trade, environmental degradation or negative social, including nutritional, impacts.

The importance of aquaculture development and the potential benefits of aquaculture are well reflected in the General Principles of the Code. However, there is also a call for due consideration of environmental and social issues which may be associated with the development of aquaculture.

CCRF 6.19. States should consider aquaculture, including culture-based fisheries, as a means to promote diversification of income and diet. In so doing, States should ensure that resources are used responsibly and adverse impacts on the environment and on local communities are minimized.

CCRF Article 9 - Aquaculture Development

Article 9 of the Code contains provisions relating to aquaculture, including culture-based fisheries. Article 9 is divided into four sub-sections, which refer to responsible development both in areas of national jurisdiction (9.1) as well as within trans-boundary aquatic ecosystems (9.2), to the use of genetic resources (9.3), and to responsible practices at the production level (9.4).

Specifically, this Article includes requirements for appropriate legal and administrative frameworks, which are to provide for an “enabling environment” for the sustainable development of aquaculture (CCRF 9.1.1). Responsible development and management of aquaculture is emphasized, with special reference to advance evaluation of environmental effect, i.e., the requirements for environmental impact assessment and regular monitoring, which should be based on best available scientific information (CCRF 9.1.2 and 9.1.5). States are encouraged to produce aquaculture development strategies, to allow for appropriate use of resources shared by aquaculture and other activities, as well as to ensure avoidance of negative effects on the livelihood of local communities (CCRF 9.1.3 and 9.1.4).

With a perspective of addressing trans-boundary issues, the Code invites States to collect, share and disseminate data related to their aquaculture, and encourages co-operation on planning for aquaculture development at national and various international levels (CCRF 9.2.4). Special emphasis is given to development of appropriate mechanisms to monitor the impacts of inputs which are utilized in aquaculture including, for example, feeds, stocked organisms, equipment, chemicals, etc. (CCRF 9.2.5).

The selection, use, propagation, and movements of species is prominently addressed in the Code (a number of provisions under 9.2. and 9.3) and precautionary measures, such as the implementation of appropriate international and national codes of practice (CCRF 9.3.2 and 9.3.3), are advocated to avoid adverse effects on endemic biological diversity, as well as to prevent impacts of disease outbreaks. States are called on to promote steps to minimize adverse genetic, disease and other effects of escaped-farmed fish on wild fish (CCRF 9.3.1).

At the farm and local level (see CCRF 9.4.), the potential benefits of sustainable aquaculture development are well recognized, and States are called to promote responsible practices in support of rural communities and producers (CCRF 9.4.1). Enabling the participation of fish farmers is advocated in the development of appropriate practices. There is significant scope for assisting producers through appropriate human resource development activities, including training, extension and capacity building in general.

Other recommendations relate, in particular, to responsible selection and use of appropriate feeds, feed additives and fertilizers, including manures (9.4.3). Emphasis is also given to effective fish health management including safe use of chemicals (9.4.4). Provision CCRF 9.4.5 calls for the regulation of the use of chemicals that are harmful to humans and the environment. Avoidance of harmful effects on both human health and the environment are also the targets of provisions 9.4.6

which requires the judicious disposal of potentially hazardous wastes and 9.4.7 which demands good practices before and during harvesting, in order to ensure food safety, good quality and improved value of aquaculture products.

The Code and integrated coastal area management (CCRF Article 10)

It should be noted that the Code's provisions on Integrated Coastal Area Management (CCRF Article 10; see also FAO, 1996b) also have a bearing on aquaculture in general, and on coastal aquaculture in particular. Very broadly, these provisions recommend that the integration of fisheries (and aquaculture) into coastal area management should occur through the formulation of management plans, the provision and enforcement of appropriate environmental legislation, a transparent consultative process, and through monitoring the post-development impact. In the coastal management process, fisheries and aquaculture agencies should participate in decisions concerning the following:

- the planning and conduct of environmental impact studies;
- when permits for construction are being issued;
- whenever the drafting of laws and regulations are required; and
- in the spatial planning process (e.g., port development).

Fisheries and aquaculture agencies and sector representatives should also be full partners in interagency and interdisciplinary fora. CCRF Article 10 calls on States to ensure that representatives of the fisheries and aquaculture sector and fishing communities are consulted in the decision-making processes related to coastal area management and development.

The Code and post-harvest practices and trade (CCRF Article 11)

CCRF Article 11 deals with post-harvest practices and trade, and is also relevant to aquaculture. Responsible fish utilization is one of the main chapters of this article, claiming the consumer's' right to safe, wholesome and unadulterated fish and fishery products (see also FAO, 1998d). It refers to the work of the FAO/WHO Codex Alimentarius Commission and calls on States to promote the implementation of quality standards agreed therein. Those involved in the processing and marketing of fish and fishery products are encouraged to reduce post-harvest losses and waste, to improve the use of by-catch to the extent that this is consistent with responsible fisheries management practices, and to use resources such as water and energy, in particular wood, in an environmentally sound manner. The manufacture of value-added fishery products by developing countries is advocated and States are requested to ensure that domestic and international trade in fishery products accord with sound conservation and management practices. This latter remark points towards the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The Convention can limit, regulate and prohibit trade in these species and products there from if they are listed in one of the Annexes.

During the consultations leading to the CCRF, there was a debate of the FAO membership which was related to the remaining two chapters of Article 11 (Responsible International Trade, and Laws and Regulations relating to Fish Trade), and which was strongly influenced by the intention not to create clauses which would contrast with provisions issued under the Agreements leading to the Establishment of the World Trade Organization (WTO) and to make it clear that the formulation of trade rules is the prerogative of the WTO. The Code also states that policies and practices related to the promotion of international fish trade and export production should not result in environmental degradation or adversely impact the nutritional rights and needs of people for whom fish is critical to their health and well-being and for whom other comparable sources of food are not readily available or affordable. According to the Code, laws, regulations and administrative procedures applicable to

international fish trade should be transparent, as simple as possible, comprehensible and, when appropriate, based on scientific evidence. They should be reviewed periodically and simplified without jeopardizing their effectiveness. In cases where regulations are changed, sufficient time should be allowed for preparing the implementation of the Code and consultation with affected countries would be desirable. In this connection the Code stipulates that due consideration be given to requests from developing countries for temporary derogation from obligations.

In summing up, the Code of Conduct for Responsible Fisheries was adopted by FAO Member Governments in 1995 and is considered as the practical foundation on which to establish sustainable fisheries and aquaculture in the future. The Code's structure and its different components correspond roughly to different groups of stakeholders (fishermen, managers, processors, traders, fish farmers, and scientists). The FAO Fisheries Department has been producing a number of Technical Guidelines to assist those concerned in the implementation and adaptation of the recommendations of the Code of Conduct (FAO, 1996a,b, 1997, 1998d). Such guidelines could be complemented as required by specific technical protocols, codes of practice, instruction manuals, best management practices, etc. General awareness on the existence and significance of the Code is growing, and its scope and purpose are becoming known to increasing numbers of persons and institutions involved in fisheries and aquaculture. However, the challenges of implementation of the Code's provisions in aquaculture can be significant, especially when considering the complexity of the issues and the diversity of aquaculture practices and people involved.

Due consideration should be given hereby to diversity of aquaculture species and species groups (finfish, crustacean, molluscs, aquatic plants) and systems utilized (e.g. extensive, semi-intensive, intensive, super-intensive systems). There are also varying purposes and contexts of aquaculture practice, for example, commercial aquaculture with significant focus on local, regional and international markets, and the very important practices of subsistence and household aquaculture for food security. The role of the various types of aquaculture in rural development, poverty alleviation and enhancing of food security can be significant.

Likewise there is significant diversity between aquaculture producers, as well as consumers of aquaculture produce, within countries, as well as between regions and economic status of countries, which is often related to different socio-economic circumstances in LIFDCs, developing and developed countries.

Selected Initiatives in Support of the Implementation of the CCRF

There are increasing numbers of initiatives aiming at the implementation of the CCRF. Selected examples of such initiatives are presented here, as they relate to aquaculture developments, and associated issues and themes of international interest or concern.

The FAO Bangkok Consultation on policies for sustainable shrimp culture and follow-up of related activities

The principal objective of this Consultation was to contribute to the preparation of guidelines containing policy options and methodologies for government policy-makers and, especially planners, to develop an appropriate incentive structure and regulatory and decision-making framework for the development of sustainable shrimp culture. The guidelines are in support of the implementation of the Code of Conduct on Responsible Fisheries including relevant provisions contained in its Article 9 "Aquaculture Development", and may facilitate the development of voluntary self-regulatory schemes implemented by farmer groups or industry associations.

The Consultation, held in December 1997 in Bangkok, Thailand, was attended by government delegates and observers from 12 countries of Asia and America accounting for about 90 % of the global production of cultured shrimp and including major consuming countries. Observers from 5 inter-governmental organizations (ASEAN, INFOFISH, NACA, SEAFDEC, World Bank) and from 4 international NGOs also attended, including Global Aquaculture Alliance (GAA), Greenpeace International, International Collective in Support of Fishworkers (ICSF), and World Wide Fund for Nature (WWF)

The main outcomes of the Consultation (FAO, 1998b) were produced in three working groups which addressed:

- (1) the legal, institutional and consultative framework for sustainable shrimp culture,
- (2) planning and regulatory methods and tools and economic incentive schemes for sustainable shrimp culture, and
- (3) development of voluntary codes of practice for sustainable shrimp culture.

As stated in the report of the Bangkok Consultation (FAO, 1998b), "*The Consultation produced a broad consensus that sustainable shrimp culture is practised and is a desirable and achievable goal, which should be pursued. When practised in a sustainable fashion, shrimp culture is an acceptable means of achieving such varied national goals as food production, employment and generation of foreign exchange.*

Achievement of sustainable shrimp culture is dependent on effective government policy and regulatory actions, as well as the co-operation of industry in utilizing sound technology in its planning, development and operations. Noting that appropriate government responsibilities are outlined in Article 9 of the Code of Conduct for Responsible Fisheries, the Consultation recommended a range of desirable principles to be followed in the establishment of legal, institutional and consultative frameworks and regulatory policies for sustainable shrimp culture. It also noted that the Code provided an accepted baseline for the development of additional codes or guidelines applicable to shrimp culture.

The policy recommendations of the Consultation relating to legal, institutional and consultative framework for sustainable shrimp culture, planning and regulatory methods and tools and economic incentive schemes are significant (FAO, 1998b). Emphasis here is given to the recommended development of voluntary codes or similar self-regulatory instruments.

The Consultation concluded that codes of conduct, codes of practice and guidelines all have useful purpose and should be encouraged by FAO and others at various levels, e.g., local and national, and for various sectors, e.g., production, processing, input supplies, etc.. Voluntary codes can be useful instruments for reduction of government costs, to promote efficiencies, to provide protection and assurance to consumers and to producers alike, and most important, to help achieve sustainable operations. The Code of Conduct for Responsible Fisheries, particularly in its sections pertaining to aquaculture, provides an accepted baseline for development of additional codes or guidelines applicable to shrimp culture.

The Bangkok Consultation emphasized that contents of voluntary codes will vary depending on the objective of the developing entity. Codes appropriately could include:

- Provisions to better control disease;
- Provisions to govern use of drugs and chemicals;
- Provisions for record keeping to monitor various impacts of shrimp culture;

- Provisions for sound engineering practice and use of best practicable technology to achieve sustainability and effective operations with minimal impacts on the environment.
- Provisions to define sustainability with one possibility to seek intergenerational sustainability.
- There have been increasing efforts in recent years to develop such codes. Examples of “guiding principles “ and “goals” of such codes are shown in Box 3.

Box 3. Guiding principles and goals of voluntary industry codes

Goals of the Code of Conduct for European Aquaculture, by Federation of European Aquaculture Producers (FEAP, 1999)

- to promote the responsible development and management of a viable European aquaculture sector in order to assure a high standard of quality food production while respecting environmental considerations and consumers’ demands,
- to establish and recommend guiding principles for those in Europe who are producing live fish species through aquaculture,
- to establish a common base, through effective self-regulation, for sectoral responsibility within society and demonstrate the considerations of the production sector towards the fish it rears, the environment and the consumer.

Principles developed by Global Aquaculture Alliance (GAA, 1999):

- Cooperate with regulatory authorities
- Avoid environmentally sensitive sites
- Minimize impacts from water exchange
- Strive to improve feed use
- Avoid spread of disease
- Cooperate with research
- Benefit local community
- Strive for sustainability

Voluntary codes as well as best practice and other such guidelines are being developed by the private sector, often in co-operation with interested government agencies, not only for shrimp culture, but also in other aquaculture sectors, for example, for specific aquaculture commodities, such as mussels, trout, salmon, etc. or specific themes or issues, for example, on introduction and transfers of aquatic organisms, feed manufacturing, product hygiene and food safety, etc. A summary of potential benefits of developing and adopting codes of practice in aquaculture is given in Box 4.

Box 4. Potential benefits of developing and adopting codes of practice in aquaculture

- Public image can be enhanced through adherence to established and agreed norms and adequate self-regulation;
- Aquaculturists are in a better position to defend their interests, and to negotiate for rights and privileges against competing interests;
- Producers may form and strengthen producer associations and organizations when cooperating on such codes;
- Greater common understanding and agreement on specific measures which can be implemented to ensure sustainable aquaculture development;
- Roles and responsibilities of concerned agencies and interest groups can be properly identified and negotiated;
- Management can be improved and sustainability enhanced through cooperation on technical

Box 4 (Cont'd.)

information and training;

- Products may be labelled to inform consumers on adopted practices.

Specific reporting by Governments on implementation of the Code of Conduct for Responsible Fisheries in respect of sustainable shrimp culture

The 1997 Bangkok Consultation recommended that FAO specifically request governments of countries engaged in shrimp culture to report on progress in implementing the Code of Conduct for Responsible Fisheries in relation to shrimp culture activities to the FAO Committee on Fisheries (COFI) at its next and subsequent sessions. This is seen as a means of encouraging the use of the Code to achieve more quickly full sustainability and to maximize the benefits of shrimp culture. The Consultation recommended a range of possible areas for such reporting, and, in this regard, FAO was requested to develop appropriate criteria and indicators.

In pursuance of this recommendation, FAO held an expert meeting (FAO, 1998c) which prioritized a short-list of the criteria and indicators of sustainable shrimp culture, which could form the basis for regular reporting by countries to COFI. However, the group stressed that these criteria and indicators related to the national level and did not encompass farm-level and local-level indicators, which were inappropriate for the envisaged reporting exercise. The meeting concluded that it would be premature at this stage to request governments to report actual data on those indicators to the next session of COFI, 15-19 February 1999. Instead, it elaborated a questionnaire to allow governments to review and comment on the recommended indicators and on their present and future ability to acquire the related data and information.

The questionnaire elaborated by the ad-hoc expert meeting was sent by FAO to 30 governments of countries producing shrimp. The responses received indicate that the scope and coverage of data collection are improving as governments become more involved in shrimp culture management through licensing and regulatory measures including provisions for environmental impact assessments. The survey results indicate that responding governments regularly collect at present, or have firm plans to do so in the near future, data on many of the pertinent environmental issues associated with shrimp culture (Barg *et al.*, 1999; FAO, 1999).

Only few countries referred specifically in their interventions to shrimp culture during COFI 1999. The primary reason was the very heavy agenda and severe time constraint, which the 23rd Session of COFI faced. Governments were required to consider and adopt three international plans of action, report on progress in the implementation of the Code of Conduct for Responsible Fisheries, and comment on certain highly debated issues such as eco-labelling of fish and fishery products. As a consequence, shrimp culture is not specifically mentioned in the meeting report (FAO, 1999b). However, it can be inferred from the report that governments do not wish to report in separate surveys or questionnaires on specific issues such as shrimp culture; instead all reporting related to progress in the implementation of the Code of Conduct including related action plans should be done within one biannual survey.

Assistance to Safe Trans-boundary Movement of Live Aquatic Animals

An important initiative in support of the implementation of the CCRF which is of significance to Asian aquaculturists and fish health management experts is the FAO Regional TCP Asia Regional Technical Co-operation Project (TCP/RAS/6714): Assistance to Safe Trans-boundary Movement of Live Aquatic Animals.

Owing to the seriousness of the recent outbreaks of disease in Asian aquaculture and the

Owing to the seriousness of the recent outbreaks of disease in Asian aquaculture and the significance of the losses incurred, the Asia regional importance of aquatic animal health management and the role of aquatic animal quarantine has simultaneously been recognized by NACA, the Network of Aquaculture Centres in Asia and the Pacific (NACA, 1996). On the request of their 15 member countries, NACA Governing Council has recommended the drafting and adoption of regional guidelines for health certification and quarantine of aquatic animals in the Asia-Pacific region. Responding to needs for the development and adoption of minimum aquatic animal health certification and quarantine guidelines and procedures for the Asian region, and the recommendation of NACA Governing Council, FAO in collaboration with NACA launched a Technical Cooperation Programme (TCP) project in early 1998.

Twenty-one governments are participating in the development of these technical guidelines which are also consistent with international legislation and agreements. Thus, they should be applicable not only to both participating and non-participating countries in Asia, but also to many countries in other parts of the world.

The purpose of the guidelines is to assist countries and territories in the Asian region with responsible international and within country movement of live aquatic animals. The technical guidelines are intended to facilitate trade and movement of aquatic species within and between regions with minimal or no intra- and international transfers/introductions of pathogens. It is also specifically provided to assist countries, territories and governments in Asia in the implementation of relevant measures contained in FAO's Code of Conduct for Responsible Fisheries and other relevant international agreements, where applicable to the region, including the OIE (Office International des Epizooties) and WTO/SPS (World Trade Organization/Sanitary Phytosanitary Agreement) measures. A comprehensive information system on aquatic animals pathogens and quarantine (Aquatic Animal Pathogen and Quarantine Information System - AAPQIS) is also being established in Asia, as a regional chapter of a global information system. FAO will extend this information system (AAPQIS) to the other regions of the world as an attempt to bring together inter-regional co-operation on aquatic animal quarantine and health certification (Subasinghe and Arthur, 1997; Subasinghe *et al.*, 1998 a,b).

Food Safety Issues Associated with Products from Aquaculture

There is growing consumer interest as well as some concerns related to food safety and food quality of aquaculture products. In 1997 an expert group meeting was organized jointly by WHO, FAO and NACA (FAO/NACA/WHO, 1999) to facilitate a review of food safety issues associated with products from finfish and crustacean aquaculture, to advise on the assessment of food safety hazards and risks, and on feasibility criteria, essential implementation requirements and recommendations for the control of priority hazards and risks. FAO is currently involved in revising the FAO/WHO Code of Hygienic Practice for the Products of Aquaculture under the auspices of the Committee on Fish and Fishery Products of the WHO/FAO Codex Alimentarius Commission.

Aquaculture-related aspects have also been addressed in the 1997 FAO Expert Consultation on Animal Feeding and Food Safety which generated a draft code of practice for good animal feeding (FAO/ESN, 1998). In addition, FAO's Fisheries Department has encouraged the preparation of Technical Guidelines on Good Aquaculture Feed Manufacturing Practice (*in preparation*)

Human health issues associated with the use of certain chemicals in aquaculture had been discussed in expert meetings such as for example, the Expert Meeting on the Use of Chemicals in Aquaculture in Asia (SEAFDEC/FAO/CIDA, in press) and for coastal aquaculture in general by GESAMP (1997). Important pioneer work on sound bases for drug and vaccine registration in the realm of aquaculture

has been undertaken for the 1997 Workshop on International Harmonisation for Aquaculture Drugs and Biologics (Schnick *et al.*, 1997). In this context, it is worth mentioning that WHO, jointly with FAO and Office International des Epizooties (OIE), will be developing a Code of Practice for prudent use of antimicrobials in livestock production (<http://www.who.int/emc/diseases/zoo/meetings/code.html>). The objective of this initiative is to develop recommendations relating to antimicrobial use in agriculture, including in particular livestock production and aquaculture, to:

- reduce the potential for the transfer of antimicrobial resistance to humans;
- preserve the efficacy of antimicrobials for humans and animals; and
- support human health and animal health

International Cooperation

Many activities in support of the implementation of the Code of Conduct for Responsible Fisheries benefit significantly from international cooperation and exchange among government agencies, stakeholder organizations, experts and institutions, and international organizations. A number of important considerations regarding Sustainable Aquaculture Development and the Implementation of the Code of Conduct for Responsible Fisheries have been presented by Dr William Dar to the Ministerial Meeting on Fisheries, held 1999 in Rome at FAO Headquarters². These are summarized here as follows:

Important considerations

- There is an important commitment to promote aquaculture for food security and rural development (follow-up to World Food Summit Action Plan³).
- Article 5 of the Code of Conduct for Responsible Fisheries calls for due consideration of the Special requirements of developing countries and continued need for technical and financial assistance
- There is scope for the formulation of a Sub-Programme on Aquaculture Development within the Inter-regional Programme in support of the implementation of the Code of Conduct for Responsible Fisheries, as suggested by NACA during the 1999 Session of COFI.
- There is a need for continued regional cooperation, particularly through strengthened cooperation among regional organizations such as, for example, NACA, SEAFDEC, INFOFISH, and others in Asia. Significant opportunities exist also for inter-regional co-operation among countries of different regions.
- Continued support should be given to Regional Programmes on specialized themes such as, for example, Sustainable Aquaculture for Rural Development, and Development of Technical Guidelines on Quarantine and Health Certification, and Establishment of Information Systems for the Responsible Movement of Live Aquatic Animals (AAPQIS);
- Strengthened support may promote national and international initiatives aiming at the formulation and implementation of voluntary self-regulatory codes of practice, supported by technical guidelines and practical manuals;
- There is a growing need for technical review and agreement on international standards (for

²**Sustainable Aquaculture Development and the Code of Conduct for Responsible Fisheries**, a presentation by William D. Dar, Ph. D., Secretary, Department of Agriculture, Republic of the Philippines, to the Ministerial Meeting on the Implementation of the Code of Conduct for Responsible Fisheries, Rome, 10-11 March 1999. <http://www.fao.org/ti/meetings/minist/1999/dar.asp>

³World Food Summit, 1996. Rome Declaration on World Food Security and World Food Summit Plan of Action. World Food Summit, 13-17 November 1996, Rome. Rome, FAO. 43 p. <http://www.fao.org/wfs/final/rd-e.htm>

example, on food safety and quality, biotechnology and biosafety, environment, use of inputs, production practices, etc) which will require appropriate an intergovernmental global forum for discussion and consensus-building; and

- Consider suggestion discussed by COFI regarding the establishment of a COFI Sub-Committee on Aquaculture

In addition to the above key considerations, a number of ongoing or planned initiatives are reported here for general information. As a follow-up to the 1997 FAO Bangkok Consultation on Policies for Sustainable Shrimp Culture, an Expert Consultation on Best Practices and Institutional Arrangements in Shrimp Culture is being organized by FAO scheduled to be held in December 2000, to provide opportunity to interested governments, experts and concerned stakeholders to present and discuss experiences and options for sustainable shrimp culture practices and sector management. Among other matters, opportunity will be given to presentation of results of the ongoing WB/NACA/WWF/FAO Programme on Shrimp Farming and the Environment. FAO is organizing an Expert Consultation on the Proposed Sub-Committee on Aquaculture of the Committee on Fisheries, which will be held during 28-29 February 2000 in Bangkok, at the FAO Regional Office for Asia and Pacific (http://www.fao.org/fi/meetings/cofi/cofi_aq/default.asp). A Conference on Aquaculture in the Third Millennium is being organized by NACA and FAO, and will be hosted by the Fisheries Department of the Government of Thailand in Bangkok during 20-25 February 2000 (<http://www.fao.org/fi/meetings/aq2000/default.htm>). An Expert Consultation on Indicators of Sustainable Aquaculture Development, is being prepared by FAO in collaboration with the Institute of Aquaculture, Stirling University, and is expected to be held in November 2000, in Beijing, China

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References

- Barg, U., R. Subasinghe, R. Willmann, K. Rana and M. Martinez. 1999. Pages: 64-81. In: B.W. Green, H.C. Clifford, M. McNamara and G.M. Montano, Editors, V Central American Symposium on Aquaculture 18-20 August 1999, San Pedro Sula, Honduras. Asociación Nacional de Acuicultores de Honduras (ANDAH), Latin American Chapter of the World Aquaculture Society (WAS), and Pond Dynamics/Aquaculture Collaborative Research Support Program (CRSP), Choluteca, Honduras. <http://www.fao.org/fi/faocons/shrimp/honduras.asp>
- Barg, U., Bartley, D.M., Tacon, A.G.J. & Welcomme, R.L. 1997. Aquaculture and its environment: A case for collaboration, p.462-70. In: D.A. Hancock, et al., eds. Developing and Sustaining World Fisheries Resources. The State of Science and Management. Proceedings of the 2nd World Fisheries Congress, Brisbane, Australia, 28 July - 2 August 1996. Collingwood (Australia), CSIRO Publishing. 797p.
- Dar, W. 1999. Sustainable Aquaculture Development and the Code of Conduct for Responsible Fisheries. Paper presented to the Ministerial Meeting on the Implementation of the Code of Conduct for Responsible Fisheries, Rome, 10-11 March 1999. <http://www.fao.org/fi/meetings/minist/1999/dar.asp>
- FAO. in preparation. Technical guidelines for good aquaculture feed manufacturing practice (FAO Technical

Guidelines for Responsible Fisheries). Rome, FAO.

- FAO Fishstat Plus (AQUASTAT) Database, 1999. FAO/FIDI Rome. [Ftp.fao.org/fi/stat/windows/fishplus/aquaq.zip](ftp://ftp.fao.org/fi/stat/windows/fishplus/aquaq.zip) and [Ftp.fao.org/fi/stat/windows/fishplus/aquav.zip](ftp://ftp.fao.org/fi/stat/windows/fishplus/aquav.zip)
- FAO. 1999a. Special Programme for Food Security. Low-income food-deficit countries (LIFDCs). <http://www.fao.org/spfs/lifdc-e.htm>
- FAO. 1999b. The State of World Insecurity in the World 1999. Rome, FAO, 32p. <http://www.fao.org/NEWS/1999/img/SOFI99-E.PDF>
- FAO. 1999c. The State of World Fisheries and Aquaculture 1998. Rome, FAO. 112 p. <http://www.fao.org/docrep/w9900e/w9900e00.htm>
- FAO. 1999d. Report of the twenty-second session of the Committee on Fisheries. Rome, 15-19 February 1999. FAO Fisheries Report. No. 595. Rome, FAO. 70p. <http://www.fao.org/docrep/meeting/x2930e.htm>
- FAO. 1999e. Summary report on the FAO Technical Consultation on Policies for Sustainable Shrimp Culture (Bangkok, Thailand, 8-11 December 1997) and on Follow-up Activities ; COFI/99/Inf.18. Rome, FAO. <http://www.fao.org/docrep/meeting/x0694e.htm>
- FAO. 1999f. Papers presented at the Bangkok FAO Technical Consultation on Policies for Sustainable Shrimp Culture. Bangkok, Thailand, 8-11 December 1997. FAO Fisheries Report No. 572. (Supplement): 266 p.
- FAO. 1998a. Issues of international trade, environment and sustainable fisheries development: report on sustainable shrimp aquaculture and trade. COFI:FT/VI/98/5. Committee on Fisheries / Sub-Committee on Fish Trade, Sixth Session, 3-6 June 1998, Bremen, Germany. <http://www.fao.org/WAICENT/FAOINFO/FISHERY/meetings/cofi/cofi98/cofitr.htm>
- FAO. 1998b. Report of the Bangkok FAO Technical Consultation on Policies for Sustainable Shrimp Culture. Bangkok, Thailand, 8-11 December 1997. Informe de la Consulta Técnica FAO/Bangkok sobre Políticas para el Cultivo Sostenible del Camarón. Bangkok, Tailandia, 8-11 de diciembre de 1997. FAO Fisheries Report/FAO Informe de Pesca No. 572. Rome/Roma, FAO. 1998. 31p. <http://www.fao.org/WAICENT/FAOINFO/FISHERY/faocons/shrimp/bangk.htm>
- FAO. 1998c. Report of the ad hoc Expert Meeting on Indicators and Criteria of Sustainable Shrimp Culture. Rome, Italy, 28-30 April 1998. Rapport de la Réunion ad hoc d'experts sur les indicateurs et critères relatifs à l'élevage durable des crevettes. Rome, Italie, 28-30 avril 1998. Informe de la Reunión Especial de Expertos Técnicos sobre Indicadores y Criterios para el Cultivo Sostenible del Camarón. Roma, Italia, 28-30 de abril de 1998. FAO Fisheries Report/FAO Rapport sur les pêches/FAO Informe de Pesca No. 582. Rome/Roma, FAO. 1998. 76 pp. <http://www.fao.org/WAICENT/FAOINFO/FISHERY/faocons/shrimp/bangk.htm>
- FAO. 1998d. Responsible Fish Utilization. FAO Technical Guidelines for Responsible Fisheries. No. 7. Rome, FAO. 33p. <http://www.fao.org/WAICENT/FAOINFO/FISHERY/agreem/codecond/codecon.htm>
- FAO. 1997. Report of the twenty-second session of the Committee on Fisheries. Rome, 17-20 March 1997. FAO Fisheries Report. No. 562. Rome, FAO. 32p.

<http://www.fao.org/docrep/meeting/x5606e.htm>

FAO Fisheries Department. 1997. Aquaculture development. FAO Technical Guidelines for Responsible Fisheries No.5. FAO, Rome. 40p

<http://www.fao.org/WAICENT/FAOINFO/FISHERY/agreem/codecond/codecon.htm>

FAO/ESN. 1998. Animal Feeding and Food Safety - An FAO Expert Consultation on Animal Feeding and Food Safety, Rome, 10 -14 March 1997. Rome, FAO.

<http://www.fao.org/WAICENT/FAOINFO/ECONOMIC/ESN/animal/animapdf/contents.htm>

FAO. 1996a. Precautionary approach to capture fisheries and species introductions (FAO Fish.Tech.Pap., 350/1), reissued as FAO Technical Guidelines for Responsible Fisheries. No. 2. Rome, FAO. 54p

<http://www.fao.org/WAICENT/FAOINFO/FISHERY/agreem/codecond/codecon.htm>

FAO. 1996b. Integration of fisheries into coastal area management. FAO Technical Guidelines for Responsible Fisheries. No. 3. Rome, FAO. 17p.

<http://www.fao.org/WAICENT/FAOINFO/FISHERY/agreem/codecond/codecon.htm>

FAO. 1995. Code of Conduct for Responsible Fisheries. Rome, FAO. 48 p.

<http://www.fao.org/WAICENT/FAOINFO/FISHERY/agreem/codecond/codecon.htm>

FAO/NACA/WHO. 1999. Report of the Joint FAO/NACA/WHO Study Group on Food Safety Issues Associated with Products from Aquaculture, Bangkok, Thailand, 22-26 July 1997. Geneva, World Health Organization. WHO Technical Report No. 883; 55pp

<http://www.who.int/fsf/trs883.pdf>

FEAP. in preparation. A Code of Conduct for European Aquaculture - Draft. Federation of European Aquaculture Producers (FEAP).

GAA. 1999. Codes of Practice for Responsible Shrimp Farming. Global Aquaculture Alliance, St Louis, USA.

GESAMP (IMO/FAO/Unesco/WMO/WHO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection), 1997. Towards safe and effective use of chemicals in coastal aquaculture. Rep.Stud.GESAMP, (65): 40 p.

<http://www.fao.org/fi/publ/report/gesamp/r65/r65.asp>

Kent, G. 1995. Aquaculture and food security. Paper presented at the Pacific Congress on Marine Science and Technology (PACON), Honolulu, USA, 17 April 1995.

NACA. 1996. The second five year programme of the Network of Aquaculture Centres in Asia-Pacific (NACA), 1996-2000. Theme: Aquaculture Sustainability. Network of Aquaculture Centres in Asia-Pacific, Bangkok, Thailand. 27p.

Schnick, R. et al. 1997. World wide aquaculture drug and vaccine registration progress. Bull. Eur. Ass. Fish Pathol. 17: 251-260.

SEAFDEC/FAO/CIDA. (in preparation). Report and proceedings of SEAFDEC/FAO Expert Meeting on the Use of Chemicals in Aquaculture in Asia, held 20-22 May 1996, at the Aquaculture Department of the Southeast Asian Fisheries Development Center in Tigbauan, Iloilo, Philippines.

Subasinghe, R. and Arthur, J.R. 1997. Introducing AAPQIS: the FAO's Aquatic Animal Pathogen and Quarantine Information System. The FAO Aquaculture Newsletter 16:3-6.

[FTP://ftp.fao.org/FI/document/newslet/fan/fan16.pdf](ftp://ftp.fao.org/FI/document/newslet/fan/fan16.pdf)

Subasinghe, R., Arthur, J.R., Kumar, D., Phillips, M.J., and Bernoth, E-M. 1998a. FAO's assistance for the responsible movement of live aquatic animals in Asia. The FAO Aquaculture Newsletter 19:19-22.

[FTP://ftp.fao.org/FI/document/newslet/fan/fan19.pdf](ftp://ftp.fao.org/FI/document/newslet/fan/fan19.pdf)

Subasinghe, R.P., Barg, U., Phillips, M.J., Bartley, D., and Tacon, A.G.J., 1998b. Aquatic animal health management: investment opportunities within developing countries. *J. Applied Ichthyology* 14: 123-129.

World Food Summit. 1996. Rome Declaration on World Food Security and World Food Summit Plan of Action. World Food Summit, 13-17 November 1996, Rome. Rome, FAO. 43 p. <http://www.fao.org/wfs/final/rd-e.htm>