Socioeconomic and Bioeconomic Performance of Philippine Fisheries in the Recent Decades

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Abstract

The fishing industry in the Philippines was tantamount to a marine capture fishery in the 1950s to 1960s. Aquaculture and inland fishery production were not significant. Only during the 1970s did aquaculture and inland capture fisheries contribute significantly to fish production. From 250 000 t fish production in 1951, this increased substantially to 1.6 million t in the 1990s.

An average 4.3% was contributed by fisheries to the gross domestic product from 1988 - 98. Fisheries export earnings reached P12 billion in the 1990s. Exports of fishery products include tuna, shrimps, prawns and seaweed.

Fishing industry employees in the Philippines are distributed thus: 70% in the municipal (artisanal) sector, 25% in aquaculture and 5% in the commercial sector.

Fish and fish products comprise more than 50% of total animal protein intake vis-à-vis meat and meat products and poultry. However per capita consumption of food fish decreased from 40 kg•year^{-1} in 1988 to 36 kg in 1998.

In the Philippines, small scale fishing is defined as fishing within municipal waters using fishing vessels of 3 GT or less, or fishing without vessels. In 1948, there were 63 005 fishers rising to 743 544 in 1995. There was a declining trend in catch per unit effort (CPUE) from 2.10 t•HP^{-1} in 1948 to 0.29 t•HP^{-1} in 1985.

Time-series data from 1976 - 87 showed that small pelagics accounted for 38% of total catch followed by demersals, 26%; tuna, 16%; seaweeds, 14%; large pelagics, 6% and invertebrates, 9%. The most important fishing 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 while hook and line, gillnets, and fish corrals account for 60% of demersal catch.

Commercial fishing can be classified into: (a) small scale commercial fishing (fishing with passive or active gear and utilizing vessels of 3.1 GT up to 20 GT); (b) medium-scale commercial fishing (fishing with active gear and utilizing vessels of 20.1 GT up to 150 GT); and (c) large scale commercial fishing (fishing with active gear and vessels of more than 150 GT). In the 1950s the three dominant types of gear were

bag net, the trawl (including beam and otter types) and the round haul seine. The larger tonnage category (more than 100 GT) became more significant in the 1980s.

There are 35 species comprising 70 - 95% of total commercial fish production grouped as demersals, small pelagics and large pelagics. Roundscads dominated the small pelagics, followed by slipmouth, a demersal species.

Declining catches, disappearance of high value species and increasing volume of juveniles are indications that the fishery is biologically over-fished. This translates as declining profit for the fishery sector. It also means that the fishery employs excess labor and utilizes capital that could be used in other economic sectors.

The Fisheries in the Philippines: A Panorama of Contradictions

The importance of fisheries in the Philippines has been frequently extolled.

- The fishery sector contributes significantly to the income. An average 4.3% was contributed by the fishery to GDP over 1988 - 98. Its contribution to gross value-added to agriculture averaged 19% during the same priod.
- The fishery sector contributes to foreign exchange earnings. Exports of fishery products such as tuna, shrimps, prawns and seaweed garnered top earnings together with garments and semiconductors. During the 1990s, fisheries contributed an average of P12 billion to export earnings, a huge boost during the financial crisis.
- The fishery sector employs a total of one million people broken down as follows: municipal sector, 70%; aquaculture, 25%; and the commercial sector, 5% (Bureau of Fisheries and Aquatic Resources (BFAR) 1998). This figure represents about 3% to 4% of the labor force.
- The fishery sector provides food. Fish and fish products comprise more than 50% of total animal protein intake vis-á-vis meat and meat products and poultry. In rural coastal communities, up to 80% of the animal protein may be supplied by fish caught in municipal waters (Savina and White 1986).

These attributes of the fishery are being dissipated.

- While fisheries contribute significantly to national income, the people behind this economic sector remain poor. Various studies indicate that poverty along the coast is worsening due to increasing population and fewer income opportunities in other sectors (Añonuevo 1989; Librero et al. 1985; Smith 1979).
- Production from the marine capture fishery has leveled at 2.7 million t. This mirrors the trend in global fisheries where production has leveled at 90 million t. Over 60% of the world's main fish stocks are fully exploited, over-exploited or depleted (Williams 1994). The reasons are similar: the extraction rate is greater than the resources' regenerative capacity, habitats are severely degraded and population increase results in varied stresses, such as higher demand for food fish and higher generation of waste and discharge into coastal waters.
- Empirical studies provide evidence of economic over-fishing in both pelagics and demersal fish stocks. (Dalzell et al. 1987) estimated that maximum sustainable yield (MSY) for small pelagics was attained in 1975 at a production level of 544 000 t. (Trinidad et al. 1993) support this finding and suggest that open access equilibrium (OAE) had already been reached during the early 1980s. Both studies support an effort reduction ranging from 20% to 60% of current levels to attain MSY and/or maximum economic yield (MEY). Biological and economic over-fishing in the demersal fishery was also verified by (Silvestre and Pauly 1987). MSY and MEY for demersal stocks were breached in the early 1970s translating to a loss of P2.0 to P3.2 billion (US$100 - 160 million•year $^{-1}$) if MEY level was otherwise attained.
- Aquaculture has suffered declines in productivity on a per hectare basis (Coastal Resource Management Project (CRMP) 1998a). This productivity decline is due to a scale-back in extension services for fish-pond operators (Juliano 1996), water quality problems such as that experienced in Laguna de Bay (Librero 1988), shortage of

breeders, and disease. The contribution of aquaculture should also be evaluated in the context of destruction of a highly productive resource, the mangroves. Of the 450 000 ha of mangrove that existed in 1918, only 138 000 ha exist now. An average of 3 100 ha of mangroves have been lost every year to alternative uses including fish-ponds. From 1970 to 88, the rate of mangrove destruction increased to 8 000 ha per year attributable to expansion of fish-ponds. Unfortunately, fish-pond productivity is one of the lowest in Asia, i.e. less than 1 $t \cdot ha^{-1}$ and a significant hectarage of ponds is now unproductive, unutilized or abandoned. Furthermore, the (World Bank 1989) estimates that sustained use of one hectare of mangroves would provide the equivalent of about a person-year's earnings for a typically poor fisher, whereas conversion to fish-ponds would provide only one months' earnings to labor. (White and Trinidad 1998) estimate that mangroves yield an average of US$600 per year from direct benefits alone (wood, fish and crustaceans). If the existing mangrove cover were maintained in a healthy state, this would yield a total of US$83 million per year.

- Per capita consumption of food fish is decreasing. In 1988, this was 40 $kg \cdot year^{1}$; ten years later, this figure had dropped to 36 kg. Per capita consumption of fish is estimated using two parameters: food fish production and population. Both parameters counteract each other and the result is a decline in per capita consumption. This decline is even more pronounced in the very communities that make consumption of fish possible for the urban consumers. This is a worldwide trend; UNICEF for the first time, reported a protein-calorie deficiency in fishing communities (Coastal Resource Management Project (CRMP) 1998a). If population growth continues at its current pace and nothing is done to arrest the pattern of fishery extraction, the use of destructive fishing practices and degradation of marine habitats, it is estimated that by the year 2010, only 10 kg of fish would be available on an annual per capita basis (Bernascek 1994). While the country has embarked on various food security programs, we have yet to see some degree of importance given to fish vis-á-vis its more privileged cousins, rice and corn.

Trends in Fisheries Production, Trade and Prices

Our period of analysis encompasses five decades, beginning during the 1950s and culminating in the late 1990s. For the first two decades, fisheries production was tantamount to the marine capture fishery with aquaculture and inland capture fisheries contributing to production only during the mid -1970s. Fishery production was 250 000 t in 1951 doubling after 15 years. By the 1970s the million-ton mark was breached; thereafter, production hovered at 1.2 million t for almost the entire decade of the 1970s. Modest but constant growth was registered thereafter finally reaching a plateau of 1.6 million t in the 1990s (Fig. 1).

Average growth rates for the entire fishery sector (including aquaculture) show that production peaks occurred during the 1960s and to a lesser extent, the 1970s (Table 1). These peaks were 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 negative and/or minimal growth. This is particularly true for the small scale sector. Aquaculture continued the growth trend for the fisheries sector. Unlike industries which start off low on the growth curve, aquaculture began with a "bang". For the first five years, it posted double-digit growth, i.e. a 15% average for the first four years. In 1980, aquaculture yielded 300 000 t, almost 25% of total capture fishery production and by 1990, this figure doubled. By 1996, total aquaculture production had already eclipsed production from both the large scale and small scale fishery sectors.

The main contributors to fisheries production are the small scale or municipal sector and the large scale fishery. These two sectors dominated the fishing industry for the first two decades during the period of analysis. During the early 1950s, the small scale sector comprised the bulk of fisheries production which was, on average, 150% greater than the commercial sector. Towards the 1970s and well into the 1990s, this ratio drastically dropped to a little over 30% indicating either a stagnation in the catch of the municipal fishery or increased activity in the commercial sector. By the 1990s, the advantage of the small scale sector would be completely overturned (Fig. 1).

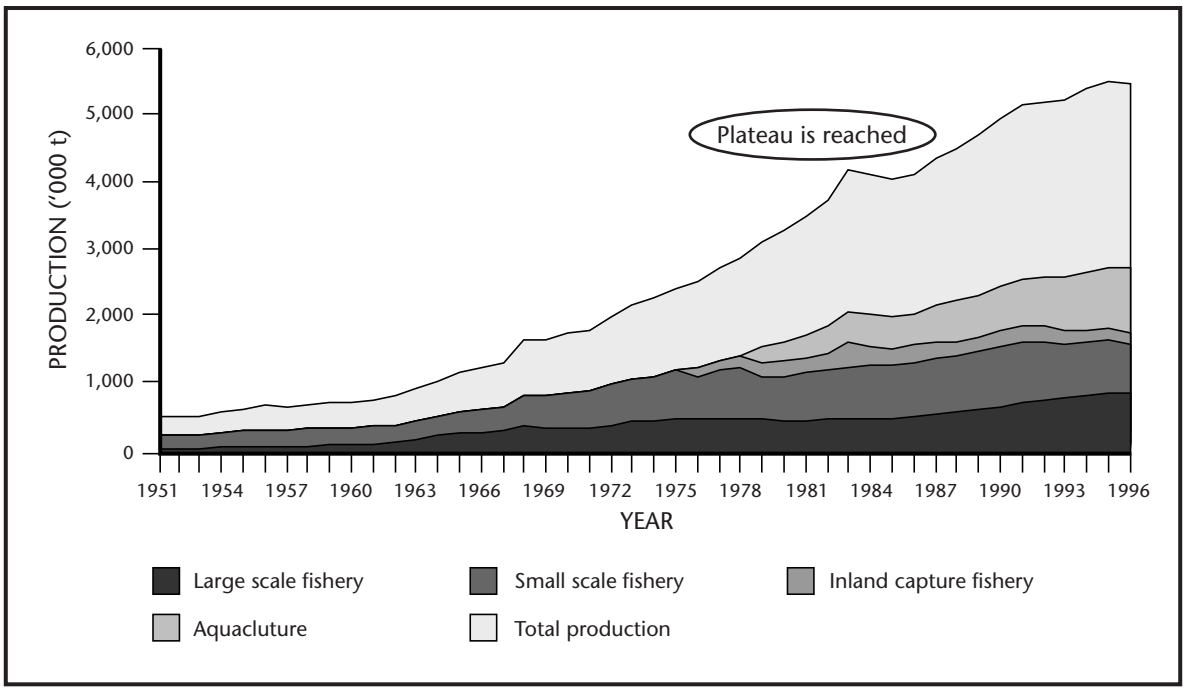

Fig. 1. Fisheries production in the Philippines, contribution by major sector, 1951 - 96.

Table 1. Average production growth rate of the fisheries sector for 5-year periods, 1952 - 95.

Period	Average growth rate per sector (%)				
	All	Capture fishery	Large scale	Small scale	Aquaculture
1952 - 55	5.4	5.4	12.8	2.7	–
1956 - 60	3.4	3.4	2.8	4.0	–
1961 - 65	9.5	9.5	20.6	2.9	–
1966 - 70	8.4	8.4	5.4	11.2	–
1971 - 75	6.7	6.7	5.6	7.5	–
1976 - 80	6.4	-1.3	-0.4	-1.5	–
1981 - 85	4.3	2.7	1.0	4.0	11.5
1986 - 90	4.1	4.2	6.5	2.7	6.5
1991 - 95	2.2	1.0	5.0	-2.5	6.5

Inland capture fisheries and aquaculture only began to contribute to official production statistics during the 1970s, however there was an undocumented but robust inland capture fishery especially in freshwater lakes such as Laguna de Bay and Sampaloc Lake. Aquaculture started during the late 1970s with fish-pens and ponds.

According to available trade reports, the Philippines was a net importer of fisheries products from 1970 - 77; thereafter, the balance of trade turned positive for the next 10 years. This reversal is largely due to tuna and aquaculture products notably shrimp, prawn and seaweed (Fig. 2). Towards the 1990s the country again became a net importer of fish but the balance of trade in value terms remained favorable due to the depreciation of the peso against the dollar. Exports hovered at P12 billion during this period. More than half of the volume was accounted for by tuna while shrimps and prawns accounted for a significant share (> 40%) in value terms (Fig. 3).

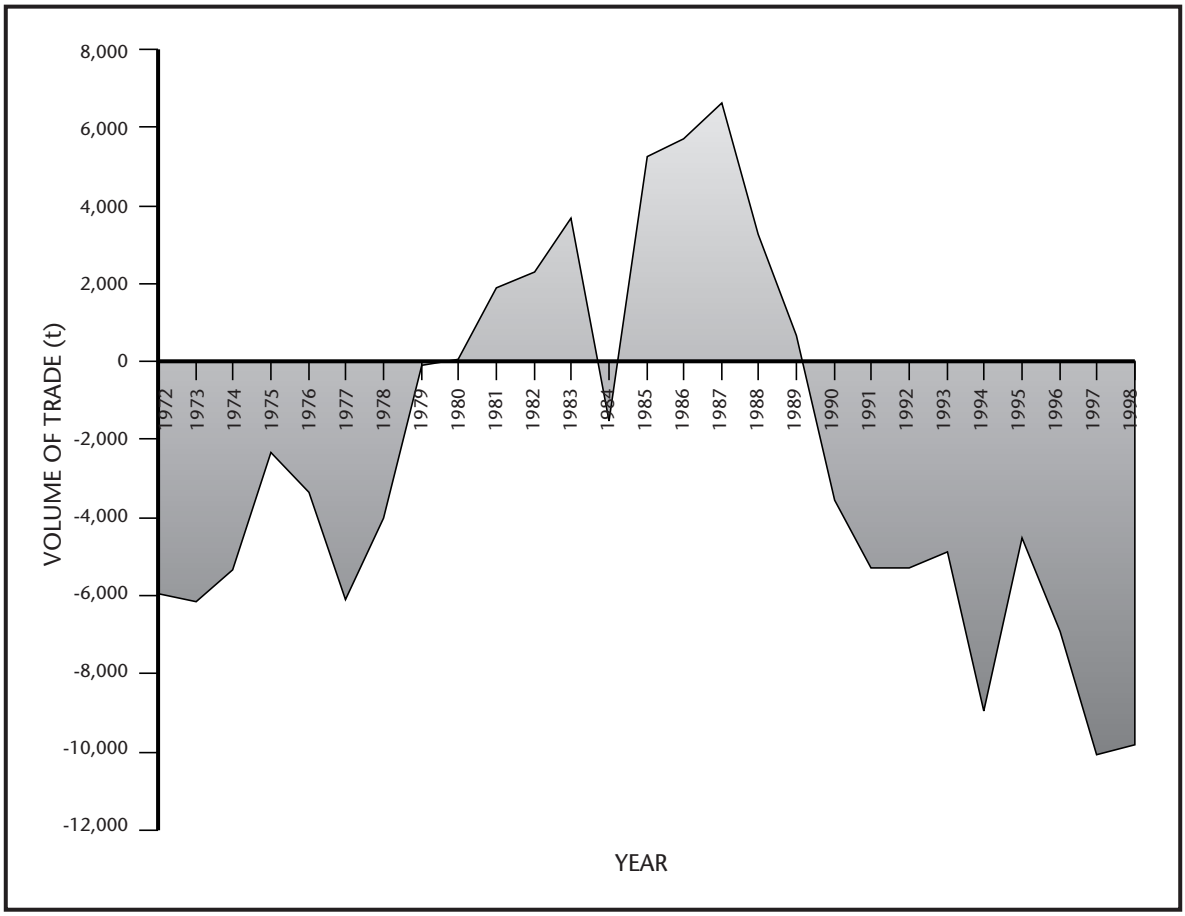

Fig. 2. Balance of trade in fisheries products, in volume terms, 1972 - 98.

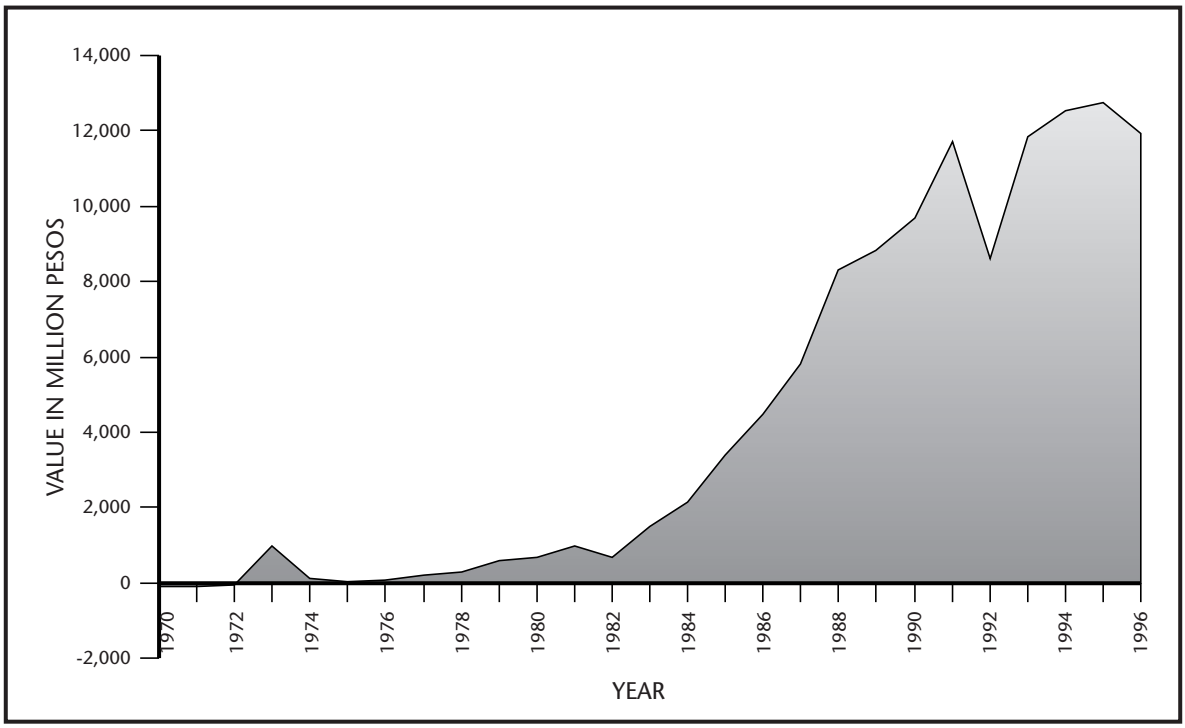

Fig. 3. Balance of trade in fisheries products, in value terms, 1970 - 96.

Price data of fish are rather patchy; thus, the five decades cannot be characterized completely. Wholesale or producer prices of seven major fish species comprising tuna (*tulingan*), roundscads (*galunggong*), anchovies (*dilis*), slipmouths (*sapsap*), threadfin breams (*bisugo*), Indian mackerel (*alumahan*) and Indian sardines (*tamban*) were observed to move in tandem with the inflation rate over 1979 - 96 (Fig. 4). Fish prices also generally move a little faster than the composite price of commodities (Fig. 4). The period 1982 - 1985 saw prices of all fish species increasing faster than inflation generating an increase in the real (inflation-adjusted) price of fish. This corresponds to the years of the financial crisis with inflation reaching all-time highs of 40% or greater. In 1984, prices of the above-mentioned fish species almost doubled. *Alumahan*, *sapsap* and *bisugo* were the species with the highest price change. Price change was also above inflation in 1987 - 1990 although to a lesser extent. Changes in fish prices were generally slower than inflation during 1981, 1985 - 86, and 1991.

For urban consumers, the retail price is a more appropriate price barometer. A comparison of wholesale and retail prices for six species including milkfish (*bangus*) indicates that the wholesale and retail prices move in the same direction (Figs. 5 - 10). A widening gap is noticeable starting in the 1990s attributable to increasing costs of transportation and marketing.

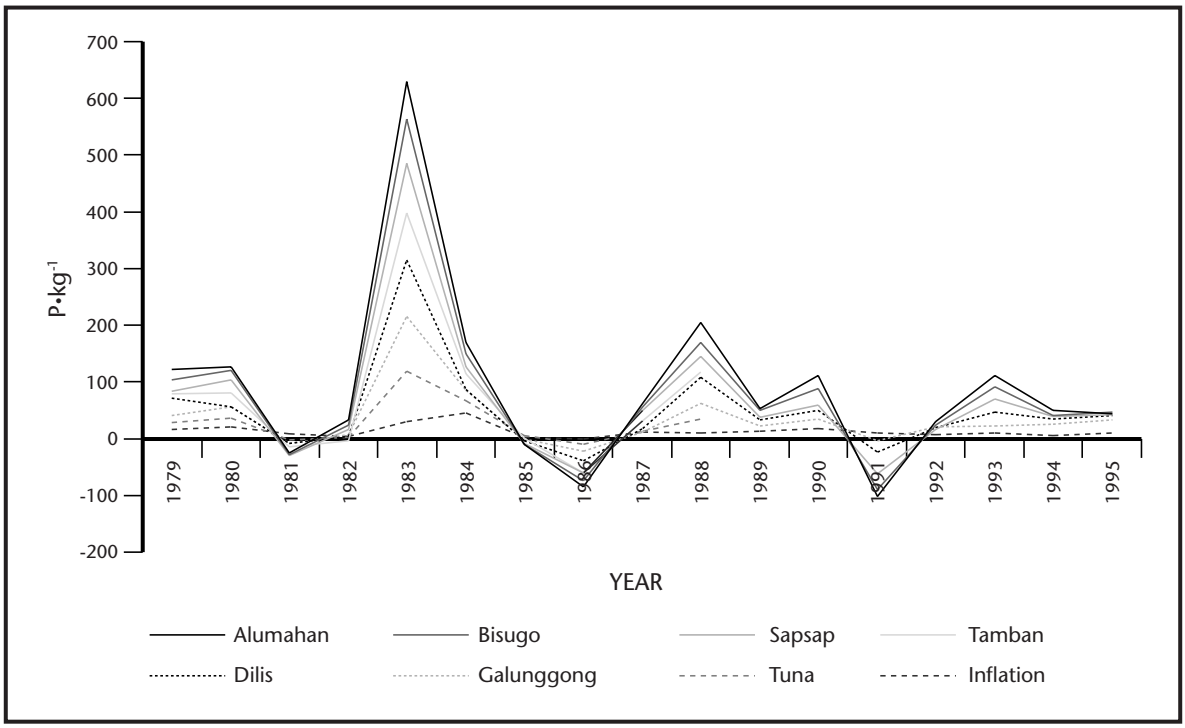

Fig. 4. Comparison of fish wholesale price movements with inflation rate, 1979 - 96.

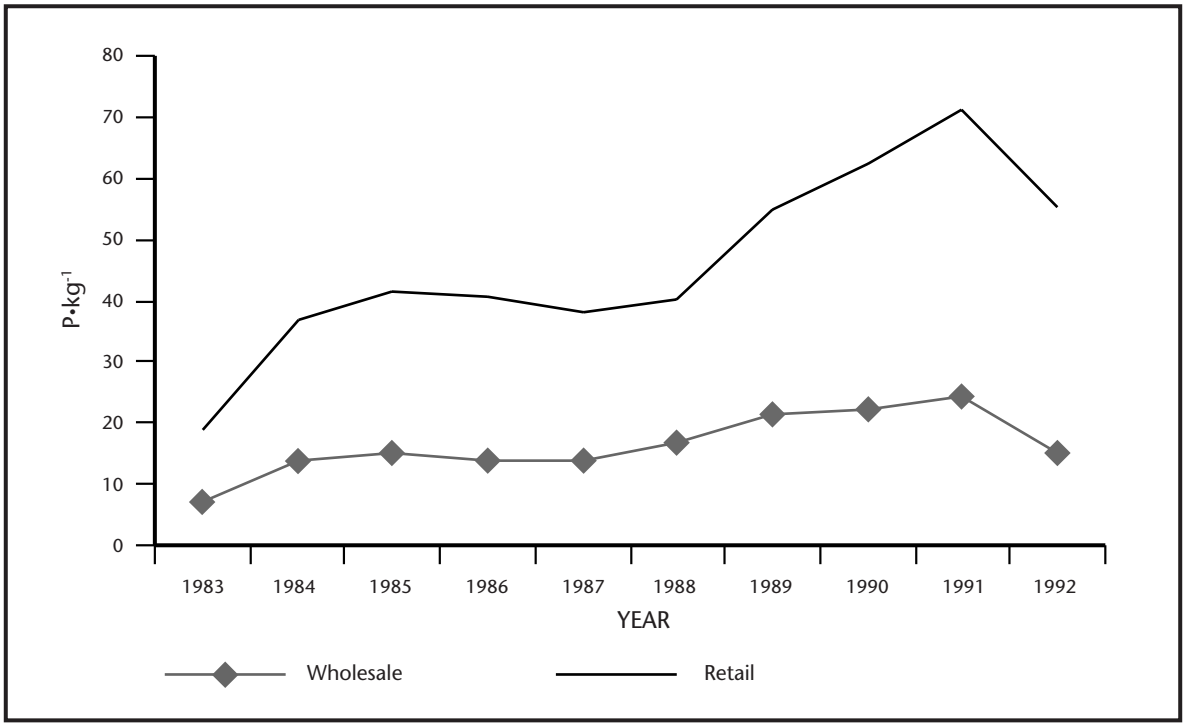

Fig. 5. Wholesale and retail price of *sapsap*, 1983 - 92.

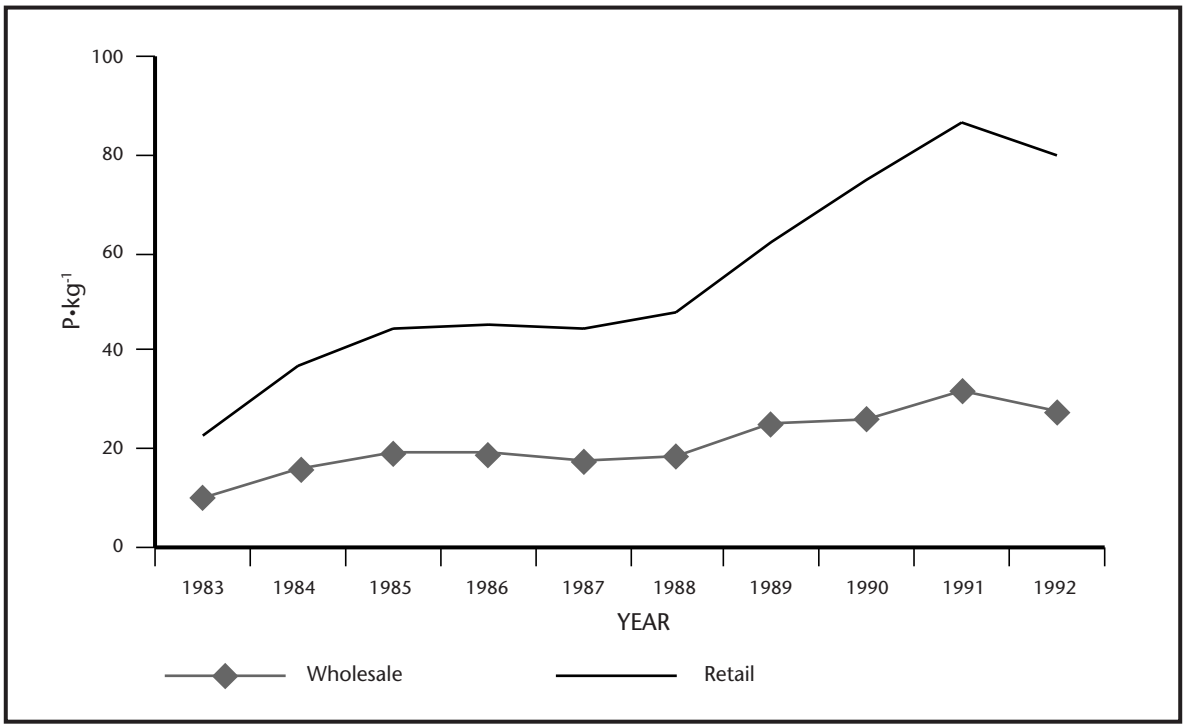

Fig. 6. Wholesale and retail price of *alumahan*, 1983 - 92.

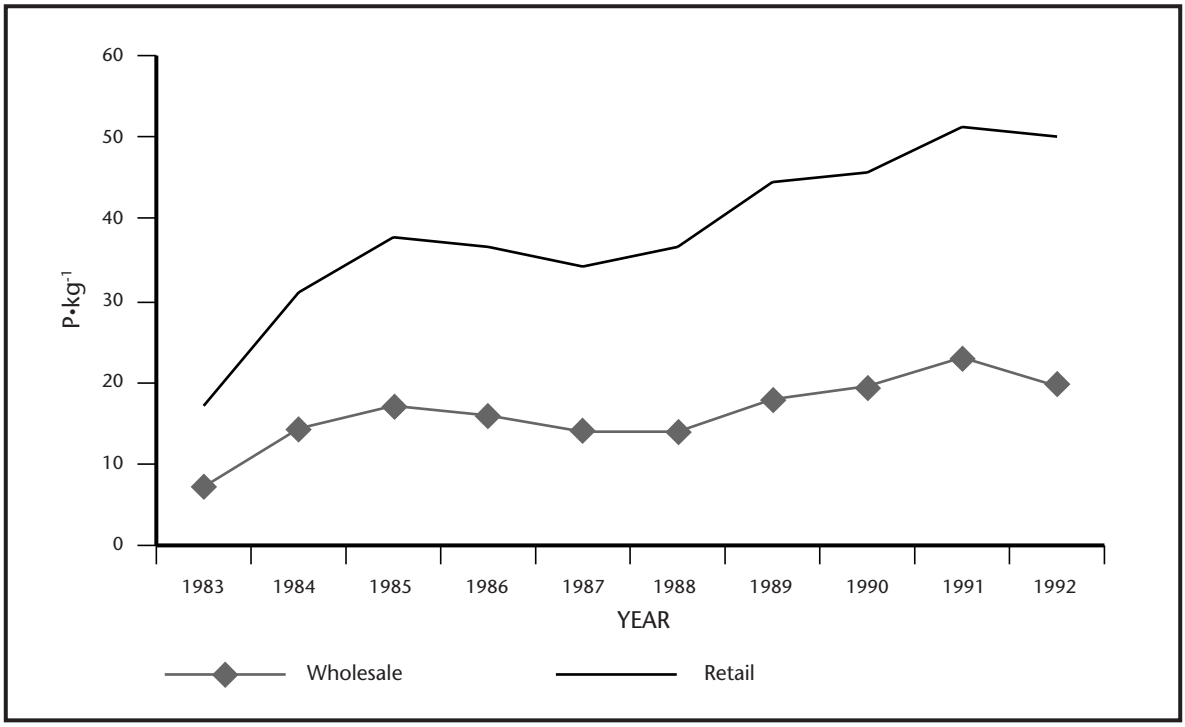

Fig. 7. Wholesale and retail price of *galunggong*, 1983 - 92.

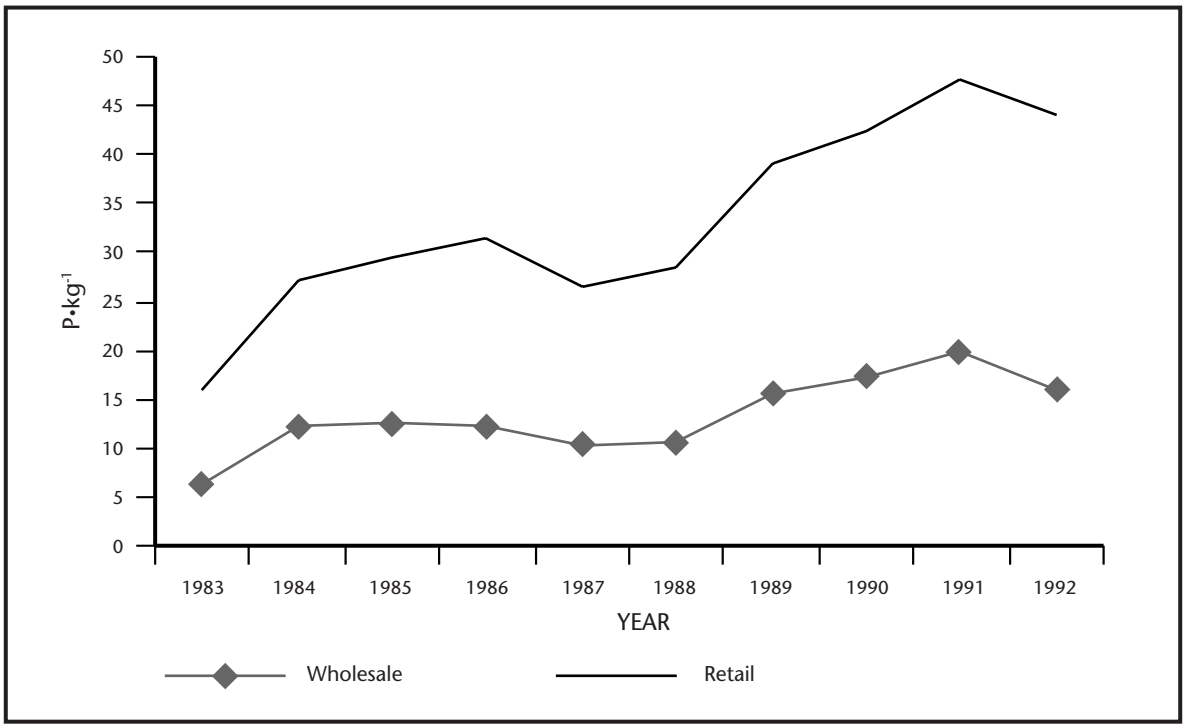

Fig. 8. Wholesale and retail price of *dilis*, 1983 - 92.

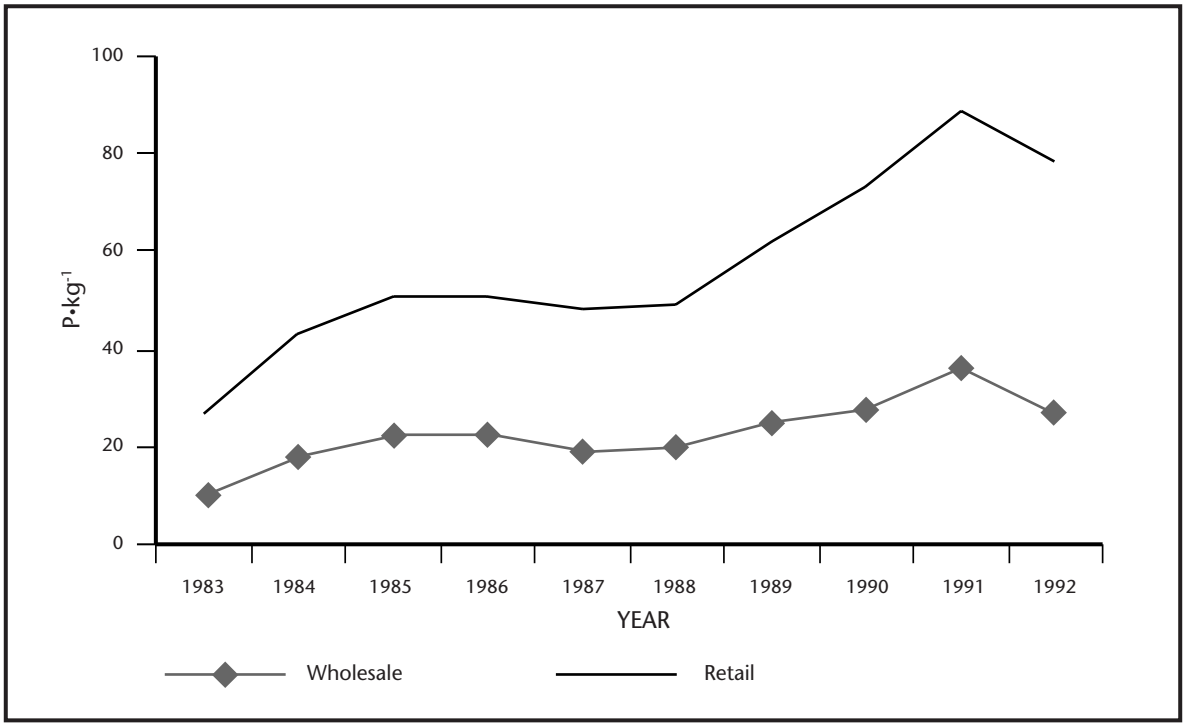

Fig. 9. Wholesale and retail price of *bisugo*, 1983 - 92.

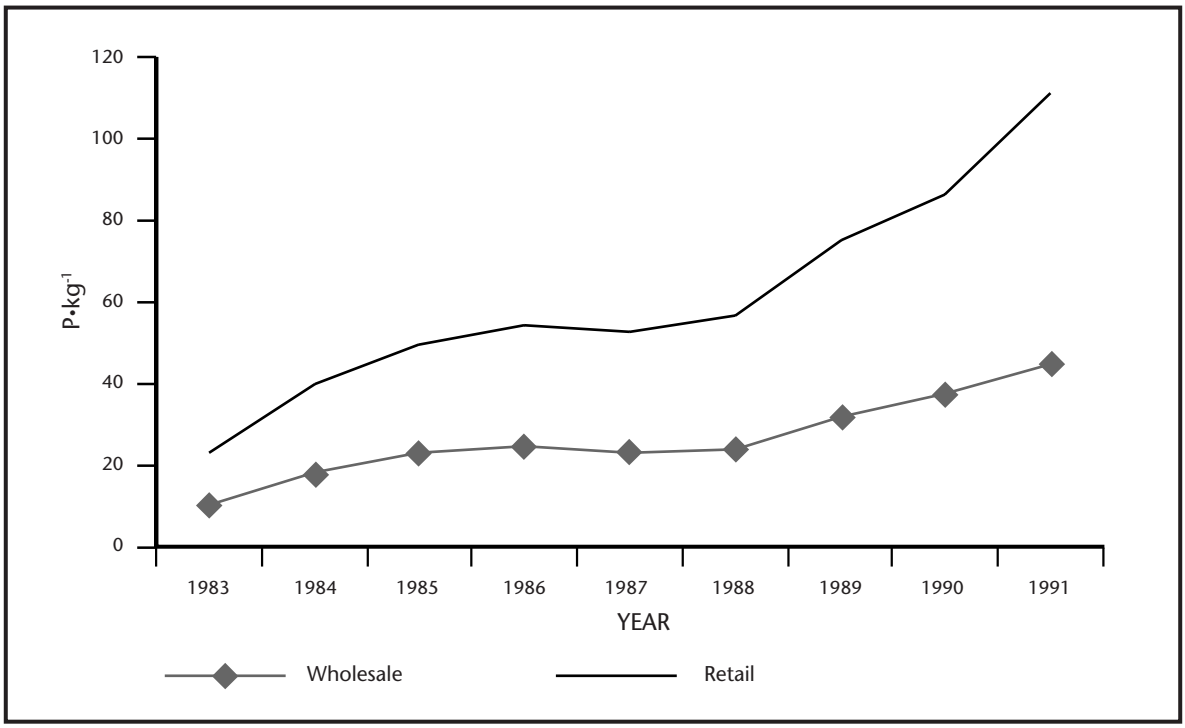

Fig. 10. Wholesale and retail price of *bangus*, 1983 - 91.

A possible explanation for this trend is the shortage of fish coupled with strong demand. Thus, the prices of severely exploited demersal stocks, such as *sapsap* and *bisugo*, topped this list for which prices moved faster than the consumer price index (CPI). Escalating costs of fishing, especially that of fuel, contributed to the fast change in prices, which also implies that the costs were being passed on to the consumers.

An earlier analysis done by (Smith 1979) using retail prices and the CPI from 1970 - 78 tells a different story. During this period, prices of fish moved in the same direction as the CPI but were noticeably lower. The study inferred that the price change in the fuel component of the CPI far outweighed the ability of fishers to pass on the costs to the consumers.

Characteristics of the Municipal Fishery

Definition

The Fisheries Code of the Philippines (1998) defines municipal fishing as "*fishing within municipal waters using fishing vessels of three (3) gross tons or less, or fishing not requiring the use of fishing vessels*. The literature uses the terminology "small scale", "artisanal" and "traditional" fishing interchangeably with municipal fishing.

Characteristics of the Fleet

Production and Employment

Data concerning the municipal fisheries sector is patchy. Except for production data, which is aggregated at the macro-level, information about vessel and gear, employment, target species, operational regimes, etc, are to be found in specific case studies. (Dalzell et al. 1987) attempted to consolidate selected information on vessels and employment from various national censuses (Table 2). The total number of vessels in the municipal sector was estimated at 20 000 in 1948 of which 83% were non-motorized. After 40 years, the municipal vessels grew to 500 000 units with the number of motorized vessels increasing substantially but not fully. An appraisal by the Fisheries Sector Project (FSP) noted that as of 1989, more than 60% of the fisher-participants at the Rapid Social Assessments were still using non-motorized vessels (PRIMEX 1996).

Table 2. Number of vessels and fishers in the municipal sector for selected years.

Year	Number of non-powered vessels	Number of powered vessels	Number of fishers
1948	16 618	3 384	63 005
1971	129 793	59 875	330 505
1977	144 742	80 774	365 388
1980	262 748	105 090	675 677
1985	270 419	193 976	700 369
1990	–	–	721 633
1995	–	–	743 544

Source: Dalzell et al. 1987; Bureau of Fisheries and Aquatic Resources (BFAR) 1948/1971/1977/1980/1985 - 95, were estimated based on a 0.06% average growth rate computed from 1948 to 1971.

Development studies suggest that municipal fishers eventually "graduate" and become commercial in nature. In the Philippine setting, the "graduation" is equivalent to motorization and improvement of gear. As the data shows, motorization has never been completed and to this day, the municipal sector exists side by side with the commercial fishery. In fact, the motorized category of the municipal sector already approximates the level of fishing effort of small commercial vessels. A good example would be baby trawlers prevalent in San Miguel Bay. While these are classified as municipal by virtue of tonnage, their operation is at par with commercial counterparts putting to great disadvantage the non-motorized fishers.

The number of fishers provided in Table 2 represents full-time and occasional fishers (Dalzell et al. 1987). Total employment in the municipal sector was 63 000 in 1948; 20 years later, the number had swelled to 330 000 fishers representing an average increase of 20% per year. The number of fishers doubled in 1980.

There are indications that the official statistics on employment are under-estimated. First, there are an estimated 500 000 fishing vessels in the municipal sector. Assuming that two people operate each boat, then the one million estimate would represent the small scale fishery alone. Second, the inputs of women engaged in processing and marketing are not accounted for, in addition to those employed in ancillary activities such as fish transport, marketing and processing.

(Dalzell et al. 1987) constructed a time series of catch and effort for the municipal fishery from 1955 - 85. Catch refers to total catch of small pelagics while effort is represented by horsepower used by motorized vessels; labor is also converted into its HP equivalent. The analysis shows a declining trend in catch per unit of effort (CPUE) (Fig.11). From an estimated 2.10 $t \cdot HP^{-1}$ in 1948, CPUE has gone down to 0.29 $t \cdot HP^{-1}$ in 1985, a mere 15% of original values. Various case studies also support the declining trend in catch rates (Table 3). Data from Olango and Candijay indicate that current catch rates represent only a tenth of the catch rates in the 1960s.

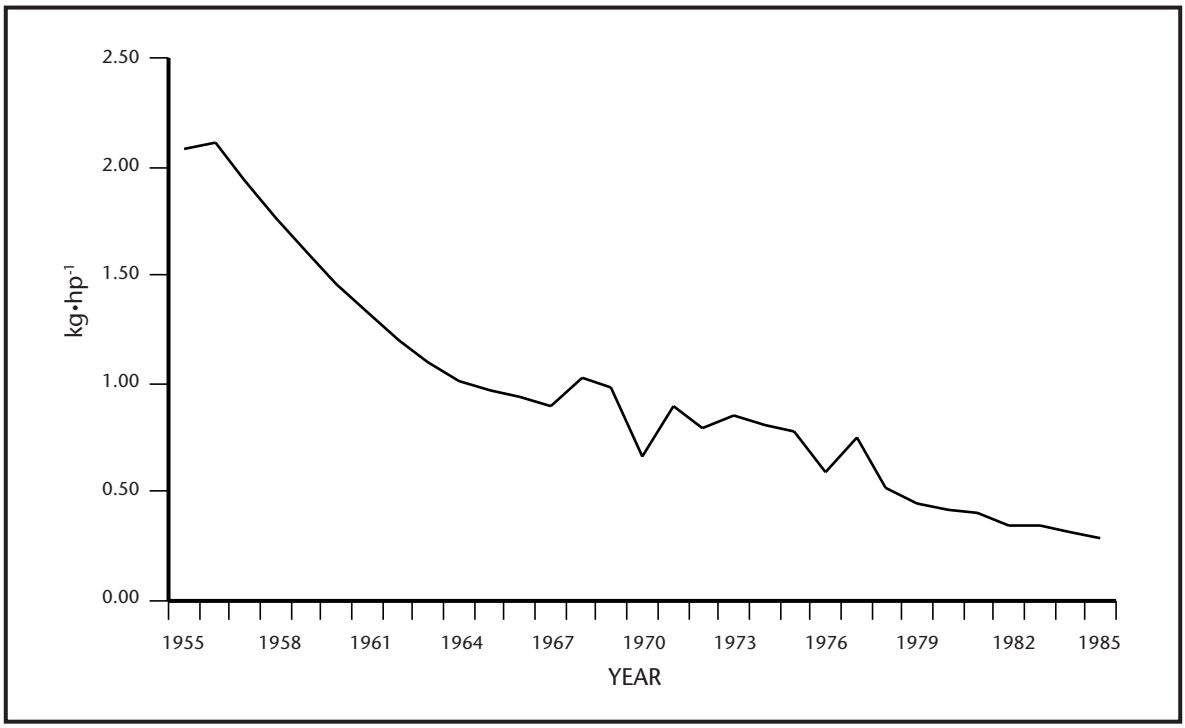

Fig. 11. Catch per unit of effort for the municipal fishery, 1955 - 85.

Table 3. Catch rates in the municipal fishery sector, various sites.

Study site	Estimated Catch Rate[1]	Source
Misamis Oriental	2 590 kg•year^{-1} for motorized vessels; 990 kg•year^{-1} for non-motorized vessels	Herrin et al. (1978)
Olango Island	6 000 kg•year^{-1} in 1960; 600 kg•year^{-1} in 1998	Coastal Resource Management Project (CRMP) (1998b)
Candijay, Bohol	6 000 kg•year^{-1} in 60s; 600 kg•year^{-1} in 90s	Katon et al. (1998)

Note: [1] Assuming 300 trips per year.

Gear and Species

Towards the end of the Spanish period (1898), municipal fishers employed various methods of fishing, such as fish corals and pots adopted from the Malays and lever net *(salambao)*, cast net *(dula)* and push net *(sakag)* adopted from China.

Gear used by municipal fishers to capture reef fish are traps, hook and line, drive-in nets, gillnets and makeshift spear guns. Up to 23% of all municipal fisheries catch is derived from coral reef areas. In addition to coral reef fisheries, there are the small pelagic stocks such as anchovies and tuna. Times series data from 1976 - 87 show several generalizations concerning gear type and species composition of the municipal fishery:

- Small pelagics accounted for 38% of catches, followed by demersals, 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 for the municipal sector;
- Hook and line, gillnets and fish corrals account for 60% of the demersal catch in the municipal sector (Pagdilao et al. 1991).

The contribution of the various gear types and species caught in municipal fishery production remains similar for 1995 (Table 4).

Table 4. Marine municipal fish catch by major fish species and fishing gears, CY 1995 (in t).

Major Species	Major Fishing Gear						% of Total
	Hook and line	Ringnet	Fish corral	Gillnet	Others	Total	
1. Squid (*Pusit)*	7 407	223	1 394	14 857	19 420	43 309	5.5
2. Fimbrated Sardines *(Tunsoy)*	1 640	1 765	1 672	33 187	4 999	43 263	5.5
3. Frigate tuna *(Tulingan)*	20 171	3 385	1 561	7 462	9 780	42 359	5.4
4. Anchovies *(Dilis)*	265	2 576	3 858	7 072	28 137	41 908	5.3
5. Indian Sardines *(Tamban)*	2 377	11	391	15 901	13 922	32 602	4.2
6. Yellowfin Tuna *(Tambakol)*	25 505	78	58	1 658	3 004	30 303	3.9
7. Blue Crabs *(Alimasag)*	21	38	838	16 695	10 349	27 941	3.6
8. Indian Mackerel *(Alumahan)*	1 919	1 673	197	19 939	3 881	27 609	3.5
9. Big-eyed Scad *(Matangbaka)*	16 743	614	388	4 363	1 895	24 003	3.1
10. Roundscad *(Galunggong)*	4 620	6 219	83	6 901	6 132	23 955	3.1
11. Others	106 834	23 934	20 616	129 986	166 755	448 117	57.1
TOTAL	187 502	40 516	31 056	258 021	268 274	785 369	100.0
% of TOTAL	23.9	5.2	4.0	32.9	34.2	100.0	

Municipal Tuna Fishing

Tuna fishing started during the 1960s (Thomas 1999). Organized fishing by municipal fishers started in South Basilan, Jolo, Siasi and Tawi-tawi with the use of hand-line and troll lines in boats without outriggers. About 2 000 craft were estimated to operate during this period. Fishing operations were usually done at night in near-shore areas. Later, tuna fishing would be exported to the Visayan seas and by 1968, an organization of 500 fishers from Negros Occidental had been contracted for deep-sea tuna fishing in the Sulu Seas (Thomas 1999). The municipal fishery was invigorated during the 1980s because of the strong demand for sashimi-grade tuna. Municipal fishers from General Santos City cashed in on this boom.

Socioeconomics

(Smith 1979) provides a graphic description of the ordinary life of a municipal fisher.

"On extreme days when bad weather precludes any fishing from the small barrios of Ilocos Norte, Philippines, for example, it means that the day's meals consist of rice and salt and nothing more. Even on good days the catch is so low that it does not go far when sold in order to purchase other necessities. It means that some families have never consulted a doctor, even though several are located only a few kilometers away, because they cannot afford the nominal fee. It means that the family's sole possessions, besides its single room nipa palm house and the clothes they are wearing, are cooking utensils and some sleeping mats. It means that with

no savings and materials possessions, the poorest fishing families can never hope to secure loans for gear purchase from collateral-minded banks, whose experience with previous loans to fishermen has been anything but rewarding. It means that with little or no education, and few non-fishing skills, the poorest fishermen have little hope of shifting to another occupation ...".

After almost 30 years, the Socioeconomic situation remains the same. Preparatory reports of the FSP (PRIMEX 1996) noted that 80% of fisherfolk households were living below the poverty threshold. Average family size is 5.5 members, larger than the average for the rural sector and certainly larger than the national average. Houses are constructed of light materials and 60% do not own the land on which their houses are built, so they are renting or squatting. Access to education, electricity and water is limited.

A comparison of income estimates indicates that fishing income is mired below poverty levels. (Librero et al. 1985) estimated annual net household income (including non-fishing activities) of municipal fishers at P5 000 (P7.40 = US$1), which was above those of rice farmers, P3 500, and slightly lower than coconut farmers. Nevertheless, this estimate was still lower than the rural average of P8 500 (Table 5). In 1989, average net returns from fishing in the Lingayen Gulf area were estimated at P17.20 per day or P344/month (Añonuevo 1989). The study further shows that among four types of traditional fishing including that of bottom set gillnet, baby trawl, lift net and dynamite, the latter resulted in the highest level of net returns. This is because of the relatively low fishing cost and high catch volume.

The PRIMEX study estimates a higher income level because sampled respondents were in FSP project sites. The study was a post-FSP impact assessment. Furthermore, the peso-dollar exchange rate had by then dropped to P24:US$ 1.

The Large Scale or Commercial Fishery

Definition

Commercial fishing is defined by the Fisheries Code as follows: "the taking of fishery species by passive or active gear for trade, business or profit beyond subsistence or sports fishing, to be further classified as:

1. *Small scale commercial fishing - fishing with passive or active gear utilizing vessels of 3.1 gross tons (GT) up to twenty (20) GT;*

2. *Medium-scale commercial fishing - fishing utilizing active gears and vessels of 20.1 GT up to one hundred fifty (150) GT; and*

3. *Large scale commercial fishing - fishing utilizing active gears and vessels or more than one hundred fifty (150) GT."*

Commercial fishing and large scale fishing are used inter-changeably in this report.

Characteristics of the Fleet, Catch Rates and Species Landed

Prior to World War II, the commercial fishing industry was limited to beam trawls or "utase" which were pulled by sail and motorized sampans. After the war, various motorized war-surplus craft were converted to trawl fishing vessels.

Table 5. Income estimates of municipal fishers from various case studies.

Study site	Estimated Income	Source
Misamis Oriental	$750 for owners of motorized vessels; $625 for owners of non-motorized vessels	Herrin et al. (1978)
Nationwide	$675 of fishing households but including non-fishing activities	Librero et al. (1985)
Lingayen Gulf	$206 per year	Añonuevo (1989)
Fisheries Sector Project selected areas	$1 059 weighted average for owners of motorized (27%) and non-motorized (63%) vessels	PRIMEX (1996)

The development of the large scale fishery during the last four decades is characterized by increasing tonnage and horsepower of fishing vessels and changes in dominance of gear types (Table 6). In the 1950s, the three dominant gear were the bagnet, the trawl (including beam and otter types) and the round haul seine. However, it was the *muro-ami* that had the highest catch rate per vessel. In 1952, the total number of commercial fishing vessels was 1 200. Of this figure, only 75% were powered, 15% were non-powered and the rest unreported. At the end of the decade, there was an average of 1 277 vessels with tonnage ranging mostly from 3 GT to 10 GT, i.e. 54% of the total.

During the 1960s, the number of commercial fishing vessels increased dramatically by 67% with *muro-ami* and purse seines growing by more than 200% and trawler and bagnets growing by more than 50%, on the average. The average catch rate per vessel also increased from 73 t to 122 t. Purse seines recorded the highest increase followed by bag-nets, trawlers and *muro-ami*.

The total number of fishing vessels increased minimally, i.e. 15%, during the 1970s, with specific gear types such as *muro-ami* and round haul seines decreasing in numbers during this period. Nevertheless, catch rates especially for purse seines and trawlers continued to increase.

The fishery experienced the doldrums during the 1980s with minimal expansion and a decline to modest catch rates. Vessels with engine displacement of 300 HP and greater became a significant force during the 1980s; meanwhile those which utilized engines with 50 HP and less were reduced to roughly 1% before the decade ended. Bagnet and trawl started to decrease in number to be replaced by purse seines. However bagnets and trawls still apparently dominate despite the fact that the use is decreasing. This is also true for tonnage. During the 1970s, the contribution of vessels from 3 GT to 5 GT diminished and was replaced by those ranging from 5 GT to 10 GT. The significance of the larger tonnage category became more distinct towards the 1980s with vessels of 100 GT and greater accounting for 10%. Of these, half were in the 450 GT category.

There are 35 species comprising 70% - 95% of total commercial fisheries production which are grouped as follows: (a) demersals; (b) small pelagics and (c) large pelagics. Small pelagics have dominated commercial catches since the 1950s with roundscads, locally known as "*galunggong*", being the single most important species in terms of volume. Slipmouths, a demersal fish of lesser value, is the second most important species caught. A comparison of major species caught by different gear for selected years shows changes in species composition and dominant gear (Fig. 12). Big-eyed scad featured prominently in 1965 but diminished towards the 1970s; this was replaced by frigate tuna in the 1980s and 1990s. Roundscads clearly dominated catches in 1965; this had diminished by the 1990s and had been replaced by sardines.

Table 6. Selected characteristics of the large scale fishery sector.

Parameter	Period			
	1950 - 59	1960 - 69	1970 - 79	1980 - 89
Total number of vessels	1 277	2 043	2 348	2 489
Average gross tonnage	30 291	62 321	96 620	75 981
Modal HP (HP category, % to total)	50 - 125, (32%); 200 - 300, (45%)	50 - 125, (22%); 200 - 300, (58%)	125 - 200 (17%); 200 - 300 (52%)	125 - 200 (21%); 200 - 300 (27%); > 300 (17%)
Modal tonnage (tonnage category, % to total)	3 - 10 (42%); 10 - 20 (27%)	3 - 10 (38%); 10 - 20 (15%)	5 - 10 (23%); 50 - 100 (18%)	5 - 10 (22%); 50 - 100 (22%)
Modal gear type	Bagnet (54%); Trawl (26%)	Bagnet (45%); Trawl (29%)	Bagnet (32%); Trawl (36%)	Bagnet (24%); Trawl (32%)

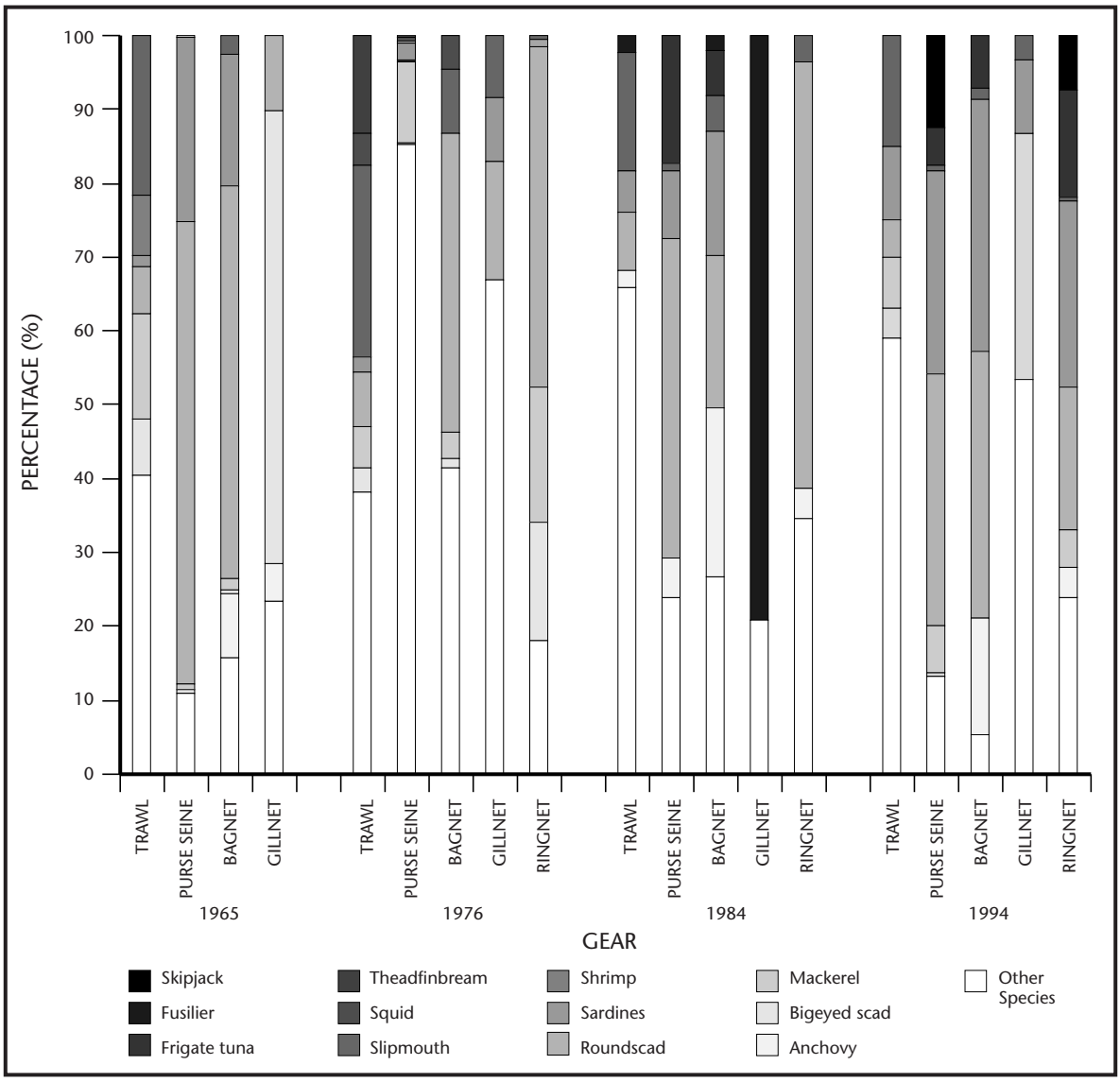

Fig. 12. Changes in species composition of selected fishing gear in the Philippines (1965 - 94).

Socioeconomics

The socioeconomic analysis in this report is based on two studies of the Development Academy of the Philippines: (a) The National Statistics Office (NSO) survey of establishments for fisheries (Development Academy of the Philippines 1996a) and (b) Cost and returns study of the Philippine commercial fishing industry (Development Academy of the Philippines 1996b). Both studies were undertaken in fulfillment of a larger project entitled "Economic rent study for commercial fishing vessels" done under the Fishery Sector Project.

NSO Survey

Background

The "Annual Survey of Establishments, Fishery" is part of a larger survey of establishments covering other sectors including mining and quarrying, aquaculture and other industries. A fishery establishment is defined in the NSO survey as "*one which*

engages in ocean and coastal water fishing, operation of fish farms, inland fishing and gathering of pearl, shells, seaweeds, pearl culture, seaweed farms and gathering of fry." The NSO survey contains information on employment, compensation, revenue, costs, assets, capital expenditures and inventories.

Raw data were collected from 61 and 62 fishing establishments for the years 1991 and 1992, respectively. These establishments were categorized according to tonnage and HP (Table 7).

Table 7. Tonnage and horsepower categories of sampled commercial fishing vessels.

Category	Tonnage Categories (GT)	HP Category
1	1 - 500	1 - 2 000
2	501 - 1 000	2 001 - 4 000
3	1 001 - 1 500	4 001 - 6 000
4	1 501 - 2 000	6 001 - 8 000
5	2 001 - 2 500	8 001 - 10 000
6	2 501 and up	10 001 and up

Analysis and Estimation of Profitability

Out of the 62 sampled fishing establishments, 73% had vessels totaling 500 GT and below. Only five fishing establishments (8%) had vessels greater than 2 000 GT. In turn, these fishing establishments accounted for 89% of tonnage for the whole fishing industry. In terms of horsepower, 46 establishments, or 74% of total, had fishing vessels using 2 000 HP engines and below. Only three fishing vessels utilized engines of 10 000 HP. Less than five fishing establishments accounted for 88% and 74% of total tonnage and horsepower, respectively, for the entire fishing industry.

Revenues from fishing included three primary fishery products which unfortunately did not allow further categorization. Total revenue of the marine fishery sector amounted to P2.28 billion (US$ no conversion available) in 1991 and P2.17 (US$ No Conversion Available) billion in 1992. For both years, at least 74% of the combined revenues were accounted for by vessels belonging to tonnage and HP category 6, i.e. greater than 2 500 GT and 10 000 HP. The rest of the categories accounted for 5 to 7% of total revenue (Tables 8 - 9).

Average revenues for the entire industry were P38 million (US$ no conversion available) and P35 million for 1991 and 1992, respectively. Between tonnage categories, however, average income is greatly dispersed. Vessels belonging to category 1 had an average income of P4 million in 1991 compared to those in category 6 which earned 120% more at P556 million (Tables 10 - 11).

Table 8. Combined revenue, cost, and net profit by total tonnage of fishing vessel fleet.

	1991			1992		
Category GRT	Revenue	Cost	Net Profit	Revenue	Cost	Net Profit
1 - 500	169 316 719	140 469 760	28 846 959	222 984 926	179 837 046	43 147 880
501 - 1 000	125 064 729	109 268 625	15 796 104	108 151 312	90 641 185	17 510 127
1 001 - 1 500	168 403 743	122 325 452	46 078 291	43 645 317	47 286 048	(3 640 731)
1 501 - 2 000	141 515 325	130 701 498	10 813 827	147 554 252	120 588 440	26 965 812
2 001 - 2 500	–	–	–	–	–	–
Above 2 500	1 670 976 652	1 077 143 672	593 832 980	1 646 859 884	1 206 605 864	440 254 020
All Establishment	2 275 277 168	1 579 909 007	695 368 161	2 169 195 691	1 644 958 583	524 237 108

Table 9. Combined revenue, cost and net profit by total engine horsepower of fishing vessel fleet.

Category HP	1991			1992		
	Revenue	Cost	Net Profit	Revenue	Cost	Net Profit
1. 1 - 2 000	201 064 347	166 323 739	34 740 608	227 597 752	193 878 913	33 718 839
2. 2 001 - 4 000	59 244 175	54 541 101	4 703 074	94 298 751	82 249 704	12 049 047
3. 4 001 - 6 000	81 079 069	66 371 312	14 707 757	47 318 899	34 853 281	12 465 618
4. 6 001 - 8 000	140 297 600	90 319 220	49 978 380	123 451 931	113 233 378	10 218 553
5. 8 001 - 10 000	122 615 325	125 209 961	–	53 847 442	31 651 422	–
6. Above 10 000	1 670 976 652	1 077 143 672	593 832 980	1 622 680 916	1 189 091 885	433 589 031
All Establishment	2 275 277 168	1 579 909 005	695 368 163	2 169 195 691	1 644 958 583	524 237 108

Table 10. Average revenue, cost and net profit by total tonnage of fishing vessel fleet.

Category GRT	1991			1992		
	Revenue	Cost	Net Profit	Revenue	Cost	Net Profit
1. 1 - 500	4 031 350	3 344 518	686 832	4 955 221	3 996 379	958 842
2. 501 - 1 000	17 866 390	15 609 803	2 256 587	21 630 262	18 128 237	3 502 025
3. 1 001 - 1 500	28 067 291	20 353 867	7 713 424	10 911 329	11 821 512	(910 183)
4. 1 501 - 2 000	47 171 775	43 567 166	3 604 609	49 184 751	40 196 147	8 988 604
5. 2 001 - 2 500	–	–	–	–	–	–
6. Above 2 500	556 992 217	359 047 891	197 944 326	329 371 977	241 321 173	88 050 804
All Establishment	37 299 626	25 900 147	11 399 479	34 987 027	26 531 590	8 455 437

Table 11. Average revenue, cost and net profit by total engine horsepower of fishing vessel fleet.

Category HP	1991			1992		
	Revenue	Cost	Net Profit	Revenue	Cost	Net Profit
1. 1 - 2 000	4 569 644	3 780 085	789 559	4 947 777	4 214 760	733 017
2. 2 001 - 4 000	14 811 044	13 635 275	1 175 769	18 859 750	16 449 940	2 409 810
3. 4 001 - 6 000	20 269 767	16 592 828	3 676 939	15 772 966	11 617 761	4 155 205
4. 6 001 - 8 000	35 074 400	22 579 806	12 494 594	30 862 983	28 308 345	2 554 638
5. 8 001 - 10 000	61 307 663	62 604 981	(1 297 318)	53 847 442	31 651 422	22 196 020
6. Above 10 000	556 992 217	359 047 891	197 944 326	540 893 639	396 363 962	144 529 677
All Establishment	37 299 626	25 900 147	11 399 479	34 987 027	26 531 613	8 455 414

Cost items include materials and supplies, fishing equipment rental, fuel, electricity, industrial and non-industrial services. Also included are fixed expenses such as interest, indirect taxes, and depreciation. Indirect taxes in the NSO survey include all other forms of taxes (other than income tax) including business licenses, franchise, real estate and other local taxes.

Fuel was the most important cost component contributing an average of 37% to total cost in 1992[2]. Next to fuel in importance is supplies and materials at 28%. Indirect taxes make up 2% of total cost. Operating costs account for more than 80% of total cost allowing wider flexibility to earn profit.

Total cost for the entire industry averaged P1.6 billion in 1991 and 1992. As in revenues, costs were characterized by a huge disparity across tonnage and HP categories. For example, average costs of category 1 amounted to P3.3 million in 1991 compared to that of category 6 which reached P359 million in the same year.

Generally, commercial fishing establishments realized net profits amounting to P695 million and P524 million in 1991 and 1992, respectively. As with the cost and revenue structure, that of profit is highly biased towards vessels in category 6. Vessels in category 6 accounted for more than 80% of industry profit. Meanwhile, average net profit ranged from a low of P686 000·year^{-1} to a high of P198 million.

Limitations of the NSO Study

The NSO survey provided a good source of data to compute fishing industry profitability. However, it was not possible to make any inference about profitability estimates across tonnage and HP categories as well as within each category due to the absence of basic information on operational characteristics, i.e. gear used, species caught, travel time, fishing area, etc.. While the NSO survey is accurate, the statutory limitation on confidentiality of information meant that data could not be cross-checked because information on ownership was not provided.

The Cost and Returns Study

Background

This study embarked on a sampling of commercial fishing vessels from August to December 1994 using a combination of simple random sampling and quota sampling. The sample population consisted of commercial fishing vessels that landed in 47 fish landing sites covered by the National Fisheries Statistics Program (NFIS) of the Bureau of Agricultural Statistics (BAS). The sampling design was based on the 1987 BFAR Statistics which categorizes commercial fishing vessels by gear type, region and tonnage. A survey questionnaire was developed to elicit information on cost and revenue. The questionnaires were administered by BAS enumerators.

The method used to estimate financial and economic returns to capital and labor is depicted schematically (Figs. 13 and 14).

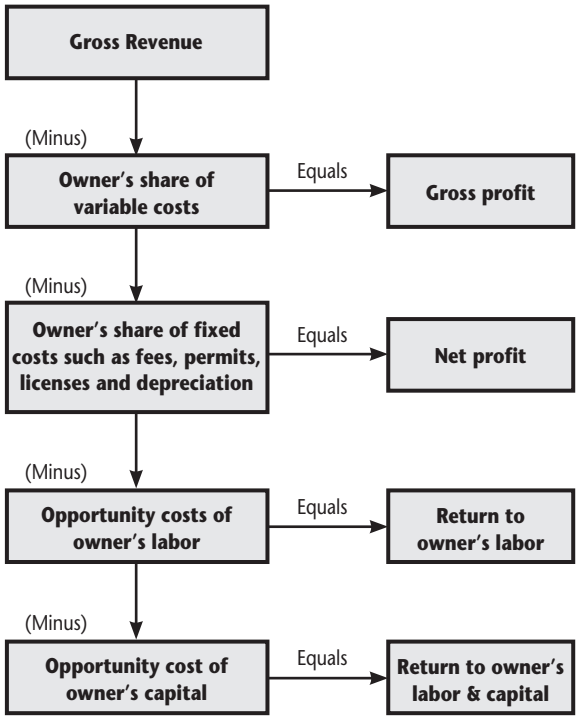

Fig. 13. A flowchart depicting the estimation of owner's profit.

[2] Similar proportion were observed for the 1991 data

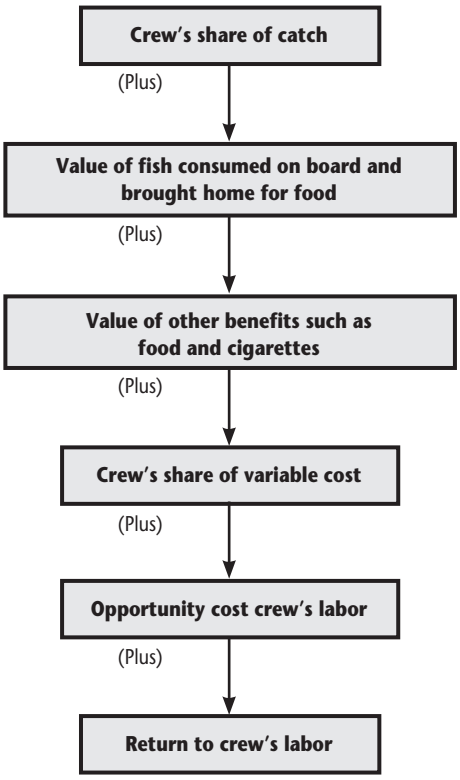

Fig. 14. A flowchart depicting the estimation of crew labor's rent.

Characteristics of Sampled Vessels and Gears

The number of vessels sampled totaled 675, or 50% of the target. On a regional basis (see Table 12), the sample ranged from a low of 20% (Regions 6 and 8) to a high of 86% (Regions 5 and 9) of target. Bagnets, ringnets and Danish seines accounted for more than 60% of gear sampled, half of which operate in Regions 4, 5 and 9. More than 75% of the sample consisted of vessels weighing 3 to 15 GT.

The survey allowed for replication, i.e. one vessel could be re-surveyed, provided that the same vessel was not surveyed twice within one week. This was because operational regimes vary per trip. The survey information including that of replicates totaled 1 351 vessels. The breakdown based on tonnage, horsepower, gear type and region is consistent with the sample size without replicates.

The survey respondents included owners, owner/operators and captains, all of whom are credible sources of information on fishing operations. Twenty-two percent of respondents had college degrees or better while the majority (65%) had either elementary or high school education. Only 2% of respondents had no formal education.

Purse seiners were the largest vessels sampled with an average tonnage of 68 GT while the smallest were those using drift filter net, gillnet, round haul seines and hook and line, i.e. from 5 - 7 GT. The smaller vessels used smaller engines, ranging from 35 to 82 HP. Trawlers, which have an average tonnage of 22 GT - a considerable deviation from the size of purse seiners, utilized the highest powered engines, 266 HP on average. Other information on the number of boats, size and number of gear is provided in Table 12.

Operational Regime of Sampled Vessels

The gear prevalent in a particular fishing ground depends on the geophysical characteristics of the fishing ground, target species, technological adaptation and economic factors (Development Academy of the Philippines, 1996b). Trawlers dominate the fishery in Lingayen Gulf, Manila Bay, Guimaras Strait and the Visayan Sea. Bag-nets are also prevalent in Manila Bay, Lamon Gulf, and Ragay Gulf, since they target small pelagics. In Regions 10, 11 and 12, where tuna is the targeted species, the more popular gear are purse seines, ring-nets and troll lines.

Table 12. Selected characteristics of commercial fishing vessels sampled from August to December 1994, by gear type and region.

Gear type	Size of boat (GT)	Size of Engine (HP)	Number of boats	Age of boats (years)	Number of gear	Age of gear (years)
Bagnet	11	132	1	8	4	–
Region 4	12	162	1	10	1	4
Region 5	11	170	1	9	7	1
Region 9	13	80	1	5	1	3
Danish seine	13	166	1	3	1	–
Region 1	19	200	1	3	1	1
Region 6	8	97	1	4	1	< 1
Region 9	23	132	1	3	1	3
Drift filter net	7	39	1	2	2	–
Region 2	7	39	1	3	2	2
Gillnet	5	75	1	7	49	–
Region 3	5	75	1	2	50	< 1
Hook and line	5	82	2	4	15	–
Region 9	3	83	1	5	17	2
Region 12	5	81	3	4	13	< 1
Purse seine	68	235	5	3	1	–
Region 1	208	550	4	7	1	< 1
Region 4	15	190	5	10	1	< 1
Region 5	118	290	5	4	1	< 1
Region 8	6	80	2	2	1	< 1
Region 11	57	220	6	4	1	3
Ringnet	13	130	2	5	1	–
Region 5	3	88	1	6	1	9
Region 7	25	225	2	5	1	4
Region 11	16	128	1	6	1	3
Round haul seine	5	35	9	3	1	–
Region 11	3	80	9	6	1	< 1
Trawl	22	266	1	3	1	–
Region 5	10	227	1	13	1	2
Region 6	34	249	1	5	2	< 1
Region 9	15	235	2	4	1	1

Cost Structure

Costs are broken down into investment and operating costs; the latter are further decomposed as fixed and variable. The main investment items are boat(s), engine, gear/net, and motors. For larger vessels, assets may include sonars, radios, radars, and on-board processing equipment. Average investment costs for hull, engine and gear of the major types of fishing operations surveyed are provided in Table 13.

Variable costs are incurred when fishing, while fixed costs are incurred regardless. Fixed costs include different types of licenses and fees including operating license, BFAR licenses, coast guard fees, insurance, police clearance, and cost of plate. Fixed costs were observed to vary between gear types and among tonnage classes; however, there was no evident pattern in the frequency and amount of fixed costs among tonnage categories. A likely explanation is the unstructured collection of fees and charges and the often arbitrary manner in which these are collected. Depreciation, which is based on estimates of acquisition (or replacement) cost, accounts for more than 95% of fixed cost. Given that depreciation does not involve any cash outlay, the only cash outflow of a commercial vessel is meagre (Table 14).

Variable cost is related to the type and duration of the fishing operation. The main variable cost items are fuel, ice, food, labor and repairs and maintenance. Fuel and ice are the major components of material expense. Purse seiners and trawlers have the highest operating expenses, mainly because of fuel cost. Material expenses generally increase in tandem with tonnage (Table 15). Repairs and maintenance expense, i.e. wharfage, dry-docking, hull and engine repair, and gear repair, were positively correlated to age of the asset (Development Academy of the Philippines 1996b).

Crew size ranged from 8 members, for hook and line, to 27 members, for gillnetters and purse seiners. Some variability was observed for crew size across tonnage classes for particular gear types. For example, smaller bagnetters (< 5 GT) counted 11 crew members while those ranging from 26 to 50 GT had 26 crew members. On the other hand, hook and line operations maintained a uniform number of crew, i.e. 4 to 5 people, despite a wide range of boats, from 5 to 50 GT.

Table 13. Average investment (acquisition and replacement) costs, age, and economic life of commercial fishing vessels sampled from August to December 1994, by gear type.

	Hull				Engine				Gear			
Gear type	Age (yrs)	Economic Life (yrs)	Acquisition Cost (P'000)	Replacement Cost (P'000)	Age (yrs)	Economic Life (yrs)	Acquisition Cost (P'000)	Replacement Cost (P'000)	Age (yrs)	Economic Life (yrs)	Acquisition Cost (P'000)	Replacement Cost (P'000)
Bagnet	8	11	208.5	259.9	7	8	51.1	38.0	2	7	86.6	105.1
Danish seine	3	4	354.0	513.0	2	4	48.0	60.0	1	3	66.0	94.0
Gillnet	7	10	161.1	132.1		2	95.2	91.1		9	213.6	73.3
Drift filter net	2	8	24.4	30.9	2	8	55.4	61.7		6	20.2	24.0
Hook and line	4	8	86.0	152.0		8	23.0	30.0	1		1 850.0	973.0
Purse seine	5	14	472.0*	360.0*	5	12	76.0	220.0		10	3 200.0	3 700.0
Ringnet	6	8	362.0	470.0	4	6	54.7	50.9	3	7	258.2	403.8
Round haul seine	3	10	23.0	25.0	3	10	30.2	39.3	4	10	116.7	137.1
Trawl	7	8	339.0	568.1	4	6	110.1	132.3		2	82.6	112.0

1 US$ = P26.60 in 1994 (source: oanda.com)
Note: * larger variance (see text for detail)

Table 14. Average annual fixed costs incurred by commercial fishing vessels sampled from August to December 1994, by gear type and tonnage, in pesos.

Gear Type	Depreciation	Licenses and Fees	Total
Bagnet			
< = 5	114 858	1 878	116 736
5 - 15	52 950	5 412	58 362
16 - 25	35 360	4 334	39 694
26 - 50	20 678	2 932	23 610
Danish seine			
< = 5	73 556	1 260	74 816
5 - 15	142 163	2 554	144 717
16 - 25	153 275	7 897	161 172
> - 50	159 778	9 125	168 903
Drift filter net			
< = 5	36 982	1 165	37 547
5 - 15	45 398	1 217	376 481
Gillnet			
< = 5	65 466	2 086	67 552
5 - 10	70 913	1 704	72 616
Hook & line			
< = 5	241 348	1 630	242 978
5 - 15	160 608	1 305	161 913
25 - 50	140 224	180	140 404
Purse seine			
< = 5	10 279		10 279
5 - 15	48 029	1 125	49 154
50 - 100	1 069 697	475	1 070 172
> = 100	873 893	950	874 843
Ringnet			
< = 5	35 615	233	35 847
5 - 15	80 031	1 540	81 570
16 - 25	214 862	3 301	218 163
26 - 50	194 668	2 866	197 554
Round haul seine			
< = 5	10 914	210	11 124
5 - 15	15 813	311	16 124
Trawlers			
< = 5	16 388	5 556	21 944
5 - 15	172 726	1 331	174 057
16 - 25	1 571 807	1 519	1 573 327
26 - 50	144 514	6 481	145 009
51 - 100	427 038	245	427 283
> = 100	125 546	713	126 258

Table 15. Average material expenses of commercial fishing vessels sampled from August to December 1994 in peso per trip, by gear type and tonnage category.

Gear Type	Fuel	Oil	Kerosene	LPG	Ice	Salt	Food	Cigarettes	Others	Total
Bagnet										
< = 5	409	115	0	0	183	0	10	1	8	726
5 - 15	871	189	12	8	507	2	186	12	34	1 821
16 - 25	1 262	223	3	2	421	2	228	2	2	2 145
26 - 50	1 412	93	0	5	330	0	90	5	15	1 950
Danish seine										
< = 5	1 252	85	0	0	1 027	0	373	246	12	2 995
5 - 15	3 729	424	15	48	2 888	5	605	93	63	7 870
16 - 25	2 105	256	0	70	1 823	0	1 159	108	105	55 626
> - 50	3 281	477	0	40	1 483	0	1 130	103	74	6 588
Drift filter net										
< = 5	248	31	40	0	0	0	410	180	30	939
5 - 10	278	29	0	0	0	0	467	190	22	986
Gillnet										
< = 5	702	410	33		2 398	116	943	123	0	4 742
5 - 15	652	473	53	17	2 151	55	1 891	194	0	5 524
Hook & line				55						
< = 5	3 582	545	2 810	0	1 736	50	646	100	275	9 690
5 - 15	7 821	1 030	108	0	2 063	150	1 044	236	900	13 352
Purse seine										
5 - 15	2 839	72	1 095	5	1 085	0	110	40	10	5 256
50 - 100	2 550	6 800	0	0		4 125	1	3 232	0	39 707
> = 100	53 194	843	0	98	4 056	0	744	50	0	58 985
Ringnet										
< = 5	457	53	27	1	90	1	118	10	12	769
5 - 15	1 163	162	75	0	419	13	298	32	32	2 194
16 - 25	2 194	73	2	0	1 047	1	310	1	28	3 656
26 - 50	2 112	501	5	86	1 577	2	405	24	80	4 910
Round haul seine										
< = 5	434	60	160	0	0	0	120	40	27	841
5 - 15	583	90	287	0	0	0	150	60	55	1 225
Trawlers										
< = 5	2 860	42	3	22	576	0	350	0	0	3 853
5 - 15	5 922	592	3	12	1 955	56	584	122	45	9 291
16 - 25	10 583	1 301	6	42	3 016	133	1 096	146	27	16 350
26 - 50	5 293	571	0	30	1 322	4	592	153	57	8 022
51 - 100	35 000	4 179	325	67	4 581	26	1 054	317	350	45 899
> = 100	46 570	713	0	73	8 655	5	1 208	11	74	57 309

In this study, labor was considered from two perspectives: (i) as a cost to the owner and (ii) as a benefit to the crew member. From the owner's perspective, labor cost is a component of operating cost. From the laborer's perspective, "return to labor" is computed based on the prevailing compensation system and other benefits earned per fishing operation. The most common form of payments to labor is that of the share system which varies according to gear (Table 16). Other fringe benefits include food and cigarettes provided on board and fish taken for home consumption. A crew member sometimes receives a fixed salary on top of his share; however, the bulk of the fisher's earning comes from his share. This then depends on the volume of catch.

Table 16. Average crew size and crew/owner sharing system by gear type.

Gear Type	Average Crew Size	Owner: Crew Sharing Ratio
Bagnet	13	54:46
Danish seine	11	50:50
Drift filter net	10	75:25
Gillnet	27	47:53
Hook and line	8	63:37
Purse seine	27	57:44
Round haul seine	8	50:50
Ringnet	20	55:45
Trawler	9	58:42

Revenue Structure

Revenues of commercial fishing vessels depend on three things: total volume of catch, species composition, and prices. A higher volume of catch results in higher revenues; this is further enhanced when the species caught are commercially desirable.

Catch per trip for purse seiners was 13 259 kg, the highest among the gears surveyed. On a regional basis, purse seine catch of region 11 (55 000 kg) was higher than the national average despite the fact that the vessels sampled here were smaller than those surveyed in regions 1 and 5. Trawlers ranked next followed by Danish seiners and gillnetters (Table 17).

Table 17. Average catch of commercial fishing boats by gear type, region and average tonnage.

Gear Type	Region	Tonnage GT	Catch (kg)
Bagnet	4	12	421
	5	11	2 158
	9	13	785
Danish seine	1	19	759
	6	8	636
	9	23	15 230
Drift filter net	2	7	258
Gillnet	3	5	4 452
Hook and line	9	3	3 098
	12	5	741
Purse seine	1	208	7 428
	2	415	207
	5	118	4 120
	8	6	1 474
	11	57	55 000
Ringnet	5	3	232
	7	25	837
	11	16	2 262
Round haul seine	11	3	50
Trawler	5	10	1 278
	6	34	2 361
	9	15	1 298

Dominant species varied across gear and region. Catches of Danish seiners in regions 1 and 6 were dominated by demersals (lizard fish, moonfish and threadfin bream) while those of region 9 were dominated by Indo-Pacific mackerel. Purse seiners operating in regions 1 and 11 yielded skipjack and yellowfin tuna; however those operating in regions 4 and 5 yielded pelagics such as big-eyed scad, short-bodied mackerel, and roundscads (Development Academy of the Philippines 1996b).

Ex-vessel prices for species caught varied across different landing sites due to market dynamics and micro transactions that include quality and type of species landed, its volume in relation to aggregate landing and preferential relationships between buyer and fisher (Table 18).

Profitability, Productivity and Efficiency Parameters

Average gross and net profit were positive for all

tonnage categories (Table 19). Profit was positively correlated with tonnage. Returns on investments (ROIs) were all positive and greater than one. Hook and line vessels had the largest ROIs especially those of less than 5 GT (Development Academy of the Philippines 1996b). This is because of the relatively smaller investment and the high-valued species targeted (tuna).

The operating ratio is a measure of the efficiency of converting inputs into outputs. A low operating ratio means that a peso spent on operating expense results in more than a peso worth of gross profits and *vice-versa*. According to the data collected, only tonnage categories 1 and 8 are cost-efficient (operating ratio is less than 1) while the least efficient category are those with vessels from 30 to 50 GT (Table 20). Another measure of efficiency used is the Fuel to Fish ratio (FF) which indicates how much fish is produced per liter of fuel. The FF ratio is observed to increase with tonnage; among gear types, the FF ratio is highest for trawlers and lowest for hook and lines and gillnets.

The study also computed the pure net profits accruing to owner and labor (Figs. 13 and 14). Pure profits to owner and labor are positive for all tonnage categories (Table 21). The implications are as follows: for the owner of capital, investing in fisheries is profitable even when compared to alternative uses of capital and owner's labor; for the laborer, working in fisheries results in earnings greater than alternative forms of labor. In total, the industry earned P11 billion in pure profits during 1994.

Table 18. Comparison of ex-vessel prices of important fish species landed by commercial fishing vessels from August to December 1994, by landing site.

Fish Species	Damortis	Palawip	Hagonoy	Dalahican Lucena	Sabang Calabanga	IFPC Iloilo City	Hinigiran	CDCP Fort Pilar	Naga	Lions' Beach
Anchovies			18		8		17		13	
Big-eyed herring		37								
Big-eyed scad	60	46		47				11	18	37
Cavalla		76			48		45	35	34	
Crevalle	40	59			17		12	21	19	
Goatfish	34	38			19	21	22		16	
Grouper	80	120					78	46	30	
Hairtail			10	33		19	19			
Indian sardines					17			8	12	
Indian mackerel	65	58					31		16	
Indo-pacific mackerel	69	60	46			27	21			
Mackerel			20							
Round herring									12	
Roundscad		38		36			26	8	11	20
Sardines		10							13	18
Skipjack tuna										
Slipmouth	70	59				26				
Spanish mackerel		78	56				183	70		
Squid	83	70	66	65		35	33	40	25	
Threadfin bream	77	57		50			41			
Yellowfin tuna						55	58	20		

Table 19. Average annual profitability parameters of commercial fishing vessels sampled by DAP from August to December 1994, by tonnage class.

Category number/Tonnage class	Number of vessels sampled	Gross profit (P'000)	Net profit (P'000)	Return on investment (%)
Category 1 / < 5 GT	40	3 149.4	3 064.7	29.94
Category 2 / 5 to 10 GT	374	5 032.2	4 933.6	19.41
Category 3 / 10 to 15 GT	232	4 661.3	4 554.3	13.73
Category 4 / 15 to 20 GT	76	2 703.6	2 580.9	7.25
Category 5 / 20 to 25 GT	89	2 735.8	2 309.6	4.31
Category 6 / 25 to 30 GT	51	6 800.0	6 623.3	10.62
Category 7 / 30 to 50 GT	70	6 426.6	6 228.0	12.75
Category 8 / 50 to 100 GT	9	29 866.2	29 441.0	22.01
Category 9 / 100 GT and up	8	18 380.8	17 966.5	2.48

Note: 1 US$ = P26.60 in 1994

Table 20. Efficiency parameters of commercial fishing vessels sampled by DAP from August to December, 1994.

Category number/ Tonnage class	Operating ratio	Fuel to Fish ratio (liter of fuel: kilo of fish)
Category 1 / < 5 GT	0.25	0.23
Category 2 / 5 to 10 GT	2.49	0.62
Category 3 / 10 to 15 GT	7.99	0.64
Category 4 / 15 to 20 GT	1.37	0.88
Category 5 / 20 to 25 GT	2.10	0.86
Category 6 / 25 to 30 GT	2.36	0.87
Category 7 / 30 to 50 GT	18.2	0.42
Category 8 / 50 to 100 GT	0.91	1.13
Category 9 / 100 GT and up	3.46	2.22

Table 21. Estimates of average pure profit to owner and labor in the commercial fishing industry.

Tonnage	Pure profit to Owner (P'000)	Pure profit to labor (P'000)	Total pure profit of the fishing unit (P'000)
< 5	3 024.6	2 683.1	5 707.7
5 to 10	4 870.2	5 202.3	10 072.6
10 to 15	4 475.2	4 928.2	9 403.4
15 to 20	2 471.1	1 917.0	4 388.0
20 to 25	2 146.2	2 559.1	4 705.3
25 to 30	6 447.7	6 202.2	12 650.0
30 to 50	6 005.0	4 888.7	10 893.7
50 to 100	29 179.5	5 578.0	34 757.6
100 and up	17 282.0	3 654.8	20 936.7

Limitations of the Study

A possible limitation of this study is the fact that data collection and the short duration of the survey automatically excluded vessels which stay out at sea for months. The survey thus focused on the "small" commercial vessels, those greater than 3 GT but less than 50 GT.

Bioeconomics of Fisheries

This section discusses the available bioeconomic analyses done for the fisheries sector instead of reconstructing the models. These studies utilized theoretical constructs called "surplus production models" to determine whether or not a particular fishery is over-fished. Over-fishing is viewed from both the biological and economic angles.

Three studies focused on the small pelagics fishery: (Dalzell et al. 1987; Padilla and de Guzman 1994; Trinidad et al. 1993). An earlier study on the demersal fishery was authored by (Silvestre and Pauly 1987).

(Dalzell et al. 1987) analyzed both the municipal and commercial sectors which were exploiting small pelagics. Data used were published statistics of the BFAR. The authors employed extrapolation to compete the time series for 1948 - 85 especially for the municipal sector. MSY was reached in 1975 while MEY was reached in 1970 at 500 000 t.

The study of (Trinidad et al. 1993) used both primary and secondary data. The primary data were collected through a cross-section survey conducted in selected sites in six regions of the country which accounted for a significant share in total small pelagics catch including: 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. The study also analyzed the cost and revenue components, technical efficiencies and pure profits of commercial and municipal gears exploiting the small pelagics fishery. The study bolstered the earlier findings of (Dalzell et al. 1987) by confirming that the small pelagics fishery was truly over-fished and that open-access equilibrium had been reached during the 1980s. This meant that on average, pure profits accruing to labor and capital were either zero or negative. A 20% reduction in fishing effort was recommended in order to attain MSY levels.

The (Padilla and de Guzman 1994) study focused on developing a method for environmental resource accounting in the fishery. The study utilized the same techniques as in the above-mentioned studies and resulted in similar observations, i.e. that the small pelagics fishery is overfished and that at the time of writing, about P7 billion was being lost by not operating at MEY levels.

(Silvestre and Pauly 1987) used trawler horsepower as a measure of fishing effort given that it is the major gear for catching demersal species. The study concluded that the demersal fishery was already over-fished during the 1970s.

Table 22. A comparison of selected results of bioeconomic studies in Philippine fisheries.

Study	Time series	Fishery analyzed	Model used	MSY parameters
Dalzell et al. (1987)	1948 - 85	Small pelagics, municipal and commercial sector	Fox model	Catch level = 544 000 t Effort = 256 000 HP
Trinidad et al. (1993)	1949 - 85	Same	Schaefer and Fox model	Catch level = 515 000 t Effort = 320 000 HP
Padilla and de Guzman (1994)	1948 - 91	Same	Fox model	Catch level = 573 000 t Effort = 294 000 HP
Silvestre and Pauly (1987)	1952 - 84	Demersal, municipal and commercial sector	Fox model	Catch level = 340 000 to 400 000 t

Policy Highlights in the Fisheries Sector

The policy environment for fisheries in the past half decade has been generally characterized by the following:

a. shift in governance from centralized to localized
b. shift from open access to limited access
c. shift from full development to management.

A timeline showing the policy highlights in fisheries is depicted in Table 23. Centralized governance was the prevailing management regime during the 1950s and 1960s. The (then) Secretary of Agriculture and Natural Resources (and designated deputies) had full control over management and regulation of fisheries including that of local legislation. Presidential Decree (PD) 704 recognized municipal fishing as being within the purview of municipalities since it already provided for licensing and granting of fishing rights even before the Local Government Code (LGC) was enacted. The trend towards localized participation is affirmed by both the LGC and later by the Fisheries Code. A listing of the responsibilities of local governments in the implementation of coastal management, and in particular, fisheries management, is contained in the "Legal and Jurisdictional Guidebook for Coastal Resource Management in the Philippines" (Department of Environment and Natural Resources (DENR) et al. 1997). The LGC further expanded, causing much confusion, the coverage of municipal waters to 15 km. Local governance also entails genuine community participation as guaranteed by the creation of Fisheries and Aquatic Resources Management Councils (FARMCs) through Executive Order EO 240 and reiterated and strengthened by the Fisheries Code.

The impact of the LGC on the expansion of municipal waters to 15 km is 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. The policy was driven by issues of economic efficiency and food security, especially of urban consumers. The policy prescription of the LGC came at a time when catches from the marine capture fishery, both f rom 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 near-shore municipal waters. 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. Access limitations are strategies that veer away from full development to that of management. The policy framework, as well as the analysis of fleet development, depict a short period of robust growth during the 1960s. This was reduced during the mid-1970s as evidenced by the enactment of PD 704 and the ultimate "takeover" by the aquaculture sector.

Presently, the Fisheries Code "seals the fate" of the ailing capture fishery sector. The Code's policy biases are seen through various provisions for incentives (and disincentives) to the commercial and municipal sectors (Tables 24 and 25). Specific provisions, i.e. those which limit access and tend towards the protection side, are unfavourable to both sectors. Incentives for commercial fishers to utilize the offshore fishing grounds portent another "development" phase while limiting their options in municipal waters, i.e. through exclusion and prohibition of active gear. Municipal fishers have been granted greater advantage in the 15 km area but are also subject to controls and stringent penalties administered by local governments.

Table 23 . 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 providing 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, s1994 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: Department of Environment and Natural Resources (DENR) et al. 1997.

Note: AFMA - Agriculture and Fisheries Modernization Act
DENR - Department of Environment and Natural Resources
DILG - Department of Interior and Local Government
DA - Department of Agriculture
BFAR - Bureau of Fisheries and Aquatic Resources
CRMP - Coastal Resources Management Project

Table 24. Provisions of the Fisheries Code and its impact on municipal fishing.

Relevant provision*	Impact on municipal fishing (✔, if favourable; X, if non-favourable)	Comment
Limitation of access to non-resident fishers	X	Limits fishing areas; increases cost if non-resident fishers look for farther areas
Establishment of FARMCs at various governance levels	✔	Ensures participatory mechanism
Grant of fishing privileges in municipal waters	✔	Increases fishing areas accessible to municipal fishers and cooperatives
Ban on commercial fishing in municipal waters increased to 15 km from the coastline	✔	Defuses conflict with commercial fishers in municipal waters; potential to increase revenue for municipal fishers
Support to fishers from DA and the LGUs	✔	Technical assistance from NGO and LGUs
Prohibition against the use of active gear in municipal waters and bays and other fishery management areas	X	Discriminates against municipal fishers using round haul seine, bag net, drive-in net and motorized push nets

Note: * Annotated only.

Table 25. Provisions of the Fisheries Code and its impact on commercial fishing.

Relevant provision*	Impact on municipal fishing (✔, if favourable; X, if non-favourable)	Comment
Ban on commercial fishing in municipal waters and mapping/delineation of municipal waters	X	Excludes commercial fishing in municipal waters
Incentives for fishing in the Exclusive Economic Zone	✔	Increases revenue for commercial fishers
Establishment of FARMCs at various governance levels	X	Participatory mechanism might be unfavourable to commercial fishers
Prohibition against the use of active gear in municipal waters and bays and other fishery management areas (Sec. 90)	X	Discriminates against commercial fishers (from 10.1 to 15 km) using trawl, purse seine, Danish seine, etc.
Licensing of commercial vessels	✔	Minimal increase in license fees

Note: * Annotated only.

Epilogue: Issues and Prospects for the Next 50 Years

The socio and bioeconomic performance of the fisheries sector of the last 50 years was one of growth and eventual decline. Robust growth occurred during the 1960s due to the expansion of the commercial and municipal fleets. After this, there were several growth spurts in fisheries production attributable to gear development and the opening of new markets for specific fisheries commodities. Aquaculture induced a growth spurt during the mid-1970s, when marine capture fisheries were in the doldrums. Meanwhile the municipal sector, specifically in Southern Mindanao, rallied during the 1980s in response to the great demand for sashimi-grade tuna.

These developments resulted in a predictable trend: increase in numbers of vessels, increase in tonnage and horsepower, and increase in the numbers of fishers. These increases were made possible not only because of a policy to expand the fishery but more so by an open access regime. Open access was the de-facto management system before the advent of access limitation mechanisms espoused by the Fisheries Code. For both the commercial and municipal sectors, the entry barriers have been very low: few licenses needed, relatively low capital investment, and low production costs.

Declining catches, disappearance of highly valued species, and an increasing volume of juveniles are indications of biological over-fishing. Economic over-fishing, diagnosed by several studies as discussed, implies that the fishery employs excess labor and utilizes capital that should have been used in other economic sectors. The result of economic over-fishing is declining profits for the participants in the fishery.

What does economic over-fishing mean for the municipal fishery? The municipal fishery has been the traditionally beleaguered sector. Studies indicate that income levels of fishers have not improved (or have even worsened) over the last 50 years. (Lawson 1975) provides an explanation, *"as industrial fisheries expand, the standard of living of traditional fishermen relatively declines"*. This is because both sectors exploit the same resource and cater to the same market. Most likely, the commercial sector can lower the price substantially because its cost of production per unit of catch is lower. From the marketing end, traders would also prefer to purchase fish by bulk instead of from a multitude of fishers, thereby lowering transaction costs.

What does this mean for the commercial sector? The commercial sector utilizes the same near-shore grounds, now classified as municipal waters, for their fishing operations but their access to these grounds have been gravely impaired by the Fisheries Code. Commercial fishers are now encouraged to seek farther areas for fishing. This means increased costs (due to higher fuel consumption) and the threat of small catches. Already, a large number of commercial vessels have ceased operations in anticipation of strict enforcement of this prohibition. Certainly, a shake-out of the less efficient and under-capitalized firms is to be expected.

How should the fishery sector gear up for the next 50 years? The following basic strategies should be considered: resource rehabilitation, enhancement of the roles of LGUs, national agencies and communities, and heightened appreciation of the "real" values of the fishery resource.

Resource Rehabilitation

Improvement of the resource base is not an option for the next 50 years: it is a survival strategy. Current policies show how several layers of stakeholders can make this happen. First, the LGUs should comply with the provisions of the Fisheries Code that mandates them to set aside a certain portion of the coastal area for establishment of marine protected areas. In relation to this, mechanisms should be in place to ensure that marine protected areas achieve what they were intended for, to improve fish catch and preserve biodiversity. These mechanisms might include local legislation, manpower and logistics to support monitoring and enforcement, a well-informed community, and an attendant budget. Second, national agencies such as the DA-BFAR and to a certain extent, the DENR can provide technical assistance in the establishment and monitoring of these marine protected areas. Third, the communities which include the municipal fishers should ensure that local regulations concerning no-catch areas and selective fishing areas are faithfully adhered to. Illegal fishing with cyanide and dynamite should be shunned and local norms and cultural relationships utilized to penalize offenders. It must be stressed that efforts to rehabilitate the resource does not single out the possible harmful effects of commercial fishing in near-shore waters; it recognizes the potent role of municipal fishers in resource rehabilitation.

A good question to ask is: will it take 50 years to fulfill this strategy? No. Evidence from learning sites of the Coastal Resource Management Project (CRMP) and a sampling of municipalities that have initiated coastal management programs indicate that after two years (at the very least), fish catch and biodiversity will improve, inside and outside the marine protected area (Coastal Resource Management Project (CRMP) 2000).

Role of Local Governments and Community Participation

Local governments, day-to-day managers of the resource, must accept their responsibility in fisheries

and overall coastal management. The Local Government Code and the Fisheries Code articulate their roles and responsibilities that include: protection and conservation, regulation, legislation, planning and program implementation, enforcement, and resource generation. LGUs must view the fishery as an asset base that needs to be protected in order for the benefits to be enhanced.

LGUs must also recognize the role of communities and participatory processes which have been enshrined through the Fisheries and Aquatic Resources Management Councils (FARMCs). FARMCs can be a potent force in decision-making pertaining to coastal management if their roles are viewed seriously. Meanwhile, genuine participation should be encouraged by LGUs through facilitating meetings and sponsoring training programs. Genuine participation ensures acceptability and sustainability of initiatives. All these need to be accomplished in the interim period.

Role of National Agencies

National agencies such as the DA-BFAR and DENR should reorient their roles to usher in a new governance order. Instead of directly implementing programs and projects which have been the norm of the past 50 years, national agencies should redirect their efforts to provide technical support for LGU (Local Government Units) implementation in the form of training, standard setting and provision of information materials. Likewise, a collaborative mechanism should be established among national agencies to respond to emergency situations and to questions pertaining to jurisdiction.

Putting the Right Value to the Fishery

An essential framework for fisheries management is proper valuation. Proper valuation implies assigning both economic and ecological values to the fishery. In the past, the fishery has been managed based on economic values alone. This results in under-estimation of the costs of production because embedded costs are not considered. These costs might include the cost of fish (which has been considered as a free good), cost of extraction (especially of juveniles) and its impact on biodiversity, and the costs of habitat destruction such as that of coral reefs and mangroves. Ecological valuation might also include some values assigned to future users of the resource (Option Value) and for those who have no intention of using it, and yet derive value from knowing that the fishery still exists (Existence Value). Proper valuation will guide managers into determining how it should be used in the following practical matters: (a) amount and value of licenses to be distributed; (b) area allocated for establishment of fish-pens, cages, etc. and how much to charge; (c) areas to be maintained for protection purposes.

The immediate challenge is to initiate national agencies and LGUs in this "mode of thinking". Acceptance of this approach and its application in practical matters will then make it appropriate to educate the rest of the populace.

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References

Añonuevo, C. 1989. The economics of municipal fisheries: the case of Lingayen Gulf, p. 141 - 155. ICLARM Conference Proceedings 17.

Bernascek. 1994. The role of fisheries in food security in the Philippines: a perspective study for the fisheries sector to the year 2010. Unpublished.

Bureau of Fisheries and Aquatic Resources (BFAR). 1948/1971/1977/ 1980/1985 - 95. Fishery Statistics of Philippines. Department of Agriculture, Quezon City, Philippines.

Bureau of Fisheries and Aquatic Resources (BFAR). 1998. Philippine fisheries profile, 1988. Fisheries Policy and Economics Division, Bureau of Fisheries and Aquatic Resources, Quezon City, Philippines.

Coastal Resource Management Project (CRMP). 1998a. Fisheries Resource Management Project (FRMP) and Agricultural Training Institute (ATI). Coastal resource management for food security.

Coastal Resource Management Project (CRMP). 1998b. Results of participatory coastal resource assessment of Olango Island, CRMP Document and Maps, Cebu City, Philippines.

Coastal Resource Management Project (CRMP). 2000. CRMP in mid-stream: On course to a threshold of sustained coastal management in Philippines. Special mid-term report (1996 - 99), Coastal Resource Management Project, Cebu City, Philippines.

Dalzell, P., P. Corpuz, R. Ganaden and D. Pauly. 1987. Estimation of maximum sustainable yield and maximum economic rent from the Philippine small pelagic fisheries. Bureau of Fisheries and Aquatic Resources Technical Paper Series 10(3).

Department of Environment and Natural Resources (DENR), Department of Interior and Local Government (DILG), and Department of Agriculture-Bureau of Fisheries and Aquatic Resources (DA-BFAR) and the Coastal Resource Management Project (CRMP). 1997. Legal and Jurisdictional Guidebook for Coastal Resource Management in the Philippines. Coastal Resource Management Project CRMP, Manila, Philippines.

Development Academy of the Philippines. 1996a. What the NSO survey of establishments for fishery can tell us? Unpublished report submitted to the Fisheries Sector Project.

Development Academy of the Philippines. 1996b. Cost and returns study of the Philippine commercial fishing industry. Unpublished report submitted to the Fisheries Sector Project.

Herrin, A.N., M.L. Fabello, C.E. Fabello and L.C. Palma. 1978. A social and economic study of selected municipal fishing communities in Misamis Oriental, Philippines. Research Institute of Mindanao Culture, Xavier University, Cagayan de Oro City, Philippines.

Juliano, R.O. 1996. Fisheries Sector Development Project, Philippines (ADB TA NO. 2236-PHI) Phase 1 Report, Volume III, Appendices.

Katon, B.M., R.S. Pomeroy, M. Ring and L. Garces. 1998. Mangrove rehabilitation and coastal resource management: A case study of Cogtong Bay, Philippines. Naga, The ICLARM Quarterly 21, No. 1 : 46 - 52.

Lawson, R.M. 1975. Interim report on Socioeconomic aspects of the development of artisanal fisheries on the east coast of Malaysia. SCS/75/WP/15. South China Sea Fisheries Development and Coordinating Programme, Manila, Philippines.

Librero, A.R. 1988. Philippines, p. 403 - 428 Fishing industry in Asia and the Pacific. Asian Productivity Organization, Tokyo, Japan.

Librero, A.R., R.F. Catalla and R.M. Fabro. 1985. Socioeconomic conditions of small scale fishermen and fish farmers in the Philippines, p. 36 - 45. *In* T. Panayotou, ed. Small scale fisheries in Asia: socioeconomic analysis and policy. Ottawa: International Development Research Centre (IDRC).

Padilla, J.E. and F. de Guzman. 1994. Fishery resources accounting in the Philippines: applications to the small pelagic fisheries, p. 26. Philippine Environmental and Natural Resources Accounting Project, Phase II, Quezon City, Philippines.

Pagdilao, C., W.L. Campos and S.S. Salacup. 1991. Status of nearshore fisheries in the Philippines, p. 218. Philippine Council for Aquatic and Marine Research and Development (PCAMRD). Management of Nearshore Fishery Resources. Proceedings of the seminar - Workshop on management of nearshore fisheries, ECOTECH Center, Cebu City, 23 - 25 January 1990. Philippines Council for Aquatic and Marine Research and Development, Los Banos, Laguna, Philippines.

Philippines. 1998. The Philippine Fisheries Code of 1998: (Republic Act No: 8550). Metro Manila, Philippines.

PRIMEX. 1996. Fisheries sector development project, Philippines (ADB TA No.2236-PHI). Phase I Report Volume II. Fisheries Sector Program Review. Unpublished report, Quezon City, Philippines.

Savina, G.C. and A.T. White. 1986. Reef fish yield and non-reef catch of Pamilacan Island, Bohol, Philippines, p. 497 - 500. *In* L. V. Hosillos (ed.) The First Asian Fisheries Forum, Asian Fisheries Society, Manila, Philippines.

Silvestre, G. and D. Pauly. 1987. Estimate of yield and economic rent from Philippine demersal stocks (1946 - 84) using vessel horsepower as an index of fishing effort. University of Visayas, Philippines. Fisheries Journal 3(1&2) : 11 - 24.

Smith, I.R. 1979. A research framework for traditional fisheries. ICLARM Studies and Reviews No. 2. International Center for Living Aquatic Resources Management, Manila, Philippines.

Thomas, F.C. 1999. The commercial fishery sector of the Philippines. A centennial chronicle 1989 - 98. LDC Printers.

Trinidad, A.C., R.S. Pomeroy, P. Corpuz and M. Aguero. 1993. Bioeconomics of the Philippine small pelagics fishery. ICLARM Technical Report No. 38. International Center for Living Aquatic Resources Management, Manila, Philippines.

White, A.T. and A.C. Trinidad. 1998. The Values of Philippine coastal resources: why protection and management are critical. Coastal Resources Management Project (CRMP), Cebu City, Philippines.

Williams, M. 1994. The transition in the contribution of living aquatic resources to food security. Food, Agriculture and Environment Discussion paper 13.

World Bank. 1989. Philippines forestry, fisheries, and agricultural resource management study. Report No.7388-PH, Washington D.C., USA.