Responsible aquaculture: Is this a special challenge for developing countries?[1,2]

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Introduction

Many general definitions of the concept of sustainability exist (Cataudella 2002). Some scholars consider them too vague to be of any practical importance; however, the term sustainability may be useful precisely because it is vague and, like moral principles and human rights, needs to be refined and interpreted on a case-by-case basis (Kaiser 2002). One of the simplest and best known definitions is that sustainable development is that which meets the needs of the present without compromising the ability of future generations to meet their own needs.

Sustainable literally means to keep going indefinitely, although in practice this has been modified to include an element of responsibility. The word responsibility is probably more appropriate than sustainability because it implies being morally accountable for one's actions. It has been used for several years in relation to both capture fisheries and aquaculture by the Food and Agriculture Organization (FAO) of the United Nations (FAO 1995).

My definition is simple. Responsible aquaculture is profitable aquaculture with a conscience.

Responsible aquaculture has been the topic of numerous conferences, symposia, and workshops over nearly two decades. Scientists and administrators were the main people involved in the early meetings. Until a 1997 World Aquaculture Society (WAS) meeting in Seattle, Washington USA, shrimp farmers, processors, exporters and distributors, together with feed manufacturers, had largely shunned the debate on responsibility and taken a very defensive posture (Hargreaves 1997). During that WAS meeting, they were busy forming the Global Aquaculture Alliance in a satellite meeting to mount a coherent response to attacks on the shrimp farming industry.

Scale of Aquaculture in Developing Countries

Aquaculture produced 29 percent of total global foodfish supplies in 2001, up from 14 percent in 1991 and seven percent in 1981 (Figure 1). Delgado *et al*. (2002) forecast that the proportion provided by aquaculture will rise to 41 percent by 2020. A significant proportion of the totals of both captured and cultured foodfish arise in China. Aquaculture produced only five percent of the foodfish supplies in the rest of the world in 1981, and grew more modestly to eight percent in 1991 and 13 percent in 2001.

Aquaculture production in industrialized countries was about nine percent of the global total in 2001. Even when Chinese production is excluded, the output of foodfish from aquaculture in developing countries is much greater than in industrialized countries and the gap is widening (Figure 2). About 7.5 million people work on fish farms, and the numbers doubled between 1990 and 2000 (Table 1). Most are in the developing countries of Asia. While the workforce remained relatively static in the Americas, Europe and Oceania, significant increases occurred in Asia and Africa during the past decade. The value of foodfish produced in industrialized countries seems to have leveled off but in developing countries it is still expanding (Figure 3).

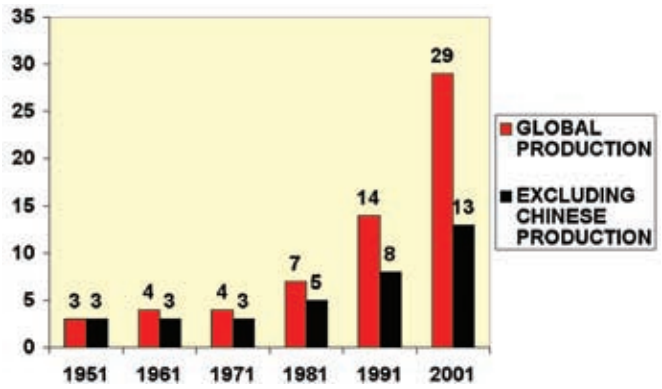

Fig. 1. Contribution of aquaculture (percent) to total foodfish supplies 1951-2001. (FAO 2003)

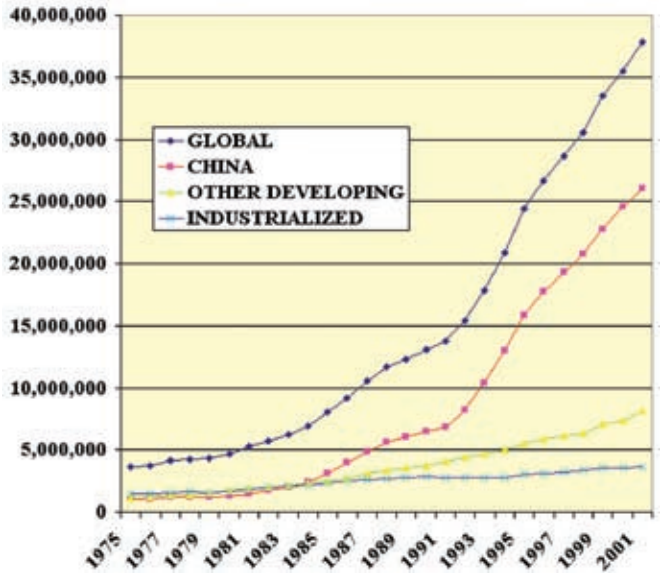

Fig. 2. Aquaculture production (mt) 1951-2001. (FAO 2003)

Table 1. Numbers (thousands) of fish farming workers 1990-2000 (FAO 2002d)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Africa				5	6	14	62	55	56	57	75
North and Central America	53	73	101	206	206	176	182	185	191	190	190
South America	16	15	15	20	30	43	44	42	41	42	41
Asia	3,698	3,882	4,292	4,927	5,389	6,003	6,051	6,569	6,758	6,930	7,132
Europe	11	12	13	23	26	18	23	25	25	26	27
Oceania					1	1	4	5	5	5	5
World	**3,778**	**3,982**	**4,421**	**5,181**	**5,658**	**6,255**	**6,366**	**6,881**	**7,076**	**7,250**	**7,470**

In coastal areas (Figure 4), when Chinese production is excluded, production in other developing countries (20 percent) is similar to that in industrialized countries (17 percent). Even excluding Chinese production, freshwater aquaculture (Figure 5) in other developing countries (24 percent) is much higher than in industrialized countries (3 percent).

Most shrimp production occurs in tropical developing countries (Figure 6). Most salmon production occurs in industrialized countries but a significant proportion now comes from Chile, which produced nearly as much as Norway in 2001 (FAO 2003) and has since overtaken Norway as the largest producer of farmed salmon and trout (Anonymous 2002i).

Aquaculture is of particular importance in what are termed low-income food-deficit countries (LIFDCs) - the poorest countries. Aquaculture production in the LIFDCs is 82 percent of the global total (Figure 7), with China having a dominating influence (69 percent of the global total). The production of foodfish in the other LIFDCs is about 13 percent. In addition, a further nine percent is produced in other developing countries.

Aquaculture is responsible for more than one third of the total foodfish production in 11 of the top 25 aquaculture LIFDCs (Table 2).

The data exclude farmed fish produced, consumed and sold locally by poor rural people within those countries. Aquaculture is therefore much more important to developing countries than the statistics indicate.

Responsibility of Aquaculture in Developing Countries

Intensive coastal aquaculture

Shrimp is the most traded seafood product (FAO 2002d). Thirty percent of the supply comes from aquaculture (FAO 2003), almost all from developing countries. Although there have been problems caused by irresponsible development, great improvement has been made.

An unfair proportion of the blame for mangrove destruction is still directed at shrimp farming. Non-aquaculture activities causing mangrove damage include pollution from urban, industrial and agricultural sources; overfishing; oil extraction and transport; timber cutting; silt formation from soil erosion; dam construction; tree cutting for charcoal production; general deforestation; dynamite and poison fishing; urban expansion; tourism; agricultural expansion and irrigation; and salt production.

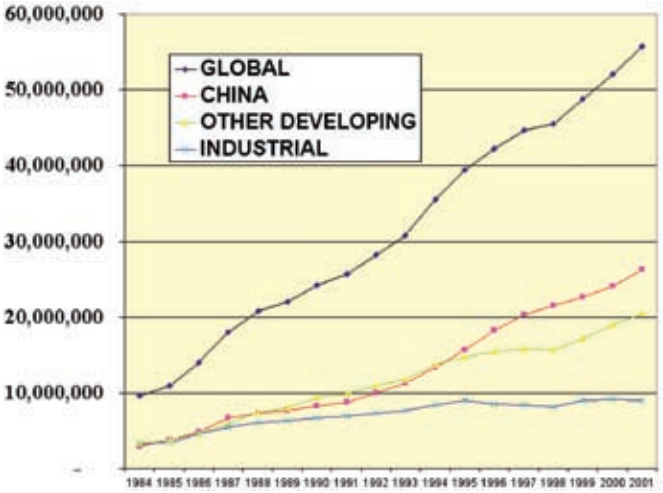

Fig. 3. Value of aquaculture products (US$ '000) 1984-2001. (FAO 2003)

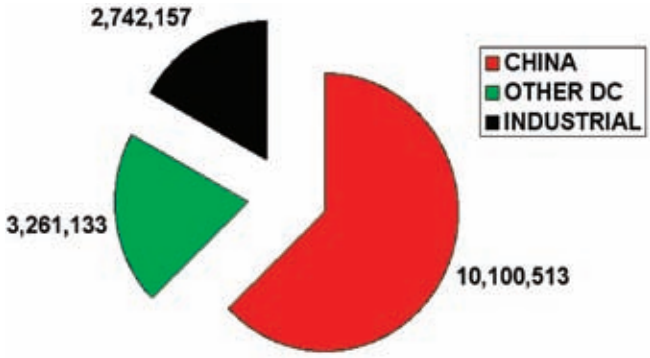

Fig. 4. Coastal aquaculture production (mt) by economic group in 2001. (FAO 2003)

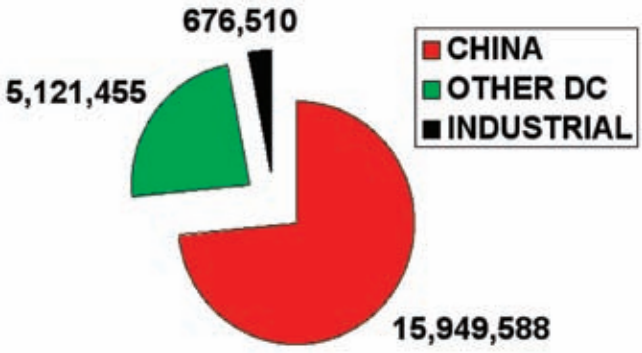

Fig. 5. Freshwater aquaculture production (mt) by economic group in 2001. (FAO 2003)

Table 2. Top 25 LIFDC aquaculture producers in 2001 and proportion of total fish production from aquaculture (derived from FAO 2003)

	Aquaculture (mt)	Capture and aquaculture (mt)	Aquaculture as proportion of total (%)	Rank (#)
Armenia	1,331	2,197	61	25
Bangladesh	687,000	1,687,000	41	4
Cambodia	15,500	412,700	4	14
China	26,050,101	42,579,490	61	1
Cuba	54,330	110,380	49	9
Ecuador	67,969	654,539	10	7
Egypt	342,864	771,516	44	6
Ghana	6,000	451,287	1	18
Guatemala	4,200	14,300	29	21
Honduras	9,000	16,451	55	15
India	2,202,630	5,965,280	37	2
Indonesia	864,276	5,069,107	17	3
Korea DPR (North)	63,700	263,700	24	8
Laos	50,000	80,000	63	10
Madagascar	7,749	143,364	5	17
Morocco	1,362	1,084,641	<1	24
Nepal	16,570	33,270	50	12
Nicaragua	5,721	28,520	20	20
Nigeria	24,398	476,544	5	11
Pakistan	16,405	623,425	3	13
Philippines	434,657	2,382,315	18	5
Sri Lanka	8,370	288,508	3	16
Syria	5,880	14,171	41	19
Uganda	2,360	223,086	1	23
Uzbekistan	4,082	8,152	50	22

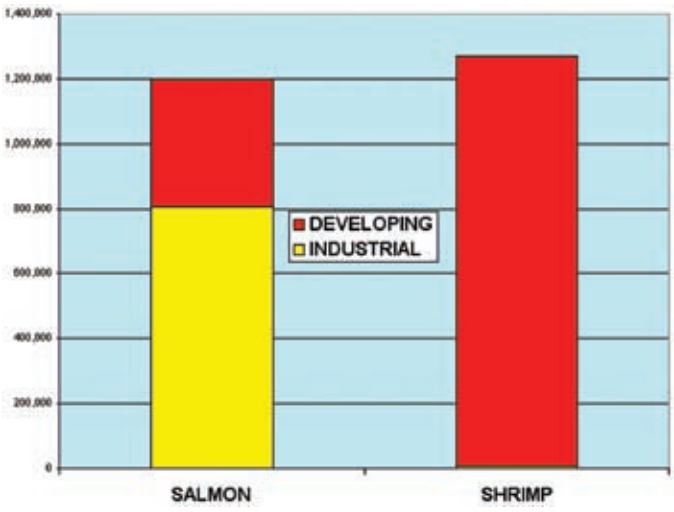

Fig. 6. Aquaculture production (mt) of salmon and shrimp in 2001. (FAO 2003)

Fast and Menasveta (2003) noted that conversion of mangroves for shrimp culture in Thailand mainly occurred during the phase when extensive production technologies were used. Most farms built after 1987 were intensive and built above the tidal range, behind the mangroves or in non-mangrove areas, but some further conversion of mangroves occurred through 1996. While Thai farmed shrimp production continued to increase after 1996, the mangrove area also increased by 46 percent (nearly 77,000 ha) between 1996 and 2000, ultimately exceeding the area that existed in 1980. Shrimp farms constructed and operated in an irresponsible manner have also had an impact on crop production and the quality of water available for human use (Khan *et al*. 2000).

The potential negative impacts of aquaculture on the environment are now widely recognized. Less well publicized are the benefits that aquaculture brings.

Rural aquaculture

Many small-scale aquaculture systems are integrated with crop and/or livestock production, but some need outside inputs because of limited resources within the farm itself. The term rural aquaculture, which can be considered as the poorest of the poor aquaculture, whereby most, if not all of the output is consumed by the producer, or less poor aquaculture, whereby most of the output is sold for profit (Ridler and Hishamunda 2001). The term rural aquaculture implies low-cost production with extensive and semi-intensive technologies most appropriate for the limited resource base of small-scale households (Edwards and Demaine 1997).

While sometimes unpopular, the concept of the ecological footprint, a tool for aquaculture development, neatly demonstrates the potential environmental sustainability of rural aquaculture (Kautsky *et al*. 1997). Those authors showed that it is necessary to expand perspectives and actions far beyond the site of the farm to put aquaculture into its ecological context. They found that semi-intensive farming, supported on waste products from fisheries, agriculture and households, depends very little on external ecosystem areas.

Edwards (2001a) noted that the blue revolution in aquaculture has not yet taken place outside China but rural aquaculture has vast unfulfilled potential to contribute to food security and pov-

erty alleviation. Edwards (2001b) provided a personal review of the state-of-the-art of rural aquaculture that listed the benefits for the poor as improved food supply, employment and income.

Sorgeloos (2001) commented that although traditional aquaculture still produces the major part of global aquaculture output, it has been based on trial and error practices, evolved over a very long time, and has received minimal research input. He felt that recent attempts to intensify this form of aquaculture implied serious threats to sustainability. However, it is important to remember that external environmental threats are often a greater danger to the development of aquaculture than the effects of aquaculture on the environment (Hecht 2001).

Martinelli (2000) warned that there was a risk that governments may be just as susceptible to being dazzled by the promises of riches as the average small farmer. He recommended that the (Vietnamese) government should adopt a more cautious approach that seeks to balance the twin objectives of sustainable poverty alleviation and economic development. In his view, ensuring that the benefits of increased intensification of production were shared widely and contributed to national economic development would also depend on being able to resist the trans-national corporations which were dominating the aquaculture industry.

Fish culture has proved successful in improving the standard of living of rural farmers in Asia (Edwards 2000). Despite this, the promotion of aquaculture for rural development has had a poor record in many developing countries, often because of a lack of adoption by one of the intended target groups: the rural poor (FAO 2002b). Social, economic and institutional issues remain the greatest constraints to enhanced rural development by aquaculture adoption but a more holistic approach toward improved livelihoods and greater household food security is emerging (Halwart *et al*. 2002). The need to document and disseminate success stories in rural aquaculture development, and to draw strategies from these experiences has been expressed (FAO 2002c).

Both small- and large-scale commercial aquaculture contribute to food security and economic growth in sub-Saharan countries and tilapia, catfish and shrimp should be the focus, at least for the time being (Anonymous 2001b). Some believe that the target groups chosen in early attempts to foster aquaculture development in sub-Saharan Africa were wrong, and at least in that region, the creation of wealth through the production

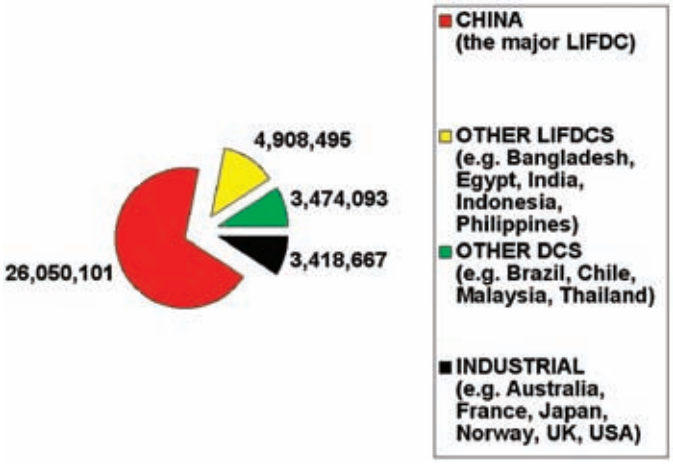

Fig. 7. Importance of aquaculture production in low income food deficit countries in 2001. (Derived from FAO 2003)

Table 3. Codes of conduct: examples applicable to aquaculture

Name	Targets and topics	References
FAO Code of Conduct for Responsible Fisheries (CCRF)	Includes aquaculture	FAO (1995)
Philippines Fisheries Code	Includes aquaculture	Yap (1998)
Thai Code of Conduct (2003)	Shrimp farming	Tookwinas and Songsangjinda
Federation of European Aquaculture Producers Code of Conduct	European aquaculture	www.feap.info
Nutreco Code of Conduct	Commercial aquafeed and aquaculture producer	Anonymous (2002a)
Codex Alimentarius	Food safety and quality standards, including 29 relevant to fresh and processed fisheries products	www.fao.org/es*/esn/codex
Australian Aquaculture Forum National Code of Conduct	Australian aquaculture	Shelley (1999)
Draft Code of Conduct (Brazil)	Environmental issues	Santiago Caro Ros (2002)
Thai Code of Conduct	Shrimp farming	Fegan (1999); Anonymous (2000a,b,c); Tookwinas *et al.* (2000)
Codes of Conduct	Shrimp farming	Boyd (1999)
US Department of Commerce Code of Conduct	Responsible aquaculture development in the EEZ (draft to be published Summer 2003)	C. Nash (pers. Comm. 2003)

and sale of aquaculture products should be the objective, rather than strategies designed to improve the nutrition of the poor (Hecht 2001). More recently, a new wave of optimism for African aquaculture has been reported by Roderick (2002), with several privately funded tilapia farming projects showing promise. Promoting wealth creation could be regarded as means of alleviating poverty, but policies that concentrate on fostering those who have already achieved a measure of success would worry me. In fact, as in industrialized countries, there is room for both large-scale and small-scale aquaculture in developing countries; most employment will be in the latter (Brummett 2003).

Aquaculture needs to partner with its competitors for finite resources in producing food for a burgeoning population (New 1991). Integrated farming can be broadly defined as the concurrent or sequential linkage between two or more activities, of which at least one is aquaculture (Little and Edwards 2003).

The environmental impact of uncontrolled disposal of both livestock production and processing wastes is becoming unacceptable (Little and Edwards 1999). Fish culture should be promoted as part of a broader agricultural system; the efficiency of the whole system, rather than that of single components alone should be considered (D. Little, pers. comm. 2002). There is a need for a comparative socioeconomic evaluation of the use of land and water for aquaculture with respect to other forms of agriculture and also to show how aquaculture adds value to water resources in farming systems (FAO 2002c).

In a review of the integration of aquaculture into the rural development of coastal and inland areas, Haylor and Bland (2001) defined a number of principles for improved planning and management. Two are particularly important, in my opinion: 1) putting people in the center, so that rural development and the role for aquaculture within it are determined by an understanding of people's livelihoods; and 2) the involvement of poor people in the policy-making process.

Codes, Management and Cooperation

Many codes of conduct (Table 3), codes of practice (Table 4), and guidelines and strategies (Table 5) already exist. FAO is the leader in promoting a code of conduct for fisheries and aquaculture (FAO 1995). The European Parliament (2003) has encouraged the use of codes of conduct by the aquaculture profession. In the marine shrimp sector, the challenge began to be taken up by the Global Aquaculture Alliance (GAA) in 1997. Boyd (1999) developed codes and best management practices (BMPs) for aquaculture and continues to advise the GAA and others on the topic.

Small-scale shrimp farmers may be disadvantaged by the establishment of good management practices (GMPs). Their adoption might affect the competitive position of small farmers and prevent them benefiting from the price premiums attained through eventual certification and labeling schemes (FAO 2001).

Hambrey (2000) pointed out that one of the weaknesses of codes is that it is easier for large producers to adhere to them and demonstrate that they have done so. Unless they are very well organized, small-scale producers may lose out. The Federation of European Aquaculture Producers (FEAP), which generally represents small producers, has developed a code of conduct for aquaculture (FEAP 2000). FEAP has also provided assistance in transferring its experience as an association to developing countries (Hough and Bueno 2002). Nongovernmental organizations (NGOs) are also involved in a positive way in working toward enhanced responsibility.

Certification systems are emerging (Table 6). The growth of fisheries ecolabelling and product certification in industrialized countries poses problems for developing countries (Wessells *et al*. 2001). Not all countries that export aquaculture products will be able to meet the environmental standards that other countries set for products, or afford the costs of certification. They may also find it difficult to comply with all the traceability requirements that are imposed. The elaboration of transparent and nondiscriminatory certification procedures has been identified as a priority (FAO 2002c).

I recently stressed that we may confuse our multifarious audiences with the plethora of uncoordinated codes, declarations, guidelines, guarantees and

(Continued on page 60)

Table 4. Codes of practice: examples applicable to aquaculture

Name	Targets and topics	References and notes
Guidelines for GMPs	Shrimp farming	Annex D in FAO (2001)
Thai GMPs	Shrimp farming	Tookwinas *et al.* (2000)
Malaysian Code of	Aquaculture	Anonymous Practice (1999a)
Malaysian Code of	Shrimp farming	Anonymous Practice (2002d)
Australian Prawn Farmers Environmental Code of Practice	Shrimp culture	Anonymous (2001a) www.apfa.com.au
Consortium Program on Shrimp Aquaculture and the Environment (CPSAE)	Developing BMPs	www.enaca.org/shrimp/bettermanagement.htm
Guidelines on GMPs	Shrimp farming	Aquaculture Authority (2002)
Global Aquaculture Alliance Codes of Practice	Responsible shrimp farming	www.gaalliance.org Adopted (e.g.) by producer associations in Ecuador, Honduras and Nicaragua in 1999 (Anonymous 1999b)
Sundry codes of practice or BMPs produced by net-pen, oyster, and shrimp farmers, etc. in the USA	Various industry sub-sectors	C. Nash (pers. Comm. 2003) Likely to set national quality standards, which would also need to be met by exporters from developing countries

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ecolabels with which we are attempting to surround ourselves (New 2002). Ecolabel proliferation will increase the cost burden on producers in educating consumers about their meaning and credibility and to differentiate one ecolabel from another (Wessells *et al*. 2001). Consumers may become confused with multiple ecolabels and decide that none have any real credibility. Development of a data bank of national codes may be desirable (FAO 2002c).

Codes are often very general in nature. According to Hambrey (2000), locally adapted codes of conduct and BMPs should ideally be promulgated as part of district or regional sector environmental assessment. Ackefors and White (2002) concluded that codes of practice should be designed around the interests of the specific farm animals as well as the interests of local people and consumers. What is really needed is a general code of conduct for each district that takes into account international and national codes and policies, covers all local resource users and environmental and socioeconomic activities, and has specific, but inter-related BMPs for each activity category.

Table 5. Guidelines, policies and strategies for responsible aquaculture: Examples

Name or type of document	Targets and topics	References
FAO Technical Guidelines	Aquaculture development	FAO (1997)
Strategy for the sustainable development of European aquaculture	Aquaculture development	European Commission (2002); New (2003)
NACA/FAO Strategy for Aquaculture Development beyond 2000	Aquaculture development	NACA/FAO (2001)
Holmenkollen Guidelines	Sustainable aquaculture	NATS (1997); Sundli (1999)
Draft framework	General aquaculture	Ackefors and White (2002)
Guidelines	Improved technology in traditional and improved traditional shrimp farming in India	Aquaculture Authority (1999)
Guidelines	Effluent treatment in shrimp farms in India	Aquaculture Authority (2001)
Audubon Guide to Seafood	NGO evaluating captured and culture species	www.audubon.org Chamberlain (1999)
Environmental Defense	NGO (300,000 members in the US) evaluating captured and culture species	www.environmentaldefense.org
Sustainability indicators Guidelines (India)	Aquaculture Sustainable aquaculture	Pullin *et al.* (2003 in press); www.mpeda.com
Recommended policy (Taiwan)	Sustainable aquaculture (shrimp farming)	Liao (1998)
Global planning and management	Sustainable coastal aquaculture development	GESAMP (2001)

Organic Production

Organic aquaculture has grown up alongside the development of codes of practice and certification. The international market for many types of organic food is booming (Stern 2002); however it represents less than 0.5 percent of total food sales. Global organic fish production is said to be about 18,000 tons per year and mainly consists of organic salmon and marine shrimp (Bousquet 2002). Several European organizations have pioneered labeling for certified organic farmed fish (Stern 2002), including carp, salmon and trout.

It is believed that the existing market for organic fish and other seafood will expand. In Europe, organic salmon achieves a premium price of 15-40 percent (Subasinghe 2002). The concept of organic aquaculture has had less relevance and interest in the domestic markets of developing countries. However, there are opportunities for developing countries to produce organic products for export (J. McInerney, pers. comm. 2002). Even freshwater prawns are being considered for an organic farming label (Anonymous 2002e); this may partly be because their culture is considered more environmentally and socially acceptable than marine shrimp farming (New *et al*. 2000).

Many consumers are skeptical about the motives of producers and retailers of organic products. In a survey conducted in Spain, Denmark and Germany, respondents had difficulty conceptualizing ecological fish (Montfort 1998).

Critics of Aquaculture and Trade Implications

Opposition, especially to intensive aquaculture, is strong and originates not only from well-funded NGOs but also from the scientific community. Criticism of aquaculture in developing countries, especially shrimp farming, has been very potent.

Criticism From our Peers

Criticism of intensive aquaculture practices has come from both outside the industry and from within. Some feel that we should be more concerned about criticism from our peers than from environmental and welfare organizations (Kaiser 2002). Certainly papers by Naylor *et al*. (1998, 2000) caused uproar in the aquaculture industry and drew rebuttals (Chamberlain 1999, Tidwell and Allan 2001). Kaiser and Stead (2001) commented that the worst thing that one can do is reject such challenges out of hand,

to ignore them, or to downplay their importance. Despite such efforts to present a more balanced viewpoint, the original criticisms caught the eyes of the media and have remained in the minds of the public.

Criticism of aquaculture from the scientific community continues. Pauly *et al*. (2002) referred to the "slash and burn" tactics of some shrimp farming operations, but the papers cited to back up that contention were written a decade ago (Pullin *et al*. 1993) or refer to the situation in China at that time (Feigon 2000). There is no mention of the efforts by governments and the global shrimp farming industry to curb those environmentally or socioeconomically unsustainable activities. Browdy (2002) discussed the unfair portrayal of aquaculture in the public and scientific press and noted that the lack of balanced reviews on critical issues such as these hamper our ability to counter "…examples of weak science, overt exaggerations and broad generalizations."

The use of diets rich in fish meal and fish oil in the developed world were also targeted by Pauly *et al*. (2002), though such feeds are also used in developing countries. Aquaculture has the potential to utilize 70 percent of the total supply of conventionally produced fish meal by 2015 and 100 percent of fish oil by 2010 (New and Wijkstrom 2002). However, criticisms of the intensive culture of carnivorous species because of their use of marine resources ignore several pertinent factors. New and Wijkstrom (2002) found no evidence that aquaculture has increased the exploitation of fish for fish meal manufacture; it has simply diverted existing and relatively static supplies of the commodity from feeds for other livestock, a phenomenon that is expected to continue (Pike and Barlow 2003). In fact, using fish meal for aquaculture may actually be environmentally friendly since farmed fish are more efficient converters than other livestock (Tidwell and Allan 2001).

Positive results from research into the partial or complete replacement of fish meal and fish oil by alternative plant and animal sources is gradually reducing the use of these resources by the aquafeed industry (Kaushik 2002). It has recently been reported that farmed fish will accept a greater percentage of plant material when synthetic pheromones are incorporated into the feed (Anonymous 2002b). Reductions in the dietary levels of fish meal and oil are being offset by expanded aquaculture production. Thus, it may be necessary to turn to alternative sources of marine protein and oil, such as mesopelagic fish, and possibly krill (New and Wijkstrom 2002).

Pullin *et al*. (2003) suggested that aquaculture needs a fundamental transition from a concentration on maximizing output from the target species to integrated management of natural resources and ecosystems. This applies not only at the farm level but also to watersheds, coastal areas and open waters. I believe this approach represents a framework within which we will be forced to operate, like it or not.

It is unfortunate that a gulf has existed between aquaculturists and environmentalists. Surely it would be more professional and productive for both groups to recognize that neither is perfect and to work together for improvement. I have often stressed that dialogue, not confrontation, is essential.

Costa-Pierce (2002) suggested that global aquaculture expansion should be accomplished through promoting an alternative development model that not

Table 6. Certification schemes

Name or type of document	Targets and topics	References
International Federation of Organic Agriculture Movements Draft standards	Organic aquaculture	Anonymous (2002e) www.ifoam.org
Marine Stewardship Council Certification	Currently applies to capture, but has ambitions to extend to aquaculture	www.msc.org
International Organisation for Standardization (ISO)	Environmental labels and declarations (ISO 14000 and 14020 series)	www.iso.ch
Natureland Certification	Organic aquaculture	www.naturelandzeichen.de
Aquaculture Certification Council (Aquaculture Certification Council)	Shrimp farming facilities	www.aquaculturecertification.org Aquaculture Certification Council (2002)
SCS Marine Certifications	Accredited certifier of marine fisheries, with ambitions to extend to aquaculture	www.scs1.com
World Wildlife Fund (WWF)	Works with MSC on fishery certification. Involved (with NACA etc.) in CPSAE	www.wwf.org
International Organisation for Standardization (ISO)	Environmental labels and declarations (ISO 14000 and14020 series)	www.iso.ch

only brings in the technical aspects of ecosystem design and ecological principles, but also incorporates comprehensive planning for the wider social, economic and environmental context. He contended that the public will not accept any new forms of food production that exploit people, cause environmental harm or produce new sources of aquatic pollution. He also expressed the opinion that environmental groups have done a service to both society and global aquaculture by pointing out ecological and social effects.

Ethics must now play a significant role in the development of both industrial and small-scale aquaculture for poverty alleviation. In arguing for greater public participation, Kaiser (2002) noted that when balanced information was clearly presented, it was not necessary to be an expert to make good ethical decisions. However, convincing scientists, who Hallerman (1997) described as professional skeptics, about the importance of straightforward discussion of ethical issues is not easy.

Criticism From the Community

The consumer is certainly influenced by the opinions of NGOs. Doubt can be used to generate concern, to raise the profile of unscrupulous NGOs and solicit income, and to generate fear in consumers by unscrupulous journalists.

WAS has been concerned with the issue of sustainability for many years. In 1997 WAS held a special two-day session on the topic at the Seattle conference. An illuminating description of the conflicts that took place between pro- and anti-aquaculture participants during the session, and the litany of real or perceived problems caused by salmon and shrimp farming, was provided by Hargreaves (1997). Lassen (1997), complaining about the behavior of some of the representatives of NGOs present at the session asked, "If they are watchdogs and bark at everything, who will continue to listen to their warnings?" Demonstrations were held outside the conference hall and a large poster proclaimed, "Salmon don't do drugs."

WAS continues to provide a forum for discussion rather than a vehicle for lobbying for the aquaculture industry. Yet, some NGOs continue to make capital out of attacks on aquaculture that resound in the media.

We must realize the necessity to work with NGOs in a constructive manner, rather than simply defending ourselves against negative criticism (New 2002). Hans van Bieman, the CEO of Nutreco, said that the industry has nothing to hide and therefore nothing to fear from cooperating freely with interested outside entities (Anonymous 2002a). Such openness is certainly not always rewarded. Having seen material released by the company, Friends of the Earth (FoE) made an unsubstantiated attack on Nutreco (Dallimore 2002). FoE subsequently apologized but the damage had been done since the media picked up their original comments.

Far from being responsible, some NGOs show extreme irresponsibility. Hepburn (1997) noted that the environmental activist does not have to stake his career, his family, his ties with the local community, or his self esteem. Some NGOs that oppose aquaculture have even recruited high profile restaurant chefs in their campaigns (Anonymous 2002c).

In the West, some media commentators regard modern farming methods, in general, as unacceptable (Humphrys 2001a). Intensive salmon farming in particular has been described as a "scandal" (Humphrys 2001b) and an activity that is carried out in a "bath full of chemically tainted, lice-infested and occasionally toxic seawater" (Girling 2001). Any suggestion that genetically-modified fish might be used in fish culture in Europe leads to front page newspaper headlines accusing our industry of developing "Frankenfish." A major protagonist from the developing world regards global business in general as the ogre that "starves the poor" (Shiva 2000) and shrimp farming in particular as a "highly wasteful and inefficient technology…that puts the luxury consumption of shrimp by rich northern consumers, and the profits of corporations, above the need for drinking water, food, and the livelihoods of local fishing and farming communities" (Shiva 1995).

I wonder why aquaculture is such a target when it is a minor polluter compared with many other activities. Is it just that we are the latest and most obvious activity seen by the populace, or just a soft target?

Trade implications

Recently, an INFOFISH editorial noted the plethora of legislation affecting the trade in aquaculture products (Anonymous 2002g). Added to this the new 'bio-terrorism legislation' that is currently being enacted by the USA brings yet more worries to traders and aquaculture producers (Woodhouse 2003). Recently, the President of the Shrimp Hatchery Association of Bangladesh commented that many international producers were worried that certification systems may become "an instrument of denial to market access" (Anonymous 2003a). Increasingly, seafood products have to be labeled as farmed or wild, and with their country of origin. Such rules seem reasonable; however, they may also have an impact on the exports of farmed fish and shrimp from developing countries because consumers are rather fickle and may ostracize the products of those countries that are not currently in favor for political reasons. While fish farmers in industrialized countries may see such developments as beneficial, since they tend to level the playing field, those in the developing countries may see their imposition as a form of trade barrier.

According to Ahmed and Delgado (2000), there are justifiable fears that trade liberalization will divert fish products and their inputs to markets with higher purchasing power. Free trade will direct resources to their most productive use, which will affect opportunities worldwide. Liberal trade regimes and concentrated income growth raise concern about worsening imbalances in consumption and income between industrialized and developing countries and among economic classes. However, various international organizations have expressed a commitment to help developing countries solve their difficulties in implementing current World Trade Organization agreements (World Trade Organization 2001).

Vested interests still seek, on the one side to exploit export opportunities and on the other to impose trade barriers to protect local producers. Tariff privileges exist but not everything is one-sided in the trade barrier story. Producers sometimes evade the EU General System of Preferences by exporting through an intermediate country (Fegan 1999). Despite the ongoing dispute between Vietnam and the USA over catfish dumping (Anonymous 2003b), local farmers are planning to double the amount of catfish produced in some provinces in

the Mekong Delta (Conley 2003a). The fish are exported to 27 countries, but the USA is the major market. The catfish industry in the southern Mekong Delta region is said to employ 300,000-400,000 people (Conley 2003b). In an effort to overcome the problems with exporting Asian catfish from Southeast Asia to the USA, the Thai government is promoting the farming of channel catfish, *Ictalurus punctatus*, which is the species cultured in the USA (Buranakanonda 2002).

Animal welfare concerns are likely to have an increasing impact on aquaculture development. This was recognized at the 2002 EAS conference in Trieste (Anonymous 2002f) and by the welfare partners in a European project on sustainable breeding and reproduction in farm animals, including fish (Komen *et al*. 2002; www.sefabar.org). The recent resolution on aquaculture by the European Parliament (European Parliament 2003) contains references to animal welfare in several of its clauses. The European Parliament has also expressed the view that the introduction of genetically modified fish into the EU should be prevented until it can be shown to present no dangers. The members of FEAP have also rejected their production. In addition, the European Parliament has urged the European Commission to impose the same health, food safety and animal welfare standards on products from non-member countries so as to avoid unfair competition (European Parliament 2003).

Poor fish-exporting countries are concerned that technical standards, such as sanitary and phytosanitary measures, hazard analysis critical control point standards and ecolabelling may act as trade barriers (WorldFish Center 2002). Bans by industrialized countries on certain aquaculture products grown in developing countries have been viewed as trade barriers. The question of chloramphenicol residues is a case in point and was a subject of dispute between Thailand and the European Commission. A ban on the antibiotic was said to have caused the largest Asian feed company (CP) to have reduced feed output by 25 percent, a measure of the economic impact on shrimp farmers (P. Sorgeloos, pers. comm. 2002). Recently, the EU has been providing support for equipment and calibration to Thailand to help in the assessment of chloramphenicol residues and that country no longer sees the ban as a campaign against products from developing countries (P. Sorgeloos, pers. comm. 2002).

Aquaculture Development for the Poor

Pillay (2001) noted that aquaculture is still mainly a small-scale enterprise. However, he believed that the compulsions of ensuring food security for the increasing world population and the need to utilize the opportunity for international trade and investment may make large commercial farms become more common. Larger farms may bring in the specter of globalization, which has its positive and negative sides. Roth (2002) said that incorporation into the world economy effectively diminishes the capacity of local producers to exercise control over their choice of production system and the way resources are to be managed. On the other hand, globalization can provide environmental impact mitigation opportunities, enabling the use of less sensitive habitats and ecosystems for extractive and productive purposes. So centralization of global aquaculture production within a few, responsible hands might be considered a desirable goal. However, some wonder if the aquaculture industry can be considered globally sustainable if it caters primarily to the needs of richer people (Kaiser and Stead 2001).

In my opinion, more importance needs to be given to the direct food requirements of the poor. Considerable debate occurred as long as 30 years ago about whether FAO should concentrate its efforts on promoting aquaculture for food production or for income generation. The attractiveness of income and foreign exchange earnings led to a greater emphasis on high-value species with a global export market or targeted rich consumers within the producing country. More recently, there are indications that FAO is again paying more attention to the poor (Jia *et al*. 2001). While export-oriented, industrial and commercial aquaculture practices bring much needed exchange, revenue and employment to a country, more extensive and integrated aquaculture not only make a significant, grass-roots, contribution to improving livelihoods among the poorer sectors of society but also promote efficient use of resources and environmental conservation (FAO 2002a).

Billions of people have no access to electricity or clean drinking water and nearly 800 million people in developing countries are chronically undernourished (FAO 2002c). In countries with the highest level of malnutrition, nearly 40 percent of the population exist on less than US$ 1 per day. Six million children under the age of five die from hunger every year. Is it entirely relevant to talk about sustainability and responsibility in aquaculture when there are much more pressing issues? Is it surprising if the less developed parts of the world demand a greater share of the global resources and claim the right to be able to pollute the earth if it is a precondition to end hunger and despair?

Aquaculture supplies a large share of the low-value foodfish consumed by the poor. Furthermore, investment in improving the productivity and sustainability of low-value foodfish aquaculture is a good way of making it more obtainable by the poor (Delgado *et al*. 2002). In addition, there are indications that concentrating on those sectors of aquaculture in developing countries that produce low-value foodfish could have a significant impact on poverty alleviation. However, the market for high-value aquaculture items such as crustaceans and mollusks in the urban markets of developing countries makes it important that ways be found to keep poor fishers and fish farmers involved in those key sectors.

Poverty Alleviation

Not everybody agrees that small-scale aquaculture is a proper route toward poverty alleviation. Marttin and de Graaf (2001) indicated that from a macro-economic point of view it is indeed more attractive to aim at richer rather than poor pond owners and noted that the poorest of the poor find themselves in a vicious circle. Their poverty means that they cannot acquire resources to generate income; thus they remain poor. The micro-credit programs operated by some NGOs help give people the chance to break this circle. Many poor people have no land tenure but have access to the land on which their home is built and to water and what limited resources the area around it can provide. Making fish fry available at reduced prices, providing training in raising fish in small hand dug ponds and utilizing local feed ingredients

are additional methods of breaking the circle. Using species that are tolerant of poor water quality, with relatively high disease resistance, is essential.

Constraints to promoting aquaculture for poverty alleviation include inappropriate technology; locally limited supplies of fry or fingerlings; the failure of scaled-down integration of feedlot livestock with fish following the withdrawal of external support; insecure access to water and water bodies; lack of government commitment and, where commitment exists, policy implementation failures; lack of training and credit; lack of participatory decision-making; mass poaching; and lack of awareness among development professionals and policymakers about the large potential contribution of aquaculture (Edwards 2000).

Lovshin (1999) referred to the introduction of fish culture as a much easier chore when directed to financially secure high- and middle-income farmers rather than impoverished subsistence farmers. It is easy to fund and supply technical assistance to those who are already successful. Supporting those whose needs are greatest may seem less visibly rewarding but that is no excuse for avoiding it. We tend to measure aquaculture in terms of total increases in production and value. For poverty alleviation, more appropriate parameters, such as the growth in the availability of protein and income for the rural poor need to be used (de Graaf and Latif 2002).

For those poorer farmers who are involved in fish culture, even the limited production that they achieve has a significant impact. The 201 Bangladesh households participating in an African catfish rearing trial were able to produce the equivalent to two months of food for a family or a 5-10 percent increase in family income (Marttin and de Graaf 2001, de Graaf and Latif 2002).

The Role of NGOs in Poverty Alleviation Through Aquaculture

There are many reports on the positive activities of NGOs in the developing world, where they are important but often overlooked components of the institutional structures supporting aquacultural development. Some NGOs have religious origins but their work is neither confined to their co-religionists nor to recruiting proselytes. They serve the needy in general (M.C. Nandeesha, pers. comm. 2003). Other NGOs appeal to the more general public for their funds.

Bangladesh is but one example of a nation that has been a focus for many NGOs with a positive attitude toward aquaculture, no doubt because of its extreme levels of poverty. Over 60 percent of the people are below the poverty level, mostly living in rural areas (Begum and D'Costa 2002). According to Shelley and D'Costa (2002), there were over 18,000 beneficiaries of the aquaculture program of Caritas Bangladesh between 1998 and 2000, of which 47 percent were women. Capacity building support, followed by some special provisions to overcome socio-cultural taboos have been successful in getting women involved in aquaculture. Caritas provides grants for individuals and groups to re-excavate ponds, as well as providing credit support (Begum and D'Costa 2002).

Alam (2001) reported that more than 500 NGOs were involved in aquaculture and fisheries in Bangladesh. Several international and local NGOs have direct-support programs targeting over 250,000 households. Most commercial and development banks, financial institutions and NGOs in Bangladesh have rural credit programs for aquafarmers, however, small-scale farmers still find difficulty in obtaining credit.

Problems in NGO Implementation

Some local NGOs have limited access to up-to-date information and lack well-trained staff (Menasveta 2001). As in any other human activity, progress is not always smooth. In Bangladesh, due to illiteracy, beneficiaries find it difficult to understand the technical suggestions given to them; beneficiaries are unable to utilize their skills when the leasing period is over; natural, biological and environmental hazards often retard fish production; big problems in resource ownership, multi-ownership, marketing, leasing and superstition occur; and donor funds and services dry up, often when the program is just beginning to show its value (Begum and D'Costa 2002).

Nandeesha and Reshad Alam (2001) noted that careful selection of local NGOs is essential, capacity building is a priority and NGOs are not always accepted as equal partners by government agencies. Many NGOs think aquaculture is an easy option and try to carry out the activity without proper expertise. With no experience in aquaculture, projects sometimes have negative results, which create a poor impression. Even with the screening processes used in selecting NGOs, many local NGO partnerships have proved to be unproductive, generally due to poor planning and accountability issues. Finally, a modification of the funding policy of major international donors that allows them to favor local NGOs will cause an expansion in the number of small NGOs, with the intention of increasing the number of beneficiaries. This is expected to increase the sustainability of the programs. However, experience so far has been mixed.

One Way Forward: A New NGO for Responsible Aquaculture in Developing Countries?

It is clear that the NGOs need help to utilize the potential of aquaculture efficiently and, as individuals, I feel that we should be ready to assist. Groups such as WAS are often regarded as professional societies, but unless they are qualification-granting bodies, they are not. It would be more accurate to describe them as societies of professionals; they simply provide a forum for discussing aquaculture issues and a means of disseminating information about aquaculture. In truth they are a form of NGO. Associations like GAA and FEAP may also be regarded as NGOs. Both types of NGO originate with those who work in the various sectors that make up aquaculture.

However, aquaculture does not have any NGO that appeals directly to the public, nor do we raise any funds for aquaculture development from the public. I think it is most unlikely that we could persuade the public to support a lobbying organization for aquaculture, especially as we have suffered so much criticism from existing NGOs with environmental, socioeconomic, ethical and animal welfare themes. Any proposition to form a pro-aquaculture movement would be perceived simply as a defensive negative reaction to criticism.

International NGOs that address specific issues certainly appeal to the public,

and generate huge sums of money. Why are these types of NGOs so successful in raising funds? In general, I believe that they get support because they are believed to be for a cause. It is a positive, not a negative public reaction that initiates support. NGOs give donors a sense they are doing something positive. NGOs do not seem to be warped by political or commercial interests and, in general, they are not perceived as being corrupt. They appeal to people's instincts to care for other people and animals, for the environment and to be ethical. They are seen as a means of reaching the grass roots level more rapidly and efficiently than governmental organizations.

I am totally skeptical about the possibility for forming a pro-aquaculture movement that seeks solely to promote the industry. However, I think that there may be potential for establishing an NGO that is clearly independent of commercial interests and has the goal of alleviating poverty through aquaculture development. This would have to be initiated by people in their private capacity and would need to generate its primary funding by public appeal. While poverty alleviation would be the sole aim of such an NGO, the positive image that it would generate would be beneficial to all forms of responsible aquaculture.

I suggest that a new NGO with the purpose outlined above be developed. Since this is only a concept, it may seem premature to name this NGO, but nevertheless, I propose the title *Aquaculture Without Frontiers* from here on.

Aquaculture Without Frontiers would aim to: 1) promote and introduce practical techniques for responsible aquaculture; 2) pay special attention to forms of aquaculture that have the potential for alleviating poverty; 3) provide the wide technical and managerial experience of the existing aquaculture community for these purposes, utilizing every age strata from students to retirees; 4) demonstrate simple techniques for facility construction, responsible resource use, farm operation and management, and product consumption and/or sale; 5) train others to carry on this work locally; 6) pay special attention to the role of women in responsible aquaculture development; 7) cooperate with existing NGOs, where appropriate; 8) concentrate on working mainly at the grass-roots level; 9) seek the integration of responsible aquaculture with other income and food generating activities using common natural resources; 10) seek to carry out long-term, properly designed, operated, monitored and assessed for efficacy; and 11) be transparent and accountable in its work.

I think funding could follow the lines of existing NGOs. First find beneficent individual, corporate and foundation donors to provide start-up funds for a promotional and educational campaign. Then seek funds from the general public, especially in the industrialized countries. Finally, enhance those funds through appeals for major funding from private foundations and the public sector for individual field project work.

Every government needs a unified, general national policy for sustainable aquaculture development (New 1999), within which an NGO such as *Aquaculture Without Frontiers* could operate. Those who lobby for environmental conservation, social equity, food safety and animal welfare, as well as the producers themselves (whether industrial or small-scale) must be involved in developing these policies. Jia *et al*. (2001) noted the need to assist in social development, poverty alleviation and improving the livelihoods of people. The authors indicated a need to increase emphasis on aquaculture in national, social and economic development plans and stressed the importance of stakeholder participation.

The concept of *Aquaculture Without Frontiers* cannot be achieved through the public sector; the average citizen is unlikely to support it if it is initiated by any government. It can not be supported through the existing aquaculture industry; people would suspect commercial motives. I believe *Aquaculture Without Frontiers* can only be initiated successfully by a group of demonstrably independent people.

Some dedicated people are needed to take the initial steps. Perhaps some of the individual members of WAS, or of other groups with which we are associated, such as the European Aquaculture Society or the Asian Fisheries Society, could be the pioneers of *Aquaculture Without Frontiers***.** However, which of us has the time to take on more work, especially if it is unpaid?

In 2001 I was invited by I-Chiu Liao to organize and co-chair a session at the 6th Asian Fisheries Forum in Taiwan. The session was entitled "Post-retirement careers in aquaculture and fisheries." Six fisheries and aquaculture retirees were selected to give papers during that symposium (New and Liao 2002). The criteria for participation were that they were either Asian or had contributed to the development of Asian fisheries and aquaculture. The number of people suggested as potential speakers made it clear to me that there are many aquaculture retirees who have the energy, knowledge, enthusiasm and time to continue for many years after retirement. Perhaps the founders of *Aquaculture Without Frontiers* could be partly drawn from the ranks of this strata of our societies. Retirees could also provide continuing guidance and technical expertise.

Who would be mainly involved in the field work of *Aquaculture Without Frontiers*? Like most NGOs, its staff could be a mixture of paid individuals and volunteers. Numerous people devote at least part of their life to volunteer work at home or abroad. Why not aquaculturists too?

Cooperation with existing NGOs need not necessarily be confined to those that now include aquaculture in their portfolios. Exploring the potential benefits of working with some of those organizations that have, up to now, been active opponents of aquaculture should not be neglected (Davy and MacKay 1999). Perhaps the existence of *Aquaculture Without Frontiers* would provide an opportunity for cooperation, not conflict.

The development of *Aquaculture Without Frontiers* might be a useful follow-up to our discussions at World Aquaculture 2003. Despite the cautionary advice of a good friend, Tom Hecht, who has called for "a little less idealism and much more realism," I hope that my ideas about *Aquaculture Without Frontiers* will provoke some reactions; if they do, please write to me at Michael_New@compuserve.com

I end with a quotation from Oscar Wilde (Rolfe 1997):

Nothing is worth doing except what the world says is impossible.

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Notes

[1] This paper formed the basis for developing the keynote paper given by Michael New at *World Aquaculture 2003* on 20 May 2003 in Salvador, Brazil.

[2] The version published here is a condensation of a more detailed discussion of the subject that can be found on the WAS website.

[3] President, European Aquaculture Society, Past-President, World Aquaculture Society, Wroxton Lodge, 25 Institute Road, Marlow, Bucks SL7 1BJ, United Kingdom Michael_New@compuserve.com

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Aquaculture Development: The role of NGOs

A special session planned for Aquaculture 2004. Hawaii, USA (1-5 March 2004)

To be moderated by: Michael B. New (Michael_New@compuserve.com) and M.C. Nandeesha (mcnraju@yahoo.com).

Background

Until recently, aquaculture has been largely a government controlled and promoted activity in many developing countries. Now, with the increasing confidence of people in the aquaculture technologies that have been developed, several nongovernmental organizations (NGOs) are working in this area with the primary objective of improving the livelihoods of the people. With the increasing activities of NGOs, there are many operational constraints experienced at various levels, which revolve around technical, social and administrative issues. However, both governments and donors have recognized the ability of NGOs to work in the most difficult situations and to bring changes that benefit Society in general and the poorest of the poor in particular.

The role of NGOs was featured in the keynote address by Michael New presented in the opening session of World Aquaculture 2003 in Salvador, Bahia, Brazil. A version of that address is also published in this edition of World Aquaculture. WAS has taken the lead to organize a special session to address varied aspects of aquaculture development through NGOs and to promote responsible and sustainable aquaculture systems in its triennial meeting in Hawaii in March 2004. We seek your help to enrich the outputs of this special session.

How Can You Help Us?

If you are interested to present a paper in the session, please contact WAS when the call for papers got Aquaculture 2004 is issued and send a copy to the moderators.

If you know NGOs, either in your country or elsewhere, that have contributed significantly to the development of aquaculture, please provide us either with the information you are aware of or a contact address which we can follow up. Our email addresses are given above.

We also need financial support to be able to invite speakers from NGOs to present invited papers in Hawaii, so if you can help us identify sources we would be very grateful. We thank you in advance for your assistance. All contributed information will be duly acknowledged and appropriate information will be included in the workshop proceedings with due acknowledgements.

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(Continued on page 72)

(Continued from page 68)

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