SMALL-SCALE FISHERIES PERSPECTIVES ON AN ECOSYSTEM-BASED APPROACH TO FISHERIES MANAGEMENT

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Humanity stands at a defining moment in history. We are confronted with a perpetuation of disparities between and within nations, a worsening of poverty, hunger, ill health and illiteracy, and the continuing deterioration of the ecosystems on which we depend for our well-being. However, integration of environment and development concerns and greater attention to them will lead to the fulfilment of basic needs, improved living standards for all, better protected and managed ecosystems and a safer, more prosperous future. No nation can achieve this on its own; but together we can – in a global partnership for sustainable development.

Para 1.1, Preamble, Chapter 1, Agenda 21:
Programme of Action for Sustainable Development

EXECUTIVE SUMMARY

In 1992, UNCED Agenda 21 highlighted the protection and preservation of highly diverse marine ecosystems and the problems that degraded ecosystems posed to marine fishing activities. The 1995 UN Fish Stocks Agreement referred to the need to maintain the integrity of ecosystems and to consider problems posed by fishing and degrading ecosystems. Further, the 1995 FAO Code of Conduct for Responsible Fisheries gave greater significance to an ecosystem-based approach to fisheries management.

Artisanal and small-scale fisheries are accorded special recognition by the Code of Conduct for Responsible Fisheries, and it is in fact the only fisheries subsector specifically mentioned in the Code. It contributed more than a quarter of world catch, and accounted for half of the fish used for direct human consumption.

Individually, small-scale fishing units are less threatening to the marine ecosystem than are large-scale ones, because they participate in a multi-species fishery with low quantities of gear that are often passive and selective, and in accordance with the fisheries resources that are seasonably accessible to their gear.

With the widespread adoption of motorization, small-scale fisheries have grown significantly over the past two decades. The rapid expansion of artisanal fishing capacity under open access regimes has begun to exert overfishing pressures on coastal fisheries resources, especially in Asia and Africa. There are increasing conflicts between different gear groups as a result of increased mobility of fishing vessels, capacity expansion and overfishing pressures.

In the present scenario, there is an urgent need for the State to take up fisheries management measures for greater equity and sustainability through consultative mechanisms. In this context, greater recognition should be given to small-scale rather

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than large-scale fisheries. The emphasis has to change from increasing fish production, toward conservation and management goals.

To initiate fisheries management measures in developing countries, a "crossword" approach could be considered, i.e., filling up management niches that are relatively easy at first, and then moving to more difficult ones with the aid of early breakthroughs or solutions.

There could also be global initiatives towards fisheries management in developing countries. Industrialized countries, in the first place, should not transfer their excess fishing capacity to developing countries. There is also a need to establish a well-designed, time-bound, international aid programme in exchange for a commitment to manage fisheries in a consultative, transparent and sustainable manner.

For small-scale fisheries that are overcrowded in developing countries, industrialized nations could contribute to alleviating such demographic pressure in fisheries by facilitating temporary migration of surplus labour into their fisheries, particularly into fisheries that are earmarked by labour shortage.

Concurrent with proposing and implementing measures that basically address the impact of fishing on fish stocks and the marine habitat, there is also need for measures to minimize the effect of pollution-related habitat degradation on fish stocks, and to better understand the intricacies of weather and climate factors. Programmes to conserve "charismatic" species like sea lions, dolphins and sea turtles also sometimes become counterproductive when these resources multiply in large number and compete with fishers for the quarry, without significantly contributing to the health of the marine ecosystem.

Unlike the single-species model in fisheries management, which is by far the most prominent model in most parts of the world, an ecosystem-based approach to fishery management could be an effective tool in developing countries since it could take into account the complexity of the marine and coastal ecosystems.

A universally acceptable definition of ecosystem-based fishery management, however, has to consider fishers as part of the ecosystem, which is an important consideration for developing countries that have 95 per cent of the world's fisher population and over 60 per cent of the world's marine fisheries resources.

An ecosystem approach has to be used in a dialectical sense. It should, on the one hand, take into account the effects of fishing on fish stocks, especially the unequal impact of small-scale and large-scale fishing on targeted fish stocks and the marine and coastal ecosystems, undertaken under different economic, social and political milieu. On the other hand, it should also take into account the effects of marine ecosystems, and alternative livelihoods for fishers. This would be within the framework of what could be considered as an ecosystem-based approach to fisheries management indicated in Agenda 21 and the UN Fish Stocks Agreement.

1. INTRODUCTION

[1] As far back as half-a-century ago, at the United Nations Technical Conference on the Conservation of the Living Resources of the Sea, in Rome in 1955, the components of an ecosystem approach to fisheries management were already recognized. The Conference observed that conservation measures for the living marine resources were to be in accordance with the "maintenance of the existing ecological system in a given maritime zone" (UN, 1955 ¶45). Further, the 1982 UN Convention on the Law of the Sea (UNCLOS) made a mention of "ecosystem" in the context of protecting and preserving rare and fragile ecosystems (UN, 1983, Article 194(5)).

[2] The impact of degraded ecosystems on fishing was internationally recognized for the first time at the United Nations Conference on Environment and Development (UNCED). In the 1992 Agenda 21 of UNCED, protection and preservation of highly diverse marine ecosystems and the problems posed by degraded ecosystems to marine fishing activities were recognized. The impact of fishing on degrading ecosystems was, for the first time, highlighted at the 1995 UN Fish Stocks Agreement. It referred to the need for maintaining the integrity ecosystems and to consider the problems that fishing posed in degrading ecosystems, noting the need "to assess the impacts of fishing … on target stocks and species belonging to the same ecosystem." (UN Fish Stocks Agreement, 1995, Article 5(d)). Further, the 1995 FAO Code of Conduct for Responsible Fisheries gave great significance to an ecosystem-based approach to fisheries management.

[3] At the national level, in the aftermath of the cod crisis in the early 1990s, Canada appears to be the first country in the world to have adopted an ecosystem approach to fisheries management. According to the 1996 Oceans Act, "… Canada holds that conservation, based on an ecosystem approach, is of fundamental importance to maintaining biological diversity and productivity in the marine environment." The USA has also recently (January 2001) adopted an ecosystem-based fisheries management plan, a plan for the coral reef ecosystems in the Western Pacific. The EU is in the process of implementing "ecosystem-oriented" management in Community waters from 2002 as part of the Common Fisheries Policy (EC, 2001). Further, countries like Iceland, Norway, Australia and New Zealand, are in the process of adopting an ecosystem-based approach in their fisheries. There are, however, no developing countries that have adopted such an approach.

[4] What is an ecosystem, or an ecosystem-based approach to fisheries management? According to the Fisheries Resource Conservation Council of Canada (FRCC), which has been involved since 1993 in finding a solution to the dramatic declines in the Atlantic Canadian groundfish stocks, "the term [ecosystem approach] implies trying to manage our own participation in the system with a fuller understanding of its processes and our effects upon them" (FRCC, 1996). It further observes, "In the broadest sense, ecosystem management in the ocean means managing the behaviour of people (chiefly their fishing) in order to maintain or restore desired levels of diversity, abundance and productivity in the ocean system … " It goes on to add, "Because so much remains unknown, this is an ongoing process, moving at the pace of learning." (FRCC, 1996). The FRCC definition thus seems to draw a distinction between ecosystems and the people who interact with them.

[5] The National Research Council of the USA (NRC) defines the ecosystem-based approach to fisheries management as "an approach that seriously takes all major ecosystem components and services – both structural and functional – into account in managing fisheries and one that is committed to understanding larger ecosystem processes for the goal of achieving sustainability in fishery management" (NRC, 1999). It advocates recognizing humans as "components of the ecosystems they inhabit and use," and cautions against dividing the world into "the ecosystem" and "the users of the ecosystem," as implied in the FRCC approach.

[6] A third definition is from the Report to Congress of the USA by the Ecosystem Principles Advisory Panel (EPAP), set up by the USA National Marine Fisheries Service (NMFS). An ecosystem-based approach to fishery management, according to the EPAP, should take into account four aspects: (1) the interactions of a targeted fish stock with predators, competitors and prey species; (2) the effects of weather and climate on fisheries biology and ecology; (3) the interactions between fish and their habitat; and (4) the effects of fishing on fish stocks and their habitats, especially how the harvesting of one species might have an impact upon other species in the ecosystem (NMFS, 1999). In this definition, however, there is no direct reference to "managing the behaviour of the people" nor any recognition of humans as "components of the ecosystems they inhabit and use," as in previous definitions.

[7] None of the above definitions make a distinction between "small" and "large"; the significance of the scale of fishing operations is not an issue that is dealt with, although it is well known that the effects of fishing on fish stocks and fish habitats are bound to vary between small- and large-scale fishing units. Small-scale fishing units, with minor exceptions, are individually less threatening to the marine ecosystems than are the large-scale fishing units, because they participate in a multi-species fishery with low quantities (and greater diversity) of gear that are often passive and selective, and in accordance with the fisheries resources seasonably accessible to their gear.

[8] As has been pointed out by the *International Conference of Fishworkers and their Supporters,* in Rome in 1984, small-scale units are also capital and fuel-saving, and in the tropical belt they are better adapted to the aquatic ecosystems (DAGA, 1984).

[9] In contrast, the large-scale subsector employing non-selective fishing gear, such as bottom trawls, often has a negative impact on fish stocks, as demonstrated by the collapse of the cod stocks in Newfoundland, Canada, and overfishing pressures in countries like China.

[10] According to the Canadian Senate Committee on Fisheries,

> "before the development of the offshore trawler fishery for northern cod, the inshore [traditional passive gear] was able to harvest annually an average of 950 000 tonnes of fish over an uninterrupted period of 400 years [in Newfoundland and Labrador]. This average is more than the total landings from the stock in recent years, when most of the fish were caught by the offshore fisheries." Senate Committee on Fisheries, 1993

[11] In Canada, 40 years of offshore bottom trawling thus almost drove to commercial extinction cod stocks that had been fished for 400 years by the inshore passive gear groups.

[12] Similarly, in China, the indiscriminate development of large-scale bottom trawls since the 1960s has led to overfishing of demersal stocks and a change in the composition of catch. Low-value, low trophic-level species and immature fish in particular increased in catches in the 1990s. The overall catch per unit effort declined from 12 t/kW in 1960 to 3 t/kW in 1995. Although more than half the total Chinese marine fish production originated from bottom trawling in 1995, it is now completely banned in the Bohai Sea.

2. MARINE FISHERIES IN DEVELOPING COUNTRIES

[13] The contribution of developing countries to world marine fish production in 1998 was 60%. Of the top seven fish-producing countries in the world, five are developing countries. Three of them (China, India and Indonesia) have a huge population of nearly one billion people living below the UNDP income poverty line of US$ 1/day (UNDP, 1999). Artisanal, small-scale fisheries contributed than 25% of the world catch, and accounted for half of the fish used for direct human consumption. What is most significant about the contribution of small-scale fisheries to world fish production is that it has been achieved in spite of receiving very little subsidies from governments, and insignificant development assistance from the international aid community.

[14] According to an FAO estimate (FAO, 2001) there are about 36 million fishworkers in the world, of which 80% are in Asia. Sixty per cent of the global population of fishworkers are in marine capture fisheries, 25% in inland and marine aquaculture and the remainder in inland capture fisheries. The proportion of fishers to total population is highest in Viet Nam and Indonesia – one in every 25 of the population is a fisher in Viet Nam, and one in every 44 in Indonesia. Most of them are employed in artisanal, small-scale fisheries. In absolute terms, Bangladesh, China, India, Indonesia, the Philippines and Viet Nam have the largest number of fishers in the world. For example, Chennai, the capital of the State of Tamil Nadu, India, where the International Collective in Support of Fishworkers (ICSF) is located, alone has an active fisher population of 31 000. In contrast, Iceland and New Zealand together account for less than 12 000 fishers, but their combined fish production, at 2.6 million t (1998 figures) equals the total marine fish production of India.

[15] According to FAO, while employment in agriculture in developing countries grew by 35% over the last 25 years, employment in fisheries doubled, but in developing countries, as employment in fisheries in the OECD countries saw a one-third decline in the same period, with the exception of Iceland and Portugal (OECD, 2000). Small-scale fisheries, being an economic activity in the remote areas of many coastal countries, especially in areas where alternative sources of employment are scarce, seem to have played a crucial role in employment creation, income generation and poverty alleviation, arguably because of resilient coastal fisheries, to where people migrate from other, less-rewarding, occupations, or from occupations that cannot guarantee a basic livelihood due to factors such as drought conditions. China, India, Madagascar, Peru and Senegal provide examples of such migration. It has also been estimated by FAO that, for every full-time fisher in the small-scale subsector, additional employment for between one and three persons is generated in the fisheries sector.

[16] Since the small-scale subsector also targets fish for the international market, it contributes to foreign exchange earnings. The contribution of small-scale fisheries to foreign exchange revenue in many developing countries is significantly much higher than the contribution of small farmers or peasants in agriculture. Though commodity export prices for cocoa, rubber, palm oil, coffee and tea have been considerably depressed since the 1990s, prices for fish exports have remained advantageous. In several African, Caribbean and Pacific (ACP) countries, for example, fisheries exports, especially from the small-scale subsector, are now the major export earner, ahead of tea, coffee, cocoa or groundnuts, such as in Senegal.

[17] Fisheries products are one of the few areas where ACP countries have seen their participation in world trade increase. Between 1976 and 1986, ACP fish exports to the EU rose from ECU 36 million to ECU 309 million, while, by 1996, the value of ACP fish exports exceeded ECU 946 million. In the four years from 1992 to 1996, the ACP share of total EU fish imports rose from 16.4% to 22.5%. This contrasts with general ACP trade performance, which saw the ACP share of imports into the EU decline from 6.7% to 3.4% in 1994 (Brian O'Riordan, pers. comm.).

[18] Despite being among the top ten fish-producing countries in the world, the per caput shares of marine fish production in China, Indonesia and India are quite low, at 1.7 t, 1 t and 0.5 t, respectively (1998 figures) because of their large fisher populations. The difference is very striking when these developing countries are compared with the Nordic countries. In 1998, for example, Iceland had an annual per caput marine production of 334 t, Denmark 325 t and Norway 125 t. The difference is quite significant when export figures are examined. China, Indonesia and India had fishers annual per caput export earnings of US$ 300, US$ 790 and US$ 190, respectively, while the equivalent figures for Iceland, Denmark and Norway were US$ 285 400, US$ 600 000 and US$ 161 440, respectively. The differences in annual per caput production averages a factor of 260, and the difference annual per caput export value is a factor of over 800. This comparison highlights the disparity between poor and rich countries, and underscores the human dimension of fisheries in developing countries.

3. ARTISANAL AND SMALL-SCALE FISHERIES IN DEVELOPING COUNTRIES

[19] Artisanal and small-scale fisheries are accorded special recognition by the 1995 FAO Code of Conduct for Responsible Fisheries, and it is in fact the only fisheries subsector specially mentioned in the Code. Article 6.18 of the Code states: "Recognizing the important contributions of artisanal and small-scale fisheries to employment, income and food security, States should appropriately protect the rights of fishers and fishworkers, particularly those engaged in subsistence, small-scale and artisanal fisheries, to a secure and just livelihood, as well as preferential access, where appropriate, to traditional fishing grounds and resources in the waters under their national jurisdiction."

3.1 What is "artisanal" or "small-scale" or "traditional" fishery?

[20] What exactly do we mean by terms like "traditional," "small-scale," or "artisanal" fisheries? These terms seem to have gained currency during the post-mechanization phase in many developing countries as a descriptive characteristic of those fisheries that were not mechanized, and those fisheries that were opposed to mechanization. Traditional, small-scale or artisanal became the antonyms of "modern," "large-scale," "mechanized," and "industrial" fisheries. These terms had political significance in some contexts, where they became rallying points for fishers who opposed the introduction of destructive forms of bottom trawling, especially in Asia.

[21] However, the situation changed with the widespread adoption of motorization in small-scale fisheries worldwide. Traditional, artisanal or small-scale fisheries now include a range of fishing activities targeting anything from sedentary molluscs in littoral waters to highly migratory tuna stocks in distant waters. Thus, according to FAO (2001), half of the tuna production in the Indian Ocean originates from artisanal fisheries, meaning tuna that are caught by all gear other than purse-seines and longlines. It includes subsistence fishers in the South Pacific as well as those fishing mainly for the export market, in Senegal and Chile. It ranges from resident women crab gleaners in the mangroves of northeastern Brazil, to Mexican longline fishers who go up to 200 n.mi. in their 7-m fibre-reinforced plastic (FRP) boats with 200 hp outboard motors in pursuit of shark, to the migrant longline fishers of Sri Lanka, who fish the farthest points of the Indian Ocean targeting tuna and shark resources. It may be an activity that is resident or migrant; occasional, seasonal, part-time or full-time.

[22] Traditional, artisanal or small-scale fisheries include rudimentary 3-m dugout canoes with a crew size of just one in Madagascar, as well as the 18-m *pirogue* of West Africa and the 16-m plywood or FRP boat of India that employ up to 40 crewmembers on board a single fishing trip, and the term extends further to shore-seines of Sri Lanka and India that would employ as many workers on shore to haul the net as a pirogue or a plywood boat would employ on board for purse-seine operations. Artisanal fishing thus includes *highly individualized* fishing operations like cast nets and handlines; *small-crew* operations like setting traps or pots in lagoons, estuaries or nearshore waters, diving for sedentary species in reefs and lagoons, operating a regime of gillnets and longlines; and the *labour-intensive* purse-seining and shore-based, beach-seining operations.

[23] The terms traditional, small-scale or artisanal could, however, have distinct connotations in different socio-economic contexts., for example, the definition of what constitutes traditional, artisanal or small-scale in an economic sense is *fishing-operation-specific,* although the definition of traditional fishing *per se* also has social overtones. Whereas in Madagascar the term *artisanal* (primarily applied to a small-trawler sector of around 600 vessels fishing mainly for the local market – Brian O'Riordan, pers. comm) refers to motorized fishing for the domestic as well as for the international market, the term *traditional* refers to unmotorized, kinship-based fishing for subsistence or for the local market, undertaken by fishers who respect local taboos and customs.

[24] In Fiji, the term *artisanal* is used to refer to fishing units harvesting for the domestic market; it is thus *market-specific*. In India, only the term *traditional* is legally recognized, but, unlike Madagascar, it denotes traditional fishing craft, i.e. a fishing craft of a type already in use

before the arrival of mechanized fishing vessels. India also includes boat designs of foreign origin that were adopted during colonial times. The definition is thus *craft-specific*. In Indonesia and Malaysia, the term *traditional* is used, but, unlike India, the term is used in a *gear-specific* sense. All fishing units, excluding trawling, are defined as *traditional* fishing units.

[25] In Peru, *artisanal* is the term in vogue, defined in *tonnage-specific* terms to indicate fishing vessels below 30 GRT, although, according to *Federacíon de Integracíon y Unificacíon de Pescadores Artesanales del Perú* (FIUPAP), the organization of the artisanal fishers of Peru, about 85% of fishing vessels in Peru are below 10 GRT. In Chile, the term artisanal is used to indicate vessels below 50 GRT and less than 15 m in length, and an artisanal fisher in Chile will also hail from a particualr *caleta*, work on a particular type of boat or in a particular sector (line fisherman, shellfish diver, seaweed harvester, etc.). Indeed, back in 1995-96 in Chile, there was debate as to whether trawling could be considered as an artisanal gear in the hake fishery. In France, the term used is *artisanal*, but the definition is *length-specific*. All vessels up to 25 m in length are categorized as artisanal units (Le Sann, 1999). The equivalent term in Canada is *inshore* fisheries, which refers to fishing vessels that are less than 20 m in length. A major distinction between the North and South is that, irrespective of the size of the unit, trawling operations, in general, are not considered small-scale or artisanal in the South.

[26] There is thus no elegant definition. The problem of defining traditional, artisanal and small-scale categories has been compounded of late because of new technical changes, viz., motorization of hitherto-unpowered vessels, the use of powered gear-hauling devices, ice boxes, synthetic webbing for fishing gear, and the adoption of modern miniaturized electronic aids for navigation and fish detection. It can be assumed that *artisanal* and *small-scale* fisheries, in general, refer to the smallest viable fishing units in a country or a province, with downward or lateral compatibility in fishing gear operation.

[27] Depending on the context, the definition could be based on:

(i) whether or not the fishers are recognized as originating from a fishing caste, community or tribe;

(ii) whether or not the fishers are known to operate a specific regime of fishing craft or gear, or combination, and if they are at the bottom end of the hierarchy in a particular fishery in a country or province; and

(iii) whether or not the fishers were traditionally fishing, but not necessarily confined to near-shore or inshore waters.

[28] The definition of what constitutes traditional, artisanal or small-scale could be any one or a combination of these characteristics.

[29] In contrast to large-scale fishing units, the small-scale subsector is adaptable and is far mor dispersed geographically. In a social and economic sense, especially in many developing countries, small-scale fishers, more so than the large-scale fishers, take into account the livelihood interests of the fishers, and provide nutrition to the poor. It is arguably the most equitable in terms of distributing the benefits from fishing to the greatest number of coastal peoples. In a cultural sense, it often provides an identity to fishworkers who practice it, as well as to their communities. Also, it earns valuable foreign exchange for the nation in many developing countries. Although there are exceptions to this depiction of the small-scale, it can be argued from social, economic, cultural and ecological perspectives, that small-scale fisheries make better sense than large-scale industrial fisheries, which are capital- and energy-intensive and too often tend toward biological and economic overfishing.

3.2 New technical changes in artisanal and small-scale fisheries

[30] The act of embracing motorization and the use of new technical accessories in the small-scale fishing sector in developing countries has had a dual origin. On the one hand, it is a

reaction to mechanized fishing operations, for instance in several Asian and African countries where bottom trawling and purse-seining intercepted and removed fish stocks before they could migrate into the estuaries or inshore waters where traditional fishing vessels, dependent on passive fishing techniques, used to fish. The small-scale subsector was thus forced to adopt fishing methods that would help them to fish in competition with the large-scale subsector. On the other hand, it was also a *response* to burgeoning marketing opportunities as a result of growing demand for fish, coupled with easy availability of ice and credit.

[31] The latter phenomenon in particular has contributed to a tremendous expansion of fishing capacity in small-scale fisheries. Motorization particularly suited those artisanal fishers who wanted to migrate to distant fishing grounds and those fisheries that were heavily dependent on labour power for the propulsion of larger pelagic fishing units. The technical flexibility offered by outboard motors and fish storage facilities was a significant factor in influencing artisanal fishers to motorize their fishing craft and exploit new fishing grounds. The fish merchants were enthusiastic to extend credit facilities to artisanal fishers and encouraged them to modernize their fishing operations. Fishermen's cooperatives have also contributed to this process by extending credit and marketing facilities to their members in several developing countries.

[32] The small-scale subsector, has changed, away from one that was protected by legislation, most often through the enactment of an exclusive fishing zone, toward a situation where it is promoted at the expense of the large-scale industrial subsector by national and provincial governments. There are several examples of changing emphasis at government level in some countries, partly due to the growing realization that the small-scale sector makes better economic and social sense than the large-scale, industrial subsector. This perception recognizes the failure of an earlier model, which strongly emphasized investing in large-scale industrial fisheries (Tvedten and Hersoug, 1992; Dahou and Deme [2001]). Such changes in official perception can be witnessed in important fishing nations, like Senegal, India, the Philippines and even China, as well as among multilateral and bilateral aid agencies (e.g. World Bank *et al.*, 1992).

3.3 Impact of new technical changes on small-scale fisheries

[33] During the pre-motorization phase under quasi-open access conditions, the fishing pressure that could be exerted by the small-scale fishing fleet was most often limited by "inefficient" manual or wind-powered means of propulsion. These propulsion techniques also limited the size of the vessel and gear, and contributed to avoiding overfishing pressures. There was a division of labour practised by small-scale fishers, which often in effect acted like a limited- access regime. A beach-seine operator, for example, would not operate another gear type. Hook-and-line fishers would do only that kind of fishing. Gillnet fishers were often categorized according to the particular species they specialized in fishing.

[34] From an exclusive dependence on manual or wind power, almost all these gear groups have now moved into dependence on sophisticated fishing technologies in many countries. From a technical point of view, outboard motors used by small-scale fishers are far more sophisticated than the diesel inboards currently used in most developing countries. Small-scale fishers have expanded the range of their fishing operations in several countries, to deeper as well as to distant waters, and their fisheries continue to be multi-species in nature. In some countries, such as Senegal, they have emerged as the most significant fishing power (Gaspart and Platteau, 2000).

[35] The technical developments, however, do not seem to have led to labour displacement as yet; on the contrary, it seems to have led to more fishing days and greater employment opportunities (Overa, 1998), possibly because the most labour-intensive of the range of craft-gear combinations are increasingly being used across seasons. The small-scale subsector thus seems to have maintained its labour-intensive character, with significant implications for poverty alleviation in rural areas. The sharing system prevailing on board small-scale fishing vessels in some instances, such as in Kerala, India, does not seem to indicate any major shift away from labour in favour of capital. Thus from the employment and income points of view, the impact of

technical changes in the small-scale subsector, at least in the short run, seems to have been positive in some labour-surplus fishing economies.

[36] Studies in Ghana, however, show that after the introduction of motorization in canoe purse-seine fishing, the owners of canoes and their families benefit more from new allocation regimes than do workers and their families. This is because the share of catches accruing to capital, and hence to owners, has increased since the introduction of motorization. The shares are in physical quantities of fish; therefore the larger the share for owners, the greater the amount of fish available for their wives, who are fish processors or traders. This contrasts with the much lower volumes of fish for the wives of workers (Overa, 1998).

[37] There is growing inequality between those fishing for the domestic market and those fishing for the export market, with implications for gender relations in artisanal fishing communities. With growing dependence on the export market and export agents, there are negative impacts on access of women to artisanal fish production, for example, in Senegal. Fish traditionally sold through fishers' wives are now directly sold to export agents, often men from outside the fishing community (ICSF, 1997). There also seems to be a widening gap between unmotorized and motorized fishing units. The implications of such growing social inequalities have yet to be analysed in any systematic fashion.

[38] An expansion in the scope of small-scale fishing activities in the relatively limited time span of 10 to 20 years has not been without its negative consequences. With the technical capacity to go after the quarry, as against waiting for it in the nearshore fishing ground, the gear base of the small-scale fishers, especially of those in the forefront of technical change, has been losing its diversity, becoming narrower and more standardized. The artisanal fisheries, as a result, have become far more differentiated; they include now both powered and unpowered vessels, and both active and passive gear groups. There has been a tremendous expansion of fishing capacity and increasing fishing pressure in the artisanal sector in many developing countries, especially in West Africa, South and Southeast Asia. In the Senegalese artisanal fisheries, for example, there has been a 42% increase in the number of pirogues between 1994 and 1997 (Gaspart and Platteau, 2000). In the traditional fisheries of Kerala, India, the number of plywood boats has increased by 300%, from less than 2 000 in 1991 to close to 6 000 in 1998, and all these craft are motorized fishing vessels using outboard motors (SIFFS, 1992, 1999).

[39] The rapid expansion of artisanal fishing capacity has begun to exert overfishing pressure on coastal fisheries resources, especially in Asia and Africa, which, until the beginning of the motorization phase, were mainly caused by the large-scale, industrial fishing vessels. As Gaspart and Platteau (2000) have pointed out in the case of Senegal,

> "They [the fishermen] do not seriously consider the possibility of their being partly responsible for overfishing and, therefore, the idea that they could combat environmental degradation by restricting their own fishing effort seems alien to most of them. Revealingly, there is a clear tendency among Senegalese fishermen to externalize the problem by blaming industrial fishing vessels for the destruction of fish resources."

[40] This is now true of small-scale fisheries in several other developing countries as well. It may not, however, be easy for the small-scale subsector to acknowledge biological and economic overfishing problems that they themselves are contributing to, unless large-scale, non-selective industrial fisheries that have been unleashing their destructive potential for the past 30 or 40 years are effectively regulated.

[41] Although the size of the gear still remains small in comparison with gears used in large-scale fishing, those used in the small-scale subsector are nevertheless growing in size. These are also becoming less and less selective. In the Statement of the *Workshop on Problems and Prospects for Developing Artisanal Fish Trade in West Africa*, Dakar, Senegal, 30 May to 1 June 2001, organized by ICSF, *Collectif National des Pêcheurs Artisanaux du Senegal* (CNPS) and *Centre de Recherches pour le Developpement des Technologies Intermediaries de Pêche*

(CREDETIP), and supported by the FAO-DFID Sustainable Fisheries Livelihood Programme (SFLP), participants from 13 West African countries, including small-scale fishworker representatives, were critical of the destructive impact of monofilament nets and ring seines in the small-scale subsector on inshore fisheries resources (ICSF, 2001a, b). There are also increasing conflicts within the small-scale subsector amongst different gear groups as a result of increased mobility of fishing vessels, capacity expansion and overfishing pressure. With motorization, the division of labour also seems to have broken down by making it easier for unskilled people to migrate into fishing activities. Built-in conditions of limited-access regimes have broken down under pressures of motorization.

4. SMALL-SCALE FISHING INDUSTRY PERSPECTIVE ON AN ECOSYSTEM-BASED APPROACH TO FISHERIES MANAGEMENT

[42] In spite of the problems of biological and economic overfishing posed by small-scale fisheries in some contexts, an ecosystem-based approach to fisheries management could help valorize small-scale compared to large-scale fishing, and could also help to bring about the required changes that might minimize threats to its existence. What could be a small-scale fishing industry perspective on an ecosystem-based approach to fisheries management?

[43] Since the fishing grounds of the small-scale subsector are often the richest and the most diverse, and since the impacts of pollution and destructive fishing practices, such as bottom trawling, are most immediately experienced by this subsector, and ecosystem-based approach to fisheries management could be of immense interest. Also, with greater mobility of fishers across borders following migratory fish stocks, for example in West African countries, an ecosystem-based approach to fisheries management might help to design coherent regional fisheries management strategies that take into account all factors that influence fish stocks in their entire range of movement, and all fisheries that interact with such stocks.

[44] An ecosystem approach could help bring about greater control over large-scale fishing operations that employ non-selective fishing gear and methods like bottom trawling, to minimize the cascade effect on fish stocks and on the livelihood of small-scale fishing communities. It could also help prevent destructive fishing operations such as dynamiting and cyanide fishing, and help to regulate the use of fine-meshed nets by small-scale fishers themselves.

[45] An ecosystem-approach can be applied to understand, and to prevent, land-based sources of pollution that have an adverse impact on plankton, which are food for smaller pelagic fish, the mainstay of small-scale fisheries in many Asian and African countries (E. Vivekanandan, pers. comm.). Thus, concurrent with proposing and implementing measures that basically address the impact of fishing on fish stocks and the marine habitat, there is need to take steps to minimize the effect of pollution-related habitat degradation on fish stocks arising from coastal settlements, industries and agriculture, and oil spillage from the production and transport of crude oil. In addition, an ecosystem-based approach could be used when addressing reduction of nursery grounds as a result of destructive activities like construction and reclamation in coastal areas, mangrove deforestation, and brackish-water aquaculture, as well as the loss of marine biological diversity as a result of destruction of coral reefs due to global warming, dynamiting or cyanide fishing.

[46] Land-based sources of pollution could also have a direct negative impact on mollusc beds, the mainstay of artisanal fisheries in several Latin American countries. CONAPACH and FIUPAP – the artisanal fishers' organizations of Peru and Chile respectively – have often been complaining of such impacts arising from mine-tailings and fishmeal effluent. Agriculture and water-use regimes on land could also have an indirect impact on coastal fishing grounds through soil erosion and decreased fresh water discharges into the sea. Given that in modern times the fisheries sector, especially the small-scale subsector, is at the receiving end of land-based and sea-based sources of habitat degradation (ICSF, 1994, 1996), an ecosystem-based approach can

broaden the scope of fisheries management, especially in many developing countries, to effectively address these forms of degradation.

An ecosystem-based approach could help generate information on natural factors and their impact on fish stocks, to better understand the intricacies of weather and climate factors. This is significant because most of the small-scale fishers in the world are dependent on pelagic stocks, which, under the influence of changing weather and climate conditions, are highly vulnerable to oceanographic factors. Such understandings need to be articulated to fishers to enhance their understanding of the "prey in context," mainly to draw the distinction between the impact of natural factors and of fishery-dependent factors on relative abundance or scarcity of fisheries resources. In Pulicat Lake, India, for example, the artisanal fishers argue that the mullet resources of the lagoon will simply perish if the salinity level exceeds that of the sea due to evaporation, zero exchange of water (as a result of spit formation at the mouth of the lagoon), and zero discharge into the lagoon from rivers (due to upstream dams). Fishers do not, therefore, believe that conservation of mullets under such conditions is possible just by refraining from fishing.

[47] An ecosystem-based approach can facilitate a better understanding of prey-predator relationships at sea, and also the impact of fishing gear selectivity on marine living resources. Programmes designed to conserve charismatic species like sea lions, dolphins and sea turtles sometimes become counterproductive when these resources multiply in large number and compete with fishers for the quarry, in the process conflicting with the interests of small-scale fishers, and often adversely affecting their livelihood without significantly contributing to the health of the marine ecosystem. In Talara, northern Peru, for example, squid jiggers in the artisanal fisheries complain about predation of squid resources by sea lions and dolphins. FIUPAP has estimated that the annual damage caused by the southern sea lion to their fisheries is about US$ 64 million (Manuel, 1997), and similar complaints are also reported from the Maritimes, Canada. In spite of using selective fishing methods, the small-scale fishers of Orissa – the poorest province of India – are prohibited from fishing in their traditional grounds because of arbitrary declaration of sea turtle conservation zones for the protection of olive ridleys.

[48] Most importantly, an ecosystem approach can valorize and build upon the ecosystem principles inherent in traditional knowledge systems of artisanal and small-scale fishing communities around the world. Kurien, based on an analysis of Asian coastal proverbs, provides an insight into various facets of traditional knowledge, about the complex ecological systems with which they interact (Kurien, 1998). Traditional ecological knowledge, based on locale-specific understanding of the components of the ecosystem, however, is often confined to an understanding of a limited number of environmental and oceanographic parameters, and restricted to the biology and behaviour of the target species and species that immediately predate on, or are prey for, these target stocks (V. Vivekanandan, pers. comm.). Also, as Cordell [2000] tersely points out, customary marine tenure is designed to preserve "the social order, not the balance of nature."

5. ECOSYSTEM-BASED APPROACH TO MANAGING SMALL-SCALE FISHERIES IN DEVELOPING COUNTRIES

[49] An ecosystem-based approach id a holistic approach within a broader timeframe. Such an approach to fisheries conservation, management and development can make it possible to look at all aspects of fisheries, including land- and sea-based parameters, as well as known and unknown factors. It can enable the subsector to address issues of immediate and long-term concern, especially to prevent the impact of land-based sources of pollution and coastal degradation, to rebuild depleted fish stocks and to restore marine habitats. It can facilitate the building up and strengthening of traditional knowledge systems in artisanal and small-scale fishing communities.

5.1 Problems in managing small-scale fisheries

[50] The main challenge in applying an ecosystem approach to small-scale fisheries management is in negotiating the adverse impacts on the ecosystem arising from factors outside the control of the small-scale subsector. So, if we are talking about applying such an approach to small-scale fisheries, then we are confined to discussing input and output control measures, and institutional arrangements to regulate access to fishing grounds, especially when they are overcrowded or are in a state of ecological stress. In multi-species, multi-gear and multi-cultural fisheries, especially in the small-scale subsector, what indeed would be the best locus of measures to manage fisheries would be a moot point. Quota management regimes are ruled out because by using such measures it would be impossible to manage with any reasonable degree of success the "mosquito" fleet operating from a multitude of landing centres in many developing countries. Moreover, the associated problems of such regimes, particularly high grading and concentration of ownership in the hands of a few, would only exacerbate social problems in labour-surplus, small-scale fisheries.

[51] While discussing the need for fisheries management in small-scale fisheries, especially effort control and limited-entry measures, the role of conventional management measures is limited by poor institutional arrangements. The problem is further complicated by numerous landing centres, too many fishing vessels as well as people in the fisheries. It would, therefore, be difficult, if not impossible, for governments to successfully regulate marine fishing activities, especially to introduce limited-entry regimes in small-scale fisheries, without the active participation of fishing gear groups or fishworker organizations. There is, however, a lack of such organizations in many developing countries.

[52] Although fisheries management programmes in industrialized countries can directly focus on fishing capacity, fisheries resources and fish habitat-related issues, such an approach may be difficult in developing countries, where the State, as a priority, may have to focus on the human dimension in the fisheries sector, especially the need for poverty alleviation and food security in coastal areas, before addressing fisheries management issues *per se.* The short-term goals of small-scale fisheries management under the aegis of the State cannot be exclusionary in nature, given the widespread poverty and unemployment in rural societies in many developing countries. A State that cannot provide an alternative employment to fishers may also not find it easy to ask people to leave the fishery to alleviate overcrowding in fishing grounds. However, such exclusionary regimes can be designed and implemented by the small-scale fishing industry itself and legitimized by the State machinery.

[53] We have yet to see effective fisheries management programmes in any labour-surplus, small-scale fisheries in developing countries that have been successfully implemented by the State. Even in large-scale fisheries, for that matter, there is hardly any success story of fisheries management, especially from developing countries. The large-scale fisheries of important fish-producing countries like China, Thailand, India and Indonesia still do not figure as countries with effective management programmes. Given the collapse of fisheries even in countries like Canada – which was believed to have an effective fisheries management system until the collapse of the Canadian Atlantic cod fisheries in the 1990s – the lack of political will, or confidence in the feasibility of fisheries management programmes, is understandable in many developing countries.

[54] There is no straightforward, universal solution to many of the vexing problems of overfishing and overcapacity in small-scale fisheries, however, and this calls for a better understanding of the structure of fisheries, the motives of, and constraints on fishers, and the interaction between various components of fisheries, especially between the large- and small-scale, and between different gear groups within the small-scale subsector.

[55] Given all the failures – and indifference – of the past, new fisheries management initiatives should be based on a process of dialogue with the small-scale fishing industry, to arrive at long-term and short-term goals for management, taking into account social, economic, ecological, and other relevant aspects of labour-surplus fisheries in developing countries. Such initiatives can be

taken by the State. One way to create room for such a dialogue would be to progressively redistribute fishing space to the small-scale fisheries subsector by phasing out large-scale, non-selective fishing units. Such a measure would also consolidate the recognition granted to small-scale fisheries by several governments since the 1990s and by the 1995 FAO Code of Conduct for Responsible Fisheries.

[56] Simultaneously, there should be a serious effort initiated by the State in the long term for greater institution building, such as building up fishworker organizations, that will help devolve principal fisheries management functions to the representative small-scale fishing industry organizations. As Jentoft and McCay (1995) point out, a devolutionary process should aim at delegating authority – not just decentralization – based on the subsidiarity principle, i.e. implementing management functions at the most effective level, starting from the bottom. In large countries like China, Brazil, India and Indonesia, where it is almost impossible to have a centralized or even provincial-level effective fisheries management progamme, such an approach seems better sense. These institutions, however, should be designed in such a manner that they become true representative bodies, that they do not become hegemonic or inequitable, or end up just as mere conduits for State patronage.

5.2 Building upon community-based fisheries management

[57] In developing countries, there is a greater need to look into the best institutional structures that are ideal for undertaking fisheries management functions.

[58] Some lessons may be drawn from traditional community-based fisheries management initiatives involving fishing communities, especially to regulate access to fisheries and to limit fishing capacity. These tend to be more localized initiatives among homogenous gear groups, and often have a conflicting relationship with other gear types. They are forms of rights-based fisheries, often based on rotational access to fisheries resources, but their effectiveness is more confined to stationary or beach-based gear or to sedentary species, than to mobile gear or species.

[59] There are already several examples of such traditional arrangements in developing countries. The most salient aspect of these arrangements is that they have clearly defined rules of exclusion based on allegiance to a caste, community or a group. These arrangements, however, most often emphasize aspects of allocation, and are mainly designed to mitigate conflicts within their membership over access to marine fishing space. The fishing capacity of the members, however, could exceed the regenerative capacity of the resource and thus contribute to overfishing pressures, especially in the context of new technical changes in fisheries (Cordell, 2000).

[60] In Pulicat Lake, India, for example, there is the *padu* system, a system of rotational access to shrimp fishing grounds, but it does not mitigate pressure on shrimp resources because different groups of members, in a rotational fashion, are incessantly harvesting the resources. Similarly, in several estuarine fisheries in Asia, although several stake-net groups practice rotational access, the mesh size is below the legal limit and it often contributes to overfishing of juveniles of diadromous species. It is also noticeable that traditional arrangements to regulate access are challenged under conditions of greater market demand, when non-member gear groups in coastal fishing villages refuse to recognize the legitimacy of these arrangements, and often do so with the support of the government (Mathew, 1991).

[61] As Cordell [2000] points out (emphasis added):

> "Whereas available information may be sufficient to document general features of tenure practices, it is usually not sufficient to generate specific recommendations concerning how local tenure could be integrated with contemporary systems of marine resource use. *Communities today must deal with environmental issues on a scale the ancestors were never confronted with*."

[62] The issue of legitimacy is further exacerbated by the conflicts between exclusionary traditional arrangements and the non-exclusionary formal arrangements under the auspices of the

State. This can be effectively tackled if the governments throw their weight behind traditional systems. In exchange for lending formal recognition, the governments can insist that these arrangements should adopt and implement effective conservation measures.

5.3 Adopting a "crossword" approach to small-scale fisheries management

[63] Conservation of fisheries resources, protection of fish habitats, and allocation to fishers are the three most important considerations in fisheries management. The vantage point to start from is the gear group, because without its cooperation it would not be possible to adopt effective conservation measures and to protect fish habitats from fishery-related stress. It is thus the principal link in fisheries management, especially in small-scale fisheries in developing countries.

[64] Initiating fisheries management measures in small-scale fisheries in developing countries could be through a "crossword" approach, i.e. filling up management niches that are relatively easy at first, and then moving on to more difficult ones with the aid of early breakthroughs or solutions.

[65] Stationary and beach-based gear groups, gear groups fishing around artificial reefs, and gear groups targeting sedentary stocks, are arguably better candidates to collaborate in a fisheries management programme. The most difficult ones could be the migrant gear groups, who may have a vested interest in maintaining an open-access regime, like the longline fishers of Senegal (Gaspart and Platteau, 2000).

[66] Formal and traditional fisheries arrangements need to combine, to generate effective fisheries management policies and programmes. Simultaneously, measures should be drawn up to regulate large-scale fishing operations, including a proscription of fishing gear and fishing operations that are destructive or socially inappropriate.

[67] There should also be programmes to build up user participation in fisheries management, especially in small-scale fisheries, which are highly scattered and difficult, if not impossible, to 'manage' in a centralized fashion. The Senegalese Government often complains of its "powerlessness to control" small-scale fisheries! (Aliou Sall, pers. comm.). In this context, devolutionary mechanisms are vital and strong fishworker unions that can successfully undertake fisheries management programmes are required to be built with full legitimacy (Jentoft and McCay, 1995).

5.4 International cooperation to manage small-scale fisheries

[68] As a global solution to the national, provincial or local problems, the most important responsibility of industrialized countries is to not sell their excess fishing capacity to developing countries at low prices, nor to send it as an article of aid (although it might appear to be the easiest solution to their problems of overcapacity), nor to transfer the excess capacity through joint ventures. What is in fact required is weeding out of the excess capacity problem, and Northern countries should not, in the first place, be building up excess capacity. Subsidies are still extended for fleet expansion, for example, in several EC countries, and this practice should be strongly discouraged.

[69] To ensure the cooperation of the most significant gear groups in the small-scale subsector, incentive schemes might be considered. In this context, we have to look for global solutions to local and national problems. There are three possibilities that could be considered.

[70] First, for the manage,ment of overexploited fisheries in developing countries, there is need to set up a well designed, time-bound, international fisheries management assistance fund in exchange for a committment to manage fisheries in a consultative and transparent manner, within the framework o an ecosystem approqch. However, governments in developing countries should also consider investing in fisheries management from existing revenue resources. Although net earnings from fisheries exports for many developing countries are quite high, little significant investments are made in conservation and management by most developing countries. For

example, India, with a gross value of fisheries output of US$ 5 000 million in 1997-98 (at ex-vessel prices) and export earnings of over US$ 1 000 million, spends insignificant amounts on activities that can be treated as fisheries management. As Willmann *et al.* (2000) point out, in 1999, when Norway spent about 8% of total gross revenue from marine fish landing on fisheries management, Iceland 3% and Newfoundland 20%, Thailand spent only 1.64%, although its fisheries have been beset with overcapacity and overfishing problems for some time. The mindset has yet to change from considering fisheries as an extractive industry, to seeing it as an industry based on renewable natural resources.

[71] There are two ways to set up such an international fisheries management assistance fund: through a Tobin tax (a tax on currency trades across borders, as proposed by the USA economist James Tobin in the 1970s), and Belgium has put such a tax on foreign exchange transactions on the discussion agenda for its current six-month EU Presidency; and through a consumption tax on fish and fish products in industrialized countries.

[72] The finanacial assistance for cash-starved developing countries with a clear political will to manage their fisheries could include assistance to:

(i) bring about better control over the input of fishing effort and the output of fish;

(ii) introduce participatory and devolutionary management regimes and equitable property rights;

(iii) set up effective monitoring, control and surveillance (MCS) systems;

(iv) protect fish habitats (ICFS, 2001);

(v) conduct research on tye status of fish stocks; and

(vi) build up fishworker organizations at the local, provincial and national levels.

[73] Second, for fisheries that are well managed, ecolabelling might provide an incentive to fishers, but it might be relevant only to exportable species in developing countries , principally for the USA and EU markets, and produced mainly by homogenous gear groups. Also, even if a particular small-scale fishing fleet is using a selective fishing gear and has acceptable levels of by-catch or discard, it may not qualify for an ecolabel if it is targeting a stock that is subject to overfishing pressure from a large-scale, non-selective fishing fleet.

[74] Third, for small-scale fisheries that are overcrowded as a result of demographic pressure in developing countries, industrialized nations may contribute to alleviating such pressure by facilitating temporary migration of surplus labour into their domestic or distant-water fisheries, particularly into fisheries that are characterized by labour shortage. The substitution of labour with capital in many developed country fisheries *inter alia* is believed to be a function of growing labour shortage. The average age of a Japanese and Korean fisherman, for example, is over 60 (OECD, 2000) and that of a Canadian fisherman in the Maritimes is around 47 (M. Belliveau, pers. comm.).

[75] Instead of substituting labour with capital, fisheries at low levels of technical intensity can be maintained, even in the event of chronic labour shortage in the North, if well-trained migrant workers from developing countries are recruited. Threats to immigration can be addressed by carefully designing time slots for transient accommodation of labour. Already, several OECD countries are employing migrant fishworkers from developing countries in their fisheries because of labour shortage. This is especially noticeable in Spain, France and Italy. It is just a matter of legalizing such arrangements. There are several examples of employment arrangements between the North and the South, especially in relation to the employment of computer and medical professionals from countries like India in the USA and Europe. Needless to say, this will not be a solution to the problems arising from demographic pressure, but it would certainly be seen as a positive gesture from the North to the South.

6. CONCLUSION

[76] Unlike the single-species model in fisheries management, which is by far the most prominent model in most parts of the world, an ecosystem-based approach to fishery management could be an effective tool in developing countries since it may take into account the complexity of the marine and coastal ecosystems, an attribute already factored in a limited way into the decision-making processes of several traditional, small-scale fishing communities. A multitude of species further exacerbates the problem in countries in the tropical belt. According to the FAO FishBase, in India, for example, about 263 out of the 1 000 marine and brackish water fishes identified so far are commercially significant, as against just 25 out of 250 in Norway, and 21 out of 300 in Iceland. In Indonesia and the Philippines, countries with the greatest marine biodiversity in the world, the figures are 681 out of 2 511 and 616 out of 2 255, respectively. Each of these fish will have several stocks and the total number of stocks could run into thousands. Very little is known about the impact of fishing on these stocks. It is therefore quite doubtful whether an ecosystems approach can be considered, in its entire range, in tropical multi-species fisheries.

[77] An attempt to deal with the complexity of the ecosystem should take into account the scale of fishing operations as well as the heterogeneity of fishers. There are small-scale and large-scale, active and passive, and there are responsible and destructive fishers. An ecosystem approach has therefore to be used in a dialectical sense: it should, on the one hand, take into account the effects of fishing on fish stocks, especially the unequal impact of small-scale and large-scale fishing on target fish stocks and the marine and coastal ecosystems, undertaken under different economic, social and political contexts. On the other hand, it should also take into account the effects of marine ecosystems on fishworkers.

[78] However, adopting an ecosystem approach is easier said than done. Developing the building blocks of an ecosystem-based approach with social sensitivity, and documenting the impact of fishing on targeted stocks and their habitats, as well as on other species in the ecosystem, are complex, difficult and expensive tasks, and require a "global partnership for sustainable development," as quoted in the epigraph of this paper. It should be based on a crossword approach, which implies a realistic time frame to implement various components in a sequential manner. To persuade the small-scale subsector to adopt an ecosystem approach, governments should phase out all destructive forms large-scale fishing, such as bottom trawling, as an incentive to the small-scale subsector, but subject to the subsector agreeing to improve its own fishing practices.

[79] There is need to broaden the artisanal and small-scale knowledge base to encompass ecological parameters hitherto ignored or not sufficiently understood, e.g. the greater impact of natural factors, the broader picture of prey-predator relationship, the larger role of fish habitats, and factors that contribute to unprecedented habitat degradation, like pollution. There should, however, be a sense of "historical continuity" (Kurien, 1998), in an ecosystem-based approach, an attempt to build up on what already exists, especially to transmute the past traditions with new scientific insights to meaningfully address the needs of the present, or "the contemporary systems of marine resource use," as Cordell puts it (Cordell, 2000). Of course, at the level of practice, it is indeed a challenge, with huge financial implications, which few developing countries can afford without international assistance.

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REFERENCES

Cordell, J. [2000]. Remapping the waters: the significance of sea tenure-based protected areas. Paper presented at the Third Conference on Property Rights, Economics, and Environment: Marine Resources. International Centre for Research on Environmental Issues. Universite of Aix-Marseille III, Aix-en-Provence. (Unpublished).

DAGA. 1984. International Conference of Fishworkers and their Supporters. Report. DAGA, Hong Kong.

Dahou, K., & Deme, M. [2001]. Socio-economic and environmental impacts of Senegalese fisheries support mechanisms. (Unpublished)

EC [European Commission]. 2001. Green Paper: The Future of the Common Fisheries Policy. Vol I. Brussels: EC.

FAO. 1995. Code of Conduct for Responsible Fisheries. Rome: FAO.

FAO. 2001. *The State of World Fisheries and Aquaculture 2000*. Rome: FAO.

Gaspart, F., & and Platteau, J-P. 2000. Promotion of Coastal Fisheries Management: 1. Local-level Effort Regulation in Senegalese Fisheries. *FAO Fisheries Circular*, No.957/1.

ICSF [International Collective in Support of Fishworkers]. 1994. Proceedings of the Cebu Conference. ICSF, Madras.

ICSF. 1996. Proceedings of the South Asia Workshop and Symposium on Fisheries and Coastal Area Management. ICSF, Chennai.

ICSF. 1997. Globalization, Gender and Fisheries. Report of the Senegal Workshop on Gender Perspectives in Fisheries. ICSF, Chennai.

ICSF. 2001a. Report of the Workshop on Problems and Prospects for Developing Artisanal Fish Trade in West Africa. Dakar, Senegal, 30 May - 1 June 2001. ICSF, Chennai (forthcoming).

ICSF. 2001b. Editorial. *SAMUDRA Report*, No.28 (April). ICSF, Chennai.

Jentoft, S., & McCay, B. 1995. User participation in fisheries management: Lessons drawn from international experiences. *Marine Policy*, **19**(3): 227-246.

Kurien, J. 1998. Traditional ecological knowledge and ecosystem sustainability: new meaning to Asian coastal proverbs. *Ecological Applications*, **8**(1): S2-S5.

Le Sann, A. 1999. No more bounty. *SAMUDRA Report*, No.24 (December). ICSF, Madras.

Manuel, M. 1997. The roar of the sea lion. *SAMUDRA Report*, 18 (July). ICSF, Madras.

Mathew, S. 1991. Study of territorial use rights in small-scale fisheries: traditional systems of fisheries management in Pulicat Lake, Tamil Nadu, India. *FAO Fisheries Circular*, No.839.

National Research Council. 1999. *Sustaining Marine Fisheries*. Washington D.C: National Academy Press.

NMFS [USA National Marine Fisheries Service]. 1999. Ecosystem-based fishery management: a report to the Congress by the Ecosystem Principles Advisory Panel. http://www.nmfs.noaa.gov/sfa/reports.html

OECD. 2000. *Transition to Responsible Fisheries: Economic and Policy Implications.* Paris: OECD.

Overa, R. 1998. Partners and Competitors: Gendered Entrepreneurship in Ghanaian Canoe Fisheries. Dissertation for Dr Polit. Degree. Dept. of Geography. Univ. of Bergen, Norway.

Senate Committee on Fisheries. 1993. See: http://www.parl.gc.ca./36/1/parlbus/commbus/senate/com-e/fish-e/past_rep-e/93repen1.htm

SIFFS. 1992. *A Census of the Artisanal Marine Fishing Fleet of Kerala 1991*. SIFFS, Trivandrum.

SIFFS. 1999. *A Census of the Artisanal Marine Fishing Fleet of Kerala 1998.* SIFFS, Trivandrum.

Tvedten, I., & Hersoug, B. (eds) 1992. *Fishing for Development: Small-Scale Fisheries in Africa*. Motala: Scandinavian Institute of African Studies.

UN. 1955. Report of the International Technical Conference on the Conservation of the Living Resources of the Sea. UN, New York.

UN. 1983. The Law of the Sea: United Nations Convention on the Law of the Sea. UN, New York.

UN. 1992. Agenda 21: Programme of Action for Sustainable Development. UN, New York.

UNDP. 1999. *Human Development Report*. New York, NY: UNDP,.

Van Dyne, G.M. (ed) 1969. *The Ecosystem Concept in Natural Resources Management*. New York and London: Academic Press.

Willmann, R., Boonchuwong, P., & Piumsombun, S. 2000. Fisheries management costs in Thai marine fisheries. *In:* Proceedings of the IIFET 2000 Conference. International Institute of Fisheries Economics and Trade, Oregon, USA.

World Bank *et al*. 1992. A Study of International Fisheries Research. World Bank, Washington D.C.