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INTERNATIONAL CENTER FOR LIVING AQUATIC RESOURCES MANAGEMENT
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FOREWORD

From August 1986 to November 1988, ICLARM, through its former Resource Assessment and Management Program, conducted jointly with the Research Division of the Bureau of Fisheries and Aquatic Resources (BFAR), Manila, Philippines, a World Bank-funded project on the Assessment and Management of Small Pelagic Stocks of the Philippines. This extremely successful project, led by Mr. Paul Dalzell of ICLARM (now with the South Pacific Commission) and his counterpart, Mr. Reuben Ganaden of BFAR, is documented in a large number of publications and reports on the biology, fisheries catch and recommended management for the resources of small pelagic fishes of the Philippines, i.e., sardines, anchovies, mackerels and the like, a major source of animal protein for poor Filipinos (see Appendix I).

In 1987, Dr. Max Agüero, then in charge of a Ford Foundation-funded project on "Management Options for Small-Scale Fisheries," along with Ms. Perlita Corpuz, began collecting, in various areas of the Philippines, economic data from small pelagics fishery gears, in view of complementing the results of the above project with a report on gear profitability and economic performance.

Exequiel Gonzales, Maria Lourdes Palomares and Annabelle C. Trinidad accompanied the team on several occasions to observe fishing activities in data collection.

The preparation of Dr. Agüero's transfer to Latin America and the change of his terms of reference, however, prevented this report from being completed as expected, and I am therefore very pleased to have been able to assemble a team to interpret and complement the extremely valuable information assembled by the group led by Dr. Agüero.

The economic analyses presented therein largely confirm the earlier overall finding of the biologists led by Messrs. P. Dalzell and Ganaden, i.e., that the small pelagic resources of the Philippines are overfished - at least as far as the "national" level is concerned.

As expected, however, the added economic dimension has yielded new crucial insights into the fishery, notably

1. that on a national level, there is evidence of economic overexploitation as shown by decreasing catches, decreasing sizes of fish caught, and increasing incidence of lesser-valued species, which translate from the economic standpoint to lower profitability for fishers and inefficient use of labor and capital in the fishery;
2. that significant differences exist in the municipal and commercial sector in terms of technical efficiency, ownership patterns, employment patterns, and economic efficiency, with strong implications for proposed management schemes.

Thus, overall, this report confirms - if need be - that fisheries research must include more than looking at the resource base. Indeed, a description of a fishery based only on the status of the fish stock will necessarily be incomplete - the information provided by examining the economic and other social aspects of a fishery is crucial for management.

Thus, I am particularly pleased to present this report, which concludes our study of the assessment of small pelagic stocks of the Philippines.

DANIEL PAULY
Director
Coastal Resource Systems Program
ICLARM
Manila, May 1993

ABSTRACT

Time series analysis of catch and effort data in the Philippines small pelagics fishery resulted in a level of biological and economic overexploitation. Open-access equilibrium has been reached at 410,000 hp representing a catch level of 465,000 tonnes. Present levels of effort would have to be reduced by 40% to attain maximum economic yield. An analysis of producer surplus showed that municipal and commercial fishers were sustaining pure losses amounting to P9.4 billion indicating misallocation of labor and capital in an already overexploited fishery. Solutions to fisheries management problems are shown to emanate not just from the fishery, but more importantly, from the broader macroeconomic environment.

Chapter 1

INTRODUCTION

The value of Philippine fisheries production was placed at \$1.8 billion in 1991, accounting for approximately 4% of the GNP[1]. The fishery sector employs over one million municipal (small-scale) fishers and 50,000 commercial or industrial fishers. Overall, a total of seven million people or 12% of the population has been estimated to be dependent in some way on the fishing sector. Estimates of fish consumption in the Philippines vary between regions and different social strata, but is estimated to range between 30 and 40 $kg \cdot capita \cdot year^{-1}$. This accounts for 50-70% of the total animal protein consumed by Filipinos (NSCB 1992).

Small pelagic fish species, primarily roundscads, anchovies, sardines and mackerels (Table 1.1), comprise about 40% of the total marine fisheries landings and 30% of all fish landings in the Philippines. Small pelagic fishes are a cheap staple source of protein, particularly for lower income groups. Besides being consumed fresh, they are processed into dried, canned and fermented products. A major reduction of small pelagic fish production would have serious consequences for Filipinos, especially those in lower income groups who have been shown to be most sensitive to price changes of fish (Gonzales 1985). Shortfalls of fisheries production from the small pelagics fishery in terms of animal protein are not likely to be compensated for by other fisheries production such as aquaculture or from the agricultural sector.

Dalzell et al. (1987) analyzed catch and fishing effort of the small pelagics fishery from the mid-1940s to the mid-1980s[2] (Fig. 1.1). This showed that over the 40-year period, fishing effort in the small pelagics fishery of the Philippines increased in an exponential manner. On the other hand, catches of small pelagic fish increased up to the early 1970s, when they levelled out at around 500,000 $t \cdot year^{-1}$. Clearly, where fishing effort is increasing, in terms of number of vessels and fishers, but catches remain static, then the amount of fish caught per unit of effort declines. From Fig. 1.1 it can be seen that catch per unit effort (CPUE) has declined, from 11 $t \cdot hp^{-1}$ to 1 $t \cdot hp^{-1}$ between 1948 and 1988.

The commercial fishing sector in the Philippines has reacted to this by investing in new fishing gear, such as payaos, which aggregate and concentrate pelagic fish (Aprieto 1982; Floyd and Pauly 1984). Greater numbers of carrier vessels have been deployed, particularly during the mid-1970s to the mid-1980s, to maintain catch per vessel. Such innovations have generally, however, not occurred in the small-scale fishery; technological adaptations are often beyond the available capital resources of small-scale fishers and thus the catch rates, and general standard of living, of this sector have declined (Dalzell 1988). Moreover, improvements in technology would have marginal contribution to catch per effort due to the overexploitation of nearshore waters (Tandog-Edralin et al. 1988).

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[1] US\$1 = ₱25 at 1991 current prices; relevant exchange rate used in economic analysis is US\$1 = ₱20, which was the average prevailing rate in 1987-88 (National Economic and Development Authority).

[2] The authors have updated the time series of catch and effort to 1988 levels.

Table 1.1. The composition of Philippine small pelagic fishes and the contribution to marine and total landings (from Dalzell and Ganaden 1987).

Common name	Family	Common species	Mean annual catch[a] (t)	Proportion of marine catch (%)	Proportion of total catch (%)
Roundscads	Carangidae	*Decapterus macrosoma, D. ruselli, D. maruadsi*	167,043	13.0	9.6
Sardines	Clupeidae	*Amblygaster sirm, Sardinella fimbriata*	112,909	8.8	6.5
Anchovies[b]	Engraulidae	*Stolephorus heterolobus Engraulis japonicus*	89,347	6.8	5.0
Mackerels[c]	Scombridae	*Rastrelliger kanagurta R. brachysoma*	61,000	4.7	3.5
Big-eye scads	Carangidae	*Selar crumenophthalmus*	38,455	3.0	2.3
Round herrings	Clupeidae	*Dussumieria acuta, D. elopsoides*	32,878	2.6	1.9
Fusiliers	Caesionidae	*Caesio erythrogaster C. tile, C. diagramma*	17,718	1.4	1.0
Flying fish	Exocoetidae	*Cheilopogon cyanopterus C. nigricans Oxyporhamphus convexus*	16,918	1.3	1.0
Half beaks	Hemiramphidae	*Hemiramphus far*	4,687	0.4	0.3
Silversides	Atherinidae	*Atherina* spp.	2,370	0.2	0.1
Gizzard shads	Clupeidae	*Anodontostoma chacunda*	686	0.1	0.0
TOTAL			544,010	42.3	31.3

[a]Mean of period from 1976 to 1989.
[b]*Stolephorus* spp. only.
[c]*Rastrelliger* spp. only.

This report on the bioeconomics of the Philippines small pelagics fishery is one of a series of reports prepared under a research project on the small pelagics fishery, conducted by the Bureau of Fisheries and Aquatic Resources (BFAR) and the International Center for Living Aquatic Resources Management (ICLARM) and funded by a World Bank loan to the Philippine government with ICLARM as the executing agency.

The Small Pelagics Management Project was established to review available secondary data on small pelagics stock assessment, biology, technology and economics and to undertake primary data collection of fisheries, biological and economic data. This data collection and analysis were conducted with the goal of providing a comprehensive assessment of the small pelagics fishery in order to formulate a rational management policy. A second general objective was to determine the potential for improved efficiency (cost-saving) of the fishing fleets in the context of the required management policy.

As a result, a number of papers and reports have been prepared dealing with the stock assessment, biology and technology of the small pelagics fishery (Appendix I). In addition, options for management have been suggested based on these studies (Dalzell and Ganaden 1987; Dalzell et al. 1987; Dalzell and Corpuz 1990a; Dalzell et al. 1990).

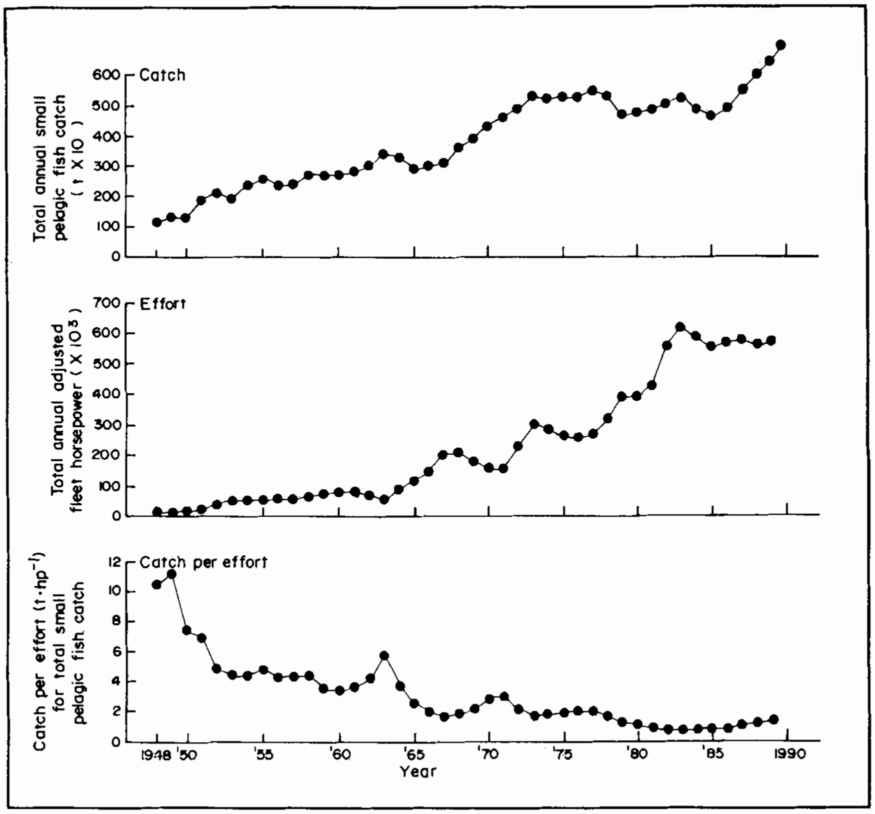

Fig. 1.1. Time series of total small pelagic catch, fishing effort and catch per effort, 1948-1988 (from Dalzell et al. 1987).

The objective of this study is to complement this by providing an economic dimension to the existing project results.

The economic component of the project seeks to quantify total societal benefits derived from the fishery. This is accomplished through an analysis of the technological efficiency, economic efficiency, and profitability of the small pelagics fishing fleet and the determination of the existence of economic profits (or losses) and resource rents in the fishery.

Chapter 2

DESCRIPTION OF THE STUDY METHODS

Data Collection

Both primary and secondary data were used in this study. Secondary data sources were obtained from a variety of Philippine government agency reports, notably the Bureau of Fisheries and Aquatic Resources (BFAR) and the National Economic and Development Authority (NEDA).

Primary data for the economic analyses were collected as part of the overall small pelagics project. The sites covered six regions of the Philippines whose aggregate catch of small pelagics represent 85% of the total country catch (Fig. 2.1). Important landing sites in each of the six regions were chosen as sampling site(s) for the study; these sites are described below.

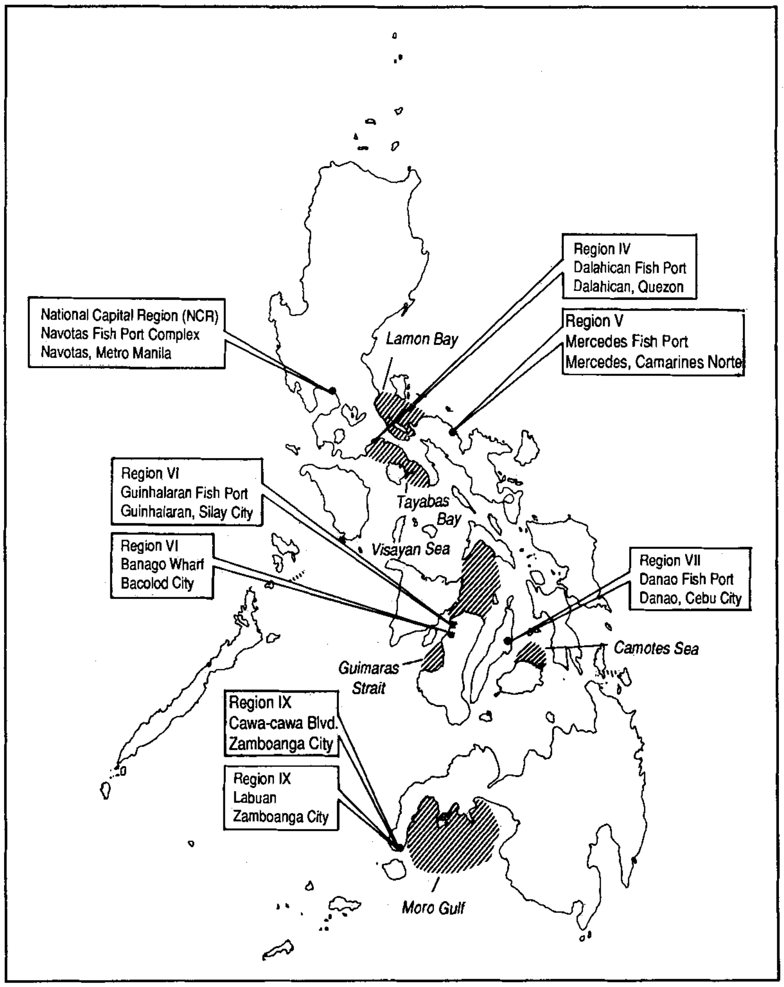

Fig. 2.1. Regional distribution of sampling sites covered by the Small Pelagics Management Project survey team and associated fishing grounds.

The dominant fishing gear types (both commercial and municipal) identified and the number and catch of each gear type are listed in Table 2.1. Lists of registered fishing vessels operating in each of the landing sites were obtained from BFAR regional offices and the Coast Guard offices. These vessels were grouped according to their gross tonnage and the modal tonnage class was determined. The original sample size was set at 15% of the total number of fishing vessels reported. The samples were drawn randomly from the modal class. However, due to problems during data collection (e.g., unwillingness of some fishers to be interviewed, difficulty in locating boatowners, etc.), the required number of

Table 2.1. Contribution of small pelagic gears to total catch; number and regional distribution of sampled gears.

Gear	Mean catch ($t \cdot year^{-1}$)	Percentage of total	Region	No. of units sampled
Commercial[1]				
Trawl	38,246	14	NCR, IV	3
Purse seine	132,858	28	NCR, IV	2
Bagnet	68,262	25	IV, IX	5
Ringnet	26,250	9	VII, IX	12
Municipal[2]				
Gillnet	78,157	36	IV, V	7
Beach seine	52,272	24	VI	2
Fish corral	7,750	4	VI	4
Drive-in net	938	-	VII	1

[1]Includes three round haul seines from Region IV.
[2]Includes one encircling gillnet from Region V.

fishing units was not met. Out of the original sample of 112 fishing units, only 40 were actually monitored.

A sampling team consisting of two biologists and one economist was assigned to each landing site. The team members were trained to administer a lengthy questionnaire that included information on catch and effort, ex-vessel prices of fish species landed, investment and operating expenses, mode of operation, and a variety of technical information (tonnage, horsepower, size of net, etc.) about the fishing vessel and gear. A copy of the questionnaire is included as Appendix II. The team members complemented the information obtained from interviews with direct observation at landing sites and wholesale markets.

The data collection period for the economic analysis was from March to April 1988; however, catch data were collected by gear type from all landing sites for a period of 14 months, i.e., from February 1987 to March 1988, by the project's biological sampling team. Data on costs and earnings were collected once a week over a four-week period for each fishing unit.

In line with the "data-rich books" concept of Pauly (1993) and previously implemented in several ICLARM publications, the cost and earnings data of sampled gears and time series data on cost and revenue of small pelagic gears used in this contribution are available from ICLARM on diskettes (see Appendix III).

The accuracy and reliability of the analysis depended largely on the quality of data collected. To improve the quality of the sampling, data collected by the sampling team were verified by another group which asked the same questions of the respondent fishers. Results of the initial survey were tabulated and presented to the respondents who were asked to affirm or negate such results. Inconsistencies were then rectified.

Description of Sampling Sites

Navotas Fishing Port Complex

The Navotas Fishing Port Complex (NFPC) which is located in the northeastern part of Manila Bay is the largest in the country and in Southeast Asia. It covers a total land area of 67 ha and is equipped with an ice plant and cold storage facility, fuel-oil facility, landing quay and repair yard and fish trading halls.

About a thousand commercial fishing and nonfishing vessels operating in various fishing grounds land their catch into the complex. These vessels whose size ranges from 3 to 450 GT include purse seiners, trawlers, muro-ami and longliners.

Different species of fish and other fishery products which are brought to the port either by sea or by land come from different places all over the country with Region IV giving the highest contribution. Landings are generally high from March to May and generally low from December to January. Species in abundance include roundscads, mackerels and fusiliers.

Based on 1983-1986 landings, the NFPC accounted for about 35-40% of total commercial fish landings in the country. On the average, NFPC supplies 80% of Metro Manila's total fish requirement. The high volume of landings at NFPC is due mainly to the high concentration of carrier vessels unloading fish catches at the complex. Carrier vessels are particularly important in maximizing fishing time of commercial fishing vessels.

NFPC has four trading halls covering a total area of 8,320 m^2 where wholesalers, retailers and brokers conduct their market activities. Basically a night market, trading starts at 10:00 p.m. and ends at about 3:00 a.m. Fish and fishery products are traded through whisper bidding.

Dalahican, Lucena City

One of the important fish landing sites in Quezon province is in Dalahican, a small town located at the northwestern part of Tayabas Bay. The landing site is a 2-km stretch along Dalahican Beach. It is equipped with an ice plant capable of producing 10 t of ice. The site is also a public market where all types of vendors (e.g., fish, vegetable, meat), wholesalers, retailers, brokers and consumers transact business.

Fish landings at Dalahican come from both municipal and commercial fishing vessels operating in Tayabas Bay. These vessels are either from the region or migrants from the Bicol region. Commercial fishing is carried out principally with bagnets, trawls and purse seines. There are about 53 bagnetters (5 to 50 GT), seven trawlers (5 to 15 GT) and eight purse seiners (50 to 200 GT) in the area. The municipal fleet on the other hand consists of 130 surface gillnets and round haul seines, eleven skimming nets, ten scoop nets, nine beach seines and seven baby bagnets.

The bulk of small pelagics catch landed at Dalahican consists of anchovies and roundscads. Other species landed although in minor quantities include sardines and mackerels.

Fish landing and trading usually start at 4:00 a.m. and last for four to five hours. Selling of fish is usually carried out by brokers who are stationed in the area through whisper bidding. Brokers who sell fish in behalf of fish producers get an average commission of 5-7% of gross sales. Aside from their marketing function, these brokers also provide capital to fishers particularly those engaged in municipal fishing.

Dalahican basically supplies the fish needs of its residents and that of the nearby towns. A significant proportion of landed catch is also brought to Manila.

Mercedes, Camarines Norte

Camarines Norte is approximately 400 km from Manila in the Bicol Region. Fishing grounds in the region include Lamon Bay, Lagonoy Gulf, Ragay Gulf and the Pacific side of waters of Camarines Norte and Sur.

The commercial fleet consists of 22 bagnetters (3 to 50 GT) and 13 trawlers (10 to 100 GT). The municipal fleet is composed of 27 surface gillnetters, 16 hook and lines, 8 hoopnets and 8 baby bagnets. While these vessels usually operate in fishing grounds close to their home port, during the lean season they migrate to Quezon, operate in Tayabas Bay and land their catch in Dalahican.

Big-eye scads, roundscads, anchovies and mackerels constitute the bulk of landed catch. These fish are either sold fresh or in dried form. The Bicol Region is one of the important sources of dried fish in the country.

As in other regions, brokers sell fish in behalf of fish producers and get an average commission of 5 to 7% of gross sales. They also provide capital to fishing boat operators for their day-to-day operations.

Banago Wharf, Bacolod City

The Banago Wharf is the landing place of commercial vessels operating in the Visayan Sea. Sixty-six trawlers (10 to 150 GT) and 28 purse seiners (25 to 150 GT) are registered in the area. These vessels are usually equipped with carrier vessels, lighboats and skiff boats.

Carrier vessels usually bring the fish catch to the landing site. Fish landing and trading take place from midnight to early morning. Trading is carried out by brokers through whisper bidding.

Guinhalaran, Silay City

Covering approximately 50 m^2, the Silay City landing site accommodates the landed catch of municipal fishing vessels. The municipal fleet consists of 68 shallow and deepwater carrier vessels for fish corrals, 16 bottom gillnetters, 15 beach seiners and 5 hook and lines. These vessels exploit the Guimaras Strait.

Sardines constitute the largest component of landed catch. Other important species include roundscads, mackerels, anchovies, round herrings and big-eye scads.

Landing and trading start early in the morning and end at about 8:00 a.m. Trading is done by brokers through open bidding. The bulk of the landed catch is distributed to local residents. Some fishing boat operators do not even sell but keep their catch for home consumption only.

Danao City, Cebu

Located in Central Visayas, Danao City is one of the major landing sites of commercial and municipal fishing vessels operating around the Camotes Islands.

The commercial fleet consists of 33 ringnetters ranging from 5 to 50 GT. These vessels are manned by an average crew of 35 fishers. Ringnetters fish at night until early morning using fish aggregating devices (FADs), i.e., floating rafts of bamboo. Most of them have carrier vessels which bring their catch to Danao.

Important species landed by commercial ringnetters include anchovies, mackerels, sardines and roundscads.

The municipal fleet consists of 17 vessels using drive-in nets catching mainly flying fish. Fishing time is usually from early morning to midday.

Trading begins at noontime and lasts for about two to three hours. A small area is provided to accommodate brokers, wholesalers and retailers from the area and nearly towns. Trading is done through open bidding.

Cawa-cawa Blvd., Zamboanga City

Zamboanga City is situated at the southern tip of the Zamboanga Peninsula.

Fishing vessels which land their catch at Cawa-cawa exploit the Sulu Sea and Moro Gulf. The commercial fleet consists of 50 bagnetters (5 to 150 GT) and 28 ringnetters (3 to 50 GT). Although these vessels consider Cawa-cawa as their home port, there are times when they would land their catch in other places where prices are better. Equipped with communication systems (e.g., radios), some of these vessels are able to gather information on fish prices from different landing sites.

The highest concentration of small pelagics catch is found in this region. Sardines and roundscads constitute the bulk of landed catch. Other important species include anchovies, round herrings and big-eye scads. Due to limited supply of ice, salting of fish is very common in the area.

Labuan, Zamboanga

Labuan is a small Muslim fishing village located in Zamboanga City. There are 16 ringnetters and two beach seiners in the area which exploit the Moro Gulf. Although vessels used exceed 3 GT, they are still classified as municipal vessels. Fishers are forced to use larger boats due to the incidence of piracy. These vessels are each manned by 6-8 fishers.

Species in abundance include roundscads, big-eye scads and sardines. Due to oversupply of fish in the area, fishers usually receive low prices for their catch. To expand the market for their product and get better prices, municipal fishers process their fish either by salting or drying.

Most of the Labuan fishers sell their catch directly to buyers. Trading is done through open bidding. Since these fishers have no weighing scales, fish are sold by piece.

Analytic Methods

Two distinct types of analysis are presented in Chapters 4 and 5. In Chapter 4, Production Technology and Efficiency, the first section focuses on an analysis of differences in the level of technology between fishing gear types, sectors of the fishery and regions using descriptive statistics. The second section focuses on technical efficiency of fishing gear types using three indicators: catch per person-hour, catch per vessel tonne-day, and catch per adjusted horsepower-day.

Chapter 5, Cost Structure and Profitability, provides a parallel analysis to that conducted in Chapter 4 by focusing on the assignment of monetary values to asset ownership, operation efficiency and technical efficiency. The cost structure of fishing operations (capital investment and total cost) is analyzed by fishing gear type, sector of the fishery, and region. Fishing costs are distinguished as fixed and variable (i.e., operating costs). The cost structure is described and various costs are expressed as percentages of total costs. The sharing systems, including mode of payment, frequency of payment and share arrangement for each fishing gear type and region, are described. Catch and price for the major small pelagic fish species are analyzed. The relative labor and capital intensities of the various fishing gear types are compared to assess the economic efficiency of the fishing operations.

Profitability is examined in two ways. First, return to owner is calculated by subtracting fixed and operating costs from owner's earnings and treating the difference as a return to owner's labor, capital, risk and management. Second, pure profits (resource rents above all costs) are calculated by comparing returns to labor and capital with their respective opportunity costs. This comparison shows whether or not pure profits exist in the small pelagics fishery, which users are earning them, and whether there is room to expand the fishery (i.e., increase fishing effort) to redistribute benefits. For example, if the sum of returns to capital and labor in the fishery exceeds the opportunity costs of capital and labor, it would be to society's benefit to increase the amount of capital and labor in the fishery, if the management goal is to simply maximize employment. Otherwise, the amount of capital and labor in the fishery should be reduced and the excess diverted to alternative activities where they can earn more (Smith and Mines 1982). In addition, revenue and cost functions for the small pelagics fishery are estimated to provide an overall assessment of the economic rents derived from the fishery. The implications of these findings are considered in the final chapter of this report.

Chapter 3

BIOLOGY OF SMALL PELAGIC FISHES IN THE PHILIPPINES*

The small pelagics are a diverse group of marine fishes inhabiting the upper surface layer of the water column, usually above the continental shelf, i.e., in waters not exceeding a depth of 200 m. They consist of mackerel and herring-like species, but also include flyingfishes, halfbeaks and fusiliers. A list of Philippine small pelagic fishes is given in Table 1.1 (p. 2).

Small pelagics are mostly schooling, planktivorous feeders. Yesaki (1983) classified the pelagic fishes into three groups based on their feeding habits, namely, planktivores, primary carnivores and secondary carnivores. The small pelagics fall into the first two categories. Anchovies and mackerels are considered phytoplanktivores while the clupeids and scads are primary carnivores. While the diet of anchovies and mackerels contains phytoplankton, crustaceans (especially copepods) form the main diet component (Dalzell and Ganaden 1987). Small pelagic fishes usually attain a maximum weight of less than 500 g and are characterized by short life spans, fast growth rates and subsequent high natural mortalities (Dalzell and Corpuz 1990b).

The coastal zone is inhabited by big-eye scads, anchovies, clupeids, halfbeaks and fusiliers; the mackerels occur further offshore while the roundscads range between the neritic and truly oceanic waters. More detailed information on the distribution of small pelagics may be found in Dalzell and Corpuz (1990b).

Although the Philippines is well within the tropics where primary and secondary production does not show strong seasonal fluctuations (Yesaki 1983), the biological production of small pelagics is highly seasonal, being influenced by environmental conditions most notably by monsoon winds (Pauly and Navaluna 1983; Navaluna and Pauly 1988; Dalzell and Corpuz 1990a).

The complex nature of tropical marine communities requires highly diversified gears and fishing methods to enable the full utilization of a wide range of pelagic resources. Thus, more than 30 different commercial and municipal gears are used to catch small pelagic fishes in the Philippines.

A common feature of small pelagics fishing in the Philippines is the use of *payaos* or floating fish aggregating devices (FADs). *Payaos* are used extensively by purse seiners, ringnetters and occasionally by liftnetters (*basnigans*). Another feature is the use of light to concentrate fish for capture. Lights are essential for the operation of *basnigs* and other liftnets and are also commonly used with ringnets, purse-seines and sometimes with gillnets. Their operations are thus curtailed or reduced over the full moon period when increased ambient light suppresses the phototactic response of small pelagic fishes (Dalzell et al. 1990).

The commercial sector operates 12 gears that catch small pelagics, while in the municipal sector at least 20 gear types have been recorded. In the commercial sector, purse

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*By Francisco S.B. Torres, Jr., Research Assistant, Coastal Resource Systems Program, ICLARM.

seines, trawls, bagnets, ringnets and *muro-ami*** account for 98% of the catch; of these five, purse seining produces about 40%. In the municipal sector about 40% of the catch comes from gillnetting followed by another 40% from beach seines, bagnets, handlines and ringnets. In terms of total small pelagics fishery, three gears - purse seines, bagnets and gillnets - produce about 60% of the catch, in roughly equal proportions. Beach seines and trawls together account for a further 17% of the catch while the balance is derived from other gears (Dalzell and Corpuz 1990b). Although trawls are normally associated with demersal species, 10-20% of trawl landings in the Philippines are small pelagic fishes (Dalzell et al. 1990).

Results of the Small Pelagics Management Project conducted between February 1987 and March 1988 (in eight landing sites in six administrative regions known to be major producers of small pelagics) showed that the average catch rates of the municipal gears ranged from 14 to 108 kg/haul. Small pelagics account for 50-100% of the total catch and this was comprised predominantly of anchovies and sardines. Average catches of commercial vessels ranged from 120 to 1,100 kg/haul and unlike the municipal gears, those of the commercial fisheries catch substantial amounts of roundscads and mackerels, although anchovies and sardines still make significant contributions, particularly in those nearshore commercial gears, such as ringnets. The higher proportion of roundscads in the catches of the other commercial gears is due to the greater range of these larger vessels, which are able to operate away from the coastal margin over the continental shelf where these neritic species are more common (Dalzell et al. 1990).

Carangids, particularly *Decapterus macrosoma* and *D. maruadsi,* are important components of the commercial small pelagics landings; other dominant species are the sardine *Amblygaster sirm*, the anchovy *Stolephorus heterolobus* and the mackerel *Rastrelliger kanagurta*. In the municipal landings, the largest components of the catch consist of *Sardinella fimbriata*, *S. heterolobus* and the mackerel *Rastrelliger faughni*. In the total combined landings, five species, *D. macrosoma*, *D. maruadsi*, *S. fimbriata*, *S. heterolobus* and *A. sirm* comprise nearly 60% (Dalzell et al. 1990).

Fishes with short life span and rapid growth (expressed by the parameter K of the von Bertalanffy growth equation) have a high natural mortality (M), expressing deaths due to natural causes such as predation and diseases. The ratio of K to M thus relates to the probability of a fish completing its potential growth before dying of natural causes. If M/K is large, many fish will die of natural causes before realizing their growth potential, and it will therefore pay to exploit these fishes relatively hard, and using a low size at first capture, such as to catch the fish before they die (Gulland 1983). Conversely, when M/K is low, it is advisable to let the fish realize their growth potential before they are caught; thus such fishes should be lightly exploited and their size at first capture should be large.

To assess the status of an exploited stock, an index commonly used is the exploitation rate (E), defined as the ratio of fishing mortality (F) to the total mortality (Z), where total mortality is the sum of natural mortality (M) and fishing mortality (F).

A value of E ranging from 0.3 to 0.5 suggests that stocks are optimally exploited (Gulland 1971; Pauly 1984). However, based on the results of the Small Pelagics Management Project, Philippine small pelagic fishes have values of E that are generally beyond this (Fig. 3.1) indicating overfishing, even if one accounts for the fact that the apparent mortality rates of small pelagics may have been overestimated, due to their migratory habits (Dalzell and Corpuz 1990b).

**A movable drive-in net set among reefs used chiefly for fusiliers and surgeon fish (Umali 1950).

Different species groups vary in their reaction to fishing pressure, such that even if fishing effort is constant, it may bring about changes in stock biomass, i.e., in changed catch composition. Dalzell and Corpuz (1990b) have shown that anchovies have partially replaced sardines, scads, and mackerels in the catch, which possibly reflects the change in their relative abundance (see Fig. 3.2). The decline of sardines, scads and mackerels may be viewed as an indication of a gradual stock collapse. With anchovies being the cheapest pelagic fish, the absolute value of the total catch may also have declined.

The top six species groups which account for 90% of the total small pelagics catch are briefly described below. Also some information on fusiliers is provided since these represent 75% of all fish and 99% of the small pelagics caught from coral reefs (Dalzell and Corpuz 1990b). More detailed information on the species described below, as well as other Southeast Asian species, may be found in FishBase (Pauly and Froese 1991).

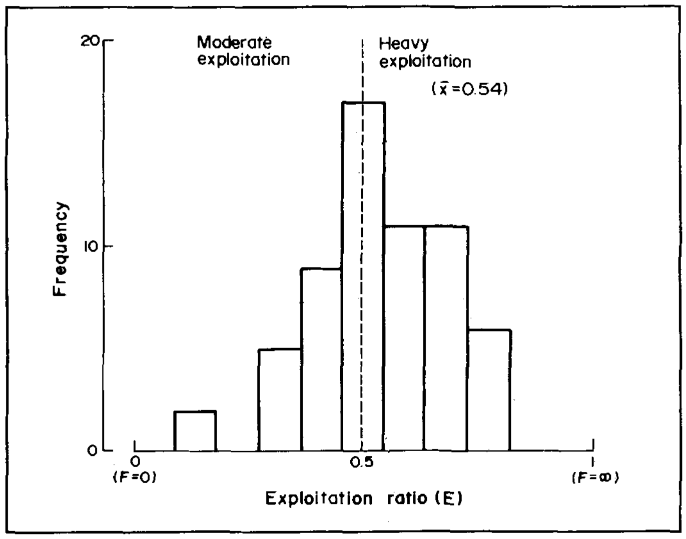


Fig. 3.1. Frequency distribution of exploitation rates (E) for Philippine small pelagic fishes.

Roundscads

Roundscads are small to moderate-sized coastal fishes, widely distributed, tending to avoid waters with salinities below 30 ppt. They are found in bays of the entire archipelago (Tiews et al. 1970a). Catches of roundscads consist of a mixture of *Decapterus maruadsi*, *D. macrosoma*, *D. kurroides*, *D. russelli* and *D. macarellus* (Dalzell et al. 1990). *D. macrosoma* is a typical zooplankton feeder, while *D. russelli* preys to a much larger degree on fishes. Both species consume *Stolephorus* eggs (Tiews et al. 1970a).

The degree of separation of stocks of *Decapterus* spp. in the Philippines is generally unknown although it has been suggested that roundscads are capable of considerable migrations (Dalzell and Ganaden 1987). Biological information and the development of the fishery were reviewed by Ronquillo (1975), while the status of the exploited stocks was reviewed in Calvelo and Dalzell (1987).

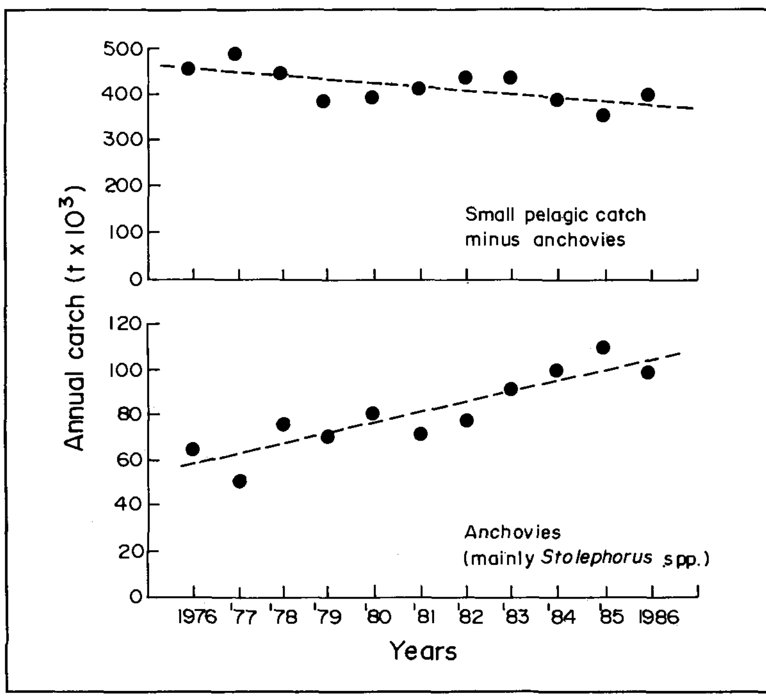


Fig. 3.2. Time series of Philippine small pelagics catches, showing partial replacement of sardines, carangids and mackerels (above) by *Stolephorus* spp. (below) (from Dalzell and Pauly 1990).

Roundscads have a maximum life span of 3-5 years depending on species and stock (Ingles and Pauly 1984; Dalzell and Ganaden 1987). The production peak for roundscads occurs between March and June, i.e. following the end of the northeast monsoon and the beginning of the southwest monsoon.

The principal gears for roundscads are purse seines, ringnets, *basnigs* and trawls; they account for approximately 32% of the total small pelagics landings.

Sardines

Landings of sardines consist of *Sardinella fimbriata S. brachysoma*, *S. longiceps*, *S. albella*, *S. gibbosa*, *Amblygaster sirm*, *Herklotsichthys quadrimaculatus* and *H. dispilonotus* (Dalzell et al. 1990).

Sardines are characterized by an elongate, fusiform body, a strongly compressed belly with keeled scutes and deeply forked caudal fin (Ronquillo 1960). They are gregarious, moving in schools followed by pelagic fishes that prey upon them. Fishers detect schools through the phosphorescence created by the sardines as they move in the water (Anicete and Yapchiongco 1960).

The life span of sardines in general appears to be 2-3 years, possibly up to 4 (Ingles and Pauly 1984; Dalzell and Ganaden 1987). They have a production peak during the southwest monsoon which normally lasts from June to October (Dalzell and Corpuz 1990b).

Information on their distribution suggests a wide range of salinity tolerance by various species. The relative abundance of the various sardine species is not well understood; purse seine catches in the Visayan Sea are dominated by *Sardinella gibbosa* while catches from Manila Bay suggest the dominant species to be *Sardinella longiceps* (Dalzell and Ganaden 1987).

Gillnets, purse seines, *basnigs*, ringnets and beach seines are the main gears for sardines and they comprise 22% of the total small pelagics landings.

Anchovies

Anchovies are small planktivorous fishes, found in a variety of habitats in the tropical zones of the Indo-Pacific Region. Their distribution in various coastal habitats appears to be a combination of varying degrees of salinity tolerance and differences in feeding habits (Dalzell and Ganaden 1987).

Catches of anchovies consist of *Stolephorus heterolobus*, *S. devisi*, *S. commersonii*, *S. indicus*, *S. punctifer*, *S. waitei*, *S. ronquilloi* and *Engraulis japonicus*, though the last mentioned is usually associated with subtropical and warm temperate waters such as those of Taiwan and southern Japan (Dalzell et al. 1990).

The identity of the various stocks of stolephorid anchovies in the Philippines is generally unknown, but the Philippine stocks of *E. japonicus* may be contiguous with those of Taiwan and Indonesia (Ronquillo and Dalzell 1989).

The average life span of stolephorid anchovies is 1-2 years with *S. indicus*, the largest in the genus living up to 3 years (Tiews et al. 1970b; Ingles and Pauly 1984; Dalzell and Ganaden 1987).

The production peak of stolephorid anchovies occurs between September and November, towards the end of the southwest monsoon and the transition to the northeast monsoon (Dalzell and Corpuz 1990b). Anecdotal information suggests that *Engraulis japonicus* is seasonally abundant during the cool months of December to March (Ronquillo and Dalzell 1989).

Approximately 17% of the total small pelagics catch are anchovies and the principal gears used to effect their capture are beach seines, round-haul seines, bagnets, baby trawls and fish corrals.

Mackerels

Mackerels inhabit the epipelagic waters, both inshore and offshore. They are of moderate to large size and are characterized by their streamlined, spindle-shaped bodies.

Four species of mackerel are caught in Philippine waters: *Rastrelliger brachysoma, R. kanagurta, R. faughni* and *Scomber australasicus*; the latter tends to be associated with subtropical and warm temperate waters (Dalzell et al. 1990).

Rastrelliger brachysoma is a coastal or inshore form subsisting principally on microplankton while *Rastrelliger kanagurta* is an open sea form and from examination of stomach contents, feeds mostly on macroplankton such as larval shrimps and fishes (Manacop 1956). The growth parameter estimates for *R. kanagurta* and *R. brachysoma* suggest that the life span of these mackerels is between 1.5 and 2 years (Ingles and Pauly 1984; Dalzell and Ganaden 1987).

Mackerels account for 10% of the total landed catch of small pelagics and the main fishing gears used are gillnets, purse seines, ringnets and trawls.

Big-eye Scads

Catches of big-eye scads consist of *Selar crumenophthalmus* and *S. boops*, but usually they are not the prime focus of most pelagic fisheries and are common incidental species in catches (Dalzell and Peñaflor 1989).

Big-eye scads are characterized by an elongate moderately compressed body and by a deep notch on the lower margin of the operculum (Schroeder 1984).

Selar boops ranges from shallow coastal reefs and sandy areas to deep pelagic waters. This schooling fish feeds on small fishes and invertebrates. *Selar crumenophthalmus* is a migratory fish ranging from shallow murky inshore reefs and sand flats to clear pelagic waters. It forms dense schools of several hundred to several thousand individuals. The water seems to boil and underwater a hissing sound may be heard as they swim rapidly near the surface. It feeds on small fishes, crustaceans, gastropods and foraminiferans, the juveniles eating predominantly the benthic forms (Schroeder 1984). *S. crumenophthalmus* may have a longevity of 2.5 years (Ingles and Pauly 1984; Philbrick 1988; Dalzell and Peñaflor 1989; Dalzell and Corpuz 1990b).

Big-eye scads account for approximately 5% of the total small pelagics catch and the gears that usually catches them are handlines, ringnets, purse seines and trawls.

Round Herrings

Round herrings are small to moderate-sized fishes characterized by their W-shaped pelvic scute and the absence of any other scutes. They are pelagic inshore schooling fishes widely distributed in the Indo-Pacific region and feed mainly on zooplankton (Whitehead 1985).

Catches of round herrings consist of *Dussumieria acuta, D. elopsoides, Spratelloides gracilis* and *S. delicatulus* (Dalzell et al. 1990).

Although they form a significant part of the catches of clupeids, information on their biology is scarce. Growth and mortality estimates for *Dussumieria acuta* from Ragay Gulf were made by Corpuz et al. (1985) based on length frequency data. An examination of otoliths suggests it attains 13-14 cm in the first year of life and the estimated life span is about 2-3 years (Dalzell and Ganaden 1987).

Purse seines, gillnets, round-haul seines and trawls are the gears that usually catch round herrings, which comprise about 4% of the total landed catch of small pelagic fishes.

Fusiliers

Fusiliers (*Caesio* and *Pterocaesio* spp.) are also included in the small pelagics category. Their distribution is determined largely by the extent of coral cover which is generally associated with shallow coastal water. Studies on reef fish populations have shown that fusiliers formed the largest component of reef fish biomass (Dalzell and Corpuz 1990b).

Fusiliers differ from the closely related snappers in a number of ways. In general they are smaller than snappers, streamlined and torpedo-shaped and have more iridescent colors. Fusiliers are capable of rapid color changes and assume different colors during the day and at night. They are midwater schoolfishes which swim actively across the reef, feeding on plankton (Schroeder 1984).

Cabanban (1984) presented growth and mortality estimates for *Pterocaesio pisang* and estimated a longevity of 2-3 years.

Catches of fusiliers consist of *Caesio tile, C. diagramma, C. erythrogaster, C. chrysozona, C. caerulaureus, C. lunaris* and *Pterocaesio pisang*. They account for about 2% of the total landed catch of small pelagics and the principal gears used to catch them are *muro-ami*, handlines and gillnets (Dalzell et al. 1990).

Chapter 4

PRODUCTION TECHNOLOGY AND EFFICIENCY

Introduction

The multispecies nature of Philippine fisheries resources, and of the small pelagics, in particular, calls for a multigear technology ranging from handlines to a purse seine fleet (see Fig. 4.1). The wide spectrum of assets ownership, gear operation and crew as well as technical efficiency as observed in this study further validates this thesis.

Asset Inventory

Table 4.1 describes the characteristics of small pelagic gears sampled by the project. These include number, size and age of boats, number of nets, and engine horsepower. The average for drive-in net and encircling gillnet, each with a single observation, represents actual values.

All gears were classified as commercial or municipal based on the 3 GT benchmark except for beach seines, with average tonnage of 6 GT, which were classified as municipal. All fishing units surveyed use at least one boat although there are other small pelagic gears such as hook and line and liftnet that do not use crafts. These boats are either carrier vessels, as in the case of fish corrals, or catcher boats as in the case of trawlers and gillnets. Purse seiners have the highest number of associated boats; these are light boats, escorts and skiffs to complement the catcher and carrier vessels. Among the municipal gears, the round haul seine requires five boats at the least; these consist of catcher boats, lightboats and carrier vessels.

Fish corrals and surface gillnets operate the smallest boats whereas trawlers and purse seiners operate the largest. On a sectoral level, the average size of municipal vessels is a little over 1 t while that of the commercial sector averages 27.5 t. Most commercial gears sampled utilized only one net except for trawlers, which use an average of 4.3 nets, and purse seiners which use an average of two nets. In the municipal sector, surface gillnets sampled own an average of two nets. [Gears with more than one net use the second to target different species, as in the case of gillnets, or as a substitute when the other is destroyed.]

The sampled units show a high degree of mechanization. The purse seine and beach seine use the largest engines in the commercial and municipal sector, respectively. The round haul seine, while utilizing an average of 5-6 boats, uses engines for catchers and carrier vessels; the lightboats are nonmotorized. Although all municipal vessels are motorized, the sectoral hp average is significantly lower than that of the commercial sector.

Fig. 4.1. Gears included in the Small Pelagics Management Project survey.

Gear type : **Surface gillnet**

Local name : *largarete*

Classification : Entangling gillnet

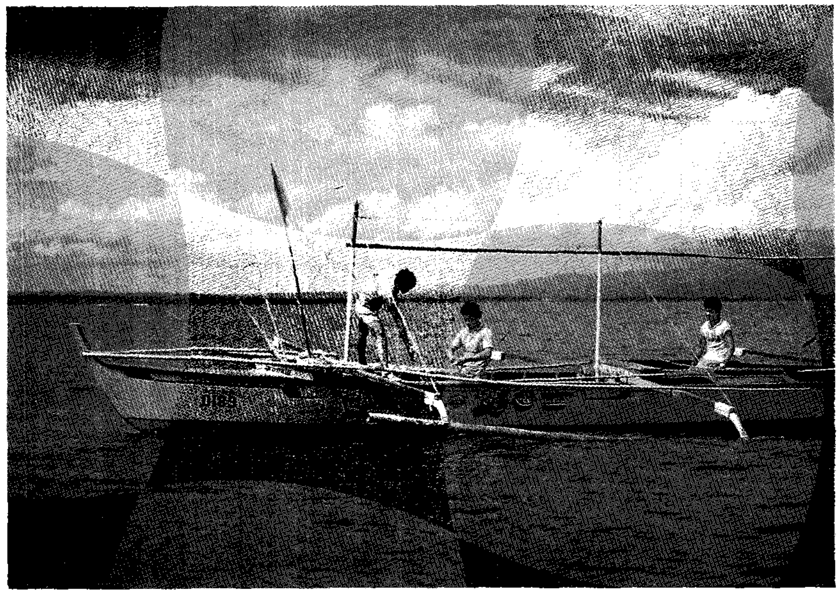
Description : A curtain-like net which catches fishes as they get entangled in the meshes. It is hung directly under the boat from two bamboo booms, each protruding outwardly at the bow and stem of the boat. To each boom, a pulley is attached. Through these pulleys are passed spreader lines the loose ends of which are held and controlled by a fisher located at the midportion of the boat. The net could be spread (opened) or retrieved (closed) at the center of the boat, a system very much like that of a stage curtain.

Operation : Night

Fishing season : Peak - January to April
Low - May to December

Fishing grounds : San Pedro, Maqueda, Tayabas and Carigara Bays

Target species : Sardines, mackerels and other small pelagics



Gear type : **Fish corral**

Local name : *baklad, tangkop, punot*

Classification : Trap

Description : Fish corrals are guiding barriers constructed of bamboo, brush or chicken wire, which are set by means of regularly spaced stakes or posts across the migration routes of fishes, and which are of such shapes as to direct the voluntary movements of fish into a desired area.

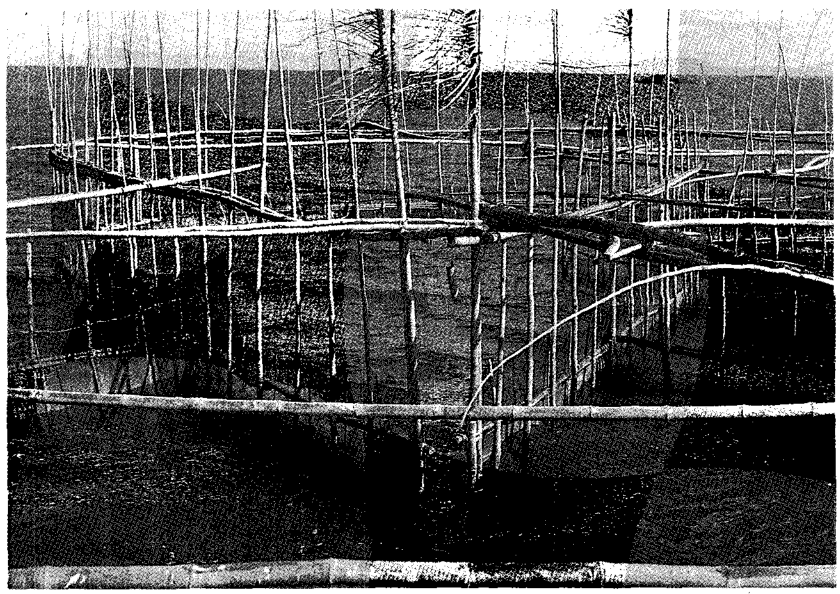
Operation : Day and night

Fishing season : October to May[1]

Fishing grounds : North Guimaras Strait, Visayan Sea

Target species : Mackerels, sardines, roundscads, tuna and tuna-like fishes and other demersals

[1]Fish corrals are operated for only 7 months a year.



Gear type : **Bagnet**

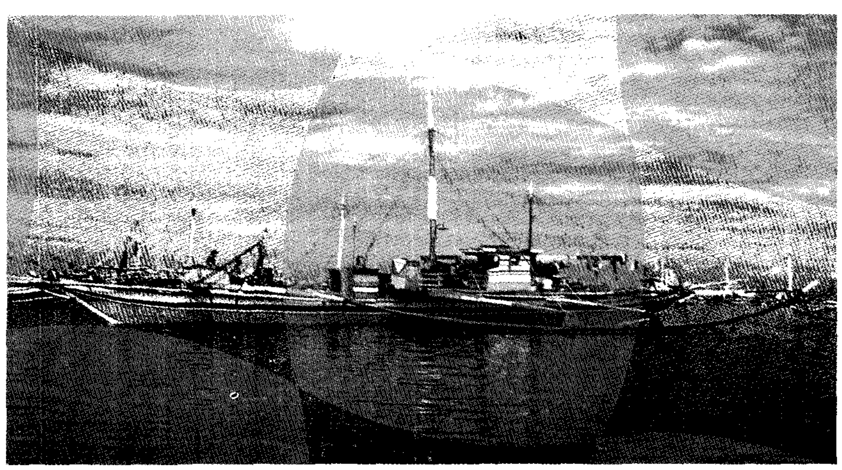
Local name : *balasnig, basnig*

Classification : Mobile impounding liftnet

Description : A box-like net operated from outrigger or booms of a boat with the aid of light, effecting capture of fish by its lowering and lifting motion. The gear simulates an inverted mosquito net under the boat during the operation.

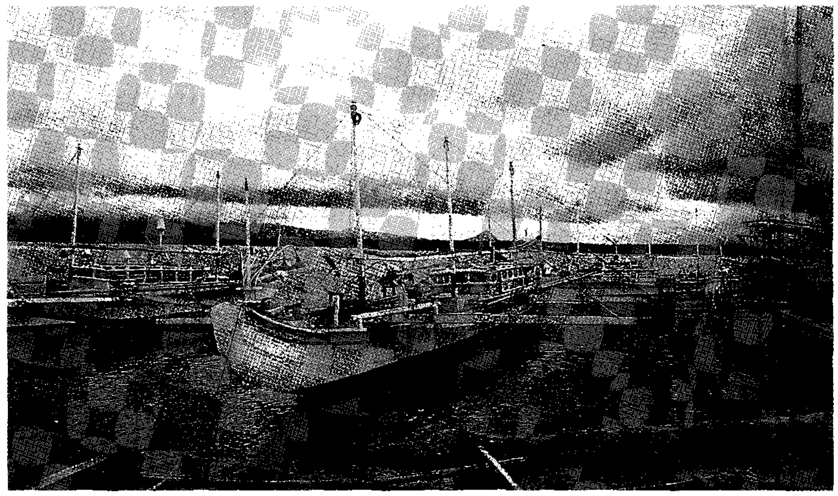
Operation : Night

Fishing season : Peak - January to April
Low - May to December



Fishing grounds : East Sulu Sea, Tayabas Bay, Manila Bay, Ragay Gulf

Target species : Anchovies, sardines, herrings and mackerels and some demersals such as slipmouths



Gear type : Drive-in net

Local name : *surambaw*

Classification : Mobile impounding net

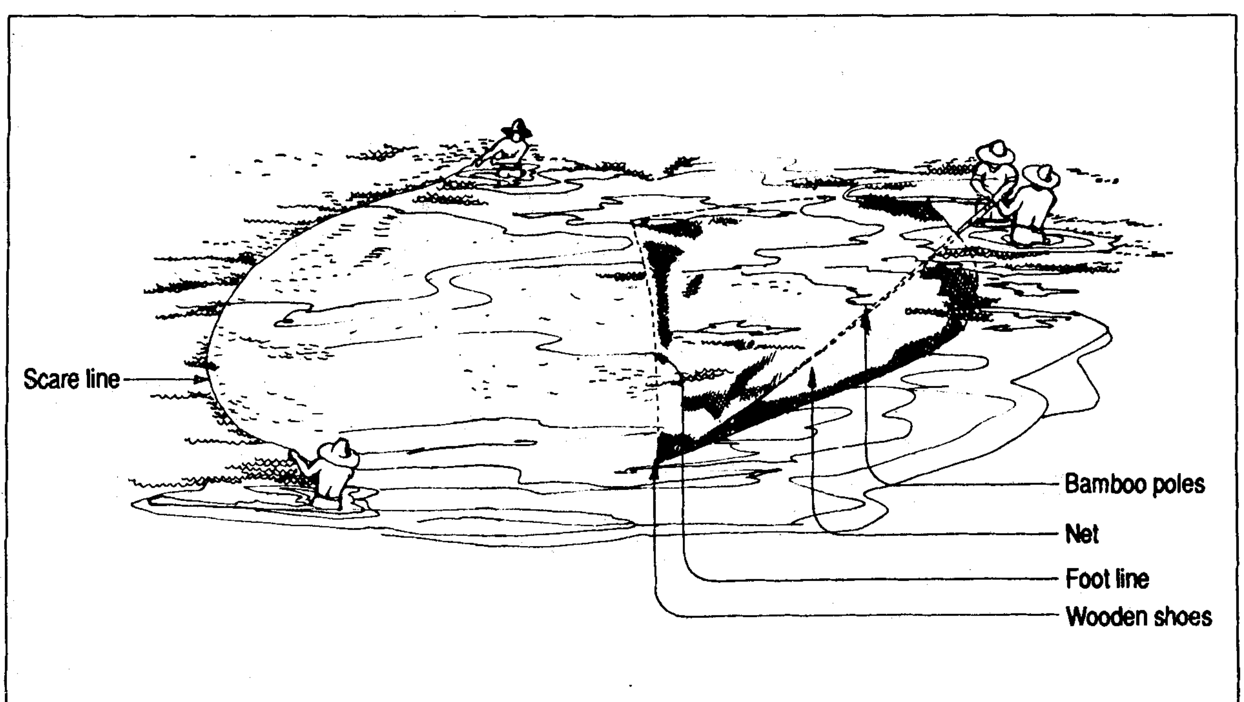
Description : A fishing gear used for catching flyingfish in the open sea. The net is usually made of fine nylon netting and is constructed in a cone with a pair of long wings. A scareline is used as an accessory of the gear during operation. Catching is effected by driving the schools of fish towards the net with the scarelines with plastic ribbons.

Operation : Day

Fishing season : Peak - April, July, December
Low - August to September

Fishing grounds : Camotes Sea, Bohol Strait

Target species : Flyingfish



Gear type **: Round haul seine**

Local name : *lawagan, lampara*

Classification : Mobile impounding pullnet

Description : A type of seine net operated by paying it out in a circle form, thereby surrounding the attracted school of fish. Fish are attracted to lights, then hauled on board two separate boats by means of pull ropes attached to the lower half of the net until the catch is concentrated in the bag or bunt, from where it is brailed out.

Operation : Night

Fishing season : Peak - November to April
Low - May to October

Fishing grounds : Pagbilao Bay, Tayabas Bay, Ragay Gulf

Target species : Anchovies, sardines, mackerels, herrings, roundscads

Round haul seine with auxilliary vessels.

Gear type **: Trawl**

Local name : *galadgad*

Classification : Mobile impounding dragnet

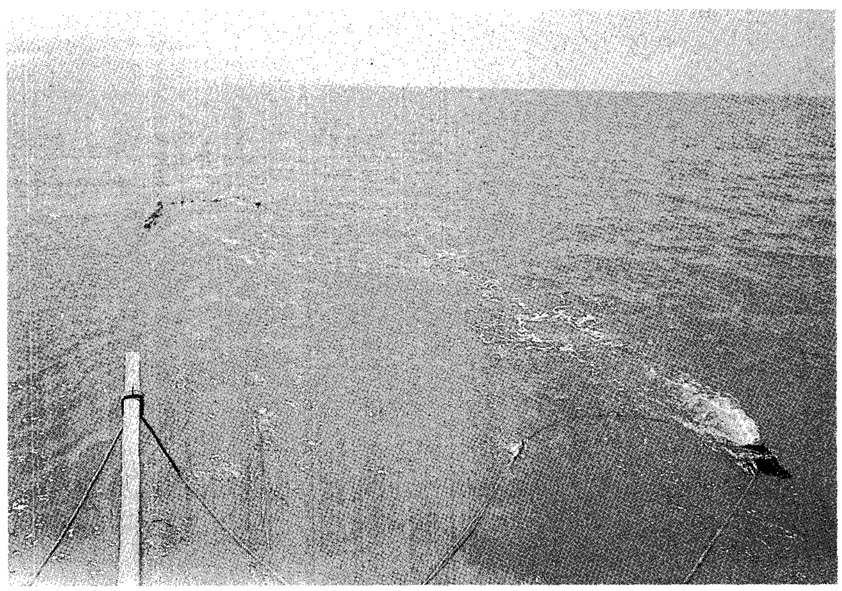
Description : A conical bagnet with mouth flanked on both sides by wings which are kept open by otter boards or doors acting as kites, trawled near the sea bed to catch species of fish living near the bottom.

Operation : Day and night

Fishing season : Peak - January to May
Low - June to December

Fishing grounds : Visayan Sea, Palawan waters, Manila Bay

Target species : Shrimps, slipmouths, goatfish, groupers, hairtails, snappers, croakers, whitings, lizard fish, soles, eels and crabs, nemipterids and other bottom fishes



A trawl net being payed out.

Gear type **: Purse seine**

Local name : *kubkob, pangulong*

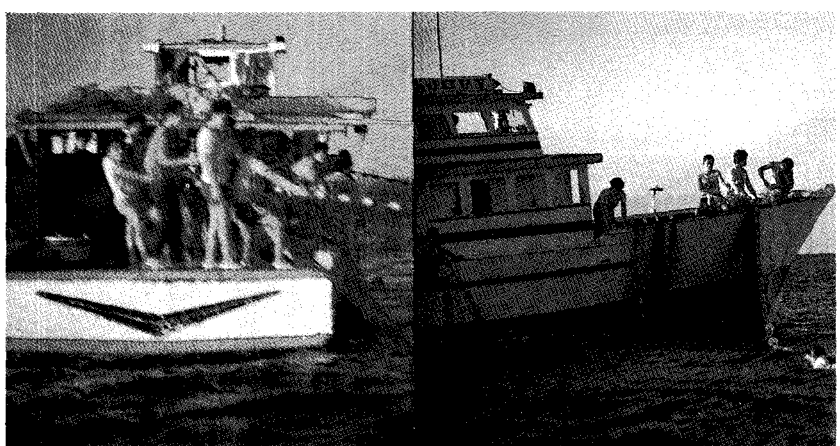
Classification : Mobile impounding tuck seine

Description : A kind of "tuck seine" with a long wall-like net of almost uniform mesh size hanging down between the float and leadline. The most salient feature of purse seines is the circling of the fish school and impounding it by pulling the purse line that passes through the purse rings and closes the bottom, thereby forming a trap or purse. The purse rings are attached to the leadline by bridles at regular intervals.

Operation : Night

Fishing season : Peak - February to June
Low - July to January

Fishing grounds : Camotes Sea, Bohol Strait, Visayan Sea, Mindoro and Palawan waters



Fore and aft of purse seine in operation.

Target species : Sardines, mackerels, slipmouths, herrings, tunas and squids

Gear type : **Encircling gillnet**

Local name : *bating, halang*

Classification : Entangling gillnet

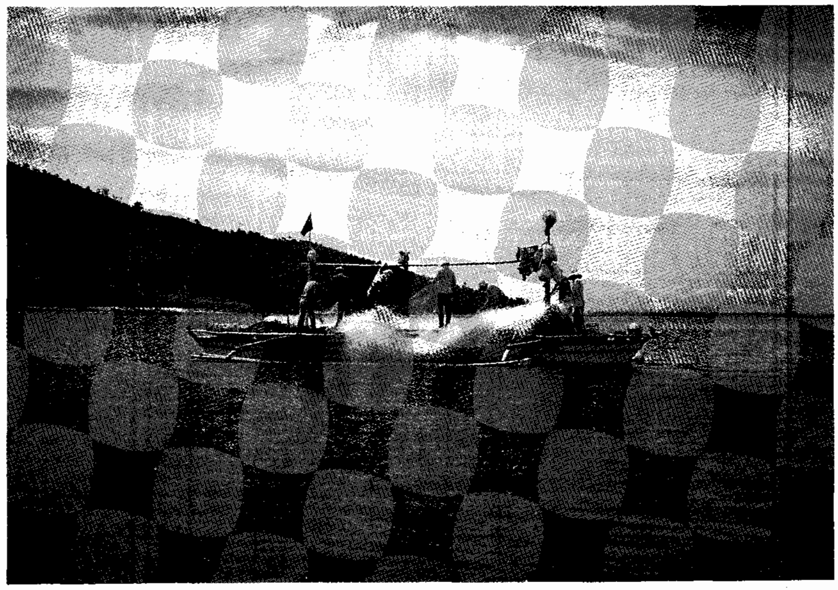
Description : A curtain-like net consisting of a set of one or more pieces of rectangular nets made of fine nylon. It is payed out in a circle effecting the capture of fish by gillnetting. A line with wooden floats is attached to the upper rim of the net while copper rings which serve as sinkers are distributed on the lower rim of the net.

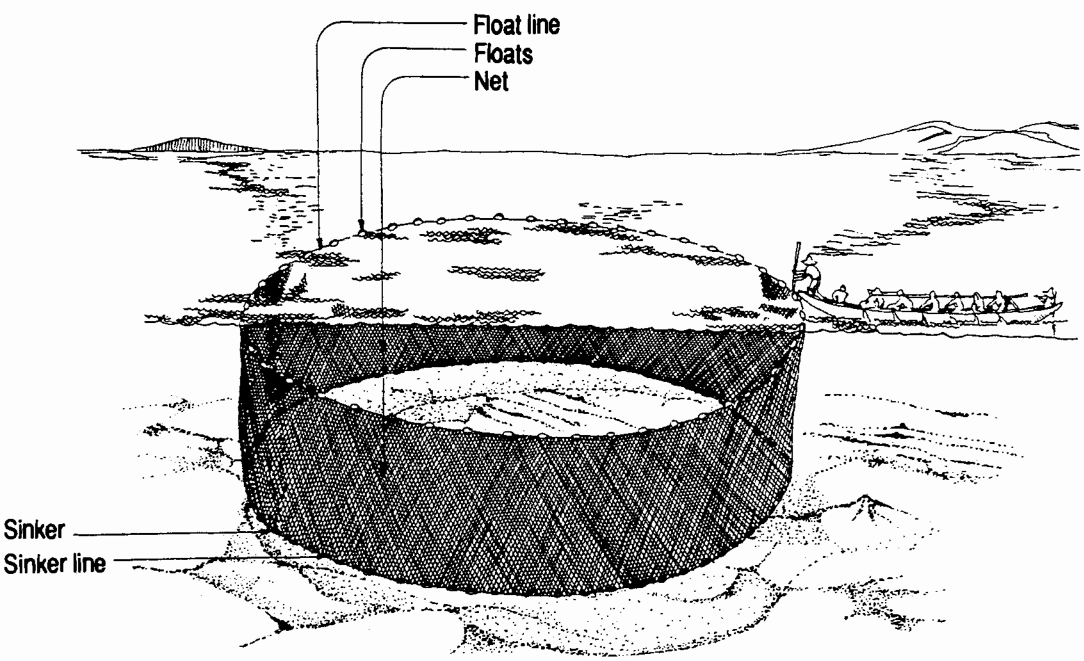
Operation : Day

Fishing season : Peak - January to May
Low - June to December

Fishing grounds : Ragay Gulf

Target species : Sardines





Gear type : **Ringnet**

Local name : *pukot, talakop*

Classification : Mobile impounding tuck seine

Description : A rectangular net held vertically in the water by a line of floats above and a line of lead sinkers below with a bunt at the center and a pursing device along the sinker line.

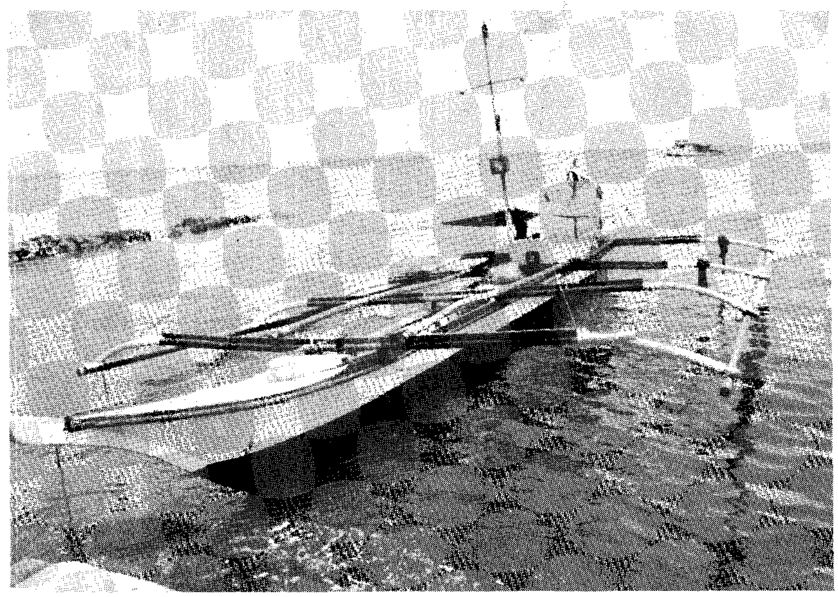
Operation : Night

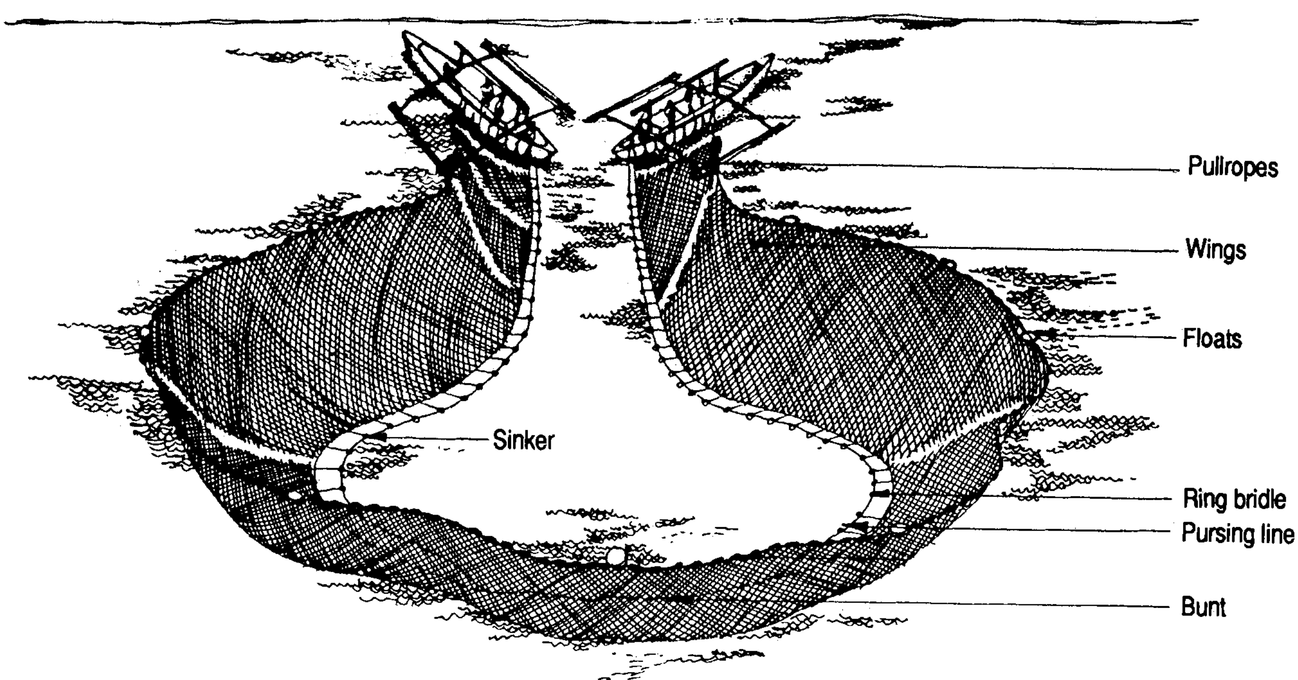
Fishing season : Mindanao
Peak - January to August
Low - September to December

Visayas
Peak - October to May
Low - June to September

Fishing grounds : South Sulu Sea, East Sulu Sea, Visayan Sea, Camotes Sea

Target species : Mackerels, sardines, roundscads, *Caranx*, tuna, bonito





Gear type : **Beach seine**

Local name : *pukot, bayakos, baling, salop, baring, sahid*

Classification : Mobile impounding pullnet

Description : A type of dragnet made of either cloth, *sinamay*, polyethylene or cotton netting consisting of a bag or bunt flanked on both sides by two long wings. Attached to the upper rim of the net is a headrope provided with floats and to the lower rim is a footrope provided with stone or lead sinkers. The float and sinker lines are extended to the wing-ends to which a wooden bar is attached. A pair of towing ropes are tied to the bars and pulled by fishers to the shoreline.

Operation : Night

Fishing season : Peak - June to December
Low - January to May

Fishing grounds : Visayan Sea

Target species : Sardines, anchovies, other small pelagics and demersal fishes

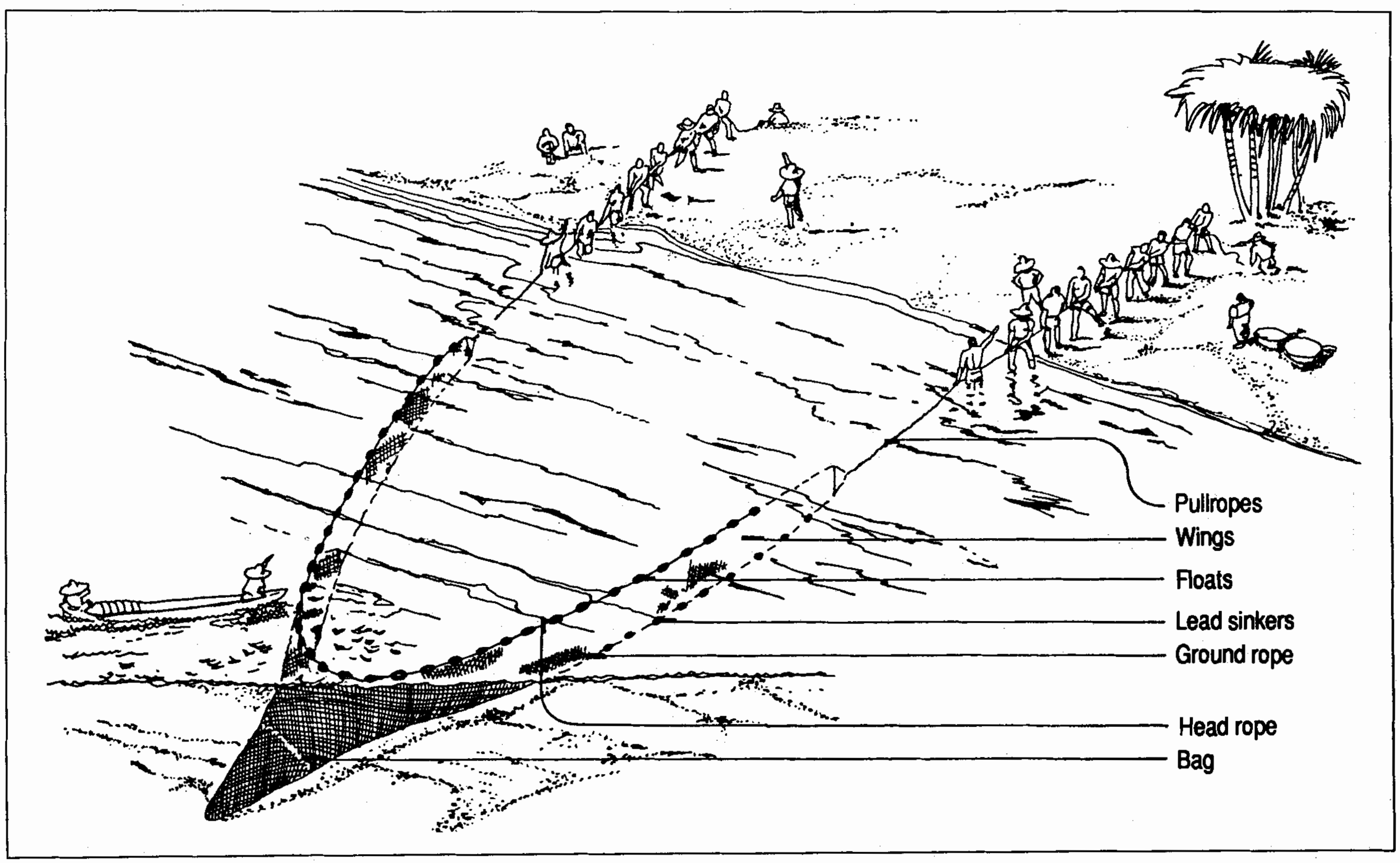


Table 4.1. Average asset inventories of small pelagic gears sampled from Regions IV, V, VI, VII, IX and National Capital Region (NCR), by gear type, sector and region, March-April 1988.

	No. of boats	No. of nets	Tonnage	hp	Age (year)
A. Intergear comparison					
Municipal	**2.4**	**1.1**	**1.1**	**25.4**	**9.1**
Surface gillnet	1.0	1.7	1.2	23.4	6.2
Fish corral	1.0	1.0	0.8	9.5	4.5
Drive-in net	2.0	1.0	0.6	10.0	13.0
Round haul seine	5.7	1.0	2.0	58.7	12.7
Commercial	**2.6**	**1.8**	**27.5**	**160.4**	**8.1**
Trawl	1.0	4.3	43.2	193.3	6.0
Purse seine	8.5	2.0	84.7	382.5	5.0
Bagnet	1.4	1.6	21.9	179.0	11.2
Ringnet	1.7	1.0	9.2	64.6	9.4
Beach seine	1.0	1.0	6.3	127.5	13.0
Encircling gillnet	2.0	1.0	8.4	16.0	4.0
B. Regional comparison					
Region					
NCR	3.7	2.7	61.3	290.0	4.7
Municipal	-	-	-	-	-
Commercial	3.7	2.7	61.3	290.0	4.7
Region IV	2.3	1.8	7.1	79.0	10.0
Municipal	2.6	1.4	1.5	36	8.7
Commercial	1.7	2	24.1	208.3	14
Region V	1.5	1.0	0.8	16.0	4.0
Municipal	1	1	0.8	16	4
Commercial	2	1	-	16	4
Region VI	1.8	1.8	16.3	109.8	7.2
Municipal	1	1	2.8	58.6	7.3
Commercial	4.5	4.5	57.4	237.5	7
Region VII	3.0	1.0	10.7	52.8	13.8
Municipal	2	1	0.6	10	13
Commercial	3.2	1	13.1	63.5	14
Region IX	1.0	1.0	9.5	79.2	7.1
Municipal	-	-	-	-	-
Commercial	1.0	1.0	9.5	79.2	7.1

Additional information pertaining to assets is the age and mode of acquisition. The fish corrals, trawlers and purse seines sampled are relatively new, with ages ranging from 4 to 6 years. The oldest gears in the municipal sector are the round haul seines while in the commercial sector bagnets, beach seines and ringnets are the oldest. Ringnets from Region VII have an average age of 14 years, with the oldest being 24 years, while those from Region IX, have an average age of 7 years.

The survey showed that 30% of commercial vessels, notably trawlers and purse seiners, acquired their assets through formal credit lines. Ringnets, however were either purchased using personal savings and/or were constructed by their owners. Most municipal gears were bought using savings, and in some cases, built by the owner. All fish corrals, owing to the nature of the gear, were constructed.

The small number and distribution of sampling units among regions precluded an exhaustive comparison of gear performance. Nonetheless, some characteristics could be derived from the sample. We noted that vessels with a larger capacity (number and size of boats and nets and engine horsepower) came from the National Capital Region (NCR); these vessels were also relatively new (5 years). Ringnets were sampled from Regions IX and VII with the latter accounting for the larger (and older) ringnets in the sample.

Gear Operation

Parallel to the asset index is the gear operation index (Table 4.2) which summarizes key indicators of fishing operation, notably, distance from port, number of hours per trip, number of days allotted for repair and number of days without fishing.

There is a large discrepancy observed across gears as to the maximum distance travelled. The sectoral average for distance travelled is 112 km for commercial vessels while that for municipal vessels is 18 km. Commercial vessels generally reach more distant areas. Trawlers and purse seiners operating in the NCR, for example, reach as far as Palawan (over 700 km) while bagnets, specifically those operating in the Tayabas Bay area (Region IV), go as far as 200 km offshore. It is quite noticeable, however, that municipal vessels such as those mentioned travel as far as 60 km from their home port. Surface gillnets and round haul seines, which both fish in Tayabas Bay, travel the longest distance among municipal gears.

Commercial vessels, particularly purse seines and trawls, with their carrier vessels are able to stay at the fishing ground and to operate continuously for extended periods of time. For example, one of the purse seiners reportedly fished continuously for 18 months. However, its carrier vessel returned to port every 23 days which is still and by far, the longest number of days at sea for any vessel. For the smaller vessels, trip duration is constrained by the amount of provisions that can be taken aboard, their limited capability in preserving catch, and the relatively shorter distance their boats can reach safely.

Some gears, i.e., fish corral and beach seine, are shore-based and thus the distance and number of fishing hours reflected in Table 4.2 are relatively low.

Number of days spent for repair are distributed quite evenly among all gears; even the sectoral averages show no significant difference. Fish corrals allot the highest number of days for regular repair of nets and bamboo posts, one reason for the advantage of nearshore operations. The other gears are repaired when necessary (as in surface gillnets) which is most likely a function of their age.

Nonfishing days include those allotted for repair of boat and gear and major weather disturbances. During the four-week sampling period, there was at least one week, which coincided with the full moon, in which most vessels were inactive. It was observed that among the gears surveyed, surface gillnets went out fishing for the least number of days, i.e., 5 days out of a maximum of 28 days, during the sampling period, due to the scarcity of fish.

On a regional basis, the average distance covered and number of fishing hours is highest in the NCR, which has the biggest boats in the sample. Region IV, which, like Region VI, had a fair sampling of both categories of gears, showed a significant difference with respect to distance travelled. However, commercial vessels operating in the same Region, which include bagnets, sailed less often than the municipal vessels.

The measure for actual number of trips, which is lowest in the NCR, appears to be inconsistent with the size of assets and operation of gears in the region, because it is being compared with day-trips (or trips that last for 15 hours or less) of other gears, al-

Table 4.2. Average indicators of fishing operation of small pelagic gears sampled from Regions IV, V, VI, VII, IX and National Capital Region (NCR), by gear type, sector and region, March-April 1988.

	Distance from port	Manpower	No. of hours per trip	No. of days repair	Nonfishing days	Actual no. of trips
A. Intergear comparison						
Municipal	**17.5**	**9.5**	**10.3**	**28.6**	**4.8**	**14.5**
Surface gillnet	26.8	2.9	12.7	-	6.7	4.3
Fish corral	2.8	3.7	2.4	43.0	3.0	17.5
Drive-in net	12.0	8.0	11.0	36.0	4.0	15.0
Round haul seine	28.3	23.3	15.0	35.3	5.3	21.3
Commercial	**93.0**	**23.9**	**115.1**	**31.1**	**8.8**	**6.8**
Trawl	293.0	12.7	188.0	34.3	24.6	3.0
Purse seine	149.0	67.0	456.0	37.0	0.0	1.0
Bagnet	91.4	20.2	18.4	17.0	6.4	12.6
Ringnet	21.6	17.9	9.0	32.3	5.6	9.8
Beach seine	3.0	17.5	7.0	30.0	8.5	4.5
Encircling gillnet	-	8.0	12.0	36.0	8.0	10.0
B. Regional comparison						
Region						
NCR	320.3	22.0	252.0	49.7	20.0	2.3
Municipal	-	-	-	-	-	-
Commercial	320.3	22.0	252.0	49.7	20.0	2.3
Region IV	82.8	16.4	13.1	13.2	7.6	12.8
Municipal	27.3	9.8	14.3	26.4	6.4	10.2
Commercial	138.3	23.0	12.0	0.0	8.7	15.3
Region V	-	5.0	8.7	21.5	6.5	6.0
Municipal	-	2.0	5.5	7.0	5.0	2.0
Commercial	-	8.0	12.0	36.0	8.0	10.0
Region VI	55.9	15.7	181.9	26.4	5.9	7.6
Municipal	2.9	3.7	3.9	38.8	4.8	13.2
Commercial	109.0	27.7	360.0	14.0	7.0	2.0
Region VII	20.1	18.4	8.5	36.0	4.4	17.6
Municipal	12.0	8.0	11.0	36.0	4.0	15.0
Commercial	28.2	28.7	6.0	36.0	4.7	20.2
Region IX	18.9	13.2	14.0	32.9	5.4	5.4
Municipal	-	-	-	-	-	-
Commercial	18.9	13.2	14.0	32.9	5.4	5.4

though a trip, especially those of purse seiners and trawlers, may actually take from three to 23 days.

Crew

Crew size depends on the type of gear used although there are intragear differences for the same reason that there are differences in asset ownership and operation. On the average, each gear in the commercial sector requires a crew complement of 23 people while an average of 9 persons is required in the municipal sector. Crew size is positively related to the number and size of boats in the fleet. This is the case for both purse seine and round haul seine which use the most number of fishing boats in the commercial and municipal sector, respectively.

The responsibilities of the crew members are more or less defined in commercial fishing units. The positions are captain, master fisher, engineer, mechanic/machinist, "engineman", storage keeper, "lightman", "skiffman" and ordinary fisher. The last group comprises about 30% of the total crew and may perform tasks such as cooking, nethauling, and other minor but tedious jobs during a fishing operation. Rather rigid role definitions are likewise established in round haul seine operations although it is a municipal gear. Where there is a complement of only two persons, as in surface gillnets, or four, as in the case of fish corrals, one functions as a captain while the rest are ordinary fishers.

Crews of ringnets operating in the Sulu Sea range from 11 to 15 (Region IX) while those operating in the Camotes and Visayan Seas (Region VII) average 30. This is consistent with the fact that ringnets from Region VII are significantly larger, averaging 13 t, whereas those of Region IX average 7.3 t. The average number of crew members is again highest in the NCR although averages from all other regions, which range from 13 to 18, show little variance.

The survey also collected information on alternative sources of employment and/or likely ventures for those who are willing to give up fishing. These included trading, farming, aquaculture, and employment in the service sector, i.e., stevedoring, driving and mechanic work. More than 52% of respondents in the municipal and commercial sectors desire to engage in business, 32% in the service sector and the remaining in farming and aquaculture. Of the total, 30% estimate they will earn more in alternative employment while the remaining percentage is divided equally among those who will definitely earn less and those who are not sure.

Technical Efficiency

Since each fishing gear represents a particular level of technology, an interesting feature of intergear, intersectoral, and interregional comparison is their effectiveness in catching fish. Catching efficiency is usually expressed as a ratio of catch to fishing effort. Three indicators of fishing effort have been chosen: 1) total fisher-hours 2) vessel-tonne-days; and 3) adjusted horsepower-days. These indicators were chosen such that differences in catching efficiency resulting from inherent biases among gears are evened out.

The three indicators provide an aggregate measure of the elements of time, distance, crew size, engine power and overall vessel capacity which affect technical efficiency. There are other measurable variables such as age, years of fishing experience, and years of formal education of the fishers which have been used in estimating production functions (Kurien and Willman 1982; Smith and Mines 1982; Panayotou and Jetanavanich 1987). However, these are not incorporated in this study for lack of suitable data.

The first indicator, total person-hours, is estimated by multiplying crew size with number of hours per trip. For some gears, notably trawlers and purse seiners, an estimate of the fishing hours is provided; this was used in lieu of hours per trip. The second indicator, vessel-tonne-days is estimated by multiplying vessel tonnage with the number of boats per gear. The last indicator considers engine horsepower of all boats and converts each person-day (number of crew multiplied by number of days per trip) to its horsepower equivalent of 0.18 hp (Dalzell et al. 1987)[1]. Total adjusted horsepower is then multiplied by the actual number of fishing days. The efficiency ratios are then computed by dividing average catch per trip by these measures of effort.

Table 4.3. Technical efficiency parameters estimated for small pelagic gears sampled from Regions IV, V, VI, VII, IX and National Capital Region (NCR) by gear type, sector and region, March-April 1988.

	Catch/ fisher-hour	Catch/ vessel tonne-day	Catch/ adjusted hp-day
A. Intergear comparison			
Municipal	1.2	13.0	1.5
Surface gillnet	0.5	12.0	1.0
Fish corral	3.3	25.6	2.2
Drive-in net	0.5	10.8	2.1
Round haul seine	0.3	3.5	0.6
Commercial	2.0	16.4	8.0
Trawl	1.1	11.3	15.2
Purse seine	1.3	9.0	10.2
Bagnet	0.8	1.8	2.9
Ringnet	5.4	34.0	12.3
Beach seine	1.8	35.7	1.1
Encircling gillnet	1.7	6.8	6.1
B. Regional comparison			
Region			
NCR	3.0	11.4	42.7
Municipal	-	-	-
Commercial	3.0	11.4	42.7
Region IV	0.3	4.3	0.6
Municipal	0.4	8.3	1.0
Commercial	0.1	0.2	0.2
Region V	1.5	12.5	5.2
Municipal	0.7	19.2	0.5
Commercial	2.4	5.8	9.8
Region VI	2.5	22.7	6.1
Municipal	3.6	25.6	2.1
Commercial	1.4	19.8	10.1
Region VII	3.2	12.8	8.6
Municipal	0.5	10.7	2.1
Commercial	5.8	14.8	15.1
Region IX	4.6	39.2	9.8
Municipal	-	-	-
Commercial	4.6	39.2	9.8

The technical efficiency indicators of small pelagic gears are presented in Table 4.3 by gear type, by sector and by region. The sectoral averages indicate that commercial gears are more technically efficient than municipal gears using the three parameters. Ringnets and fish corrals are the most efficient users of labor and vessel power in the commercial and municipal sector, respectively; trawlers are the most efficient users of person and machine power.

[1]The use of horsepower as a standard of effort is discussed more extensively in Chapter 5 in which the cost curve is estimated.

Chapter 5

COST STRUCTURE AND PROFITABILITY

Introduction

Beyond the technological characterization of the small pelagics fishery is an equally important input to fisheries management — economic analysis. At this level, we "simplify" the analysis by converting variables previously discussed (assets, operational regimes, technical efficiency) into a single comparable numeraire — its peso value. We utilize basic concepts in microtheory such as prices of inputs and outputs and the resulting costs and revenue structure per fishing unit to arrive at parameters which can serve as basis for policy recommendations.

Among the many objectives of fisheries management, we zero in on the twin objectives of efficiency and equity. The former is achieved when all factors of production (labor and capital) are used most efficiently, i.e., net of opportunity costs (Anderson 1986; Panayotou and Jetanavanich 1987). Indicators of economic efficiency are profitability and productivity parameters which were derived for all gears. Likewise the analysis of resource rents determines the efficiency of use of labor and capital.

Equity objectives maintain that aside from increases in income, the distribution of benefits should be fair (Ray 1984). Here, we take into consideration the measure of producers' surplus, i.e., net economic benefits earned by the owners of factors of production, labor and entrepreneurs.

Cost Structure

Investment

Capital investment is usually valued as acquisition cost but in cases where the assets are not brand new, as in the small pelagic gears sampled, replacement cost is used as substitute.

Surface gillnets, fish corrals and drive-in nets which have smaller boats and engines and simpler modes of operation have an estimated average investment of P30,000 while the level of investment for round haul seines, also in the municipal category, is P270,000 (mainly because round haul seines consist of at least five boats (Table 5.1)). For the commercial sector, investment average is P2.9 million, 30 times more than that of the municipal sector. This is due primarily to the purse seines for which total investment cost amounts to P16 million. Trawlers rank next to purse seines in terms of investment cost with an average of P858,000.

Table 5.1 shows the breakdown of investment cost into several components, namely boat, engine, net and others. The last item includes, for municipal gears, tubs, flashlights

Table 5.1. Investment costs and percentage contribution of major assets of small pelagic gears, March-April 1988.

Gear	Average capital investment (P)	% Contribution of Boats	Engine	Nets	Others
Municipal	**90,006**	**30**	**18**	**49**	**3**
Surface gillnet	28,682	30	32	31	7
Round haul seine	270,303	68	10	20	2
Fish corral	30,780	8	11	78	2
Drive-in net	30,260	13	20	66	1
Commercial	**2,933,132**	**46**	**16**	**32**	**6**
Trawl	858,133	56	17	14	14
Purse seine	16,074,300	60	18	10	11
Bagnet	400,844	53	15	30	2
Ringnet	162,451	43	21	32	4
Beach seine	47,904	39	5	49	7
Encircling gillnet	55,160	24	22	54	0

and baskets, and for commercial gears, generators, radios, and echo-sounders. The obvious disparity in the type and costs of these miscellaneous assets explains why this component accounted for only 3% in the municipal sector *vis-à-vis* 6% in the commercial sector. While nets constitute the most important investment item in the municipal sector, accounting for an average of 49% of total investment costs, boats comprise the most important investment component in the commercial sector, accounting for an average of 46%.

Fish corrals and drive-in nets, for which nets account for 78% and 66% of total investment, respectively, depend primarily on the effectivity of the net rather than on the boat, whereas the catching efficiency of gears such as purse seines and trawlers is highly dependent on the design and size of the boat and of other implements used to detect fish, such as echo-sounders for purse seiners.

Operating costs

Operating cost per month is based on operating cost per trip multiplied by the estimated number of trips per month, the latter being based on the average trips taken during the survey and the average trips for the rest of the year in order to account for seasonal factors.

Operating costs are classified as fixed or variable. Fixed costs include depreciation, licenses, insurance, repairs and salaries. These were provided on an annual basis and adjusted to their monthly equivalent. Variable costs were estimated using quantity consumed multiplied by price per unit. This was done for material expenses such as gas, oil, kerosene, ice, salt, food and cigarettes, of which prices and quantities were provided for every trip. Shore and marketing expenses which include broker's fee, wharfage, and landing fees and wages (other than fixed salaries which were provided on an annual basis) were likewise provided per trip. Brokers' and landing fees were computed based on percentages of catch value with the rates being provided by the respondents.

Operating costs reflect the mode and intensity of fishing operations and the amount of capital invested. On the average, a municipal gear needs P12,734 per month as compared to a commercial gear which needs P176,054 for the same month (Table 5.2). It is cheapest to operate the fish corral, P4,172/month, as against a purse seine, P697,900/ month. Aside from trawlers which operate at an average cost of P270,357/month, the rest of the gears fall within two ranges: P1,000-15,000, which includes all municipal gears except for round haul seines, the latter falling within the next range, P15,000-50,000 which also includes bagnets and ringnets.

Table 5.2. Average monthly fixed and variable costs (in pesos) of small pelagic gears, March-April 1988.

Gear	Total cost	Variable cost	Running cost	Shore & mktg	Repairs & maintenance	Fixed cost	Depc'n	Interest	Fixed salary	Fees & licenses	Fringe benefits
Commercial	**176,054**	**129,798**	**97,150**	**21,468**	**11,180**	**46,256**	**26,933**	**28**	**17,405**	**1,584**	**307**
Trawler	270,357	240,651	209,059	25,134	6,458	29,706	18,319	0	8,460	2,320	608
Purse seine	697,900	458,782	315,245	92,495	51,042	239,118	135,363	0	95,562	6,960	1,233
Bagnet	47,966	43,144	34,788	2,848	5,508	4,821	4,430	167	100	125	0
Ringnet	18,542	15,714	8,516	4,478	2,720	2,828	2,439	0	308	81	0
Beach seine	8,360	7,563	5,819	1,010	733	797	797	0	0	0	0
Encircling gillnet	13,198	12,932	9,472	2,843	618	266	248	0	0	18	0
Municipal	**12,734**	**11,188**	**9,137**	**575**	**1,476**	**1,546**	**1,213**	**14**	**309**	**10**	**1**
Surface gillnet	2,899	2,642	2,227	263	152	258	245	0	0	12	0
Round haul	33,562	30,584	25,599	624	4,361	2,978	2,952	0	0	26	0
Fish corral	4,172	1,822	487	511	824	2,350	1,055	56	1,235	3	3
Drive-in net	10,303	9,703	8,235	902	567	600	600	0	0	0	0

Variable costs, which consist of running costs, shore and marketing expense and repairs and maintenance, account for more than 80% of operating costs in both sectors. The largest component of running cost is fuel (gasoline, kerosene and oil), which accounts for an average of 69% across all gears. Table 5.3 shows that purse seines are the largest consumers of fuel and oil while fish corrals are least dependent on them. The use of kerosene is highest for surface gillnets, round haul seines, ringnets and bagnets which operate at night and for relatively longer fishing hours and which use kerosene lamps to light up their fish aggregating devices.

Other than hydrocarbons, ice, salt and food for the crew constitute the remaining portion of running expense. Beach seines, encircling gillnets, fish corrals and drive-in nets, gears which relatively have shorter trips do not require ice and salt. Gears including trawlers, purse seines, bagnets and round haul seines use at least 20% of running cost for this item. Food allowance is most prominent in the operation of purse seines, which not only have the largest crew but also the longest trip duration.

Table 5.3. Average consumption of petroleum products, ice and salt by small pelagic gears, per trip, March-April 1988.

Gear	Fuel (liter)	Oil (liter)	Kerosene (liter)	Ice (block)	Salt (sack)
Purse seine	80,300	3,568	-	989	-
Trawl	7,168	83	0	419	0.9
Bagnet	130	2	1.2	2.8	-
Ringnet	40	2.3	20.5	3.5	-
Beach seine	41	1.3	-	-	-
Encircling gillnet	52	2	4	-	-
Round haul seine	68	0.6	37.3	3.3	-
Surface gillnet	14	0.7	5	0.2	-
Fish corral	2	0	0	0	-
Drive-in net	40	2	0	0.3	-

Shore and marketing expense is generally higher among commercial gears but is highest for ringnets and fish corrals. Trawlers, bagnets and round haul seines use from 2 to 10% of variable costs for marketing. Average repairs and maintenance expense is 10% in the commercial sector and 18% in the municipal sector. This item is perhaps as expected, more prominent in fish corrals than in any other gear. In the commercial sector, repairs are more prominent among ringnets and bagnets, although to a lesser degree. This is more likely traced to the relative age of bagnets and ringnets, the latter specifically referring to those from Region VII.

Salaries represent an average of 13% of fixed costs but this applies only to fish corrals for which 53% of fixed cost consist of salaries. Only surface gillnets entail interest payment but it is nevertheless a minimal amount. Fees and licenses are paid for surface gillnets and round haul seines at rates equal to 5% and 1%, respectively. No municipal gear pays out fringe benefits to crew members.

The contribution of fixed costs to total operating costs is higher in the commercial sector with depreciation and salaries accounting for 82% and 14% of total fixed costs, respectively. The single most expensive cost item for purse seines is labor (40%). The wage arrangement is such that crew members receive a fixed monthly salary, depending on rank, in addition to share of catch. All commercial gear operators except for beach seines and encircling gillnets pay fixed salaries. All commercial gears have some form of license or permit except for beach seines. Only bagnets involve interest payments while only trawler and purse seine operators pay additional fringe benefits.

A comparison of the unit prices of material inputs (fuel, ice and food) and that of brokers' commission results in the following (Table 5.4):

i. Municipal gears use regular gasoline whereas commercial gears use diesel fuel, with average price at P7.32/l or P6.62/l, respectively. Regulated pump prices of regular and diesel fuel in March 1988 were P7.15/l and P5.25/l, respectively (data courtesy of Filipinas Shell). The relative contribution of value-added tax is 45% in the case of regular gasoline and 21% in the case of diesel. This can be viewed as an indirect subsidy to the commercial sector or indirect taxation of the municipal sector, a problem also noted elsewhere (Smith and Mines 1982).

ii. While the price of lubricant is pegged at P28.22/l, it costs commercial gears, which have relatively more use for lubricants, an average of P29.92 as opposed to P30.90 for the municipal sector. The situation is reversed in the case of kerosene which is used more heavily in the municipal sector. The pump price of kerosene is set at P5.30/l, with municipal gear operators paying an average of P5.13/l and commercial gear operators paying P6.09.

iii. The differences in price of petroleum products, despite their regulation by a national government board, imply the existence of a secondary market for gasoline and diesel fuel, which, as in the case of the San Miguel Bay fisheries, is controlled by fish processors (Tulay and Smith 1982; Yater 1982). This secondary market permits the interplay of market forces to prevail such that sectoral prices tend to fluctuate depending on the demand for the product and the scale with which individual gears operate.

iv. The rates charged by brokers as percentage of catch value range from 5 to 10%. Catches from beach seines, surface gillnets and round haul seines are charged a uniform rate of 7% while no consistent pattern emerges with the other gears. Regional comparisons show that the lowest rate is in Region V at 5% (but note that there is only 1 sample) while in Region VII, the charge is 6%; Region IX has the highest rate (9%), mainly because operators of 7 out of 10 gears (mostly ringnets) pay 10% to their brokers. In Regions IV and VI, a uniform rate of 7% is paid, which applies to both the municipal and commercial sectors.

Table 5.4. Average unit prices of major operating items of small pelagic gears, March-April 1988.

	Food allowance (P/crew/trip)	Permit (P/year)	Broker's commission (%)	Gas (P/liter)	Oil (P/liter)	Kerosene (P/liter)	Ice (P/block)
GEAR							
Municipal	**5**	**152**	**7**	**7.32**	**30.90**	**5.13**	**40.15**
Surface gillnet	11	173	7	7.19	31.58	5.36	10.30
Fish corral	2	120	9	7.60	31.00	-	-
Drive-in net	5	-	5	7.10	31.00	-	-
Round haul seine	4	316	7	7.38	30.00	4.90	70.00
Commercial	**86**	**22,807**	**7**	**6.62**	**29.92**	**6.09**	**56.08**
Trawl	209	27,843	6	5.20	29.83	6.20	65.83
Purse seine	275	83,514	7	5.29	28.25	6.90	69.50
Bagnet	14	1,498	8	8.69	30.25	5.56	59.00
Ringnet	8	969	8	5.45	30.67	5.70	30.00
Beach seine	1	-	7	7.60	31.00	-	-
Encircling gillnet	10	210	5	7.50	29.50	-	-
REGION							
NCR	253	30,043	6	5.17	26.67	6.43	57.33
Municipal	-	-	-	-	-	-	-
Commercial	253	30,043	6	5.17	26.67	6.43	57.33
Region IV	9	953	7	8.19	30.83	5.37	76.97
Municipal	8	239	7	7.25	31.25	5.19	93.94
Commercial	10	1,667	7	9.13	30.42	5.56	60.00
Region V	13	139	6	7.40	29.50	-	-
Municipal	15	67	7	7.30	29.50	-	-
Commercial	10	210	5	7.50	29.50	-	-
Region VI	53	20,114	9	7.03	31.50	-	20.56
Municipal	1	120	11	7.60	31.00	-	-
Commercial	105	40,107	7	6.47	32.00	-	41.13
Region VII	4	1,359	6	6.39	31.50	2.85	-
Municipal	5	-	5	7.10	31.00	-	-
Commercial	3	1,359	6	5.68	32.00	5.69	-
Region IX	12	868	9	5.87	30.00	3.98	26.50
Municipal	-	-	-	-	-	-	-
Commercial	12	868	9	5.87	30.00	3.98	26.50

v. No clear pattern emerges as to which gear or region provides the highest food allowance. This is also true for permits and licenses although it is clear that the municipal fishers pay less than commercial fishers down to nothing, as in the case of surface gillnets and fish corrals.

Catch and Prices

Catch and species composition

Monthly catch rates were derived from a monthly series of catch data collected by the project's biological team from February 1987 to March 1988 (Corpuz and Dalzell 1988).

Catch per trip was estimated by dividing average monthly catch rates by the estimated number of trips per month (as in operating cost).

Monthly estimates of catch and species composition are presented in Table 5.5. There is considerable variance between catch rates within sectors and even among the same gear types. For example, monthly catch estimates for surface gillnets ranged from 76 kg to 952 kg whereas for the three trawlers sampled it was from 8,600 to 86,000 kg.

Table 5.5. Average monthly catch rates and species composition of small pelagic gears, February 1987-March 1988.

Gear	Average catch/unit ($kg \cdot month^{-1}$)	Species composition (%)						
		Round-scads	Anchovies	Sardines	Mackerels	Big-eye scads	Other pelagics	Other species
Municipal	**1,341**	**-**	**18**	**11**	**15**	**-**	**29**	**27**
Surface gillnet	445	1	26	21	29	2	15	7
Round haul seine	2,486	-	41	13	30	-	-	16
Fish corral	745	-	7	8	1	-	-	84
Drive-in net	1,687	-	-	-	-	-	100	-
Commercial	**13,733**	**19**	**7**	**42**	**6**	**1**	**3**	**22**
Trawl	23,332	-	5	-	-	-	9	86
Purse seine	22,449	71	-	4	4	7	1	13
Bagnet	5,344	-	5	65	5	-	4	21
Ringnet	23,343	42	-	17	28	1	1	12
Beach seine	4,057	-	31	69	-	-	-	-
Encircling gillnet	3,874	-	-	100	-	-	-	-

Roundscads are primarily caught using commercial gears such as purse seines and ringnets. Anchovies and sardines are caught by surface gillnets and round haul seines and in the commercial sector by bagnets and beach seines. Drive-in nets and encircling gillnets, both lone sample points, are specialized gears that target flying fish and sardines, respectively. More than 80% of the catch of fish corrals and trawlers are demersal species such as slipmouths, pomfrets, other fishes and squids. In the commercial sector, this consists mainly of catch of bottom trawlers, which includes lizard fish, threadfin bream, slipmouths and other bottom-dwelling fishes. All entries in survey forms which were marked "mixed species" have been incorporated in this species group, i.e., "Other Species".

Regional productivity, seasonality of production and dominant gears exploiting major species are summarized in Table 5.6. The estimate of landings from the NCR (Navotas Fish Landing Complex) do not represent the productivity of the Manila Bay waters but the landings of commercial vessels from all over the Philippines.

Prices

Ex-vessel prices were provided by the survey respondents. Weighted price was then estimated based on recorded unit price and percentage contribution of weight per species groups in relation to total volume of catch (Table 5.7). The ex-vessel price averages of the four more important small pelagic species groups appear to be consistent with the whole-sale prices as recorded by the Bureau of Agricultural Statistics. Anchovies are the cheapest small pelagics, followed by sardines, roundscads and mackerels. Prices for all four species groups are notably cheaper in Region IX and relatively more expensive in Regions IV and VI. In Region VI, where both municipal and commercial sectors are repre-

Table 5.6. Major small pelagic species principal gears and peak production months, 1980-86.

Species name	Peak month	Principal gears
Roundscads	March - May	Bagnet, purse seine, ringnet
Sardines	June - Dec.	Gillnet, beach seine, bagnet, purse seine, ringnet
Fusiliers	March, Oct	Handline, muro-ami
Anchovies	Sept, Oct, Jan	Round haul seine, bagnet, fish corral, beach seine
Round herring	June - Oct	Gillnet, round haul seine
Indo-Pacific mackerel	June, Oct	Gillnet
		Purse seine
Indian mackerel	March - June	Gillnet
		Purse seine

Table 5.7. Weighted ex-vessel price of major small pelagic species, by region, March-April 1988; wholesale price is annual average for 1988.

	Weighted price (₱/kg)						
Region	Round-scads	Anchovies	Sardines	Mackerels	Big-eye scads	Other pelagics	Other species[3]
NCR	11.60	3.66	-	-	16.1	14.65	13.30
Municipal	-	-	-	-	-	-	-
Commercial	11.60	3.66	-	-	16.1	14.65	13.30
Region IV	21.00	13.19	16.61	24.18	-	0.10	0.43
Municipal	21.00	13.19	16.61	23.04	-	10.50	21.39
Commercial	-	-	-	25.32	-	10.20	14.48
Region V	-	-	6.79	17.00	-	-	13.00
Municipal	-	-	-	17.00	-	-	13.00
Commercial	-	-	6.79	-	-	-	-
Region VI	14.08	13.05	13.81	13.29	-	14.08	14.13
Municipal	-	13.19	14.00	12.50	-	-	14.29
Commercial	14.08	12.90	13.62	14.08	-	14.08	13.96
Region VII	-	-	5.00	8.41	-	10.55	6.20
Municipal	-	-	-	-	-	10.55	-
Commercial	-	-	5.00	8.41	-	-	6.20
Region IX	5.05	5.80	3.84	3.40	5.80	5.22	4.93
Municipal	-	-	-	-	-	-	-
Commercial	5.05	5.80	3.84	3.40	5.80	5.22	4.93
Average[1]	12.93	8.92	9.21	13.26	10.95	8.92	8.66
Wholesale price[2]	13.98	10.72	12.11	18.50			

[1]Weighted average ex-vessel price
[2]Source: Bureau of Agriculture Statistics.
[3]Includes demersals and squids.

sented, no evident pattern is seen as to the price received by these two sectors; this is consistent with what respondents say about the "quality of fish" being the primary concern of brokers when pricing fish.

Analysis of the estimated price for the "other pelagics" and "other species" category is inconclusive because many species of varying price range were included in this group.

Sharing Arrangements

Sharing systems show the allocation of expenses, earnings and risk between the owners of factors of production, i.e., labor and capital. Four types of sharing systems are observed in the small pelagics fishery: fixed-wage system, share system, fixed minimum plus share and a fixed minimum plus incentive. In the fixed-wage system, fishers are given a fixed amount on a daily or monthly basis thereby assuring the crew of a steady income regardless of catch levels or whether the fishing unit operates or not. The last two are variations of the fixed and sharing system.

The sharing system is the most common arrangement in the fishery. Trawler and purse seiner owners administer a fixed salary plus a certain share of total catch; for fish corrals there is a minimum salary plus incentive, whereas for the rest there is a full share system. Fish corral operators, like all commercial gear owners pay their crew in cash and kind whereas in all municipal gears crew are paid in cash. No evident pattern is established as to the frequency of payment.

Three types of sharing arrangements have been identified in the survey questionnaire: 1) catch value minus all running expenses is divided between owners and crew; 2) catch value is divided between owners and crew; and 3) fixed salaries for crew members. This arrangement as opposed to the sharing system earlier presented defines the actual administration and sharing of costs and benefits between the owner(s) and the crew members. The first option is the most commonly practiced although there are operators who give fixed salary in addition to a share of divisible earnings. With the share system, variable costs are usually deducted from total revenue, the residual (divisible earnings) being divided between the owner and crew. Payments for insurance, licenses and permits and other fixed expenses are usually shouldered by the owner.

The 50-50 arrangement is most common except for fish corrals (see Table 5.8). The total crew share is then divided among the crew members, with the more skilled senior member receiving a larger portion of total share. A common practice among boat owners is the granting of incentives to crew members with special skills, e.g., masterfisher or captain, mechanic, engineer, diver, etc. which is on top of fixed salary and share payment. The incentive is an additional share payment that is given when a quota, measured either in terms of quantity or value of catch, is reached.

Profitability and Efficiency Parameters

Profitability indicators focus on the significance of the margin between revenues and cost (profit) and determine the short- and/or long-run viability of the operation. Profitability is examined from two points of view: that of the fishing enterprise (financial profitability) and that of society via the owners of factors of production, i.e., entrepreneurs and laborers. Efficiency indicators measure the productivity of specific factors of production such as labor, capital and raw materials.

Table 5.8 Share system, mode and frequency of payment, and allocation to owners and crew, by gear, sector and region.

	Share system	Mode of payment	Frequency	% for Owners	% for Crew
GEAR					
Municipal					
Surface gill net	fixed minimum + share	cash	monthly	50	50
Round haul seine	fixed minimum + share	cash	monthly	50	50
Fish corral	full share	cash & kind	weekly	88	12
Drive-in net	fixed minimum + share	cash	per trip	50	50
Commercial					
Trawl	fixed salary	cash & kind	per trip	n.a.	n.a.
Purse seine	fixed salary	cash & kind	combination	n.a.	n.a.
Bagnet	fixed minimum + share	cash & kind	combination	42	58
Ringnet	fixed minimum + share	cash & kind	monthly	50	50
Beach seine	fixed minimum + share	cash & kind	per trip	20	80
Encircling gillnet	fixed minimum + share	cash & kind	weekly	50	50
REGION					
NCR					
Municipal	-	-	-	-	-
Commercial	fixed salary	cash & kind	per trip	n.a.	n.a.
Region IV					
Municipal	fixed minimum + share	cash	monthly	50	50
Commercial	fixed salary + share	cash & kind	combination	30	70
Region V					
Municipal	fixed minimum + share	cash	per trip	50	50
Commercial	fixed minimum + share	cash	weekly	50	50
Region VI					
Municipal	full share	cash & kind	weekly	88	12
Commercial	fixed salary + share	cash & kind	per trip	20	800
Region VII					
Municipal	fixed minimum + share	cash	per trip	50	50
Commercial	fixed minimum + share	cash & kind	monthly	46	4,500
Region IX					
Municipal	-	-	-	-	-
Commercial	fixed minimum + share	cash & kind	monthly	54	53

The profitability measures used include: gross profit, net profit, operating ratio and returns on investment (ROI). Gross profit is the difference between total catch value and variable costs (return above variable cost), while fixed costs are incorporated in the estimation of net profits. Catch value was derived from monthly catches multiplied by percentage average species composition and average prices. Gross profits provide an indication of the short-run viability of the enterprise whereas net profits indicate long-run viability.

Table 5.9 shows that on the average, municipal and commercial gears earn positive gross profits although net profits are negative in the commercial sector. The latter is due mainly to the high level of fixed costs associated with depreciation and interest payment. Round haul seines, trawlers and purse seines sustained losses because of high operating costs, i.e., fuel costs and labor. Ringnets, particularly those from Region IX, attained catch rates comparable to those of trawlers and purse seiners but maintained a lower level of operating cost, thus, resulting as the most profitable gear. The drive-in net is the most

Table 5.9. Average profitability indicators of small pelagic gears.

Gear	Gross profit (P/year)	Net profit (P/year)	Return on investment (%)	Operating ratio (%)
Municipal	**1,714**	**167**	**79**	**87**
Surface gillnet	1,982	1,724	72	146
Round haul seine	-5,182	-8,160	-36	-648
Fish corral	4,710	2,360	92	89
Drive-in net	5,345	4,745	188	193
Commercial	**15,995**	**-30,261**	**501**	**168**
Trawl	-37,747	-67,453	-94	-716
Purse seine	-188,034	-427,152	-32	-371
Bagnet	6,400	1,579	5	749
Ringnet	263,165	260,337	1,923	7
Beach seine	29,437	28,640	717	28
Encircling gillnet	22,748	22,482	489	58

profitable in the municipal sector but only weak inferences can be made because it is a single sample.

ROI, the ratio of net profit to total investment, provides a measure of the return to capital investment; its reciprocal, on the other hand, indicates the payback period. Ringnets and beach seines show high ROIs, i.e., a peso invested earns by a multiple of 19 and 7 times, respectively. Except for round haul seines, the municipal gears showed positive rates of return, albeit lower than the ROIs of the commercial sector.

The operating ratio is the ratio of operating costs to gross profits and as such provides a measure of cost efficiency. Sectoral averages show that the municipal sector is more cost efficient than the commercial sector, the latter being influenced by high operating ratios of trawlers, purse seines and bagnets.

The commercial sector uses both labor and capital more productively than the municipal sector (Table 5.10). The physical and monetary measures are consistent with the difference being accounted for by the average price per kg of fish caught by a specific gear. Round haul seines have the lowest labor productivity rates while ringnets and fish corrals have high labor productivity rates; this is consistent with the technical efficiency parameters (Table 4.3). Capital productivity is relatively higher in the commercial sector than in the municipal sector; however, capital productivity is lowest for trawlers and purse seines and is comparable to the municipal sector average.

Another measure of productivity is capital intensity. This is the ratio of capital invested per crew member. In a labor-surplus economy, capital intensity should be low. Such is the case for the small pelagics fishery, specifically that of the municipal sector which is characterized by low capital intensity (and low capital productivity). On the average, labor

Table 5.10. Average productivity indicators for small pelagic gears.

Gear	Labor productivity (k/person-hour)	Labor productivity (P/person-hour)	Capital productivity (k/P)	Capital productivity (P/invest)	Capital intensity (invest/ man-hour)	Sales/ Peso spent on fuel
Municipal	**1.41**	**12.74**	**0.32**	**2.96**	**5.01**	**8.40**
Surface gillnet	0.66	6.75	0.20	2.08	3.24	54.20
Round haul seine	0.29	2.96	0.11	1.15	2.58	48.90
Fish corral	3.79	33.30	0.30	2.59	12.90	435.50
Encircling gillnet	0.89	7.95	0.67	6.02	1.32	43.50
Commercial	**2.88**	**30.98**	**0.68**	**7.00**	**10.83**	**4.59**
Trawl	1.80	15.40	0.3	2.80	5.40	5.01
Purse seine	0.70	8.50	0.02	0.20	44.30	5.40
Bagnet	0.80	7.60	0.16	1.50	5.13	42.70
Ringnet	9.90	116.90	1.74	20.60	5.70	926.50
Beach seine	1.96	17.90	1.02	9.27	1.93	106.00
Drive-in net	2.12	19.60	0.84	7.60	2.52	89.80

productivity and capital intensity increase with scale of operation (Fig. 5.1). This relationship was also observed by Kurien and Willman (1982) in the Kerala fishery.

The profitability and productivity indicators used are static variables that are based on survey results at a particular point in time. Assuming that resource productivity remains stable, prospective investors can use the figures above as gauge for project planning. However, investment items (boat, gear, engine and equipment) and operational regimes must closely approximate the vessels used in the analysis. Note, however, that continuous exploitation, i.e., numbers and/or intensity of fishing effort, may cause the figures to decline further. In like manner, these results may not represent the situation 10 or 15 years ago, when investments for said vessels were made.

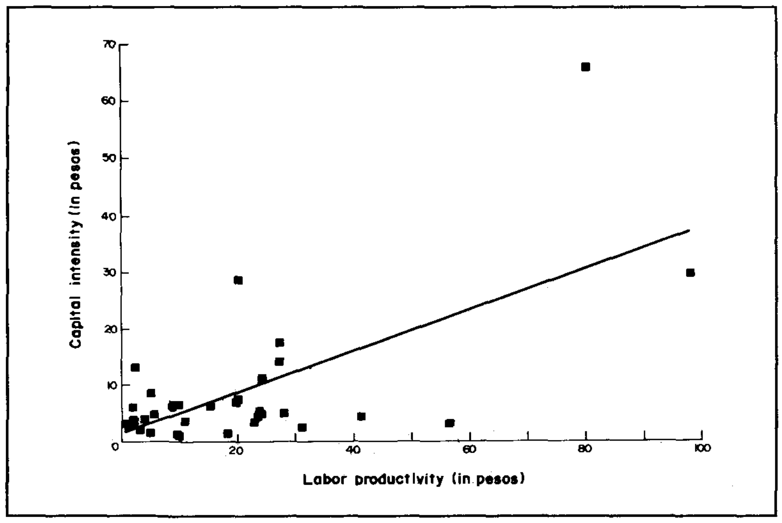


Fig. 5.1. Capital intensity of small pelagic gears as a function of labor productivity sampled from six Philippine regions from March to April 1988 (US$1 = ₱20)

Producers' Surplus and Resource Rents

The remaining sections deal with profitability from the social and economic viewpoint as opposed to an entrepreurial viewpoint. The critical distinction between the two approaches is explained by the concept of opportunity cost, which is used in estimating producers surplus, and marginal cost and revenue, which form the basis for estimating optimum resource rents. Producers' surplus and resource rent constitute two of three elements which comprise the maximum gain derived from exploiting a fishery (Turvey 1970). The third measure, consumer surplus, was not estimated here, for lack of information on demand.

Producers' surplus

Producers' surplus is estimated as returns above opportunity costs of owners and crew members, i.e., suppliers of capital and labor, respectively. The existence of pure profits is then investigated by subtracting the opportunity costs of capital and labor. These measures of profit can also be interpreted as "quasi rent" (Copes 1972) which accrues to factors of production other than the resource itself.

Returns to labor, capital and management are estimated by subtracting from the gross value of catch, common operating expenses (fuel products, hired labor, food and cigarettes, and marketing costs) (Fig. 5.2). The resulting value is then distributed to owner and crew depending on the sharing arrangement. Fixed costs and repairs are subtracted from the owner's share. Lastly, the opportunity cost of managerial labor and capital is subtracted. In this study, we considered opportunity cost of managerial labor to be zero because of the minimal time investment of the owners (especially in the commercial sector) and their involvement in other gainful activities. In the municipal sector, where the owners

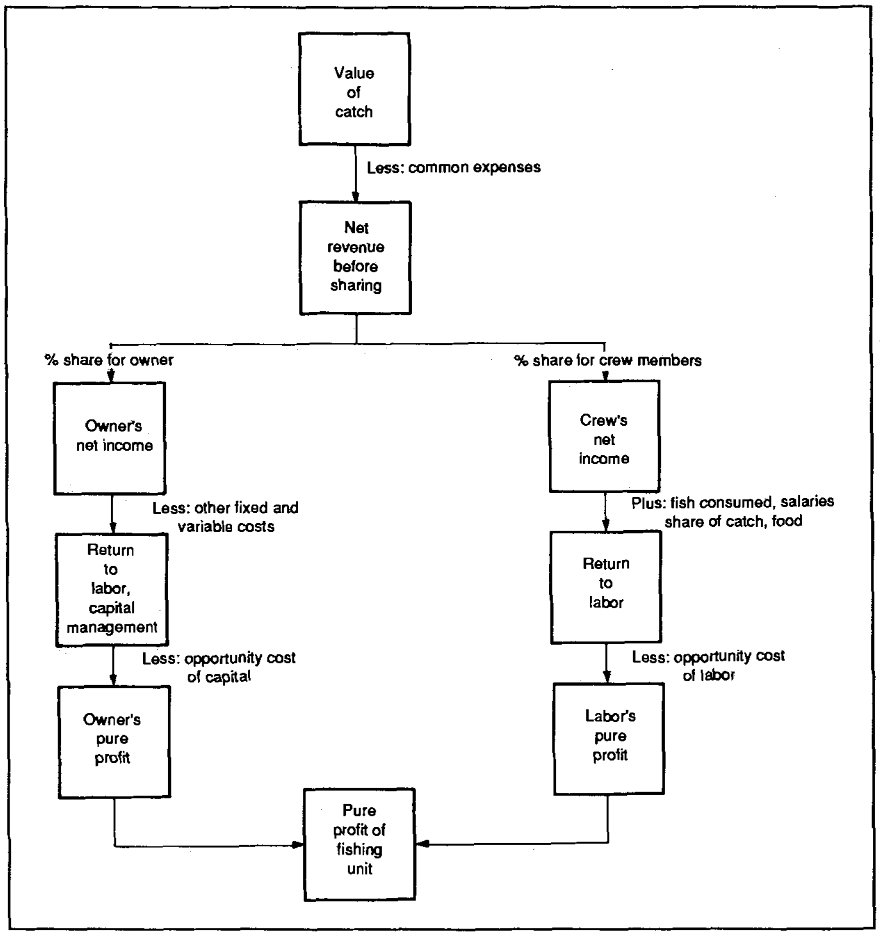


Fig. 5.2. Estimation procedure for producer's surplus as applied to the Philippine small pelagics fishery.

also function as crew, part of pure profits of labor is captured by them. Opportunity cost of capital is computed using the prevailing savings rate, 11.32% in 1988 (NSCB 1989) multiplied by total investment cost.

Labor's net income is estimated as labor's share after accounting for the common costs. To this is added all expense items which accrue to labor such as fringe benefits, salaries, fish consumed on board, employee share of catch and food and cigarettes. Opportunity cost is then subtracted to arrive at pure profits of labor. Two assumptions were made regarding opportunity cost: the first is based on the estimates of Medalla et al. (1990) of shadow wage rate (SWR) in 1988 while the second is founded on the premise of zero opportunity costs (Smith 1979; Panayotou 1980).

SWR is defined as the direct and indirect opportunity cost of unskilled labor in a given sector of the economy. It reflects the impact on aggregate income distribution and saving of transferring unskilled labor from one sector (e.g., agriculture, fishery) to project employment. SWRs are as follows: Southern Tagalog and Bicol, ₱40.07; Visayas, ₱30.03; and Mindanao, ₱35.31. These daily rates were then multiplied by the corresponding number of crew members and person-hours spent. Zero opportunity cost is based on the nonexistence of alternative livelihoods or if there are any, the high barriers to entry including capital requirements and specialized skills.

Table 5.11 presents gear and sectoral averages of pure profit accruing to owner, labor, and the fishing unit. Owners incurred pure losses for the municipal and commercial sectors. This result is attributed to the high operating costs which are borne solely by the owners and not to high opportunity costs of capital. Trawlers, purse seines and bagnets maintained high operating costs and resulted in pure losses to owners as opposed to ringnets, beach seines, surface gillnets and fish corrals.

Table 5.11. Pure profit to owner, labor and fishing unit of small pelagic gears (in pesos), March-April 1988 (US$1 = ₱20).

Gear	Owner	Labor[a]	Labor[b]	Fishing unit[a]	Fishing unit[b]
Municipal	**-1,738**	**-10,852**	**2,886**	**-12,590**	**786**
Surface gillnet	118	-1,798	1,522	-1,680	1,640
Round haul seine	-10,256	-40,321	2,751	-50,577	-7,505
Fish corral	1,679	2,062	2,795	3,741	3,751
Drive-in net	1,509	-3,351	4,475	-1,842	5,258
Commercial	**-85,669**	**44,208**	**86,307**	**-41,461**	**638**
Trawler	-71,219	-28,657	19,361	-99,876	-518,58
Purse seine	-578,787	183,398	312,815	-395,389	-265,971
Bagnet	-4,298	-35,918	12,578	-40,216	82,80
Ringnet	125,960	121,771	131,491	247,731	257,450
Beach Seine	4,052	20,586	28,392	24,638	324,44
Encircling gillnet	10,279	4,067	13,203	14,346	23,481

[a]Opportunity cost of labor is equal to shadow wage rate.
[b]Opportunity cost of labor is zero.

Pure profits to labor resulting from positive opportunity costs yield positive values for the commercial sector but negative values for the municipal sector. The latter is a reflection of the relatively low level of earnings in the municipal sector and the compensation structure that distributes the risk between owner and crew. This is opposed to the commercial sector, especially in trawlers and purse seines, where a fixed wage system (plus fringe benefits), passes the risk factor to the owner. Pure profits to labor resulting from zero opportunity cost yielded positive values for both sectors. This, however, represents an unstable situation, because the large number of unemployed may exert a downward pressure on wages such that rents accruing to labor are totally dissipated. Furthermore, owners of the fishing unit capture some of labor's pure profits either by wage bargaining, as in the commercial sector, or by functioning as owner-operator or by hiring family members as crew as in the municipal sector (Hannesson 1978).

Pure profit of the fishing unit is the sum of the pure profits of owners and labor. Using the two assumptions on opportunity cost, sectoral pure profit is negative when derived wage rates are used and is positive but close to zero when the assumption is relaxed. Trawlers and purse seiners sustain losses using either assumption whereas ringnets, beach seines and fish corrals make pure profits.

The fact that owners of commercial vessels (bagnets, trawlers and purse seines) and round haul seines suffer pure losses indicates a misallocation of capital resources. However, since fishing assets are not readily convertible to cash, economic theory provides a reasonable explanation for continuous operation that covers, at the least, variable cost. Clearly, labor has more to gain; more so, if zero opportunity cost becomes a realistic assumption. However, producer's surplus accruing to labor is bound to decline as unemployment swells in the fishery and the resource itself yields lower catches.

A rough estimate of total societal gains/losses of the small pelagics fishery is estimated by multiplying pure profits with total municipal (small pelagics) crafts in 1980 and average numbers of bagnets, purse seines, trawlers and ringnets from 1978 to 1984. The zero opportunity cost assumption yielded total gains of $10.2 million while the positive opportunity cost assumption yielded a net loss of $242 million.

Resource rents

Resource rent is estimated using cost and revenue functions of the fishery as done by Silvestre and Pauly (1989) and by Panayotou and Jetanavanich (1987).

An exponential model was used to fit the cost function instead of the more common linear function which yielded negative costs at low levels of effort. The cost function has the form:

$$C = a * f^{b} \qquad ...1)$$

where C = cost per unit horsepower; f = effort, in horsepower equivalent; and b = an exponent.

The time series of cost was estimated using average cost per unit horsepower (CUHP) of municipal and commercial small pelagic gears. Operating cost was based on Table 5.2 whereas horsepower was adjusted by converting "manpower" into its horsepower equivalent. Two further adjustments were made to account for i) depreciation and ii) the absence of cost data for other small pelagic gears, notably the *muro-ami*, which comprised an average of 30% of total effort. The first adjustment was based on the assumption of an economic lifetime of the engine equal to 10 years; each gear surveyed was assumed to be at its mid-point. The latter is a straightforward deduction of 30% to average CUHP to account for all other gears not included in the survey.

The time series from 1949 to 1985 was then constructed by deflating the current cost data by the Consumer Price Index (outside Metro Manila). Finally, each cost series was multiplied by the sectoral share of total catch of small pelagics. The CUHP series was then multiplied by total fishing effort to arrive at the fishery cost function. The derivation of the time series of fishing effort for the commercial and municipal sector was developed by Dalzell et. al. (1987) and the subsequent estimation of the fishery cost function was developed by the authors; these are depicted in Fig. 5.3.

The resulting plot of CUHP and total cost is shown in Fig. 5.4. CUHP is P3.14 x 10^{-3} in 1949 and total cost of small pelagic gears is P42 million. By the mid-1970s, CUHP has risen to P12 x 10^{-3} and by 1985 to P59 x 10^{-3} or a total of P32 billion for the fishery. There are two phases of cost increase: one is the period from 1949 to 1970 in which costs increased by an average of 3% per annum and the second, 1971 to 1985, in which costs increased by an average of 17% per annum. These are represented by CUHP functions C_1 and C_2 of the form:

$$C_1 = (0.248) * f^{(0.253)} \qquad ...2)$$

$$C_2 = (7.54 * 10^{-8}) * f^{(1.506)} \qquad ...3)$$

The averages generated by C_1 and C_2 were then multiplied by annual fishing effort to arrive at the fishery cost function. With b>1, the cost function increases rapidly when effort levels are high. This implies that at high levels of effort, resources are wasted to catch a declining quantity of fish.

The yield curve was estimated using the generalized stock production model of Pella and Tomlinson (1969), which includes a parameter, *m*, to adjust for the skewness of the

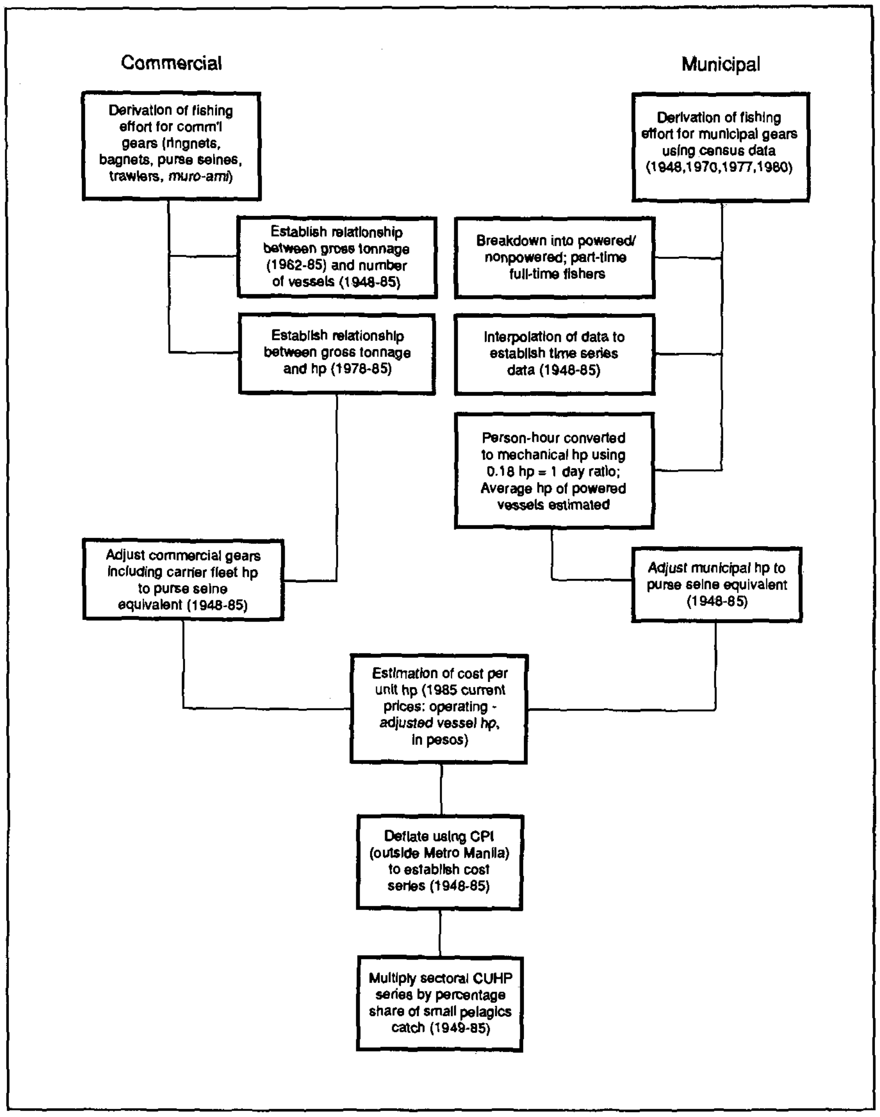


Fig. 5.3. Flowchart showing derivation of hp as standard of fishing effort and time series of cost using vessel hp.

plot, and which is absent in both the Schaefer (1954, 1957) and Fox (1970) surplus-production models. The yield equation is of the form:

$$Y = f * ((f + a)/k)^{(1/m-1)} \qquad \text{...4)}$$

where Y = annual catch in tonnes; k = an empirical coefficient; and f = effort per year, in horsepower equivalent.

The parameters a and b were estimated using a search routine which minimized the residual sum of squared differences between observed and predicted catch (Fox 1975). The skewness coefficient, m, was set equal to 0.5 following Pella and Tomlinson (1969).

The revenue function using a fixed price model is taken as the yield function multiplied by a constant price, P10.86/kg, the average price of major small pelagic fishes from 1979 to 1988. The estimated revenue function is:

$$R = P * f * [(f + 324.8)/818.6]^{(1/(0.5-1))} \qquad \text{...5)}$$

(see also Fig. 5.5).

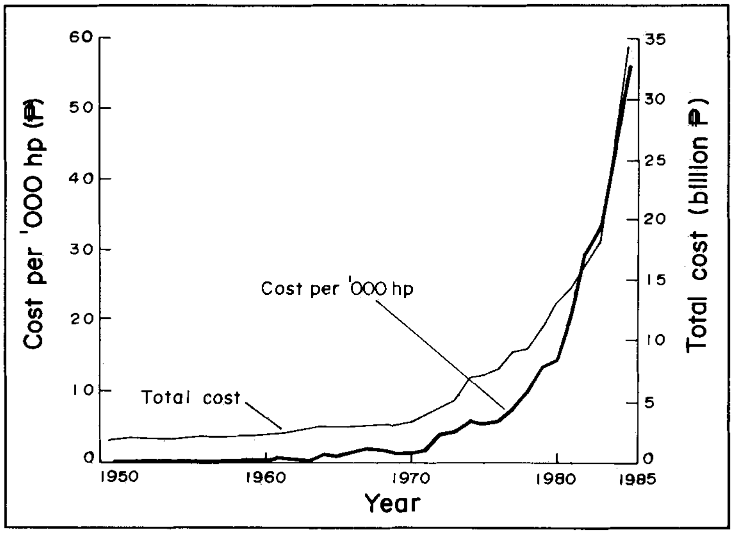


Fig. 5.4. Cost per unit horsepower and total cost of small pelagic species from 1949 to 1985.

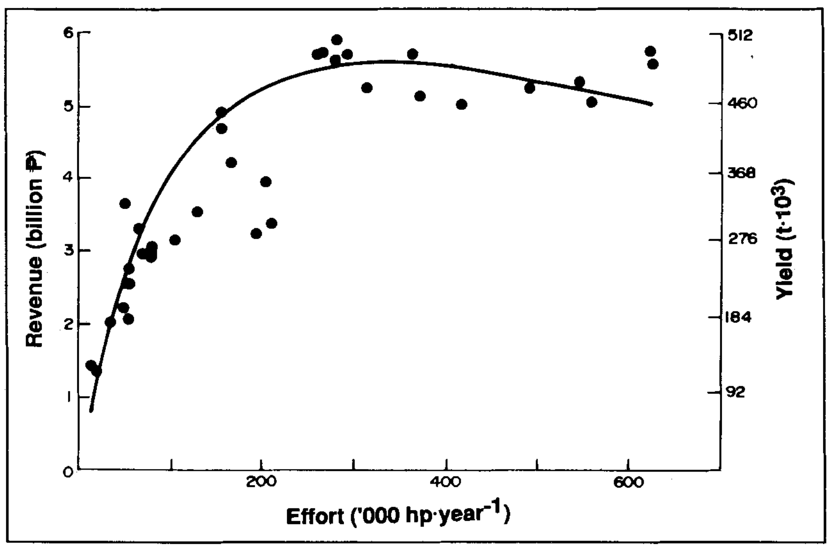


Fig. 5.5. Revenue function of small pelagic gears from 1948 to 1985 using the Pella and Tomlinson (1969) model.

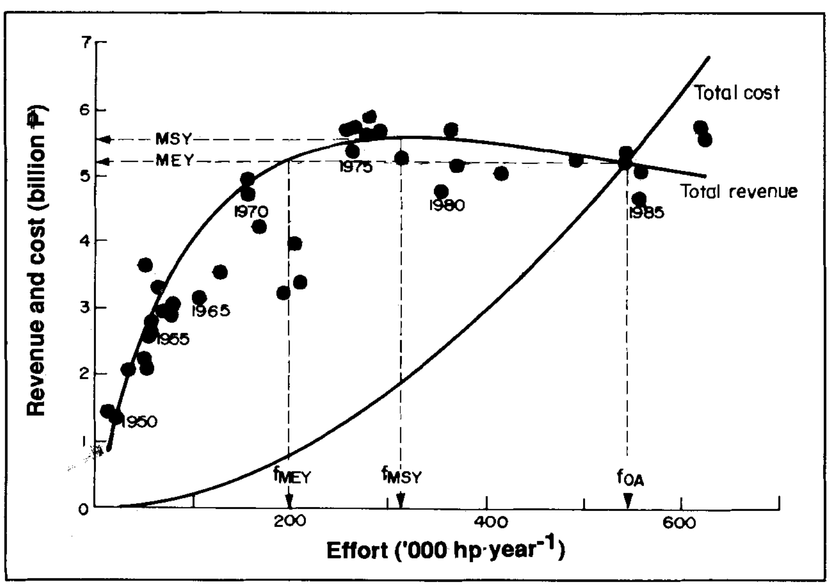


Fig. 5.6. Revenue and cost functions of the Philippine small pelagics fishery. MEY and MSY and the corresponding levels of effort have both been attained in the 1970s. Open-access equilibrium has been reached in the early 1980s. Note that the same catch level can be attained at level of effort corresponding to MEY.

The estimated cost and revenue functions are plotted in Fig. 5.6. The area between the two curves represents profit or rents to society when revenue is greater, and loss, when the opposite occurs. The cost and revenue curves quantify three possible elements for fisheries management: a) maximum economic yield (MEY); b) maximum sustainable yield; and c) open-access equilibrium (OAE). MEY is the level of effort which maximizes profit. MEY in this case corresponds to a catch level of 465,000 t or P5.05 billion/year and an effort level of 170,000 hp. Since the resources are best used at this level, MEY is favored as a management objective from the economic point of view. However, the maximum yield of the resource is not attained at this level, which, in poor economies, can be translated to wastage of a protein source. The MSY responds to this limitation. It is attained at a higher level of effort, 320,000 hp and corresponds to a catch of 515,000 t or P5.6 billion/year.

The last point considered is the OAE, the effort level in which cost and revenue are equal. This is attained at 410,000 hp, which according to the data used, must have occurred in the early 1980s (thus confirming the scenario assumed by Dalzell et al. 1987). The graph shows that at OAE, rent to society is dissipated although it is still possible for some efficient producers to obtain producer's surplus or quasi-rent (Copes 1972). This is reflected in the huge variance in technical and economic efficiency across sectors and among gear types. The presence of such profits encourages the influx of more effort, which in effect, increases cost and minimizes revenue due to declining catch rates; as such, losses sustained at OAE amounted to P9.4 billion in 1985. The perpetuation of this management scheme can only cause further losses to society, mainly because the potential of resources such as labor and capital are not optimized, and to individual producers, mainly because of declining technical and economic efficiency. Overall, our result shows that it would be necessary to decrease effort to about 60% of its present levels to attain MEY (and maintain approximately the same catch levels, see Fig. 5.6) and at least 20% to attain MSY.

Chapter 6

IMPLICATIONS AND OPTIONS FOR MANAGEMENT

Background

The dualistic nature of the small-scale and commercial fishery is reflected in the large differences between assets, degree of mechanization, and mode of operation. This dualistic nature is also reflected in ownership patterns, employment patterns, and compensation practice. Technical and economic efficiency as well as factor productivity was slightly higher in the commercial sector, but the difference (between sectors and among gears) was not significant. The huge variance can be attributed to the arbitrary classification of gear types (Pauly et al. 1982), the inability of the methods applied to account for the "subjective components" of fishing effort, i.e., skills of the fishers, and lastly, data limitations caused by the small sample size.

The existence of producer surplus or "quasi-rents" depended critically on our assumptions regarding opportunity costs. Thus, large economic losses are generated by both sectors when the opportunity cost of labor is set at values above the poverty level; however, large "profits" are generated when opportunity cost is moved towards zero - not an unrealistic proposition for some segment of the labor force. Owner's profit, which provides an indication of returns to capital, showed pure losses for both sectors implying a misallocation of capital in the fishery. The former is a reflection of the low level of earnings in the municipal sector and the distribution of risk between owners and crew. The assumption of zero opportunity cost is unstable because influx of more labor into the fishery will, in the long run, depress wage rates and result in lower catches; thus, labor surplus is bound to be dissipated.

The economic analyses confirmed the results of the biological analyses reported earlier, that the resource is being exploited at levels which are not economically efficient. Open-access equilibrium has been reached during the early 1980s at a level of effort approximately corresponding to 410,000 hp. This translates to a catch level of 500,000 t worth about P5.5 million in 1988 prices. A parallel analysis of producer surplus based on positive opportunity cost of labor showed that the fishery experiences a net annual loss of P9.4 billion (US$242 million) by operating at present levels.

The results of the economic analysis of the small pelagics fishery in the Philippines lead to two conclusions. First, small pelagic fish stocks are subjected to levels of fishing effort far beyond that necessary to generate MSY let alone MEY. This entails localized stock collapses and gradual changes in catch composition whereby long-lived species are replaced by short-lived species (see Fig. 3.1), reflective of a gradual erosion of biodiversity (Dalzell and Pauly 1990). Second, and as a result, both sectors are sustaining economic losses (negative economic rents) implying inefficiencies in the use of labor and capital in the small pelagics fishery. This is true despite the existence of (financial) profits for most gears surveyed.

Management Issues

Solutions to the problems of overexploitation will rest not only within the fisheries sector, but, more importantly, in sectors outside its traditional realm (see Fig. 6.1). This includes issues such as population growth and structural adjustment policies that, offhand, may not have any direct and obvious effects on the fisheries. This broader policy context for management is justified by the interlinkages among fisheries resource issues, on the one hand, and issues of economic development, on the other. The underlying causes of fisheries resource overexploitation and degradation are often of socioeconomic, institutional, political and/or cultural origins. Thus, fisheries management policies made without regard for these other "people" influences relating to development and population have little chance of being effective. The approach to fisheries management must have a wider focus; principally that of identifying solutions to causes rather than for combatting symptoms.

Population growth, poverty and environmental degradation

While the issues of population growth, poverty and environmental degradation are global concerns, specific implications on the Philippine fisheries sector merit strong policy recommendations. Rapid population growth causes an imbalance in the demand-supply ratio of scarce resources, some of which are fixed, such as land, and some of which are renewable, such as the fishery. In the Philippines, population doubling time is estimated to be 23 years given an annual growth of 2.9 to 3.0% (World Bank 1989). Assuming that real incomes are maintained, basic human needs such as food and shelter must also double during the same period.

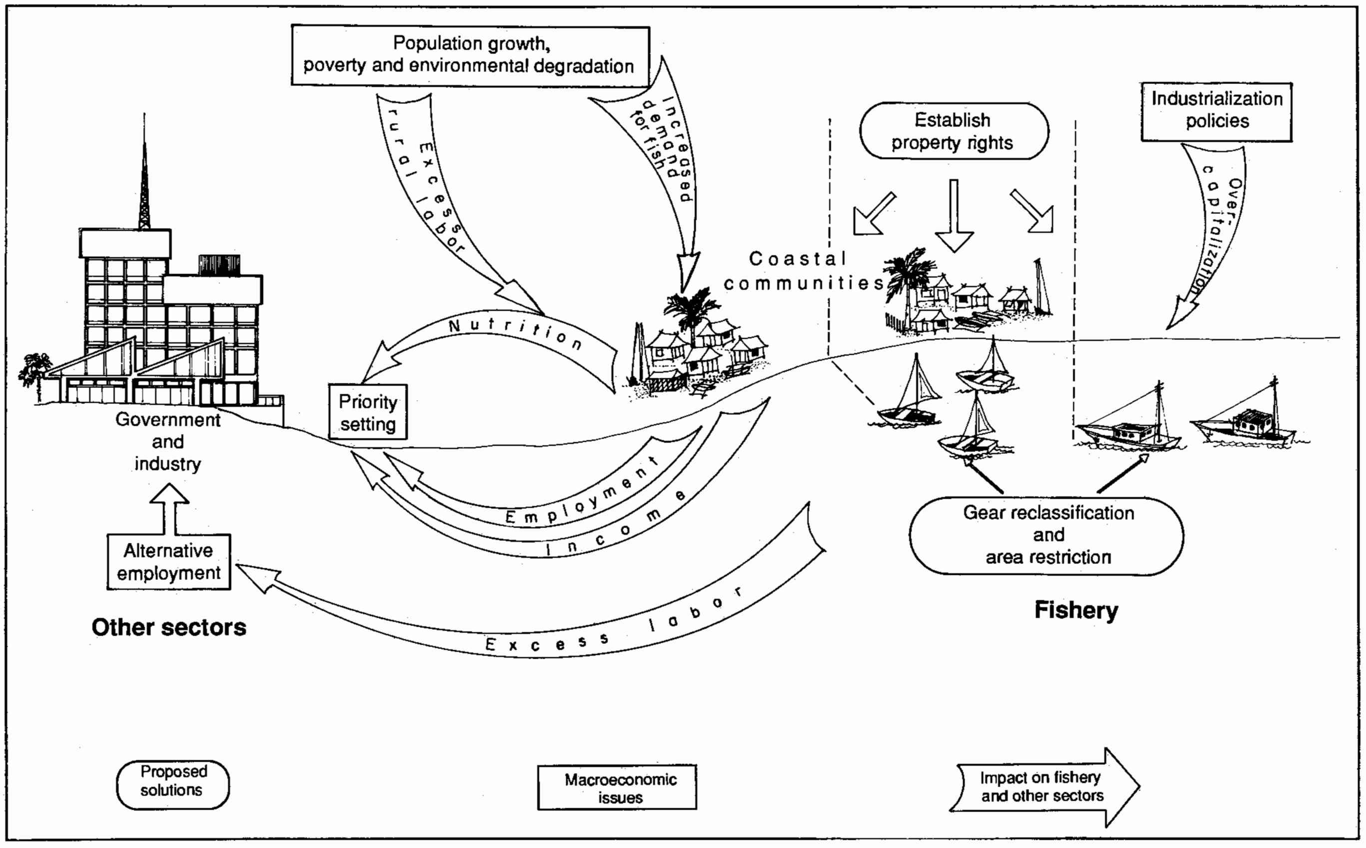


Fig. 6.1. Causes and impact of the Philippine small pelagics fishery sector problems and proposed solutions from fisheries and external sectors.

Population growth exerts a two-pronged pressure on the resource: first is the increasing demand for food, especially for cheap sources of protein such as fish, and particularly small pelagic fish, i.e., *galunggong*. Second is the increasing number of fishers and resource-dependent population which causes "Malthusian overfishing" (Pauly 1990).

While this and earlier studies of Dalzell et al. (1987) show that the small pelagics fishery has been biologically and economically overfished, the general level of overexploitation of marine resources in the Philippines (see Fig. 6.2) (Malig and Montemayor 1987; Tandog-Edralin et al. 1988), and other Southeast Asian countries (Pauly and Chua 1988), shows that natural supply limits have been reached. Thus, real prices of fish, such as the lowly *galunggong*, have risen, making it less affordable to the lower income groups (BAS 1991).

The second impact of population growth (increase in number of fishers) can be directly attributed to the reason previously discussed and indirectly to the economic crisis experienced by developing countries undergoing rapid population growth (World Bank 1992). Unemployment and underemployment as well as inaccessibity of major factors of production and basic human needs such as food and shelter swell the numbers of the impoverished and aggravate income disparity. As a result, landless and marginalized farmers and unemployed urban poor seek refuge in the fishery, oftentimes being the first ones to use destructive techniques (Pauly and Chua 1988; Padilla and de los Angeles 1992). It is not surprising to observe that income distribution in the fishery sector is more skewed than the national average (Padilla and Cruz-Trinidad 1992). The role assigned to the poor as destroyers and yet, unwilling victims, completes the cycle of poverty and resource degradation.

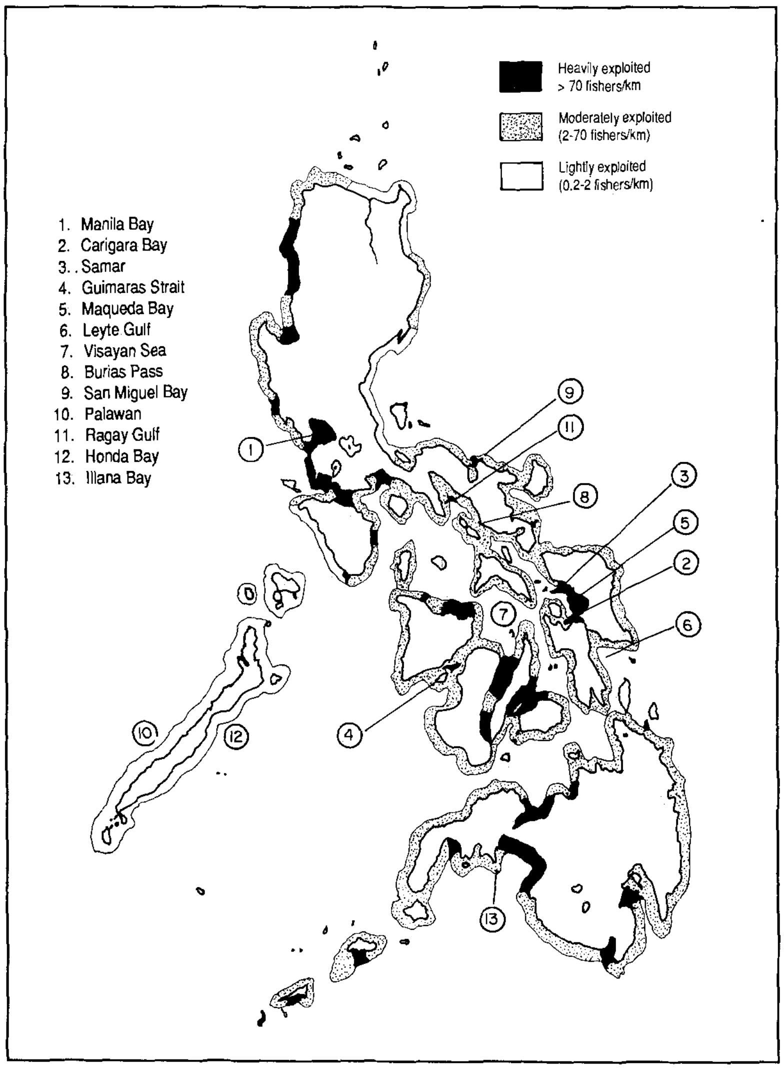


Fig. 6.2. Degree of exploitation of major fishing grounds in the Philippines (inshore areas) (adapted from Tandog-Edralin et al. 1988).

Although positive advocates of population growth claim that an increase in infrastructure and technology allows an escape from the "Malthusian trap", empirical studies by Evenson (1992) show that increases in population result in a decrease in real labor and land incomes, i.e., resource rents.

The only lasting solution to the problems attributed to population growth is investment in human capital, i.e., nutrition, education, social services, which is particularly relevant in a labor-rich economy like the Philippines (Balisacan 1992).

The relevance of technological improvement in an overfished resource

Technological improvement is an important backbone of Schultz's (1984) paradigm of the "poor but efficient" farmer. This proposition is based on the profit maximizing behavior of the producer who operates at an optimum level of efficiency given the level of technology. Despite this, the producer is faced with a declining marginal product, and thus, low income. With technological innovation, the production possibility curve is shifted outwards, i.e., factor productivity is enhanced.

The role of technological progress in world fisheries has been of an initial expansionary phase where real benefits in terms of output, employment and incomes have been enhanced. Whitmarsh (1990) observed that mechanization in the fishery was paralleled by depletion of fish stocks. This is, furthermore, not a modern phenomenon because as Cushing (1988) writes, the North Sea trawl fishery dropped by half from 1889 to 1898 in relation to the introduction of steam trawlers. In the Philippine small pelagics fishery, expansion of the commercial fleet after the post-war years led to a decline in catch per effort (Calvelo and Dalzell 1987; Dalzell et al. 1987).

Induced innovation brought about by technological change occupies a great role in the development process. Does it have the same impact in an overexploited fishery?

In an overfished resource, granting that no policies have been implemented to restore resource productivity, technological innovation will serve as an incentive for further entry (Smith 1981). The likely effects in the municipal fishery are: i) in the short run, increase in incomes due to reduction in cost per unit of catch brought about by improved gear/engine; ii) in the long run, increase in the number of fishers due to improved profitability; and iii) further deterioration of the inshore fishery and declining incomes. Technological innovation in the commercial sector would cause unemployment due to capital-labor substitution, resource degradation, and declining incomes for both commercial operators and municipal crew.

Structural adjustment policies

The roots of poverty, unemployment and underemployment in this country run deep into the heart of our industrialization policies (Balisacan 1992). The adverse effects of these policies are manifested in the fishery in the form of overcapitalization, protectionist regimes that lead to production inefficiencies, and low repayment rates of credit programs. This is also reflected in the continuous influx of migrant labor from unemployed rural and urban poor.[1]

Tax exemption of imported capital equipment formed the stimulus to commercial fisheries development. Seligman (1982) reported that most commercial vessels were imported from Japan because it was cheaper than having them built in Philippine shipyards. The incentive for commercial fisheries expansion is also reflected in fuel pricing. As mentioned earlier, commercial gears use the cheaper diesel fuel, municipal gears use highly taxed regular gasoline. The price structure of petroleum products show that 45% of the pump price of regular gasoline goes to taxes whereas tax contribution is only 21% in the case of diesel. This shows that the municipal sector indirectly subsidizes the commercial sector.

The ban on fish imports and the institution of protection rates (tariff imports) perpetuated inefficiencies in our commercial fishing industry. Seligman (1988) estimated effective

[1]While share of the service sector rose from 26% in the mid-1950s to 33% in the late 1980s, employment grew by only 2.9% and even less in the manufacturing sector. Excess labor was therefore absorbed by agriculture (and fisheries) (Balisacan 1992).

protection rates of fresh/frozen fish ranging from 108% in 1974 to 99% in 1979. This implies that domestic cost of production is, on the average, 100% higher than world prices.

Lastly, lending programs such as the *Biyayang Dagat*, Development Bank of the Philippines (DBB) assistance scheme, and *Kilusang Kabuhayan and Kaunlaran* (KKK) loans, that enabled fishers to acquire vessels and equipment, did not effect an increase in income or production, and yielded low repayment rates (FIDC 1983; Librero and Catalla 1985; Octavio et al. 1986).

Alternative sources of income

The holistic approach to fisheries management is based on the premise that solutions to low incomes must be dealt with outside the fishery, i.e., increasing opportunity costs (Panayotou 1980; Smith 1981). Contrary to the popular notion that all fishers are culturally "tied" to the sea, previous studies have indicated a widespread willingness to shift occupations to earn higher incomes (Emmerson 1980; Bailey 1982). Our study showed that employment alternatives do exist but it was not possible to determine whether these were available on a permanent basis. More than 52% of respondents in both sectors desire to engage in business, 32% would rather seek employment in the service sector and the remaining in farming and aquaculture. Of the total, 30% estimate they will earn more in alternative employment while the remaining percentage is divided equally among those who will definitely earn less and those who are not sure.

Since seasonality of production of small pelagics is quite pronounced, the availability of off-season jobs will remove excess pressure from the coastal fishery, and will have the effect of enhancing the productivity of the stock.

The greatest drawback for fishers to engage in nonfisheries activities is the access to cheap capital, a factor which the government and private sector should consider, possibly through the involvement of NGOs. Meanwhile, the employment of excess labor is dependent on land ownership and tenurial arrangements and the economic activities in the area which should be the concern of government in regional planning. A parallel move would be training programs and educational support to enhance skills of displaced fishers.

The long-run effect of these recommendations is a decrease in the number of active fishers, a decrease in the exploitation of the resource (thereby improving its productivity), and lastly, an improvement in incomes.

The creation of property rights

The creation of property rights in natural resources has been identified by the World Bank (1992) as an important measure for their sustainable use. The positive impacts of creating property rights include firstly, the empowerment of "owners" to enforce measures that would result in optimum benefits and secondly, the creation of a market such that appropriate user costs and taxes (on externalities) can be charged. The former yields further discussion on the form and manner of regulation.

The open-access character of the fishery is often identified as the culprit for biological and economic overexploitation (Panayotou 1980; Anderson 1986). This is because each fisher, who is assumed to be a rational economic agent, maximizes the benefits derived from the resource. If the aquatic resource base were viewed as a public good, the amount provided from an individual's perspective would be less than the Pareto optimum, i.e., the level arising from a central planner's perspective.

There are alternative forms of management for fisheries ranging from the extreme positions of private property and full state control. Ostrom (1990) provides examples of successfully managed traditional common property systems while de-emphasizing the ultimate resort to government as a management panacea while Jentoft (1989) and Pomeroy (1991) opt for a middle-ground: co-management. Here, national government sets rules among communities and community sets rules within their community while fishers participate in establishing the rules and organizational structure for management. The fishers exercise authority for enforcement and administration based on existing social, economic, technological, cultural and political conditions. A management strategy is specifically designed for the conditions of the community and fishery. These issues are presently relevant because of the devolution of authority spelled out by the recent Local Government Code.

Whatever management form is chosen, the following guidelines should be considered in establishing regulatory schemes: i) content of the regulations must also reflect the way fishers view the problems; ii) equitable distribution of restrictions; iii) involvement of fishers in the decisionmaking process; and iv) involvement of fishers in administering and enforcing regulations (Jentoft 1989).

Most of the transactions involving use of natural resources fall outside the confines of the market (Dietz and van der Straaten 1992). As such, no price is assigned to their use or is not reflective of their real costs, if there are any. De los Angeles et al. (1990) enumerate costs incurred in fisheries exploitation as: i) *private costs* directly borne by the current producer; ii) *user costs* experienced by future users who need not be identical with current users particularly if the latter are not assured of future access to the same resource; and iii) *environmental costs* borne by other types of resource users, both at the present and in the future.

The ideal procedure would be to incorporate all three types of costs and charge them as a single tax based on the marginal gains of each user. Taxes collected from resource users could then be used to compensate the less efficient fishers for the right not to fish (N.A. Nielsen, unpubl. data) or to generate related marketing or processing activities.

Problems arising from information assymetry and enforcement are likewise lessened when an organizational setup has been established.

Conflict of objectives

Management options for fisheries planning and management should be guided by the numerous benefits attributable to the resource. Amongst the many are: i) increase in exports; ii) increased fish supply to domestic markets; iii) increased fisher's income; and iv) provision of alternative employment opportunities (Smith 1981; Lawson 1984) which Bailey and Jentoft (1990) characterized as conflicting and mutually exclusive. Table 6.1 articulates the highlights and mode of attaining the objectives of nutrition, employment and income, which are the main contributions of the small pelagics fishery, and their long-run effects.

The objective of satisfying consumer demand for fish is achieved by keeping fish prices at affordable levels. This is achieved, as with rice and corn, through price control. Price controls tend to depress ex-vessel prices and fishers' incomes but tend to be unstable, because if enough fishers stop operating due to low incomes, fish prices will eventually rise. The long-run effect of price controls would be to decrease numbers of fishers and improve resource productivity. If no alternative employment exists, the number of subsistence fishers will rise.

Table 6.1. Objectives of the Philippine small pelagics fishery, implementation procedure, and long-run effects on number of fishers, fishers' incomes, and resource productivity.

Management objectives	Highlights	Target beneficiary		Implementation procedures	Long-run effects: No. of fishers	Long-run effects: On incomes	Long-run effects: Resource
Nutrition	55% of animal protein intake is accounted for by fish	urban consumers	i)	maintain low prices of fish	Decrease	Decrease	Increase
Employment	The fishery provides employment to 1.04 million people or 3.4% of national labor force (NSCB 1992)	municipal fishers & commercial crew	i)	provide alternative employment	Decrease	No effect	Reduced
Income generation	The fishery accounts for 5.1% of GNP (NSCB 1992)	municpal owner-operators and comm'l operators & crew[2]	i)	improve market infrastructure[1]	Increase	Indeterminate	Reduced
			ii)	from market cooperatives[1]	Increase	Indeterminate	Reduced
			iii)	increase on-vessel prices	Increase	Decrease	Reduced
			iv)	regulate production effort	Decrease	Increase	Increase

[1]Smith (1981).
[2]Commercial operators generate more income on a per capita basis.

With fisheries being an employer of last resort, there is a natural tendency for landless farmers and urban poor to migrate to the fisheries either as subsistence fishers, owner operators of municipal boats, or as crew members in commercial vessels (Pauly and Chua 1988; Padilla and de los Angeles 1992). Therefore, suggesting measures to increase employment would be irrelevant. However, there remain activities enhanced by backward and forward linkages in the fishery, i.e., processing, repair service for boats and gears, which should be tapped for employment. This will have the effect of decreasing fishers and increasing the incomes of those left behind.

Increasing fishers' incomes in an overexploited resource implies direct controls on inputs (level of effort) and/or production (quotas and bans) (Copes 1987) and improvements in marketing via infrastructure or fishers' organizations (Smith 1981). Regulation may have an immediate effect of reducing effort and improving incomes in the long run but the attendant costs of enforcement may obliterate the marginal gains.

Enhancement of marketing has the effect of increasing resource productivity as well as keeping effective costs at a minimum. This recommendation, as with the succeeding one, has the effect of increasing prices, which will increase incomes in the short run. This will attract new participants in the fishery and will exact further pressure on the resource. The long run effect on income would depend on whether the productivity decline is offset by the price increase (i.e., elasticity of demand and supply) (Smith 1981).

The conflicting results of the three objectives are summarized as follows: low consumer prices can be achieved at the expense of fishers' incomes. Low consumer prices need not affect the level of employment but the latter tend to deflate fishers' incomes.

While it is not this report's mandate to determine the priorities, it is enough to mention that the objectives chosen should, as Lawson (1984) points out, be consistent with national social, political and economic objectives.

Development of gear reclassification standards and strict enforcement of the 7-km limit

A rational gear classification is critical in setting appropriate fishing zones and in avoiding resource-use conflict between municipal fishers and others. A complement to this recommendation is stricter enforcement of the 7-km limit. Both recommendations have the long-run effect of improving the productivity of inshore waters and therefore municipal incomes, although they may negatively affect the numbers of fishers who are actively exploiting the resource.

This recommendation is particularly relevant in the small pelagics sector because of certain difficulties encountered when classifying gear types. For example, round haul seines are classified as municipal gears because of the 3 GT standard, but these same gears employ, on the average, five boats and twenty-five crew members, which clearly differentiates them from other municipal gears. Pauly et al. (1982) made similar observations in San Miguel Bay, Bicol, where the current legal definition of "municipal" lumped together radically different gears, in terms of cost and energy, and different types of fishers, in terms of their access to capital. Gear reclassification is not only relevant in research but in formulating tax charges and licenses as well.

Conflicts between municipal and large-scale fishers can be averted by reviewing the present 7-km limits and recommending a more realistic limit based on ecological studies. A suggested alternative is the 30-40 m bathymetric region which delineates a marked difference in demersal fish assemblages (McManus 1986). These recommendations require implementation and monitoring of policy by government agencies and where possible, fishing community organizations.

CONCLUSIONS

We have consciously veered away from traditional solutions to fisheries management problems and opted to recommend measures that attack fisheries-related problems as emanating not from the fisheries itself but from sectoral interlinkages. While the issues we have raised may seem too broad-based, we realize that recommending traditional resource-based measures alone would only lead to stop-gap remedies. Indeed, it appears that while searching for solutions to manage the small pelagics fishery, we stumbled on solutions to manage effectively our national economy as well.

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Appendix II

SMALL PELAGICS MANAGEMENT PROJECT

Questionnaire A : FISHING ASSETS

REGION ______________________
Questionnaire no. ______________
Enumerator ____________________
Date of survey _________________
Landing site ___________________

General information :

Gear :________________ Name of boat ______________

Name : Owner___________________
Main operator ____________

Level of operation : ____ Municipal ____ Commercial

1. Fishing assets owned (Please check).

_________ a. Motorized banca (specify name[s])

	Percentage of ownership	No. of owners	Relationship of other owners to you:
F/B			
F/B			
F/B			
F/B			

_________ b. Nonmotorized banca (specify name[s])

F/B			
F/B			
F/B			
F/B			

_________ c. Engine (indicate the banca to which the engine is installed)

Engine Name of Boat

No. 1 F/B			
No. 2 F/B			
No. 3 F/B			
No. 4 F/B			

_________ d. Nets with corresponding accessories

No. owned			

_________ e. Containers (indicate capacity in kg and number owned)

Item	Capacity	No. owned
Styrofoam boxes		
Small baskets		
Large baskets		
Tubs		
Pails		
Cans		
Others (specify)		

_________ f. Others (indicate number owned)

Item	No. owned
Fish finder	
Lamps	
Flashlights	
Others (specify)	

2. Mode of acquisition

Asset	Mode of acquisition*	Year acquired	Fully paid (Yes/No)	Remaining amount to be paid (P)	Amortization (P)

a. Motorized banca
F/B

F/B					
F/B					
F/B					

b. Nonmotorized banca
F/B

F/B					
F/B					
F/B					

c. Engine

Eng. 1					
Eng. 2					
Eng. 3					
Eng. 4					

d. Nets

Net 1					
Net 2					
Net 3					
Net 4					

* Code : 1 - Purchased (using own savings)
2 - Purchased (thru credit from banks, other sources)
3 - Built/made
4 - Inherited/gift

3. Replacement cost

Asset	Replacement cost (P)	Remaining years
a. Motorized banca		
F/B ______	______	______
F/B ______	______	______
F/B ______	______	______
F/B ______	______	______
b. Nonmotorized banca		
F/B ______	______	______
F/B ______	______	______
F/B ______	______	______
F/B ______	______	______
c. Engine		
Engine 1 ______	______	______
Engine 2 ______	______	______
Engine 3 ______	______	______
Engine 4 ______	______	______
d. Nets		
Net 1 ______	______	______
Net 2 ______	______	______
Net 3 ______	______	______
Net 4 ______	______	______
e. Containers ______	______	______
f. Others (specify)		
______	______	______
______	______	______
______	______	______
______	______	______
______	______	______

4. Given the present condition of your assets, how long do you expect them to last? (Use the table above for the answers).

5. How much do you spend every year for the maintenance and repair of your boat and gear?

	Amount (P)
a. Maintenance and repair of boat	
i. Vessel hull	________
ii. Main engine	________
iii. Fishing and navigation equipment	________
b. Repair and maintenance of fishing gear	
i. Fishing net	________
ii. Rope	________
iii. Others (floats, sinkers, lines)	________

6. What other costs do you incur annually? (Indicate amount)

	Amount (P)
Mayor's permit	________
Operating license	________
Others (specify)	________
________________	________
________________	________
________________	________
________________	________

*****

THANK YOU VERY MUCH!

SMALL PELAGICS MANAGEMENT PROJECT

Questionnaire B : COSTS and RETURNS

REGION ______________________
Questionnaire no. ______________
Enumerator ___________________
Date of survey ________________
Landing site __________________

Fishing Information

Gear : __________________ Name of boat ____________

Respondent : ______ Owner
______ Main operator

Fishing ground	Distance from shore (km)	Distance from home (km)	Period of operation (indicate months)

Peak months : ________________________________
Low months : ________________________________

Questions : (/ is inserted where applicable)

1. How many times did you go out fishing this week?

2. Is this the normal number of trips you make every week? _____Yes _____No
   If not, indicate the reason(s).
   __________ a. bad weather
   __________ b. repair of boat/gear
   __________ c. no capital to finance the trip
   __________ d. incomplete no. of fishers
   __________ e. personal
   __________ f. others

3. How long was each trip?

Hours spent per fishing trip*	1	2	3	4	5	6	7
< 4							
4-8							
8-12							
> 12							
_____ day(s)							

* Traveling + actual fishing

4. Operating expenses

Item	Quantity/trip	Item	Value/trip (P)
Gasoline (li)		Ice	
Oil (li)		Salt	
Gas/kerosene (li)		Food and cigarettes	
		Transportation expenses	
		Others	

5. Fishing crew

a. How many persons go fishing?
Total ________
Family members _______
Employees ______

b. Indicate the number of persons assigned per position and their shares.

Position	Number	Share*	Amount of fixed salary per month
Master fisher			
Captain			
Chief engineer			
Assistant engineer			
Mechanic			
Netman			
Oiler			
Cook			
Repairman			
Ordinary fisherman			
Others (specify)			

* Code: 01 - fixed salary
02 - fixed minimum salary plus share
03 - full share system

c. Working time

	Peak months	Low months
No. of days/week		
No. of weeks/month		
No. of months/year		

d. Payment system

1. How do you pay your crew?
   ____ payment only in cash
   ____ cash plus kind

2. How often do you pay your crew?
   ____ salary paid each trip
   ____ salary paid each week
   ____ salary paid each month
   ____ combination (per trip and per month)

6. Sharing arrangement

a. Do you deduct the running expenses (e.g., fuel, food, ice, etc.) before dividing the catch value among you and your employees?

_____ i. $\boxed{\text{Catch Value}}$ - $\boxed{\text{Running Expenses}}$ = $\boxed{\text{Divisible Earnings}}$ for owners / for employees

_____ ii. $\boxed{\text{Catch Value}}$ for owners / for employees

b. What per cent of catch value or divisible earnings was shared with the employees? (Enter the percentage shares for owners and employees in cases [i] and [ii] above.)

c. For the case (i) above, did you deduct all the running expenses?

_____ Yes _____ No

If not, please check the running expenses deducted.

____ a. Gasoline
____ b. Oil
____ c. Gas/kerosene
____ d. Ice/salt
____ e. Food and cigarettes
____ f. Transportation expenses
____ g. Others

7. Fish catch and disposal per trip

Species caught	Catch/trip (kg)		
	Sold	Consumed	Employees' share

8. Marketing practices

a. Market outlet

Item	Share (%)
_____ Itinerant buyer	__________
_____ Town market (Location : __________)	__________
_____ Provincial market (Location : __________)	__________
_____ Greater Manila market	__________

If catch was sold to more than one outlet, please indicate above the share of each outlet (in terms of percentage).

b. Reason for choice of outlet

_____ favorable prices
_____ *suki* relationship
_____ buyer pays in cash
_____ no choice (buyer financed the fishing operation)
_____ others (specify)

c. Selling arrangement

_____ direct wholesale
_____ direct retail
_____ consignment
_____ contractual
_____ others, specify

____
____
____

d. Terms of sale

_____ cash
_____ credit

e. Who sets the price?

_____ seller (you)
_____ buyer (e.g., wholesaler, retailer)
_____ broker
_____ fixed by contract
_____ others, specify

f. Basis of pricing

_____ volume of catch
_____ operating costs
_____ species of fish
_____ quality of fish
_____ level of competition
_____ others (specify)

*****

THANK YOU VERY MUCH !

Appendix III

Documentation of Available 3-1/2" MS DOS Data Diskettes

This appendix is written for interested readers who may wish to test, verify and update the results presented in this technical report, using the data we used here.

All data used in the cost and earnings analyses of Chapters IV and V as well as the time series data on cost and revenue, including those derived by the authors are contained in 14 LOTUS 1.2.3 spreadsheet files on a single 3-1/2" diskette. The catch and effort data and the species composition data collected monthly from 1987 to 1988 are presented in an unpublished compilation by Corpuz and Dalzell (n.d.) are also available from ICLARM upon request.

The table below lists the file names, file sizes and contents. The contents of files (1) to (11) refer to cost and earnings data of specific gear types itemized per respondent, e.g., PURSE.WK1 contains cost and earnings data from commercial and municipal purse seines sampled from all regions.

Files COMM.WK1 and MUNIC.WK1 are large spreadsheets that summarize information contained in files (1) to (11).

File YIELD.WK1 contains time series data on catch and effort of small pelagic gears (used earlier by Dalzell et al. 1987), on a national basis, including cost per unit effort data derived by the authors.

File name	File size (KB)	Gear type
(1) PURSE.WK1	23,610	purse seines
(2) BSEINE.WK1	38,880	beach seines
(3) RHS.WK1	28,030	round haul seine
(4) BAGNET.WK1	54,893	bagnets
(5) FISHCOR.WK1	35,828	fish corral
(6) TRAWL.WK1	26,788	trawlers
(7) DRIVEIN.WK1	18,178	drive-in nets
(8) EGN.WK1	17,939	encircling gillnets

Continued

File Name	File size (KB)	Gear type
(9) SGN.WK1	70,951	surface gillnets
(10) RNIX.WK1	38,658	ringnets (reg. 9)
(11) RNVII.WK1	25,741	ringnets (reg. 7)
(12) COMM.WK1	54,063	cost and earnings summary of all commercial gears
(13) MUNIC.WK1	27,864	cost and earnings summary of all municipal gears
(14) YIELD.WK1	27,946	time series data (secondary and derived) of cost and revenue of small pelagic gears in the Philippines, 1949-1985

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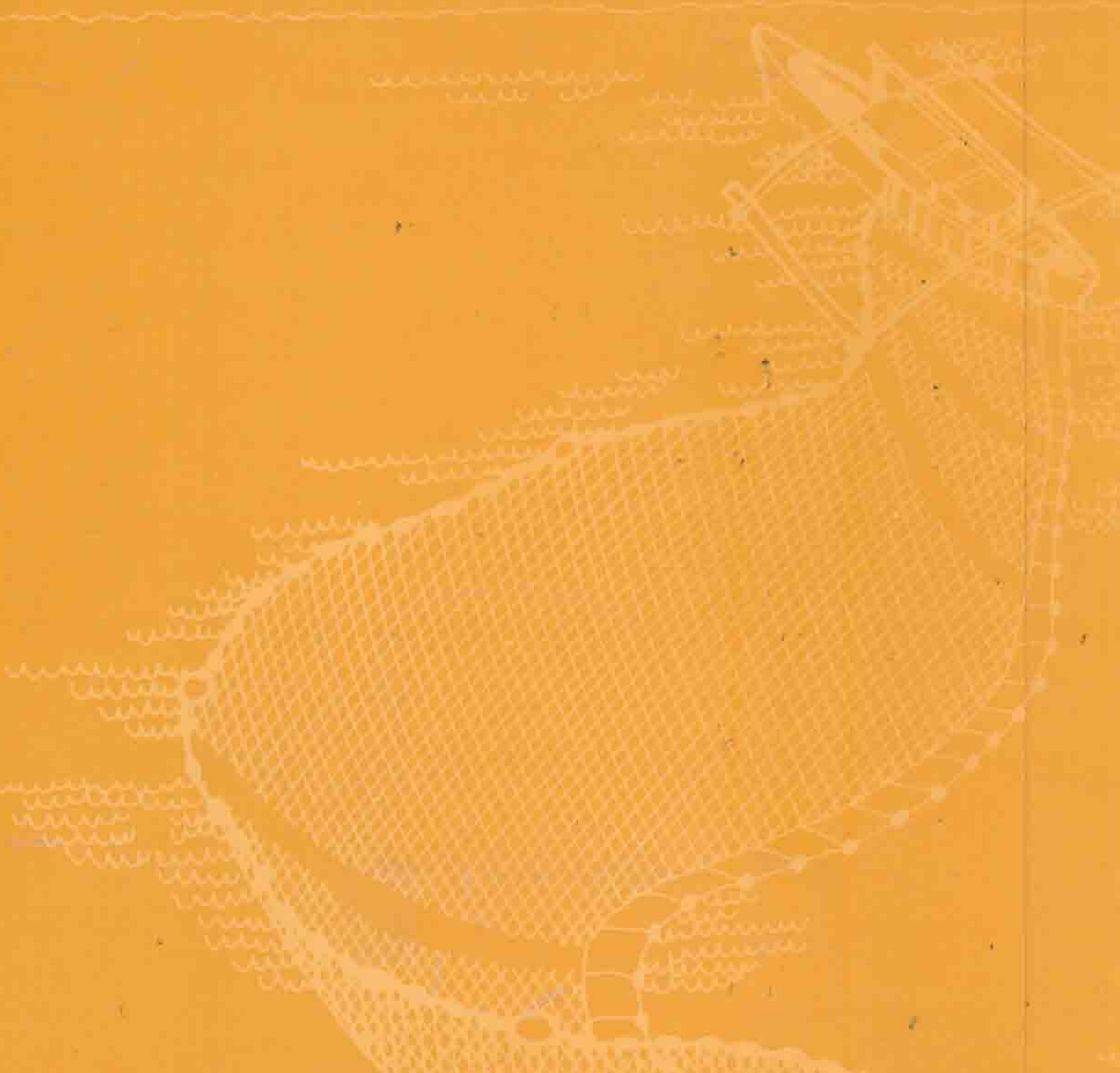

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