Philippine Coastal Fisheries Situation*

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Abstract

The fisheries sector in the Philippines provides a significant contribution to the national economy in terms of income, foreign exchange and employment. In 2000, total fish production was estimated at 2.94 million t, 84% of which was derived from marine capture fisheries. The export of fish and related fishery products amounted to about US$400 million in the same year. Between 1984 and 1997, the fisheries sector contributed between 3.8% to 5.0% of the national GDP and 18.4% to 20.6% of the agricultural GDP in the same period. The fisheries sector also provided employment to about 1 million people in 1997.

This paper reviews the Philippine coastal fisheries situation in terms of the status of the marine/coastal environment, resource potential, socioeconomic aspects of the fisheries and management measures to sustain the fishery. It also presents the problems, opportunities and recommendations for sustainable exploitation of coastal fish stocks based on a multi-sectoral workshop under the "Sustainable Management of Coastal Fish Stocks in Asia" Project in September 2000.

We highlighted the following areas that should be addressed in attaining improved fisheries management in the context of the Philippines: (1) maintaining integrity of coastal stocks and habitats; (2) maintaining the integrity of shared stocks; (3) maximizing economic benefits from utilization of resources; (4) promotion of equity in sharing benefits from the utilization of the resources; (5) minimizing conflicts among resource users; and (6) minimizing poverty among small scale fishers.

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Introduction

The Philippines has a coastline of 17 460 km and territorial waters (including the Exclusive Economic Zone) covering about 2.2 million km^2. Of this area, 12% are considered coastal waters and 88% are oceanic. The coastal zone has coral reef areas of about 27 000 km^2 and swamp-lands covering 3 384 km^2. The fishponds for aquaculture in the country cover about 2 539 km^2, and are mostly located in the coastal zone. They were originally mangrove areas.

The Philippines has been one of the largest fish producers in the world and ranked 12th in 2000 (FAO 2000). In 2000, total fish production was estimated at 2.94 million t (BAS 2001). Of this, marine capture fisheries contributed 2.47 million t or 84% of the total production. Fish exports in the same year were valued at US$400 million (~ Php1.78 billion)[1]. However, due to increasing population size and demand for fish (Cruz-Trinidad this vol.), fisheries resources in most areas of the country are now experiencing over-exploitation. This situation is becoming more serious in some fishing areas due to habitat destruction and pollution from sources such as agricultural activities (see Silvestre et al. 1995; Barut et al. 1997). This complex situation requires improved resource management that is integrated within an overall coastal zone management approach (DA-BFAR 1996; Barut et al. 1997).

This paper reviews the status and management of Philippine coastal fisheries. It begins with the background of the coastal environment, the estimated potential of fishery resources, the socioeconomic setting and the institutional and policy environment. Next, the small scale and commercial fisheries sectors are compared in terms of production, employment, gear, target species and economic contribution and performance. The management of coastal capture fisheries is then examined, including fisheries management philosophy, management objectives, issues and opportunities. Finally, short- and long-term recommendations for the sustained and optimal utilization of Philippine coastal fisheries are presented.

Environmental Setting

The Philippines is an archipelago consisting of more than 7 100 islands located in the western Pacific, north of the equator between latitudes 21º 5' and 4º 23' N and longitudes 116º 00' and 127º 00' E (Fig. 1). The country is bounded by the Pacific Ocean to the East, the Sulu and Celebes Seas to the South, the South China Sea to the west and the Philippine Sea to the North. It extends about 2 000 km in a south-north direction, between 4º 05' and 4º 30' N Latitude, from the northeast coast of Borneo to 150 km off Taiwan. The total area of territorial waters, including the Exclusive Economic Zone (EEZ), is approximately 2.2 million km^2. The shelf area, up to the 200-m isobath, covers 184 600 km^2, and the coral reef area within 10 - 20 fathoms, (20 - 40 m), where reef fisheries occur, is about 27 000 km^2. The Philippines coastline measures approximately 17 460 km, making it one of the longest coastlines in the world.

The marine waters off the eastern part of the country are affected by the large scale currents of the Pacific Ocean (Wyrtki 1961). The North Equatorial Current flows westward across the Pacific, hits the eastern coast of the country and splits into the Kuroshio Current that flows northward and the Mindanao Current flowing southward. The Kuroshio Current flows along the east coast of Visayas and Luzon to Taiwan and Japan.

The Mindanao Current flows farther into the eastward flow, becoming the Equatorial Counter Current (ECC) with a weaker branch flowing along the east coast of Mindanao. The ECC then enters the Celebes Sea between Mindanao and Sangir and Talaud Islands and eventually exits into the Indian Ocean.

On the west coast currents are influenced by the seasonal monsoon winds. During the north-east monsoon (or *Amihan*) between October to March, a cyclonic pattern of surface water movement originates from the South China Sea. This develops into a northwesterly flow along the coast of Luzon and Palawan. During the southwest monsoon (or *Habagat*) from April to August the current flow is north-easterly, flowing out through the straits between Luzon and Taiwan.

[1] 1 US$ = Php44.34 (average value in 2000)

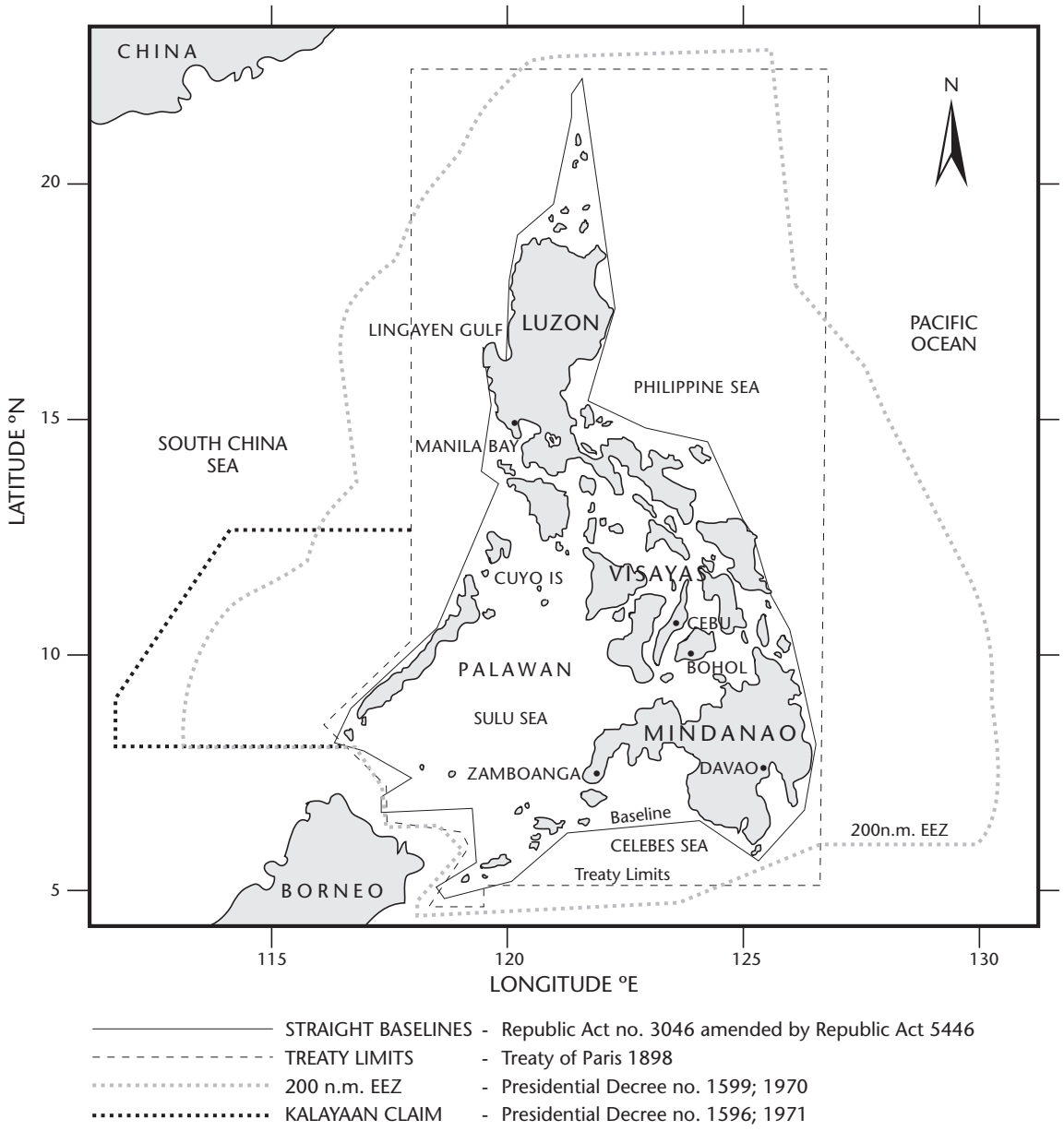

Fig. 1. The marine jurisdictional boundaries of the Philippines.

The country's marine environment is distinctly tropical with relatively warm waters with reduced salinity. Sea surface temperature ranges from 24° C to 30° C and averages about 27° C to 28° C. During the cold months of the north-east monsoon, i.e. from November to March, the temperature drops by a few degrees, mostly in Northern Luzon, where there is an increased inflow of cold water through the Strait of Formosa. Salinity variations in Philippine waters are very small, especially in the eastern parts. For example, sea surface salinity in the west - north-west of the Philippines exhibits minimal variations ranging from 33.7 to 34.6 psu[2]. (SEAFDEC 1999). These variations increase during the period of the south-west monsoon, when the western parts of the country experience rains.

[2] psu = means pratical salinity units which is equivalent to parts per thousand (ppt)

Philippine seawaters are typically poor in nutrients, with some small upwelling, gyres and mixing processes occasionally enhancing local productivity. Wyrtki (1961) also observed relatively low surface productivity in the South China Sea, Philippine and Celebes Seas at less than 0.5 g $C \cdot m^{-2} \cdot day^{-1}$. Recent estimates of primary productivity in the northern portion of the South China Sea indicated a range of 0.10 to 1.53 g $C \cdot m^{-2} \cdot day^{-1}$ (Furio and Borja 2000). Water quality in the coastal areas shows signs of deterioration due to a number of factors such as mine tailings, agricultural runoff, siltation, domestic sewage and oil spills (Talaue-MacManus 1999). Water quality parameters such as pH, dissolved oxygen, salinity, turbidity, heavy metal content and coliform counts have been shown to exceed standards set by the Philippine Environmental Management Bureau in many areas (Valmonte-Santos et al. 1996; Talaue-MacManus 1999).

With more than 400 species and 70 genera of hard corals, the Philippines has one of the most diverse coral faunas, with reefs that are on a par with the Great Barrier Reef of Australia (Nemenzo 1986; Gomez 1991; Gomez et al. 1994). The known coral reef area is 27 000 km^2 within the 10 - 20 fathom (20 - 40 m) depth zone. However, based on aerial survey and satellite data, there are approximately 84 928 km^2 of islands and shallow offshore areas, which could be considered as potential coral beds within 0 - 10 fathoms (0 - 20 m) (NAMRIA 1996 cited in DA-BFAR 1997). The province of Palawan and Autonomous Region in Muslim Mindanao (ARMM), which includes Sulu - Tawi-Tawi Islands and Turtle Islands, have 43% and 16%, respectively, of the total coral reefs in the country.

The coral reefs are under threat from siltation and destructive fishing (Yap and Gomez 1985; Gomez et al. 1994, White and Vogt 2000). Based on 85 coral reef sites reviewed by Gomez et al. (1994), they described the coral reefs of the country as 23.5% poor (0 - 25% coral cover), 51.8% fair (26% - 50% cover), 22.4% good (51% - 75% cover) and 5% in excellent condition (76% - 100% cover). In a recent project i.e. DA-BFAR CITES Coral Project (DA-BFAR 1997), the status of reefs in 1995 from 27 study sites was classified into 3.7% excellent, 33.3% good, 55.5% fair and 7.4% poor. With a majority of once pristine reefs now in fair or poor condition, the benefits forgone are substantial. The net value of quantifiable loss from over-fishing and destruction of 1 km^2 of coral reef over a 25 year period is estimated at $108 900 (White and Trinidad 1998). In addition, the loss in terms of coastal protection forgone is estimated at $193 000 while the forgone earnings from sustainable fisheries and tourism are estimated at $86 300 and $482 000, respectively.

Mangrove communities are an integral component of coastal ecosystems. There are two categories of mangrove habitats in the country: mangrove swamps characterized by the presence of large trees and associates, and *Nipa* swamps having stem-less palm growths. There are at least 39 mangrove species in the country (Calumpong and Menez 1997). The country's mangroves have been gravely impacted by both human and natural causes. The rate of loss in mangroves between 1965 to 1975 was 243 $km^2 \cdot year^{-1}$, and 60% of this was due to conversion to aquaculture ponds (Primavera 1991). This has prompted the government to suspend permits for mangrove conversions, accelerate reforestation activities in collaboration with non-government organizations, and spur community-based rehabilitation and management of mangroves (White and Cruz-Trinidad 1998).

The country has about 16 seagrass species (Fortes 1995). Seagrass habitats perform various ecological functions such as providing nurseries for certain aquatic species, exporting nutrients to adjacent habitats and promoting the settlement of waterborne silt, thus reducing the impact of siltation. Like other critical coastal habitats, seagrass communities are showing increasing signs of degradation. Biophysical factors (e.g. siltation, pollution, eutrophication, weather and climate change), sociocultural factors (e.g. poverty, population, social conflicts, aesthetic etc.), and factors such as institutional incapacity, and conflicting and inadequate/inappropriate local and national policies are the identified causes of such effects (Fortes 1995).

The Philippines has about 824 species of marine macrobenthic algae consisting of 214 species of "green algae" (Chlorophyta), 134 species of "brown algae" (Phaeophyta) and 472 "red algae" (Rhodophyta) (Trono 1997). The country produces 70% of the world's supply of carageenan raw material, 95 000 t, annually (BFAR 1997; BAS 1998). Seaweeds rank third in export value next to tuna and shrimp, earning an estimated foreign exchange profit of US$130 million annually (BAS 1998). About 500 000 people are directly or indirectly dependent on the seaweed industry (Dacay 1992). An estimated 10 000 ha of reefs and shallow coastal areas are utilized to

farm seaweed. As such, seaweed farming is now considered a major source of livelihood in many coastal communities.

There is growing recognition that the health of coastal ecosystems is intimately linked with the conditions of watersheds. As of September 1999, there were 1.38 million ha of proclaimed watershed forest reserves in the country. Among the country's 14 regions, central Luzon (Region III) has the most reserves with a combined area of 221 385.10 ha (DENR 1997).

Fisheries Resources Potential

Fisheries Production

From the fifties to the mid-seventies, the reported fisheries production consisted entirely of marine capture fisheries landings because production from aquaculture and inland capture fisheries only started entering the official statistics during the mid-1970s (Fig. 2). Starting from 250 000 t in 1951, fisheries production doubled after 15 years. By the early 1970s the million-t level had been reached. Thereafter, production was maintained at 1.2 million t for almost the entire decade of the 1970s. Modest but constant growth in production was registered thereafter, finally reaching a plateau of 1.6 million t in the 1990s.

Average growth rates for the entire fishery sector show that production peaks occurred during the decade of the sixties and to a lesser extent, the seventies (Fig. 3). This was fuelled by the large scale sector, from 1960 - 65, and the small scale sector, from 1966 - 70. After 1976, growth rates of the capture fishery sector registered minimal or even negative growth at certain times. This is particularly true for the small scale sector. The continued growth of the fisheries sector was due to aquaculture. Unlike typical industries that start low on the growth curve, aquaculture began with a "bang". For the first five years, aquaculture posted double-digit growth, i.e. 15% average for the first four years. In 1980, aquaculture accounted for almost 25% of total capture fishery production at 300 000 t, a yield that had doubled by 1990. By 1996, total aquaculture production had already eclipsed production from both the large scale and small scale fishery sectors.

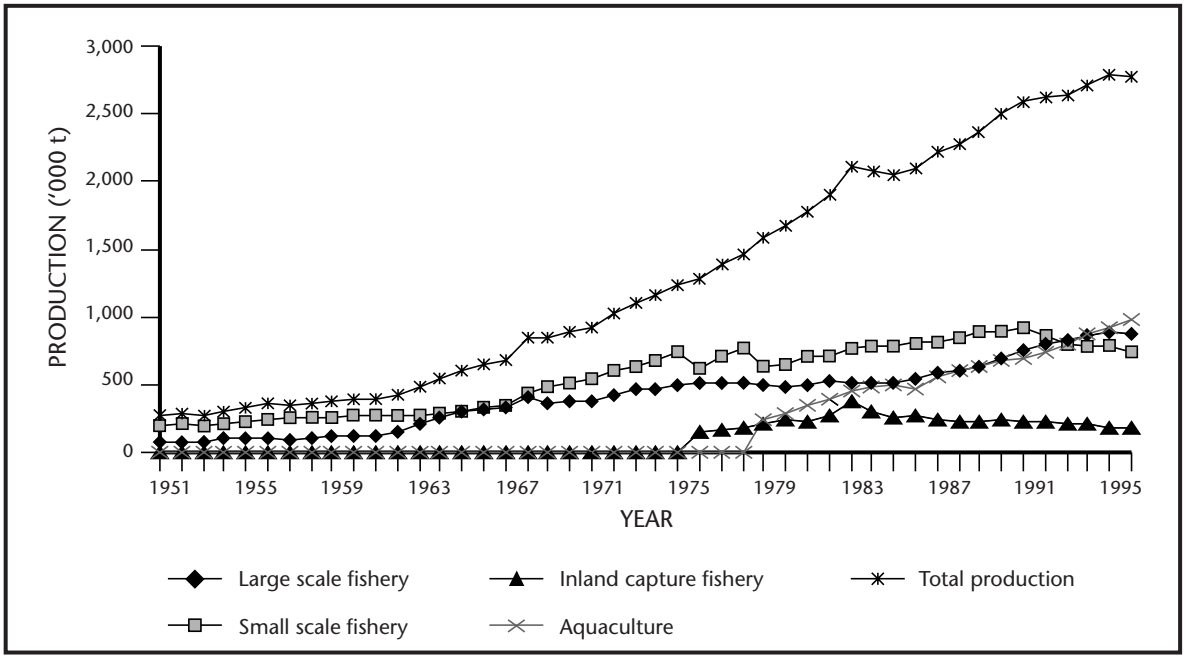

Fig. 2. Philippine fish production, from large scale and small scale marine fisheries, inland capture fisheries and aquaculture between 1951 - 96. Source: BFAR 1950 - 87; BAS 1998.

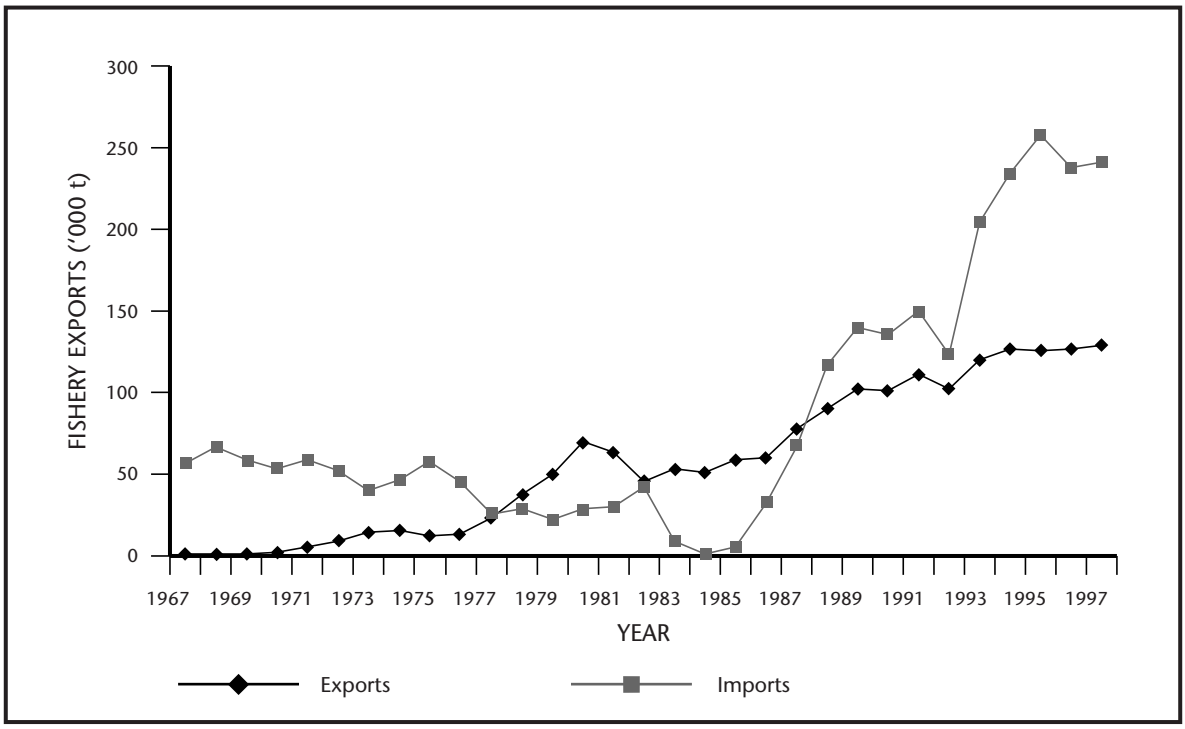

Fig. 3. Volume of Philippine fish exports and imports (1967 to 1997).

The small scale (equivalent to municipal) and the large scale (or commercial) capture fisheries sectors dominated the fishing industry in the fifties and sixties. During the early fifties, the small scale sector contributed the bulk of fisheries production, which was, on average, 150% greater than the commercial sector. Towards the seventies and well into the nineties, this ratio dropped to a little over 30%, indicating relative stagnation in the catch of the small scale sector and increased activity in the commercial sector. By the nineties, the advantage of the small scale sector would be completely overturned (see Fig. 2). Inland capture fisheries and aquaculture began to contribute to official production statistics during the seventies. This does not preclude the existence of undocumented but robust inland capture fisheries prior to this time, especially in freshwater lakes such as Laguna de Bay and Sampaloc Lake. Aquaculture started during the late seventies with fishpens and ponds.

Pelagic and Demersal Resources

The potential yield from the marine fishery resources particularly demersals and small and large pelagic species have been studied extensively (Munro 1986; Silvestre et al. 1986; Dalzell and Ganaden 1987). Estimates of maximum sustainable yield (MSY) from these resources vary widely between 1.1 and 3.7 million t. The higher estimates are based on overly optimistic values of yield-per-unit-area and do not consider productivity decline with depth (Silvestre et al. 1986). Since the 1980s, the consensus on the MSY values of the Philippines for conventional resources has been 1.65 million t, 600 thousand t for demersals, 800 thousand t for coastal pelagic species, and 250 thousand t of tunas or oceanic pelagics (BFAR 1995).

Dalzell et al. (1987) and Silvestre and Pauly (1987) estimated the MSY for exploited demersal resources (excluding offshore hard bottoms off Palawan, southern Sulu Sea area and the central part of the country's Pacific coast) to be around 340 000 to 390 000 t. Adding this figure to the estimated MSY of 200 000 t for unexploited or lightly fished hard bottom areas, results in a total MSY of about 600 000 t. This value is within the consensus mentioned above. However, studies have also indicated that demersal stocks are over-fished. The biomass

of fished stocks declined in the mid-1980s to about 30% of levels in the late 1940s, resulting in an annual rent dissipation of about US$130 million per year, due to over-fishing of demersal stocks (Silvestre et al. 1986)

Dalzell et al. (1987) estimated MSY for small pelagics at 550 000 t, the Maximum Economic Yield (MEY) for fish and invertebrates in the exploited fishing grounds at around 250 000 t and the Maximum Economic Rent (MER) for the latter at US$290 million. Subsequent refinements of this assessment have yielded similar results (Trinidad et al. 1993). The 550 000 t MSY for small pelagics when combined with the MSY estimates of 250 000 t for lightly fished small pelagic resources in waters off Palawan, parts of the country's Pacific coasts and some parts of Mindanao, is within the consensual earlier MSY estimate for small pelagics of 800 thousand t noted above.

Tuna are experiencing high fishing pressure mainly brought about by the magnitude of the catches and the concentration of fishing effort within a small surface area (Dalzell and Corpuz 1990; BFAR 1995). Oceanic large pelagics such as marlin, swordfish and sailfish are not fully exploited at present (Dalzell and Ganaden 1987). From a landing of 17 000 to 25 000 t in the 1980s, the large pelagic landings declined to 9 000 to 15 000 t in the 1990s (BFAR 1997).

Invertebrates

Invertebrate resources also constitute an important source of food and livelihood for Filipinos. Species of prawns and shrimps (e.g. tiger prawn) are cultured and exported, while crabs, octopus, squid and other shrimps are consumed locally. Species of shelled mollusks are processed for the export market.

Evidence of over-exploitation of wild stocks of shrimp/prawn resources has been observed since the late eighties and early nineties (Agasen, pers. com.). The five species considered commercially important are the white shrimp (*Penaeus merguensis*), the "green tiger prawn" (*P. semisulcatus*), giant tiger prawn (*P. monodon*), the brown shrimp (*Metapeneaus ensis*) and *Acetes* spp. The combined total production recorded for these species in 1997 was around 25 334 t mostly coming from small scale fisheries (BAS 1998). The shrimp/prawn production, including that from aquaculture, ranked second to tuna in terms of export earnings at around US$ 4.0 million in 1997 (BFAR 1997).

Other commercially important invertebrate resources include (i) squids and cuttlefishes, (ii) octopus and (iii) crabs. These resource groups contributed 56 958 t valued at Php 2.6 million, 7 991 t equivalent to Php 452 660 and 31 224 t or Php1.0 million, respectively, to the total landings in 1997 (BAS 1998). Oceanic squids and deep-sea shrimps occur in the waters of the country but there is no established fishery for these resources and, consequently, little information to assess potential.

Sharks and Rays

Except for the piked dogfish, *Squalus acanthus*, a species targeted for squalene oil, sharks were generally the by-catch of some major fisheries from the late-1960s to early-1980s (Barut and Zartiga 1999). Since the early 1980s shark meat has been used for producing fishballs, while the fins are dried and sold to local restaurants mainly for shark fin soup. Hong Kong is the leading importer of sharks' fins and meat while Japan is the primary importer of shark liver oil (Barut and Zartiga 1999). The average annual production from sharks for the past 20 years has been 5 882 t. In 1997 the municipal and commercial landings for this fishery were estimated at 3 485 t and 330 t respectively. The three most important shark-fishing grounds in the Philippines are in West Sulu Sea, Lamon Bay and Visayan Sea. Barut and Zartiga (1999) identified 22 species of sharks but believe that more species await discovery and description. Recently, sharks and rays have been receiving much attention because of their vulnerability and conservation status. The catching, taking, possession and exporting of whale shark (*Rhyncodon typus*) and manta ray (*Manta birostris*), for example, have been banned by virtue of Fisheries Administrative Order 193, series of 1998. Other sharks like the great white shark (*Carcharias carcharodon*) have been proposed recently for inclusion in the CITES endangered species list.

Endangered Marine Species

Marine mammals are among the endangered species in the country. To date, 15% of Philippine waters have been surveyed for marine mammals and 25 species have been documented so far (Dolar et al. 1997). Despite the issuance of Fisheries Administrative Orders 185 and 185-1 that ban the catching of marine mammals, incidental and intentional catches for local consumption and for shark bait are still reported. However, such reports have declined after the passage of the said fisheries administrative orders. A concerted effort to increase

public awareness by government, NGOs and the private sector has also considerably minimized threats to these animals (Heany et al. 1998, Dolar 1997 and Dolar 1999).

Marine turtle exploitation was also been banned by virtue of Ministry of Natural Resources (MNR) Administrative Order No. 12, Series of 1979. Five turtle species are known to occur in Philippine waters. Vigorous efforts have been undertaken to protect and conserve these vulnerable and threatened species mainly by the DENR's Task Force Pawikan created by Executive Order No. 542, Series of 1979.

Socieconomic Background

The fisheries sector employed close to one million (990 872) fishers in 1997. Employment in the sector is divided into: aquaculture with 258 480 employees, municipal fisheries with 675 677 and commercial fisheries with 56 715 employees. This employment level is slightly above the 1988 level i.e. about 942 000. Assuming that a typical Filipino family is composed of five to six people, then roughly 5 to 6 million people are directly dependent on the sector. This is equivalent to 7.4% - 8.8% of the country's total population for 1997. Moreover, the sector indirectly provides employment to those engaged in fish distribution and marketing, fish processing (e.g. canning), operation of ice plants and cold storages, and other related industries such as net making, boat building, boat engine or motor sales, and boat repairs among others. The income, employment and other socioeconomic indicators of the fisheries sector may be viewed against similar indicators for the national context, which are presented in Table 1.

For the period 1984 - 1997, the fishery sector contributed 3.8 - 5% of the country's gross domestic product (GDP). From 4.8% of the GDP in 1984, the contribution of fisheries to the GDP peaked at 5.01% in 1987, fluctuated within a 0.5% range until 1996, and then declined to 3.8% in 1997. These figures are based on data from the National Statistics Office (NSO) that utilize 1985 as the base year. In terms of percent share of the gross value-added for the agriculture, fishery and forestry industries/sectors, the fisheries' contribution ranged between 18.4% to 20.6% for the period 1984 to 1997.

Since 1977, foreign trade of fishery products has generated a surplus balance of trade, which means more export earnings or foreign exchange to the economy than importation expenses (Fig. 3). The trade surplus in export and imports of fishery products ranged between US$19.4 million in 1977 to US$439 million in 1987. However, the latter figure declined to US$271.8 million in 1997.

In 1993, the biggest source of foreign exchange earnings among exported fish products was shrimp and prawns, followed by tuna and tuna-like fish, and seaweeds (*Eucheuma* spp.) (BFAR 1997; BAS 1998). In 1997, tuna and tuna-like fish had overtaken shrimp and prawns. In terms of volume, the Philippines shifted from being a net importer of fishery products in 1967 - 77 to being a net exporter in 1978 - 87. For the period 1988 - 97, the country again became a net importer, with imports consisting mainly of fresh/frozen and chilled fish and fishmeal (Cruz-Trinidad, this vol.). These imports were probably the needed inputs for local fish canning facilities and local poultry and livestock feed producers.

The fourth national nutrition survey conducted by the Department of Science and Technology in 1993 revealed that the average Filipino consumes 36 kg of fish per year or 99 grams per day (CRMP-FRMP-ATI 1998; Cruz-Trinidada this vol.). Fish accounts for 18.3% of the total food intake and 66.7% of the animal protein intake. Fish is generally affordable and widely available, particularly in processed form such as canned, smoked and dried. There is a lack of information on nationwide demand and supply of fish. However, estimates can be made to determine if the present fish production is sufficient to meet local demand. With an estimated population of 74.7 million in 1999 and a per capita consumption of 36 kg per year, the total demand for fish can be estimated at 2 689 200 t, which was slightly below the total production of 2 766 507 t in the same year.

In terms of meeting the fish protein supply needs, considering population and fish production, there are some regions which can be considered as surplus regions while the others can be considered deficit regions. In 1997, Region IV (Southern Tagalog), the Autonomous Region of Muslim Mindanao, Region IX (Western Mindanao), and Region VI (Western Visayas) were the top fish producers (BAS 1998). The Cordillera Autonomous

Region, Region II (Cagayan Valley), Region XII (Central Mindanao), and Region X (Northern Mindanao) were the lowest producers. Differences are compensated for by a marketing network that distributes fish from fish-surplus to fish-deficit regions.

Table 1. Philippine Socio-Economic Indicators, 1999

Indicator	Value
Population, mid-year	75.1 million
Population growth rate (%)	2.04
Urban population (% of total population)	57
Labor force	32.0 million
Employment - by sector to total employment (%) Agriculture Government and Social Services Services Manufacturing Construction	 40.1 19.5 44.2 9.5 5.3
Unemployment rate (%)	9.7
Inflation rate (consumer prices)	6.6
Industrial Production Growth rate (%)	0.5
External Debt	$51.2 billion
Gross Domestic Product (GDP)-real growth rate (%)	3.2
Gross Domestic Product - composition by sector (%) Agriculture Industry Services	 17 32 51
Gross National Product	$80.3 billion
Gross National Product (GNP) per capita	$1 050
Poverty (% below national poverty line)	38
Infant mortality rate	35 deaths/1 000 live births
Life expectancy at birth	68 years
Child malnutrition (% of children below 5)	30
Access to safe water (% of population)	83
Illiteracy (% of population age 15+)	5

Source: World Bank 2000.

The value of total fish output has increased through the years except for 1997 when declines in volume and value occurred (Fig. 3). However, the value of catch for the municipal fisheries continued increasing, despite the decline in volume of catches for the periods 1983 - 88 and 1991 - 97 (Cruz-Trinidad this vol.). For aquaculture, total value of fish output has declined since 1994 despite the increase in volume of production (BAS 1998). This can be attributed to declining prices of aquaculture products, particularly prawn and shrimp.

Aquaculture production has been included in official statistics since the mid-1970s. The volume of aquaculture production has been rising ever since, except for 1997 when output slightly declined. Indeed, aquaculture has offset the declines in the municipal catches since 1983 such that total fish production has increased. Since 1984, fish production from aquaculture has registered volumes close to the output of the commercial sub-sector. Aquaculture output overtook commercial fishery production in 1994, and began to exceed municipal output in 1996 (see Fig. 2). A closer look at the aquaculture statistics however, indicates that at least two-thirds of the sector's output comes from seaweed production. Furthermore, several lakes, rivers and swamp-lands can still accommodate aquaculture production at sustainable levels.

In terms of value of total fish output, statistics show an increasing trend through the years except for 1997 when decline occurred, which accompanied the decreased volume (see Fig. 2 and 3). For the municipal fisheries, the value of the catch increased steadily despite the decline in catches for the periods 1983 - 88 and 1991- 97. For aquaculture, total value of fish output has declined since 1994 despite increasing output, which is mainly due to the downward pressure on prices of aquaculture products, particularly prawn and shrimp

Characteristics of Fishers and Fishing Households

Based on the data gathered from the 12 priority bays studied under the Fisheries Sector Program (PRIMEX 1996), the socioeconomic characteristics of small scale fisher folks are given in Table 2.

In contrast to the small scale fisheries sector, there is a dearth of information on the socioeconomics of the commercial sector. This may be attributed to the fact that this sector accounts for a small portion of the total fishing labor force, i.e. a mere 5.72% (or 56 715 of 990 872) for 1997. In addition, many studies have focused on the small scale fishers, usually with the end in view of alleviating their poverty (see Smith et al. 1980, Smith et al. 1983, Panayotou 1982, Librero et al. 1985).

Among the few socioeconomic studies on the commercial sector is the bioeconomic analysis of the

Table 2. The socioeconomic characteristics of small scale fishers in the Philippines.

Characteristic	Value
Average household age	41 years
Average household size	5.1 members
Educational attainment	4 - 6 years of schooling
Average annual household income	Php25 426 (1992)
House owners	82 %, however only 40% owned their lots
Housing type	Nipa and bamboo for 41.1% and nipa and wood for 34 %
Fishing boat owners	Most fishers owned a boat but only 27 % were motorized
Members of community organizations	25 % of households
Availed of loans	20 %, of which 83 % came from informal sources
Main fishing gear	hook and line, gillnet, and beach seine

Philippine small pelagic fishery by Trinidad et al (1993). Twenty-two commercial vessels were monitored in Regions IV, VII, IX and NCR for the period March - April 1988. The average manpower or crew size per boat across six gear types was 23.9, with purse-seiners having the biggest crew size of 67, while encircling gillnetters had the smallest at eight. The average number of trips undertaken during this period was 6.8 trips for all types of gear, with an average duration of 115.1 hours or 4.8 days. The duration of fishing trips was longest among purse-seiners at 456 hours or 19 days and shortest for beach-seiners at seven hours per trip.

The crews of trawlers and purse seiners were given a fixed salary while crews of bag-netters, ring-netters, beach seiners and encircling gill netters were each given a fixed minimum plus a share of the catch (Trinidad et al. 1993). The frequency of payment varied from per trip, weekly, monthly to a combination of these. The pure profit of labor (percent share of crew plus fish consumed, salaries, share of catch and food) amounted to an average of Php 86 307 per monitored vessel assuming a zero opportunity cost of labor. This is equivalent to Php3 611.17 per crew member (laborer) for the average of 32.6 days of fishing operation, i.e. without distinguishing the difference in crew members' skill and pay. This is much larger than the average profit of municipal gear at Php2 886 per boat, which is equivalent to Php303.79 per crew member for an average of 6.2 days of fishing. If converted to a 32.6-day period, this amounts to Php1 591.47, which is less than half of what a commercial crew member could earn over the same period.

The average non-fishing days for commercial fishing vessels amounted to 8.8, with the trawler having an average of 24.6 non-fishing days in a year. The commercial vessels' average was almost double the municipal (small scale) boats' non-fishing days at 4.8 days. This implies more rest days or opportunity for non-fishing productive activities. Although the study covered few boats, we can infer that the commercial fishery labor force is much better off than the labor force in the municipal fishery.

Institutional Background

Table 3 gives a summary of the highlights of fisheries policies in Philippines for the past 50 years. The degree of pressure or exploitation of any fish stock or fishery is largely influenced by institutional factors, such as organizations, established customs or practices, regulations (both formal and informal), and social arrangements. The interaction of these factors with the fishery determines the sustainability of the fishery resources.

Prior to the introduction of centralized fisheries management by the Spanish and American colonizers, the resource utilization and property rights were based on common property principles within a village, and managed by those who belonged to the village (or *barangay*). Pomeroy and Carlos (1997) noted that the Philippines has a long history of indigenous fisheries and resource management systems where the village had jurisdiction over natural resource use and access.

The arrival of the Spaniards meant the establishment of a centralized system of government, including a state-led, centralized system for managing fisheries (Pomeroy and Carlos 1997). This ushered in the decline of common property management and open access to use of resources. Later, American colonizers continued the centralized scheme as well as the thrust of maximizing revenues from the colony. In fisheries, this translated to a development thrust with progressively increasing fishing effort and resource utilization. Several fish companies embarked on large scale (or commercial) fishing, while poor coastal communities were encouraged to intensively exploit their adjacent fisheries resource. The pattern of centralized governance prevailed through the fifties and sixties (Pomeroy and Carlos 1997).

During the 1970s, the expansion, use and development orientation of the country's fisheries policy continued under Presidential Decree 704, which is widely known as the Fisheries Decree of 1975. In particular, the Expanded Fish Production Program implemented the development thrust of the Fisheries Decrees of 1975. However, the effects of a virtually open-access regime began to manifest in declining catches, rent dissipation and increasing poverty among small scale fishers. Thus, during the 1980s fisheries policy gradually shifted towards management. Also, initiatives for decentralized management were started. Although the Fisheries Decree of 1975 granted overall control over management and regulation of fisheries to the then Secretary of Agriculture and Natural Resources, the Decree recognized that small scale or municipal fishing was within the purview of municipalities. The latter had

the authority to issue licenses and grant fishing rights to small scale fishers (which can operate within 7 km from shore). From the mid-1980s, the policy environment for fisheries was generally characterized by the following:

a. a shift in governance from centralized to localized;
b. a shift from open access to limited access, and;
c. a shift from development focus to management.

Table 3. Fisheries policy highlights in the last 50 years.

Year	Milestone
2000	The DENR and DA sign the Joint Memorandum Order on the implementation of the Fisheries Code.
1999	Philippines is signatory to the implementation of the Rome Declaration on the Code of Conduct for Responsible Fisheries. Pres. Proclamation No. 57 declares the yearly celebration of May as Month of the Ocean.
1998	RA 8550 (Fisheries Code) establishes coastal resource management as the approach for managing coastal and marine resources.
1997	RA 8435 (AFMA) recognizes the importance of fisheries to food security and provides for Integrated Coastal Management Training.
1996	Memorandum Order 399 directs operationalization of Philippine Agenda 21.
1995	EO 241 creates Fisheries and Aquatic Resources Management Councils (FARMCs).
1994	DA-DILG MOA 1994 devolves some regulatory functions pertaining to fishing regulations to LGUs. The Philippines becomes a signatory to the Law of the Sea.
1991	RA 7160 (LGC) devolves primary mandate for managing municipal waters to LGU.
1990	The Presidential Commission on Illegal Fishing and Marine Conservation coordinates all government and non-government efforts in the planning and implementation of a national program for the conservation of marine and coastal resources.
1987	DA abrogates and subsumes BFAR's administration, regulatory, and enforcement functions. The DENR and BFAR are given mandates for fisheries development.
1986	Ban on operations of commercial trawl and purse seine in marine waters within 7 km from shoreline of all provinces in the Philippines. *Muro-ami* and *kayakas* are prohibited from operating in Philippine waters.
1985	Distant water fishing fleets are encouraged
1984	Regulation on gathering, catching, taking, or removing of marine tropical aquarium fish.
1981	The Philippines becomes a signatory to CITES.
1979	A Coastal Zone Management Committee composed of 22 government agencies is formed.
1977	Assignment of the Secretary of the National Resources to train *barangay* officials as deputy fish wardens or deputy forest wardens.
1976	Commercial and other fishing gear operating within a distance of 7 km from the shoreline may be banned by the President of the Philippines upon the recommendation of the Secretary of Natural Resources.
1975	PD 705 declares mangrove forests under DENR jurisdiction but areas released for fishponds under BFAR. PD 704 (Fisheries Decree of 1975) develops rules and regulations on the fishing industry, upholds provisions of the Fisheries Act of 1932.
1972	PD No. 43, Fishery industry development decree of 1972, providing for the accelerated development of the fishing industry of the Philippines; fishing industry considered as a Board of Investments pioneer project.
1963	RA 3512 created the Philippine Fisheries Commission under the Department of Agriculture and Natural Resources.
1950	RA 428, as amended, declared as illegal the possession, sale or distribution of stupefied and/or disabled fish and aquatic animals.
1932	Act. No. 4003, Fisheries Act, Provided for the Secretary of Agriculture and Natural Resources to issue rules, regulations and instructions consistent with the law. All ordinances of fishing should be approved by Department Secretary.

Source: DENR, DILG, DA-BFAR and CRMP 1997.

Laws and Policy Instruments

The Local Government Code (LGC) of 1991 firmly established the jurisdiction of municipalities over small scale fishing. The "Legal and Jurisdictional Guidebook for Coastal Resource Management in the Philippines" (DENR, DILG, DA-BFAR and CRMP 1997) lists the responsibilities of local governments in the implementation of fisheries and coastal management. Though causing much confusion, the LGC expanded the coverage of municipal waters from 7 km from the shoreline under Presidential Decree 704 to 15 km from the shoreline. The impact of the expansion was twofold: (a) it limited access to commercial fishers and (b) it highlighted the need for a more equitable distribution of benefits to the marginalized municipal sector. Issues pertaining to economic efficiency and food security, especially of urban consumers, have been affected by such policy bias. The policy prescription of the LGC came at a time when catches from marine fisheries, both from the commercial and municipal sector, were on a continuous decline. Given this scenario, a possible intent of the LGC was to limit access to both the municipal and commercial sectors, especially of the nearshore municipal waters.

The Philippine Fisheries Code of 1998 (or RA 8550) seeks to address widespread coastal poverty and resource degradation, along with other fisheries problems and concerns. At the core of this law is the country's fisheries policy which is aimed at: attaining food security, conservation, protection and sustained management of the country's fishery and aquatic resources; alleviating poverty and the provision of supplementary livelihood among municipal fishermen; improvement of aquaculture productivity within ecological limits; optimal utilization of offshore and deep-sea resources; and upgrading of post-harvest technology. The Fisheries Code reinforces provisions in the LGC that are aimed at strengthening local governance of municipal fisheries. Furthermore, the Fisheries Code seeks to institutionalize community participation through the creation of Fisheries and Agriculture Management Councils (FARMCs) at the village (*barangay*), municipal, regional and national levels.

Compared to the LGC, access limitations are more straightforward in the Fisheries Code with such mechanisms as: (1) registry of municipal fisherfolk; (2) exclusion of non-resident fishers in certain municipal waters with the attendant coding of vessels; (3) mapping and delineation of municipal waters; (4) traditional limitations such as closed areas and seasons; and (5) non-traditional access limitations such as use of economic rent indicators to set production targets for the fishery. These access limitation strategies indicate a progressive shift in policy from full development to management.

In addition to the Local Government Code, the Fisheries Code and the Implementing Rules and Regulations of the Fisheries Code, fisheries are also governed by various fisheries administrative orders issued by the Bureau of Fisheries and Aquatic Resources. Among the latter are administrative orders for the protection of rare, threatened and endangered species, including dolphins, whale sharks, and whales and porpoises. The Agriculture and Fisheries Modernization Act (or RA 8435) also defines policies on fisheries management and development.

International Agreements

The Philippines is signatory to a number of international and regional conventions that have major implications on the conservation and management of the fisheries and aquatic resources. Table 4 presents a partial list of such conventions.

Table 4. Key international conventions that influence Philippine fisheries policy.

Convention	Date signed	Date ratified
UN Convention on the Law of the Sea (UNCLOS), Montego Bay, 10 December 1982	10 December 1982	08 May 1984
Convention on the Prevention of Marine Pollution by Dumping of Waste and Other Matter, London 19 December 1972	29 December 1972	
Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES), Washington, 03 March 1973	03 March 1973	18 August 1981
Convention on the Conservation of Migratory Species of Wild Animals (CMS), Bonn, 23 June 1979	20 June 1980	
Convention on Biological Diversity (CBD), Rio de Janeiro, 05 June 1992	12 June 1992	October 8 1993

Structure and Mandate of National Fisheries Institutions

The Fisheries Decree of 1975 established the Bureau of Fisheries and Aquatic Resources (BFAR) under the Department of Agriculture. Essentially, the BFAR was created by renaming the Philippine Fisheries Commission and expanding its functions. The BFAR has the responsibility to formulate, administer and implement fisheries policies.

In 1986, BFAR was changed to a Staff Bureau but was reconstituted to a line agency by virtue of the passage of the Philippine Fisheries Code of 1998. Under this Act, BFAR shall, among others, prepare and implement a Comprehensive National Fisheries Industry Development Plan, establish and maintain a Comprehensive Fishery Information System and formulate and enforce rules and regulations governing the conservation and management of fishery resources. However, BFAR is heavily constrained by a limited budget and facilities that do not match the huge areas it is supposed to manage. The constraints have resulted in the inability to effectively oversee the nation's fisheries utilization, including the enforcement of fisheries laws and the compilation of data for "Philippines Fisheries Statistics".

The Fisheries Code of 1998 also called for the establishment of the National Fisheries Research and Development Institute (NFRDI) to function as the primary research arm of the BFAR and the main Department of Agriculture (DA) unit for the conduct and coordination of fishery research and development in the country. Recently, the DA organized the NFRDI's Governing Board and appointed the current BFAR Director as the interim head of the NFRDI, pending the approval of staff positions for the institute by the Department of Budget and Management. The Philippine Fisheries Development Authority (PFDA) is the principal agency tasked to develop, build and maintain fishing ports in the country.

The Department of Environment and Natural Resources impacts fisheries management through its implementation of the National Integrated and Protected Areas System Act (RA 7586) and various policies and programs to protect critical coastal habitats (e.g. mangroves and coral reefs) and threatened or endangered species (e.g. dugongs).

Annex 1 provides a list of other national and subnational institutions that also play a role in the development, management and conservation of the fisheries resources and the coastal zone.

Coastal Fisheries in Focus

Philippine fisheries are legally categorized into municipal and commercial fisheries sectors. Municipal fisheries involve the use of motorized and non-motorized fishing boats of three gross tons (GT) or lower, as well as fishing without the use of vessels. The literature uses the terminology "small scale", "artisanal", and "traditional" fishing interchangeably with municipal fishing. Commercial fisheries utilize fishing vessels of more than 3 GT and operate legally in fishing areas more than 15 km from the shoreline.

Characteristics of the Fleet, Catch Rates and Species

The total number of vessels in the municipal sector was estimated at 20 000 in 1948 of which 83% were non-motorized (Dalzell et al. 1987). After 40 years, the number of vessels grew to 500 000 units with a substantial reduction in the ratio of non-motorized to motorized vessels. An appraisal of the Fisheries Sector Project (FSP) noted that as of 1989, more than 60% of the fisher-participants in the Rapid Social Assessments were using non-motorized vessels (PRIMEX 1996).

Development studies suggest that municipal fishers eventually "graduate" and become commercial in nature through motorization and improvement of gear (PRIMEX 1996). Although significantly more efficient in catching fish, such fishers retain their municipal status by operating motorized boats below 3 GT. A good example would be the baby (or small) trawlers in San Miguel Bay. While these are classified as municipal by virtue of tonnage, their operations are on a par with commercial counterparts, putting to great disadvantage the non-motorized fishers (PRIMEX 1996).

Dalzell et al. (1987) reported the number of fishers (both full-time and occasional fishers) to have increased from 63 000 in 1948 to 330 000 fishers in 1980, an average increase of 20% per year. Time series analysis of catch and effort data for the municipal fisheries between 1955 to 1985 (Dalzell et al. 1987) indicated a declining trend in catch per unit of effort (CPUE) (see Fig. 4). Catch refers to total catch of small pelagic species while horsepower (hp) used by motorized vessels represents effort; labor is also converted into its hp equivalent.

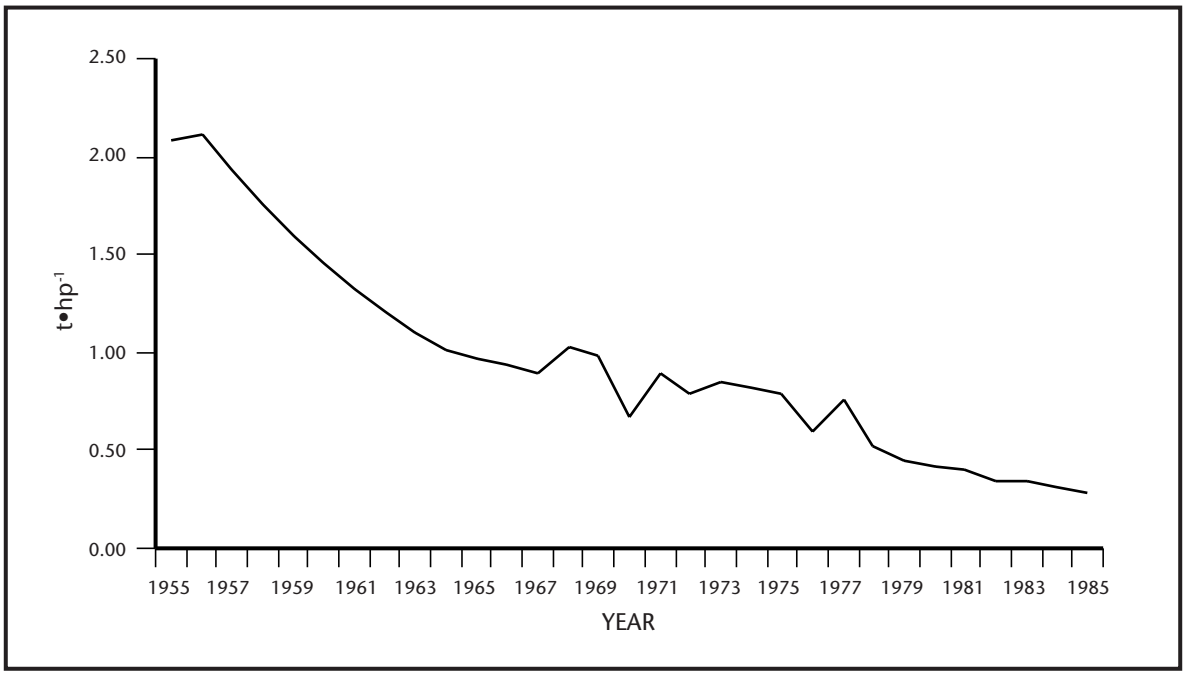

Fig. 4. Catch per unit of effort (CPUE) for small pelagic fishery in the municipal sector. (1955 to 1985).

Coral reef areas contribute up to 23% of the total municipal catch (Munro 1986). Gear used in small scale reef fisheries includes traps, hook and line, drive-in nets, gillnets and makeshift spear guns. Municipal fishers target small pelagic stocks such as anchovies and tuna. Times series data from 1976 - 1987 shows some generalizations concerning gear type and species composition of municipal fisheries (Trinidad this vol.):

- Small pelagics accounted for 38% of catches followed by demersals at 26%; tuna, 16%; seaweeds, 14%; large pelagics, 6%; and invertebrates, 9%;
- The most important gear in terms of contribution to total catch are gillnets, 30%; hook and line, 24% and beach seine, 8%;
- Hook and line accounts for almost 60% of tuna catch by the municipal sector;
- Hook and line, gillnets and fish corrals account for 60% of demersal catch in the municipal sector.

Tuna fishing started during the 1960s. By 1968, an organization of 500 fishers from Negros Occidental had been contracted for deep-sea tuna fishing in the Sulu Sea (Thomas 1999). The municipal fishery was invigorated during the eighties because of the strong demand for sashimi-grade tuna. Municipal fishers from General Santos City cashed in on this boom, which propelled their economic fortunes.

The development of the large scale (or commercial) fisheries during the last four decades has been characterized by increasing tonnage and horsepower of vessels and changes in dominance of certain gear types (see Trinidad this vol.). The commercial sector experienced slow development during the 1980s with minimal expansion and declines to modest catch rates. Vessels with engine displacement of 300 hp and greater became a significant force. Meanwhile, vessels that utilized engines with 50 hp and less were reduced to roughly 1% before the decade ended. Bag-nets and trawls decreased in number while purse seines increased. Today, bagnets and trawls still are dominant gear but their use is decreasing. During the seventies, the contribution of vessels from 3 GT to 5 GT diminished, these were replaced by those ranging from 5 GT to 10 GT. The progressive dominance of larger tonnage vessels became more distinct towards the eighties with vessels of 100 GT and greater accounting for 10%. Of these, half were in the 450 GT category. A detailed analysis on the profitability of the various fishing gear in the commercial sector is described in Trinidad (this vol.). Commercial fishing estab-

lishments in 1992 realized net profits of Php524 million.

The species composition of commercial fisheries production is described in Trinidad (this vol.). There are thirty-five (35) species comprising 70 - 95% of total commercial fisheries production, which are grouped into demersals, small pelagics and large pelagics. Small pelagics have dominated commercial catches since the fifties with roundscads (*Decapterus* spp.), locally known as "*galunggong*", being the single most important species in terms of volume. Slipmouths (Family Leiognathidae), a demersal fish of lesser value, is the second most important species caught. Big-eyed scad (*Selar crumenopthalmus*) featured prominently in 1965 but diminished towards the 1970s and were replaced by frigate tuna (*Auxis thazard*) in the 1980s and 1990s. Roundscads clearly dominated catches in 1965 but had diminished by the 1990s and were replaced by sardines. These changes in species composition may have been influenced by fishing patterns i.e. the use of particular gear types targeting specific species. The changes may also be a result of biological over-fishing problems as documented in some fishing areas (see Silvestre 1990; Silvestre et al. 1995)

Assessment of Exploitation Status

Available bioeconomic analyses of Philippine fisheries are based on surplus production models. Dalzell et al. (1987), Trinidad et al. (1993) and Padilla and de Guzman (1994) focused on small pelagics fisheries while Silvestre and Pauly (1987) investigated demersal fisheries. Dalzell et al. (1987) analyzed published BFAR statistics from 1948 - 85 to investigate the municipal and commercial fisheries targeting of small pelagics. The authors concluded that Maximum Sustainable Yield (MSY) was reached in 1975 while Maximum Economic Yield (MEY) was reached in 1970 at 500 000 t. At the time of writing, the reduction in effort required to attain MSY was estimated at 35%. They also estimated that about US$125 million per year of economic losses via rent dissipation was due to excess fishing effort (Silvestre and Pauly 1987).

Trinidad et al. (1993) studied cost and revenue components, technical efficiencies and pure profits of commercial and municipal gear exploiting small pelagics in Navotas Fish Port; Dalahican, Lucena City; Mercedes, Camarines Norte; Banago Wharf, Bacolod City; Guinhalaran, Silay City; Danao City, Cebu; and, Cawa-cawa Blvd and Labuan, Zamboanga. These areas are known top-producers of small pelagics. Their study confirmed the earlier findings of Dalzell et al. (1987) that the small pelagics fishery was truly over-fished but concluded that open-access equilibrium was reached during the eighties. This meant that on average, pure profits accruing to labor and capital were either zero or negative. A twenty percent (20%) reduction in fishing effort was recommended to attain MSY levels.

Padilla and de Guzman (1994) focused on developing a method for environmental resource accounting in fisheries. Their study utilized the same techniques as in the above-mentioned studies and resulted in similar observations; that the small pelagics fishery was over-fished and that at the time of writing, society was losing about P7 billion by not operating at MEY levels.

Silvestre and Pauly (1987) used trawler horsepower as a measure of fishing effort given that trawl is the major gear for catching demersal species. Their study concluded that the demersal fishery was already over-fished during the seventies. Fig. 5 illustrates the trend of decline in demersal species abundance in Philippine shelf waters during 1947 to 1995. The index of demersal abundance (stock density in $t \cdot km^{-2}$) was computed using the swept area method from various trawl surveys conducted in the Philippines. Data for 1947 to 1980 are from Silvestre et al. (1986), while data for 1981 to 1995 are consolidated from more recent surveys in selected fishing grounds, i.e. Lingayen Gulf (Silvestre et al. 1991), Ragay Gulf and Burias Pass (Federizon 1993), Manila Bay (Armada 1994), San Miguel Bay (Cinco et al. 1995), San Pedro Bay (Armada 1994), and Tayabas Bay (Resource Combines 1997). The data are based on arithmetic means as much of the original data are available for log-transformation and recomputation of geometric means. The stock density estimates also incorporate "learning effects" as given by Silvestre et al. (1986). Despite the paucity of surveys, Fig. 5 clearly illustrates the substantial decline in demersal abundance in the country's shelf waters. Fig. 6 gives the grouping of the data into the country's western, central and eastern shelf waters. Similarly, it illustrates the substantive trend of decline in demersal abundance, but more importantly it shows that the decline is widespread over the country's shelf waters (see also Table 5).

The tremendous decline in demersal biomass is supported by the results of length-based assess-

ments to examine the relative exploitation status of the fishery resources. Fig. 7 shows the mean exploitation ratios (E=F/Z) derived from these assessments, i.e. 0.58. The mean E values are way above the "optimum" values of 0.3 - 0.5 suggested by conventional fisheries theory and imply very heavy fishing pressure from the mix of gear used. In addition, the E value confirms heavy fishing pressure of the fishery resources in the study areas and is consistent with the declines in demersal biomass as previously discussed. A detailed summary of the growth and mortality parameters of various species is given in Appendix III to this volume.

Species composition changes are also observed due to over-fishing. Silvestre et al. (1995) suggested that trends in the species composition changes from trawl surveys in San Miguel Bay for example are reflective of growth, recruitment and ecosystem over-fishing (see Table 6): (1) disappearance or greatly reduced numbers of sharks and rays (together with other large, long-lived species); (2) increased squid (Loliginidae) abundance; (3) increased abundance of shrimps in relation to fish biomass; and (4) increased abundance of cardinal fishes (Apogonidae) and puffer fishes (Tetraodontidae). Similar trends of recruitment and ecosystem over-fishing have been observed for multispecies resources elsewhere in the Philippines (see Silvestre 1990) and Southeast Asia (see Pauly et al. 1989). Moreover, trends in species composition changes from commercial fishery catches have also been noted by Cruz-Trinidad (this vol.). For example, roundscads (*Decapterus* spp.) dominated coastal pelagic fisheries catches since 1965 and have declined in abundance in the 1990s and now replaced by sardines (Clupeid species).

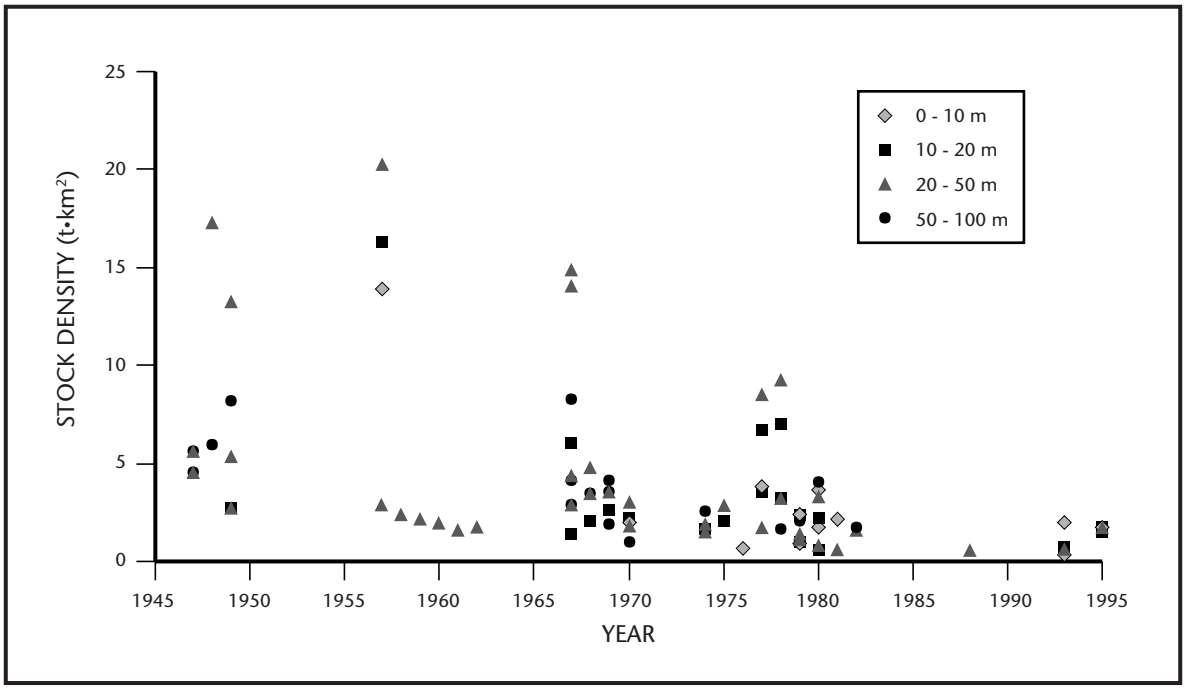

Fig. 5. Scatter diagram of demersal stock density (t·km^{-2}) estimated from different trawl surveys conducted in the Philippines from 1947 to 1995. The Data for 1947 - 80 are from Silvestre et al. 1986 and data for 1981 - 95 are consolidated from recent trawl surveys.

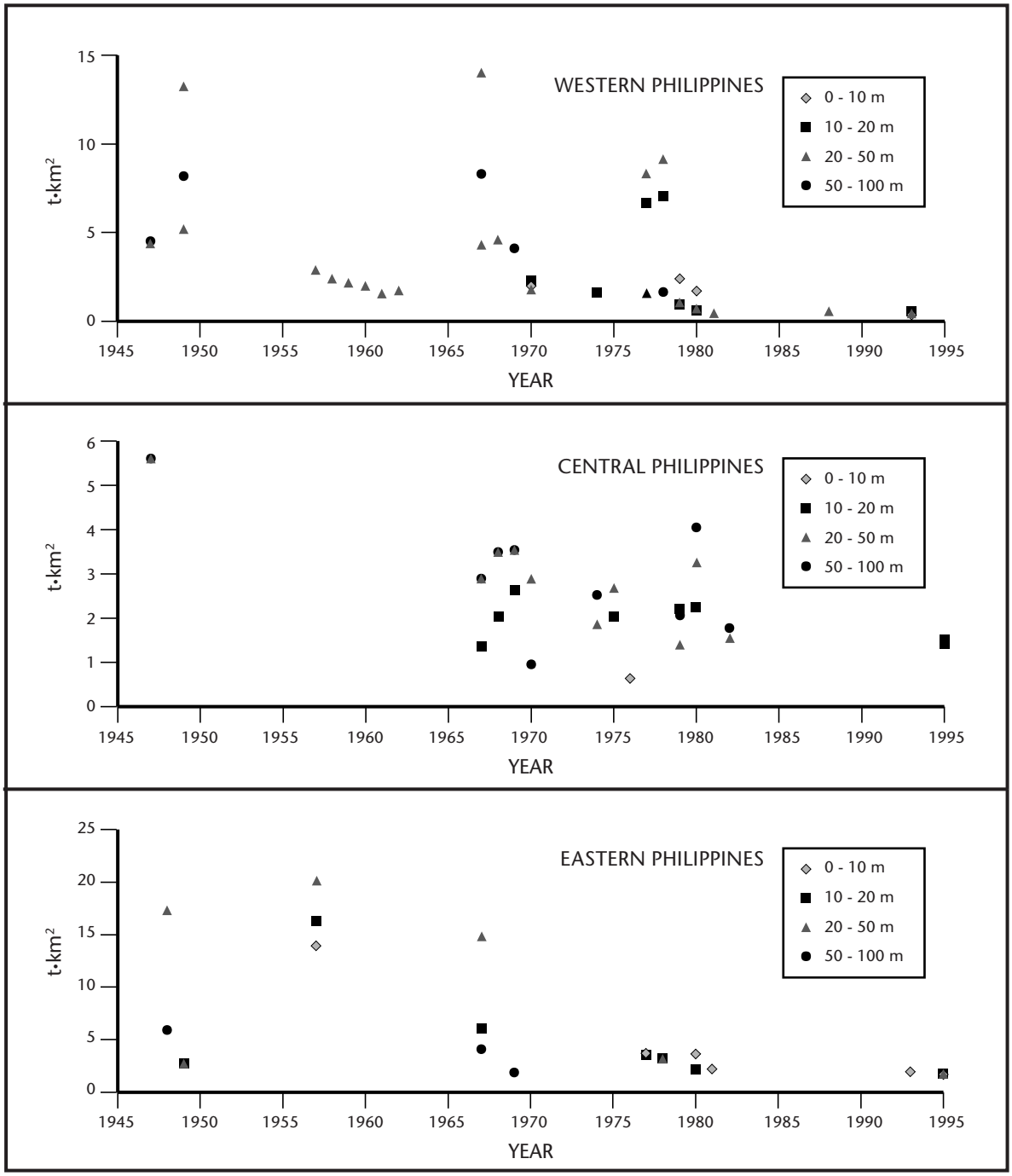

Fig. 6. Scatter diagram of demersal stock density (t•km^{-2}) estimated from different trawl surveys conducted in Western, Central and Eastern Philippines from 1947 to 1995. The data for 1947 - 80 are from Silvestre et al. 1986 and data for 1981 - 95 are consolidated from recent trawl surveys.

Table 5. Estimates of stock density and biomass in selected fishing areas in the Philippines.

Area	Year	Stock density ($t \cdot km^{-2}$)	Relative density (%)	Stock Biomass (t)	Source
San Miguel Bay	1947	10.60	100.0	8 900	Warfel and Manacop (1950)
	1980 - 81	2.13	20.1	1 790	Vakily (1982)
	1992 - 93	1.96	18.5	1 646	Cinco et al. (1995)
	1995 - 96	1.31	12.4	1 107	Soliman and Dioneda (1997)
Carigara Bay	1979 - 80	2.00	100.0	1 624	Armada and Silvestre (1981)
	1995 - 96	1.04	52.0	533	Pura et al. (1996)
Manila Bay	1949 - 52	4.61	100.0	8 240	Warfel and Manacop (1950)
	1992 - 93	0.47	10.2	840	MADECOR (1995)
Sorsogon Bay	1972	1.87	100.0	477	Ordoñez et al. (1972)
	1994 - 95	1.20	64.0	306	Cinco and Perez (1996)

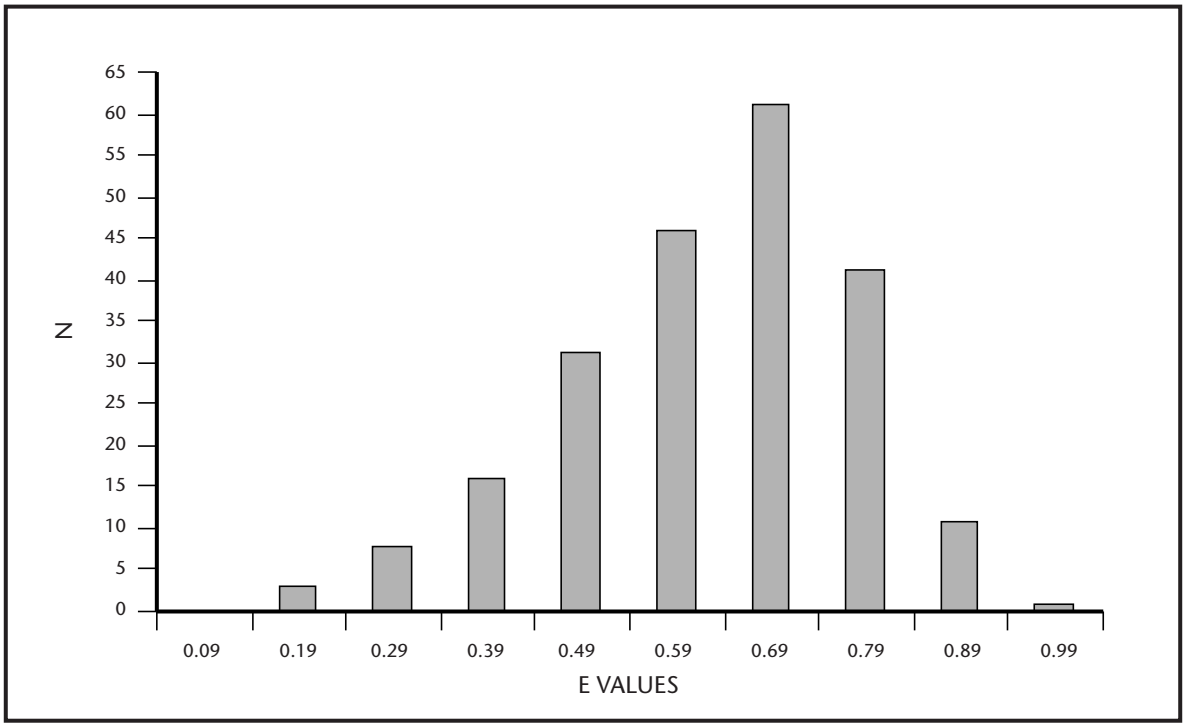

Fig. 7. Distribution of E values for 218 fish stocks in Philippines waters for which estimates are available. Note: Mean E value = 0.58; standard deviation = 0.153; N = 218. (Note: data from Appendix III, this vol.).

Table 6. Evident changes in relative abundance of various families/groups in trawl survey catches. (Adopted from Silvestre 1990).

Family/Group	Observed change in relative abundance	Probable cause
Cephalopoda	Relative increase	Reduced predation
Lactaridae	Disappearance	Recruitment over-fishing
Dasyatidae	Disappearance	Recruitment over-fishing
Balistidae	Relative increase	Species replacement
Lutjanidae	Relative decrease	Growth and recruitment over-fishing
Psettodidae	Relative increase	Growth and recruitment over-fishing
Penaeidae	Relative increase	Reduced predation
"Trash" fish Low value species (e.g. Apogonidae) Juveniles of high value species	 Relative increase Relative increase	 Reduced predation, species replacement Growth over-fishing
Leiognathidae	Massive decrease	No straightforward explanation
Carangidae	Relative increase	Technological (higher trawl opening and trawl speed)

Management Issues and Opportunities

Fisheries Management Philosophy

The Republic Act 8550, otherwise known as the Philippine Fisheries Code of 1998, sets forth the rules and regulations for the development, management and conservation of the fisheries and aquatic resources of the country. The policy under this law constitutes seven basic principles/declarations, namely:

a. *to achieve food security as the overriding consideration in the utilization, management, development, conservation and protection of fishery resources in order to provide the food needs of the population. A flexible policy towards the attainment of food security shall be adopted in response to changes in demographic trends for fish, emerging trends in trade of fish and other aquatic products in domestic and international markets, and the law of supply and demand;*
b. *to limit access to the fishery and aquatic resources of the Philippines for the exclusive use and enjoyment of Filipino citizens;*
c. *to ensure the rational and sustainable development, management and conservation of the fishery and aquatic resources in Philippine waters including the Exclusive Economic Zone (EEZ) and in the adjacent high seas, consistent with the primordial objective of maintaining a sound ecological balance, protecting and enhancing the quality of the environment;*
d. *to protect the rights of fisherfolk, especially of the local communities with priority to municipal fisherfolk, in the preferential use of the municipal waters. Such preferential use, shall be based on, but not limited to, Maximum Sustainable Yield (MSY) or Total Allowable Catch (TAC) on the basis of resources and ecological conditions, and shall be consistent with our commitments under international treaties and agreements;*
e. *to provide support to the fishery sector, primarily to the municipal fisherfolk, including women and youth sectors, through appropriate technology and research, adequate financial, production, construction of post-harvest facilities, marketing assistance, and other services. The protection of municipal fisherfolk against foreign instruction shall extend to offshore fishing grounds. Fishworkers shall receive a just share for their labor in the utilization of marine and fishery resources;*

f. to manage fishery and aquatic resources, in a manner consistent with the concept of an integrated coastal area management in specific natural fishery management areas, appropriately supported by research, technical services and guidance provided by the State; and

g. to grant the private sector the privilege to utilize fishery resources under the basic concept that the grantee, licensee or permittee thereof shall not only be a privileged beneficiary of the State but also an active participant and partner of the Government in the sustainable development, management, conservation and protection of the fishery and aquatic resources of the country.

Fisheries Management Goals and Objectives

The Philippine Fisheries Code of 1998 or Republic Act 8550 sets forth five major objectives for the fishery sector namely:

a. Conservation, protection and sustained management of the country's fishery and aquatic resources;
b. Poverty alleviation and the provision of supplementary livelihood among municipal fisherfolk;
c. Improvement of productivity of aquaculture within ecological limits;
d. Optimal utilization of offshore and deep-sea resources; and
e. Upgrading of post-harvest technology

The objectives of fisheries management in the Philippines were reviewed in a national consultative workshop on 6 to 8 September 2000. This workshop was the culminating activity of the Philippine sub-component under the Sustainable Management of Coastal Fish Stocks in Asia Project (ADB-RETA 5766). Resource persons from the government, the academe and non-government organizations reviewed the outputs of national-level assessments of Philippine fisheries, including biophysical, socioeconomic and management/policy assessments. Workshop participants discussed resource management issues that surfaced from these assessments and raised additional issues for discussion. The participants then identified related issues and formulated fundamental objectives to address the issues. Fig. 8 presents the fundamental objectives of fisheries management in the Philippines as viewed by the workshop participants.

The fisheries management objectives in Fig. 8 are consistent with the spirit of the objectives of the Philippine Fisheries Code (or RA 8550). The difference in the presentation of these two sets of objectives stems from the effort of workshop participants to identify the ultimate ends or the fundamental objectives of fisheries management in the Philippines. In contrast, the Philippine Fisheries Code mixes fundamental objectives with "means objectives" (e.g. upgrading of post-harvest technology), which are not pursued as ultimate ends but are desired for their potential contribution towards achieving objectives that are more fundamental.

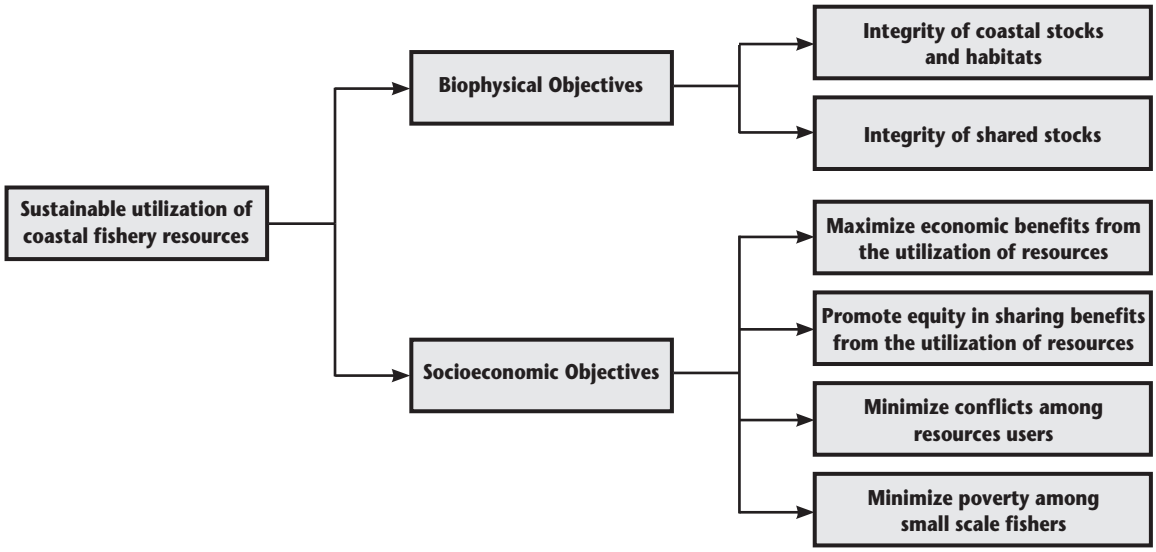

Fig. 8. The fundamental objectives of fisheries management in the Philippines, agreed on by the national consultative workshop.

Fisheries Sector Issues/opportunities/key Interventions

The Philippine Fisheries Code of 1998 sets the policy to sustainably manage the country's fisheries and aquatic resources as a means to contribute to poverty alleviation among the fisherfolk. It also takes into account the issues and concerns that hamper these objectives and as such, it sets forth the provisions that will hopefully address these concerns and ultimately attain the said objectives.

Fisheries sector issues were discussed and analyzed in a national workshop in September 2000. Table 7 lists the issues and corresponding causes, effects and suggested interventions that resulted from the workshop discussions. Opportunities in Philippine fisheries were also noted (Table 8). The following sections provide recommended follow-up actions that need to be undertaken to attain the management objective of sustainable utilization of coastal fisheries resources.

Recommendations for Immediate Government Action

a. Immediate promulgation of the Fisheries Administrative Orders under the Philippine Fisheries Code
b. Immediate implementation by BFAR of specific tasks under the Implementing Rules and Regulations of the Fisheries Code
c. Production of reliable, comprehensive and uptodate Fisheries Statistics
d. Evaluation of completed projects e.g. Fisheries Sector Program, as a basis for management interventions
e. Demarcation of Municipal and Commercial water boundaries by (National Mapping and Resource Information Authority) NAMRIA
f. Collect and publish fishery resource data of the EEZ using M/V DA-BFAR

Table 7. Fisheries Management Issues and Key Interventions.

Issues	Causes	Effects	Interventions
Over-fishing	Increased fishing effort	Habitat degradation Resource depletion	Resource enhancement Effort reduction Strengthen licensing system
	Open access		Limited entry Fishery reserves, refuges, sanctuaries & protected areas Effort reduction Strengthen licensing system
	Destructive fishing		Encourage income diversification
	Poverty		Law enforcement Market denial
	Over-emphasis on profits		Provision of alternative livelihood
	Weak law enforcement		Integration of value formation in IEC
	High population growth		Formulate a law enforcement framework Advocacy

Table 7. Fisheries Management Issues and Key Interventions. (continued)

Issues	Causes	Effects	Interventions
Habitat degradation *(mangroves, coral reefs, seagrasses, algal beds, soft bottom, etc.)*	Siltation		Riparian rehabilitation Mangrove rehabilitation Catchment/watershed management.
	Pollution		Wastewater management (domestic sewage, agriculture-aquaculture, industrial effluents) Implementation of anti-pollution regulations Solid waste management
	Destructive fishing		Law enforcement Market denial
	Increased fishing effort Poverty		(same as above)
	Weak law enforcement		Capability building (Supplemental/alternative livelihood, vocational skills training, credit program for non-capture fisheries livelihood) Formulate law enforcement framework
Inappropriate exploitation patterns *(mesh size, temporal/ spatial, destructive fishing)*	Ignorance		Information and Education Campaigns (IEC)
	Traditional practices (padas, danggit and other fisheries)		Formulate appropriate policy
	Lack of information		
	Market demand (for fry & juveniles)		Research on spatio-temporal dynamics of resources Formulate appropriate policy
Post harvest losses *(Spoilage, loss of value, discarding/by-catch)*	Adherence to traditional patterns Lack of quality consciousness		IEC (e.g. consumer consciousness)
	Lack of technology Improper handling		Technology dissemination & development
	Inappropriate exploitation pattern Lack of appropriate post-harvest infrastructures (e.g. design, absence, location)		Rehabilitation of existing cold storage facilities & construction in strategic locations
	Farm to market roads Air transport Seasonal over supply		Provide infrastructure
	Inadequate understanding/ appreciation of market demand		Develop market/ technologies appropriate for localities

Table 7. Fisheries Management Issues and Key Interventions. (continued)

Issues	Causes	Effects	Interventions
Opportunity losses *(processing)*	Insufficient adherence to quality management Lack of marketing strategies and skills	Lack of quality value-added products	Popularize adherence to quality standards (e.g. HACCP)[3] Initially subsidize entrepreneurship activities
Opportunity losses *(marketing)*	Lack of marketing strategies and skills		Entrepreneurship activities (enhance fisherfolk's business skills)
Small/large scale fishing conflicts *(e.g. encroachment)*	Weak law enforcement Un-delineated municipal boundaries Depleted resources		Formulate law enforcement framework Require transponders for commercial fishing vessels Establish identifiable boundaries (deploy buoys, payaos) (same interventions for over-fishing & habitat degradation)
Intra-municipal conflicts *(spatial)*	Depleted resources Lack of zoning regulations/ management schemes		(same interventions for over-fishing & habitat degradation) Formulate/implement zoning plans
Inter-municipal conflicts *(among municipalities)*	Un-delineated municipal boundaries Regulations/ordinance conflicts		Delineate identifiable boundaries Conflict resolution Propose common management scheme (IFARMC)
Information inadequacy	No information at all Unreliable information Inappropriate information Lack of dissemination of available info No "reading culture"		Tap existing information Generate information Translation of research output into useful form (e.g. print, advocacy) Establish info centers at the national, regional and local levels (e.g. licensing, production statistics, resource assessments info, etc) Advocacy Appropriate packaging of info
Research output inadequacy	Improper research protocol Weak research administration (funding and implementing agencies) Research agenda not driven by the needs of the sector Non publication of research results		Adaptation of scientific international standards Provide incentives for publishing Proper documentation

[3] HACCP mean Hazard Analysis and Critical Control Point.

Table 7. Fisheries Management Issues and Key Interventions. (continued)

Issues	Causes	Effects	Interventions
Institutional weakness/ Constraints	Lack of understanding of mandates	Weak implementation of mandates	Professionalize career system
	Unsustained and conflicting policies		Rationalize and institutionalize key policies
	Lack of coordination Lack of resources		Develop country-wide CRM (coastal resource management) policy framework
	Lack of political will/ political intervention		Implement pertinent provisions of RA 8550
	Lack of government commitment		Popularize CRM and make it a basic service of local governments Institutionalize CRM at local levels
			Clarify national environment and resource management priorities and legitimize in form of an official document (e.g. medium-term development plan)
	Donor-driven priorities		Improve donor coordination
Lack of continuity	Changes of policies due to change in administration		Institutionalize key environmental policies
Overlapping mandates	Lack of coordination		Resolution/rationalization of mandates Operational planning at the local level
	Lack of understanding of mandates		Clarification and prompt dissemination of mandates at all levels

Table 8. Opportunities identified in Philippine fisheries.

Opportunities	Benefits
High biodiversity	Implies ecosystem resilience
High recruitment rate of fishes	Implies high stock recovery rates
High growth rate of fishes	Implies high stock recovery rates
Long experience in implementation of (community-based coastal resource management) CBCRM	Sustained CRM
Wide acceptance of CBCRM	Easier introduction/implementation

Recommendations for Government Follow-up Action

a. Implement Monitoring, Control and Surveillance (MCS) activities
b. Implementation of commitment under various international conventions e.g. FAO Fisheries Code of Conduct (FAO 1995)
c. Incorporate and strengthen relevant concerns e.g. environment impact assessments, biodiversity conservation through sanctuaries, biosafety etc.

Recommendations for Regional Collaborative Efforts

a. International Waters concern to include:
   1. Highly migratory and transboundary aquatic species (e.g. fishes, marine mammals, marine turtles; invertebrates)
   2. Monitoring and evaluation of catch in the high seas by commercial fishing fleets
   3. Bilateral fisheries cooperation (utilization, management, research and development)
b. Stock assessment and stock delineation studies of shared fishery resources using available technologies e.g. surveys, tagging, morphometrics and molecular genetics (Barut and Santos 2000)
c. Establishment of a joint fisheries management framework between and among neighbouring countries sharing resources e.g. the Multilateral High Level Conference on Straddling Fish Stocks (MHLC),
d. Joint management and research of shared threatened and/or endangered biodiversity e.g. marine mammals and whale sharks

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Annex 1

List of national and sub-national (local) agencies involved in the development, management and conservation of the coastal and fisheries resources in the Philippines

a. National/Sub-national Agencies

- Department of Science and Technology - Philippine Council for Aquatic Marine Resources Research and Development (PCAMRRD)
- Department of Agriculture- Bureau of Agricultural Statistics (Fisheries Sector)
- Department of Agricultural- Bureau of Agricultural Research (Fisheries Sector)
- Department of Environment and Natural Resources - Protected Areas and Wildlife Bureau (DENR_PAWB)
- Department of Tourism - Philippine Tourism Authority
- Philippine Council for Sustainable Development (PCSD)
- Southeast Asian Fisheries Development Council (SEAFDEC)
- Agricultural Credit and Policy Council (ACPC)
- Quedan and Rural Credit Guarantee Corporation (QUEDANCOR)
- National Fisheries and Aquatic Resources Management Councils (NFARMC)
- Municipal/City/Integrated Fisheries and Aquatic Resources Management Councils (M/C/IFARMCs)
- Department of Interior and Local Government - Local Government Units
- Department of Foreign Affairs - Maritime and Ocean Affairs Unit
- Department of Transportation and Communication - Philippine Coast Guard
- Department of National Defense - Armed Forces of the Philippines
- State Universities and Colleges (e.g. University of the Philippines, Mindanao State University, Silliman University)
- Non Governmental Organizations (NGOs)
- People's Organizations (POs)
- Project based (e.g. DENR-Coastal Resources Management Project, BFAR-Fisheries Resources Management Project)
- International Organizations e.g. UNDP, UNEP
- Funding Institutions e.g. ADB and WB
- National Economic Development Authority (NEDA)

b. Research and Training Facilities/Opportunities

1. Bureau of Fisheries and Aquatic Resources

- BFAR National Centers
  - National Brackishwater Fisheries Technology Center
  - National Freshwater Fisheries Technology Center
  - National Integrated Fisheries Technology and Development Center
  - National Inland Fisheries Technology Center
  - National Marine Fisheries Development Center
  - National Seaweeds Technology and Development Center
  - National Fisheries Biological Center
  - Mindanao Freshwater Fisheries Technology Center
- BFAR Central Office Laboratories
  - Fish Health Lab
  - Microbiology and Chemical Laboratory
  - Biochemical and Genetics Laboratory
  - BFAR Regional Fish Health Laboratories
  - Research and Training Vessel (M/V DA-BFAR)
  - Regional Fishermen's Training Center (RFTC)

2. Southeast Asian Fisheries Development Center (SEAFDEC)

3. State University/Academic Institution Facilities e.g.

- University of the Philippines System
- Silliman University
- Mindanao State University
- Don Mariano Marcos State University

4. Ocean and Littoral Affairs Group of the Navy (OLAG)

5. Department of Environment and Natural Resources Facilities

- National Mapping and Resource Information Authority (NAMRIA)
- Environmental Management Bureau (EMB)
- Ecosystems Research and Development Bureau (ERDB)

6. Local Government Unit Facilities

7. Privately owned facilities e.g. Patrol Boat of the South Cotabato Purse Seiners Association (SOCOPA)

8. Non Governmental Organization (NGO) Facilities

- WWF-Philippines GIS Center
- International Marinelife Alliance Laboratory

c. Financing Institutions Relevant to Fisheries Activity

- Japan International Cooperating Agency (JICA)
- Asian Development Bank (ADB)
- World Bank (WB)
- Overseas Economic Cooperation Fund of Japan
- Global Environment Facility (GEF)
- Canadian International Development Agency (CIDA)
- Danish International Development Agency (DANIDA)
- US Agency for International Development (USAID)
- Australian Agency for International Development (AusAID)
- Food and Agriculture Organization (FAO)
- United Nations Development Program (UNDP)
- United Nations Environment Program (UNEP)
- UNESCO
- International NGOs e.g. World Wildlife Fund
- German Technical Assistance (GTZ)
- Convention on the International Trade in Endangered Species of Wild Flora and Fauna (CITES)
- Convention on Migratory Species (CMS)