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Small-scale fisheries of San Miguel Bay, Philippines: economics of production and marketing

Edited by

Ian R. Smith and Antonio N. Mines

INSTITUTE OF FISHERIES DEVELOPMENT AND RESEARCH, COLLEGE OF FISHERIES, UNIVERSITY OF THE PHILIPPINES IN THE VISAYAS; INTERNATIONAL CENTER FOR LIVING AQUATIC RESOURCES MANAGEMENT; THE UNITED NATIONS UNIVERSITY

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QUEZON CITY, PHILIPPINES

INTERNATIONAL CENTER FOR LIVING AQUATIC RESOURCES MANAGEMENT
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Cover: *Upper:* Gill-netters are the most prevalent small-scale non-trawl gear used in San Miguel Bay. *Lower:* Satellite view of the Bay, to the right of center. [Photo, NASA, U.S.A.].

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Preface

The research project "Small-Scale Fisheries of San Miguel Bay: A Multidisciplinary Analysis" was conducted jointly by the Institute of Fisheries Development and Research (IFDR) of the College of Fisheries, University of the Philippines in the Visayas and the International Center for Living Aquatic Resources Management (ICLARM), both based in Manila, Philippines.

San Miguel Bay is one of the more important fisheries of the Philippines, being a shallow productive body of water producing large catches of fish, shrimp and other crustaceans. It is located in the Bicol Region of the Philippines towards the southern end of the island of Luzon, approximately 400 km south of Manila, the capital city and major market for fishery products, especially shrimp.

In addition to the Bay's high biological productivity, there were several other reasons why this site was chosen for an in-depth multidisciplinary study, the first of its kind in the Philippines, if not all of Southeast Asia. The Bicol Region is one of the more depressed areas of the country, with per capita incomes well below the national average. For this reason, and because of the potential for increased production from the agricultural sector, the Bicol River Basin Development Program (BRBDP), an integrated area development plan, was formulated in the early 1970s with the major purpose of building the necessary physical and social infrastructure to bring irrigation to the region's rainfed rice land. With its subsequent responsibilities expanding both geographically beyond the Bicol River basin and administratively to include activities other than rice, the BRBDP became interested in the potential for incorporating fishing communities into its development planning. The opportunity existed therefore for this IFDR/ICLARM research project to provide some of the basic biological and socioeconomic information on the fisheries that would make such planning possible.

Other reasons for selecting San Miguel Bay were related to the biology of the fishery. With a narrow mouth in the north, the Bay sustains what can be identified essentially as a unit fishery, with almost all the fishing activity of residents around the Bay confined to the Bay itself. Moreover, biological data were available from the 1950s, thus providing a basis for comparison with data collected by this research project, and allowing the researchers to address allegations that the Bay is overfished.

Finally, two major gear types typical of Philippine waters, gill-netters and trawlers, compete for the same stocks within the Bay. This research project was designed to determine the distribution of total catch and revenues among major gear types, so that informed decisions regarding possible gear regulations could be made by the Bureau of Fisheries and Aquatic Resources (BFAR) and the municipalities which have responsibility for enforcing fishery regulations in San Miguel Bay and other fishing grounds of the country.

In addition to funding from IFDR and ICLARM the project received grants from the United Nations University (UNU), Tokyo, Japan and the Philippine Council for Agriculture and Resources Research and Development (PCARRD), Los Baños, Laguna, Philippines. IFDR and ICLARM are both grateful for this support because completion of this research project would have been impossible without it.

The project has produced four technical reports which cover the biological, economic and sociological aspects of the San Miguel Bay fisheries. A fifth report synthesizes these complementary perspectives and discusses their implications for managing the San Miguel Bay fisheries.

The various papers in this report analyze the economic aspects of fisheries production and marketing in San Miguel Bay. It represents the results of data collection and analysis over approximately a two-year period, 1979-1981. We are pleased to include a paper in this volume on institutional issues related to the San Miguel Bay fisheries by Wilfrido Cruz who spent several months with the project team during 1981 to collect field data for his dissertation. Also, we would like to take this opportunity to acknowledge the contributions of Jan Michael Vakily to our data collection methods, the assistance of Gregorio Bañacia and earlier Dennis Pamulaklakin for managing the administrative and logistical aspects of our field work.

This economic study was implemented by a three-member team under the guidance of Dr. Ian Smith of ICLARM. Three research assistants—Francia Yater, Neri Supanga and Estrella Tulay—participated in all aspects of the project from planning, data collection and analysis to report writing, and deserve the major credit for the successful completion of this study. We have benefited considerably from the interaction among the project's biologists, sociologists and economists and heartily recommend such multidisciplinary approaches.

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The Research Site, Data Collection and Methods of Analysis

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Abstract

Objectives, sampling and analytical methods and data collection methodology of an economic survey of the small-scale fishery of San Miguel Bay, Philippines, are discussed. The fishing community from which the majority of economic data were gathered is described.

Introduction

As in other parts of the world, small-scale fishing communities in the Philippines have benefited only marginally from rural development programs since the main thrust of government policies and programs historically has been in the agricultural sector. Most fisheries development programs have focused on relatively large-scale commercial operations which are export oriented and capital intensive. Yet small-scale fisheries contribute over 60% of fishery production (excluding aquaculture) and involve a significant proportion of the population of the country. The sector is estimated to employ 600-700,000 persons or about 90% of those engaged in Philippine fisheries (EDPITAF 1978). In the Bicol Region alone, it is estimated that there are about 64,000 small-scale or municipal fishermen representing about 10% of the total population of the region (BFAR 1979). Small-scale fishermen in the Philippines are known as municipal fishermen. Defined to include those using vessels less than 3 gross tons (GT) or no vessel at all, they fish in marine and inland municipal waters. All other fishermen are considered commercial fishermen (Santos 1979; De Sagun and Bautista 1979).

Since 1977 when the Integrated Fisheries Development Plan was formulated by the Fishery Industry Development Council of the Ministry of Natural Resources, municipal fisheries have been receiving increased attention and concern from government planners. Recent attempts to improve the income levels of municipal fishermen have included a variety of financing schemes, the formation of associations and cooperatives, and extension work by the Bureau of Fisheries and Aquatic Resources (BFAR). Unfortunately, results of these efforts have not been especially encouraging. Repayment rates under the various credit programs have averaged less than 10% and very few of the Samahang Nayons (pre-cooperatives) formed since the early 1970s remain viable. The underlying causes for these problems remain unclear, but one appears to be that there is increasing evidence of overfishing in the form of declining yields from many of the traditional coastal fishing grounds upon which municipal fishermen depend (Smith et al. 1980). These declining yields have made loan repayment difficult.

Planning for the municipal or small-scale fisheries sector in the Philippines has long been hampered by an almost complete lack of economic data on the various gear types that are used by the municipal fishermen. There have been occasional community studies which have shed some light on income levels and general standards of living in fishing communities, but no results have been published to date on detailed costs and returns or estimates of profitability of the major municipal gear types. The few economic results that have been published to date are either from extremely small samples or from what appear to be highly unreliable survey data. A much awaited study entitled "The impact of credit on small-scale fisheries and aquaculture in the Philippines" is being conducted by the Philippine Council for Agriculture and Resources Research and Development (PCARRD). In a country where fish supplies 50-55% of total animal protein, and municipal fisheries supply almost two-thirds of the estimated fisheries production (excluding aquaculture), this lack of economic information is surprising.

One possible explanation for this paucity of economic data is that the potential of economics to enlighten us about the status of fisheries is not fully appreciated. It is often assumed that it is necessary to mount expensive exploratory fishing expeditions and surveys to determine the status of fish stocks and thus the potential for expanding fishing effort or the need to curtail it. The belief that biological information is the sole pre-requisite to fisheries management decisionmaking has led to domination of the field by biologists. Or possibly they have simply been more persuasive than economists in arguing their case. While for an undeveloped fishery, biological surveys are indeed necessary, economists would argue that for developed fisheries, economic data are equally as important, if not more so. Moreoever, as Lampe (1980) has argued, economic data can in many cases be collected more cheaply through interviews of fishermen and can provide predictions very close to those made through more expensive exploratory fishing methods. Similarly, Pauly and Mines (1982) demonstrate cheaper alternative shore-based methods to conduct biological stock assessment.

The main point to be made here is that researchers charged with assessing the status of fisheries overlook a gold mine of valuable information if they fail to collect catch and effort and costs and returns data from the fishing fleet(s) that have historically operated in the fishing grounds in question.

Objectives

A major purpose of this technical report was to demonstrate the usefulness of economic data in assessing the status of a specific fishery as a prelude to the difficult allocation decisions that face fisheries policymakers in the Philippines, as elsewhere in Southeast Asia. This objective was pursued through an examination of catch, effort, costs, returns, and price data collected through the cooperation of a group of fishermen owning and operating various municipal gear types in San Miguel Bay, located in the Bicol Region of the Philippines (Fig. 1).

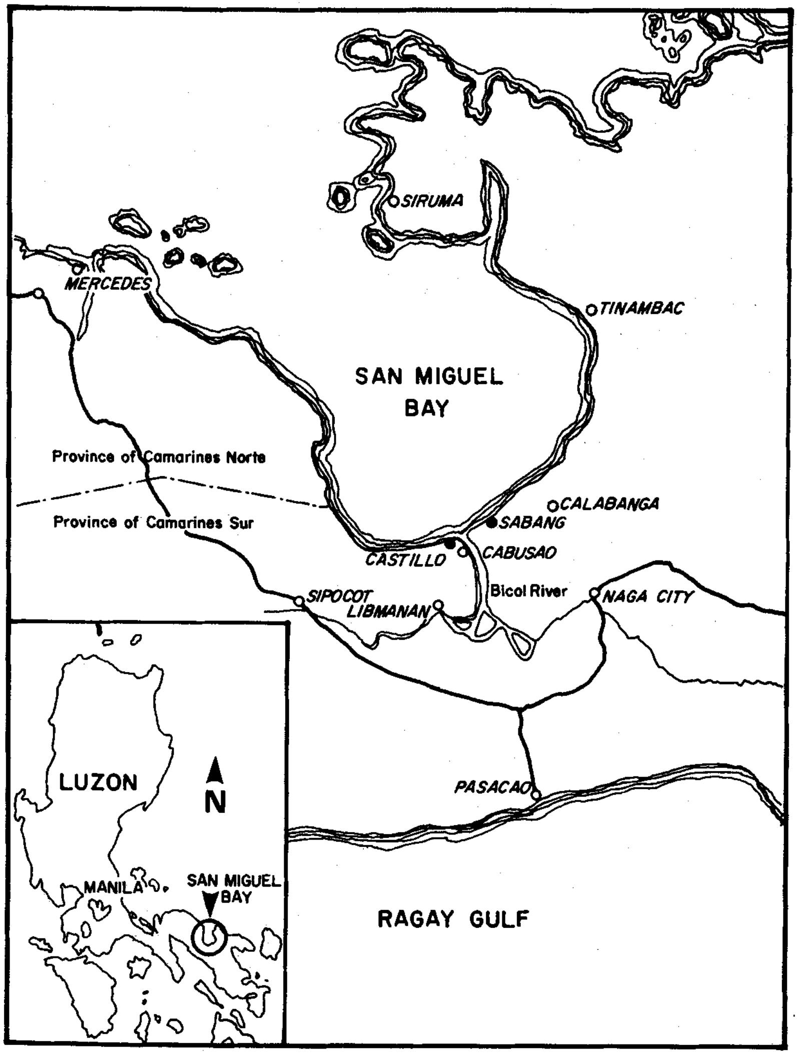

Fig. 1. San Miguel Bay, Philippines.

The preface of this technical report has outlined why the fisheries of San Miguel Bay were ɩelected for intensive study. The specific objectives of the economics component of the IFDR/ CLARM research project were:

- to determine the costs and returns of the major municipal fishing gears used in San Miguel Bay;
- to determine the returns to labor and capital according to the predominant sharing system practiced for the major gear types, and to compare these returns with the opportunity costs of labor and capital;
- to determine the relationship between prices received by fishermen and those prevailing in nearby wholesale and retail markets;
- to determine costs and returns for fish processors and middlemen and to examine the efficiency of the marketing systems; and
- to analyze the implications of the above production and marketing data as they relate to issues of allocation of fishing rights and distribution of the net benefits from the fishery.

Implicit in the above objectives was the testing of certain data collection methodologies, particuɜrly those related to collection of accurate price data.

Municipal Fisheries Defined

The Philippine fisheries sector, as elsewhere in the tropics, contains a myriad of gear types, many competing for the same fish stocks. A legal/administrative distinction is made between 'commercial' fisheries, which consist of vessels in excess of 3 GT, and 'municipal' fisheries which consist of the remainder, including gears which do not require the use of a vessel. Eighteen municipal gear types operate within San Miguel Bay (Table 1). Great diversity is found within the municipal fisheries sector, with gear types ranging from simple hook and line and traps to 2.99-GT 'baby' trawlers and 'baby' purse seiners powered by 180-hp engines. The definition of 'municipal' as supposedly synonymous with 'small-scale' or 'sustenance' (a commonly used term in the Philippines) does not therefore appear to be appropriate or adequate.

Table 1. Gear types used in San Miguel Bay (1980).

Gear type (local name)	Number[1]	Percent of total
Gill-net (various types)	1,515[2]	42.7
Scissor (push) net *(sakag)*	634	17.9
Hook and line *(banwit)*	424	12.0
Mini trawl *(itik-itik)*	188	5.3
Stationary liftnet *(bukatot)*	171	4.8
Fish pot *(bubo)*	106	3.0
Longline *(kitang)*	103	2.9
Baby trawl[3]	95	2.7
Fish corral *(baklad)*	89	2.5
Crab liftnet *(bintol)*	71	2.0
Filter nets *(biakus)*	60	1.7
Spear gun *(antipara)*	51	1.4
Mobile bagnet *(baby basnig)*	17	0.5
Beach seine *(sinsoro)*	11	0.3
Fish weir *(sabay)*	5	0.1
Round haul seine	4	0.1
Stationary tidal weir *(ambak)*	2	–
Cast net[4]	1	–
Total	3,547	100

[1]Gears counted between November 1979 and March 1981. See Esporlas (1982).

[2]These 1,515 gill-nets are used on approximately 350 gill-net fishing units.

[3]See text for distinction between small and medium trawlers which together comprise the so-called 'baby' trawlers in the Philippines. Of these 95 trawlers, 75 are small (<3 GT) and 20 are medium (> 3 GT).

[4]Probably underestimated.

We are not the first researchers to question the adequacy of the 'municipal' and 'commercial' fisheries labels. Spoehr (1980) raised the same issues when he discussed the extreme variation in investment required for different gear types, and the increasing separation in a management sense between owners and operators or crewmen as the capital intensity of the gear increased. He proposed three categories: small-scale, medium-scale, and large-scale with distinctions based on variations in the owner/crewmen relationship and investment levels. While useful for purposes of research, this breakdown is cumbersome for administrative or licensing purposes because the medium-scale grouping would include vessels and gear types that are licensed by different national and local authorities.

All 'commercial' gears are licensed by national authorities and all 'municipal' gears are under the jurisdiction of local municipalities. This separation of responsibilities has existed since Spanish times (pre-1900) when the 3-GT demarcation was first arbitrarily established. For this study, we used the overall 'municipal' label, but made some clear distinctions within that category.

Distinction was made between *municipal trawlers* and all other *municipal non-trawl gears.*[1] This leaves a large number of diverse gears under the municipal non-trawl label, but as subsequent papers in this report show, there is a clear-cut distinction between the two groups in terms of profits earned. Municipal trawlers were divided into 3 groups:

- *mini trawlers,* which are no bigger than gill-netters, that is 0.1 to 0.2 GT, powered, as are many gill-netters, by 16-hp gasoline engines;
- *small trawlers,* which range generally from 1 to 3 GT;
- *medium trawlers,* which are technically 'commercial' vessels, and range from 3.01 to 5.0 GT, though they are usually registered with municipalities as 2.99 GT.

Small and medium trawlers are commonly called 'baby' trawlers in the Philippines. All three trawler types operate within San Miguel Bay. A fourth category, *large trawlers* ('commercial' trawlers of 50 t or more), fish outside San Miguel Bay though approximately 30 vessels are based at Camaligan, just outside Naga City, the commercial center of Camarines Sur. Because they fish almost exclusively outside the Bay and the cooperation of their owners to provide data was thought to be unlikely, large trawlers were not included in this study.

The Research Site

As indicated in Table 1, over 3,500 units of fishing gear are used in the San Miguel Bay fisheries. Not all of these are used simultaneously; the stationery liftnets, for example, operate only during a relatively short season (see Supanga, this report). Also, many fishing units use more than a single gear; a gill-netter for example, uses 5 gill-nets on average. Gill-netters and trawlers operate year-round, however, between them catching the bulk of the Bay's total catch. Consequently, it was especially important to monitor the activities of these major gear types. The majority of gill-netters and trawlers are based in the three municipalities of Cabusao, Calabanga and Tinambac at the southern end of the Bay. During 1979-1981, parts of Tinambac were closed to outsiders by the Philippine Constabulary due to the lack of peace and order. Therefore we concentrated on Cabusao and Calabanga and more specifically on the major fishing barrios in these two municipalities—Castillo in Cabusao and Sabang in Calabanga.

Castillo lies on the western bank of the Bicol River near its entrance to San Miguel Bay (Fig. 1). Sabang is on the opposite side of the river and further along the coast to the east. Castillo is the base for large numbers of gill-netters and mini trawlers, the owners and crewmen of which live in the community. Sabang is the major landing area in the Bay for the small and medium trawlers. Both communities, because of their active fishing fleets, have become centers for post-harvest activities, primarily drying and salting. Mercedes, at the western side of the Pacific Ocean mouth of the Bay has developed along similar lines. Processed fishing products from these communities are a major source of supply in Camarines Norte and Camarines Sur provinces. Shrimp from Castillo and Sabang is shipped as far as Manila, from where wholesalers export to Japan in addition to supplying the Metro Manila market.

A complete overview of the San Miguel Bay fishing communities can be found in Bailey (1982). The major point we wish to make here is that the San Miguel Bay fisheries are thoroughly integrated into the market economy, and it would be incorrect therefore to think of this fishery as 'subsistence' or 'sustenance' in nature (Szanton 1971). It is our view that use of these terms to describe the municipal fisheries of the Philippines is inappropriate and misleading, due to the market orientation of most municipal fisheries. Of course there are exceptions in more remote communities where a proportion of the catch is for the consumption of the fishermen's own households. With the exception

[1] See Pauly and Mines (1982) for a complete discussion of measurement of fishing effort of the various gear types.

of some isolated areas in Siruma, however, the San Miguel Bay fisheries have a strong market orientation.

Castillo, the base of the economics research team, is one of the largest fishing barrios around San Miguel Bay, and is heavily dependent upon fishing. Located on sandy soil bordering mud flats near the mouth of the Bicol River, there are few opportunities for gainful employment other than fishing. A 1978 survey of Castillo's 430 households by the Ministry of Local Government and Community Development (MLGCD 1978) found that 68% were engaged in fishing or fishing related activities (e.g., processing). During a household survey conducted in late 1979, we confirmed this heavy dependence upon fishing. A total of 211 households with one or more family members engaged in fishing and 106 households engaged in various forms of fish marketing and/or processing. Seven of these households engaged in both fishing and processing which means that in 1979, 310 households (72% of all households) in Castillo were dependent upon fishing. Over and above these are small numbers engaged in boat building. There are 286 fishermen in the 211 fishing households; but three quarters of the households have only one fisherman (Table 2).

The purpose of the 1979 household inventory was to establish the extent and distribution of ownership of fishing assets in Castillo and to construct a sampling frame from which a sample for

Table 2. Fishermen per household in Barangay Castillo, Cabusao.

No. of fishermen per household	Frequency (households)	% of total households (211)	Cumulative frequency (fishermen)
1	157	74.4	157
2	34	16.1	225
3	19	9.0	282
4	1	0.5	286
	211	100	

costs and returns analysis could be selected. The inventory results are summarized in Table 3. The 211 fishing households in Castillo own 144 boats *(bancas)*, of which 107 (74%) are motorized, and 188 sets of fishing gear. Counting the 10-15 *bancas* owned by outsiders but operated by Castillo residents, approximately 155-160 *bancas* are used by Castillo fishermen. Gill-nets and mini trawls predominate, comprising 69% of all gears in the community.

Asset ownership is not evenly spread throughout these 211 fishing households (Table 4); 87 families (41%) own no *banca;* 61 families (29%) own no gear; and 63 families (30%) own neither *banca* nor gear. Therefore, while approximately two thirds of Castillo's fishing households own one or more fishing assets, one third is entirely dependent upon being able to rent or borrow others' *bancas* and/or gear or working as laborers for a share of the catch. For the Bay as a whole, 26% of fishermen own neither *bancas* nor gear (Villafuerte and Bailey 1982), so Castillo's pattern of asset ownership is similar to that of other surrounding communities.

The community is also characterized by a large number of fishing households that lend out their *bancas* and gear in return for a share of the catch. Strictly speaking, these lenders are not fishermen though in some cases they may be lending *bancas* or gear to other members of their own household.

Of the 114 households who own motorized *bancas*, 35% acquired their *bancas* through Development Bank of the Philippines (DBP) loans under the *Samahang Lima* scheme. The remainder were self-financed. According to the Naga City DBP office, a total of 1,419 loans were granted in Camarines Sur province up to 1978, of which none have been repaid in full (Mr. Jesus Naval, DBP Planning Department, Naga City). Though no data could be made available by DBP specifically on

Castillo, there is no reason to expect that the partial repayment rate was much different there than elsewhere in the province. Consequently, a fairly substantial proportion of the community who own motorized *bancas*, acquired them cost free which may explain the observations of fishermen that growth in numbers of boats operating in the Bay has been rapid during the 1970s.

Table 3. Fishing asset ownership in Barangay Castillo, Cabusao (1979).

Item	Subtotals	Number owned	Item	Subtotals	Number owned
I. Boats *(bancas)*[1]			Drift gill-net *(pamating)*	1	
			Crab gill-net *(pangasag)*	19	
Motorized		107	Bottom set gill-net *(palubog)*	20	
Non-motorized		37			
			Stationary gears		33
Total		144			
			Filter net *(biyakus)*	28	
II. Gear			Fish corral *(baklad)*	4	
			Liftnet *(bukatot)*	1	
Small trawl[2]		0			
Mini trawl		51	Push nets *(sakag)*		25
Gill-nets (sets)		78			
			Fish pot *(bubo)*		1
Drift gill-net *(panke)*	35				
Drift gill-net *(palataw)*	3		Total		188

[1] An additional 10-15 *bancas* are used by Castillo fishermen but are owned by individuals living outside the community.
[2] Two small trawlers began operation in Castillo during 1980 and were subsequently included in the costs and returns study (see Tulay and Smith, this report).

Table 4. Distribution of fishing assets in Castillo, Cabusao.

	Number	Percentage
I. *Bancas* (motorized and non-motorized)		
Families owning motorized *banca(s)* only	87	41
Families owning non-motorized *banca(s)* only	35	17
Families owning both motorized and non-motorized *bancas*	2	1
Families owning no *banca*	87	41
Total	211	100
II. *Bancas* (motorized only)		
Families owning one motorized *banca*	79	89
Families owning two motorized *bancas*	6	7
Families owning three motorized *bancas*	3	3
Families owning four motorized *bancas*	0	0
Families owning five motorized *bancas*	0	0
Families owning six motorized *bancas*	0	0
Families owning seven motorized *bancas*	1	1
Total	89	100
III. Gears		
Families owning one or more gear	150	71
Families owning no gear	61	29
Total	211	100

Castillo has three beach landing areas (Fig. 2) where middlemen and processors wait to transact business during landing times. There is some degree of specialization at each landing, determined primarily by where the fishermen expect the buyers to be (Table 5). For example, fish paste *(bagoong)* processors live near Landing Areas 1 and 3, hence the mini trawls which catch the sergestid shrimp *(balao)* land only at these two landing areas and choose between them depending upon prior arrangements made with buyers (the so-called *suki* system; see Smith et al. 1980), or, if they have no such arrangements, upon where they expect to obtain a higher price. If the mini trawler has a particularly good catch of the larger shrimps (other than *balao*), the fisherman will land his catch at Area 3 since this is where the shrimp middlemen and agents *(factorador)* who buy and ship to Manila wholesalers are located. Gill-netters tend to concentrate in Landing Area 2 because the processors who buy their catch for drying are located nearby. Because of this specialization at landing areas, fishermen tend to live near their landing area. For example, most gill-netters live near either Area 1 or 2. During the period February 1980 to January 1981, approximately 1,000 t (including *balao)* was landed at these three landing areas (Table 6). Thirty nine percent by weight was finfish; 61% was invertebrates.

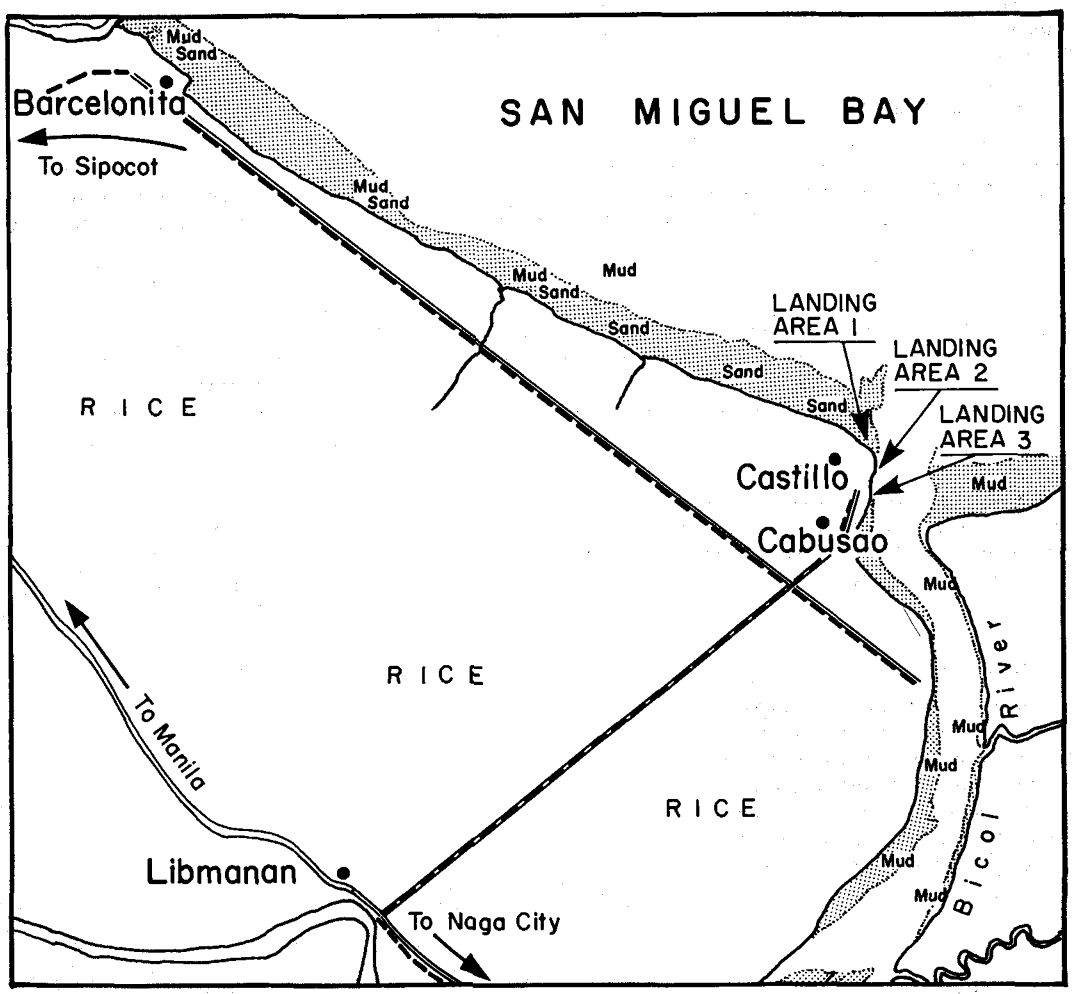

Fig. 2. Map of Cabusao Municipality showing Castillo landing areas.

The landing times shown in Table 5 also indicate at what time of the day the various gears are used. Crab gill-netters set their nets at night and retrieve them in the early morning; mini trawlers operate during daylight hours, landing their catch in the early evening. The catch of stationary gears (filter nets, corrals, and liftnets) is brought to Landing Areas 1 and 3 in the early morning.

Table 5. Castillo landing areas, time and gears.

Landing area	Landing time	Gears
Area 1	6 a.m. – 8 a.m.	Crab gill-nets Stationary gears
	12 noon – 2 p.m.	Gill-netters
	5 p.m. – 7 p.m.	Mini trawlers
Area 2	12 noon – 2 p.m.	Gill-netters *(panke)*
	12 noon – 2 p.m.	Gill-netters *(palubog:* 1st trip)
	5 p.m. – 6 p.m.	Gill-netters *(palubog:* 2nd trip)
Area 3	6 a.m. – 8 a.m.	Crab gill-nets Stationary gears
	5 p.m. – 7 p.m.	Mini trawlers

Table 6. Estimated total landings (in tonnes)[1] at Castillo, San Miguel Bay, 1980-1981.

Months	Castillo landing areas[2] Area 1	Area 2	Area 3	Total production (tonnes)	Catch composition (%) Fish	Invertebrates
1980						
Feb	100.0	29.0		129.1	20.3	78.7
Mar	45.6	18.5		64.1	30.4	69.4
Apr	123.6	33.0		156.6	24.9	75.1
May	17.6	18.5		36.1	57.3	42.6
June	15.3	9.8	9.4	34.5	42.3	57.6
July	10.8	15.5	20.8	47.1	75.1	24.8
Aug	25.3	17.8	25.8	68.9	79.8	20.1
Sept	21.7	12.6	36.8	71.1	60.3	39.6
Oct	76.6	10.5	20.1	107.2	20.7	79.3
Nov	83.0	11.8	16.6	111.4	19.2	80.8
Dec	60.0	5.2	10.7	76.0	15.1	84.9
1981						
Jan	69.0	9.3	6.0	84.3	17.3	82.7
Annual total	648.6	337.8		986.4	38.5	61.3

[1]Extrapolated from actual catch and effort (#boats landing) data collected approximately 3 days per week at each landing area. Extrapolation took into account actual fishing days in each month.
[2]Distinction between landing areas 2 and 3 was not made until a third research assistant was hired by the project in June 1980.

There is, of course, some variation in these landing times and in the types of gear that frequent each landing area. Although the whole year is considered productive, the southeast monsoon *(habagat)* favors the operation of gill-netters while the northeast monsoon *(amihan)* favors the operation of mini trawlers. From October to June, sergestid shrimp *(balao)* are the predominant species landed in Castillo. From June to October, mini trawlers' catches decline in volume as many of the operators change their gears from the fine-mesh *pamalaw* to the larger-mesh *pamasayan*, the gear used for catching bigger shrimps (Fig. 3).

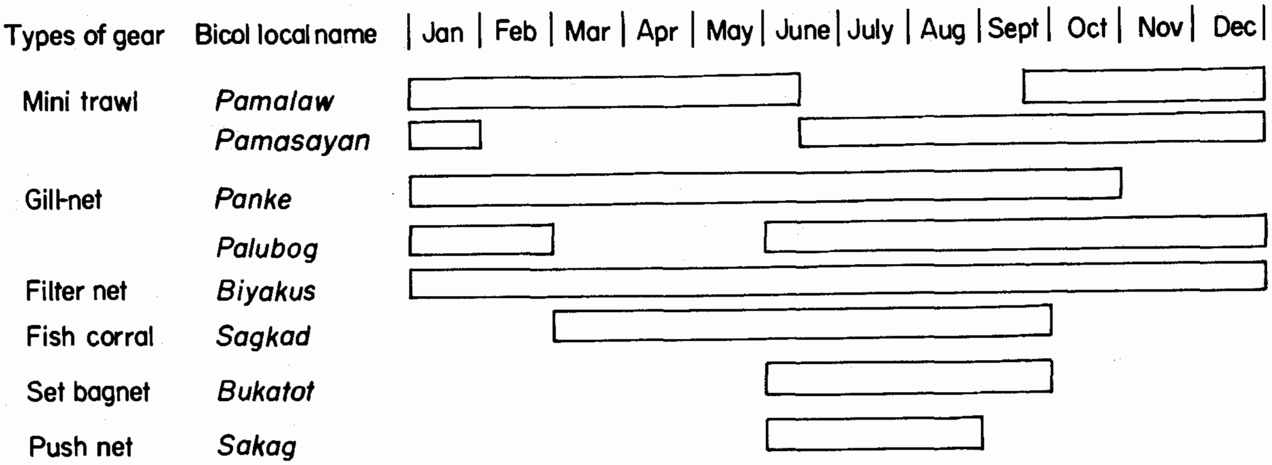

Fig. 3. Months of operation of major gears in Castillo as observed in 1980.

Gill-netters also change their gear during the year, using *panke* from March to September, to catch primarily croakers (locally known as *abo)*, and *palubog* from October to February to catch mullets and herrings (known locally as *banak* and *tamban*, respectively). The filter net *(biakus)* is a year-round operation. The stationary liftnets *(bukatot)* which catch primarily anchovies *(dilis)* operate during *dulum*, the dark phase of the moon with the aid of lamps and are highly seasonal, as are the fish corrals *(baklad)*.

The combined effect of these gears on Castillo landings produces extreme variation in catch of invertebrates, especially sergestid shrimp *(balao)*, but somewhat less variation in fish catch (Fig. 4). By volume, the *balao* catch of the mini trawlers dominates the landings (Table 6).

Castillo is an active center for processing, particularly the drying of the gill-net catch and the salting of mini trawl catch into fish paste or *bagoong*. As noted earlier, over 100 or approximately 25% of Castillo's households are engaged in some form of processing or middleman activities. Most of the fresh fish catch is marketed in nearby Libmanan; only occasionally does Castillo's fresh fish reach as far as Naga City. Dried products, on the other hand, are marketed in Libmanan, Sipocot and Naga. *Bagoong* after salting, is sent to Pangasinan Province, north of Manila, where the fermenting process is completed. Recently, the Institute of Fisheries Development and Research (IFDR) of the College of Fisheries, University of the Philippines in the Visayas has been introducing improved methods of drying and salting in an attempt to increase the value added to these products locally, but there has not yet been widespread adoption of the new techniques (Orejana 1982).

In contrast to Castillo, which with the exception of 2 small trawlers and 51 mini trawlers is the base primarily of municipal non-trawl gear, Sabang, Calabanga is the base of the majority (74 of 95) of the small municipal trawlers in San Miguel Bay. Because of their large catches, an even more intensive processing sector has evolved in Sabang. The major market for Sabang catch is Naga City, and part of the trawl catch is processed into fish meal used as a feed ingredient for local piggeries. A detailed description of Sabang and particularly its marketing sector can be found in Esporlas (1982).

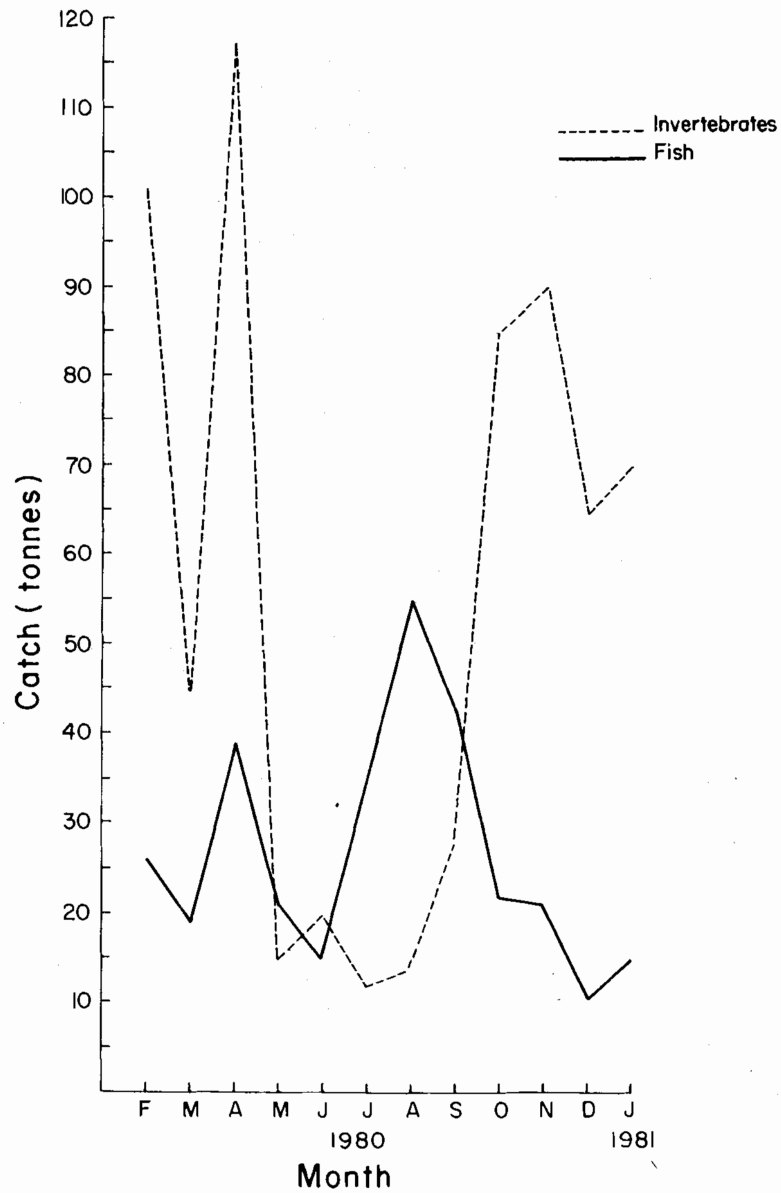

Fig. 4. Castillo landings, February 1980-January 1981.

The bulk of the economic team's work was conducted in Castillo supplemented by data gathered from a small sample of small and medium trawlers and processors from Sabang.

Sampling Methodology

Much of the information on Castillo in the preceding section was gathered between 1979 and 1981 by various survey techniques. (See Appendices for copies of the data collection instruments.) The only previous socioeconomic study conducted in the area (Piansay et al. 1979) covered the whole of Camarines Sur province and provided little detail on Castillo.

Our data collection activities covered four distinct phases: household inventory, landing and market survey, costs and returns record-keeping, and middlemen/processors survey. Table 8 lists the data collected during each phase and the sampling methodology used in each case. Except for the costs and returns record-keeping, either census or random sampling techniques was used.

In the case of the record-keeping activity, the primary criterion was the respondents should be willing to participate in the tedious process of recording daily costs and earnings. The sampling unit was the fishing unit, not fishermen or households. Both the landing and market survey and the costs and returns record-keeping spanned 12 months, though not the same period since our limited staff (3 research assistants in the field) could not initiate both activities simultaneously.

The major municipal fishing gears were included in the costs and returns record-keeping (Phase III) and the sample was as follows:

	No. fishing units
Gill-netters (Castillo)	20
Mini trawlers (Castillo)	16
Small and medium trawlers (Castillo and Sabang)	13
Liftnets (Castillo)	3
Filter nets (Castillo)	4
Fish corrals (Castillo)	3
Scissor (push) nets (Castillo)	5
Total sample size	64

Total number of trips of these 64 fishing units was 11,250; costs and returns data were collected from each of these trips.

Table 7. Catch composition by month (percentage of monthly total volume) at Castillo landings.

Species	Bicol/ local names	Feb	Mar	Apr	May	June	1980 July	Aug	Sept	Oct	Nov	Dec	1981 Jan	Full year
FINFISH:														
Croakers	*Abo*	8.9	14.4	11.5	26.1	12.9	14.6	12.9	8.0	0.6	–	0.2	5.1	8.1
Mullet	*Banak*	0.3	0.2	0.1	0.5	4.9	4.6	1.7	3.0	7.0	5.1	4.1	1.5	2.8
Silverbar fish	*Barera*	1.0	0.9	1.7	–	0.2	–	–	–	–	–	–	–	0.5
Thread fin	*Bucadulce*	–	–	0.2	0.5	0.3	0.5	0.8	0.4	–	–	–	–	0.2
Transparent herring	*Bulinao*	–	–	–	–	–	0.9	1.2	1.3	–	–	–	–	0.2
Barracuda	*Bulyos*	–	–	–	–	–	–	2.1	1.5	–	–	–	–	0.2
Trash fish	*Diaco*	–	–	–	–	4.8	18.3	20.7	11.8	4.5	7.5	6.8	5.2	6.0
Anchovies	*Dilis*	–	0.2	0.1	0.2	0.3	4.1	14.6	22.9	3.2	0.3	0.5	0.5	3.0
Sea catfish	*Dupit*	–	0.2	–	–	0.2	0.4	1.2	–	–	–	–	–	0.2
Cutlass fish	*Langkoy*	0.9	4.4	0.5	0.3	–	–	–	–	–	–	–	–	0.4
Common whiting	*Osoos*	0.3	0.4	0.1	–	0.2	0.3	0.2	0.2	–	–	–	–	0.1
Croakers	*Pagotpot*	2.6	4.7	6.8	22.0	11.9	14.5	12.1	7.1	0.5	–	–	3.3	6.0
Flatfishes	*Palad*	0.2	–	0.1	0.3	0.1	–	–	–	–	–	–	–	0.06
Sharks	*Pating*	–	0.1	–	–	–	–	–	–	–	–	–	–	0.04
Deep-bodied crevalle	*Salaysalay*	–	–	0.1	0.6	0.2	0.5	–	–	–	–	–	–	0.1
Deep-bodied herring	*Tamban*	1.0	4.0	0.3	0.6	0.7	1.4	0.2	0.4	17.8	6.0	1.0	–	2.0
Deep-bodied anchovy	*Tigi*	–	–	0.2	0.4	0.1	–	–	–	–	–	–	–	0.1
Miscellaneous species		0.9	2.7	1.0	7.5	2.0	15.7	12.5	7.1	1.2	0.7	0.9	1.2	5.45
INVERTEBRATES:														
Small shrimps	*Balao*	81.8	64.5	75.6	31.0	48.8	–	–	13.8	55.2	75.8	81.9	79.2	56.1
Shrimps	*Bilugan*	1.1	2.0	1.3	5.6	0.3	9.2	6.7	14.3	7.8	3.3	4.6	3.3	4.6
Shrimps	*Buhukan*	–	–	–	–	0.4	1.2	0.9	0.3	0.5	0.1	–	–	0.3
Shrimps	*Guludan*	–	1.1	0.1	0.3	–	–	0.2	–	–	–	–	–	0.01
Blue crabs	*Kasag*	–	–	0.3	4.1	6.4	13.3	10.7	13.2	1.3	0.9	–	–	3.2
Squids	*Pusit*	–	–	–	–	–	0.2	0.3	–	–	–	–	–	0.04
Shrimps	*Usbon*	0.1	–	0.1	–	–	–	1.2	1.1	0.4	0.3	–	–	0.3
Total (%)		100	100	100	100	100	100	100	100	100	100	100	100	100
Total (t)		129.1	64.1	156.6	36.1	34.5	47.1	68.9	71.1	107.2	111.4	76.0	84.3	986.4

Table 8. Data sources and sampling methodology.

Phase	Duration	Frequency	Data collected	Sampling methodology	Sample size
I. (Household inventory)	Sept.-Dec. 1979	Single visit per household	Number of fishermen per household Fishing assets owned or used Sources of financing for owned fishing assets Sources of borrowed boats and/or gear	Census of Castillo house–holds during which all fishing households were identified	211 of 430 households engaged in fishing
II. (Landing survey)	One year: Feb. 1980-Jan. 1981	Three times weekly	Landed (ex-vessel) prices of major species Catch per vessel landing Number of vessels/ gear types landing per landing period	Data were collected from all vessels landing (an occasional vessel may have been missed, but such occurrences were very infrequent)	Varied depending on day
(Marketing survey)	One year: Feb. 1980-Jan. 1981	2-3 times weekly	Prices of fresh fish from Libmanan and Sipocot markets Prices of fresh fish from Naga market Prices of processed products in Castillo, Libmanan and Sipocot	Data were collected from all sellers in each market Secondary data from the Philippine Fish Marketing Authority (PFMA) Data were collected from all sellers in each market	Varied depending on day
III. (Costs and returns record-keeping)	One year: June 1980-May 1981	Daily records	#fishing trips and fishing days per month Catch, operating costs, value of catch per trip/ fishing day	Purposive sample with selection of respondents based primarily on willingness to cooperate in the daily record-keeping activity. The sampling unit was the fishing unit, rather than individual fisherman or household	64 fishing units (11,250 trips approx.)
	June 1980	Single visit per respondent	Fishing assets, fixed costs, estimated life of assets, acquisition date	Sample size was approximately 20%	
IV. (Middlemen/ processors survey)	March-April 1981	Single recall interview	Fixed and operating costs, estimated life of fixed assets, daily volume handled, average daily purchases and receipts; certain attitudinal data regarding ease of entry to business	Randomly selected from list of all middlemen and processors purchasing fishery products in Castillo and Sabang	64

The landing and market surveys (both of Phase II) covered Castillo landings and the nearby markets for fresh and processed products in Castillo itself, Libmanan, Sipocot and Naga City. Two to three visits were made to the first three of these markets each week; one visit on the weekly market day, the other visits on non-market days. Naga City prices were provided by the regional office of the Philippine Fish Marketing Authority (PFMA) and were collected from PFMA monthly.

The middlemen/processors survey was conducted in Castillo and Sabang with the sample randomly selected from a list of all middlemen and processors in the two communities. The sample breakdown and size were as follows:

	Castillo	Sabang	Total
Processors (drying)	10	15	25
Processors (salting)	6	2	8
Middlemen (fresh shrimp)	4	–	4
Middlemen (fresh fish)	20	–	20
Middlemen (dried fish)	7	–	7
Total sample size	47	17	64

Analytical Methodology

There are two parts to this study: economics of the fishery and economics of marketing. The essential elements of the analyses are outlined here.

ECONOMICS OF THE FISHERY

No historical data are available on economic aspects of the San Miguel Bay fishery. Consequently, the analyses in the papers that follow focus on current (1980-1981) costs and earnings for the major municipal gears to determine the returns to capital and labor of each gear type. Profitability is examined from two points of view. First, return to owner is calculated in the usual fashion (see Ovenden 1961) whereby fixed and operating costs are subtracted from owners' earnings and the residual treated as a return to owners' own labor, capital, risk and management. Return to labor is determined from the sharing system in operation for each gear type.

Second, the possible existence of pure profits (resource rents above all costs) is calculated by comparing returns to labor and capital with their respective opportunity costs (Panayotou 1981). This comparison shows whether or not pure profits exist in the fishery, which users are earning them, and whether there is room to expand the fishery (i.e., increase fishing effort) to redistribute the 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 used in the fishery, *if the management's goal is to simply maximize employment in the fishery.* If the reverse is found to be the case, the amount of capital and labor in the fishery should be reduced and the excess diverted to alternative activities where they can earn more. In the final paper of this report (Smith and Mines), the implications of these findings for fisheries management and the tradeoffs among goals of maximizing employment, maximizing production, or maximizing economic efficiency are considered. Suffice it to say at this point that each of these goals is associated with different levels of fishing effort and different allocations of the catch among competing users.

ECONOMICS OF MARKETING

Based on price data collected at the Castillo landings and the nearby markets, the relationship (if any) among these prices is established to determine the efficiency of the marketing system to provide price information at the landings (Bressler and King 1970). If no relationship can be established among these prices, imperfection in the marketing system is implied. Differentials among prices are calculated to show the mark-up by species and this differential is compared with the marketing costs of middlemen (see Appendices for further detail). A similar procedure is followed to determine the efficiency of the processing sector; that is, price differentials between fresh and processed products (adjusted for weight loss in processing) are compared with the costs of processing. Economies of scale of processors (drying and salting) are estimated to determine the possible role/impact of marketing cooperatives engaged in processing.

Conclusion

The complete lack of historical data on economic aspects of the San Miguel Bay fisheries is a major handicap to any serious analysis. Only with time series data can trends be determined. This economic study provides only a picture of the fishery at a particular point in time, but a particularly valuable one because it allows conclusions to be drawn regarding the likely distribution of benefits from the fisheries among the various competing users.

The question of distribution of benefits is important for two reasons. First, change in this distribution has occurred rapidly with the introduction in 1970 of the small and medium trawlers which now harvest almost half the total catch of the Bay (Pauly and Mines 1982). Political pressure has been brought to bear on this situation through several petitions from municipal fishermen to government agencies, as well as to President Ferdinand Marcos. Concerned officials are anxious to respond in a responsible manner and this study's findings on the distribution of benefits should aid in their decisionmaking.

Second, an examination of benefits is important because the economics of the small-scale fishing units of San Miguel Bay are soon to undergo radical change. Since the mid-1970s there has been a rapid influx of new capital into the fishery and much of it was obtained by fishermen at little or no cost. The *Samahang Lima*, or Small Foreshore and River Fishermen Program of the Development Bank of the Philippines (DBP) as it was more formally known, was a national credit scheme that loaned over ₱275 million during its 4 years of operation from 1975 until its suspension in 1978 (Smith et al. 1980). Nationwide, less than 1% of loans were paid off; in the province of Camarines Sur, not one of the 1,419 borrowers repaid his loan in full. A total of ₱5.47 million was loaned to fishermen in Camarines Sur province which includes the major fishing grounds of San Miguel Bay, Lake Buhi, and several smaller lakes. It was estimated by DBP that 85% of these loans went to fishermen in the 5 Camarines Sur municipalities that adjoin the Bay. This means that in addition to private capital there was an infusion of approximately ₱4.5 million in public financing to the fishery, much of it for vessels and gear such as those used by gill-netters. In fact, this ₱4.5 million would be sufficient to purchase over 340 complete gill-net fishing units at current prices, or to replace the entire current motorized gill-net fleet of 300 units (Pauly et al. 1982).

Although there are no hard data to substantiate it, it appears that expansion in the fishing power of the competing users exploiting San Miguel Bay has been substantial during the 5 years preceding this study. Because these units are now wearing out and 'free' capital is no longer available for replacement, the economics that fishermen face today are quite different from the economics that prevailed for the few years after 1975. Though many small-scale municipal fishing units may have been profitable because of the DBP's 'social financing', they may find it much more difficult to remain so when private or commercial bank sources are the only means to refinance vessels and gear as they wear out.

This report's attempts to analyze the economics of the fishery and distribution of benefits among competing users are thus very timely and have important implications for management of the fishery.

References

Bailey, C., Editor. 1982. Small-scale fisheries of San Miguel Bay, Philippines: social aspects of production and marketing. ICLARM Technical Reports 9, 57 p. Institute of Fisheries Development and Research, College of Fisheries, University of the Philippines in the Visayas, Quezon City, Philippines; International Center for Living Aquatic Resources Management, Manila, Philippines; and the United Nations University, Tokyo, Japan.

BFAR. 1979. 1977 fisheries statistics of the Philippines. Bureau of Fisheries and Aquatic Resources, Quezon City, Philippines.

Bressler, R.G. and R.A. King. 1970. Markets, prices and interregional trade. John Wiley and Sons, Inc., New York.

De Sagun, R.B. and R.S. Bautista. 1979. Updated index to Presidential decrees on fisheries. Bureau of Fisheries and Aquatic Resources, Quezon City, Philippines.

EDPITAF. 1978. Fisheries education study: Committee on Fisheries Integrated Development Study. Educational Development Projects Implementing Task Force, Manila, Philippines.

Esporlas, A.E. 1982. The seasonality of fishing, marketing and processing, p. 14-24. *In* C. Bailey (ed.) Small-scale fisheries of San Miguel Bay, Philippines: social aspects of production and marketing. ICLARM Technical Reports 9, 57 p. Institute of Fisheries Development and Research, College of Fisheries, University of the Philippines in the Visayas, Quezon City, Philippines; International Center for Living Aquatic Resources Management, Manila, Philippines; and the United Nations University, Tokyo, Japan.

Lampe, H.C. 1980. Conceptual considerations for fisheries management programs. Report prepared for the Fishery Industry Development Council (FIDC), Ministry of Natural Resources, Manila. (Internal report).

MLGCD. 1978. Unpublished data from household survey. Ministry of Local Government and Community Development, Cabusao, Camarines Sur, Philippines.

Orejana, F.M. 1982. Low-cost fish processing and the use of appropriate technology in the Philippines, p. 153-160. *In* R.C. May, I.R. Smith and D.B. Thomson (eds.) Appropriate technology for alternative energy sources in fisheries. ICLARM Conference Proceedings 8, 215 p. Asian Development Bank and International Center for Living Aquatic Resources Management, Manila, Philippines.

Ovenden, A.E. 1961. Costs and earnings investigations of primary fishing enterprises: a study of concepts and definitions. FAO Fish. Stud. No. 10. 72 p.

Panayotou, T. 1981. Cost structure and profitability of small-scale fishing operations: methodological framework. Paper presented at the IDRC small-scale fisheries workshop, May 1981, Singapore. (Mimeo)

Pauly, D. and A.N. Mines, Editors. 1982. Small-scale fisheries of San Miguel Bay, Philippines: biology and stock assessment. ICLARM Technical Reports 7, 124 p. Institute of Fisheries Development and Research, College of Fisheries, University of the Philippines in the Visayas, Quezon City, Philippines; International Center for Living Aquatic Resources Management, Manila, Philippines; and the United Nations University, Tokyo, Japan.

Pauly, D., A.N. Mines and N.A. Navaluna. 1982. Catch and effort in the small-scale fisheries, p. 56-64. *In* D. Pauly and A.N. Mines (eds.) Small-scale fisheries of San Miguel Bay, Philippines: biology and stock assessment. ICLARM Technical Reports 7, 124 p. Institute of Fisheries Development and Research, College of Fisheries, University of the Philippines in the Visayas, Quezon City, Philippines; International Center for Living Aquatic Resources Management, Manila, Philippines; and the United Nations University, Tokyo, Japan.

Piansay, E., Z. dela Cruz and M. Lizarondo. 1979. Marketing operations of sustenance fishermen in Camarines Sur. Agricultural Marketing Report, Vol. 1, No. 1. Bureau of Agricultural Economics, Ministry of Agriculture, Quezon City, Philippines.

Santos, A.B. 1979. Relevant laws on municipal fisheries. Bureau of Fisheries and Aquatic Resources, Quezon City, Philippines.

Smith, I.R., M.Y. Puzon, C.N. Vidal-Libunao. 1980. Philippine municipal fisheries: a review of resources, technology and socioeconomics. ICLARM Studies and Reviews 4, 87 p. International Center for Living Aquatic Resources Management and Fishery Industry Development Council, Manila.

Spoehr, A. 1980. Protein from the sea: technological change in Philippine capture fisheries. Ethnology Monographs No. 3. Dept. of Anthropology, University of Pittsburgh, Pennyslvania.

Szanton, D.L. 1971. Estancia in transition: economic growth in a rural Philippine community. Institute of Philippine Culture Papers No. 9. Ateneo de Manila University, Quezon City, Philippines.

Villafuerte, E.D. and C. Bailey. 1982. Systems of sharing and patterns of ownership, p. 25-41. *In* C. Bailey (ed.) Small-scale fisheries of San Miguel Bay, Philippines: social aspects of production and marketing. ICLARM Technical Reports 9, 57 p. Institute of Fisheries Development and Research, College of Fisheries, University of the Philippines in the Visayas, Quezon City, Philippines; International Center for Living Aquatic Resources Management, Manila, Philippines; and the United Nations University, Tokyo, Japan.

Appendix 1

Glossary of Local Bicol Terms

Alsada — a kind of transaction in which a middleman gets processed fish from processors in advance and pays them after the product is resold

Amihan — northeast monsoon

Baca-baca — small rattan container which can accommodate 3-5 kg of fish

Barato — cheap or bargain

Baratero — one who buys commodities at the lowest price possible

Baroto — a small canoe usually used by the poorest fishermen

Bulanon — when moon is full or waxing

Dakup — the volume of catch

Dulum — dark phases of the moon

Habagat — southwest monsoon

Hayuma — mending or darning of net

Hikot — the local and general term for the net used by fishermen regardless of gear type

Hinalang — hauling of fish from the net

Itcha — to drop the net at sea

Kamalig — a structure usually made of temporary materials like bamboo walling and nipa roofing, as typically used by processors

Lahod — to go out fishing

Maestro — *(buso mayor)* boat pilot, whose main task is to operate the boat and direct it to the most productive fishing area. This is most commonly used in reference to trawlers

Partida — sharing of catch revenue after deducting all the expenses incurred during fishing including repair of parts and gears from the gross value of catch

Rigaton — a fresh fish vendor

Sadan — a market place

Talang — fish gilled in the net

Tibaw — the process of harvesting fish from the net at sea

Tiklis — a rattan container which can accommodate from 10 kg up

Appendix 2

Sample Data Collection Forms Used in Record-Keeping and Middlemen/Processors Survey

- Questionnaire A: costs and returns (fishing assets)
- Questionnaire B: costs and returns (daily trip records)
- Questionnaire C: middlemen survey

The following forms are samples of the types used; similar forms were used for other types of fishing units and for other middlemen/processors. In general, we were pleased with the costs and returns forms though we found it very difficult to collect accurate data on fishing area and time spent fishing. The middlemen/processors survey form was adequate for its limited purpose, but the survey should have been implemented at regular intervals throughout a one-year period to capture seasonal variation in volume handled.

Questionnaire A: Costs and returns (fishing assets)

A. Capital assets	Specification	No. owned	Whether for personal use/ rented out	How acquired (own finances DBP loan, etc.)	Year acquired	Acquisition cost	Expected life (no. yrs. from acquisition to discard)	Annual depreciation (cost ÷ life)
1. *Banca*								
Motorized *banca* (length and size of motor)								
Non-motor *banca* (length of *banca*)								
2. Gear								
Drift gill-net								
Set gill-net								
Baby trawl								
Fish corral *(baklad)*								
Biyakus								
Sakag								
Bukatot								
3. Others								
Containers								
Tub (galvanized)								
Kamalig								
Others								

B. Other annual fixed costs

1. License : ₱________
2. Others : ₱________ = ₱________
₱________

Total capital Σ cost = ₱________

Total annual Σ depreciation = ₱________

Questionnaire B: Costs and returns record-keeping (daily trip records).

(a) Owner (b) Borrower/renters (circle category) (c) Fishing unit type ____________ (d) Fishinç code no. ____________

	Fishing		Hours spent fishing		Expenses						Catch					
												Volume				
(Month)	Yes–1 No –0 Remarks	Fishing area	Traveling	Actual fishing	Gasoline	Oil	Repair parts	Ice	Food	Others	Species code	Kg	Other units	ıtal lue	No. of partners	Sharing %
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13																
14																
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19																
20																
21																
22																
23																
24																
25																
26																
27																
28																
29																
30																
31																
Monthly totals ($\sum$) =		trips	hrs	hrs												
Average per day ($\frac{\sum}{\#\text{days in month}}$) =			hrs	hrs												
Average per trip ($\frac{\sum}{\#\text{of trips}}$) =			hrs	hrs												

Total monthly expenses = ₱____________ Total montł /alue = ₱____________

Monthly net revenue = total monthly value minus total expenses = ₱____________
(before sharing)

Questionnaire C: Middlemen survey.

Buy/sell middlemen (check category)

Iced shrimp
Fresh (Castillo-Libmanan) ________
Fresh (Castillo-Sipocot) ________
Fresh (Castillo-Mercedes) ________
Dried (Castillo-Libmanan/Sipocot) ________
Local vendors (Fresh/dried) ________

Name of R: ____________ Age: ______ No. of yrs. in business: ________ Part time: ______ Full time: ______

1. Investment items (assets)	Number owned	Rented	Acquisition cost	Year acquired	Expected total life
• styrofoam boxes					
• tying materials					
• weighing scale					
• cans					
• tubs					
• pails					
• *tiklis*					
• sorting device					
• kamalig					
• vehicles (% used for business? ___%)					
• others					

If any of the above are rented out to others, what is the approximate average daily rental fee? ₱________

2. Purchases/sales (for most recent active day):

Species	Volume	Total Purchase Cost	Usual or not	Volume	Total Sales Cost	Usual or not	Where sold

Sold wholesale or retail? ____________ Mode of payment ____________
Average time before payment? ____________
Price difference between cash and credit ____________
If wholesale, how much higher would the price be if you sold retail (in the same location) ____________

3. Inventory:

What was the quantity sorted the night before this day? ________ (kg)
What quantity was in storage (for later sale) at the end of this day? ________ (kg)
What is the average time from purchase to sale? ________

4. Average no. of days engaged in business: ________ per week; ________ per month.

5. Operating costs (for most recent active day):

	Current year (₱)	1 year ago (₱)

- ice
- salt
- rice hulls
- container/bags (if sold w/the product)
- labor:
  - own labor (no. of hrs.)
  - family labor (no. of hrs.)
    if in kind payment? ₱
  - hired labor (no. of hrs.)
- transportation:
  - hired vehicle
  - driver's fee (incl. food etc.)
  - gasoline/oil
  - own fare (back & forth)
  - freight
- equipment rental fee
- market fee
- brokerage fee (Manila)
- maintenance/repair (annual)
- bad debts (annual amount)
- miscellaneous:
  - snacks for hired laborers, personal (but only additional % increase over normal expenses)
  - cigarettes

Have any of the above operating costs increased since one year ago? If so, complete final column above.

6. Alternative occupation: If you were not engaged in this business, what income generating activity would you engage in?

7. Is it easy or difficult to enter this business?

- very easy
- easy
- very difficult
- difficult

8. Why?

9. How much capital is required to enter this business?

Appendix 3

Program Description for Computation of Price Per Kilogram for Each Species in a 'Multispecies' Transaction

Because much catch sold at the Cabusao landings as elsewhere in the Philippines is sold by the container rather than by weight, a method must be found to estimate price/kg of each species (P_i). Data that can be collected at the time of the transaction are:

- total value of transaction
- container used (type and no.)
- species composition (%).

We used a conversion table (see Appendix 4) to estimate the average weight of each transaction, from which the average weight of each species can be derived knowing species composition. To determine price/kg by species required the creation of an index of *relative* prices. This we obtained through interviews of middlemen at the landing by asking them the price they would be willing to pay per kg for each species that day. The index thus fluctuated throughout the season depending upon the supply and demand for each species. The index could not have been determined from nearby Libmanan prices because there too fish were sold by volume and not by weight.

The calculation of price/kg by species requires solving the following formula for P_i:

$$\text{Total value} = \Sigma X_i P_i = \Sigma (X_1 P_1 + X_2 P_2 + \ldots X_n P_n)$$

where X_i = weight (kg) of species i

P_i = price (₱) of species i

Knowing total value, X_i and the relative prices from the index, it is then possible to solve for P_i. The following program solves for up to 9 species in any 'multispecies' transaction.

Program Description

Program Title : Computation of price per kg by species in a 'multispecies' transaction.
Name : Jan Michael Vakily
Address : German Society for Technical Cooperation (GTZ) D-6236 Eschborn, Dag-Hammarksjöld Weg 1 Federal Republic of Germany
Compatability : In its present form the program can be used on a Hewlett Packard programmable calculator (HP67 or HP97)
Program Description, Equations, Variables etc.:

The program computes the actual price per kg of different species sold in a single 'multispecies' transaction. The following information is required: total value of the transaction; a price index showing relative prices of the involved species (gathered from nearby market or from middlemen for example); weight per species obtained from total weight of transaction and species composition (%).

Computation :

species(i)	index(i)	weight(i)	corrected index(i)
1	₱/kg	kg	₱/kg x kg
2	⋮	⋮	⋮
⋮	⋮	⋮	⋮
n			Σ corrected index

$$\text{Price/kg of species(i)} = \left(\text{total value} \times \frac{\text{corrected index(i)}}{\Sigma \text{ corrected index}}\right) \div \text{weight(i)}$$

Operating limits and warnings:

A maximum of 9 species can be included for any single transaction.

Program Listing

STEP	KEY ENTRY	KEY CODE	COMMENTS
001	* LBLA	31 25 11	
	CL REG	31 43	
	P ≷ S	31 42	
	CL REG	31 43	
	STO E	33 15	
	O	00	
	ST I	35 33	
	CLX	44	
	RTN	35 22	
010	* LBLB	31 25 12	
	X ≷ Y	35 52	
	ISZ	31 34	
	RCI	35 34	
	I	01	
	O	00	
	X = Y?	32 51	
	GSB b	32 22 12	
	CLX	44	
	Rv	35 53	
020	CLX	44	
	Rv	35 53	
	STO + (i)	33 61 24	
	X	71	
	STO + O	33 61 00	
	CLX	44	
	RTN	35 22	
	* LBLb	32 25 12	
	O	00	
	÷	81	
030	RTN	35 22	
	LBLD	31 25 14	
	RCLE	34 15	
	RCL O	34 00	
	÷	81	
	RCL (i)	34 24	
	X	71	
	STO (i)	33 24	
	DSZ	31 33	
	GTO D	22 14	
040	1	01	
	ST I	35 33	
	*LBL 1	31 25 01	
	RCL (i)	34 24	
	X = O?	31 51	
	RTN	35 22	
	PAUSE	35 72	
	PAUSE	35 72	
	ISZ	31 34	

STEP	KEY ENTRY	KEY CODE	COMMENTS
	GTO 1	22 01	
050			
060			
070			
080			
090			

LABELS					FLAGS
A STO total price of transaction	B Price-Index ↑ + weight per species	C	D Price per kg for each species	E	0
a	b shows "ERROR"	c	d	e	1
0	1 routine to present the results	2	3	4	2
5	6	7	8	9	3

SET STATUS

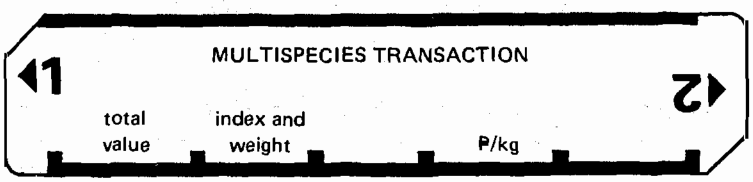
FLAGS	ON	OFF	TRIG	DISP
0	□	□	DEG □	FIX ☒
1	□	□	GRAD □	SCI □
2	□	□	RAD □	ENG □
3	□	□		n =

REGISTERS

0	1	2	3	4	5	6	7	8	9
Σ corrected index	₱/kg for species no. 1	₱/kg for species no. 2	₱/kg for species no. 3	₱/kg for species no. 4	₱/kg for species no. 5	₱/kg for species no. 6	₱/kg for species no. 7	₱/kg for species no. 8	₱/kg for species no. 9
S0	S1 used	S2 used	S3 used	S4 used	S5 used	S6 used	S7 used	S8 used	S9 used

A	B	C	D	E	I
				Total price of transaction	used

User Instructions



STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS		OUTPUT DATA/UNITS
1	Load side 1 of card				
2	Enter the total value of the transaction	₱	A		0.00
3	Enter the price/kg [index] for the first species	₱	↑		₱
4	Enter the weight of the first species	kg	B		0.00
5	For second [third, etc.] species, repeat steps 3 to 4				
6	Calculate the price per kg for each species of the transaction [the results for all species—starting with the first one—are displayed successively at two-seconds-intervals]		D		
	Note: ₱/kg for species 1 to 9 can also be called off from store 1 to 9!		RCL	(1–9)	
7	For new transaction start at step 2				

Appendix 4

Conversion Tables Used for Landing Survey (Fresh Fish) to Estimate Weight Per Transaction

Appendix 4. Conversion tables used for landing survey (fresh fish) to estimate weight per transaction.[1]

Species	Local name	Type of container	Average full container weight (kg)	Average no. pieces of fish per kg
Tiger-toothed croakers	*abo*	*baca-baca*	7	7
Other croakers	*pagotpot*	*baca-baca*	7	15
Swimming crabs	*alimasag*	*baca-baca* (small)	4.5	3-12
Swimming crabs	*alimasag*	*baca-baca* (med)	7.75	3-12
Swimming crabs	*alimasag*	*baca-baca* (big)	10.5	3-12
Fairy shrimps	*balao*	*tiklis*	57	–
Flatfish	*palad*	*baca-baca*	7.5	5-7
Spanish mackerel	*tangigi*	*baca-baca*	7	1-15
Anchovies	*dilis*	*baca-baca*	30	–
Sardines	*tamban*	*baca-baca*	5	50
Mullets	*banak*	*baca-baca*	6	27
Mixed	*abo* and *pagotpot*	*baca-baca*	7	–
Mixed	*tamban* and *banak*	*baca-baca*	5.5	–

[1]At the landing we collected observations on number of *baca-baca* or *tiklis* per transaction and used the conversion table to calculate total weight of each transaction.

Gill-netters: Costs, Returns and Sharing Systems

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YATER, F. 1982. Gill-netters: costs, returns and sharing systems, p. 27-44. *In* I.R. Smith and A.N. Mines (eds.) Small-scale fisheries of San Miguel Bay, Philippines: economics of production and marketing. ICLARM Technical Reports 8, 143 p. Institute of Fisheries Development and Research, College of Fisheries, University of the Philippines in the Visayas, Quezon City, Philippines; the International Center for Living Aquatic Resources Management, Manila, Philippines; and the United Nations University, Tokyo, Japan.

Abstract

This paper analyzes the costs and returns for gill-netters, the major small-scale fishing gear in terms of numbers of units and fishermen employed, operating in San Miguel Bay, Philippines. The analysis is based on investment costs and daily fishing trip data collected between June 1980 and May 1981 from a sample of gill-netters based in Cabusao, Camarines Sur. The 20-sample fishing units made a total of 4,680 fishing trips during this period.

Gill-net operation is described; its seasonality, species caught and fishing areas are discussed. The most commonly used sharing arrangements between owner and crew are illustrated to determine the returns to capital and labor in the gill-net fishery. Owners earn less than their opportunity costs and crewmen earn more than their opportunity costs; each fishing unit earns a small pure profit.

Finally, production functions are used to explain variations in monthly catch. Eighty four percent of the variation in monthly catch of the gill-netters can be explained by the number of fishing trips and gasoline expenditure per trip.

Introduction

Various forms of gill-nets have been used by San Miguel Bay fishermen for many years. Before World War II, at least seven different types of bottom-set gill-nets were observed, each selective through its mesh size for certain species (British Admiralty 1944). These nets were known by the general Bicol term *palubog* and they were used from non-motorized boats to catch mullet, deep-bodied herring, various scads and sea catfish. The majority of fishermen in the Bay, however, continued to use the more traditional gears such as hook and line *(banwit)* and longline *(kitang)*. Gill-nets, including the drift gill-net *(panke)*, became more prevalent in the early 1960s and by the end of that decade, gill-netters began to acquire 3 to 9-hp engines for their boats using their own finances. According to respondents, non-motorized boats outnumbered motorized boats until 1975 when the government launched the *Samahang Lima*, a major credit program for small-scale fishermen through the Development Bank of the Philippines (see Smith et al., this report, for details). Through this program, many fishermen were able to acquire larger engines ranging from 9 to 16 hp. By 1981, approximately 70% of all gill-netters in the Bay were motorized. In 1980, the tiger-toothed croaker *(abo)* was the major species caught by the gill-netters and also by trawlers.

The objectives of this study were:

- to calculate the returns on investment and residual income to owners/operators of motorized gill-netters;
- to determine the returns to labor according to the sharing system in operation for gill-netters;
- to compare the levels of income of owners and laborers.

Methodology

Ninety six gill-net operators were identified during the household inventory conducted in Castillo in late 1979. Of these, 20 fishing units (approximately 20%) were invited to participate in a record-keeping activity whereby costs and returns were recorded daily for a 12-month period. Fishing units were selected for record-keeping based on the willingness of the owner/operator and laborers to cooperate with the researchers. A randomly selected sample of all fishing units was not thought to be practical.

The 20 sample respondents fell into two categories: those who previously kept records of the daily costs/expenses and the value of their catch, and those who did no record-keeping. Fifty percent of our sample were found to be keeping records of some kind but none included all the specific items needed for this study. Initially, only half of the 20 respondents were willing to keep their own records according to the format. For the other half, daily visits by the researchers were at first necessary to record the required data. Notebooks were provided to those keeping their own records, and collected regularly; the data were subsequently recorded in survey files and the notebooks returned to the correspondents. As the record-keeping activity progressed, its value became more apparent to the respondents, so that by the second half of the data collection 90% of the respondents maintained their own records. Using the respondents' own records supplemented by frequent visits, complete costs and returns data for the 12-month period were obtained.

Not all 20 of the initial respondents completed the 12-month cycle. After one month of data collection, one respondent sold his fishing unit and moved to another locality. Three additional respondents withdrew because they feared, despite assurances to the contrary, that the information they provided would be turned over to the Bureau of Internal Revenue (BIR). Substitutes were identified for these four respondents so that the number of fishing units could be maintained at 20 through each of the 12 months during which data were collected. It was decided that such substitution would be acceptable because the sampling unit was the fishing unit, not the individual fisherman nor the fishing household and because primary interest was in the average monthly costs and returns of the sample gill-netters.

Collecting complete daily trip information required interviews of both the boat owner and boat operator in many cases since not all owners actually fish. For example, the owner could provide information on trip expenses and value of the catch while the operator could provide details on the fishing area, hours actually spent fishing and the species caught. Neither operator nor owner, however, could provide reliable data on the volume of the catch because the catch is most often sold unsorted and in various containers at the beach landing. As discussed in Smith and Supanga (this report), catch per trip data were collected separately for gill-netters at their landing based upon conversion tables derived for estimating the weight (in kg) of the various rattan containers *(baca-baca, tiklis)* used. Therefore, the record-keeping data collected from owners and/or operators concentrated on the trip expenses (e.g., gasoline, oil and food) and the landed value of the catch.

Description of the Gear and its Use

Gill-nets used in Castillo, Cabusao (Figs. 1 and 2) are curtain-like nets consisting of a set of one or more pieces of rectangular net made of nylon twine. Fish capture is effected by gilling or entangling the fish in the net. There are two kinds of gill-net used in Castillo depending upon the fishing season, namely drift gill-net *(panke)* and bottom-set gill-net *(palubog)*. Both are operated from a boat *(banca)* by a crew of three fishermen. Of these three fishermen, one is the boat pilot *(maestro)* whose main job is to operate the engine and direct the boat to the most productive fishing area.

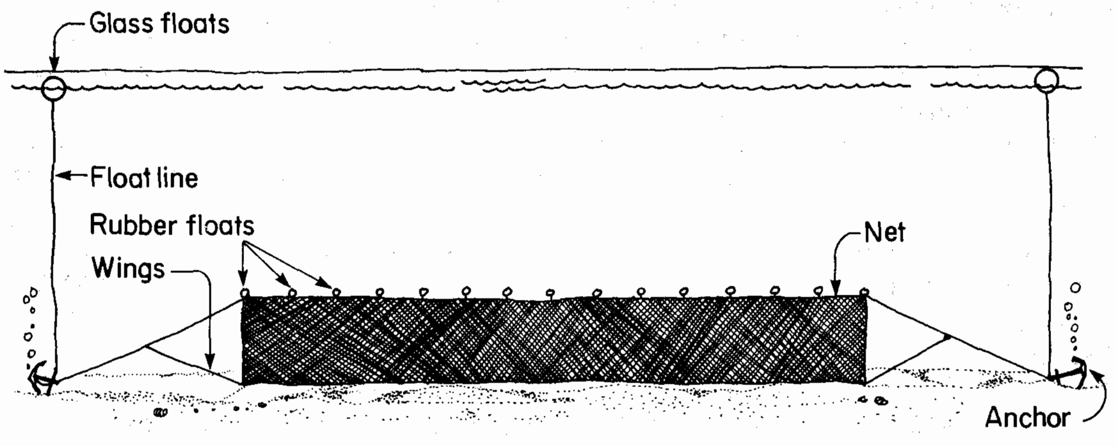

Fig. 1. A bottom-set gill-net *(palubog)*. Source: Umali (1950).

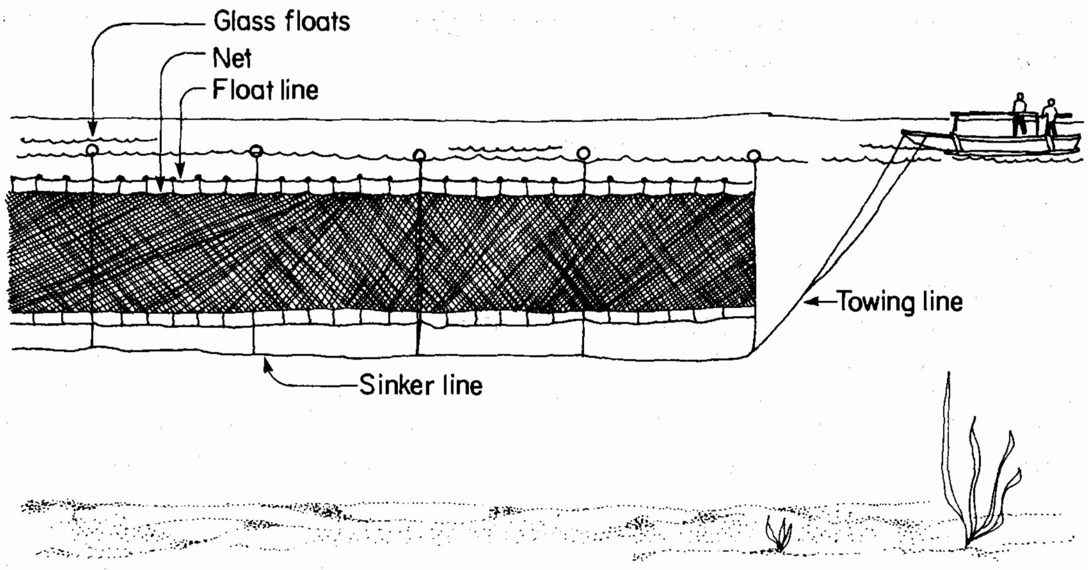

Fig. 2. A drift net *(panke)*. Source: Umali (1950).

Boat pilots are experienced fishermen who can easily detect where the fishes are. They are either the son or a close relative of the boat owner whom he can trust. These factors, plus the responsibility of the pilot in leading the crew are the main reasons why many boat owners provide part of their own share of the catch revenue to the pilot. The other two crew members take care of casting and hauling the net.

Drift gill-nets *(panke)* are only mid-water deep (6-14 m) and free to move with the current. Fishing begins at about 4 a.m. and lasts for an average of 9 hours per trip which includes travel time, fishing and marketing of catch at the landing. The length of each drift gill-net is 100 m and on average 10 units are joined to form a single long net. To check for possible catch, the fishermen scout along the set gear, looking for unusual movement of the floats on any portion of the net. The fishermen stop fishing either when they have a large catch or when they must return to the landing place to sell their catch; selling begins at about noon. If their catch is insufficient during the first, second or third haul, they may make up to 5 hauls a trip. On the average, drift gill-netters make only one trip per day.

Bottom-set gill-nets *(palubog)* are set close to the sea floor, perpendicular to the current with weights at both ends of the lower part of the net. Floats are tied to the float line to extend the net vertically. Using wooden plungers and bamboo poles, the fishermen drive the fish towards the net. Hauling starts as soon as enough fish have been gilled. Because the major species (mullet and herring) caught by the bottom-set gill-net are sold on a consignment basis to pre-arranged middlemen or processors, there is no designated landing time for operators of this gear, unlike for those of drift gill-netters.

Gill-netters are operated year-round. The net may be changed from drift net to bottom-set depending on the fishing season. Drift gill-nets are used from March to September which coincides with the *habagat* or southwest monsoon. Bottom-set gill-nets are used from October to February during *amihan* or the northeast monsoon.

The major species caught during the southwest monsoon by drift gill-nets are tiger-toothed croaker *(abo)*, whiskered croaker *(pagotpot)*, deep-bodied crevalle *(salay-salay)* and hair tail *(lankoy)*. The first two comprise 82% of the total catch. During the northeast monsoon, the bottom-set gill-net catches two major species: mullet *(banak)* and herring *(tamban)*, together comprising 99% of the catch. Some of the minor species caught by this gear are small whiskered croakers *(pagotpot)* and deep-bodied crevalle *(salay-salay)*. Details of the biological aspects of the gill-net fishery and its catch are found in Pauly and Mines (1982).

Costs and Returns

CATCH AND EFFORT

Monthly catch data (in kg) from February 1980 to January 1981 were collected from Castillo landing area II where the majority of Castillo's gill-netters land their catch (see Fig. 2 in Smith and Supanga, this report). This period does not coincide with the timing of the record-keeping effort data collected from the gill-netters but is presented simply to provide an indication of the seasonal variation in catch and the annual catch levels. Average catch per fishing trip for 12 months beginning February 1980 is shown in Table 1. Catch per trip ranged from 27.5 to 61.4 kg and averaged 45.3 kg. This information was used primarily by the project's biologists (see Pauly and Mines 1982)

Table 1. Average catch and effort of gill-netters, Castillo, San Miguel Bay, 1980-1981. N = 20 fishing units making a total of 4,680 trips.

				1980						1981			Annual	Monthly
Effort	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	totals	average
No. of days in month	30	30	31	30	31	30	31	31	28	31	30	31	365	30.42
No. of Sundays	4	4	5	4	4	5	4	4	4	5	4	5	52	4.33
No. of potential fishing days	26	27	26	26	27	25	27	27	24	26	26	26	313	26.08
No. of actual fishing days	20	21	23	20	21	16	9	11	18	22	18	20	219	18.25
No. of non-fishing days	6	6	3	6	6	9	18	16	6	4	8	6	94	7.83
No. of fishing trips	20	22	24	22	26	21	9	12	18	22	18	20	234	19.50
Catch														
Catch per trip (kg)	54.3	56.0	45.1	37.4	27.5	28.0	33.5	52.1	61.4	44.0	59.0	45.8	544.1	45.3

to estimate total catch from gill-netters in the Bay. The economic analysis based on the record-keeping data focused on costs and returns rather than catch data, which could not be obtained from respondents for reasons cited in the introduction to this paper.

Fishing days and trips were more frequent from March to October, ranging from 18 to 23 days and 18 to 26 trips, compared to those from November to February, which ranged from 9 to 18 days and 9 to 21 trips. During the 12-month period, the average gill-netter made 234 fishing trips in 219 fishing days. Operating costs and returns data from the sample fishing units (n = 20) thus covered 4,680 fishing trips.

There were many reasons why gill-netters did not fish every day of the year. Fishermen rarely went fishing on Sundays, but preferred to rest at home or engage in various forms of recreation, such as seeing movies in nearby Libmanan, going to the cock fighting arena, or playing cards or volleyball. Reasons for not fishing on weekdays included in the order of their relative importance: bad weather, engine/boat/gear trouble, sickness, crew changes, unstable market and local beliefs in "bad luck". "Bad luck" in fishing is a common idiomatic expression used by fishermen when, despite their efforts, good weather and adequate gear, they catch less than other fishermen who exert the same amount of effort with similar gear. Sometimes this "bad luck" is attributed to fishing on religious holidays or with boats/gear not properly blessed by the village priest.

During the period February 1980-January 1981, 39 days (non-Sundays) were counted as too rough for gill-netters to fish. After deducting 52 Sundays and 39 bad weather days during this period, 274 days remained. The average gill-netter fished 219 or 80% of these days.

Fishermen viewed the market as unstable when they were unable to locate buyers to buy their catch at a "fair" price on a cash basis. Cash payment for catch was very important to the fishermen because they needed money for the next trip's operating expenses, particularly fuel.

Regardless of the reason for not going out fishing, Castillo gill-net fishermen had no alternative occupation during non-fishing days. A few days each month were spent in boat and gear repair, but in general there was a lack of alternative work in Castillo. During bad times when non-fishing days passed successively and the crew ran out of money for their family's food and other needs, they asked the boat owners for loans. These are repaid from their share of the catch when fishing resumes. The boat owner's loans to his crew assure that his crew will be loyal. Frequent transferring of crew from one boat to another is symptomatic of poor relationships and attitudes of both boat owners and crew, though crew composition of gill-netters tends to be more or less stable in most cases. The concept of *utang na loob* (reciprocity of good acts done by one person for another) still dominates. Another reason why boat owners lend money to their crew in spite of their debts is that if they do not grant another loan, it is likely that the crew would transfer to another boat leaving behind their unpaid debts. Similar observations have been made about Laguna de Bay fishermen near Manila by Jocano and Veloro (1976). To avoid such situations, boat owners keep granting loans to their crew and when catch improves, they enforce strict collection of debts. This way, both parties' needs are served and safeguarded. The system, though viewed by some as exploitative, can be a means of reducing risk. To resolve the exploitation issue, one should examine the levels of indebtedness and the possible presence of any hidden interest rates.

INVESTMENT COSTS

Considering the income levels of fishermen in the San Miguel Bay area, entry into a gill-net operation requires a moderately high initial investment for the fishing unit (Table 2). The 20 gill-netter respondents invested an average of ₱10,525 for their *banca,* engine, gear and other equipment. These fishing units were acquired during the 1970s with the individual's average investment cost increasing as the years passed. Current replacement cost for a complete gill-netter unit including storage shed is ₱15,610, or ₱12,610 without the storage shed.

A gill-net owner usually owns several sets of drift gill-nets and bottom-set gill-nets. During the 1970s, one drift net set *(panyo)* had an average cost of ₱313. Owning an average of 9 sets, a gill-netter

Table 2. Average investment and replacement costs for gill-netters, Castillo, San Miguel Bay, 1980-1981.

Item	Total no. owned by all 20 respondents	Av. no. owned per respondent	Av. acquisition cost per item (₱)	Av. expected life (years)	Av. annual depreciation per item (₱)[1]	Av. annual depreciation per respondent (₱)[2]	1981 replacement cost per item (₱)
Banca	20	1	1,728	5	446	446	2,200
Engine	20	1	2,615	9	298	298	3,700
Gear							
drift gill-net sets	189	9	313	3	104	939	350
bottom-set gill-net sets	187	9	328	3	109	984	380
Miscellaneous							
rattan baskets	319	16	5	.5	10	160	5
tubs	4	.2	42	1	42	8	60
storage shed	3	.15	2,167	12	190	36	3,000
		Average total acquisition cost per respondent[3]	₱10,525		Average total annual depreciation per respondent	₱2,871	
					Current average total replacement cost per respondent[4]		₱13,012

[1]Average annual depreciation per item = average acquisition cost per item ÷ average expected life.
[2]Average annual depreciation per respondent = average annual depreciation per item times average number owned per respondent.
[3]Average total acquisition cost per respondent = $\sum$ (average acquisition cost per item times average number owned per respondent).
[4]Current total replacement cost per respondent = $\sum$ (current replacement cost per item times average number owned per respondent).

invested ₱2,817 for nets. One set of bottom-set gill-nets was ₱328, or ₱2,952 for the average 9 sets owned. The bottom-set gill-net is slightly more expensive than the drift gill-net because the former has heavier lead weights and needs an anchor, and because the net has a slightly smaller mesh size. Average total investment for nets alone was ₱5,769 or 55% of the total investment for the average fishing unit. To replace these nets in 1981 would cost ₱6,570, or 50% of the current average total investment cost. The cost of nets has, therefore, appreciated at a rate slower than those of other items, particularly engines.

The most commonly used type of engine is a Briggs and Stratton gasoline engine of 9 to 16-hp range. Eighty five percent of our respondents use a 16-hp engine; 10% use 10 hp; and 5% use 9 hp. The average acquisition cost for these engines was ₱2,615 or 25% of the average total acquisition cost per respondent. Engine costs, however, have risen considerably in the last few years, and a 16-hp engine now costs ₱3,700 and a 10-hp engine, ₱3,400.

The *banca* used is usually made of marine plywood and is relatively narrow and lightly constructed (Fig. 3). The average *banca* is 12-m long and 0.7-m wide, and is equipped with outriggers on both sides for stability. The average acquisition cost for a *banca* is ₱1,728 or 16% of the total investment cost for a fishing unit. Replacement cost is currently ₱2,200.

Only three of the 20 respondents own a storage shed or *kamalig,* a structure made of light materials like bamboo for walling and nipa for roofing. The small number of *kamalig* owned indicates that the storage shed is not a necessary item for operating a gill-netter. Most gill-netters store their fishing equipment in the house of the owner or even just in the boat in the absence of a *kamalig.* For the average gill-netter, this item and other miscellaneous items such as tubs and rattan baskets *(baca-baca* and *tiklis)* make up less than 4% of the investment costs.

Fig. 3. Gill-netters landing their catch at Castillo, Cabusao.

The total investment required for the average gill-net fishing unit (₱13,012) is slightly less than the ₱15,000 lending limit that has characterized recent credit programs for municipal fishermen. Of our 20 respondents, five or 25% acquired one or more of their fishing items through the credit programs of the Development Bank of the Philippines or other such lending agencies. These programs have done much to increase the extent of motorization in the municipal fishing fleet of San Miguel Bay and increased fishing effort as a result.

FIXED COSTS

Certain fixed costs are incurred whether the fishing unit operates or not because they relate to "sunk" capital investment which cannot be retrieved without undue loss (Panayotou 1981). In the case of gill-netters fixed costs consist mainly of depreciation of the fishing assets and the license fee for their use.

Average total annual depreciation per gill-net fishing unit was ₱2,871 (Table 2). This amount must be reserved for eventual replacement of fishing assets after they wear out. Two kinds of annual licenses that must be paid by each gill-net owner are the mayor's permit of ₱20 per operator and the operating license of ₱40 per fishing unit yearly. Earnings must be high enough to cover these fixed costs in addition to operating costs if fishing is to continue in the long run.

OPERATING COSTS

Operating costs such as gasoline, oil, parts, repair and maintenance, food, labor cost and other cash costs depend on the extent of use of the fishing unit. In the case of gill-netters, no labor cost is incurred because the crew, or partners as they are called locally, receive their payment in the form of a share of the value of the catch. Because these operating costs vary with the use of the fishing unit, they are considered variable costs.

On the basis of the total operating expenses per fishing trip (Table 3) during 1980-1981, two-thirds was for the purchase of gasoline. The increase in gasoline price during 1980-1981 from ₱3.50 to ₱5.55/l has had a significant impact on operating costs. This 67% increase in the price of gasoline resulted in a 45% increase in the average operating costs per trip over this 2-year period.

Table 3. Average operating costs per fishing trip, Castillo, San Miguel Bay, 1980-1981. N = 20 fishing units making total 4,680 trips.

Item	Cost per trip (₱)	% of total operating cost
Deducted before sharing		
gasoline	51	66
oil	1	1
repair and maintenance[1]	6	8
food	13	17
others (cigarettes, etc.)	3	4
Subtotal	74	96
Deducted from owner's share		
spare parts[1]	3	4
Total operating costs per trip	77	100

[1]Expenses for net and engine spare parts that exceed ₱50 are paid by the owner after sharing. Expenses that are less than ₱50 are considered as repair and maintenance costs and are deducted from the total value of the catch before sharing.

A common practice in the Castillo area is that gasoline and oil are advanced to the fishermen by local businessmen. There is no gasoline station in Castillo and gasoline must be brought from Libmanan in 55-gallon drums. At any one time up to five businessmen are engaged in the selling of gasoline while doubling as shrimp middlemen or as processors. The gasoline is purchased in Libmanan for ₱5.05/l and is resold in Castillo for ₱5.55/l. The cash outlay of these gasoline dealers for a full 55-gallon drum is approximately ₱1,050 from which they earn a net return of ₱102. Out of this they must pay their expenses in transporting the gasoline to Castillo and the empty container back to Libmanan, so this return appears reasonable.

It is not through the simple sale of gasoline, however, that these businessmen earn their income. If the fishermen are unable to pay cash in advance, the gasoline dealers are willing to accept payment in kind at the end of the day. Fishermen indebted to gasoline dealers in this way claim to receive about 10% less than the prevailing market price for their catch. This reduction in price paid by the gasoline dealer/processor produces an extremely high rate of return for the lender and a credit charge to the fisherman that is probably exorbitant by most standards.

This hidden interest charge can be calculated as follows. Assuming that each gill-netter requires nine liters of gasoline per day, the gasoline dealer would advance the equivalent in kind of ₱50. During the 1980-1981 period (from Table 1), the average gill-netter caught 47.7 kg/day, the average landed price of which was ₱3.15/kg (Table 4) or total value of ₱150.30. A 10% reduction in the price (₱0.32/kg) is equivalent to a reduction in sale value of ₱15.03. The gasoline dealer/processor has therefore advanced ₱50 in return for which he receives a saving in expenses of ₱15.03 or a *daily* return on operating capital of 30%!

A common money-lending scheme in the Philippines is known as 5:6 (i.e., borrow ₱5 today, repay ₱6 within 2 weeks). The credit advances by these gasoline dealers in Cabusao are providing a return that even exceeds the already high 20% return of the 5:6 schemes where the risk of non-payment is probably just as high. That the fishermen do not themselves purchase their own gasoline from Libmanan is probably related to the large capital outlay (> ₱1,000) needed and transport expenses required to purchase the gasoline in Libmanan. Certainly complaints from fishermen about their dependence on these gasoline dealers were frequently heard. The situation deserves more study to determine the true nature of costs and risks borne by the gasoline dealers and the benefits derived by fishermen of assured gasoline supply.

Table 4. Monthly average price per kg (in pesos) received by Cabusao, Castillo gill-netters, 1980-1981.

Month	₱
June 1980	2.70
July 1980	2.20
August 1980	3.00
September 1980	3.40
October 1980	4.10
November 1980	4.20
December 1980	4.00
January 1981	3.00
February 1981	3.20
March 1981	4.00
April 1981	2.70
May 1981	2.70
Weighted average price/year	3.15

Note: All data come from Table 1 using the formula:

$$\frac{\text{Total value of catch (av./boat/month)}}{\text{(catch per day} \times \text{\# days fishing)}}$$

Sharing Systems

Monthly operating costs are summarized in Table 5. These costs are deducted from the total value of the catch before the sharing system of owners and crew is applied. One of the two most common sharing systems used by Cabusao gill-netters (System A) is based on a basic 50-50 division of the net revenue (value of catch less operating expenses) with equal shares accruing to the owner, on the one hand, and to the crew as a group, on the other hand (Fig. 4). Fifty five percent of the sampled gill-netters followed System A. Forty five percent applied a variation of this system (System B) whereby the owner gave 10% of his own share (equivalent to 5% of the net revenue) to the boat pilot, or *maestro* (Fig. 5).

Owner-operators generally followed System A, thus retaining for themselves both the boat owner share and the share for being one of the fishing partners. However, one cannot categorize owner-operators and non-fishing owners according to the sharing system they used because 40% of the non-fishing owners also used this basic 50-50 sharing system and did not provide an incentive to the boat pilot. The remaining 60% provided such an incentive. A more complete discussion of sharing systems and causes for their variation can be found in Villafuerte and Bailey (1982).

Based upon these two systems and the data from our sample, it is possible to calculate the income earned by owners, boat pilots and crewmen (laborers) under these two basic sharing systems.

Table 5. Monthly costs and returns of gill-netters, in pesos, Castillo, San Miguel Bay, 1980-1981.

				1980						1981			Annual	Monthly
	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	totals	average
Total value of catch	2,939	2,762	3,191	2,831	2,952	2,457	1,217	1,806	3,575	3,647	2,863	2,677	32,917	2,743
Total operating expenses (variable costs)	1,543	1,490	1,787	1,631	1,449	1,473	673	793	1,479	1,649	1,479	1,514	16,960	1,414
gasoline	1,071	895	1,288	1,180	984	833	452	566	1,035	1,208	1,070	1,115	11,697	975
oil	38	44	35	28	27	21	9	9	19	21	17	20	288	24
repair/parts	128	214	75	111	110	167	56	82	122	78	111	78	1,332	111
food	236	206	242	236	278	313	147	120	280	325	253	263	2,899	242
others	70	131	147	76	50	139	9	16	23	17	28	38	744	62
Monthly net revenue (before sharing)	1,396	1,272	1,404	1,200	1,503	984	544	1,013	2,096	1,998	1,384	1,163	15,957	1,329

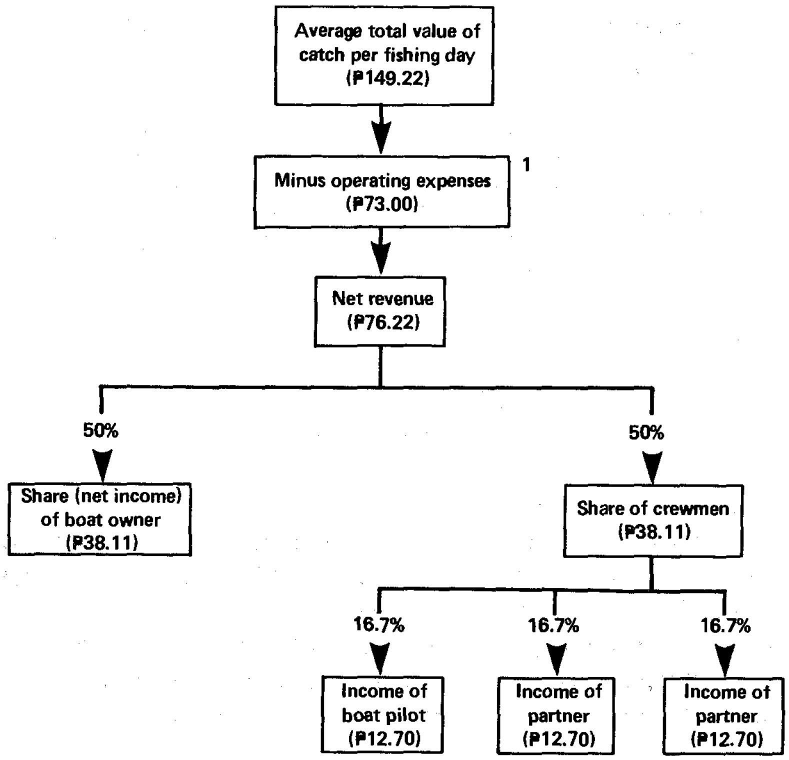

Fig. 4. Sharing system of net revenue of gill-netters, Castillo, San Miguel Bay, 1980-1981. Sharing system A: basic 50-50 sharing system for Cabusao gill-netters on a daily basis (1980-1981) with no incentive given to the boat pilot by the owner (N = 11).

[1] Note that these costs are for a daily basis in contrast to Table 3 which shows operating costs on a per trip basis.

Fig. 4 shows the daily sharing under System A whereby the total value of catch per fishing day (₱149.22) is allocated among owner, a boat pilot and 2 crewmen (partners). The crewmen (partners) and boat pilot each earn approximately ₱13/day and the owner earns ₱38.11, or three times as much as the boat pilot. However, the owner must pay the fixed costs (e.g., licenses, depreciation) and any costs for major spare parts out of his net income. If the owner goes fishing with his gill-netter, he retains not only his share as owner but also one 16.7% crew share. Usually he does not keep an additional 5% share for acting as the boat pilot although one of our respondents did so.

In contrast, Fig. 5 shows the division of the daily net revenue when the boat pilot receives an added incentive share from the non-fishing owner (System B). For those gill-netters using this system, crewmen earn ₱11 (almost ₱2 less than under the first system) while the boat pilot earns over ₱14, or almost half the net income of the boat owner. The net income of boat owners under System B is 22% less than the boat owner net income under the alternative System A which is most often used by owner-operators.

Table 6 summarizes the monthly income accruing to owner-operators, non-fishing owners, boat pilots and crewmen under the two sharing systems. Note that the income shown for owners represents the balance of their share after sharing and that they must still pay depreciation and other fixed costs out of this share.

Of the 20 gill-netters, 11 were owner-operated and 9 were borrowed and operated by a boat pilot. There was no significant difference between the two in terms of number of actual fishing days, fishing trips, catch per trip or total value of catch per fishing day. Owner-operated gill-netters fished slightly less frequently (223 days/year) than those of non-fishing owners (234 days/year). Owner-operated gill-netters, however, had lower average operating expenses per trip and thus higher income especially for the owner but also slightly higher for each member of the crew.

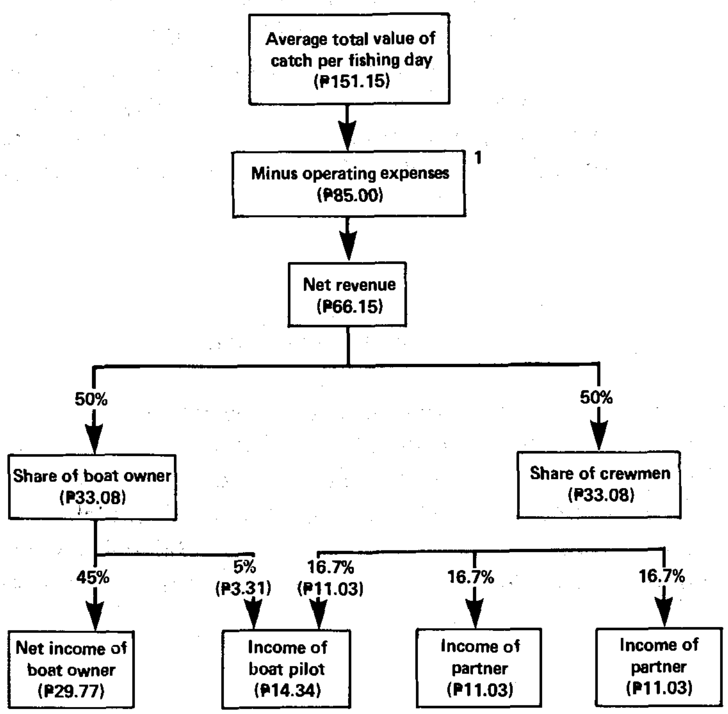

Fig. 5. Sharing system of net revenue of gill-netters, Castillo, San Miguel Bay, 1980-1981. Sharing system B: daily sharing system with boat pilot receiving incentive share from boat owner (N = 9).

[1]Note that these costs are for a daily basis in contrast to Table 3 which shows operating costs on a per trip basis.

Table 6. Comparison of monthly net incomes in pesos earned by owners, boat pilots and crew under alternative sharing systems, Castillo, San Miguel Bay, 1980-1981.

	Sharing System A 50-50 sharing *without* added incentive for boat pilot (n = 11)	Sharing System B 50-50 sharing *with* added incentive for boat pilot (n = 9)	All gill-netters (n = 20)
No. of fishing days per month	18.1	18.3	18.25
Owner-operator (including boat pilot share)[1]	919	807	869
Non-fishing owner[1]	690	544	624
Boat pilot	230	262	244
Crew (partner)	230	202	217

[1]Owners must still pay fixed costs and certain major operating costs out of their net income. See text for discussion of return to capital of owners.

The 20 respondents could be classified as follows: 35% owner-operated; 25% boat-pilot operated but with no incentive share from the owner; and 40% boat-pilot operated with 10% of the owner's share going to the boat pilot. Boat pilots who received no additional incentive share were usually the sons of owners, so the incentive share was not thought necessary due to such a relationship.

Sharing of the net revenue is once a week, most often after the owner has been paid by the processors for the catch sold to the processor during the preceding week. Sharing of net revenue on a daily basis only occurs when the owner has the cash readily available, which is infrequent.

In addition to the sharing of the cash net revenue, most gill-netters also set aside up to 4 kg of the daily catch for their own consumption. This amount of fish (approximately 8% of the total daily catch of the average gill-netter) is also divided according to the sharing system in use. Non-fishing owners and owner-operators would receive 1.8 and 2.7 kg, respectively. Crewmen and boat pilots would receive 0.7 and 0.9 kg, respectively, the imputed value of which would be ₱2.20-2.80 daily. In the cases of ordinary crewmen and boat pilots, this income in kind represents 15% of their daily income from fishing.

Returns to Capital and Labor

Because of the various sharing arrangements used by gill-netters, and other fishing gear operators, it is misleading to simply calculate costs and returns for the fishing unit as a whole. Instead, returns to owners (capital) and to crew/partners (labor) based on the various sharing systems were calculated and then compared with the appropriate opportunity costs of capital and labor. In this way, it can be determined whether there is any pure profit remaining in the San Miguel Bay gill-net fishery, while at the same time providing sufficient information to guide those who may be interested to invest in a gill-net fishing unit.

RETURNS TO CAPITAL

As shown in Table 6 (based on Figs. 4 and 5), the net income of owners depends upon the sharing system they practice. Owners (excluding their possible boat-pilot share as owner-operators which is a return to labor) earn ₱690 monthly if no incentive is given to the boat pilot or ₱544 monthly if incentive is given. These average monthly earnings add up to ₱8,270 and ₱6,549 annual earnings, respectively. Weighted according to the sample, the average gill-net owner earned a net income of ₱7,524 during the 12-month study period (Table 7).

From this net income, it is necessary to deduct fixed costs, and maintenance and repair expenses not covered before sharing to determine the annual residual return to owner's capital, labor and management. This averaged ₱3,251 for our sample gill-netters or ₱270/month.

To see if any pure profits (as defined in Smith et al., this report) are earned by the gill-net owners, the opportunity costs of their own capital and labor must be deducted from the residual return. Boat owners in the gill-net fishery on average incurred a pure loss of ₱96 in 1980-1981. 1981.

It is important that this pure profit (or loss) not be confused with the rate of return on investment that is commonly reported in costs and returns studies. The rate of return is commonly calcu-

Table 7. Annual returns to capital in pesos for gill-netters, Castillo, San Miguel Bay, 1980-1981.

		Sharing System A *without* incentive for boat pilot (n = 11)	Sharing System B *with* incentive for boat pilot (n = 9)	All gill-netters (n = 20)
No. of fishing days per year		217	220	219
Daily net income of boat owners		38.11	29.77	34.36
Annual net income of boat owners		8,270	6,549	7,524
Annual costs of owner				
Fixed costs				
mayor's fee	20			
license fee	40			
depreciation[2]	3,549			
Total fixed costs	3,609			
Variable costs				
repair and maintenance	664			
Total variable costs	664			
Total fixed and variable costs	4,273	4,273	4,273	4,273
Residual return to owner's capital, labor and management		3,997	2,276	3,251
Less opportunity costs				
of investment capital[3]	947			
of own labor[4]	2,400			
Total opportunity costs	3,347			
Owner's pure profit (loss)		650	(1,071)	(96)

[1]From Figs. 4 and 5.

[2]Based on current replacement costs (Table 2), because it is assumed the owner will need to set aside this amount annually to replace his fishing unit or parts thereof as they wear out.

[3]Based on 9% of acquisition cost (Table 2).

[4]Valued at ₱40/man-day, and 5 days/month, and representing work performed by the owner related to purchase of inputs, repair and maintenance.

lated by representing the residual return to owner's capital and management (after deducting own labor opportunity cost) as a percentage of invested capital and/or replacement cost. In fact, studies often fail to deduct the opportunity cost of the owner's labor which results in a greatly overstated return on investment (see examples cited in Smith et al. 1980).

In the case of gill-netters, the opportunity cost of the owner's labor was calculated based on the amount he would have earned in fish processing (₱40/day see Yater et al., this report), the most likely alternative activity for a boat owner, and on an estimated 5 days spent per month on work related to his fishing unit (e.g., purchase of supplies, repair and maintenance) which amounts to ₱2,400 annually.

The rate of return, based on average acquisition costs of the present gill-net fishing fleet, is calculated as follows:

$$\text{Rate of return} = \frac{\text{Residual return} - \text{labor opportunity cost}}{\text{acquisition cost}}$$

$$= \frac{₱3{,}251 - 2{,}400}{10{,}525} = 8.1\%$$

For the individual currently considering an investment in a gill-netter, acquisition cost would be higher (₱13,012) and rate of return would be lower (6.5%).

To account for the alternative uses for which the owner could have used his capital, this rate of return on investment must be compared to the opportunity costs of capital. If the rate of return is higher than the opportunity cost of capital, he is making the best use of his investment. In the case of gill-netters, it was determined that the opportunity cost of the owner's capital is that amount which he could have earned by putting his capital into the local rural bank where he could have earned 9% annual interest.

The rate of return on investment of the current fleet (8.1%) and the rate of return of a potential entrant (6.5%) are both lower than the opportunity costs of capital and the owners of gill-netters thus, on average, incurred a pure loss in 1980-1981. Interestingly, incentives for boat pilots, while increasing the income of pilots, apparently failed to increase the residual return and pure profit of owners.

RETURNS TO LABOR

As with capital, the returns to labor can be compared with their respective opportunity costs (Table 8). The actual income earned by labor is shown in Table 6. To calculate the annual opportunity cost of labor for boat pilot and crew with which to compare this actual income, it was necessary to first estimate the total number of days in the year engaged in actual fishing and in related activities such as mending nets and repairing boats. The latter tasks are performed by the crew without compensation. It was estimated that the crew spend on average 2.5 days/month or 30 days/year engaged in these activities. The total number of days/year that fishermen work is approximately 250. The second data required are estimates of the daily opportunity wage for labor. A figure of ₱10/day was used, which is the daily earning of an ordinary carpenter and also the wages of ordinary laborers who work on some of the fixed fishing gears such as the fish corrals in the vicinity of Castillo.

On average (Table 8), the boat pilot and crew earn more than their opportunity wage. Based on a crew size of 3 (1 boat pilot and 2 partners), the pure profit to labor over and above opportunity costs per gill-net fishing unit is ₱707.

RETURNS TO THE FISHING UNIT

Combining the pure losses of boat owners with the pure profits of labor provides a small pure profit of ₱611 to the average fishing unit (Table 9). It is important to note that this amount, which is very modest, accrues to the *current* fishing fleet. New entrants, who would be faced with a higher investment cost and thus a higher opportunity cost for their capital (₱1,171 vs. ₱947) would only earn a pure profit of approximately ₱400, although there are apparent differences between profit and loss depending on the sharing system used. Those units without incentive to the boat pilot (these boats are generally operated by the owner or a close family member) on average earned pure profits while those units with incentive to the boat pilot (90% owned by non-fishing owners) incurred losses because of their higher operating costs, a fact for which no explanation is evident.

Table 8. Annual returns to labor in pesos for gill-netters, Castillo, San Miguel Bay, 1980-1981.

	Sharing System A *without* incentive to boat pilot (n = 11)	Sharing System B *with* incentive to boat pilot (n = 9)	All gill-netters (n = 20)
No. of fishing days/year	217	220	219
No. of gear repair days/year	30	30	30
Total days/year	247	250	249
Boat pilots			
Daily income	12.70	14.34	13.44
Annual net income	2,756	3,155	2,943
Less opportunity cost[2]	2,470	2,500	2,490
Pure profit (loss)	286	655	453
Crew partners (2)			
Daily income	12.70	11.03	11.95
Annual net income	2,756	2,427	2,617
Less opportunity cost[3]	2,470	2,500	2,490
Pure profit (loss)	286	(73)	127
Pure profit (loss) to labor per fishing unit[3]	858	509	707

[1]Represents days of unpaid labor by the pilot and crew performed in maintenance and repair of the fishing unit estimated at 2.5 days/month.
[2]Based on an opportunity cost of ₱10/day, the daily earning of an ordinary carpenter in Castillo. See text for calculation of relevant days.
[3]Based on a crew of 3 consisting of 1 boat pilot plus 2 crew.

Table 9. Pure profit (loss) in pesos for gill-netters, Castillo, San Miguel Bay, 1980-1981.

	Sharing System A *without* incentive to boat pilot (n = 11)	Sharing System B *with* incentive to boat pilot (n = 9)	All gill-netters (n = 20)
Pure profit (loss) to owners capital[1]	650	(1,071)	(96)
Pure profit (loss) to labor[2]	858	509	707
Pure profit (loss) per gill-netter fishing unit	1,509	(562)	611

[1]From Table 7.
[2]From Table 8.

Variability of Catch

Data from 20 respondents for 12 months total 240 monthly observations of catch, effort, revenue and costs. Using these data and managerial characteristics of the respondents (age, education level, years experience in fishing), an attempt was made to explain variations in monthly catch levels. Logarithmic functions best described the data, and two (log-log) specifications are reported here.

The first specification was as follows:

$$Y = f(T, A, F, E, P)$$

or in log-log form,

$$\text{Log } Y = \text{Log}\alpha + \beta_1 \text{ Log } T + \beta_2 \text{ Log } A + \beta_3 \text{ Log } F + \beta_4 \text{ Log } E + \beta_5 \text{ Log } P + e$$

where Y = total catch per month
α = constant
T = number of trips per month
A = age of respondent
F = years of fishing experience
E = education level
P = engine horsepower
e = error (disturbance) term

Results were as follows:

Log Y	=	Log 0.828	+ 1.441 Log T	+ 0.035 Log A	+ 0.012 Log F	+ 0.011 Log E	+ 0.158 Log P + e
s.e.	=		0.067	0.160	0.059	0.079	0.166
t	=		461.3	0.05	0.05	0.02	0.90
R^2	=	0.67					
F	=	96.53					

From the above equation, the following conclusions can be drawn regarding the impact of the various effort and managerial variables on variations in catch:

- A total of 67% of the variation in catch per month can be explained by the five explanatory variables included in the equation ($R^2 = 0.67$). The overall fit of the equation is good judging by the high F-value.
- Of the five explanatory variables, only number of trips (T) has a significant impact on catch (Y). The coefficient is significant at the 0.01% level.
- None of the other four explanatory variables (age of fisherman, years of fishing experience, education level or engine horsepower) has any impact on catch variability. In all cases, the coefficients are not significantly different from zero. The results for engine horsepower are actually not surprising because all of our respondents used motorized *bancas,* with little variation in engine size.

Of side interest, the hypothesis that fishing effort (number of trips per month) would be affected by household size of the respondent was also tested but rejected.

With these results it was further hypothesized that variations in monthly catch could be explained by the number of trips and the average gasoline expenditure per trip. That is,

$$Y = f(T, G)$$

where Y = total catch per month
T = number of trips per month
G = average gasoline expenditure per trip (₱)
e = error (disturbance) term

or in log-log form,

$$\text{Log } Y = \text{Log}\alpha + \beta_1 \text{ Log } T + \beta_2 \text{ Log } G + e$$

The results were encouraging and provided greater explanatory power than the first specification.

Log Y	=	Log 0.025 +	1.069 Log T +	0.906 Log G + e
s.e.	=		0.05	0.056
t	=		449.67	260.49
R^2	=	0.84		
F	=	639.98		

The coefficients of both number of trips and gasoline expenditures were highly significant. These results indicate that 84% of the variation in monthly catch of gill-netters can be explained by the number of trips and by the amount of gasoline expenditure per trip.

Conclusion

The preceding sections have documented the economic status of the gill-netters of San Miguel Bay, and have shown the precarious position of both owners and crewmen involved. Owners earn incomes of ₱270/month but this is less than the opportunity cost of their own capital and labor inputs. Income to labor is low, ranging from ₱200 to 260/month depending upon the sharing system in use and upon the individual's role in the crew (i.e., boat pilot or crewman). However, even this absolutely low level of income exceeds the opportunity wage of labor, thus indicative of the extremely limited employment alternatives in the San Miguel Bay area.

Gill-net fishermen have demonstrated their adaptability to the changing seasons and relative species abundance by their shifts from gear to gear during the year. In addition to the documented shifts from drift gill-nets to bottom-set gill-nets, a small number of gill-netters uses a mini-trawl net *(pamalaw)* during the *balao* (sergestid shrimp) season. Twenty five percent of the Castillo gill-netters used a mini trawl at one time or the other during the year (primarily during the period December-February), but this type of shift occurs almost exclusively among a few gill-netters located near the southern base of the Bay. Moreover, the majority of gill-netters even in Cabusao and Calabanga apparently do not wish to subject their boats to the additional strain caused by towing a mini trawl. Therefore, the additional earnings (and costs) from this activity were not included in this study of the gill-netters.

One final point relates to the recent rapid motorization of the municipal fisheries of San Miguel Bay. Because none of the loans made to San Miguel Bay fishermen under the Development Bank of the Philippines Small Foreshore and River Fishermen program (also known as the *Samahang Lima* program and not to be confused with the more recent *Biyayang Dagat* credit program) were repaid in full, gill-netters, along with other gear types, have benefited from substantial capital subsidies in the recent past. Expansion of the fleet in the mid-1970s was thus much more rapid than would have been the case had capital had a cost. With the engines and boats purchased with this free credit now in need of replacement, the true economics of the fishery (as reflected in the analysis in this paper) will come into play. With more limited credit now available, and with competition from other more profitable gears, expansion in numbers of gill-nets will undoubtedly slow down, though the fleet will continue to provide positive but low incomes to owners and crew.

References

British Admiralty. 1944. Native craft and the fisheries of the Philippine Islands. B.R. 1050C (1). (U.K.) Naval Intelligence Division, British Admiralty, London.

Jocano, F.L. and C.E. Veloro. 1976. San Antonio: a case study of adaptation and folk life in a fishing community. UP-NSDB Integrated Research Program, University of the Philippines, Diliman, Quezon City.

Panayotou, T. 1981. Cost structure and profitability of small-scale fishing operations: methodological framework. Paper presented at the IDRC small-scale fisheries workshop, May 1981, Singapore. (Mimeo)

Pauly, D. and A.N. Mines, Editors. 1982. Small-scale fisheries of San Miguel Bay, Philippines: biology and stock assessment. ICLARM Technical Reports 7, 124 p. Institute of Fisheries Development and Research, College of Fisheries, University of the Philippines in the Visayas, Quezon City, Philippines; International Center for Living Aquatic Resources Management, Manila, Philippines; and the United Nations University, Tokyo, Japan.

Smith, I.R., M.Y. Puzon and C.N. Vidal-Libunao. 1980. Philippine municipal fisheries: a review of resources, technology and socioeconomics. ICLARM Studies and Reviews 4, 87 p. International Center for Living Aquatic Resources Management and Fishery Industry Development Council, Manila, Philippines.

Umali, A.F. 1950. Guide to the classification of fishing gear in the Philippines. Research Report 17. Fish and Wildlife Service, United States Department of the Interior, Washington D.C.

Villafuerte, E.D. and C. Bailey. 1982. Systems of sharing and patterns of ownership, p. 25-41. *In* C. Bailey (ed.) Small-scale fisheries of San Miguel Bay, Philippines: social aspects of production and marketing. ICLARM Technical Reports 9, 57 p. Institute of Fisheries Development and Research, College of Fisheries, University of the Philippines in the Visayas, Quezon City, Philippines; International Center for Living Aquatic Resources Management, Manila, Philippines; and the United Nations University, Tokyo, Japan.

Costs and Returns of Cabusao Stationary Gears

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Abstract

Costs and returns of three major stationary gears of Cabusao, San Miguel Bay, Philippines, are analyzed. The gears discussed include fish corrals, liftnets and filter nets. Systems for allocation of fishing rights are presented and the returns of capital and labor determined based on the sharing system practiced for each gear.

During the observation period, the fish corrals and filter nets earned pure profits in excess of their opportunity costs and the liftnets incurred pure losses.

Introduction

Stationary gears form an important part of the municipal fisheries of San Miguel Bay, Philippines. As of 1981 there was a total of 320 stationary gears in the Bay consisting of 89 fish corrals, 171 liftnets and 60 filter nets. In addition to these major types, there were also smaller numbers of tidal weirs and semi-permanent barricades which because of their lesser importance were not included in this study.

These stationary gears remain much the same as when they were first introduced into the Bay many years ago. Energy saving as they are, they represent a 'traditional' form of technology that has been very popular over the years and which, due to the recent increases in fuel prices, will undoubtedly remain popular for years to come.

As pointed out by Spoehr (1980), the fish corral (*sagkad* in Tagalog and Bicol languages) is an ancient invention and many were already in use in the Philippines when the Spaniards arrived in the 1500s. Until the 1930s it was the most important commercial fishing gear in the country, including San Miguel Bay (Herre 1927; Umali 1937). Numerous types of fish corrals exhibiting various designs are used from shallow to deep waters (Spoehr 1980). They all use a barricade to guide the fish into the inner chambers where they are trapped (Fig. 1). In San Miguel Bay, shallow water types predominate. Their contribution to the total catch of the Bay has declined considerably since World

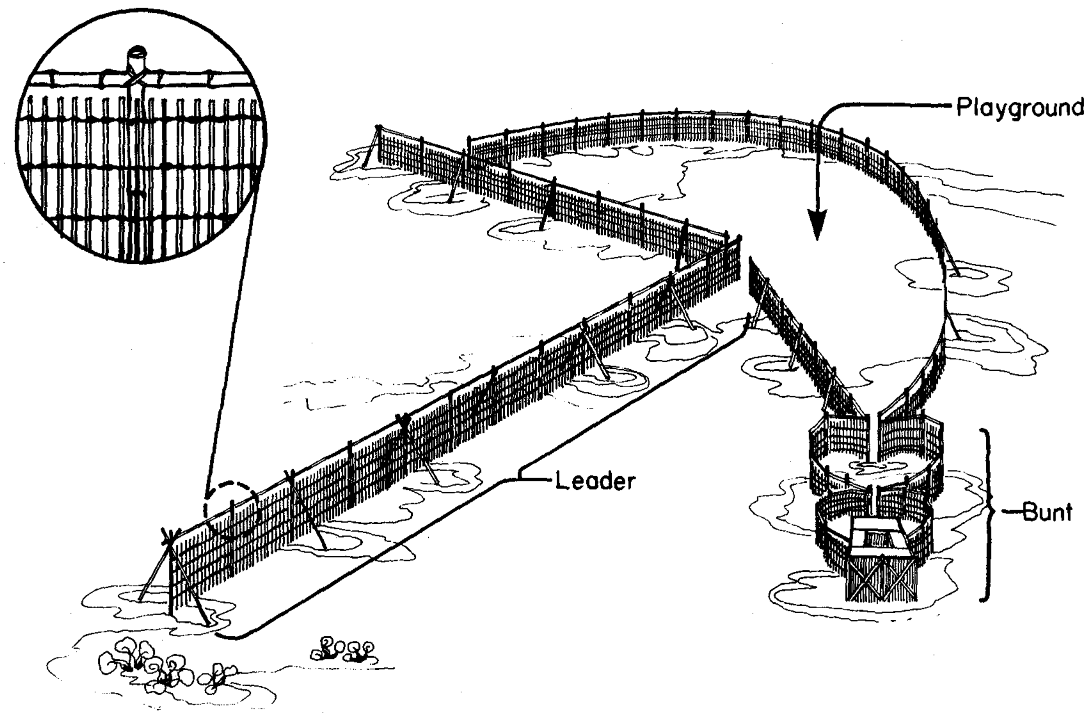

Fig. 1. Fish corral (*baklad*, also known as *sagkad*). Source: Umali (1950).

War II with the motorization of the municipal fishing fleet and particularly with the introduction of trawling. In the 1930s, Cabusao fishermen claimed that ₱500 was sufficient to erect a fish corral. Prior to 1970, the netting material used for the corral was an improvised bamboo screen (locally known as *banata*), but during the 1970s polarex material (plastic screen) was introduced. Current investment cost (approximately ₱10,000) is comparable to that required for other municipal gear such as a motorized gill-net unit.

Set liftnets (*bukatot* in Bicol) that currently operate in San Miguel Bay are also ancient fishing devices, though their reintroduction to San Miguel Bay in their present form is apparently quite recent (Fig. 2). Liftnets take many forms (Umali 1950; Spoehr 1980) and the Philippine *basnig* [a mobile liftnet usually operated from a vessel exceeding 3 gross tons (GT)], is thought to have evolved from earlier stationary liftnet types. Every year during the southwest monsoon a large *basnig* fleet is based at Mercedes at the mouth of San Miguel Bay but these vessels operate mainly outside the Bay. In the past, they used to operate within the Bay but it has now become too shallow for their nets which extend below the vessel during fishing. Although no historical data are available, respondents say that the stationary liftnet made its appearance in San Miguel Bay in the early 1960s, with Cabusao fishermen adopting it in 1967. Due to its small size, it is able to operate in the shallower depths where *basnig* do not operate. Currently, the stationary liftnets concentrate in the 4-7 fm (7.3-12.8 m) area in the center of the Bay.

Like the fish corrals, filter nets *(biyakus)* have also been prevalent in the Bay for many years. Filter nets are relatively simple gears used in shallow waters against the tide. In the 1930s, the gear was essentially mobile and could be removed from the water at the end of the day's operation. At that time the gear consisted simply of two poles with the net tied between them. By the 1940s, in Cabusao the gear evolved into a more substantial structure with up to 25 supporting poles and became a stationary gear (Fig. 3). It remains a much cheaper gear than the fish corrals and stationary liftnets.

The purpose of this paper is to examine the economics of these three stationary gears. The focus is on costs and earnings to determine the returns to capital and labor for each of the three gears.

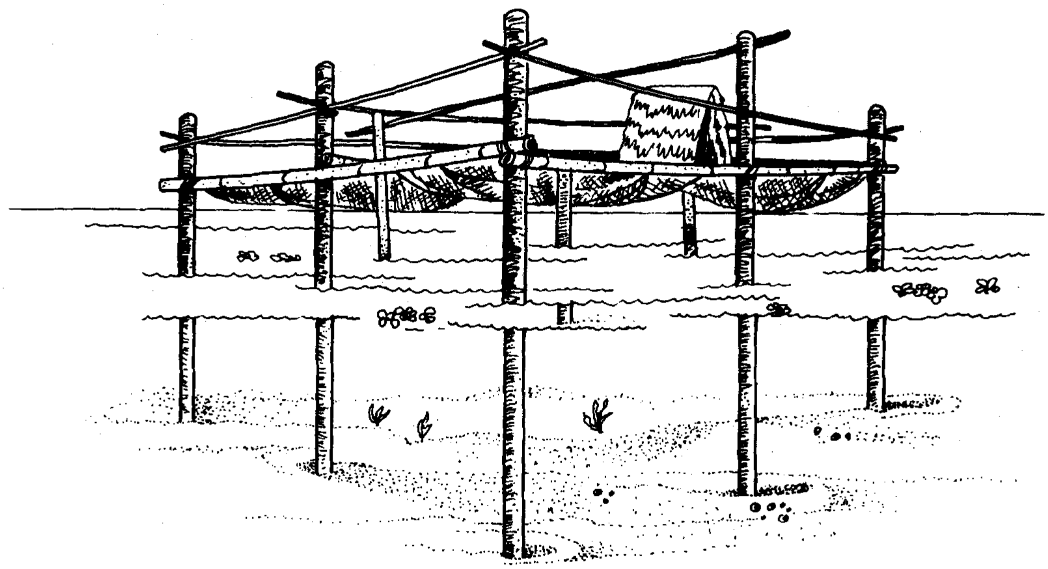

Fig. 2. Stationary liftnet *(bukatot)*.

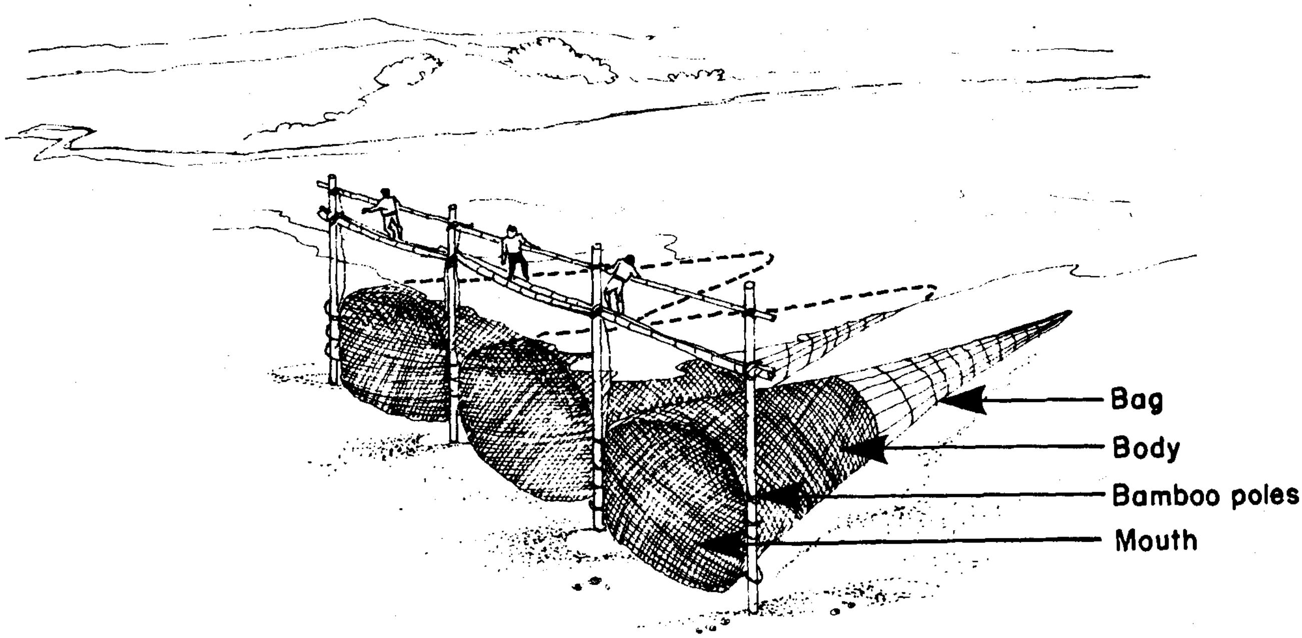

Fig. 3. Filter net *(biyakus)*. Source: Umali (1950).

Operation of Stationary Gears

FISH CORRALS

Fish corrals in San Miguel Bay are constructed in well sheltered waters along the shore and rivers. A major concentration of fish corrals is in the Looc River (actually an estuary) between Tinambac and Siruma. A second concentration is near the mouth of the Bicol River. This gear is most productive during full moon *(bulanon)* or when it is waxing. Fish corrals also operate during new moon *(dulum)* or when it is waning, but the bunt is hauled only once instead of the usual twice daily. Fish corrals operate seven months per year during the southwest monsoon, usually starting in March and ending in September. Those gears operating near Tinambac have a somewhat longer season because they are located in more sheltered areas. The most common species caught are: anchovies *(dilis)*, small herring *(bulinao)*, deep-bodied crevalle *(salay-salay)*, deep-bodied anchovies *(tigi)*, shrimps *(bilugon)* and blue crabs *(kasag)*.

LIFTNETS

The stationary liftnet *(bukatot)* consists of a platform set on posts in waters between 4 and 7 fm. The structure is made of the trunks of anahaw palms and bamboos. Liftnets are operated during the dark phases of the moon with the aid of lights to attract schools of fish. Fish attraction usually takes 2-3 hours. The light's intensity is reduced when enough fish have been detected to encourage the fish to move nearer the surface of the water towards the light. Hauling is simply done by lifting the net, and the catch is then transferred to a boat where the species are sorted. An average of three hauls are made each night. Like the fish corral, this is a seasonal type of gear operating from 4-7 months per year depending on the weather. The usual species caught are similar to those caught by the fish corral: anchovies, small deep-bodied herring *(tamban)*, small herring, deep-bodied crevalle, and squid *(pusit)*.

FILTER NETS

Filter nets *(biyakus)* are usually located at the mouths of rivers with the mouth of the net facing the current. The gear has no non-return valve but relies on the strength of the current to make escape of the catch difficult. Unlike the fish corrals and liftnets, the filter nets are used year-round, although the peak season is the same as that of the other stationary gears (March-September). Like the fish corral, the filter net is most productive during the full moon, at which time fishermen will make two trips to the gear during the night to haul the net and harvest the catch. Single trips are made at other times. The proximity of the gear to shore also allows fishermen to use this gear even during times when the catch is very low, unlike the fish corrals and liftnets for which the purchase of gasoline is required to operate the *bancas* to reach the gear. The catch of the filter nets is known as *halo*, or 'mixed' species such as small anchovies, croakers, shrimps, occasional blue crabs, tiny shrimps *(balao)* and trash fish *(diaco)*.

Methodology

Data on fishing gear economics were collected through a record-keeping activity involving a small sample of gear owners and operators who were accessible from the site of our research station in Castillo, Cabusao. The Looc River was unfortunately too far away to include in the sample.

The period during which data were collected was June 1980 to May 1981. Based on our household survey conducted in Castillo during the late 1979, all owners and operators of these stationary gears were identified. We identified three fish corrals, three liftnets (the owners actually lived outside the barrio) and 23 filter nets. All three fish corrals, three liftnets and four of the filter nets were included in the sample, and their owners were asked to keep daily records of their fishing activities. When two of the three fish corrals stopped their operation in October 1980, two others from a nearby barrio were substituted so that the full 12-month fishing cycle could be monitored. Both owners and operators of these gears were interviewed to assure completeness of data.

To avoid repetition and aid comparison the following sections discuss important aspects of the analysis for all three gears together.

Catch and Effort

Fish corrals and liftnets are seasonal gears while the filter net is operated year-round (Table 1). The catch from the filter net is collected on the average every two days. The gear is used on about 190 days per year. More than one trip is made to the gear on several of these days, however. Decem-

Table 1. Catch and effort of stationary gears sampled in the Cabusao area, 1980-1981.

	1980							1981					Annual	Monthly
	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	totals	average[1]
Fish corral														
No. fishing days	24	23	20	16						13	25	24	145	20.7
No. non-fishing days	6	8	11	15			Not operating			18	6	6	70	10.0
No. fishing trips	30	30	30	21						17	37	44	209	29.9
Total catch (kg)	1,038	1,185	916	928						398	684	1,410	6,559	937.0
Catch per fishing day (kg)	43	52	46	58						31	27	59		45.0
Catch per trip (kg)	35	40	31	44						23	18	32		32.0
Liftnet														
No. fishing days	10	14	24	7									55	13.8
No. non-fishing days	20	17	6	23					Not operating				66	16.5
No. fishing trips	10	11	24	7									55	13.8
Total catch (kg)	541	1,233	1,727	433									3,934	983.5
Catch per fishing day (kg)	54	88	72	62										69.0
Catch per trip (kg)	54	88	72	62										69.0
Filter net														
No. fishing days	15	18	15	21	14	15	18	18	10	15	16	15	190	15.8
No. non-fishing days	15	12	15	9	17	15	13	13	20	16	14	15	174	14.5
No. fishing trips	17	22	16	23	15	17	18	20	10	21	23	23	225	18.8
Total catch (kg)	472	616	356	514	509	387	306	307	105	434	541	688	5,235	436.2
Catch per fishing day (kg)	32	34	24	25	36	26	17	17	11	29	34	46		27.4
Catch per trip (kg)	28	28	22	21	34	23	17	15	11	21	24	30		22.8

[1] Average for months of operation only.

ber to February are particularly lean months when the catch is well below the average. Monthly catch averaged 436 kg during the 1980-1981 period, equivalent to almost 28 kg per fishing day and 23 kg per trip from the shore.

Both the fish corral and the liftnet were more productive on a daily basis (when they operated) than the filter net, but both are operated only part of the year. Fish corrals were operated only for seven months during the observation period, and liftnets for only four months. Rough weather in April and May 1981 was the reason that the liftnet operators did not resume fishing. The normal liftnet fishing season runs from late March to October, or approximately seven months, and thus normally coincides with the season of the fish corrals which catch essentially the same species. Being further offshore, however, the liftnet is more susceptible to damage and is more difficult to reach during rough weather and in 1981, the fishermen decided not to construct their gear until after May (the end of our record-keeping project). The volume of catch per month for the two gears was approximately the same (937 and 983 kg, respectively), but the catch per fishing day and per trip of the liftnet was considerably higher.

As is the case with other fishermen, those who use stationary gears usually do not fish on Sundays. The number of active fishing days is also regulated by the phases of the moon as explained earlier.

Costs and Returns

INVESTMENT COSTS

Stationary gears require levels of investment that are somewhat less than the investment requirements for the major mobile gears, such as gill-netters and mini trawlers. By this criteria, therefore, they can be considered very much within the municipal fisheries sector in that the amount required to set up one of these gears falls within the lending limits (₱15,000) of most credit programs for municipal fishermen.

Of the three gears discussed, the filter net has the lowest investment cost (Table 2). Almost half of the cost of the gear is the bamboo structure itself and recent increases in the price of bamboo (50% in two years) have had a significant impact on investment costs which in total have increased approximately 40% since 1980. Current replacement cost of the entire unit, including a non-motorized banca is ₱3,535. Because expected life span of the gear structure is short, annual depreciation costs represent over 40% of current replacement costs.

The fish corrals included in our sample are typical of those used in San Miguel Bay but, by nationwide standards, are small. They have no impoundment area but rather a leader that leads directly into the bunt. Their average investment cost is approximately 2.5 times that of the filter net. The current replacement cost of the average assets of the owner of a fish corral (not all owners have a complete set of all items) is approximately ₱9,000 (Table 3). Again, due to rapid depreciation of the gear structure and the net, annual depreciation per respondent is quite high (₱5,539).

Table 2. Average acquisition cost, replacement cost and annual depreciation for Cabusao filter net *(biyakus)*.

Item	Average no. owned per respondent	Per unit cost (₱)	Average acquisition cost (₱)	1982 replacement cost (₱)	Expected life span (years)	Annual depreciation (₱)[1]
Gear structure	1	1,085	1,085	1,630	2	815
Net	1	888	888	1,000	5	200
Boat (non-motorized)	1	460	460	750	5	150
Containers						
baskets	6	8	48	60	0.25	240
tubs	1	50	50	60	2	30
Paddles	2	7	14	20	1	20
Anchors	1	13	13	15	7	2
Totals			2,558	3,535		1,457

[1]Annual depreciation is based on 1982 replacement cost, using straight-line method with zero-salvage cost. US$1.00 = ₱8.00 (in 1982)

Table 3. Average acquisition cost, replacement cost and annual depreciation for fish corral *(baklad* or *sagkad)*.

Item	Average no. owned per respondent	Average acquisition cost per item (₱)	1982 Replacement cost per item (₱)	Expected life span (years)	Annual depreciation (₱)[1]
Gear structure	1	2,940	4,410	1	4,410
Boat[2]	1	1,050	1,335	5	267
Engine	0.4	2,850	3,700	9	
Net	1	1,350	1,512	3	504
Containers					
small baskets	6	9	10	0.5	20
large baskets	1	15	15	0.5	8
Paddles	1.6	9	15	1	15
Lamp	0.2	200	338	7	48
Anchor	0.4	120	135	20	7
Scoop	0.2	20	25	1	25
Storage shed	0.2	500	600	5	120

Average total acquisition cost per respondent[3] : 6,755 Average total replacement cost per respondent[4] : 9,083 Average total annual depreciation per respondent[5] : 5,539

[1]Annual depreciation is based on 1982 replacement cost using straight-line method with zero salvage cost.
[2]Forty percent of the respondents owned a motorized banca; 60% owned a non-motorized banca. The costs shown for this item are for the 'average' banca.
[3]Average total acquisition cost per respondent = Σ (average acquisition cost per item x average number owned per respondent).
[4]Average total replacement cost per respondent = Σ (1982 replacement cost per item x average number owned per respondent).
[5]Average total annual depreciation per respondent = Σ (annual depreciation per item x average number owned per respondent).

The liftnet is the most expensive of the stationary gears used by Cabusao fishermen (Table 4). As with the other two gears, the increase in price of bamboo has resulted in a higher total replacement cost (₱12,190). In the case of the liftnet, increased engine prices have also had an effect, more so than for the filter net and fish corral both of which are close enough to the shore to be reached by non-motorized bancas.

Table 4. Average acquisition cost, replacement cost and annual depreciation for liftnet *(bukatot)*.

Item	Average no. owned per respondent	Per unit cost (₱)	1980 Average acquisition cost (₱)	1982 Replacement cost (₱)	Expected life span (years)	Annual depreciation (₱)[1]
Gear structure	1	1,900	1,900	2,750	1	2,750
Motorized banca	1	4,750	4,750	5,950	5	1,190
Net	1	1,900	1,900	2,090	2	1,045
LPG lamps	4	307	1,228	1,350	4	338
Baskets	5	9	45	50	1	50
Totals			9,823	12,190		5,373

[1]Annual depreciation is based on 1982 replacement cost, using straight-line method with zero-salvage cost.

FIXED COSTS

Under fixed costs, it is necessary to include all those expenses which are incurred independently of the daily operation of the gear. In the case of stationary gears, these costs include depreciation of fishing assets, any interest payments for borrowed capital used to purchase the assets, and any license fees or permits required to operate the gear. Some argue in favor of including the opportunity cost of capital (the interest foregone) as a fixed cost (Panayotou 1981) but we have chosen instead to deduct it from the residual return to owners after sharing because it demonstrates more clearly the opportunity cost concept. However, it is important to bear in mind that it is the sum of both capital investment costs and fixed costs (less depreciation, but including the opportunity cost of capital) that represents the cost of investing in a fishery, and that both fixed costs (including depreciation) and operating costs must be covered if the fishing unit is to make a profit.

There is one category of fixed cost that deserves special emphasis because it is peculiar to these stationary gear types. In each fishing community around San Miguel Bay, there is a senior fisherman known as the *amonojador*, whose function is to advise on and give permission for the erection of any stationary gear within municipal waters (see Cruz, this report). In addition to identifying potential locations for new gear, he is also responsible for resolving disputes that may arise between owners from time to time. The *amonojador* thus has an important function as allocator of fishing rights in the municipal fisheries, at least as far as stationary gears are concerned. For this service in Castillo, he is paid ₱10 annually by gear owners, although we have heard of payments as high as ₱100 in other locations.

The role of the *amonojador* has undoubtedly declined in importance since the introduction of more mobile gear types such as gill-netters and trawlers, but the fact that such a system still exists implies that at least in some communities a traditional system for allocation of fishing rights exists. There is another reason this system is breaking down, however, and this relates to population growth. Asked whether the *amonojador* system limits fishing effort in any way by denying permission to erect stationary gears, the ex-mayor of Calabanga replied, "No, because everyone in our community has the right to fish (and eat) no matter how poor we all are."

Fishing rights are apparently acquired through a tradition of use, and highly productive sites for stationary gears rarely change hands. Although in some communities in the Philippines, fish corral sites are subject to bidding by prospective operators, such is not the case in Castillo, nor in other communities of San Miguel Bay. Municipalities thus fail to take advantage of a bidding mechanism that they are legally empowered to establish under Presidential Decree 704 and which would provide them with a share of the rent from the resource.

OPERATING COSTS

Major operating costs for the fish corral and the liftnet include the costs of gasoline for the bancas to reach the gear and of kerosene (or LPG) to operate the lights (Table 5). However, only the liftnet has significant operating costs (₱120 daily); the operating costs of the fish corral and the filter net are only ₱38 and ₱5.60 daily, respectively. Unlike most other gears in the municipal fisheries sector, owners of fish corrals do not now use a sharing system to divide the catch value with their partners as they did in the past. Rather, the owner pays a fixed daily wage rate of ₱10 to each of two laborers. Hence, a daily labor expense of ₱20 is shown under operating costs. Because these operating costs depend on the operation of the gear, they are often referred to as variable costs in contrast to the fixed costs discussed earlier.

These operating costs are subtracted from the daily value of the catch and the resulting net revenue (Tables 6-8) is divided among owners and crewmen according to the sharing system being practiced.

Table 5. Average operating costs per fishing day for stationary gears sampled in the Cabusao area, 1980-1981.

Item	Gear type: Fish corral (₱)	Fish corral (%)	Liftnet (₱)	Liftnet (%)	Filter net (₱)	Filter net (%)
Gasoline	7	18	41	34	–	–
Gas (kerosene/LPG)	4	11	33	28	0.50	9
Oil	–	–	1	1	–	–
Labor	20	53	–	–	–	–
Repairs/parts	2	5	4	3	1.40	25
Others (includes food and cigarettes)	5	13	41	34	3.70	66
Total	38	100	120	100	5.60	100

Table 6. Costs and earnings of fish corrals *(baklad)* sampled in the Cabusao area, 1980-1981.

	1980 June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	1981 Feb.	Mar.	Apr.	May	Annual totals	Monthly average[1]
Total value of catch (₱)	2,242	2,603	1,558	1,997		not operating				1,731	2,867	3,177	16,175	2,311
Total operating expenses (variable costs) in ₱	1,058	960	669	551						425	866	850	5,379	768
Gasoline	215	221	102	114						69	130	176	1,027	147
Gas (LPG)	104	88	71	66						48	100	108	585	84
Labor	480	460	400	320						260	500	480	2,900	414
Repairs/parts	88	43	10	–						–	19	–	160	23
Others (includes food and cigarettes)	171	148	86	51						48	117	86	707	101
Monthly net revenue (₱)[3]	1,184	1,643	889	1,446						1,306	2,001	2,327	10,796	1,543
Average price (₱) received per kg[4]	2.16	2.20	1.70	2.15						4.35	4.19	2.25		2.47

[1]Average for months of operation only.
[2]Labor is paid a ₱10 daily wage rather than a share of the net revenue.
[3]This amount represents the owner's share because labor has already received its share in the form of a daily wage.
[4]Total value of catch ÷ total catch per month (from Table 1).

Table 7. Costs and earnings of stationary liftnet *(bukatot)* sampled in the Cabusao area, 1980-1981.

	1980								1981					
	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Annual total	Monthly average[1]
Total value of catch (₱)	1,242	2,362	5,368	985			not operating						9,957	2,489
Total operating expenses (variable costs) in ₱	677	1,411	2,043	598									4,729	1,182
Gasoline	306	544	956	311									2,117	529
Gas/kerosene	248	509	794	145									1,697	424
Oil	11	21	14	4									49	12
Repairs/parts	40	–	102	72									214	53
Others (includes food and cigarettes)	73	337	178	66									653	163
Monthly net revenue (before sharing) (₱)	565	951	3,325	387									5,228	1,307
Average price (₱) received per kg[2]	2.30	1.92	3.11	2.27										2.53

[1]Average for months of operation only.
[2]Total value of catch ÷ total catch per month (from Table 1).

Table 8. Costs and earnings of filter nets *(biyakus)* sampled in the Cabusao area, 1980-1981.

	1980							1981						
	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Annual totals	Monthly average
Total value of catch (₱)	604	1,233	588	744	497	436	482	388	121	646	901	1,044	7,682	640
Total operating expenses (variable costs) in ₱	67	120	61	259	96	73	67	77	32	67	72	66	1,057	88
Gas (LPG)	7	19	9	15	11	3	–	–	–	10	6	10	88	7
Repairs/parts	9	33	–	189	38	–	–	–	–	–	–	–	269	22
Others (includes food and cigarettes)	51	69	52	55	48	70	67	77	32	57	67	56	699	58
Monthly net revenue before sharing (₱)	537	1,113	527	485	401	363	415	311	89	579	829	978	6,625	552
Average price (₱) received per kg[1]	1.28	2.00	1.65	1.45	.98	1.13	1.58	1.26	1.15	1.49	1.67	1.52		1.47

[1]Total value of catch ÷ total catch for the month (from Table 1).

PRICES RECEIVED

The average monthly price received by owners or operators can also be calculated for each gear from the catch value (Tables 6-8) and total catch (Table 1). These prices indicate that the stationary gears are catching low-priced species (Tables 6-8). Average prices for the fish corral and liftnet which catch similar species, were ₱2.47 and ₱2.53, respectively. During March and April, the fish corral operators received in excess of ₱4/kg, and we suspect that this may be due to the fact that the liftnets did not operate during this period due to rough weather. The average monthly price received by filter net owners or operators was only ₱1.47/kg, reflecting the low value of their mixed catch.

Sharing Systems

The sharing system formerly used for fish corrals in Castillo was locally known as *socio-industrial.* As the term suggests, a partnership was involved. The owner provided the initial capital for constructing the fish corral and purchasing the necessary equipment and the crew provided the labor. Over time, part of the share that normally went to labor was withheld by the owner as laborer's contribution to the investment cost until 50% of the investment cost was paid for. The crew's contribution to capital investment was made on a regular basis. For example, if there were five fishing days in one week, the crew received shares for two days and the owner withheld the other three. The owner and crew would then eventually be equal partners sharing the net revenue 50-50 after deducting operating expenses.

According to Castillo fishermen, this unique sharing system began to break down about 1970 and by 1980 was replaced by a system of daily wage payment to labor. Under the earlier sharing system, the crew had complete responsibility for handling the gear and selling the catch since owners often did not go fishing. The owner had to rely exclusively on his partners. Untrustworthy partners apparently resorted to selling part of their catch elsewhere to the detriment of owners. The seasonal nature of the fish corral's use contributed to this behavior because it led to lack of permanent partners. Nowadays, owners themselves handle the selling and disposal of the catch. Partners (who are now only laborers) are paid ₱10 daily after the catch is disposed. The monthly net revenue figures shown in Table 6 therefore represent the owner's share after the labor payment is made part of the operating costs. This daily sharing system for fish corrals is shown in Fig. 4.

In contrast, filter nets and stationary liftnets use the basic 50-50 sharing system that is common to other municipal gears. Partners who provide the labor for these two gears thus share in the risks of poor catch (and the windfalls of good catch) unlike the fish corral laborer who gets ₱10 daily regardless of the value of the catch. The liftnet crew usually consists of 4 members; one *buso mayor* (leader of the crew) and three laborers. Most owners of stationary liftnets do not go fishing. The *buso mayor* receives an incentive share from the owner (equivalent to 5% of the net revenue) in addition to his share as a regular crewman (Fig. 5).

Depending upon its size, the filter net requires only one or two fishermen to operate. Consequently, whether any sharing system is used depends upon whether or not the owner goes fishing himself. In the former case, the full net revenue accrues to the owner. In the latter case, the net revenue is divided 50-50 between the owner and partner(s). In our sample, 50% of the filter nets were owner-operated and 50% were operated by partners. The sharing system of those gears using partners is shown in Fig. 6. The filter nets represented by this diagram were more productive than those which were owner-operated. The owner-operated gear had an average daily net revenue of ₱31.55, all of which went to the owner. The owner's share of net revenue for the larger filter nets (Fig. 6) was ₱19.39 if he did not go fishing or ₱29.09 if he took the place of one of the two laborers.

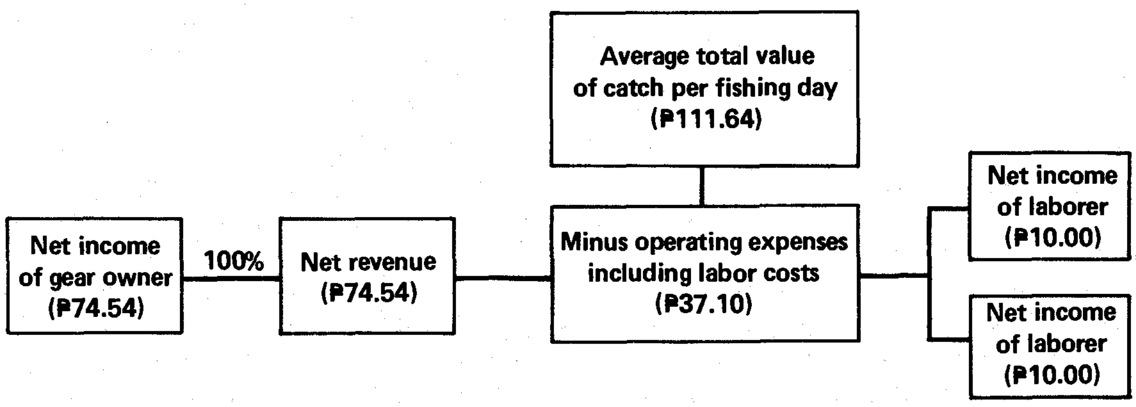

Fig. 4. Daily sharing system for fish corrals (1980-1981). This is a fixed wage system for labor.

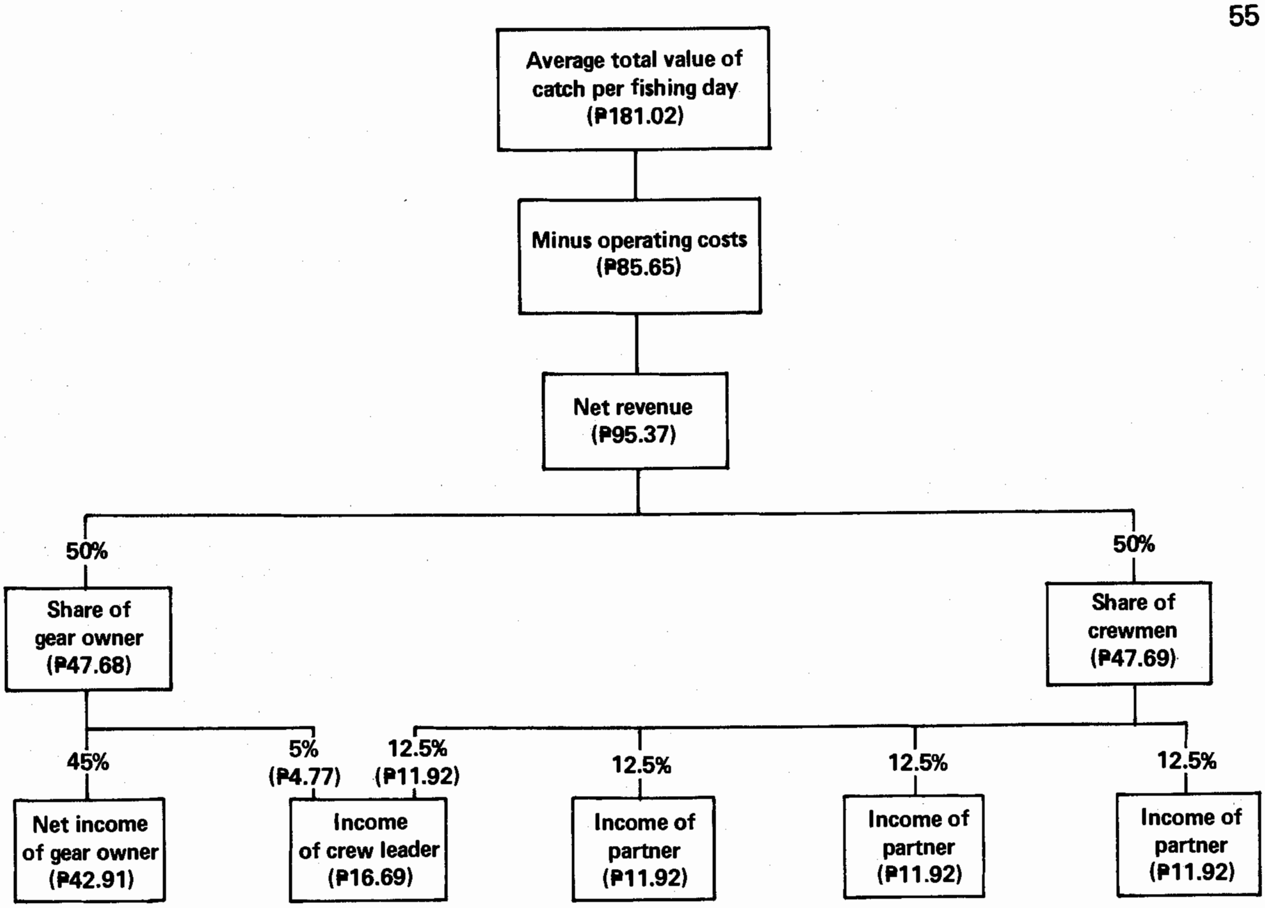

Fig. 5. Daily sharing system for stationary liftnets (1980-1981).

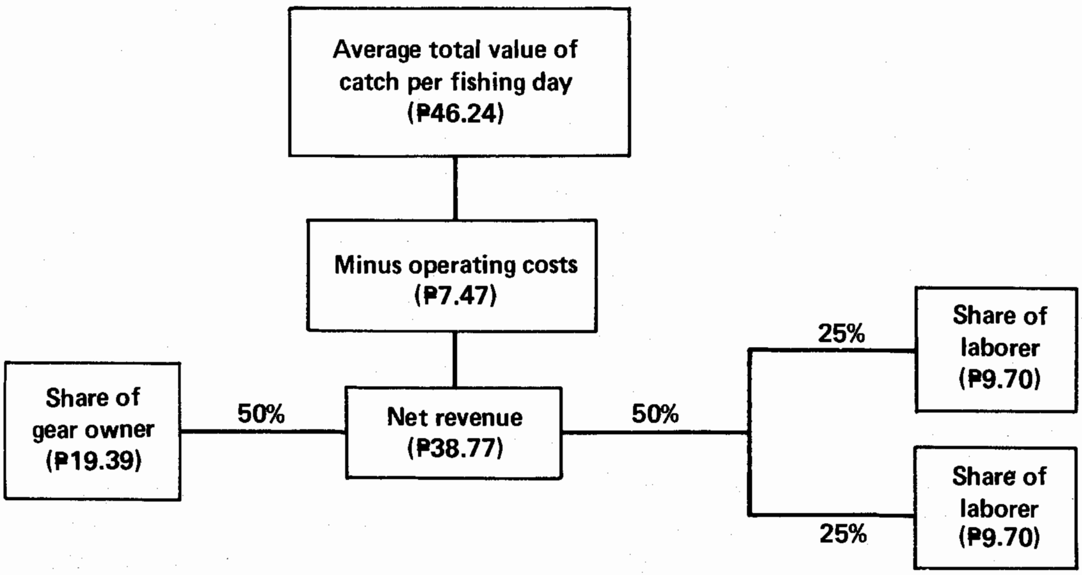

Fig. 6. Daily sharing system for filter nets owned by non-fishing owner and using two fishermen (1980-1981).

Returns to Capital and Labor

The normal procedure for calculating costs and returns is to treat the production unit (in this case the fishing unit) as a whole. In this paper, however, the net incomes of owners and partners (laborers) are treated separately as representing returns to capital (after deducting fixed costs) and labor, respectively. The residuals are then compared with the respective opportunity costs to determine whether pure profits or losses are being earned by the stationary gears.

MONTHLY INCOME

The previous section presented incomes on a daily basis; Table 9 summarizes the income data on the more usual monthly basis. It is important to note that neither the income of owners nor the income of laborers shown in this table represents their true earnings. In the case of owners, certain fixed costs must be paid out of monthly net income; laborers are expected to work free of charge a few days each month on gear maintenance and repair. One final point is that the monthly net income figures shown in Table 9 represent those months when fishing took place (seven months for the fish corral; four months for the liftnet; and 12 months for the filter net). These monthly incomes are sustained year-round only if the fishermen involved shift to other gears, as is often the case.

In addition to their incomes through the wage or sharing systems, fishermen who man these stationary gears are also able to supplement their families' diet by fishing with hook and line from the gear structure. We have no estimate of the value of these in-kind earnings.

Table 9. Monthly net incomes in pesos of owners and partners (laborers) for stationary gears, Cabusao area, 1980-1981.

	Fish corrals	Liftnets	Filter nets using 1 fisherman[1]	2 fishermen
No. months of operation	7	4	12	12
No. fishing days per month	20.7	13.8	13.3	17.8
Owners[2]				
Non-fishing owner	1,543	592	n/a	345
Owner/operator	1,750	822[3]	420	518
Partners				
Buso-mayor	n/a	230	n/a	n/a
Other laborer	207	164	n/a	173

[1]Owner-operated only.
[2]Owners must still pay for fixed expenses out of their monthly net income.
[3]Assumes that the owner also serves as *buso-mayor* or leader of the crew.

RETURNS TO CAPITAL

These can be calculated by deducting the pertinent costs from the share of net revenue that accrues to owners. This share is shown as annual net income of gear owners in Table 10 for each of the stationary gear types. From this amount must be subtracted all fixed costs such as depreciation and the various licenses and permits. Depreciation is calculated on the straight-line zero-salvage-value method and is based on the 1982 replacement costs of the gear on the assumption that the owner must set aside this amount annually if he is to be able to replace his gear as it wears out. Unlike gill-netters (see Yater, this report), the owners of stationary gears incur no further operating costs after sharing. Routine maintenance and repair are either charged as an operating expense before sharing or, if not, we assume that the depreciation is sufficient to cover them. It is important to avoid double counting of maintenance and repair (Elliston 1978). Subtracting these fixed costs from

Table 10. Annual returns to capital in pesos for stationary gears, Cabusao area, 1980-1981.

	Fish corrals	Liftnets	Filter nets[1]
No. fishing days per year	145	55	187
Daily net income of gear owners	74.54	42.91	17.71
Annual net income of gear owners	10,808	2,360	3,313
Annual costs of owner			
Fixed costs:			
Mayor's fee	60	20	20
License fee	20	50	35
Amonojador fee	10	10	10
Depreciation[2]	5,539	5,373	1,457
Total costs:	5,629	5,453	1,522
Residual return (loss) to owner's capital, labor and management:	5,179	(3,093)	1,791
Less opportunity costs:			
of investment capital[3]	608	884	230
of own labor	640	400	480
Total opportunity costs:	1,248	1,284	710
Owner's pure profit (loss):	3,931	(4,377)	1,081

[1]Average for both 1-man and 2-men filter nets, in contrast to Fig. 6 which represents 2-men filter nets only.
[2]From Tables 2-4. Based on current replacement cost.
[3]Nine percent of average acquisition cost as in Tables 2-4.

the annual net income of gear owners leaves the residual return (or loss) to owner's capital, labor and management. To determine pure profit the opportunity costs of labor and capital are subtracted from this residual. If the amount remaining is positive, a pure profit (rate of return in excess of the opportunity cost of capital) is earned; if it is negative there is a loss.

Opportunity cost of capital is estimated to be 9% of the original investment cost, or the amount of interest that can be earned on savings at the local rural bank in Cabusao. It represents the income foregone because the fisherman chose to invest his capital in fishing gear, rather than put it in the bank.

Opportunity cost of the owner's own labor represents the income foregone by working for no remuneration on his fishing gear instead of in an alternative income-generating activity. We estimate that owners spend 16, 10 and 12 days per year on work related to their fish corrals, liftnets and filter nets, respectively, over and above their actual fishing time (if any). This time includes such activities as purchase of bamboo, supplies and preparation of food for the crew. An opportunity cost of ₱40 per day (the daily income for a fish processor) was used to estimate the annual opportunity cost of owner's own labor. These amounts along with opportunity cost of capital were subtracted from the residual return to owner's capital, labor and management to estimate pure profit or loss.

After taking all these fixed and opportunity costs into account, our results show that owners of fish corrals and filter nets earned a pure profit while the owners of stationary liftnets incurred a loss during the study period.

Because we thought that 1980-81 may be an unusual year for the liftnets, we attempted to calculate the hypothetical owner's profit or loss had the season extended the full seven months. In a normal year, monthly catch may be higher in the 'missed' months than in the four months we observed. Based upon trawler catch of anchovies (the major species caught by liftnets) which was twice as high during March-May than during June-September and assuming constant operating costs per fishing day, annual net income of owners would increase to ₱7,465. Thus they still incur a pure loss of ₱556. Crew income would have almost doubled, however. There are further indications that these Cabusao liftnets were atypical in 1980-1981 from a 1982 feasibility study conducted by the Land Bank of the Philippines by the Tinambac Rural Workers organization which showed that liftnets would be profitable (B. Cervantes, pers. comm.). For that study it was assumed that groups of liftnet operators would share the use of *bancas,* thus reducing their individual costs, and increasing profitability.

RETURNS TO LABOR

In addition to work actually performed during the fishing operation, laborers also assist with net repair and other maintenance chores for which they receive no remuneration. To obtain a clear picture, therefore, of whether labor is earning an income comparable to that which can be earned in other activities these additional days must be taken into account (Table 11).

The opportunity cost of labor was estimated to be ₱10 per day which is the wage that an ordinary carpenter is paid in Cabusao. It also represents the amount that an ordinary laborer on a fish corral would be paid for one day's work.

Table 11. Returns to labor in pesos for stationary gears, Cabusao area, 1980-1981.

	Fish corrals	Liftnets	Filter nets[1]
No. fishing days per year	145	55	187
No. gear repair days per year	25	13	25
Total working days per year	170	68	212
Major fisherman *(buso mayor)*			
Daily income	n/a	16.69	n/a
Annual net income	n/a	918	n/a
Less opportunity cost[2]	n/a	680	n/a
Pure profit (loss)	n/a	238	n/a
Other fisherman (laborer)			
Daily income	10.00	11.92	11.81
Annual net income	1,450	656	2,209
Less opportunity cost	1,700	680	2,120
Pure profit (loss)	(250)	(24)	89
Pure profit (loss) to labor per fishing unit:	(500)[3]	166[4]	(702)[5]

[1] Average for both 1-man and 2-men filter nets, in contrast to Fig. 6 which represents 2-men filter nets only.
[2] Estimated to be ₱10 per working day (fishing plus gear repair).
[3] Crew consisting of 2 ordinary laborers.
[4] Crew consisting of 1 *buso mayor* plus 3 ordinary laborers.
[5] Crew consisting of 2 ordinary laborers.

The resulting comparisons show that the *buso mayor* on a liftnet earned more than his opportunity wage. The other fishermen (laborers) on corrals and liftnets earned slightly less than their opportunity costs and those using filter nets earned slightly more. Taking the whole gear crew complement into account, laborers on liftnets and filter nets earned a small pure profit; laborers on fish corrals were losing relative to their opportunity costs. The labor requirement of the fish corrals is sporadic by season and by phase of the moon covering only a few hours of each fishing day and therefore may permit other part-time employment (C. Bailey, pers. comm.). Consequently, a somewhat lower labor opportunity wage than ₱10 daily may be more appropriate for these gears, in which case the pure loss to labor would disappear.

RETURNS TO THE FISHING UNIT

Taking pure profits and losses of both capital (Table 10) and labor (Table 11) into account on an annual basis, we found that fish corrals and filter nets earned pure profits of ₱3,431 and ₱1,215, respectively, while during the period of study, stationary liftnets in the Cabusao area incurred pure losses of ₱4,211.

Conclusions

The costs and earnings of the three major stationary gears that operate in San Miguel Bay--fish corrals, liftnets and filter nets have been documented in the preceding sections. Incomes of ordinary fishermen who work these gears range from ₱164 to ₱207 per month during those months when the gears are operating. The filter nets operate year-round, but during the months when liftnets and fish corrals do not operate, fishermen who normally work them seek employment with other gears. Earnings from these gears are thus highly seasonal for owner and crewmen alike.

There are some interesting contrasts between the liftnets and the fish corrals. Both fish for much the same species, though the catch per fishing day of the liftnet is 50% higher. They also receive comparable prices per kg of catch. The much higher operating costs of the liftnet (it is the most energy intensive of the three stationary gears), however, result in losses. Lower energy costs contribute to substantial profits for the fish corral. The sharing systems are quite different, with fish corral laborers paid a daily wage and the liftnet crew sharing in the more common 50-50 sharing system. The co-existence of profits to owners of fish corrals and wages lower than opportunity costs to laborers implies an imbalance in the sharing of proceeds that can only be maintained by the power of owners.

The high (relative to other gears) profits of owners of the fish corrals may relate to the owners' role in the community. In many cases, these owners are processors who invest in fish corrals to assure themselves of supply for their processing (salting) activities. Often processors are the financiers behind the visible fish corral operators, who have borrowed bamboo and other materials in-kind from the processors to whom they sell their catch at a lower price. The sharing system for fish corrals thus favors owners over laborers.

Over and above the possible benefits in the form of higher prices that may have accrued to fish corral operators due to reduced competition from liftnets, these pure profits earned by owners of fish corrals and filter nets may be a function of their stationary nature in that their existence in a body of water makes it impossible for others to use the same space. Common property and open access conditions do not hold in this case (but there may be significant externalities from overcrowding), and if either municipalities or *amonojadors* are actually limiting access, we would expect to find such pure profits occurring. However, we found no evidence to show that restrictions were being placed on access. If they were, we would have expected to find that either the license or permit fees or the *amonojador's* fee were higher than their presently low levels.

It appears that a combination of numerous factors including advantages of location, low operating costs and the failure or unwillingness of the licensing authorities to extract more of the rent (pure profit) of the fishery for themselves contribute to the higher pure profits of fish corrals. At present there appears to be no relationship between licensing fees and gear profitability as far as stationary gears are concerned, and municipalities may be missing an opportunity to increase their revenues through increased license fees for fish corrals, especially.

Finally, it should be noted that unlike the mobile gill-netters and mini trawlers which have fishing ranges throughout the Bay, these stationary gears may be characterized by locational differences in catch and profitability. While Cabusao gill-netters and mini trawlers are believed to be representative of the Bay as a whole, our stationary gear sample is probably less so.

References

Elliston, G.R. 1978. Problems in assessing the costs and earnings of mechanized fishing boats. *In* Regional conference technology for rural development, April 24-29, 1978. Kuala Lumpur, Malaysia.

Herre, A.W. 1927. Fishery resources of the Philippine Islands. Bureau of Science, Manila.

Panayotou, T. 1981. Cost structure and profitability of small-scale fishing operations: methodological framework. Paper presented at the IDRC small-scale fisheries workshop, May 1981. Singapore. (Mimeo)

Spoehr, A. 1980. Protein from the sea: technological change in Philippine capture fisheries. Ethnology Monographs No. 3. Dept. of Anthropology, University of Pittsburgh, Pennsylvania.

Umali, A.F. 1937. The fishery industries of San Miguel Bay. Philipp. J. Sci. 63: 227-258.

Umali, A.F. 1950. Guide to the classification of fishing gear in the Philippines. Research Report 17. Fish and Wildlife Service, U.S. Dept. of the Interior, Washington, D.C.

Costs and Earnings of Cabusao Push Nets

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SUPANGA, N.C. 1982. Costs and earnings of Cabusao push nets, p. 61-63. *In* I.R. Smith and A.N. Mines, (eds.) Small-scale fisheries of San Miguel Bay, Philippines: economics of production and marketing. ICLARM Technical Reports 8, 143 p. Institute of Fisheries Development and Research, College of Fisheries, University of the Philippines in the Visayas, Quezon City, Philippines; International Center for Living Aquatic Resources Management, Manila, Philippines; and the United Nations University, Tokyo, Japan.

Abstract

Push nets operated by fishermen in the vicinity of Cabusao, San Miguel Bay, Philippines, are described. In comparison to most other small-scale fishing gears of the Bay, investment costs for push nets were very low. Daily income was less than the local opportunity wage, most fishermen apparently using the gear only on a seasonal and part-time basis.

Introduction

Push nets *(sakag)*, sometimes known as scissor nets, are operated by single fishermen at wading depths (Fig. 1). The nets are pushed along the bottom. Operation of this gear is highly seasonal because large waves make its use difficult. The major species caught by pushnetters in Cabusao are sergestid shrimps *(balao)*.

According to old-time fishermen, the gear has evolved from a two-man seine locally known as *sarap*. Before mini trawlers appeared in San Miguel Bay, fishermen claimed that daily *sarap* catches could reach 50 kg or more. Because the *sarap* catch declined after the introduction of mini trawlers, the push net was developed to allow a fisherman to operate without a partner and at reduced cost. A small sample (n = 5) of the 25 push-net operators in Castillo, Cabusao, identified during our 1979 survey was studied and the findings reported briefly here.

Costs and Earnings

Among all the gears studied in the project, the push net had the lowest average investment cost of only slightly more than ₱200 (Table 1). Except for the cost of bamboo, this investment cost has not increased substantially since the units of our respondents were acquired. Annual depreciation for the average unit was approximately ₱56.

During the survey period, June 1980-May 1981, the Cabusao push nets operated for only three months, June to August 1980. During these three months, push nets were used by respondents for a total of 44 days or 15 days/month. Average catch was 6 kg/day and consisted mostly of *balao* with occasional larger shrimps.

The operators, most of whom worked on a permanent basis with *balao* processors, should be considered part-time seasonal fishermen who relied on push-net fishing only to supplement their household income. Once the rough seas of the northeast monsoon began, they devoted themselves full-time to working for the processors of the *balao* catch of the mini trawlers or to other activities.

The average daily value of the push-net catch during the study period was only ₱13.80, or ₱10.40 after expenses for food, cigarettes and kerosene were deducted. There were no license fees for the push nets, but pro-rating the annual depreciation from Table 1 over the 44 days of operation and deducting it from ₱10.40 left a daily net revenue of only ₱9.10. This income was slightly less than the opportunity cost to labor, or the daily wage (₱10.00) that could be earned in alternative unskilled occupations in the Cabusao area during 1980-1981. Since 80% of the push nets in the Bay were operated by residents of Cabusao and Calabanga in areas similar to those of our respondents, (Esporlas 1982) we believe that their daily income was comparable to that of our sample, though they may have operated for a longer season.

Table 1. Investment costs and annual depreciation in pesos for Cabusao push nets.

Item	Average no. owned	Average acquisition cost/unit	Expected life span (years)	Average annual depreciation per item	Average depreciation per fishing unit[1]
Unmotorized *banca*	0.8	92.50	5	18.50	14.80
Banca sail	0.6	8.30	0.5	16.60	10.00
Gear	1	103.00	5	20.60	20.60
Sorting device	1.6	4.50	0.6	2.63	4.20
Paddle	0.6	10.00	3	3.33	2.00
Container	0.6	7.00	1	7.00	4.20
Anchor	0.2	10.00	20	.50	0.10
Average acquisition cost per push-net operator		201.40	Total annual depreciation per fishing unit		55.90

[1]Average depreciation per fishing unit (rounded to nearest ₱0.10) = average annual depreciation per item times average number of each item owned.

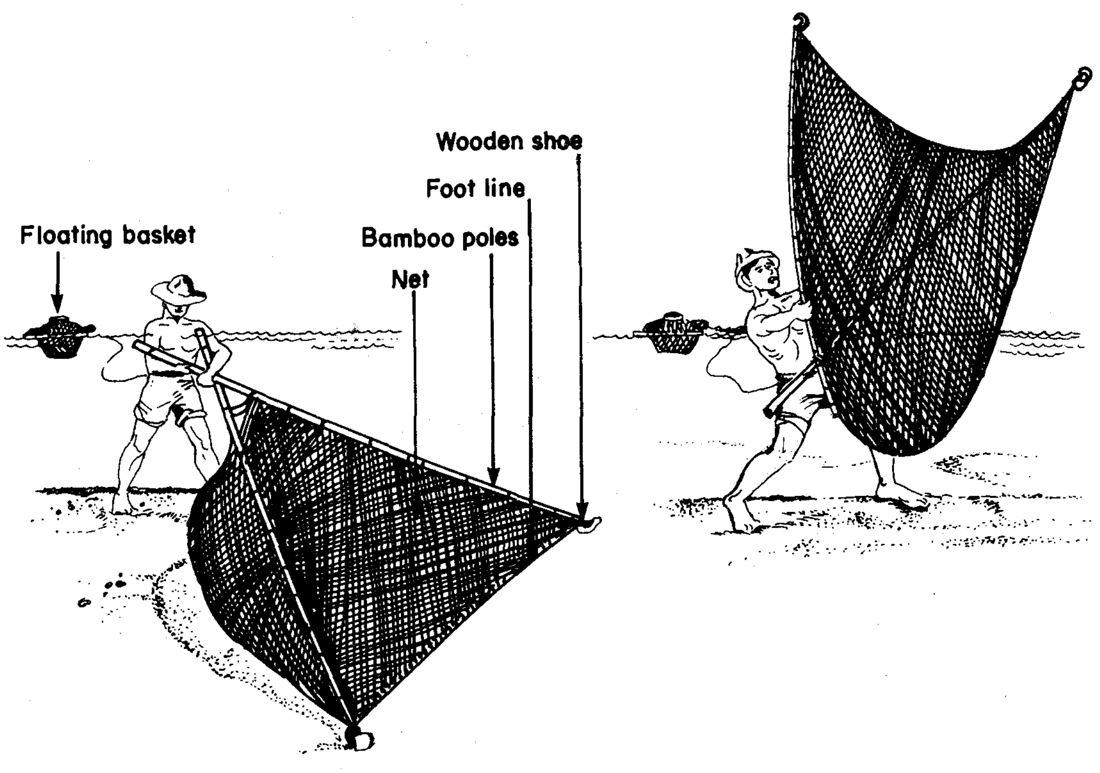

Fig. 1. *Sakag*, a push net for catching shrimps. Source: Umali (1950).

References

Esporlas, A.E. 1982. The seasonality of fishing, marketing and processing, p. 14-24. *In* C. Bailey (ed.) Small-scale fisheries of San Miguel Bay, Philippines: social aspects of production and marketing. ICLARM Technical Reports 9, 57 p. Institute of Fisheries Development and Research, College of Fisheries, University of the Philippines in the Visayas, Quezon City, Philippines; International Center for Living Aquatic Resources Management, Manila, Philippines; and the United Nations University, Tokyo, Japan.

Umali, A.F. 1950. Guide to the classification of fishing gear in the Philippines. Research Report 17. Fish and Wildlife Service, United States Department of Interior, Washington, D.C.

Costs and Earnings of Mini Trawlers

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Abstract

Mini trawlers are the smallest trawlers operating in San Miguel Bay, Philippines. This paper examines the costs and earnings of this type of gear and offers explanations for the high pure profits earned. Variations in catch and incomes are related to differences in the various sharing systems and to variations in fishing effort.

Introduction

The mini trawler, or *mangquerna*, was introduced to Castillo, Cabusao in the early 1950s by fishermen from the community of Vinzons in the neighboring province of Camarines Norte. Vinzons fishermen still migrate annually to San Miguel Bay during the sergestid shrimp *(balao)* season (November to March) when mini trawler catch is at its peak.

Mangquerna is the most widely used local term for this type of gear, though there are more localized terms, such as *bancuerna* (Barcelonita, Cabusao), *itik-itik* (Castillo, Cabusao) and *kuto-kuto* (Tinambac). According to older fishermen in Castillo, its local name *(itik-itik)* was derived from *itik* (duck) due to the tendency of mini trawl operators to congregate during a good catch, just as ducks do when a feed source is located.

This paper reports on the costs and earnings of mini trawlers in San Miguel Bay.

Methodology

As of 1980, there were 188 mini trawlers located in the Bay, not counting those from Vinzons which fish within the Bay at certain times of the year (Esporlas 1982). Fully 51 or 27% of those located within the Bay in 1980 could be found in Barrio Castillo. Castillo and other communities at the southern base of the Bay are the centers for the processing into shrimp paste or *bagoong* of that portion of the mini trawl catch that consists of *balao.*

In 1979, however, the records of the municipal treasurer in Cabusao showed only 36 registered mini trawlers in all barrios of the community, so apparently many mini trawlers failed to register with the municipality and to pay the necessary license fee. Since the 1980 registry was not available, our 1979 inventory of fishing units in Castillo became the basis for estimating the number of mini trawlers in the community. Because so many of the mini trawlers had failed to register with the municipality, we had difficulty in persuading mini-trawler owners to participate in the study. Many were afraid that the data collected would be turned over to the Bureau of Internal Revenue (BIR). Consequently, we were unable to use random sampling techniques, but instead identified a 30% sample (n = 16) of these Castillo mini-trawler owners who were willing to participate in the costs and earnings study.

Data were collected from these owners through a 12-month record-keeping exercise from June 1980 to May 1981. Prior to the monitoring of their daily costs and returns, interviews were conducted with each owner to determine their investment costs. Notebooks were provided to each respondent and data were collected and recorded either on a daily or a weekly basis depending upon the cooperation of each respondent.

At the start, 16 fishing units were monitored. Within a few months, units had to be dropped from the sample. Three units were sold to new owners who declined to participate in the record-keeping survey; the fourth suffered a major engine breakdown and because the owner was sick and could not afford to repair the engine, the vessel no longer went out fishing. These four units were replaced by four other units which had records of their costs and returns dating back to June 1980 when the study started. There were no subsequent dropouts and the sample size was maintained at 16 throughout the study. Data were collected from a total of 2,992 fishing trips.

Operation of the Gear

Mini trawlers are the smallest of the various trawlers operating in San Miguel Bay. Although smaller than the small and medium trawlers (see Navaluna and Tulay, this report), the net shape, material used and mode of operation is similar. Mini trawlers on the average are 10.5 m long, 0.9 m wide and are generally powered by 16-hp Briggs and Stratton gasoline engines (Fig. 1). Unlike the *banca* used by gill-netters, the mini trawler has no outriggers. Trawling speed is very slow, estimated to be 1 knot (1.85 km/hr) (Vakily 1982); therefore, very few fish are caught along with the shrimp. Mini trawlers are manned by a crew of two. Of our sample, only two were owner-operated while 14 (88%) were each operated by a pilot and a crewman retained by the owner. The limited number of owner-operators can probably be explained by the fact that operating a mini trawler is extremely hard work, undertaken by younger fishermen (or family members) who may not yet have the capital to purchase their own fishing unit.

Mini trawlers use two types of nets, the *pamalao* and *pamasayan* which have the same body but differ in the mesh size and material used at the cod end. The cod end of the *pamalao* consists of a fine-meshed screen like that used for mosquito nets. The *pamasayan* is made of nylon with a cod end mesh size of 17 knots. On the average these nets have a headline length of 4-5.5 m for the upper rope and 5-6 m for the lower rope (Fig. 2).

The *pamalao* is used from September to June, the southwest monsoon period, when the tiny sergestid shrimps *(balao)* are abundant (Fig. 3). The *pamasayan* is used to catch larger shrimps primarily during July and August, when *balao* are not as prevalent. Mini trawlers choose between the two nets depending upon their predicted catch. Switching by mini-trawl operators from one net to the other occurs during the months of May to June and September to October because the onset and decline of the *balao* is never exact. In this manner, the mini trawlers are able to operate throughout the year.

The Castillo mini trawlers operate throughout the shallower areas of the Bay. Though they are legally required as trawlers to fish beyond the 4-fathom (7.3 m) mark, since their main objective is to catch shrimp, mini trawlers fish very close to shore wherever shrimp are to be found. They fish with-

Fig. 1. A mini trawl hull under construction. Mini trawlers are dugout logs without outriggers.

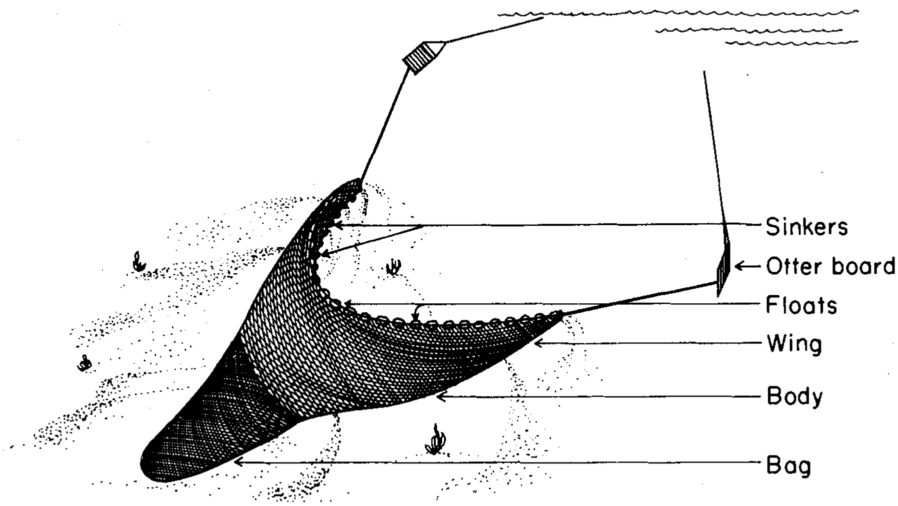

Fig. 2. Mini trawl gear is similar to that of larger otter trawlers but with smaller mesh.

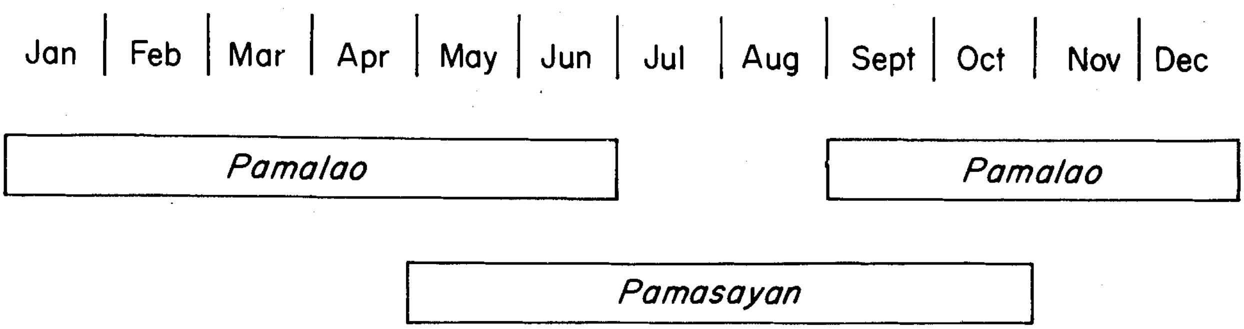

Fig. 3. Seasonality of gear use by mini trawlers.

in 500 m of the shoreline in Barcelonita, Cabusao. The mini trawlers generally do not fish beyond the 7-fm (12.8 m) mark because of their short towing rope and small net.

Other methods are also used to catch *balao*. The most common is a small scissor net *(hudhud)* pushed by one man at wading depths. This gear is similar to the scissor or push net known as *sakag* used to catch *balao* and other species of shrimp that are cooked, dyed red, sun-dried and then shipped to Manila. Push nets operate for only a few months each year, however (see Supanga, this report). Motorized push nets are used in other shrimp fisheries in the Philippines (e.g., Laguna de Bay) but are not used in San Miguel Bay in large numbers or with any regularity.

Catch and Effort

A typical fishing trip for a mini trawler lasts only one day. Fishing for the *balao* using the *pamalao* net is primarily a daytime fishery, with the mini trawlers leaving the shore at 5 a.m. and returning between 3 and 4 p.m. Fishing using the *pamasayan* net is at night often until 3 to 5 a.m. the following morning. Only during one month (June 1980) did mini trawlers on average make more than one fishing trip per day (Table 1).

The average number of trips per year was 187 with little variation from month to month. After adjusting for Sundays which are rest days in Catholic communities like Castillo, the average mini trawler fished on 60% of the 313 potential fishing days during the 12-month period, June 1980-May 1981. If a mini trawler fished on a Sunday, Monday was a rest day because most fishermen believe that when Sunday fishing is good, Monday catch will be poor.

Although average fishing effort (as measured by number of trips) showed only a small variation throughout the year, average monthly catch per fishing unit ranged from a low of 480 kg in August 1980 to a high of 4,365 kg in January 1981 (Table 1). As will be discussed in the next sections, however, average gross incomes per fishing unit did not vary as much as average catch because when catch was low prices per kg were higher. This was due to the presence of larger shrimps in the catch during the months of July-September. Average catch per mini trawler was slightly over 25 t for the 12-month period, or 2.1 t/month.

There was considerable variation in effort (no. of trips) and in catch between fishing units, however (Table 2). For the 12 months the number of trips per fishing unit ranged from 119 to 224. Average catch per trip ranged from 86 to 200 kg, and annual catch ranged from 14.4 t (fishing unit no. 11) to 35.7 t (fishing unit no. 2).

Variation in number of trips (and monthly catch) can be explained by a number of factors, including engine breakdowns (1 major case) and vessel damage during typhoons (3 cases) involving fishing units 8, 11 and 12. The variation in catch per trip can be explained by the following factors: age of the owner-operator[1] (or the boat pilot if the owner did not fish himself), years of fishing experience, education level of the owner-operator or boat pilot, and the gasoline expenditure per trip. Mathematically, this relationship can be expressed as:

$$Y = \alpha A^{\beta_1} E^{\beta_2} S^{\beta_3} G^{\beta_4} e$$

or in log-log form[2]:

$$\text{Log } Y = \text{Log}\alpha + \beta_1 \text{ Log } A + \beta_2 \text{ Log } E + \beta_3 \text{ Log } S + \beta_4 \text{ Log } G + e$$

[1] Due to the arduous work on a mini trawler, age was hypothesized to have a negative impact on catch.
[2] Log-log specification resulted in a higher R^2 than the linear specification.

Table 1. Catch and effort of mini trawlers, Castillo, San Miguel Bay, 1980-1981.

	1980								1981					
	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Annual total	Monthly av.
Effort														
No. of days in month	30	31	31	30	31	30	31	31	28	31	30	31	365	30.4
No. of Sundays	4	4	5	4	4	5	4	4	4	5	4	5	52	4.3
No. of potential fishing days	26	27	26	26	27	25	27	27	24	26	26	26	313	26.1
No. of actual fishing days	16.7	15.4	15.4	13.6	18	14.4	14.7	15.3	16.0	17.8	13.7	15.9	187	15.6
No. of non-fishing days	9.3	11.6	10.6	12.4	9	10.6	12.3	11.7	8.0	8.2	12.3	10.1	121	10.5
No. of fishing trips	16.8	15.4	15.4	13.6	18	14.4	14.7	15.3	16.0	17.8	13.7	15.9	187	15.6
Av. catch/fishing unit (kg)	1,344	748	480	588	2,014	3,240	2,970	4,365	3,136	3,168	1,554	1,456	25,063	2,089
Catch per trip	81	49	31	43	112	225	202	285	196	178	113	92	–	136
Catch per fishing day	80	49	31	43	112	225	202	285	196	178	113	92	–	135

Table 2. Annual catch and effort of mini trawlers by fishing unit, Castillo, San Miguel Bay, 1980-1981.

	Fishing units															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Effort																
No. of days in a year	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
No. of Sundays	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52
No. of potential fishing days	313	313	313	313	313	313	313	313	313	313	313	313	313	313	313	313
No. of actual fishing days	184	211	206	191	176	175	169	180	276	199	150	119	210	212	195	172
No. of non-fishing days	129	102	107	122	137	138	144	133	87	114	163	194	103	101	118	141
No. of fishing trips	179	209	204	188	174	175	171	179	224	199	150	119	210	212	195	172
Catch/fishing unit (kg)	25,187	35,703	33,969	32,080	34,750	30,393	15,481	24,800	23,069	17,067	14,384	21,707	21,278	18,309	22,483	20,663
Catch per fishing day	137	169	165	170	197	174	91	138	102	86	96	182	101	86	115	120
Catch per trip	142	171	167	171	200	174	92	139	103	86	96	182	101	86	115	120

where

Y = average catch per trip
A = age of the fisherman (owner-operator or boat pilot)
E = years of fishing experience of the fisherman (owner-operator or boat pilot)
S = years of formal education of the fisherman (owner-operator or boat pilot)
G = average gas expenditure per trip
e = error term

Average catch per trip (Y) and average gas expenditure per trip (G) are monthly averages. A dummy variable to cover seasonality effects was not included. Total number of observations for this estimation was therefore 192 for the 16 fishing units in the sample.

The estimated equation using ordinary least squares multiple regression techniques was:

Log Y	=	Log .348	– .334 LogA +	.080 Log E +	.063 Log S +	1.041 Log G
s.e.	=		(.189)	(.084)	(.238)	(.064)
t	=		1.76	0.95	0.26	16.33
F	=	70.37				
R^2	=	.60 (Adjusted R^2 = .59)				

Sixty percent of catch variation per trip can thus be explained by the four explanatory variables included in the specified equation. The overall fit of the equation is good. All the coefficients have the expected signs, including age which was hypothesized to have a negative impact on mini-trawler catch. Gasoline expenditure per trip is highly significant ($p > .01$). The coefficient for age is significant at the 10% level, and since older fishermen are less likely to be mini-trawler operators in the first place, the results support the contention that younger fishermen, all other factors being equal, are likely to be more successful than older mini-trawl operators. Fishing experience and formal education of operators have no apparent impact on catch levels. If mini trawlers do in fact group together when shrimp are located, then it is not surprising that experience and education have no effect on catch per trip, since all nearby fishing units will benefit from the success of the more experienced fishermen in identifying good fishing locations.

Gasoline expenditures per trip are a measure of fishing effort since all mini trawlers in the sample are approximately the same size and use identical engines. Increases in gasoline expenditures could be due to either longer search time, or longer trawling time or both. According to the estimated equation, a 10% increase in gasoline expenditure will result in a 10.41% increase in catch, all other factors (age, education and experience) being equal. Average gasoline expenditure per trip during 1980-1981 was ₱91.27; average catch per trip was 136 kg. Therefore, the added cost of a 10% increase in gasoline expenditure would be ₱9.13; the added return expected would be 136 kg x 10.41% = 14.16 kg, valued at ₱21.66 (average price per kg of mini trawler catch was ₱1.53/kg during the study period). The added expenditure would produce an added net revenue of ₱12.53. In the following sections dealing with costs and returns, a particular group of mini trawlers that took advantage of this added net revenue by fishing longer will be identified and some explanations for this different behavior will be put forward. However, it is necessary to first discuss the costs of owning and operating a mini trawler.

Investment Costs

The major items that are required for a mini-trawl fishing unit are the boat, engine and *pamalao* and *pamasayan* nets, including otterboards (Table 3). Together, these items comprise 93% of the current replacement cost (₱9,187) of a mini-trawl unit. Other items include various containers, store-

Table 3. Average investment costs of mini trawlers, Castillo, San Miguel Bay, 1981.

Item	Av. no. owned	Av. acquisition cost/item (₱)	Replacement cost (1981) per item (₱)	Av. expected life (yr)	Annual depreciation per item[1] (₱)
Banca	1	1,562	4,500	9.2	489
Engine	.81	2,888	3,700	10.3	359
Nets:					
Pamalao	1	444	600	2.1	286
Pamasayan	1	361	500	2.8	179
Rattan basket	7.2	14.77	15	1.2	12.50
Tub	1	50	74	1.0	74
Storehouse	.31	1,090	900	8.6	105
Otterboards[2]	.25	167	180	3.8	47
Flashlights	.75	29	54	1.5	36
Gasoline container	.75	36	40	2.2	18
Anchor	.13	50	100	5	20

Average acquisition cost per mini-trawl unit[3] = ₱5,298 Average replacement cost per mini-trawl unit[4] = ₱9,186 Average annual depreciation per mini-trawl unit[5] = ₱1,496

[1]Based upon 1981 replacement cost.
[2]For most respondents, the cost of the otterboards was included in the cost of nets.
[3]Equals $\sum$ (av. no. owned x av. acquisition cost per item).
[4]Equals $\sum$ (av. no. owned x av. replacement cost per item).
[5]Equals $\sum$ (av. no. owned x annual depreciation per item).

house (five of 16 respondents used a storehouse separate from their own house), flashlights and anchors (14 brave souls of 16 respondents used no anchor).

As shown in Table 3, there is a significant difference between the acquisition cost of the average fishing unit of our 16 respondents and the current replacement cost of the same set of items. The average length of current ownership of boats and engines in the sample units was 3.3 and 3.9 years, respectively. The oldest boat was purchased in 1972 and the oldest engine in 1973, indicating that these items can have a long life if well cared for. Respondents believed boats could, on average, last nine years and engines, 10 years. In fact several of the boats and engines used by respondents were acquired second-hand; all boats were purchased through own finances. Thirty eight percent of the engines were financed through the Development Bank of the Philippines.

All respondents used 16-hp Briggs and Stratton gasoline engines, 13 respondents own engines, one rents his engine and the other two use mortgaged engines. These mortgaged engines are owned by others who, in return for a cash payment of approximately ₱500, lend their engines to operators of mini trawls. Their engines can be redeemed upon repayment of the amount borrowed without interest. The engine lender thus receives a cash loan for no interest (except wear and tear on his engine), and the engine borrower uses an engine for only the cost of interest foregone on his ₱500 cash payment.

A mini-trawler unit can thus be acquired for less than a gill-net unit (see Yater, this report). Based on current replacement costs, annual depreciation costs for the average mini trawler is ₱1,496, assuming a straight-line basis and zero-salvage value.

Value of Catch

As mentioned earlier, the monthly catch value for the average mini trawler varies less than the monthly catch itself due to the presence of larger shrimps with high prices from June to September.

However, at its peak in January, monthly value of catch is still more than double the lower values obtained from June to September (Fig. 4). Although such variation is typical of each season, the peak apparently does not always occur during the same month each year. One determining factor is the weather. The average monthly value of catch per mini trawler during the period of study was ₱3,209.

Operating Costs

Operating expenses are deducted from the gross value of the catch, yielding the net revenue which is divided between the owner and crew depending upon the sharing system that is used. Not surprisingly, the major operating expense for mini trawlers is gasoline, which is 78.6% of the total (Table 4). An average of 16 liters is consumed per trip. Food is the second major operating expense. Because only the larger shrimps are iced, expenses for ice are very low. Some units in the sample used no ice at all during the whole period of study. However, it is a common practice for middlemen to provide ice free to mini trawlers as part of an agreement to assure supply of shrimps so absence of an expense for ice in our respondent's records does not necessarily mean no ice was used.

The production system for mini trawlers can only be understood if its links to suppliers and middlemen are explained. In addition to ice, shrimp middlemen and *balao* processors also provide gasoline in advance to mini trawlers (and to other motorized vessels) based in Castillo in return for the right to buy the catch. There are at least five regular gasoline suppliers for the mini trawlers in Castillo and several others who also sell gasoline during the peak months of the *pamasayan* season. In some cases, the whole operation of input supply, production and processing is vertically integrated. To cite an example, an individual may own a small fleet of mini trawlers of five to six vessels, engage in buying and selling of shrimps and crabs and sell gasoline and other fishing accessories.

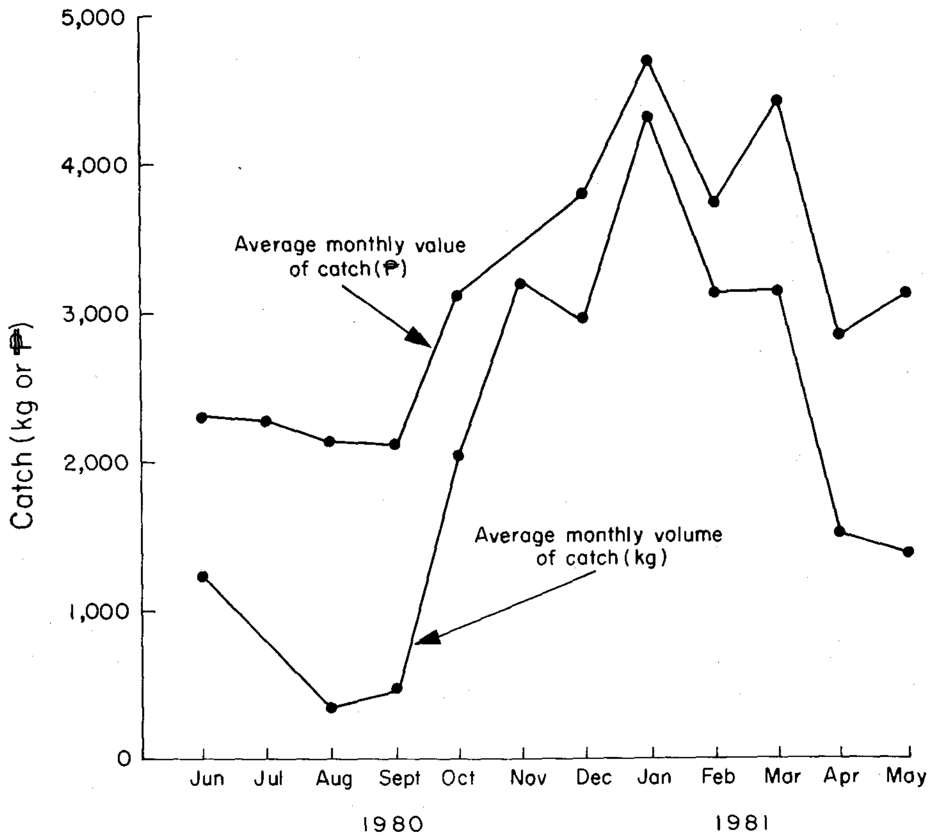

Fig. 4. Average monthly volume and value of catch of mini trawlers, Castillo, San Miguel Bay, June 1980-May 1981.

Table 4. Average monthly operating expenses and net revenue in pesos (before sharing) of mini trawlers, Castillo, San Miguel Bay, 1980-1981.

	1980 June	July	Aug	Sept	Oct	Nov	Dac	1981 Jan	Feb	Mar	Apr	May	Annual total	Monthly average
Total value of catch per fishing unit	2,377	2,347	2,168	2,077	3,105	3,601	3,867	4,715	3,788	4,428	2,876	3,155	38,504	3,209
Total operating expenses per fishing unit	1,554	1,645	1,735	1,576	2,069	1,874	1,897	1,963	1,993	2,064	1,505	1,832	21,707	1,809
gasoline	1,291	1,359	1,432	1,316	1,640	1,390	1,405	1,503	1,537	1,603	1,180	1,410	17,066	1,422
oil	37	40	38	39	44	48	48	49	53	44	37	37	514	43
repair/parts[1]	24	13	44	18	94	84	104	54	62	51	16	44	609	51
food	159	163	176	151	218	195	184	192	219	226	194	259	2,336	195
miscellaneous (cigarettes, ice)[2]	43	70	45	52	73	151	156	165	121	141	78	82	1,183	99
Monthly net revenue per fishing unit before sharing (₱)	823	702	433	501	1,036	1,727	1,970	2,752	1,795	2,364	1,371	1,323	16,797	1,400
Average price/kg received[3]	1.76	3.14	4.52	3.53	1.54	1.11	1.30	1.08	1.21	1.40	1.85	2.16		1.53[4]

[1] Some owners but not all include minor repair and maintenance costs as part of the operating costs rather than pay for them out of the owner's share.
[2] Also includes payment for occasional labor to assist with net or boat repair or to dive to recover nets entangled on underwater objects.
[3] Average price received is not the average price of *balao,* but the average per kg of the whole catch which also includes some larger shrimps.
[4] Weighted average by volume caught per month.

The capital requirement and risks for a middleman with these various activities is quite substantial which explains the small number of individuals in Castillo who can function in this manner. Gasoline is purchased in 55-gallon drums from Libmanan at ₱5.05/l (1981 price) and transported by private jeepney to Castillo where it is resold at ₱21.00/gallon (equivalent to ₱5.55/l). If the middleman is engaged in buying and selling shrimps, gasoline would be advanced to the operators of mini trawlers to assure a steady supply of shrimp. Agents may also be retained and paid a 10% commission to purchase shrimps. Iced shrimps and blue crabs are shipped to Manila 400 km away in styrofoam boxes via the bus or privately-owned jeepneys. A jeepney is used for shipments of four or more styrofoam boxes. The bus from Naga City is used for small shipments. In either case, a regular buyer in Manila receives the shipment and is responsible for selling the shrimp. Payment is made to the Castillo businessman after the sale of the shrimp. The actual transfer of funds is made when the jeepney makes the next trip or by bank transfer between Manila and Naga. Other fishing equipment, engine parts and nets to supply the businessman's own boats are purchased during trips to Manila where prices are lower.

The Castillo businessman purchases ice to preserve the shrimp he sends to Manila from the Naga City ice plant (which is the closest to Castillo) at ₱20.00 per block which is transported to Castillo in the back of a jeepney. Rice husks and sacks are used to minimize melting. What is not needed for the Manila shrimp shipments is resold to other middlemen at ₱36.00 per block (1981 price). The jeepney takes shrimp to Naga for shipment on the bus and brings ice to Castillo on the return trip thus optimizing the use of the jeepney.

The few Castillo businessmen who engage in these multifarious activities require significant amounts of capital to keep their businesses operating smoothly. Advances to mini-trawler operators is one method by which regular supply is assured. Although *balao* processors do not need the Manila outlet for their product and timeliness of shipments is less of a problem, they too assure supply by providing advances, both cash and in kind, to mini-trawler operators.

Because the per trip operating costs of mini trawlers (Table 5) are higher than those for any other gear in the community, mini-trawler operators in many cases believe they have little choice but to tie themselves to particular businessmen. For most mini-trawl operators their entire production unit, their inputs and their market outlets are all controlled by local businessmen. Whether this arrangement is exploitative or not is debatable; at least a regular, though fluctuating income for the crew of mini trawlers is assured.

Sharing Systems

The income of owners and crew of mini trawlers depends upon the sharing system used. The basic system of sharing divides the net revenue (gross income minus operating expenses) equally between the owner and the crew. In Castillo, however, there are three variations of this basic system that indicate ways by which owners successfully provide incentive to their crew. For example, owners can offer to (1) increase the share of the pilot and/or (2) shoulder more of the routine repair and maintenance costs themselves.

The first of the three variations (variation A) is that in which the pilot receives 10% of the owner's share, or 5% of net revenue in addition to his share as a member of the crew (Fig. 5). The daily incomes of the partner (ordinary crew) and the pilot under this system are ₱19.46 and ₱23.35, respectively. The owner must still pay for fixed costs (depreciation, licenses, etc.) and certain variable costs (major repair and maintenance) out of his daily income of ₱35.03. Five (31%) of the 16 mini trawlers in our sample used this sharing system.

Another five (31%) mini trawlers used a sharing system (variation B) whereby repair and maintenance expenses are paid by the owner out of his share rather than as an operating expense (Fig. 6). This system, however, did not apparently have the desired effect of increasing incomes of either crew or the owner. In fact, daily incomes were lower (but not statistically lower) than daily incomes that crew and owners received under the first sharing arrangement. Because the former group fished more often on average (16.6 vs. 13.9 days/month), monthly incomes for the two groups were the same (Table 5). We examined the average volume of catch, value of catch and price received of the 10 mini trawlers in these two sharing system groups and found no significant difference between the two. We therefore concluded that this particular method of incentives to crew is ineffectual.

The remaining six mini trawlers in our sample practiced a sharing system (variation C) whereby 20% of the owner's share (equivalent to 10% of the net revenue) is given to the pilot (Fig. 7). This incentive from the owner is thus twice as large (in percentage terms) as the incentive payment made under variations A and B. Minor repair and maintenance expenses are treated as operating expenses, as they were in variation A. This group of mini trawlers has significantly higher gross income and owner and crew income than the other two sharing system groups. The daily incomes of the partner and pilot are ₱29.22 and ₱40.90, respectively; owner's income is ₱46.76. Despite the fact that average prices received were slightly lower than for the other two groups, this added incentive to the pilot appears to have the desired effect of increasing incomes of both owner and crew.

This third group of mini trawlers tended to fish longer than the other two groups; their fuel expenses were on average ₱7.50 higher per trip, implying they either searched or fished for about one hour longer than the other two groups. This third group of mini trawlers are all owned by a single owner who is also a businessman of the type described under the previous section on operating costs. He has very little pilot turnover and claims to have been able to attract the best pilots in Castillo. His pilots, who average 25 years of age, are approximately 10 years younger on average than those of the other two groups, implying that older age is not an advantage for the strenuous work required of pilot and crew of a mini trawler. He also pays occasional bonuses to his crew. Finally, his boats are better maintained than those in the other groups. Three of the boats in the other groups were damaged or had engine trouble and unfortunately for two of them, these problems occurred during the peak of the *balao* season. A combination of factors, including the added incentive provided by this sharing system, therefore produces added benefits to owner and crew alike.

Average monthly incomes received by owners and crew under these three sharing systems are shown in Table 6. The usual sharing day for mini trawlers is Sunday since this is a rest day, but there are occasional variations depending upon the crew's need for cash and the owner's cash position. If the owner has not yet been paid by his shrimp buyers, the sharing is postponed but with the owner providing for the daily maintenance of the crew's families.

Table 5. Average operating expenses per trip for mini trawlers, Castillo, San Miguel Bay, 1980-1981 (187 trips per year).

Item	Cost (₱)	Percent of total operating cost
Gasoline	91.27	78.6
Food	12.52	10.8
Cigarettes, ice and other miscellaneous expenses	6.35	5.5
Repair/parts	3.27	2.8
Oil	2.76	2.4
	116.11	100.0

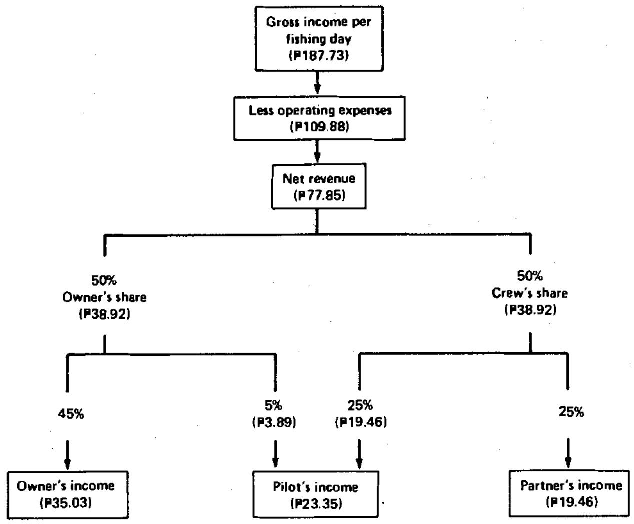

Fig. 5. Revenue sharing systems of mini trawlers, Castillo, San Miguel Bay, 1980-1981. Variation A: daily sharing system, with minor repair and maintenance costs treated as operating expense (n = 5).

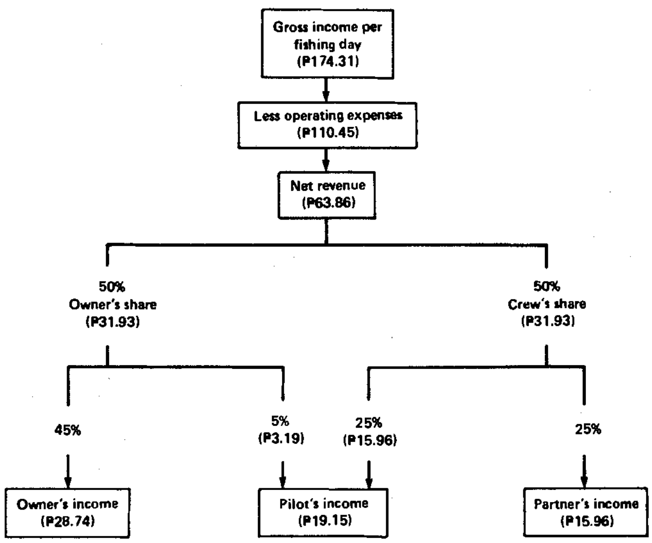

Fig. 6. Revenue sharing systems of mini trawlers, Castillo, San Miguel Bay, 1980-1981. Variation B: daily sharing system, with all repair and maintenance expenses paid by owner out of owner's share (n = 5).

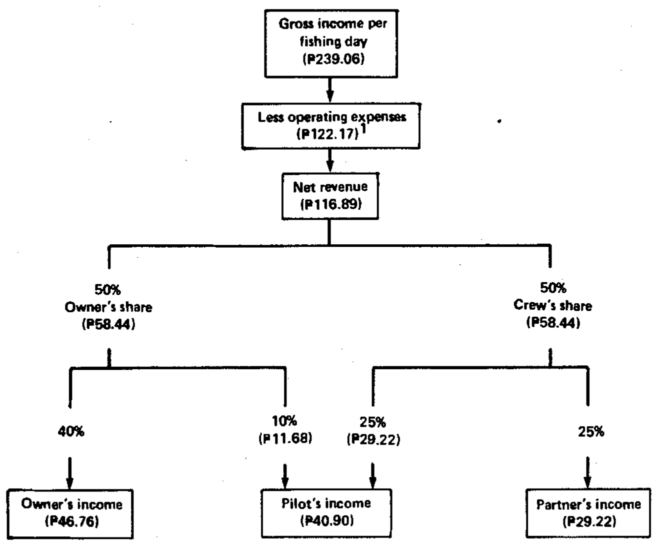

Fig. 7. Revenue sharing systems of mini trawlers, Castillo, San Miguel Bay, 1980-1981. Variation C: daily sharing system with additional incentive share to pilot (n = 6).

[1] Includes minor repair and maintenance.

Table 6. Monthly average incomes of owners, pilots and partners (ordinary crewmen) of mini trawlers, Castillo, San Miguel Bay, 1980-1981, under various sharing systems.

	Sharing systems[1]			
	Variation A (n = 5)	Variation B (n = 5)	Variation C (n = 6)	All mini trawlers (n = 16)
Average no. fishing days/month	13.9	16.6	15.9	15.6
Monthly income (₱)				
non-fishing owners[2]	487	477	743	580
pilots	325	318	650	445
partners	270	265	465	342

[1] See Figs. 5-7 for details.
[2] Before deduction of fixed and variable costs borne by owner.

Returns to Capital and Labor

To determine whether any excess profits (pure profits or rent) exist in the mini-trawler fishery, all remaining fixed, variable and opportunity costs must be subtracted from the incomes that are earned by owners and crew after sharing. Owners incur all three of these costs and crew incur opportunity costs. For this study, we have chosen to represent any pure profits remaining to owners as a return to capital and any pure profits remaining to crew as a return to labor. Together, these returns represent pure profits or returns to the fishing unit.

RETURNS TO CAPITAL

After deducting all remaining fixed and variable costs from the ₱6,960 annual income of owners, a residual of ₱5,184 remains (Table 7). This residual represents the return to the owner's capital, labor, management and risk. Further accounting for the opportunity costs of the owner's capital and own labor results in a pure profit to owners of ₱2,821 annually per fishing unit. The opportunity cost of capital is the interest foregone (9%) on the capital invested when the mini-trawler unit was acquired. The opportunity cost of the owner's labor is the income foregone (estimated at ₱38.50/man-day) during those 4 days/month when he must engage in work to support his fishing unit.

RETURNS TO LABOR

In addition to actual fishing days, boat pilots and partners spend an average of 4 days/month working without remuneration on repair and maintenance of their fishing units. Adding these days to actual fishing days results in crew working a total of 235.2 days/year on average (Table 8). We used a daily wage of ₱10 to estimate the opportunity cost of labor for pilots and partners of ₱2,352 annually. Deducting these amounts leaves a pure profit for labor of ₱4,740 for the average mini-trawl unit.

RETURNS TO THE AVERAGE FISHING UNIT

Summing up the pure profits of owners and crew results in a pure profit for the average mini trawler of ₱7,561 annually (Table 9).

Excess profits of this amount should be sufficient to attract new entrants into the fishery. Although the mini-trawler fleet in San Miguel Bay has indeed expanded rapidly during the 1970s due in part to the availability of subsidized credit, there is no evidence of a rush to this gear by

Table 7. Annual returns to capital of mini trawlers (in pesos), Castillo, San Miguel Bay, 1980-1981.

	All mini trawlers		All mini trawlers
No. of fishing days/year	187.2	Variable costs	
Daily income of owner	37.18	maintenance and repair	127
		rental fees[2]	83
Annual income of owner	6,960		
		Subtotal	210
Annual costs of owner			
		Total fixed and variable costs	1,776
Fixed costs			
		Residual return to owner's capital,	
mayor's fee	20	labor and management	5,184
license fee[1]	50		
depreciation	1,496	Less opportunity costs	
Subtotal	1,566	investment capital[3]	515
		own labor[4]	1,848
		Total opportunity costs	2,363
		Owner's pure profit	2,821

[1]Based on current replacement costs (Table 3).
[2]Two owners rented a boat and engine, respectively, for a short period while their own equipment was being repaired.
[3]Based on 9% of acquisition costs.
[4]Represents work performed by owners in support of their mini trawler. Estimated at 4 days/month and ₱38.50/day, based on daily earnings from processing, the activity foregone.

Table 8. Annual returns to labor of mini trawlers (in pesos), Castillo, San Miguel Bay, 1980-1981.

	Boat pilot	Partner	Per fishing unit
No. of fishing man-days/year	187.2	187.2	374.4
No. of gear repair man-days/year	48.0	48.0	96.0
Total man-days/year	235.2	235.2	470.4
Daily income	28.53	21.92	50.45
Annual income	5,340	4,104	9,444
Less opportunity cost[1]	2,352	2,353	4,704
Pure profit	2,988	1,752	4,740

[1]Estimated at ₱10 per day.

Table 9. Annual pure profit for mini trawlers (in pesos), Castillo, San Miguel Bay, 1980-1981.

Pure profit of owners (capital)	2,821
Pure profit of labor	4,740
Pure profit per fishing unit	7,561

fishermen presently operating less profitable types. The possible reasons relate primarily to the fact that work on a mini trawler is much more arduous than on other gear types. The average fishing trip lasts longer than that of a gill-netter for example. Also, the daily operating capital requirements of mini trawlers are the highest among the municipal fishing gears, with the exception of the small trawlers which really belong in a different category (see Navaluna and Tulay, this report). Finally, the monthly income of owners and crew is highly variable from month to month unlike those of gill-netters which tend to be more stable. These factors produce a premium to those involved in owning and operating mini trawlers. In conclusion, it is recommended that these aspects of barriers to entry and pure profits in the mini-trawl fishery be examined in more detail to determine whether this fishery offers potential for absorbing capital and labor from those other fisheries in San Miguel Bay which are far less profitable.

References

Esporlas, A.E. 1982. The seasonality of fishing, marketing and processing, p. 14-24. *In* C. Bailey (ed.) Small-scale fisheries of San Miguel Bay, Philippines: social aspects of production and marketing. ICLARM Technical Reports 9, 57 p. Institute of Fisheries Development and Research, College of Fisheries, University of the Philippines in the Visayas, Quezon City, Philippines; International Center for Living Aquatic Resources Management, Manila, Philippines; and the United Nations University, Tokyo, Japan.

Vakily, J.M. 1982. Catch and effort in the trawl fishery, p. 65-94. *In* D. Pauly and A.N. Mines (eds.) Small-scale fisheries of San Miguel Bay, Philippines: biology and stock assessment. ICLARM Technical Reports 7, 124 p. Institute of Fisheries Development and Research, College of Fisheries, University of the Philippines in the Visayas, Quezon City, Philippines; International Center for Living Aquatic Resources Management, Manila, Philippines; and the United Nations University, Tokyo, Japan.

Costs and Returns of Small and Medium-Sized Trawlers

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Abstract

Small and medium-sized trawlers are among the more recent gear innovations in San Miguel Bay, Philippines. This paper examines the economics of these two types of trawlers. Investment and operating costs of each type are presented, and the various sharing systems are used to determine the income of owners and crewmen. These incomes are compared with their respective opportunity costs. Small trawler fishing units were found to be earning significant profits in excess of their opportunity costs. Medium-sized trawler fishing units were found to be earning less than their opportunity costs. Reasons for the difference between the economic performance of the two trawler types are discussed. Finally, the paper discusses means by which trawler owners attempt to increase their profits and minimize risks through crew selection and management, choice of landing site, and ownership of more than one fishing unit.

Introduction

Trawling operations have been going on in San Miguel Bay for a considerable time. In 1936, the Japanese beam trawl was introduced in the Bay, and was used until the Japanese occupation of the Philippines during World War II, when much fishing activity was curtailed (British Admiralty 1944).

After the war, the otter trawl was introduced; it slowly gained acceptance and eventually replaced the Japanese beam trawl. By the early 1950s, most trawl fishermen were using the otter trawl (Estanislao 1954). These large trawlers were of the same type as those operating outside the Bay at present. Sabang, in Calabanga was their landing site until the early 1970s. However, because of the problem of not being able to bring the trawlers near the shore due to shallow water and also the lack of protection during typhoons, their landing base was moved to Camaligan, 16 km up the Bicol River near Naga City.

Although some of the smaller trawlers continued to use the Sabang landing site, there was a lull in trawling activity in the community. It was about 1972 when the so-called "baby" trawlers that are now based in Sabang started to increase in number. "Baby" trawlers include the two categories of small and medium-sized trawlers (see Smith et al., this report). Small trawlers are those in the 2-3 GT range; medium-sized trawlers are generally in the 3-6 GT range.

The purpose of this study was to determine the costs and returns of small and medium-sized trawlers based on the sharing systems used by each and to examine returns to capital and labor. It also aimed to provide data on trawlers for comparison with data on other gears used in the Bay.

Methodology

The study was conducted from June 1980 to May 1981. Sabang, Calabanga, the port for the majority of small and medium trawlers, was the main data collection site. Eight small trawlers and three medium trawlers made up the Sabang sample. Two small trawlers, which had recently begun operations at Castillo, Cabusao, were also included.

The sources of data were trawler owners who were willing to cooperate in the record-keeping activity. These respondents were kind enough to lend their logbooks in which all the itemized expenses and the value of the catch were recorded. These logbooks were considered reliable because they were the same ones used in recording the sharing of income among owner and crew. The owners could not arbitrarily change the entries because the crewmen knew the amount of their expenses and their catch.

Initially, the operators were reluctant to show their financial records. This reaction was expected because they had to protect their business interests, considering that trawler operations deal with a lot of money compared to the catch value of non-trawl gears. The cooperation of owners was won by explaining the purpose of the study and assuring them that the data would be considered strictly confidential and that no individual would be identified as the source of data once the results of the study were published.

The sample of 13 trawlers represented 14% of the 95 small and medium trawlers operating in the Bay at the time of this study and made a total of 1,679 trips during the 12 months under study.

Description of the Gear and Its Operation

The otter trawl net used by both small and medium trawlers is conical in form, widest at the mouth and tapering to the cod-end, deriving its name from the characteristic use of otterboards. Two towing ropes of equal length are connected to the otterboards which are in turn tied to the wings of the net. The two otterboards, with the aid of strategically located floats and sinkers, keep the net wide open during fishing operations.

In operation, the net is set in the water first together with a pair of long towing ropes and then the otterboards (Fig. 1). The boat runs first at a very slow speed to allow the gear to take its correct shape before increasing to its normal dragging speed of about 2-2.5 knots. The net is dragged for 1-4 hours but 3 hours is the usual length of time, after which it is hauled manually. The whole operation is repeated through the course of each fishing trip. Four to six men crew the small and medium trawlers operating in San Miguel Bay.

In Sabang, two kinds of trawl nets are used: the *panghipon* or *pamasayan* (for shrimps) and the *pangisda* or *panghoya* (for fish). In Castillo, a third type, the *pamalao* (for small shrimps) is used. These nets differ in design and also in the species they catch because of their different mesh sizes. The *pangisda*, which is designed for fishes, has a high opening. On the other hand, the *panghipon* has a low but wide opening because shrimps are buried in the mud. These openings are determined by the length of the headrope, which is about 17.0 m in the *pangisda* and 8.2 m in the *panghipon*.

The *pangisda* and *panghipon* nets are modified German type and Norwegian type models, respectively. The *pangisda* net has cod-end mesh sizes (stretched) of 23-28 mm, as compared to 19-23 mm in the *panghipon*. However, the fishermen usually double the cod-end with a smaller-mesh net (8 mm) which they call a "screen" and which is intended to catch anchovies.

The *pamalao* of Castillo is used to catch sergestid shrimps (known locally as *balao*) or *alamang* (see Tulay and Smith, this report). The net has an 8-mm mesh.

The 75 small trawlers (79% of the total) are those below 3 GT which are not allowed to fish in waters shallower than 4 fm (7.3 m) (Fig. 2). The 20 medium trawlers (21% of the total) are those of 3 GT or more which must fish in waters beyond 7 fm (12.8 m) (Fig. 3).[1]

Average monthly catch of the trawlers remained roughly the same in both monsoon periods; 535 t/month during the southwest monsoon and 515 t/month during the northeast monsoon. Total catch of these 95 trawlers during the 12 months was 6,316 t, or 66.5 t per vessel. See Pauly and Mines (1982) for details of catch and catch composition.

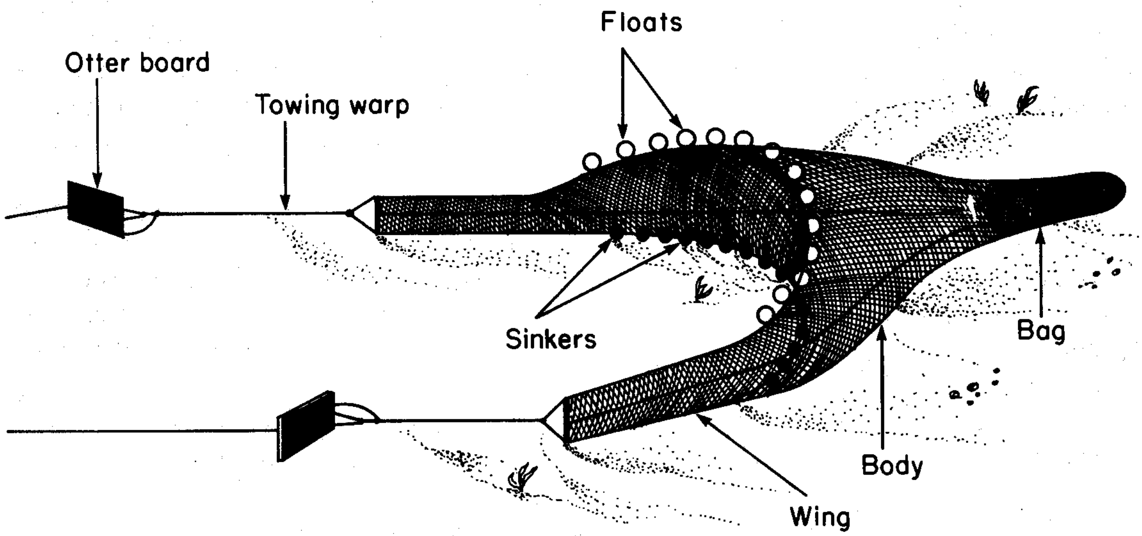

Fig. 1. 'Baby' trawl gear.

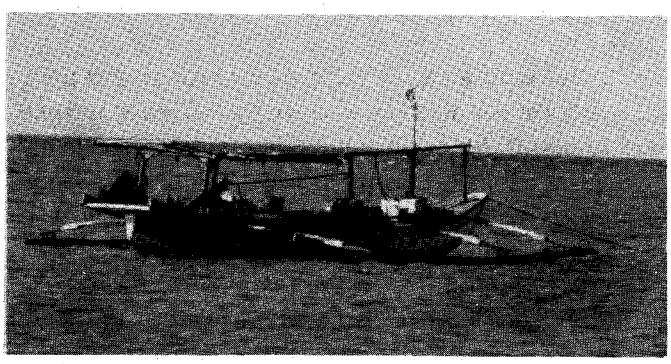

Fig. 2. A small trawler, San Miguel Bay, 1980.

Fig. 3. Medium-sized trawler under construction.

[1]Another class of trawler, the *mangquerna* or *itik-itik* used in catching sergestid shrimps or *balao,* was classified as mini trawler.

Costs and Returns

FISHING EFFORT

Trawlers in Sabang usually start in the morning, between 5 and 7 a.m., and return in the early afternoon of the next day. Their catch is sold on the same day from 2 to 4 p.m. Sometimes one fishing trip lasts for only one day, in which case the catch is sold the following morning between 5 and 6 a.m. However, 2-day trips are the most common.

When conditions are fine, there are usually three 2-day fishing trips per week; Sunday is always a rest day. There are times however, when, due to mechanical troubles of the boat, engine or gear, and when there are typhoons, the fishermen are idle for days or even weeks. In one year, the Sabang trawlers fished for an average of 250 fishing days representing 68% of the 365 days of the year or 80% of the 313 potential (365 minus 52 Sundays) fishing days per year (Table 1). An average of 11 trips (or 21 fishing days) were made by these trawlers per month. There was only slight variation throughout the year in the number of trips per month.

The weight of the catch per trip was not available because these data were not recorded in the owners' logbooks. Instead, the value of the catch was recorded, averaging ₱1,871 per trip or ₱948 per fishing day. The value of catch per trip ranged from ₱1,542 in August to ₱2,136 in May (Table 1).

Small trawlers in Castillo usually fish for one day and one night. When *pamalao* nets are used for small shrimps, fishing takes only a day because the fishermen usually do not take ice on the trip. In contrast to the active Sabang trawlers, the two from Castillo fished only 144 days during the year, representing only 46% of the 313 potential fishing days (Table 2). One reason was that one of the units operated in only nine months of the year due to major repairs and hull modification. Other reasons for non-operation were engine trouble, holidays, rough weather conditions and expectation of poor catch.

INVESTMENT COSTS

Complete investment cost data were obtained from four Sabang-based trawlers. The average acquisition cost of three small trawlers and one medium trawler in Sabang was ₱35,125 (Table 3). This amount included the cost of the boat, engine, nets, rattan fish baskets locally called *tiklis*, galvanized tubs and styrofoam containers. All four units were acquired through owner finance. Each of the three small trawlers was 10.8 m x 1.1 m (approximately 2.75 GT). The medium trawler measured 17 m x 1.5 m (5.4 GT). The three small trawlers were acquired in 1970, 1976 and 1980 and the medium trawler in 1978, an average age of five years.

The acquisition costs of the other seven trawlers in the Sabang sample were not obtained. However, because they were of comparable size, their acquisition costs would be approximately the same depending upon the year of their acquisition. Replacement costs for these Sabang trawlers have increased substantially. In 1981, a new trawl fishing unit would have cost ₱60,775 or almost 75% more than the average acquisition cost. A medium trawler would cost approximately ₱15,000 more than a small trawler. Acquiring a new boat is becoming difficult because of the rising cost of all materials needed. In an attempt to reduce costs, owners now consider buying reconditioned truck engines rather than marine engines. The cost of lumber has also increased in recent years to the point that owners are sometimes alleged to buy illegal logs coming from the Bicol National Park which are smuggled across the Bay.

Because they were purchased second-hand, the acquisition costs of the two Castillo small trawlers averaged only ₱15,840 (Table 4). One of these trawlers used a 75-hp Fuzo engine while the other used a 240-hp Isuzu engine, both second-hand. The former was bought through loans and the latter through owner finance.

OPERATING COSTS

The operating expenses incurred in trawling operations included diesel fuel, oil, repairs and parts, ice and food. Miscellaneous expenses, such as those for salt, fee for the guard, cigarettes, and

Table 1. Monthly average effort, operating costs and returns (in pesos) for small and medium trawlers, Sabang, San Miguel Bay, June 1980-May 1981.

				1980						1981			Annual	Monthly
	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	total	av.
No. of days in the month (year)	30	31	31	30	31	30	31	31	28	31	31	31	365	30.4
No. of fishing days	22	24	24	22	20	18	20	18	22	20	21	19	250	20.8
No. of non-fishing days	8	7	7	8	11	12	11	13	6	11	9	12	115	9.6
No. of fishing trips	12	13	13	11	10	9	10	9	11	10	10	10	128	10.7
Av. no. of partners per trip	6	5	5	5	5	5	5	5	5	5	5	5	–	5
Total catch value/trip	1,846	1,792	1,542	1,698	2,052	1,848	1,847	1,913	1,962	1,872	1,941	2,136	–	1,871
Total catch value/fishing day	953	970	803	866	1,026	924	924	956	981	936	970	1,073	–	948
Total catch value	21,226	23,290	19,531	19,432	20,526	16,221	18,011	17,215	21,580	18,716	20,380	20,293	236,424	19,702
Operating expenses (variable costs)														
fuel	8,667	9,425	7,783	7,771	8,270	6,644	7,699	6,559	8,498	8,434	9,425	7,528	96,708	8,059
oil	105	97	0	35	70	16	27	63	74	23	28	0	540	45
repair/parts	1,019	1,416	1,549	643	662	603	733	570	856	208	746	1,878	10,884	907
ice	826	954	858	910	861	644	741	644	895	987	923	980	10,224	852
food	1,170	1,343	1,165	1,100	1,024	977	1,174	951	1,192	1,314	1,180	1,079	13,668	1,139
miscellaneous	175	954	40	144	172	126	174	100	108	58	126	91	1,440	120
total	11,962	13,365	11,395	10,603	11,059	9,010	10,548	8,887	11,623	11,024	12,428	11,556	133,464	11,122
Broker (5% total catch value)[1]	1,061	1,165	977	972	1,026	811	901	861	1,079	936	1,019	1,015	11,820	985
Engine maintenance (10% total catch value)	2,123	2,329	1,953	1,943	2,053	1,622	1,801	1,722	2,158	1,872	2,038	2,029	23,640	1,970
Monthly net revenue	6,080	6,431	5,206	5,914	6,388	4,778	4,761	5,745	6,720	4,884	4,895	5,693	67,500	5,625
Owner's net share[1]	2,695	2,890	2,343	2,661	2,874	2,150	2,142	2,585	3,024	2,198	2,203	2,562	30,324	2,527
Crew's total share														
pilot *(maestro)*	814	827	674	771	835	634	640	771	898	660	661	769	8,952	746
machinist	672	695	571	663	708	539	546	657	763	562	562	654	7,596	633
(individual ordinary crewman[2])	(543)	(586)	(486)	(546)	(591)	(452)	(459)	(570)	(662)	(489)	(490)	(570)	(6,444)	(537)
all ordinary crewmen[2]	1,899	2,019	1,618	1,819	1,971	1,455	1,433	1,732	2,035	1,464	1,469	1,708	20,616	1,718
total crew share	3,385	3,541	2,863	3,253	3,514	2,628	2,619	3,160	3,696	2,686	2,692	3,131	37,164	3,097

[1]The owner's total share equals his share as an owner plus the broker's fee because the owner (or his family) serves as the broker.
[2]The number of ordinary crewmen varied from 3 to 4 per boat.

Table 2. Monthly average effort, operating costs and returns (in pesos) for small trawlers, Castillo, San Miguel Bay, June 1980-May 1981.

				1980						1981			Annual	Monthly
	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	total	av.
No. of days in the month (year)	30	31	31	30	31	30	31	31	28	31	31	31	365	30.4
No. of actual fishing days	18	8	18	16	7	16	13	8	17	9	12	18	160	13.3
No. of non-fishing days	12	23	13	14	24	14	18	23	11	22	18	13	205	17.1
No. of fishing trips	12	5	11	10	7	15	12	8	17	9	12	15	133	11.1
Av. no. of partners per trip	4	4	4	4	4	4	4	4	4	4	4	4	–	4
Total catch value	7,094	4,229	8,472	6,696	2,562	7,277	5,392	3,841	11,189	3,590	3,210	9,028	72,580	6,048
Total expenses (variable costs)														
fuel	3,567	1,486	3,991	3,151	975	2,806	2,239	1,278	2,990	1,176	1,387	2,681	27,727	2,310
oil	520	143	238	195	61	83	118	54	190	147	42	210	2,001	167
repair/parts	1,498	–	–	–	38	–	–	–	–	–	–	–	1,536	128
ice	274	196	250	248	94	114	65	36	69	15	–	121	1,482	124
food	241	187	352	247	171	414	348	218	484	282	361	630	3,935	328
miscellaneous	269	162	368	381	219	404	387	83	225	108	163	327	3,096	258
total	6,369	2,174	5,199	4,222	1,558	3,821	3,157	1,669	3,958	1,728	1,953	3,969	39,777	3,315
Engine maintenance (reserved)	709	423	847	670	256	728	539	384	1,119	359	321	903	7,258	605
Engine maintenance (used)	551	3,019	1,359	85	14	158	23	5	60	–	59	30	5,363	447
Difference*	158	–2,596	–512	585	242	570	516	379	1,059	359	262	873	1,895	158
Monthly net revenue	16	1,632	2,426	1,804	748	2,728	1,696	1,788	6,112	1,504	936	4,156	25,546	2,128
Owner's net share	165	–1,902	519	1,352	560	1,729	1,237	1,139	3,657	998	660	2,639	12,753	1,062
Crew's total share														
pilot *(maestro)*	–63	369	528	379	159	608	366	407	1,400	340	178	951	5,622	469
partner #1	–64	247	346	244	103	403	239	273	942	228	108	639	3,708	309
partner #2	–64	247	346	244	103	403	239	273	942	228	108	639	3,708	309
hired fisherman	200	75	175	170	65	155	131	75	230	68	144	161	1,649	137
total	9	938	1,395	1,037	430	1,569	975	1,028	3,514	864	538	2,390	14,687	1,224

*The difference between the amount reserved for engine maintenance and the amount used is added to the owner's share after the pilot's share has been deducted, the amount of which becomes the owner's net share. Positive sign of the difference indicates that not all of the reserved amount for engine maintenance was used, thus increasing the owner's share. Negative sign means that more was spent for engine maintenance than the amount reserved for it, resulting in a decreased income of the owner.

Table 3. Average investment costs in pesos of four small and medium trawlers in Sabang, San Miguel Bay.

Item	Average number owned	Average acquisition cost/item[1]	Replacement cost/item	Average expected life (years)	Annual depreciation[1] per item
Trawler	1	18,000	39,750	13	3,058
Engine	1	8,600	11,000	5	2,200
Nets (including 1 set of otterboards)	4	1,625	2,000	1	2,000
Rattan baskets *(tiklis)*	35	9	9	.08	108
Galvanized tubs	3	70	70	.25	280
Styrofoam boxes	18.75	80	80	.25	320
Average acquisition cost per trawl fishing unit[2]	₱35,125	Average replacement cost per trawl fishing unit[3]	₱60,775	Average annual depreciation per fishing unit[4]	₱23,878

[1]Based upon 1981 replacement cost.
[2]Equals Σ (average acquisition cost per item x average number owned).
[3]Equals Σ (replacement cost per item x average number owned).
[4]Equals Σ (annual depreciation per item x average number owned).

Table 4. Summary of acquisition costs, replacement costs and annual depreciation in pesos for small and medium trawlers in Sabang and Castillo, San Miguel Bay.

	Average acquisition cost per fishing unit	Average replacement cost per fishing unit	Average annual depreciation per fishing unit
Small trawler (Sabang)	28,400	57,610	21,650
Small trawler (Castillo)	15,840	54,455	9,765[1]
Medium trawler (Sabang)	55,270	70,270	30,575

[1]The main reason Castillo small trawlers have a much lower annual depreciation rate than the Sabang small trawlers is because they operate less frequently. Consequently, many items, especially nets, containers and the engine last longer, thus reducing the annual depreciation.

matches were also considered to be operating expenses. All these operating costs were deducted from the total value of the catch before sharing.

Of the ₱1,054 average expenses per trip of the Sabang-based trawlers (Table 5), fuel was by far the major cost (73% of the total). With an average diesel consumption of 239 liters per trip, at ₱3.20/l, trawlers spent ₱765 per trip on fuel alone. Consequently, they are adversely affected when there is an increase in the price of fuel. During the one-year duration of this study, the price of fuel rose twice, once in August 1980 and the second time in March 1981. In less than a year, diesel price increased from ₱2.50/l to ₱3.20/l, or by 28%. Interestingly, as shown in Table 5, fuel expenses per trip increased only slightly during the year, implying that trawlers cut back on their fuel consumption as price increased.

The second major operating expense was the cost of food for the crew (₱108 per trip) which was paid for by the owner, but deducted as an operating expense before sharing. Part of the catch was also consumed while at sea.

Ice was another important item in the trawling operation, accounting for 8% of the total operating expenses. Its importance lies in the fact that the catch is perishable and its value depends greatly on freshness.

The only other major item was cost of repairs and parts, which included maintenance and materials used for the nets and the boat (but excluding the engine) and also the labor used to repair

Table 5. Average operating expenses (variable costs) in pesos per trip of small and medium trawlers, Sabang, San Miguel Bay, 1980-1981.

	1980 June	July	Aug	Sept	Oct	Nov	Dec	1981 Jan	Feb	Mar	Apr	May	Ave./ trip	Per- centage
Fuel	754	725	615	679	827	757	790	729	772	844	898	792	765	72.6
Oil	9	8	0	3	7	2	3	7	7	2	2	0	4	0.4
Repair/parts	88	109	123	56	66	69	75	63	78	21	71	197	85	8.1
Ice	71	73	67	80	86	73	76	71	82	98	89	104	81	7.7
Food	102	103	92	96	102	111	120	106	108	132	112	113	108	10.2
Miscellaneous	16	10	3	12	17	14	18	11	10	5	12	10	11	1.0
Total	1,040	1,028	900	926	1,105	1,026	1,082	987	1,057	1,102	1,184	1,216	1,054	100.0

them. These expenses averaged 8% of the operating expenses or about ₱85 per trip. These expenses were not incurred every trip. Nevertheless, an additional sum (10% of the total value of the catch) was reserved for engine maintenance and thus deducted before sharing.

Castillo-based trawlers had much lower operating expenses per trip (₱3,315/month for 11.1 trips or approximately ₱300 per trip), although the distribution of expenses was similar to that of Sabang trawlers.

Sharing Systems

Sharing of income from small and medium trawlers was usually done every one or two weeks depending on the preference or need of the crew and the owner and the accumulated value of catch.

Though the general framework of the sharing system was similar for all small and medium trawlers, there were some differences. The sharing systems illustrated in Figs. 4 and 5 were used by 10 out of 11 small and medium trawlers in the Sabang sample. The shares for the broker and for engine maintenance were deducted before the other expenses were deducted; these shares bore less risk than those of the owner and the crew. The share of the engine maintenance was reserved for keeping the engine in good condition which included spare parts and labor or buying a new one. The owner kept this 10% share regardless of the amount actually spent for these purposes. During 1980-1981, for the average trawler in Sabang, the total engine maintenance reserve was ₱23,640. Since a new engine could be purchased for ₱11-14,000, it would seem highly unlikely that annual maintenance costs would have used up all this reserve fund. It appears, therefore, that owners could add significantly to their income when the reserve was not used. Data were not available on the amount of the reserve used, so for purposes of this analysis the owners' income was not adjusted upwards. It is important to note, however, that owners' incomes are likely to be higher than those reported here.

The broker's fee (5%) is the compensation for selling the catch through secret whisper-bidding called *bulungan*. More often than not, the owner or a member of his family served as the broker so this share was added income to the boat owner.

After the shares for the broker and engine maintenance and the operating expenses were deducted, the net revenue was divided equally between the owner and the crew. Ten percent of the owner's share (or 5% of the net revenue), was given to the pilot as incentive for being the leader of the crew. This additional amount was shared by the pilot with the machinist at his discretion and usually amounted to about one-third of the pilot's incentive share or 1.5% of the net revenue.

The members of the crew, of whom there were usually five on the small trawlers including the pilot and machinist, divided their 50% share equally among themselves. Each ordinary crewman

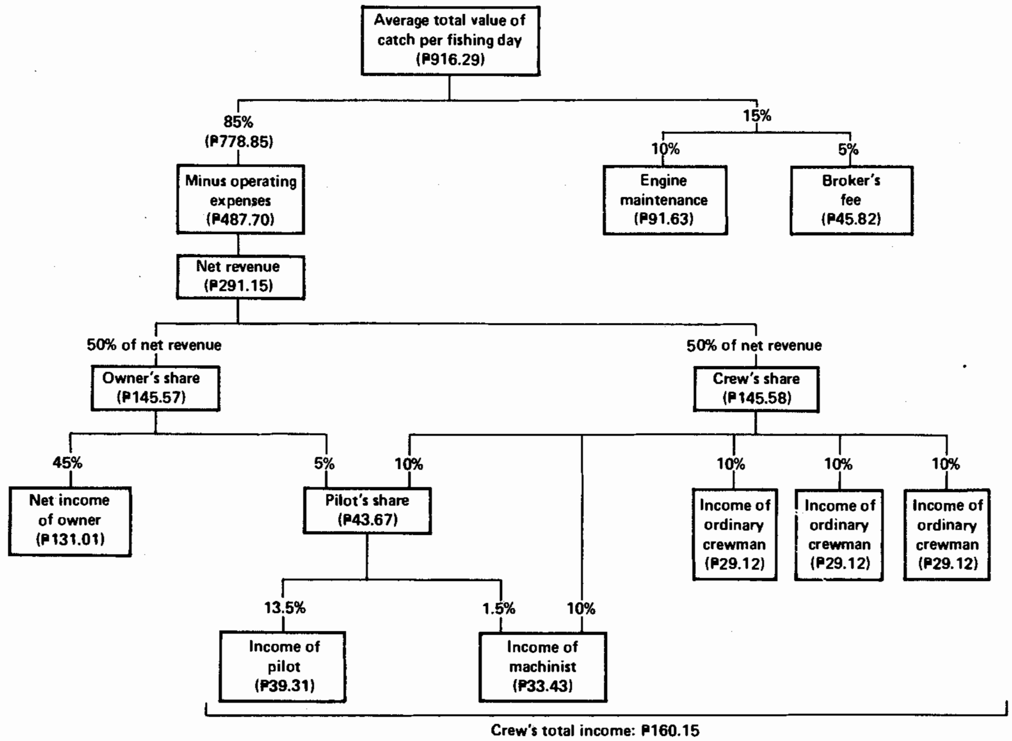

Fig. 4. Sharing system of small trawlers (n = 8) in Sabang, San Miguel Bay (daily averages, June 1980-May 1981).

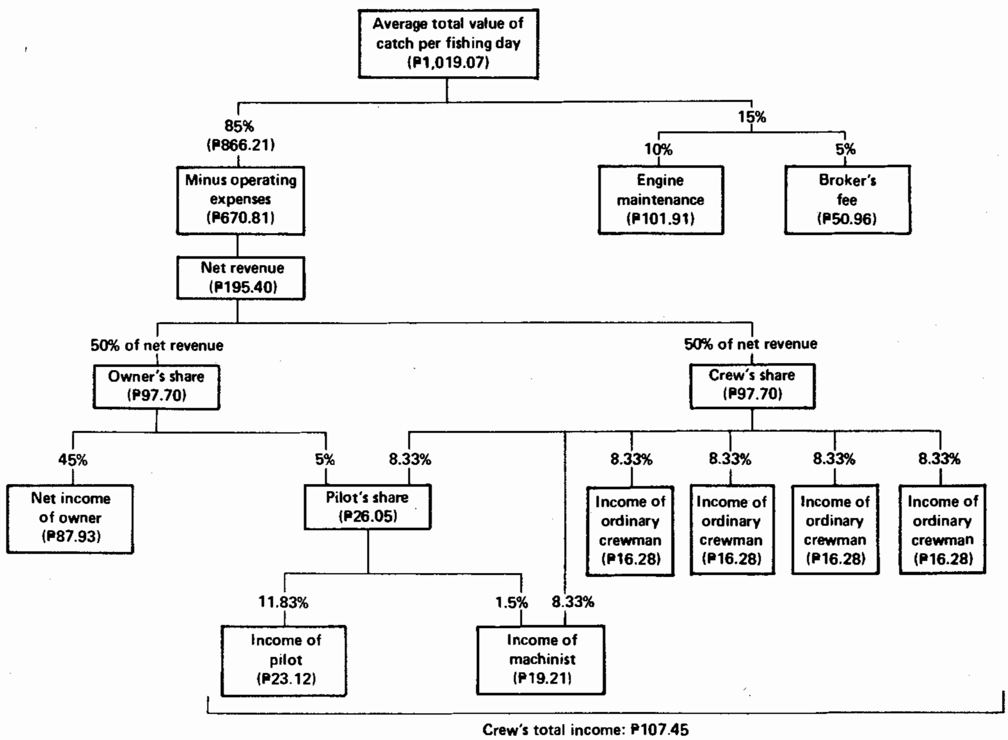

Fig. 5. Sharing system of medium trawlers (n = 3) in Sabang, San Miguel Bay (daily averages, June 1980-May 1981).

received 10% of the net revenue, while the machinist and the pilot earned 11.5% and 13.5%, respectively. The percentage share of each fisherman was less when there were six crew as in medium trawlers.

The total share of the owner was 45% of the net revenue plus the brokerage fee if he acted as broker. The amount set aside for engine maintenance also went to the owner for his use when needed.

One of the medium trawlers in the Sabang sample used a different sharing system in which the pilot received added income from the share of the crew. Instead of dividing the 50% crew's share equally by the number of crewmen (6), it was divided by 6.25. Each crewman received one share or 8% of the net revenue (as distinct from 8.33% shown in Fig. 5), while the pilot received 1.25 shares or 10%. Added to the 5% the pilot received from the owner, he received a total of 15%.

A second difference in this sharing arrangement was that the owner, instead of the pilot, provided the additional fee for the machinist. The amount shared to the machinist was at the discretion of the owner but was approximately 3% of the net income. So, the total share of the machinist was 11%. The owner thus received a smaller share, 42% of the net income as compared to 45% in the more common arrangement. The purpose of this sharing arrangement was to provide added incentive to the pilot and machinist in the hope that the net revenue of the boat would increase. Even though the percentage shares of the owner and ordinary fishermen were lower, a higher net revenue could produce higher incomes. The data showed that this trawler did not produce higher profits for the owner or higher incomes for the crew.

As can be seen, daily incomes of the small-trawler owners and crew were considerably higher than the incomes earned by those operating medium trawlers. This was primarily due to the higher operating costs of the latter.

There are two major distinctions between the sharing arrangement of the two trawlers in Castillo (Fig. 6). First, because the pilot also served as the broker, he received a broker's fee from the owner. Owners provided a total of 15% of their share (7.5% of the net revenue) to the pilot. Second, as part of the ordinary crew complement the crew hired a non-sharing crewman who was paid a daily wage of ₱10 per trip, (or ₱20 for 2 trips if both day and night fishing trips were made) regardless of the catch. The normal complement of Castillo small trawlers including the pilot and hired fisherman was four and the hired crewman was paid out of the crew's 50% share of the net revenue. While this arrangement increased the percentage share of the regular crewmen from 12.5% to 16.67%, it also increased their risk. In fact, on several occasions when catch was particularly poor, it was observed that after the regular crewmen paid the hired fisherman his daily wage, there was no income left for themselves. However, over the full year, they earned more using this system than if the hired fisherman had been a regular member of the crew earning a full crewman's share (Fig. 6).

Table 6 summarizes the monthly income earned by owners, pilots, machinists, ordinary crewmen and hired crewmen under these various sharing arrangements. To make these calculations, it was assumed that the eight small trawlers (Fig. 4) and three medium trawlers (Fig. 5) in the Sabang sample represented the total 58 small and 15 medium trawlers of Sabang and that the two small trawlers in Castillo (Fig. 6) represented only themselves. The income figures of each group were therefore weighted accordingly to show the monthly incomes for all small and medium trawlers in San Miguel Bay. Note that the net income figure for owners was not the same as owner's profit because depreciation and other fixed costs must still be deducted, nor have the broker's fee or engine maintenance reserve been taken into account (see next section).

Returns to Capital and Labor

Because all owners of small and medium trawlers were non-fishing owners, their income, after deductions of their costs, was treated as return to capital. The income of crewmen was treated as return to labor. Any excess over and above the opportunity costs of capital and labor thus represented pure profit in the trawl fishery of San Miguel Bay.

Table 6. Summary of monthly incomes of Castillo and Sabang trawler owners and crew in pesos after sharing (June 1980-May 1981).

	Sabang small trawlers	Castillo small trawlers	Sabang medium trawlers	All small and medium trawlers[1]
Owners[2]	2,725	905	1,829	2,497
Pilots	817	469[3]	481	741
Machinists	696	n/a	400	635
Ordinary crewmen	606	309	339	545
Hired crewmen	n/a	137	n/a	137

[1]Weighted averages (see text).
[2]All owners are non-fishing owners. This income figure does not include the broker's fee (Sabang trawlers only) nor the reserve for engine maintenance. Depreciation and other fixed costs have not yet been deducted.
[3]Includes income for serving as broker.

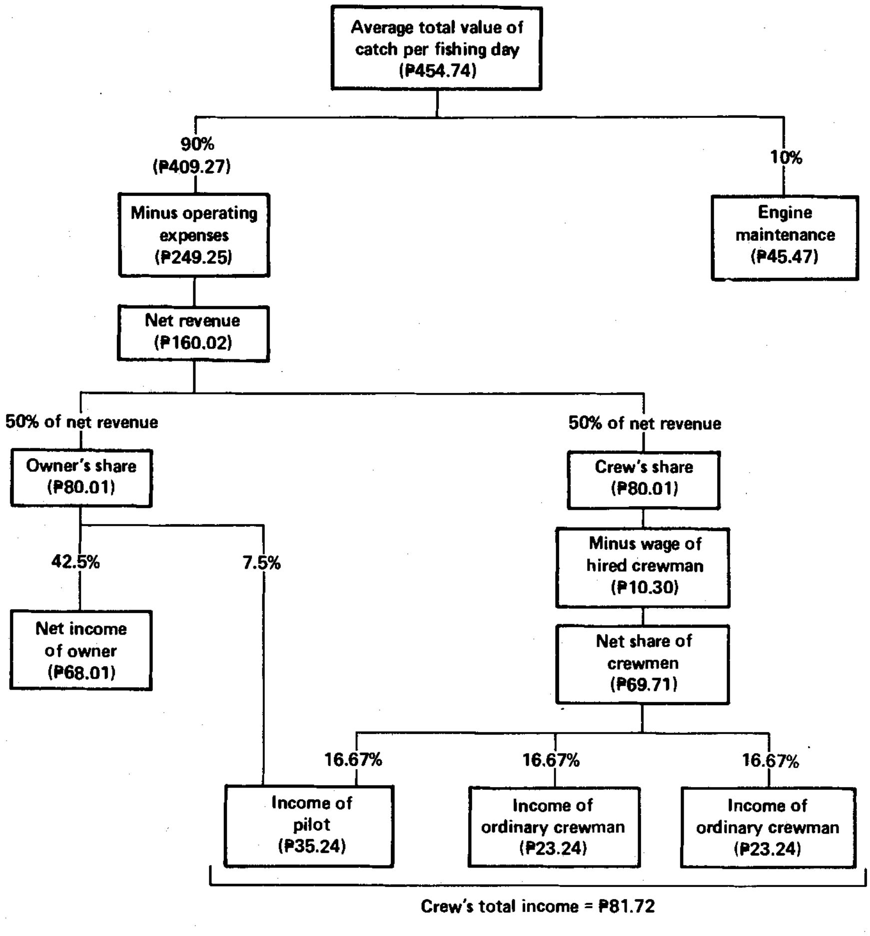

Fig. 6. Sharing system of small trawlers (n = 2) in Castillo, San Miguel Bay (daily averages, June 1980-May 1981).

RETURNS TO CAPITAL

Trawler owners derived income from three sources: their share of the net revenue, the broker's fee and the engine maintenance reserve (Table 7). For all small and medium trawlers this total income averaged almost ₱65,000 for the year June 1980-May 1981.

The major fixed cost was depreciation, and on the assumption that owners must set aside an amount from their earnings to replace their trawling units, this was based on current replacement

Table 7. Average annual returns in pesos to owners of small and medium trawlers, Castillo and Sabang, San Miguel Bay (June 1980-May 1981).

	Sabang small trawlers	Castillo small trawlers	Sabang medium trawlers	All small and medium trawlers[1]
Annual net income of owners				
from share of net revenue	32,700	10,860	21,948	29,964
from broker's fee	11,437	n/a	12,720	11,700
from engine maintenance reserve	22,870	7,257	25,437	22,967
Total income	67,007	18,117	60,105	64,631
Annual costs				
Fixed costs				
Coast Guard license	15	15	60	24
municipal license	105	105	86	101
other fees	50	50	94	59
depreciation[2]	21,650	9,765	30,575	23,147
Total fixed costs	21,820	9,935	30,815	23,331
Variable costs				
engine maintenance[3]	22,870	5,364	25,437	22,917
bonus	600	–	600	584
taxes	900	900	1,500	1,020
Total variable costs	24,370	6,264	27,537	24,521
Total fixed and variable costs	46,190	16,199	58,352	47,852
Residual return to owners' capital, labor and management	20,817	1,918	1,753	16,779
Less opportunity costs				
of investment capital[4]	2,556	1,426	4,974	3,009
of own labor[5]	5,136	2,080	5,136	5,055
of family labor[6]	750	n/a	750	730
Total opportunity costs	8,442	3,506	10,860	8,794
Owners' pure profit (loss)	12,375	(1,588)	(9,107)	7,985

[1]Weighted average (see text at end of sharing systems section).
[2]From Table 4. Based on replacement cost.
[3]See text for derivation.
[4]Nine percent of average acquisition cost.
[5]For Sabang trawlers based on one day own labor per trip at ₱40/day (this includes activity as broker); for Castillo trawlers based on one day per week at ₱35/day.
[6]For Sabang trawlers only, based on 1/3 day family labor per trip at ₱17.50/day.

costs, not the lower acquisition costs. If based on acquisition costs, current owners would not be putting aside sufficient reserve funds to replace their vessels and gear.

The major variable cost assumed by the owner was engine maintenance. As mentioned earlier, there was no concrete evidence to indicate whether the full amount of the engine maintenance reserve was used for this purpose. Expenses data were obtained only for the two small trawlers in Castillo. Here, actual expenses were approximately 75% of the amount reserved. Sabang trawler crewmen were asked if they were happy or unhappy with the withholding of 10% of the total value of the catch for engine maintenance reserve; their responses were inconclusive. Consequently, it was assumed that on the average the full amount of the reserve was used for engine maintenance. The only other variable costs for Sabang trawler owners were small bonuses given to crewmen when the catch was especially good, and nominal taxes paid on the catch.

After deducting these fixed and variable costs, a substantial residual income remained for the owners of small trawlers in Sabang. Small trawlers in Castillo and medium trawlers in Sabang returned only small amounts to their owners' capital, labor and management.

To determine whether or not an investment in a small or medium trawler was more profitable than alternative investment opportunities, this residual return to owners' capital, labor and management was compared to the opportunity costs of owner's capital and labor. The opportunity cost of capital was based upon the amount of interest (9% per annum) that the trawler operator would have earned had he put the amount he invested in the trawler unit (the average acquisition cost) into a savings account with the local rural bank. An investor considering an investment in a small or medium trawler should base his opportunity cost of capital upon the interest foregone on the current replacement cost. For small trawlers especially, the opportunity cost of capital would be double the amount shown in Table 7 because 1980-1981 replacement costs were twice as high as the average acquisition cost in the sample (see Table 4). Since the opportunity cost of capital for medium trawlers exceeded the residual return to owners even before taking the owner's own and family labor into account, it is readily apparent that an investment in a medium trawler would not be wise.

However, after deducting the opportunity cost of owners' own and family labor for the small trawlers of Sabang, a substantial pure profit of over ₱12,000 remained, indicating that these trawler units were highly profitable. The opportunity costs of owners' labor were based upon the observation that owners spent one full day of labor per trip of their trawler, serving as broker and undertaking other tasks related to the operation of the unit.

The two small trawlers of Castillo came close to covering all their costs, and since both were being remodeled for continued fishing, their owners believed that they would be potentially profitable in the future. The owners of medium trawlers in Sabang, however, were generally not planning to replace their vessels, and the survey results give adequate reasons. In contrast and consistent with our results, more small trawlers were currently being built in Sabang.

RETURNS TO LABOR

The contribution made by labor to pure profits of the trawlers was determined by comparing the income of the crew to the opportunity costs of labor (Table 8). Crew income was determined by the sharing system; the annual income figures shown for pilots, machinists and ordinary crewmen were based on the number of fishing days per year times the daily income of each. As with crewmen on other gears, trawler crewmen also spent some of their non-fishing days repairing and maintaining the fishing unit. There was no difference between small and medium trawlers in Sabang, but crewmen of Castillo trawlers provided a greater number of gear repair days as a proportion of fishing days, possibly because the Castillo trawlers had both been purchased second-hand by their current owners.

Labor opportunity costs were higher in Sabang than they were in Castillo. An ordinary crewman could earn ₱10/day in Castillo as a carpenter or working with a processor; the same jobs and others, such as tricycle driving, paid ₱15 daily in Sabang. Therefore, the daily opportunity wage of ordinary crewmen was estimated to be ₱10 in Castillo and ₱15 in Sabang. The opportunity wage of boat pilots and machinists in Sabang was estimated to be ₱20/day. The higher labor costs in Sabang were a direct result of the presence of trawlers and the alternative opportunities they provided. Owners of gill-netters in the vicinity were forced to give 60% of the value of their catch to their crew (as distinct from 50%) to attract crewmen (Villafuerte and Bailey 1982). Deducting the annual equivalents of these daily opportunity costs from the incomes earned by crewmen left their pure profit (or loss), and when summated, gave the pure profit (loss) to labor per fishing unit.

Table 8. Average annual returns in pesos to labor of small and medium trawlers, Castillo and Sabang, San Miguel Bay (June 1980-May 1981).

	Sabang small trawlers	Castillo small trawlers	Sabang medium trawlers	All small and medium trawlers[1]
Labor requirements				
No. of fishing days/year	250	160	250	248
No. of gear repair days/year[2]	41	44	41	41
Total days/year	291	204	291	289
Boat pilots				
Daily income	39.31	35.24	23.12	35.96
Annual income[3]	9,828	5,638	5,780	8,907
Opportunity cost[4]	5,820	3,060	5,820	5,746
Pure profit (loss)	4,008	2,578	(40)	3,161
Machinists				
Daily income	33.48	n/a	19.21	30.55
Annual income[3]	8,370		4,803	7,637
Opportunity cost[4]	5,820		5,820	5,820
Pure profit (loss)	2,550		(1,017)	1,817
Ordinary crewman				
Daily income	29.12	23.24	16.28	26.40
Annual income[3]	7,280	3,718	4,070	6,543
Opportunity cost[4]	4,365	2,040	4,365	4,303
Pure profit (loss) per crewman	2,915	1,678	(295)	2,240
No. of ordinary crewmen	3	2	4	3.17
Pure profit (loss) to labor per fishing unit	15,303	5,934	(2,237)	11,545

[1]Weighted average (see text under sharing systems section).
[2]Estimated to be one day per three trips.
[3]Equals daily income times number of fishing days/year.
[4]Equals daily opportunity cost (see text) times total days/year.

The calculated profits (and losses) were consistent with those for capital. Crew of small trawlers in Sabang earned significant pure profits; crew of medium trawlers earned less than their opportunity wages.

RETURNS TO THE FISHING UNIT

Summation of the pure profits and losses for both capital and labor showed that small trawlers earned considerably more than their costs and medium trawlers less than their costs (Table 9).

Although medium trawlers yielded higher value of catch per trip than small trawlers (Table 10), they had higher operating costs, primarily due to their fuel requirements. Medium trawlers spent an average of ₱1,004 on fuel per trip (77% of the total expenses) as compared with ₱702 (72%) for small trawlers.

From all indications, small trawlers are potentially more profitable than medium trawlers in San Miguel Bay. In addition to the different fuel costs, the taxes, fees, depreciation and the opportunity cost of the investment capital (in absolute terms) of medium trawlers are higher than for small trawlers. These costs contribute to the decrease of the owners' profit, but as long as their variable costs and opportunity costs of labor are covered, they may continue fishing.

Table 9. Average annual returns in pesos to capital and labor of small and medium trawlers, Castillo and Sabang, San Miguel Bay (June 1980-May 1981).

	Sabang small trawlers	Castillo small trawlers	Sabang medium trawlers	All small and medium trawlers[1]
Owners' pure profit (loss)	12,375	(1,588)	(9,107)	7,985
Labor's pure profit (loss)	15,303	5,934	(2,237)	11,545
Pure profit (loss) of fishing unit	27,678	4,346	(11,344)	19,530

[1]Weighted average (see text under sharing systems section).

Owners' Strategies to Increase Profits

Profitability is highly dependent upon management decisions of the owners. For example, owners usually put much effort into hiring a reliable and skilled crew, especially the pilot or *maestro.* Owners always knew the good pilots and sought to attract them. Piracy of crew members, especially of pilots, was rampant in Sabang because there were few good ones. Once an owner secured a good pilot, he usually gave incentives to the pilot over and above the formal share and extended help to the pilot's family. The owner also helped the other crew to a lesser extent.

There were several other methods by which owners tried to maximize their profits. The role of owners as their own brokers deserves special mention. In addition to the owner's share, they also received the 5% broker's fee. By acting as their own broker, they would try to get the highest possible price for the fish. Owners believe this is not always possible when another individual functions as the broker.

The broker's responsibility is to sell the fish by secret bidding, collect the money and give it to the owner at the earliest possible time. If the successful bidder cannot pay immediately as is often the case with fish processors, the broker may even use his own money to pay the owner in advance; frequently the bidder may take weeks to pay. Owners and brokers thus need substantial capital and brokers bear considerable risks of 'bad debts'.

Owners of medium trawlers had the option of selling their catch at Mercedes, on the northwest side of the Bay. Small trawlers usually did not risk going to Mercedes because of the rough waters they had to pass through to get there.

A disadvantage of selling the catch in Mercedes was that it was necessary to hire a broker there who would deduct 5-7% commission from the total value of catch. Furthermore, taxes commensurate with the value of the catch were paid and there were also fees for the porters. The cost of additional fuel to get to Mercedes was another consideration. Owners who wished to sell their catch in Mercedes usually had means of obtaining information on the prevailing prices there, on the basis of which they would decide if it would be more profitable to take the catch to Mercedes and when would be the right time to do so.

One way of obtaining greater value for the catch in Sabang was in proper timing for landing the catch. Trawler owners usually ordered their *maestro* to land the catch between 2 and 4 p.m. when the number of potential bidders was the greatest. If a boat missed this landing time, the owner would be forced to wait until the next morning to sell his catch, thus incurring additional expenses and possible deterioration in the quality of his catch.

Finally, one of the most important strategies that owners of trawlers adopted to maximize their profits and minimize their risks was to own more than one trawler. Of the 95 trawlers operating in the Bay, 24 were owned by one family and several other families owned smaller fleets. Although the small trawlers on average were highly profitable, the survey data showed a wide range of profitability of individual vessels. While the operating costs per trip showed little variation among vessels (Table 10), the considerable variation in value of catch per trip among vessels indicated the importance of spreading the risk through multiple ownership.

Table 10. Value of catch and operating costs in pesos per trip for small and medium trawlers, Sabang, San Miguel Bay (1980-1981).

	Small trawlers (n = 8) A	B	C	D	E	F	G	H	Average small trawler[1]	Medium trawlers (n = 3) I	J	K	Average medium trawler[1]	Average of all trawlers
Total catch value per trip	1,855	1,738	1,947	2,157	2,096	1,751	1,341	1,599	1,798	1,911	1,917	2,092	1,981	1,871
Av. operating costs per trip	%	%	%	%	%	%	%	%	%	%	%	%	%	
fuel	695 74.3	683 70.3	695 70.6	758 74.5	913 72.9	666 70.0	596 71.6	610 76.0	702 72.5	1,009 76.0	1,046 79.7	958 74.8	1,004 76.8	
oil	5 0.5	6 .6	8 .8	3 0.3	13 1.0	2 .2	2 .2	1 0.1	5 0.5	17 1.3	27 2.1	1 0.1	15 1.2	
repair/parts	44 4.7	105 10.8	88 9.0	52 5.1	99 10.4	99 10.4	73 8.8	48 6.0	76 7.9	83 6.3	6 0.4	93 7.3	61 4.7	
ice	80 8.6	56 5.8	70 7.11	88 8.7	92 7.3	79 8.3	66 8.0	51 6.3	73 7.6	92 6.9	81 6.2	93 7.3	89 6.8	
food	99 10.6	103 10.6	104 10.6	104 10.2	120 9.6	102 10.7	85 10.2	86 10.7	100 10.3	110 8.3	118 9.0	125 9.7	118 9.0	
others	12 1.3	19 1.9	19 1.9	12 1.2	16 1.3	4 .4	10 1.2	7 .9	12 1.2	16 1.2	34 2.6	10 0.8	20 1.5	
Total	935	972	984	1,017	1,253	952	832	803	968	1,327	1,312	1,280	1,307	1,039
Av. no. of trips/month	11	10	10	12	8	11	12	11	10.6	8	12	12	10.7	10.7

[1]Weighted by number of trips.

The factors discussed above—the importance of selecting the right pilot and crew, landing place and spreading the risks among more than a single boat—are important elements of success for the owners of these trawlers in San Miguel Bay.

References

British Admiralty. 1944. Native craft and the fisheries of the Philippine Islands. B.R. 1050C (1). (U.K.) Naval Intelligence Division, British Admiralty, London.

Estanislao, M.L. 1954. Otter trawl fishing in Camarines Sur (San Miguel Bay). University of the Philippines, College of Fisheries, 16 p. M.S. thesis.

Pauly, D. and A.N. Mines, Editors. 1982. Small-scale fisheries of San Miguel Bay, Philippines: biology and stock assessment. ICLARM Technical Reports 7, 124 p. Institute of Fisheries Development and Research, College of Fisheries, University of the Philippines in the Visayas, Quezon City, Philippines; International Center for Living Aquatic Resources Management, Manila, Philippines; and the United Nations University, Tokyo, Japan.

Villafuerte, E.D. and C. Bailey. 1982. Systems of sharing and patterns of ownership, p. 25-41. *In* C. Bailey (ed.) Small-scale fisheries of San Miguel Bay, Philippines: social aspects of production and marketing. ICLARM Technical Reports 9, 57 p. Institute of Fisheries Development and Research, College of Fisheries, University of the Philippines in the Visayas, Quezon City, Philippines; International Center for Living Aquatic Resources Management, Manila, Philippines; and the United Nations University, Tokyo, Japan.

Institutional and Technical Aspects of Access to Municipal Fishery Resources[1]

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Abstract

This paper examines the role of techniques and institutions in resource use. Two patterns of technical change have emerged with the increasing population pressure on fishery resources in San Miguel Bay, Philippines. The first is intensification of resource exploitation in the relatively congested barrios at the mouth of the Bicol River. This is linked to the availability of capital from the marketing sector in these barrios. The second pattern is the expansion of exploitation (using less capital-intensive gear) to the less accessible communities along the Bay. With respect to institutional change, growing interdependencies have resulted in friction among fishermen (especially between small-scale non-trawl fishermen and trawler operators). This has led to more regulation of the fishery. Specific policy options concerning less dependence on intensification and emphasizing decentralization of enforcement are presented.

Introduction

The primary objective of this paper is to discuss differential access to productive utilization of municipal fishery resources in San Miguel Bay. By focusing on different conditions of access, including the institutions that govern access, the functional differences among users of the resource are explicitly recognized. Due to the fugitive nature of the resource (Ciriacy-Wantrup and Bishop 1975), such differences are not based on exclusive property rights over the resource (except in the special case of the stationary fishing gear which will also be discussed below). Differential access is based on (a) the nature of the productive technology and access to such technology; and (b) the system of formal and informal institutions that regulate actual fishing activity, employment, and distribution in the industry.

For this paper, the definition of *institution* used is "an ordered relationship among people, socially sanctioned, whether formal or informal, that defines rights, obligations, and exposures"

[1]This paper was prepared during the author's 1981 fieldwork in the Philippines preliminary to his Ph.D. dissertation on this topic during which time he was associated with the IFDR-ICLARM project. A theoretical framework and conceptual model for examining technical and institutional change in traditional small-scale fisheries are developed in this dissertation (Cruz 1982) and condensed in Cruz (1983). The interested reader is also referred to Bromley (1979), Johnston (1977) and Wilkinson (1973) for further discussion of related issues.

(Bromley 1979). As such the definition includes, among others, sharing systems and regulations on access and use, and their enforcement.

The secondary objectives of this paper are: (1) to discuss the path of intensification of fishing effort presently being followed in the San Miguel Bay fishery; and (2) to indicate the policy implications of this analysis.

The primary data for this paper are based on fieldwork in four of the five municipalities of Camarines Sur that border on San Miguel Bay: Sipocot, Cabusao, Calabanga and Tinambác. Supporting information is based on interim survey reports of the IFDR-ICLARM project. To complement the surveys undertaken by the project, the primary technique used in the investigation was unstructured in-depth interviews of respondents involved in the relevant fishing activity in each of the communities. Choice of the respondent was purposive and based on their familiarity, as ascertained by barrio captains and the UPV (IFDR)-ICLARM field researchers, with the history, the operation and the institutional arrangements pertaining to a particular gear.

A short observation of the area was conducted in February 1981, and interviews were made by the author during June and August 1981. Table 1 provides a list of 23 respondents with whom in-

Table 1. Survey areas, sample size, description of respondents and topics discussed.

Location	n	Informant	Topic
Sipocot: Mangga	1	*Panke* (gill-net) operator	
Cabusao: Castillo	3	Municipal development officer	General conditions of enforcement of fishing laws and problems of fishermen in Cabusao
		Fish buyer	Systems of marketing and gill-net fishing in Castillo
		Itik-itik (mini trawl) operator	
Calabanga: Sabang	12	Baby trawl owner	History of trawling in San Miguel Bay; operation of gear
		Trawl net maker	Design, measurements of different trawl types
		Kuto-kuto (mini trawl, *Itik-itik*) operator	
		Baby trawl operator	
Bonot-Sta. Rosa		*Bukatot* (liftnet) operator	
		Kalikot (scissor net, *sakay*) operator	
Sibobo		*Panke* (gill-net) operator	
		Sagkad (fish corral) operator	
		Bubo (fish trap) operator	
Balonggay		*Banwit* (hook and line) operator	
		Biakus (filter net) operator	
		Bintol operator	
Tinambac:	7	Acting municipal mayor	Liftnet fishing conditions; trawler, gill-net operation; conflicts
Sogod		*Banwit* operator	
Daligan		*Biakus* operator	
		Bubo operator	
Bagacay		*Kalikot* (scissor net variant) operator	
		Baby trawl operator	
Cagliliog		*Bukatot* operator	

Notes: For the different gear operators, a detailed interview guide was used. Short interviews with minor informants are not listed here.

Table 2. Ranking of 10 major gear types according to abundance in selected San Miguel Bay communities.

	Rank of gear									
	1	2	3	4	5	6	7	8	9	10
Gear	Gill-net	Push net	Hook and line	Baby trawl[3]	Longline	Liftnet	Mini trawl[3]	Fish pot	Fish corral	Filter net
Number used[1]	486	105	68	62	55	47	44	31	18	17
Community (barrio)	Relative popularity[2] (%)									
Sipocot										
(Mangga)	91	23				5			2	
Cabusao										
(Castillo)	71	71	2	1			29		1	8
Calabanga										
(Sabang)	37		1	27			44			
(Balongay)	27	27	71		2				7	27
(Bonot-Sta. Rosa)	58	58	10		5	62	2	2	2	
(Sibobo)	81	53						12	15	
Tinambac										
(Sogod)	21		61			5	6			
(Daligan)	47		22		1			52		18
(Bagacay)		75		9						
(Cagliliog)						52				

[1] Data from sociology team. See Esporlas (1982).

[2] Relative popularity computed as number of particular gear divided by number of fishing households in the community; data based on community inventories. Relative popularity of gears (and concentration) in each community can be determined by reading across each row.

[3] For distinctions among the various trawl types, see Smith et al. (this volume). 'Baby' trawls include both small and medium trawlers; mini trawls are a separate category.

depth interviews were conducted. Ten gear types were ranked according to number in use. Thereafter the relative popularity of each of the 10 gears in each of the communities was determined by dividing the numbers of particular gear types by the number of fishing households in the community (Table 2).

Inclusion as one of the communities in the survey depended on whether a particular gear ranked first or second in terms of relative popularity in a given community. Two exceptions were applied in the community selection: (1) since fieldwork constraints limited the survey area to Camarines Sur, no Camarines Norte communities were included; (2) although gill-nets were most popular in the municipality of Siruma, the difficulty of reaching the area was the basic reason for its exclusion. Unfortunately, no informants for longline could be located in either Balongay or Bonot-Sta. Rosa. Consequently only nine gears were actually studied.

Technical and Institutional Change in San Miguel Bay

POPULATION AND RESOURCE ENVIRONMENT

The communities bordering San Miguel Bay have experienced a high rate of population growth over the past three-quarter century. An annual growth rate of 2.68% characterizes the increase in population of the four survey municipalities from 1903 to 1975, and population density with respect to total land area in the four municipalities in the study has increased from 25 to 168 persons/km^2 in the same period (Philippines (Republic) 1962, 1982).

With respect to agricultural resources, much of the area is surrounded by hilly terrain which is only marginally cultivable or suitable for grazing. The only land suited to rice farming is located in the basin of the Bicol River, in the municipalities of Cabusao and Calabanga. It is thus reasonable to presume that a process of resource circumscription in the face of population pressure is approaching (if not actually taking place) due to the limited area of cultivable land and municipal fishery resources.

TECHNOLOGY AND ACCESS TO RESOURCES

Aside from the institutions regulating fishing activity, availability of the technology of capture determines differential access to the resource. In turn, the factors affecting utilization of a particular production technology are: (1) availability of funds to meet the capital requirement for particular gear types; (2) presence of marketing capability consistent with the catch of the gear; (3) experience or skill in the utilization of such gear and (4) gear productivity with respect to the fishery environment.

Capital requirements for each gear type include allotments for the acquisition and maintenance of fishing gear. Marketing capability refers to the capacity of the fish distribution channels to absorb a large (or specialized) volume of catch and to provide the necessary credit base on which both fishing operations and marketing functions depend. Note that for all gear types, disposal of catch is usually tied to a specific landing area, except in instances when an unusually large volume or value of species is caught that is not normally bought at the landing; in this case fishermen bring such a catch to a larger landing where there are more buyers and more cash is available. Also the marketing aspect encompasses social and economic ties not usually included in the actual fishing activity, which by its nature tends to isolate individual fishing crews or boats from others in the fleet.

Experience or skill in gear utilization refers to two sub-components: the first is the amount of experience and skill that can be attributed to individual operators or potential operators of gear; the second is a broader aspect encompassing the general popularity of gear use in a particular area and the spread of both experience and skill in its use.

The fourth factor, gear productivity with respect to particular resource characteristics, includes the importance of particular location differences in the productivity of operation of particular gears and the role of gear efficiency as a basic requirement in the adoption of gears in any particular location.

GEAR DESCRIPTION AND CLASSIFICATION

The capital requirements for each gear are presented in Table 3, together with brief comments on their operation and where applicable, their special marketing requirements. From the capital requirements presented in the table, it is apparent that the trawl gears represent a different group in terms of the role of capital. The upper limit of investments for all the non-trawl gears does not exceed ₱13,000 while capitalization for both the small and medium trawlers exceeds ₱50,000 per unit.

This distinction is also apparent in two other aspects. First, except for liftnet operation in Cagliliog (the most productive area for such gears in the Bay in 1981), none of the non-trawl gears require any significant specialization in marketing capabilities with respect to volume or value of catch. Secondly, there is considerable concentration of ownership of the trawlers in the hands of a small number of families; five families owning among them almost half of the 95 small and medium trawler fleet (Bailey 1982). Ownership of non-trawl gear is considerably more dispersed. Thus small and medium trawlers represent a level of resource exploitation distinct from the other gears in the fishery.

TRENDS IN FACTORS AFFECTING ACCESS

The relative importance of each of the above four factors to differential access depends on the subsistence (or surplus) characteristics of the fishing community. The usual concept of subsistence

Table 3. Gear description and capital requirements.

Gear type	Description	Capitalization[1] (P)	Marketing[2]
Stationary:			
Liftnet	A stationary net that works best in sheltered, shallow waters (characteristic of Cagliliog), requires a skilled operator in the operation of lights and the lifting of the net	12,200	Specialized handling of significant volumes of anchovies
Filter net	A net set against a current thus requiring placement usually at the mouth of a river (characteristic of Daligan and Balongay)	3,500	
Fish corral	A fish corral requiring shallow, sheltered waters	9,100	
Net:			
Gill-net	Drift or set gill-net (with motorized *banca*)	13,000	
Trawl:			
Mini trawl	A very small trawl usually powered by a 16-hp engine; operates in shallow waters	9,200	Specialized markets for *balao*
'Baby' trawl	A small or medium trawler, usually around 3 GT in weight using a 135-240-hp engine	55,000–70,000	Large volume of catch to be marketed
Others:			
Hook and Line	Used for large fish species in rocky or coral-bottomed areas; requires knowledge of good fishing ground	500–3,200	
Push net	Hand-operated scissor net used in shallow muddy waters	250	
Fish pot	Used for large fish species in rocky or coral-bottomed areas	300–3,400	

[1]Capitalization figures are approximate for 1981 based on Smith and Mines, this report. Gill-net and liftnet cost includes motor boat (10-16 hp and 5-16 hp, respectively). Filter net and push net cost includes non-motorized boat. The upper limits for hook and line and fish pot represent inclusion of a small motor (about 5 hp).
[2]Unless specified in marketing requirements column, specific gear needs no special marketing capability.

(e.g., in farming communities) has connoted production for self-sufficient consumption so that monetization seldom occurs until the economy moves into surplus production, when both monetization and accumulation of capital tend to move hand in hand. However given the amount of specialization on fishing of production in the San Miguel Bay area, the level of monetization is not as important an indicator of the level of development of fishing communities as in other resource contexts.

While the communities around the Bay exhibit similar levels of monetization of economic transactions of individuals, the level of surplus production differs. This is most clearly observed in the function of the marketing sector in the barrio. In the more developed communities of Castillo and Sabang, marketing is essentially outward-looking, serving the consumer markets of Libmanan, Sipocot, Naga or Manila (Esporlas 1982; Yater et al., this report); while in the smaller more remote barrios, marketing is essentially a community subsistence requirement, converting fishermen's production into other goods and services for household consumption.

About two thirds of all Philippine municipal fishermen sell over 70% of their catch (World Bank 1980). However, the lack of storage facilities that small-scale fishermen may use and the prohibitive transportation costs of small volumes to better markets force them to sell to middlemen at low prices. Lower prices are often paid to fishermen if they have availed of operating credit from middlemen to purchase fuel or to meet other expenses (Yater et al., this report). This indicates that the possibility of accumulation from surplus output is strongly linked to the marketing function. Thus the role of the marketing sector, with its greater command of available capital, has been of growing importance in the determination of the productive technology that is now utilized in the Bay. In this way, the distribution of more productive (and capital-intensive) gears is linked to the historical spread of development (e.g., in the form of all-weather roads) from the Calabanga focus (where the marketing sector is most developed due to accessibility to Naga) to Cabusao and Sipocot in the west and Tinambac in the northeast.

TRENDS IN REGULATION

Aside from the set of factors affecting access discussed above, there has been a trend towards increased regulation of use of the Bay's resources. Two examples are cited here.

The first case is the stationary gear (particularly for fish corrals) where location guaranteeing good catch is a crucial element. Such sites may be held by individuals and in areas where good sites are generally available there has historically been no strict institution or rules governing access. In these areas only coordination was required and this role was usually assigned to an *amonojador*, a senior fisherman in each community. In the Bay, there has been a tendency for the role of the *amonojador* to shift from informal coordination to one of more formal regulation, and the function to shift from the barrio to the municipal level. Differences in roles and functional level were noted between the *amonojador* in the relatively developed (and congested) areas at the mouth of the Bicol River and in the less commmercialized barrios in the northeast portion of the Bay. In Calabanga, for example, the *amonojadors* are not only active, but they even charge fees for their services while in Tinambac at the time of fieldwork in 1981, no *amonojador* was involved in regulating the sites for stationary gear.

A second case is the regulation of trawlers. The formal definition of municipal fisheries includes waters up to 3 nautical miles (5.5 km) from the shore. Additional depth limitations are set for the use of trawling equipment: until 1982, trawlers of more than 3 GT could operate only in waters more than 7 fathoms (12.8 m) deep while the lighter ones[2] can operate up to as shallow a depth as 4 fm (7.3 m) if specifically permitted to do so under municipal ordinances (BFAR n.d.).

Based on charts of the Bureau of Coast and Geodetic Survey, in the municipal waters of the sampled municipalities (Sipocot, Cabusao, Calabanga and Tinambac) maximum water depth in no instance exceeds 5 fm (9.1 m). In fact, only very small portions of these municipal waters exceed 4 fm in depth (most of these are off Cagliliog in Tinambac). Thus commercial trawling is illegal in most municipal waters. In Calabanga, where the small and medium trawler fleet is based, it is debatable if any portion of municipal waters is deeper than 4 fm so that all municipal trawling there may be illegal. Illustrative of the trend towards increased regulation, commercial trawling, which includes medium trawlers, was totally banned from San Miguel Bay effective mid-1982.

Of course, regulations on the books do not necessarily mean they are abided by. The potential for enforcement is affected by the level of costs (both economic and otherwise) involved. In actual fact, enforcement of the trawling regulations has not been particularly effective in San Miguel Bay.

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[2] There is considerable confusion, however, as to whether mini trawlers must also fish beyond 4 fm. In fact, they generally fish in much shallower areas (see Tulay and Smith, this report).

EMPLOYMENT AND FACTORS AFFECTING SHARING

Aside from the factors directly associated with access to the productive use of municipal fishery resources, institutions governing sharing and disposal of catch also affect, in a less direct manner, access to resource use. For the fishermen who do not have their own gear or who own very simple and unproductive equipment (what we may call "gearless labor"), employment as a crew member is often the only means of ensuring that household subsistence needs are met. Each gear that requires more than one person to operate is characterized by a clearly defined sharing system, though there is considerable variation within gear types (Villafuerte and Bailey 1982).

Only a few cases of wage systems, as for filter nets in Cabusao (see Supanga and Smith, this report), were found and there were no instances of leasehold or renting contracts. For crew members, the popularity of the sharing system is due to its advantages given the particular economic and resource context of municipal fisheries. The critical characteristic of sharing is not the potential income it promises for gearless labor but the system's ability to tide over the subsistence fishermen during lean periods. The flexibility of sharing is built into the system in the form of the understanding that the owner's share may be waived in times of poor catch and "reimbursed" gradually as production improves. Of course, if a wage system tied to minimum income were established, this would assure the same stability, but sharing has the added advantage of allowing crew members the opportunity of benefiting from an exceptionally large catch.

From the viewpoint of the owner of the gear, if wages could be set at minimum subsistence levels lower than current crew earnings under sharing systems, then wages would be preferred to sharing since the owner would monopolize the benefits from a good catch. This would hold true for the owner-operators who can closely supervise work. Sharing will only appear advantageous to owners in the case where the owner does not participate in actual operations and thus cannot directly supervise crew members (Hayami and Kikuchi 1980).

The fact however that sharing systems have been chosen throughout the Philippines even when most gears did not have separation of ownership from operation indicates that either labor's bargaining position has been stronger or kinship ties and egalitarian considerations have been more important.

In addition to these considerations, the growing importance of capital in gear ownership makes it reasonable to presume that the trend in San Miguel Bay will be for more separation between ownership and operation of gear. Consequently, the current preference for systems of sharing rather than wages will be maintained.

FACTORS AFFECTING SHARING ARRANGEMENTS

In spite of the general background behind the choice of sharing as a system, it is still not at all clear what factors are relevant in the actual sharing arrangement chosen. Aside from the sharing for the four gear types described by Villafuerte and Bailey (1982), sharing for two other types of gear were encountered: filter nets (equal sharing of net revenue) and hook and line (a third goes to owner; the rest to crew). Although the basic formula is for equal sharing between owner and crew, many variations occur with respect to the deduction of costs and their definition and with respect to the percentage shares effectively chosen.

Further study, especially of a quantified nature, is required to investigate the factors determining the actual sharing percentages followed. The following variables should figure importantly in such an investigation: (1) the subsistence income required by the households of "gearless labor"; (2) the seasonality of income with respect to gear types; (3) kinship (and social) ties among owner and crew members; (4) bargaining position of labor; (5) cost of gear acquisition; (6) number of crewmen employed; (7) participation of owner in operations; (8) requirement for specific skills in operation (e.g., need for a *maestro*); and (9) opportunity costs of labor by geographic area.

Some Policy Implications

Up to the present, most of the technological change in San Miguel Bay has been initiated by the private sector and has been generally endogenous in nature. These changes have tended to build on existing techniques or have been gradually diffused from the technologically more advanced fisheries of Manila and southern Luzon. By their very nature, institutions (essentially motivated by the search for security in the face of social and resource uncertainties) tend towards stability and permanence. Thus, in periods when the conditions of resource exploitation are abruptly altered, institutions tend to lag. Unfortunately, the social or collective action by which institutions are reformed is difficult and costly (Hayami and Kikuchi 1980). In addition, exogenous agents, especially from the public sector, often diagnose the problem as essentially technical in nature and thus initiate programs (e.g., credit for boat motorization) that may merely aggravate the problem.

Of emerging importance is the crucial issue of the distribution of the benefits from the San Miguel Bay fisheries among the various competing users. Until the advent and increased activity of trawlers in the Bay during the 1970s, changes in the corresponding institutional arrangements in the fishery had not lagged greatly. However, growing conflict between trawl operators and the other gear owners in the Bay indicates that the institutional set-up has not adequately responded to this technological challenge.

Programs for both technical and institutional change in San Miguel Bay should be carefully evaluated. In the area of technology, it has been suggested that first steps should begin with supporting the non-trawl indigenous means of intensification (Netting 1977) or, if still possible, exploiting those more remote areas not fully exploited, since these programs do not impose undue strain on the institutional context.

In the area of institutional change, the immediate problem is in the field of enforcement. Ineffective or arbitrary implementation of formal rules not only demoralizes those affected in the present, but also tends to undermine whatever programs will be introduced in the future. From a purely logistic viewpoint, the cost of enforcement is high only because traditional sanctions and regulations have not been utilized. This author's impression of the attitudes of fishermen in San Miguel Bay is that they no longer hold to an "open-access" mentality concerning their source of livelihood. They appreciate the problems of congestion and overexploitation and, on the whole, accept the growing need for regulation.

Therefore, the first step in this area is to encourage decentralization of program implementation and enforcement. Consider, for example, the potential role of local leaders. Traditionally the role of the barrio officials and of the municipality itself has been minimal in the regulation of resource use. The trend, however, is toward increased involvement as problem areas have increasingly shifted from the individual to those involving the barrio or municipality. In fact, local municipal governments must explicitly pass ordinances to allow trawling in waters between 4 and 7 fm in depth.

Another potential area of decentralization is linking regulation with landing areas. Historically, most production in San Miguel Bay has been associated with a few landing areas only. Therefore, periodic checks on mesh sizes of nets or enforcement of closed seasons or minimum fish sizes could be accomplished with minimal expenditure for patrolling of fishing areas. Coupled with a licensing scheme, the activities of individual vessels could be effectively monitored.

To summarize therefore, it is to the area of institutional change that inputs from the public sector should now be channelled. The reason is basic but has been consistently overlooked. Technical change is costly, but it often promises benefits to individuals willing to take the risk. Institutional change, on the other hand, is not only costly, but the benefits—often diffused over a large group—do not directly accrue to the innovator. Consequently, the public sector is constrained to view the issue of institutional change as essentially a problem of public (or development) finance, to ensure that the potential benefits to the majority of fishermen in San Miguel Bay may be realized.

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The responsibility for the contents of the paper, of course, remains the author's own.

References

Bailey, C. 1982. Small-scale fisheries of San Miguel Bay, Philippines: occupational and geographic mobility. ICLARM Technical Reports 10, 57 p. Institute of Fisheries Development and Research, College of Fisheries, University of the Philippines in the Visayas, Quezon City, Philippines; International Center for Living Aquatic Resources Management, Manila, Philippines; and the United Nations University, Tokyo, Japan.

BFAR. n.d. Relevant laws on municipal fisheries. Ministry of Natural Resources, Quezon City, Philippines.

Bromley, W. 1979. Technology, institutions and economic rents: understanding rural stagnation. Paper presented at the Ford Foundation Staff Seminar for Asia and the Pacific Region, November 13-17, 1979. Yogjakarta, Indonesia.

Ciriacy-Wantrup, S.V. and R. Bishop. 1975. 'Common property' as a concept in natural resources policy. Nat. Res. 15: 713-728.

Cruz, W. 1982. Technical and institutional change in renewable resource development (with application for traditional fisheries). University of Wisconsin-Madison, 298 p. Ph. D. dissertation.

Cruz, W. 1983. An environmental-demographic model of techno-institutional change in transitional economies. Paper presented at the CDEM Staff Seminar Series. College of Development Economics and Management, University of the Philippines at Los Baños, Feb. 18, 1983. College, Laguna, Philippines.

Esporlas, A.E. 1982. The seasonality of fishing, marketing and processing, p. 14-24. *In* C. Bailey (ed.) Small-scale fisheries of San Miguel Bay, Philippines: social aspects of production and marketing. ICLARM Technical Reports 9, 57 p. Institute of Fisheries Development and Research, College of Fisheries, University of the Philippines in the Visayas, Quezon City, Philippines; International Center for Living Aquatic Resources Management, Manila, Philippines; and the United Nations University, Tokyo, Japan.

Hayami, Y. and M. Kikuchi. 1980. Economic approach to village community and institutions. Paper presented at the Joint workshop of agro-economic survey and International Rice Research Institute, August 25-27, 1980. Indonesia.

Johnston, R.S. 1977. The relationship between property rights arrangements and the nature of aquacultural developments, p. 147-153. *In* B. Lockwood and K. Ruddle (eds.) Small scale fisheries development: social science contribution. East-West Center, Honolulu.

Netting, R.M. 1977. Cultural ecology. Benjamin Cummings Pub., Menlo Park, California.

Philippines (Republic). 1962. Census of the Philippines: 1960. Vol. 1 Report by province, population and housing. (Table 1—Population by municipality: censuses 1903 to 1960.) Manila: Bureau of Census and Statistics.

Philippines (Republic). 1982. Philippine statistical yearbook. (Table 1.1—Population, land area and density of the population by region and by province: census years 1918-1980.) Manila: National Economic and Development Authority.

Villafuerte, E.D. and C. Bailey. 1982. Systems of sharing and patterns of ownership, p. 25-41. *In* C. Bailey (ed.) Small-scale fisheries of San Miguel Bay, Philippines: social aspects of production and marketing. ICLARM Technical Reports 9, 57 p. Institute of Fisheries Development and Research, College of Fisheries, University of the Philippines in the Visayas, Quezon City, Philippines; International Center for Living Aquatic Resources Management, Manila, Philippines; and the United Nations University, Tokyo, Japan.

Wilkinson, R.G. 1973. Poverty and progress: an ecological model of economic development. Methuen and Co. Inc., London.

World Bank. 1980. Aspects of poverty in the Philippines: a review and assessment. Report No. 2984-PH, Vol. I and II. Washington, D.C.

Economic Aspects of Processing and Marketing

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Abstract

This paper examines the pricing efficiency and related economic aspects of fish processing and marketing in two communities of San Miguel Bay, Philippines. Salting, dried fish processing and marketing and fresh fish marketing are covered. Pricing efficiency of the system was found to be low. Daily incomes for marketing intermediaries, except for a few large-scale wealthier fish driers, were comparable to those earned by fishing households in the communities.

It is argued that the best hope for improving processing and marketing in these communities lies in group activities that manage gasoline supply and processing to compete with existing suppliers and processors. Finally, recommendations for uniform weights and measures are made.

Introduction

A secondary objective of the economic component of the UPV(IFDR)-ICLARM multidisciplinary study of the small-scale fisheries of San Miguel Bay was to examine economic aspects of processing and marketing. In particular, the study addressed questions of spatial and form price efficiency in the system; that is the relationship between (1) spatial price differences and marketing costs, and (2) between form (fresh to processed) price differentials and processing costs. As explained in Smith et al. (this report), the study of marketing and processing was approached in this fashion because potential for improvement in the system to the possible benefit of small-scale fishermen could more easily be identified than through the more descriptive structural approach as originally espoused by Bain (1968) and often applied to Philippine marketing studies (e.g., BAEcon n.d.).

The study was only partially successful in this approach. As is true throughout the Philippines, fishery products of San Miguel Bay are often sold by volume rather than by weight. This was the case not only at the landings in Cabusao but also at the local markets in Libmanan and Sipocot. Accurate measurement of prices per kilogram by species under such circumstances was extremely difficult and the method eventually used was less than perfect.

Methodology

The estimation of prices of individual species in multispecies transactions requires prior information on (1) the total value of the transaction, (2) its total weight, (3) its composition, and (4) an index of relative prices. The first three of these data were obtained from sellers at the landings; the fourth was derived from daily inquiries of buyers who were asked to estimate the prices they would be willing to pay per kilogram of the major species expected to be landed that day. At the end of each day, a specially prepared program (see Appendix 3 of Smith, et al., this report) was used to calculate average prices by species. Weekly and monthly price summaries were then prepared.

Castillo landings, Castillo processors and markets in Libmanan and Sipocot were monitored approximately three days/week for a 12-month period, February 1980-January 1981. Data collection and tabulation were very time consuming and tedious. It was a necessary task, however, because secondary price data were not available for any of the sampled trading points in Cabusao, Libmanan or Sipocot. Secondary data on prices in Camaligan, Naga City and Sagang, Calabanga from the Philippine Fish Marketing (now Development) Authority (PFMA) were collected, which provided a check for consistency of the primary data.

A random sample of Cabusao and Sabang marketing intermediaries for fresh and dried products and processors were interviewed during March and April 1981 to collect data on marketing and processing costs.

To summarize, the data that were collected for this marketing and processing study were as follows:

• marketing and processing costs • prices (by major species) at Castillo landings • prices (by major species) at local markets – Libmanan (fresh and dried) – Sipocot (fresh and dried) – Cabusao (dried)	primary data
– Sabang (fresh) – Camaligan (fresh) – Naga City (dried)	secondary data

Cabusao and Sabang are the two major landings along the southern coast of the Bay. They are also the most market oriented among the bayside Camarines Sur communities. Consequently, one would expect marketing efficiency to be higher here than in the more isolated communities with lower volume marketed and fewer buyers. An analysis of the major factors affecting the pattern and purpose of marketing for the Bay as a whole can be found in Esporlas (1982). Cabusao and Sabang were appropriate foci for this marketing study because the diversity of activity and scale there permited a clear determination of the extent of marketing concentration and thus the potential (if any) for restructuring the marketing sector for the benefit of fishermen and consumers.

Salting

TECHNIQUES AND SPECIES USED

Salting of sergestid shrimp or *balao* has been a major processing activity in the San Miguel Bay area for many years. *Balao* make up 37% of the total catch of the Bay (Pauly and Mines 1982) and 56% of the landings in Castillo (Smith et al., this report).

Several products can be prepared from *balao*. The salting done by Castillo and Sabang processors is actually only the first step in the conversion of *balao* into fermented shrimp paste known as *bagaoong (= bagoong)*. However, since there is no Bicol area market for *bagaoong*, most of the salted *balao* is shipped to Pangasinan province north of Manila which specializes in *bagaoong* preparation. Some of the salted *balao* is sold locally as *guinamos*, another shrimp paste which is mashed, sun dried and then sold in cake form (NSDB 1980). *Balao* that is simply salted (and not fermented or mashed) and where the whole shrimp can be seen is popular with local Bicol consumers.

After purchase, the *balao* is placed in a mixing tub, most often an old wooden boat. Salt is added to the *balao* in an approximate ratio of 1:4 and then thoroughly mixed. For every can of *balao* (a can is the local measure and weighs approximately 27 kg), 4 liters of water are also added to the mixture to increase its weight and to aid in salt absorption. The resulting product is packed for sale in cans with plastic liners.

COSTS AND RETURNS

During the survey in April 1981, 13 salting processors in Castillo and 12 in Sabang were identified, of whom seven were interviewed; two had daily sales of less than 750 kg; four had daily sales of 1,600-2,000 kg and one had daily sales of 7,000 kg. On average, these processors had been in the business for four years.

Compared to the average investment costs for a small-scale unit such as a mini trawler or gillnetter, the average investment cost of a *balao* processor was low at only ₱728 (Table 1). However, operating requirements were considerably higher (Table 2), requiring almost ₱4,000 daily for *balao* purchases and daily operating expenses (Tables 3 and 4). In fact, since many processors advanced gasoline to mini-trawl operators and did not receive payment for their product until after sale, the actual capital requirements were higher. The survey respondents estimated that approximately

Table 1. Average investment costs in pesos for salting of *balao*, San Miguel Bay, April 1981.

Item	Average no. owned (n_i)	Average acquisition cost per item (C_i)	Expected life (yr)	Average annual depreciation per item (D_i)
Drying trays	42	3.29	4	0.82
Push cart	0.4	80.00	10	8.00
Baskets	16	5.00	1	5.00
Mortar/pestle	0.4	26.00	10	2.60
Wooden tubs	0.7	87.00	10	8.70
Weighing scale	0.9	88.00	7	12.60
Wooden boxes	0.1	120.00	10	12.00
Storage shed	0.6	500.00	5	100.00
Calculator	0.1	120.00	3	40.00
Stapler	0.1	30.00	10	3.00

Average investment costs per respondent = $\sum n_i C_i$ = ₱727.70

Average annual depreciation per respondent = $\sum n_i D_i$ = ₱201.61

Table 2. Average variable (operating) costs in pesos for *balao* salting, San Miguel Bay, April 1981.

Item	Daily cost	%	Annual cost
Salt	315	36	60,480
Plastic bags	25	3	4,800
Containers (baskets and cans)	405	47	77,760
Hired labor	70	8	13,440
Hired vehicle	22	3	4,224
Own fare	6	1	1,152
Snacks for laborers	18	2	3,456
Prorated annual costs			
maintenance/repair	1	–	192
bad debts	7	1	1,344
Total	869	100	166,848

Table 3. Daily costs and returns in pesos for *balao* salting, San Miguel Bay, April 1981.

	Average per processor
Daily purchases and sales (kg)	
Average quantity purchased	1,704
Average quantity sold	2,146
Percentage weight increase	26
Daily costs	
Cost of *balao* purchases	2,869
Prorated fixed costs[1]	2
Variable (operating) costs	869
Total daily costs	3,740
Daily returns	
Sales of salted *balao*	3,864
Daily net return to processor's own capital, labor and management	124
Less opportunity cost of capital[2]	1.70
Daily net return to processor's labor and management	122.30
Per kilogram costs and returns	
Average price paid	1.68
Average direct processing cost sold[3]	0.41
Average selling price	1.80
Average net return to labor and management sold	0.06

[1]Total of depreciation (₱202) and license fee (₱150) prorated over average 192 days of operation per year.
[2]Nine percent of investment cost (₱728) and operating capital (₱2,869) prorated daily.
[3]Fixed and variable (operating) costs only. Does not indicate net return to processor's own capital, labor and management.

₱10,000 capital was necessary to enter the business, placing the business on a par with most small-scale fishing gear. A final cost for entering the business is an annual license fee of ₱150.

NET RETURNS

Residual daily return to processor's labor and management (after deducting opportunity costs of capital) was ₱122, placing processors in a separate economic stratum from the fishermen who supply the *balao,* and on a par with the large-scale fish driers (see below). The number of *balao* processors has remained small due primarily to the high costs of entering this business, far beyond the reach of most small-scale fishing households.

There was no correlation between processing costs and volume of *balao* handled.

Fish Drying

TECHNIQUES AND SPECIES USED

The traditional methods of fish drying differ from community to community. In Sabang, the process includes washing, gutting, soaking in brine for 12 hours, and finally drying for 4-5 hours and packaging. In contrast, the process in Castillo involves dry-salting rather than soaking in brine.

Most fish dried in Sabang and Castillo are croakers, sardines, hairtail and trashfish. Croakers and sardines are the major catch of gill-netters which predominate in Castillo. In Sabang, where trawlers are more prevalent, the major species processed are anchovies and the trashfish bycatch.

In Sabang, anchovy landings are in the early morning, so the drying process can be completed within the same day. In Castillo, since anchovies are landed in the afternoon, the earliest that effective sun drying can begin is the next day. Ice is sometimes used to preserve the catch. A more common process, however, is to spread the anchovies on the drying trays immediately and leave them exposed to the air overnight, completing the process the next day. Since the resulting dried anchovies have similar physical characteristics to those which are iced overnight and thus no negative price differential, the traditional non-icing method is more economical. Anchovies are not put through the brining process because it would cause softening which would eventually rupture the belly portion, altering the physical appearance and lowering the value.

To determine the weight loss for the major species processed using traditional methods, samples of the product were weighed both before and after drying. The following percentage weight recoveries were determined:

Anchovies	:	60-70% weight recovery
Trashfish	:	55% weight recovery
Sardines	:	55% weight recovery
Hairtail	:	45-50% weight recovery
Croakers	:	45-50% weight recovery

This information was needed so that the price of the fresh fish could be adjusted for weight loss in processing before the processing margin was determined.

COSTS AND RETURNS

Costs and returns data for drying prorated on a daily basis, are summarized in Table 4 for 26 processors sampled. The respondents purchased an average volume of 182 kg/day at an average total cost of ₱489 or ₱2.69/kg. This average volume probably understated the daily volume handled throughout the year because data were collected in April when the peak fishing season had only recently begun. However, since daily prorated fixed costs (including depreciation) represented a small proportion of total daily costs, and there was only weak evidence of economies of scale (see next sub-heading), these figures have been used to estimate per kilo processing costs. Net returns to

Table 4. Daily costs and returns in pesos for fish drying, San Miguel Bay, April 1981.

	Castillo (n = 11)	Sabang (n = 15)	Below mean volume sold[1] (n = 16)	Above mean volume sold[1] (n = 10)	All processors (n = 26)
Daily purchases and sales (kg)					
Average volume purchased	138	215	83	341	182
Average volume sold	74	98	41	164	88
Percentage recovery	54	46	49	48	48
Daily costs					
Cost of purchases	471	502	252	867	489
Prorated fixed costs[2]	5	7	4	9	6
Variable (operating) costs	54	78	38	116	68
Total daily costs	530	587	294	992	553
Daily returns					
Sales of product	664	633	314	1,177	646
Daily net return to processor's capital, labor and management	133	46	20	185	83
Less opportunity cost of capital[3]	10	2	2	13	5
Daily net return to processor's labor and management	123	44	18	172	78
Per kilogram costs and returns					
Average price paid	3.41	2.33	3.04	2.54	2.69
Average direct processing cost sold[4]	0.81	0.87	1.02	0.76	0.84
Average selling price	8.97	6.46	7.66	7.18	7.34
Average net return to labor and management sold	1.66	0.45	0.44	1.05	0.89
Margin[5]	2.66	1.39	1.46	1.89	1.74

[1]Mean daily volume sold is 88 kg.
[2]Represents annual fixed costs prorated over 120 days of operation per year.
[3]Nine percent of investment cost prorated over 120 days of operation per year.
[4]Fixed and variable (operating) costs only. Excludes net return to processor's own capital, labor and management.
[5](Average price paid per kg ÷ percentage recovery) = effective price paid per kg. Margin per kg = (average selling price per kg minus effective price paid per kg).

a processor's capital, labor and management would vary with volume handled. The average fish drier operated 120 days/year, and annual costs were prorated to a daily basis to calculate costs and returns.

Major costs for drying included investment, fixed and operating costs. The average capital investment of the 26 respondents was ₱7,011. However, this figure was very skewed due to the presence in the sample of one processor who had a very substantial concrete storage facility; the remaining 25 respondents had an average investment of only ₱1,563 and this is a far more reasonable estimate of the costs of investing in fish drying in the area. Capital items included the processing establishment (*kamalig*, which usually has a concrete floor, nipa roof and open walls), wooden or concrete tubs for brine, drying trays and racks and rattan baskets.

The major fixed cost was depreciation, averaging ₱683 annually. Other fixed costs included licenses and annual market stall fees which averaged ₱70. Prorated daily fixed costs totalled ₱6.

Daily operating costs averaged ₱68.30. Major cost items included hired labor (32% of total operating costs), salt (27%) and bad debts (11%). Much of the hired labor, especially in the smaller operations, was women and children (Yater 1982). Wage rates were lower in Castillo than in Sabang. Bad debts were those debts that processors incurred which they believed would never be repaid. Other cost items included containers, ice, freight for shipping the product to the market, and the processor's own transportation fees.

Fish driers sold an average of 88 kg daily for ₱646, or ₱7.34/kg. Deducting all costs, including opportunity costs of processor's capital (9% of investment cost), left a net return to processor's labor and management of ₱78/day. Significant differences were found between small processors (those selling less than the mean 88 kg/day) and larger processors. The latter earned an average net return to labor and management of ₱172 daily, or almost 10 times as much as the small processors. This was due to the fact that both purchase costs and direct processing costs were lower for the large processors and because their volume of business was approximately four times as high as for the small processors. Sabang processors, who dried lower priced species (anchovies primarily), earned considerably less residual income per day than did their Castillo counterparts who dried the higher priced croakers.

EASE OF ENTRY AND ECONOMIES OF SCALE

Except for the largest operations, the investment capital required to enter the fish drying business was less than that required to purchase a gill-net or mini trawl fishing unit. However, the daily operating capital required was higher. To achieve high volume of turnover requires capital for advances to fishermen, purchases of fish, direct processing costs, and storage. Consequently, around the Bay there were large numbers of small fish drying establishments but relatively few very large establishments. In Castillo, there was only one fish drier with the facility for storage of the dried product over any length of time. This ability to bulk the product resulted in higher prices received by this processor because he was able to supply transient buyers. All other Castillo fish driers sell their product as soon as possible because of their need for immediate cash to finance the next day's purchases. In some cases, especially in Sabang, processors do not pay the trawler operators for their catch until the processed product has been paid for by their buyers.

Exit from the business also was apparently easy, at least in the eyes of those fish driers who had made only small investments in their businesses. None thought he would have difficulty finding other income earning alternatives—35% of the 26 respondents would engage in the buying and selling of fresh fish; an almost equal number would invest in small or mini trawlers. In fact, many of these small processors were already engaged part-time in some of these other activities. Those who had the least capital invested would engage in such activities as net mending, porterage or as hired laborers in another's drying establishment if they themselves were no longer able to engage in the business.

Examination of economies of scale of operation in Castillo and Sabang showed that scale (in terms of volume sold) only explained 12% of the variation in average processing costs if a linear relationship was hypothesized, and even less if a log-log relationship was assumed. Consequently, there were very limited economies of scale in fish drying which is not surprising given the labor-intensive nature of the operation.

PRICE RELATIONSHIPS

Each processor dried several species. Consequently, it was impossible to ascribe the direct processing costs and net returns reported in the previous sections to costs of processing any particular species.

Further, there was no close correlation between prices of fresh and dried forms of three major fish types—croakers, mullet and herring—over the 12-month sampling period (Figs. 1-4). Other supply and demand factors, not measured in this study, were apparently involved in determining the product price relationships. One might be tempted to conclude that there is inadequate flow of market price information in the processing sector. However, the difference between the fresh and dried fish prices did not show great variation except in *banak* where there was a considerable decline in the difference after May 1980.

The difference between the price of fresh and dried fish is termed the mark-up, while the processing margin is the difference between the price of dried fish and the price of the fresh input adjusted for the weight loss during drying. The processing margin is designed to cover all processing

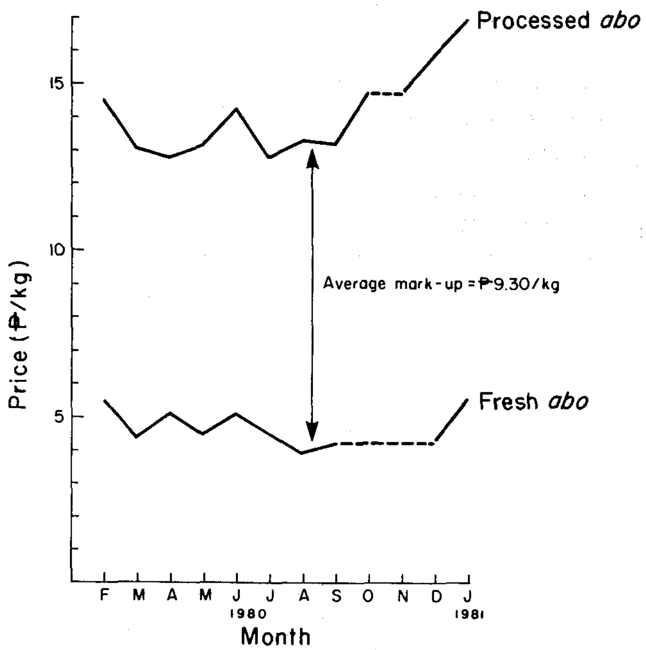

Fig. 1. Prices of fresh and dried croaker *(abo)* in Castillo, San Miguel Bay (1980-1981).

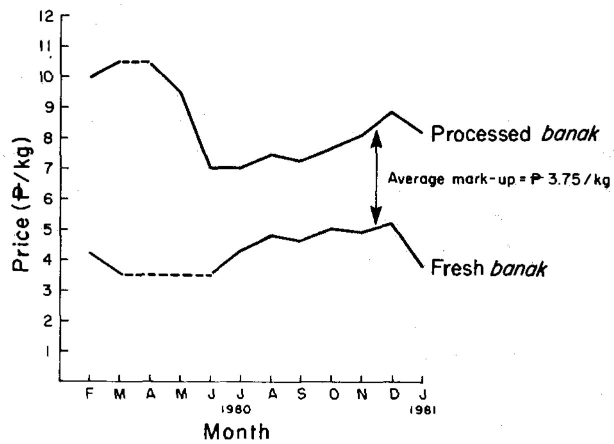

Fig. 2. Prices of fresh and dried mullet *(banak)* in Castillo, San Miguel Bay (1980-1981).

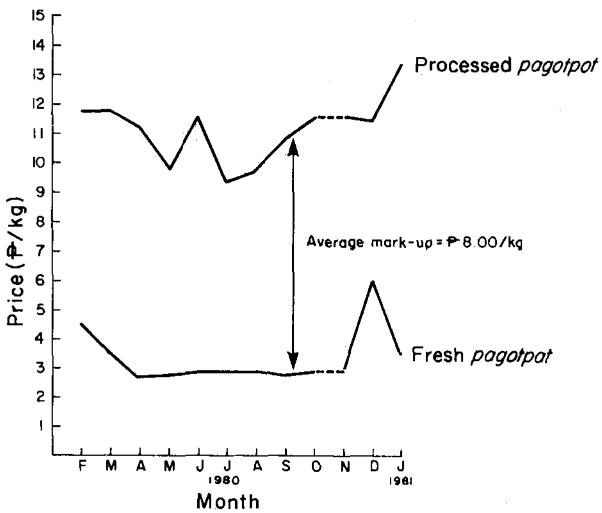

Fig. 3. Prices of fresh and dried croaker *(pagotpot)* in Castillo, San Miguel Bay (1980-1981).

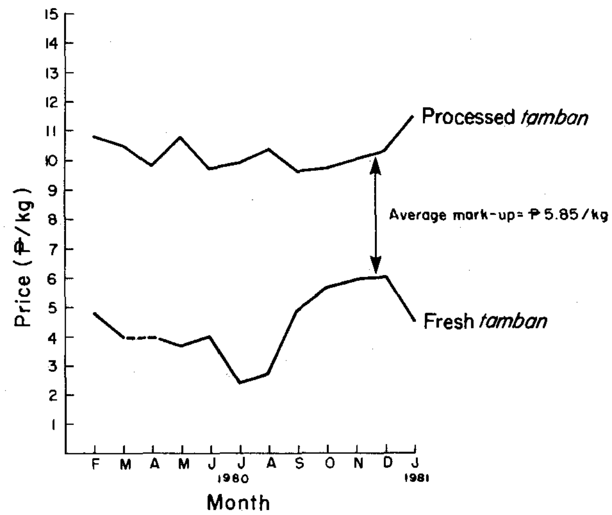

Fig. 4. Prices of fresh and dried herring *(tamban)* in Castillo, San Miguel Bay (1980-1981).

costs plus a reasonable return to the owner's own inputs (capital, labor and management) and risk. Risk due to bad debts was already taken into account when processing costs were itemized. Given the relative ease of entry into the fish-drying business, the reasonably steady mark-ups for these four species imply that the market forces of supply and demand have already settled the issue of whether or not the processing margin is reasonable given the costs and risks involved. It remains, however, that *on average* processors in Castillo and Sabang earned daily incomes that were considerably higher than the average daily incomes of fishermen. As noted earlier, however, large numbers of small processors earn daily incomes in the ₱15-20 range which is not much greater than the daily income of owners and crew of the gill-netters which supply much of the catch dried by these processors.

Dried Fish Marketing

The prices of dried fish in Castillo and the major nearby retail markets of Libmanan, Sipocot and Naga City were monitored for a period of one year, February 1980-January 1981. The purpose of this price monitoring was to establish the relationships (if any) among the prices in these four local markets, because such relationships determine the nature of product flows among the markets and the returns that can potentially be earned by middlemen who engage in dried fish marketing.

Although prices were collected for 13 different dried products, the results presented here focus on the four that were generally available in all four locations throughout the year:

Croaker *(abo)* : split
Croaker *(pagotpot)* : whole
Herring *(tamban)* : whole
Mullet *(banak)* : split

SPATIAL PRICE RELATIONSHIPS

Prices in Cabusao were monitored from one to three times per week depending upon the availability of the species. Libmanan and Sipocot prices were determined twice per week; once on the town's market day and once on an ordinary non-market day. Naga City prices were collected from the Philippine Fish Marketing Authority (PFMA). Cabusao prices were obtained from processors who were asked to provide us with the price/kg of their most recent sale. Libmanan and Sipocot retail prices were obtained from market vendors. In all three communities, 10-12 sellers were questioned on any given day of data collection. The observed prices for these four products are shown in the Appendix. The prices were surprisingly stable throughout the year.

In all cases, the relationship among Cabusao-Libmanan-Naga prices was as expected; that is, lowest at the source (Cabusao), higher at the nearby retail market (Libmanan), and the highest at the major city in the Bicol region (Naga). Prices at Sipocot which is a town along the national road between Naga and Daet, Camarines Norte, did not conform to expectations. Before beginning this study, it was hypothesized that Sipocot's proximity to the base of the Bay would lead its retail prices for dried fish being sufficiently higher than in Cabusao to warrant regular shipments of dried fish from Cabusao to Sipocot. However, during the course of this study, it was learned that the bulk of Sipocot's dried fish supply came from Mercedes in Camarines Norte. Mercedes' prices are reportedly lower than those of Cabusao. In fact, Sipocot middlemen often ship to the Libmanan market. For all four dried products, average prices in Sipocot were lower than in Libmanan and in all cases except for the split mullet, the Sipocot and Cabusao prices were almost identical.

Dried fish processed in Cabusao supplies both Manila and the local markets. The largest processor in Castillo, who handles an estimated 50% of the dried fish of the community, sells in bulk to agents representing Manila buyers. His product is not sold locally. The smaller processors, on the other hand, sell in smaller quantities to middlemen who double as retailers in the local markets. The bulk of the sales of small processors is sold to consumers in Libmanan, the third largest municipality (after Naga City and Iriga City) in Camarines Sur with 75 barrios and a population of over 65,000 in 1975 (NCSO 1975). Smaller quantities are sold in Sipocot and Naga City markets. It was estimated that 50% of the total Cabusao supply is shipped to Manila, 40% is sold in Libmanan and the remaining 10% to Sipocot and Naga.

Given the observed price differentials, only occasional shipments from Cabusao to Sipocot would be profitable; Naga, with its larger population and retail market, is better able to absorb dried fish that cannot be absorbed by the Libmanan market. Just as Libmanan and Manila are the major markets for Cabusao, Naga and Manila are the major markets for Sabang, Calabanga on the opposite side of the Bicol River from Cabusao. In Sabang, the same pattern as in Castillo prevails; that is, large processors sell in bulk for the Manila market, small processors sell in smaller quantities to middlemen/retailers who supply the local provincial markets. These major flows of dried fish are shown in Fig. 5. Additional information on the marketing of dried fish from Siruma and Tinambac can be found in Esporlas (1982).

In addition to examining the spatial price differentials to determine trade flows, the extent of correlation among the various prices was also determined. A high degree of correlation between prices in any two markets implies a highly efficient information network between the two markets (Jones 1972). The low correlations found were surprising (Table 5). In part, this was due to the low variation in prices in any single location. The only product for which reasonable correlation was obtained was the split croaker *(abo),* the major dried product of Castillo, suggesting an adequate flow of price information for this species through some of the selected market channels. The generally low correlation coefficients imply that either the flow of information was poor or that those middlemen who bought wholesale in Cabusao and sold retail in Libmanan were able to control prices in Cabusao to their advantage. To shed more light on this question, the costs of marketing were compared with the price differentials.

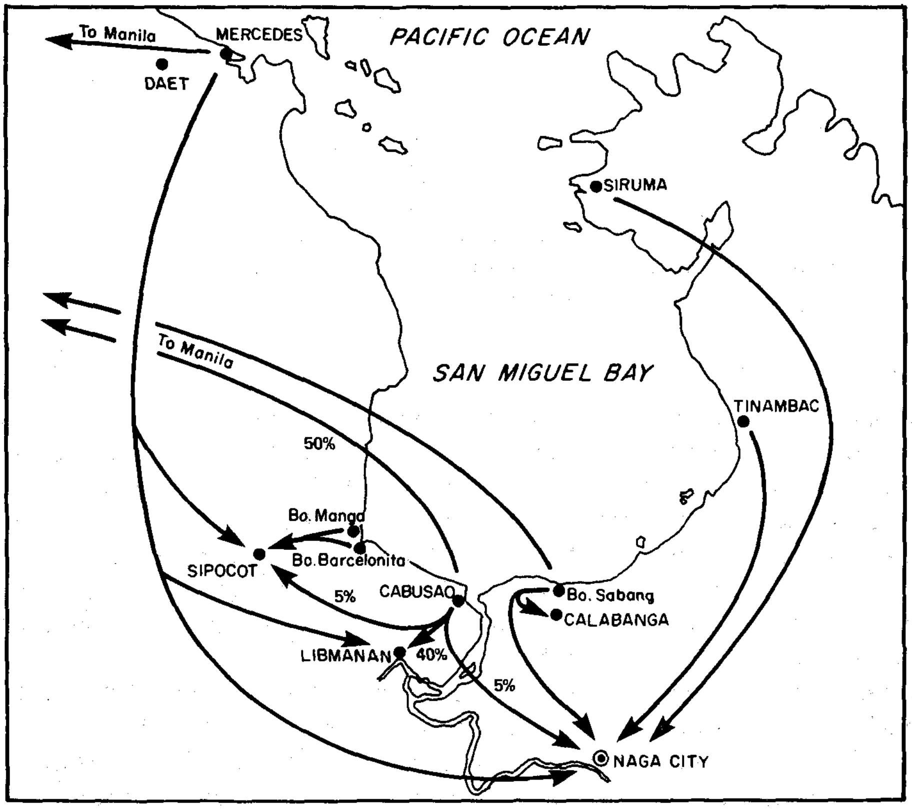

Fig. 5. Dried fish trade in the vicinity of San Miguel Bay.

Table 5. Spatial price relationships for selected species, San Miguel Bay, 1980-1981.

	Average price differential[1] (₱)	Correlation coefficient[2]
Whole croaker *(abo)*		
Cabusao-Libmanan	0.86	0.71
Cabusao-Sipocot	0.02	0.72
Cabusao-Naga	3.65	0.22
Sipocot-Libmanan	0.84	0.78
Libmanan-Naga	2.79	0.10
Sipocot-Naga	3.63	0.24
Split croaker *(pagotpot)*		
Cabusao-Libmanan	1.03	0.28
Cabusao-Sipocot	–0.10	0.14
Cabusao-Naga	2.29	0.47
Sipocot-Libmanan	1.13	0.10
Libmanan-Naga	1.26	0.32
Sipocot-Naga	2.39	0.17
Whole herring *(tamban)*		
Cabusao-Libmanan	0.66	0.20
Cabusao-Sipocot	–0.35	0.36
Cabusao-Naga	1.68	0.17
Sipocot-Libmanan	1.01	0.40
Libmanan-Naga	1.02	0.42
Sipocot-Naga	2.03	0.33
Split mullet *(banak)*		
Cabusao-Libmanan	2.21	0.17
Cabusao-Sipocot	1.79	0.44
Cabusao-Naga	3.62	0.10
Sipocot-Libmanan	0.42	0.35
Libmanan-Naga	1.41	0.07
Sipocot-Naga	1.83	0.32

[1]Average price in first market minus average price in the second market.
[2]Based on paired observations of average weekly prices as shown in Tables 1-4.

MARKETING COSTS AND MARGINS

Variable costs for marketing dried fish were not high (Table 6). The major cost was the transportation of the middleman who must physically come to Cabusao to make purchases and return with them to Libmanan. In the case of Sipocot, it was usually Cabusao processors themselves who travelled to the market to sell their product. The fact that there are no regular dried fish middlemen serving this route is further evidence that the price differential is not regularly wide enough to warrant anything more than an occasional trip to Sipocot from Cabusao by processors when market conditions warrant it. The bulk of the product sold locally goes to Libmanan. Other variable marketing costs included those of market fees and freight.

Based on interviews with dried-fish middlemen, the marketing costs over the Cabusao-Libmanan and the Cabusao-Sipocot routes were estimated. Average marketing cost per kilogram of dried fish from Castillo to Libmanan was ₱0.16 and from Castillo to Sipocot was ₱0.51. The higher costs on the Sipocot route were the result of the small volume that was marketed, transportation expenses being the same whether 10 kg or 50 kg was transported.

Table 6. Average middleman daily costs and returns in pesos for dried fish marketing (Cabusao-Libmanan and Cabusao-Sipocot routes), San Miguel Bay, 1980-1981.

Per middleman costs and returns		
Daily purchases (kg)		33.1
Daily costs		
Cost of purchases	215.00	
Prorated fixed costs[1]	1.27	
Variable (operating) costs[2]	9.49	
Subtotal	225.76	
Daily returns		
Sales of dried fish	236.00	
Daily net return to middleman's capital, labor and management	10.24	
Less opportunity cost of capital[3]	0.11	
Daily net return to middleman's labor and management	10.13	
Per kilogram costs and returns		
Average price paid	6.50	
Average marketing cost	0.32	
Average selling price	7.13	
Margin	0.63	
Average net return to middleman's labor and management	0.31	

[1]Major investment items are weighing scale and various containers. Costs of these are prorated over the average operating 164 days/year of the dried fish middlemen.
[2]Major costs are own transportation (₱5.67), freight charge (₱1.07), market fees (₱1.17) and bad debts prorated daily (₱1.58).
[3]Based on 9% of average ₱1.98 investment cost prorated on daily basis.

Deducting these marketing costs from the daily returns for the two routes for the four species, provided a return to the middlemen's capital, labor and risk of ₱10.24. On average, Cabusao-Sipocot shipments would not be profitable because the average price differential (₱0.34) did not cover the ₱0.51/kg marketing costs. On certain days, such as market days, however, the price differential was sufficient to offset marketing costs, and small shipments would be made along this route.

Based on the present survey, the average quantity marketed by the middlemen was only 33.1 kg, which provided a daily income of approximately ₱10.13 (after deducting opportunity costs of own capital, Table 6). Given this level of income for the 14 middlemen who regularly serve this route, it was not possible to argue that exorbitant profits are being earned. In fact, it was found that the prevailing attitude among those who sold dried fish in the local markets (and the fishermen and processors who supplied them) was one of live-and-let-live, each recognizing the other's need to share in the net returns that could be earned in the marketing system. Despite the ease of entry, initial capital requirements of less than ₱500, the Cabusao-based marketing system is very reminiscent of Szanton's (1972) observations on the 'right to survive' in rural Philippine markets, be they for fish or other produce.

Middlemen, or rather middlewomen, who handle most of the Cabusao dried fish supply destined for nearby retail markets, earned daily incomes comparable to those of most of the community's fishermen.

Fresh Fish Marketing

In contrast to *balao* salting and dried-fish processing and marketing, fresh fish marketing is not a major activity in Castillo, Cabusao. Other than iced shrimp which is shipped from the San Miguel Bay area primarily to Manila wholesalers, most of the fresh fish products from the Bay are sold locally. In Castillo, very little of the catch not destined for processing (salting or drying) reaches markets beyond Libmanan and Sipocot. There are seasonal variations to this pattern (Esporlas 1982), but the major market for fresh fish landed in Castillo is Libmanan, and only secondarily Sipocot.

In contrast to the processing activities previously described where there were several large-scale businesses, fresh fish marketing over the Castillo-Libmanan route was handled by a relatively small group of 32 women from the two communities, each of whom bought and sold only small quantities. These women relied on public transportation, i.e., jeepneys (Fig. 6), to bring their purchases to Libmanan. Frequently travelling together in the same jeepney (only five to eight jeepneys service the Cabusao-Libmanan route on a regular basis) the quantities which each can handle were small, and at the time of the survey (April 1981), averaged only slightly more than 10 kg/middlewoman daily.

The shipments of fresh fish from Castillo to Sipocot were irregular, but when the relative market prices warranted it, fresh fish was marketed over this route. The average quantity handled per middlewoman was somewhat higher (16 kg), but so were their transportation expenses.

The fresh-fish catch landed in Barcelonita, another barrio in the western extremity of Cabusao was almost all marketed in Sipocot and Naga City; very little goes to Libmanan because there is no regular public transportation between Barcelonita and Libmanan. The Libmanan fresh fish supply thus comes almost entirely from the Cabusao barrios, such as Castillo, in the immediate vicinity of the Bicol River. Some pelagic species are also brought into the Libmanan market from Pasacao on the Ragay Gulf of the Bicol region.

For the purposes of the present survey, 14 of the 32 middlewomen who regularly bought fresh fish in Castillo and sold them in Libmanan were interviewed. Their total time involvement was 3-5 hours/day, 324 days/year. Those few who used the Castillo to Sipocot route worked about twice as long, 7-8 hours/day, and approximately the same number of days per year on average.

Fig. 6. Jeepneys are used extensively to move fish between communities where serviceable roads exist.

Attempts to determine middlewomen daily incomes were made using two methods. First, costs and returns based on the April 1981 survey data were estimated; second, spatial price differentials were compared with respective marketing costs. The two sets of data gave different results as reported below.

COSTS AND RETURNS

Based on the survey, the average investment costs for these middlewomen was very low (₱35), most of the initial expense being for various-sized containers used to transport the purchases (Table 7). Major variable costs were for ice and transportation (Table 8), over and above the cost of their purchases. Total daily capital requirements ranged from ₱50 to ₱100 plus the credit extended to *suki* customers in Libmanan. No licenses were required for these middlewomen, though each paid a daily market stall fee in Libmanan or Sipocot.

Table 7. Average investment costs in pesos of fresh fish middlewomen (n = 14) who buy in Castillo and sell in Libmanan and Sipocot, San Miguel Bay, April 1981.

Item	Average no. owned (n_i)	Acquisition cost per item (C_i)	Expected life	Average annual depreciation per item (D_i)
Styrofoam boxes	0.125	40	1 yr	40
Weighing scale	0.06	150	6 yr	25
Containers				
Tubs (small)	0.188	11	1 yr	11
Pails	0.563	12	2 yr	6
Baskets *(tiklis)*	0.75	7	6 mo	14
Baskets *(baca-baca)*	0.06	8	6 mo	16
Other baskets	0.875	7	6 mo	14
Cans	0.06	8	2 mo	48

Average investment costs per middlewoman = $\sum n_i C_i$ = ₱35.16

Average annual depreciation per middlewoman = $\sum n_i D_i$ = ₱38.54

Table 8. Daily variable (operating) costs in pesos for fresh fish middlewomen who buy in Castillo and sell in Libmanan and Sipocot, San Miguel Bay, April 1981.

Item	Castillo-Libmanan	Castillo-Sipocot
Ice	0.75	3.00
Transportation		
Own fare (back and forth)	2.00	7.00
Freight	0.25	1.10
Market stall fee	0.30	1.50
Miscellaneous (snacks, etc.)	0.46	0.85
Total	3.76	13.45
Average volume handled (kg)	10.4	16.5
Average variable cost per kg	0.36	0.82
Average period worked per day (hours)	3-5	7-8

For their three to five hours of daily work, the Castillo-Libmanan middlewomen earned a return to their own labor, management and risk of approximately ₱10; the Castillo-Sipocot middlewomen who worked twice as long earned about twice this amount (Table 9).

The above results imply that fresh fish marketing is handled by predominantly low-volume part-time middlewomen who earn a daily return comparable to that earned by many of the fishermen from whom they make their purchases.

PRICES AND SPATIAL PRICE EFFICIENCY

In addition to interviews of fresh fish middlewomen, the prices of the major fresh fish species in Castillo, Libmanan and Sipocot were monitored for one year, February 1980-January 1981. These data were supplemented with secondary price data collected by the PFMA at Sabang and Camaligan landings near Naga City. The five major species monitored were the croakers *(abo* and *pagotpot)*, mullets *(banak)*, herring *(tamban)* and crabs *(kasag)*. The price data for each of these five species are shown in Figs. 7-11.

As noted earlier, the prices of major species from multispecies transactions were estimated at the Castillo landings. There were also occasions when these species were sold singly; these prices were collected also. Except in the case of *tamban*, there was no significant difference between these

Table 9. Daily costs and returns in pesos for fresh fish middlemen who buy in Castillo and sell in Libmanan and Sipocot, San Miguel Bay, April 1981.

	Castillo-Libmanan	Castillo-Sipocot
Daily purchases and sales (kg)		
Average volume purchased and sold	10.4	16.5
Daily costs		
Cost of fresh fish purchased	45.25	85.00
Prorated fixed costs[1]	0.11	0.11
Variable (operating) costs	3.76	13.45
Total daily costs	49.12	98.56
Daily returns		
Sales of fresh fish	59.10	120.00
Daily net return to middleman's own capital, labor and management	9.98	21.44
Less opportunity cost of capital[2]	0.01	0.01
Daily net return to middleman's own labor and management	9.97	21.43
Per kilogram costs and returns		
Average price paid	4.35	5.15
Average direct marketing cost[3]	0.37	0.82
Average selling price	5.68	7.27
Average net return to labor and management	0.96	1.30

[1]Total of depreciation (₱38.54) prorated over average 324 days of operation per year.
[2]Nine percent of investment cost (₱35.16) prorated daily.
[3]Fixed and variable (operating) costs only. Does not include net return to middleman's own capital, labor and management.

two sets of prices during the period of observation, so there was no price advantage for fishermen to sort their catch by species before sale.

Similar to the analysis of dried fish prices, the extent of correlation among the spatially diverse prices was determined for each species based on average weekly prices; in all cases it was found to be low. In no case did the correlation coefficient (r) exceed 0.75. In most cases, it was well below 0.50. Even on the Cabusao-Libmanan route no significant correlation was found between prices.

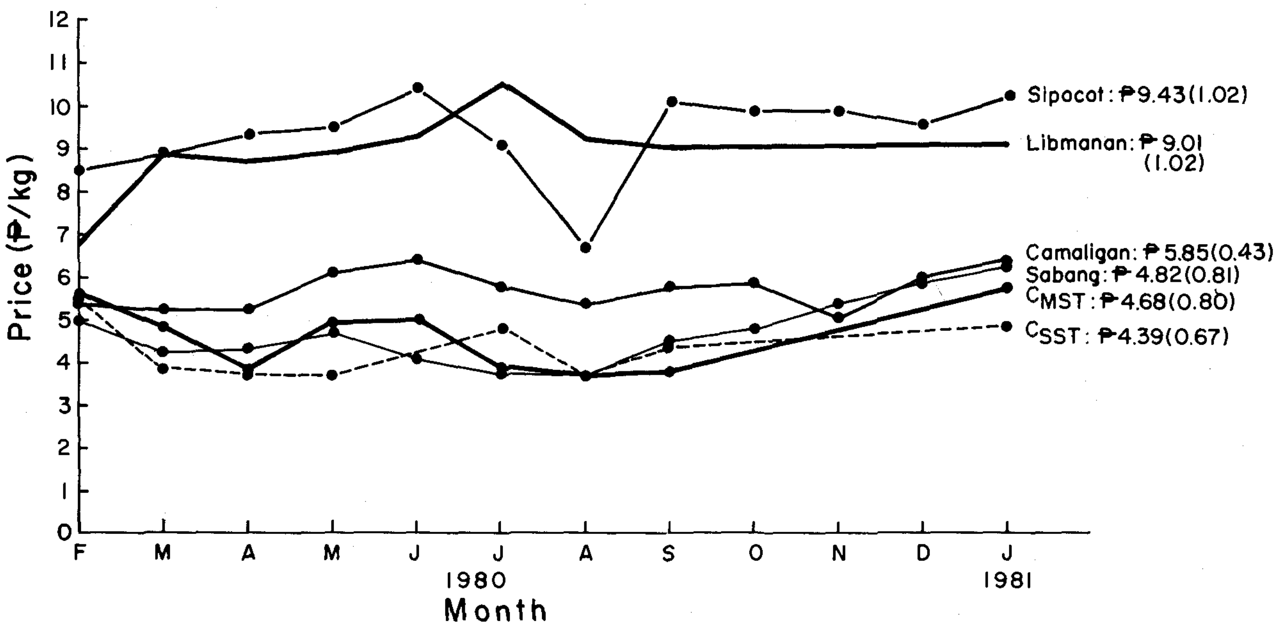

Fig. 7. Average monthly price for fresh croaker *(abo)* in selected landings and markets, San Miguel Bay, 1980-1981. Average prices for the 12-month period are shown with standard deviation in parentheses. C_{MST} = Cabusao price for multispecies transactions; C_{SST} = Cabusao price for single-species transactions.

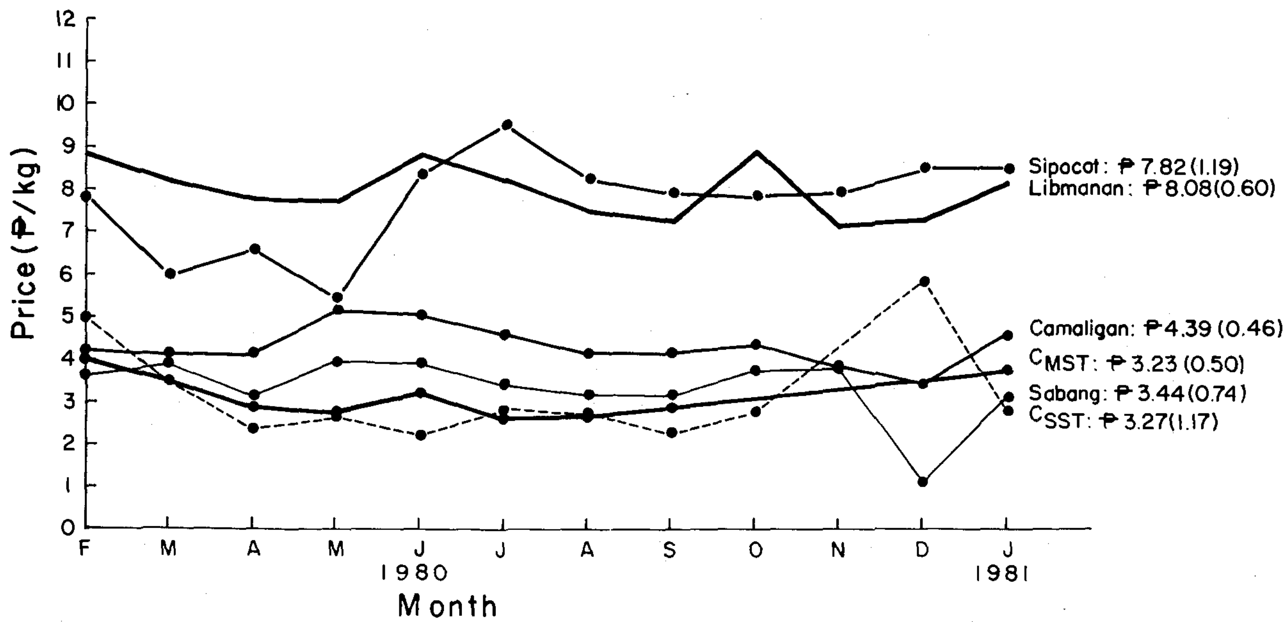

Fig. 8. Average monthly price for fresh croaker *(pagotpot)* in selected landings and markets, San Miguel Bay, 1980-1981. Average prices for the 12-month period are shown with standard deviation in parentheses. C_{MST} = Cabusao price for multispecies transactions; C_{SST} = Cabusao price for single-species transactions.

One cause of these low correlations was the reasonable stability of prices. The implication of these findings is that there was either a poor price information network or our price data were inaccurate. For all five species, the data were collected carefully and the relative prices appeared to be reasonably correct and consistent, that is, lower at the landings (Cabusao, Sabang, Camaligan) and highest in the markets (Libmanan and Sipocot).

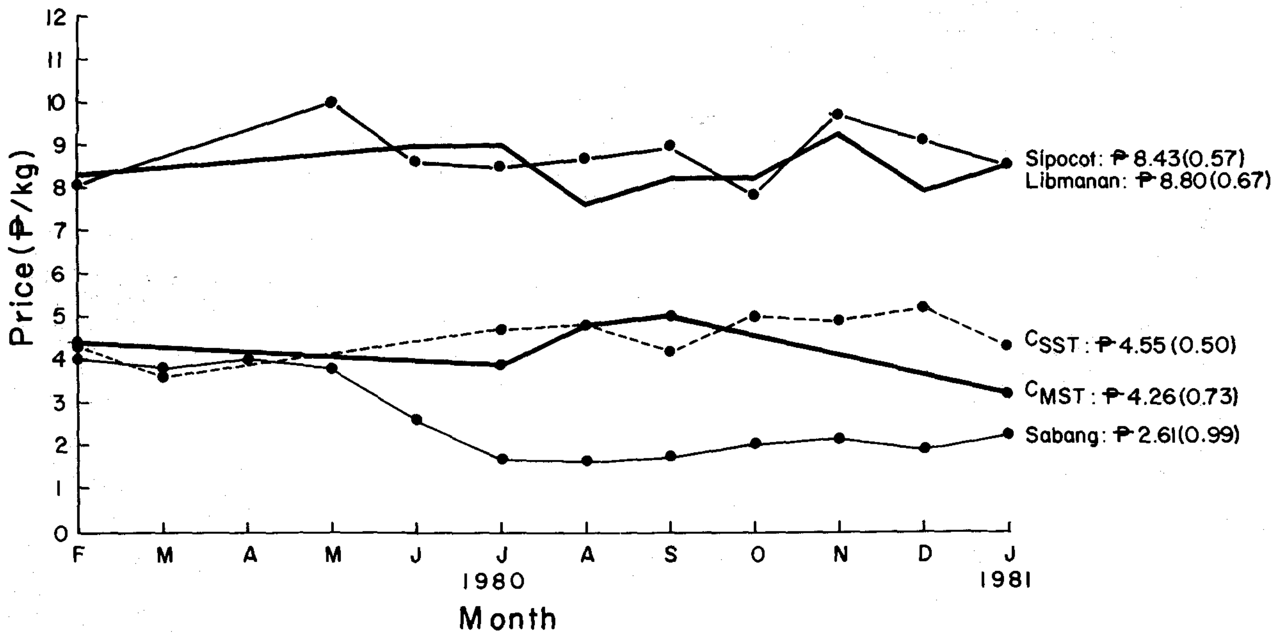

Fig. 9. Average monthly price for fresh mullet *(banak)* in selected landings and markets, San Miguel Bay, 1980-1981. Average prices for the 12-month period are shown with standard deviation in parentheses. C_{MST} = Cabusao price for multispecies transactions; C_{SST} = Cabusao price for single-species transactions.

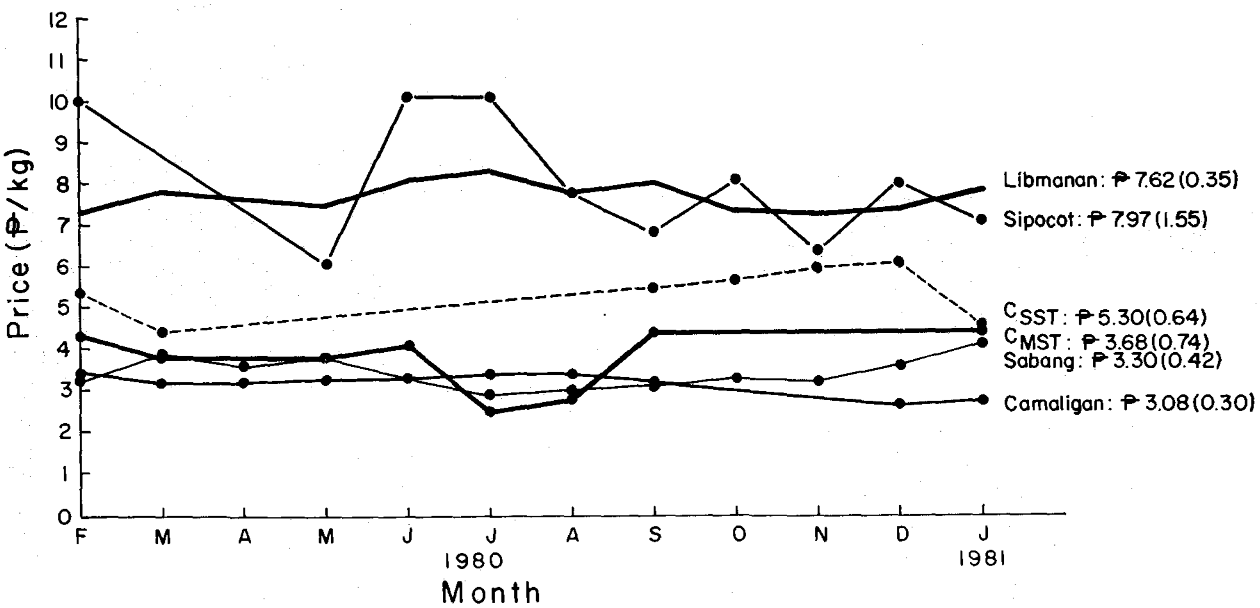

Fig. 10. Average monthly price for fresh herring *(tamban)* in selected landings and markets, San Miguel Bay, 1980-1981. Average prices for the 12-month period are shown with standard deviation in parentheses. C_{MST} = Cabusao price for multispecies transactions; C_{SST} = Cabusao price for single-species transactions.

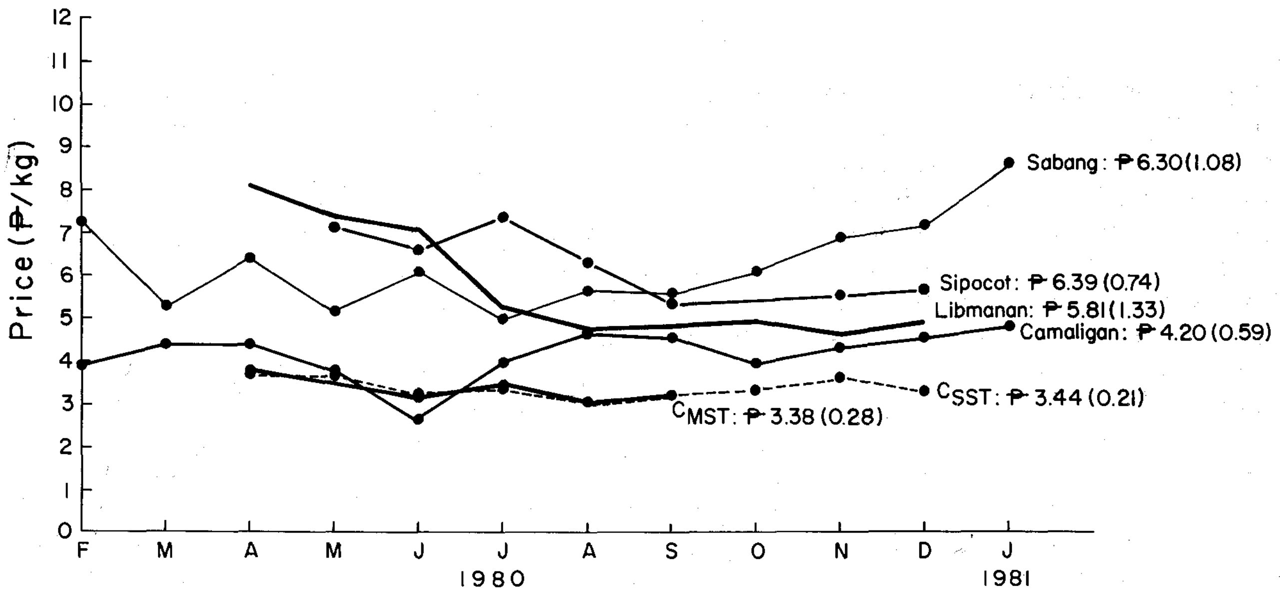

Fig. 11. Average monthly price for fresh crabs *(kasag)* in selected landings and markets, San Miguel Bay, 1980-1981. Average prices for the 12-month period are shown with standard deviation in parentheses. C_{MST} = Cabusao price for multispecies transactions; C_{SST} = Cabusao price for single-species transactions.

Nevertheless, the price differentials for the five species, based on these price data, were generally larger than the mark-ups derived from the prices (purchases and sales) information provided by the 14 fresh fish middlewomen interviewed in April 1981. Although the middlewomen assured the interviewers that the volume and cost data provided were "usual", it is believed that both the volume handled and the prices received were understated. The cost data provided appeared reasonable, based on assessment of 1981 marketing costs.

It was concluded that daily income of fresh fish middlewomen on the Cabusao-Libmanan route was probably closer to ₱35/day. The average price differential for the five species during 1980-1981 was ₱3.82/kg. Subtracting direct marketing costs of ₱0.37/kg (from Table 3) results in a return to the middlewomen's capital, labor, management and risk of ₱3.45/kg, considerably higher than the ₱0.96/kg determined by the survey of middlewomen.

Finally, the nature of the mark-ups for the five species was examined, using simple regression techniques ($P_y = \alpha + \beta P_x$); there was no consistent pattern. The mark-up between the receiving market Y and the shipping market X was constant ($H_0: \beta \neq 1$ rejected) for *abo* and *banak* and apparently based on a percentage ($H_0: \beta \neq 1$ not rejected) for *kasag*. For *pagotpot* and *tamban* β was not significantly different from zero, implying roughly constant prices in Libmanan, regardless of price fluctuations in Cabusao.

One major source of pricing inefficiency in the present marketing system is the practice of selling by volume rather than by weight. A second cause of pricing inefficiency is that the sole providers of price information to fishermen sellers for fresh fish are the middlewomen themselves. Fishermen or their wives have little knowledge of prevailing prices in Libmanan so the middlewomen have a bargaining advantage over the fishermen or female members of their households who sell the catch. These two factors, it is believed, are the primary causes of the high mark-ups that prevail between Cabusao and Libmanan for the five fresh fish species monitored in this survey.

Conclusions

Catches landed at Castillo, Cabusao fluctuated widely from month to month (see Smith et al., this report). Prices for the major species were considerably more stable. Fishermen and middlemen claimed that the usual inverse relationship between supply and prices did not hold for the San Miguel Bay landings. The present survey findings support their contention that when supply was high, demand in the form of larger numbers of buyers was also high. When supply was low, buyers were less likely to frequent the San Miguel Bay area and demand was thus also lower. The net result of this was that local prices tended to be reasonably stable as external demand (i.e., Manila), which draws on numerous fisheries throughout the country, fluctuated locally.

To this point, one of the selling methods at the landings, which is unique to the Philippines, has not been mentioned. Catches not predestined to particular buyers are sold through a whisper bidding system known as *bulungan*. It has been alleged on numerous occasions that this system results in prices paid being lower than would be the case if the bidding were open. No evidence was found, however, to indicate that this is the case nor did fishermen complain about this system. A careful collection and analysis of price data under alternative selling arrangements would be necessary to resolve this issue. The less rigorous observations of the *bulungan* system made during the survey were that it offered flexibility to fishermen sellers (or female members of their households) in selecting their buyers. They could, if they were not satisfied with the whisper bids received, open the bidding. They could also select the buyer whom they consider to be most reliable rather than necessarily the highest bidder, an important consideration if the seller was not paid until after the buyer has disposed of the purchases. In the assessment of the survey team, changes in the *bulungan* system would have marginal benefits, if any, for fishermen.

Cabusao's primary links with external markets (as distinct from local provincial markets) are through its processed products—salted *balao* and dried fish. Although no significant economies of scale were found to exist in either of these processes, the fish-drying activity in particular had a higher degree of market concentration than any of the other processing and marketing activities in the San Miguel Bay area. In Cabusao, a single processor had a 50% market share. In contrast, local dried and fresh fish marketing was performed by larger numbers of small-volume, low-income middlewomen.

Possibilities exist for technical improvements in processing. For example, the traditional drying procedures practiced in San Miguel Bay communities are quite different from those currently recommended by fish processing technicians from the University of the Philippines (NSDB 1980). The university technicians recommend a shorter 40-60 minute soaking period followed by a longer two- to three-day drying period. The longer soaking period of the traditional method allows more water to leach out at this stage which greatly shortens the required drying period. However, the salt content of the traditional product is very much higher; 13% by weight in contrast to 5% for the university recommended product. The rapid drying of the traditional product causes case (surface) hardening and leaves the inside still moist. The surface salt cakes after two weeks giving the traditional product a chalky, white appearance and a hard and brittle texture. It is also more hygroscopic than the recommended product because the surface salt tends to absorb moisture from the air thus leading to earlier spoilage.

The process recommended by the university technicians produces a product which is definitely of higher quality, but there are several reasons why the traditional process generally persists despite several years of extension effort in Castillo and other San Miguel Bay communities by the technicians. First, the traditional product with its higher salt and moisture content is heavier than its recommended counterpart. Buyers do not yet distinguish between the traditional and the recommended product so there is no incentive for the processor to produce a higher quality but lighter product because it is sold by weight. Buyers are not too interested either in the higher quality product because most of what they purchase is sold through the marketing channels to the final consumer within two weeks, thus before salt-caking and brittleness becomes a problem. Recently, a group of women from Castillo have grouped together to obtain a government loan to continue the university recommended process and there is hope that both buyers and consumers will come to recognize the higher quality product and be willing to pay a premium for it. It will obviously take some time, however.

For fishing households to benefit from improvements in the processing and marketing sector, it will be necessary for them to become more involved in these activities. Because dried fish and salted *balao* are the largest volume products handled by the communities of Cabusao and Sabang, it is in this area that the greatest potential exists for group activities of fishing households. Presently there is no organized form of cooperation among fishing households and a major barrier to the successful formation of group efforts to compete with the large-scale processors will be the large operating capital requirement.

The investment costs for the processing activities are not high, but the fishermen's needs for gasoline advances demand considerable working capital of processors. In return for these advances, processors receive assurance of supply. Gasoline supply and processing are thus inextricably linked in Cabusao and any organization of fishermen in the area must be able to be competitive in both areas.

In conclusion, it is worth reiterating the need for an improved price information network; that is, a means to provide a check and balance to the present system which concentrates all price information in the hands of buyers. Improvement in the municipal monitoring of landings in the form of implementation of a uniform system of weights and measures would add considerably to the ease of making price comparisons between markets and locations. This recommendation is of more than mere academic interest (although it would certainly aid price analysis considerably) because any improved flow of market and price information in the processing and marketing sector will stimulate increased efficiency to the benefit of both fishermen producers and consumers.

References

BAEcon. n.d. A survey on fish marketing in Iloilo, Bacolod and Zamboanga. A joint research undertaking of the Bureau of Fisheries and Aquatic Resources and the Bureau of Agricultural Economics, Ministry of Agriculture, Quezon City, Philippines.

Bain, J.S. 1968. Industrial organization. 2nd ed. John Wiley and Sons Inc., New York.

Esporlas, A.E. 1982. The seasonality of fishing, marketing and processing, p. 14-24. *In* C. Bailey (ed.) Small-scale fisheries of San Miguel Bay, Philippines: social aspects of production and marketing. ICLARM Technical Reports 9, 57 p. Institute of Fisheries Development and Research, College of Fisheries, University of the Philippines in the Visayas, Quezon City, Philippines; International Center for Living Aquatic Resources Management, Manila, Philippines; and the United Nations University, Tokyo, Japan.

Jones, W.O. 1972. Marketing staple food crops in tropical Africa. Cornell University Press, Ithaca.

NCSO. 1975. 1975 integrated census of the population and its economic activities: population, Camarines Sur. National Census and Statistics Office, Manila.

NSDB. 1980. Philippine handbook on fish processing technology. National Science Development Board, Manila.

Orejana, F.M. 1982. Low-cost fish processing and the use of appropriate technology in the Philippines, p. 153-160. *In* R.C. May, I.R. Smith and D.B. Thomson (eds.) Appropriate technology for alternative energy sources in fisheries. ICLARM Conference Proceedings 8. 215 p. Asian Development Bank and International Center for Living Aquatic Resources Management, Manila, Philippines.

Pauly, D. and A.N. Mines, Editors. 1982. Small-scale fisheries of San Miguel Bay, Philippines: biology and stock assessment. ICLARM Technical Reports 7, 124 p. Institute of Fisheries Development and Research, College of Fisheries, University of the Philippines in the Visayas, Quezon City, Philippines; International Center for Living Aquatic Resources Management, Manila, Philippines; and the United Nations University, Tokyo, Japan.

Piansay, E., Z. dela Cruz and M. Lizarondo. 1979. Marketing operations of sustenance fishermen in Camarines Sur. Agricultural Marketing Report Vol. 1, No. 1. Bureau of Agricultural Economics, Ministry of Agriculture, Quezon City.

Szanton, M.C.B. 1972. A right to survive: subsistence marketing in a lowland Philippine town. The Pennsylvania State University Press, University Park.

Yater, L. 1982. The fisherman's family: economic roles of women and children, p. 42-50. *In* C. Bailey (ed.) Small-scale fisheries of San Miguel Bay, Philippines: social aspects of production and marketing. ICLARM Technical Reports 9, 57 p. Institute of Fisheries Development and Research, College of Fisheries, University of the Philippines in the Visayas, Quezon City, Philippines; International Center for Living Aquatic Resources Management, Manila, Philippines; and the United Nations University, Tokyo, Japan.

Appendix

Weekly Average Prices of Four Dried Fish Products in San Miguel Bay Area Markets 1980-1981

Table I. Weekly average price/kg of split croaker *(abo)* in pesos in selected markets, 1980-1981.

Date	Cabusao	Libmanan	Sipocot	Naga
Feb 1980	14.29	14.40	13.50	15.67
	14.63	15.65	–	17.00
	14.48	–	13.50	15.50
	–	–	–	–
Mar	13.38	14.90	13.50	16.00
	12.20	12.25	–	17.50
	13.33	13.75	14.00	16.50
	13.57	12.97	11.50	15.75
Apr	13.94	14.58	13.83	16.75
	13.13	13.23	13.34	16.00
	12.48	13.35	12.75	16.25
	11.54	14.44	12.60	15.80
May	11.83	13.25	11.67	16.80
	13.00	12.94	12.17	16.50
	14.56	13.00	13.44	17.25
	13.31	14.62	13.25	16.00
June	14.69	14.67	–	19.20
	14.33	14.69	13.46	19.67
	14.04	14.20	14.00	18.50
	14.06	14.08	13.92	17.00
July	13.00	14.18	13.89	16.75
	13.01	13.76	13.33	18.00
	12.69	13.69	13.25	19.00
	12.44	13.97	13.25	18.00
	12.89	13.74	12.50	18.00
Aug	13.54	14.91	13.67	17.00
	13.19	13.35	14.00	17.80
	13.04	14.45	13.50	18.83
	13.04	–	14.00	17.67
Sept	13.35	14.37	13.38	17.00
	12.78	13.02	13.75	18.00
	13.00	14.21	13.67	17.60
	13.67	14.83	14.59	17.00
Oct	13.50	14.50	14.00	16.90
	15.00	16.00	14.50	17.67
	–	14.70	14.00	17.87
	15.50	–	14.00	18.50

Continued

Appendix Table I continued

Nov	–	–	–	18.40
	–	18.00	–	16.00
	–	18.00	16.00	18.40
Dec	–	16.00	15.00	18.80
	15.60	16.80	–	19.75
	16.00	15.00	–	18.00
	–	–	–	–
Jan 1981	–	17.25	14.50	16.00
	16.33	17.00	17.00	17.00
	16.50	–	15.60	17.00
	–	–	–	18.00
12-month average	13.71	14.57	13.73	17.36
Standard deviation	1.18	1.37	1.04	1.10

Table II. Weekly average price/kg in pesos of whole croaker *(pagotpot)* in selected markets, 1980-1981.

Date	Cabusao	Libmanan	Sipocot	Naga
Feb 1980	11.58	–	6.25	13.33
	11.49	13.00	10.75	14.00
	12.13	12.00	11.63	13.00
Mar	11.42	12.42	11.40	11.67
	–	11.00	10.33	11.50
	10.33	11.44	11.75	11.60
	12.30	9.00	13.25	10.75
Apr	12.25	12.28	12.00	12.00
	10.70	12.60	9.75	13.00
	11.50	12.38	10.68	13.00
	10.60	13.13	–	13.75
May	10.45	10.17	10.00	13.00
	–	12.75	10.17	12.00
	10.34	9.00	11.50	12.00
	8.44	13.50	12.00	12.00
June	13.00	13.75	13.00	14.00
	11.28	11.83	9.50	14.75
	11.30	–	10.00	15.00
	10.83	11.75	11.00	12.00
July	9.63	11.00	11.00	13.00
	9.44	10.00	12.00	13.00
	9.42	12.00	11.00	12.67
	9.00	11.00	10.60	12.50
	9.36	11.75	10.47	12.50
Aug	10.06	11.09	11.25	13.50
	9.46	10.50	10.50	13.00
	9.50	11.75	11.20	12.00
	–	–	10.00	13.67

Continued

Appendix Table II continued

Sept	9.77	11.00	9.90	12.50
	10.28	12.00	10.00	13.00
	–	11.45	–	13.67
	12.50	13.00	9.40	13.50
Oct	11.00	–	12.00	13.25
	11.25	13.00	10.75	13.50
	11.00	–	9.00	14.00
	13.00	–	11.30	14.67
Nov	–	12.30	–	14.33
	–	15.00	–	13.00
	–	13.00	–	13.00
	–	–	–	14.23
Dec	–	12.80	–	13.80
	–	13.20	12.50	14.75
	11.50	13.00	–	14.00
Jan 1981	13.00	–	–	15.00
	13.80	–	12.50	15.00
	–	–	–	15.00
12-month average	10.94	11.97	10.84	13.23
Standard deviation	1.30	1.30	1.29	1.06

Table III. Weekly average price/kg in pesos of whole herring *(tamban)* in selected markets, 1980-1981.

Date	Cabusao	Libmanan	Sipocot	Naga
Feb 1980	10.10	10.00	10.00	11.00
	11.40	11.25	12.00	10.00
	10.90	11.75	11.25	11.00
	10.50	11.10	10.50	12.50
Mar	9.70	9.25	10.00	11.70
	11.00	10.90	9.40	11.25
	10.70	10.90	10.30	11.30
Apr	10.50	11.60	9.40	13.00
	9.75	11.00	9.90	13.00
	9.80	10.30	8.50	12.00
	9.25	10.20	11.00	11.50
May	10.50	10.10	7.75	9.50
	11.00	10.30	9.50	9.50
	11.00	9.70	–	9.50
	10.70	10.10	10.20	13.00
June	9.00	10.50	–	12.00
	9.60	11.30	10.00	–
	10.30	10.00	10.50	12.00
	10.00	10.40	10.30	10.75

Continued

Appendix Table III continued

July	10.00	10.10	–	10.50
	10.15	11.30	10.00	11.00
	10.40	10.80	9.00	11.50
	9.50	10.30	8.00	11.75
	9.33	10.75	8.75	11.75
Aug	10.25	11.00	8.90	11.30
	11.65	10.25	8.80	11.00
	9.25	11.84	8.60	11.70
	9.25	–	7.00	10.50
Sept	9.20	10.80	8.80	11.30
	10.00	10.80	8.20	12.00
	9.80	10.20	9.30	11.30
	9.70	10.00	10.30	11.25
Oct	9.35	10.30	10.00	12.00
	9.85	10.00	8.90	12.00
	9.50	9.90	8.90	11.50
	10.00	–	9.00	–
Nov	10.00	11.50	–	12.00
	10.10	12.00	10.00	12.00
	9.70	11.60	12.00	12.00
	10.30	10.00	10.00	12.00
Dec	10.70	12.00	–	12.00
	9.70	10.50	10.50	12.00
	10.60	–	–	12.00
Jan 1981	10.90	12.00	11.30	14.00
	11.00	12.20	12.50	14.00
	12.70	–	–	15.00
	–	–	–	15.00
12-month average	10.07	10.73	9.72	11.75
Standard deviation	1.06	0.74	1.19	1.20

Table IV. Weekly average price/kg in pesos of split mullet *(banak)* in selected markets, 1980-1981.

Date	Cabusao	Libmanan	Sipocot	Naga
Feb 1980	10.00	–	10.00	12.50
	–	9.50	12.00	11.70
	–	11.40	–	11.70
Mar	11.00	11.80	10.90	12.00
	10.00	10.50	14.00	12.00
	–	12.00	12.25	12.50
	–	–	12.50	12.00
Apr	–	11.50	–	12.00
	–	–	–	12.00
	–	–	–	12.25
	–	10.00	–	12.25
May	–	–	–	12.00

Continued

Appendix Table IV continued

	–	11.50	–	12.00
	–	12.00	11.00	–
	9.50	9.00	–	13.00
June	7.00	10.00	10.00	13.75
	–	11.00	9.80	12.00
	7.00	11.00	10.00	11.00
July	6.90	10.10	10.00	12.00
	7.00	9.80	9.00	11.00
	7.00	7.90	9.40	10.75
	7.00	8.80	–	12.00
	7.00	10.25	9.10	12.00
Aug	7.40	9.50	9.60	11.00
	7.50	9.25	8.00	9.00
	7.50	8.80	–	8.00
	–	–	9.25	9.00
Sept	7.50	10.30	9.40	11.25
	7.00	9.10	8.00	–
	–	10.10	9.30	12.00
	7.50	10.00	8.80	11.00
Oct	7.50	10.30	9.30	12.80
	7.10	7.80	9.10	15.70
	8.50	8.60	9.30	10.00
	7.50	–	8.60	10.00
Nov	7.90	10.00	10.00	11.33
	8.10	12.00	8.50	10.00
	–	10.30	–	10.00
Dec	8.70	10.40	9.00	10.70
	9.15	10.50	9.50	12.00
	–	8.00	9.80	11.00
Jan 1981	8.20	10.70	–	12.00
	–	11.75	10.25	12.00
	–	–	11.60	12.00
	–	–	–	12.00
12-month average	7.94	10.15	9.73	11.56
Standard deviation	1.13	1.18	1.62	1.29

Implications for Equity and Management

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Abstract

The economic efficiency and distribution of benefits from the fisheries of San Miguel Bay, Philippines are examined in this paper. The total annual value of catch from the Bay in 1980-1981 was estimated to be ₱53.5 million (US$6 million). Small trawlers, which represented only 3% of the fishing units and employed 7% of the labor force were found to earn the largest shares of total catch value and 50% of the ₱3 million pure profits, or resource rents. The open-access equilibrium of this fishery has not been reached but further increases in fishing effort would reduce economic efficiency and resource rents.

Attention is drawn to the divergence between goals of economic efficiency and equity and it is concluded that serious consideration should be given to limiting effective fishing effort in this fishery so as to maintain positive resource rents and to deal with the presently highly skewed distribution of benefits that favors trawlers at the expense of non-trawl gears.

Introduction

This paper has two objectives. The first is to summarize the costs and earnings data presented in the other papers in this report so that comparisons between gear types can be highlighted. The second is to discuss the implications of these findings for issues of economic efficiency, equity and management of the San Miguel Bay fisheries. A full discussion of management options can be found in the concluding volume of this series on the San Miguel Bay fisheries.

Before presenting the summary findings it is necessary to discuss some of the concepts and terms that have been used in this study, in particular the concept of opportunity cost (see also

Smith et al., this report) because its determination is critical to the evaluation of the economic health of the fisheries. Opportunity costs of the factors of production (labor and capital) are the returns that could be earned by using these respective factors in the next best activity. Most costs and earnings studies omit this cost item (e.g., Ovenden 1961; Kurien and Willmann 1982) because they focus on financial analyses and residual returns to capital and labor. These residuals were certainly of interest in San Miguel Bay fisheries because they represent the cash income of owners and crewmen. For owners and crewmen, incomes earned are the prime factors in determining whether they continue to engage in fishing. But to weigh the option of fishing against other occupations or sources of income, owners and crewmen must compare their earnings with those that could be earned in alternative activities; in other words they must compare their returns to capital and/or labor with potential returns in the next best use.

However, Panayotou (1981) has pointed out the dichotomy that exists between conditions of entry to and exit from a fishery. The potential entrant to a fishery may be guided in part by the opportunity cost concept but the individual already engaged in fishing may find it difficult to shift his assets (i.e., vessel and gear) out of the fishery and into some alternative use, although he could consider selling out. Capital is likely to be more immobile than labor under such circumstances. The non-owner, for example, has somewhat more flexibility (assuming options for labor exist) than owners whose vessels and gear represent sunk costs. On the one hand, owners will continue to employ their vessels and gear as long as their variable costs are met. A potential entrant to the fishery, on the other hand, will want to be able to cover both variable and fixed costs. This dichotomy explains why existing vessels will continue to fish even when the profits earned are insufficient to attract additional entrants.

The presence of pure profit is an indication that open-access equilibrium of an open-access fishery has not yet been reached. To determine whether any pure profit (rent) exists in the fishery, it is necessary to conduct more than a financial analysis. Opportunity costs of capital and labor must be included as costs also and deducted along with other variable and fixed costs from total revenues to determine the pure profit or loss in the fishery. These opportunity costs are sometimes treated as variable costs (for labor) or fixed costs (for capital) (e.g., Panayotou et al. 1982). In the papers of this report, the three costs (fixed, variable, opportunity) are treated separately, so that readers will recognize the traditional expression of costs and earnings as 'return on investment' before opportunity costs of capital are deducted. A fishery would be fully exploited if, after deducting fixed, variable and opportunity costs from total revenues, no pure profit (or rent) remains (Fig. 1).

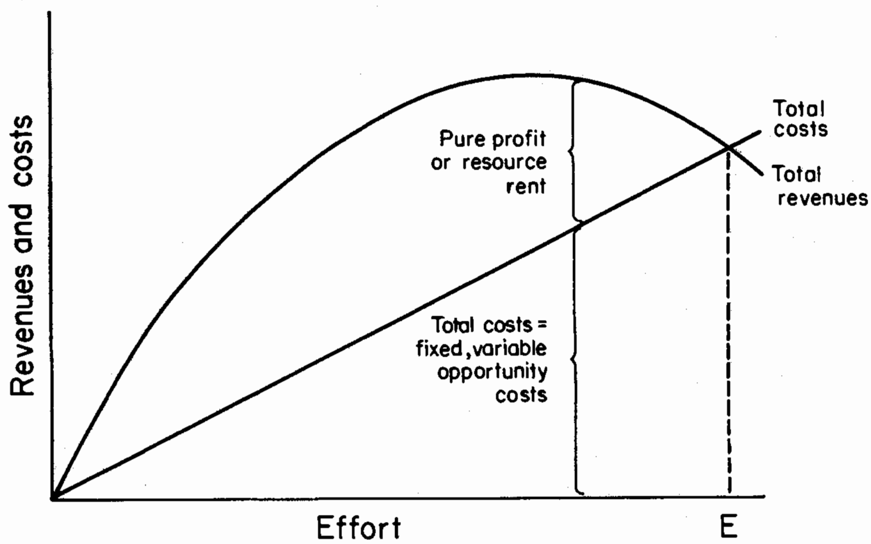

Fig. 1. An open-access fishery will tend to equilibrium (E) where total revenues just cover fixed, variable and opportunity costs and no pure profit (or rent) is earned.

The determination of the appropriate opportunity costs for capital and labor is not an easy task. Over- or underestimating either will result in a misrepresentation of the pure profits or loss in the fishery. There are those who argue that the true social opportunity cost of labor in small-scale fisheries is zero. However, this is not the case for San Miguel Bay fisheries because opportunities as laborers on rice fields and copra plantations or as piece-workers in processing establishments do exist in most communities, albeit at low wages. Also, migration of labor out of Bicol to better opportunities elsewhere is also possible and indeed is occurring (Bailey 1982). Under such circumstances, one would be hasty to conclude that the opportunity cost of labor is zero (Squire and van der Tak 1975). Consequently, for this study, a positive opportunity cost for labor was determined.

A careful assessment of the risks in these alternative occupations compared to the risks inherent in fishing has not been made. Therefore, any income earned by fishing labor above its opportunity cost includes a potential premium for risk. For most alternative activities, the opportunity wage was ₱10/day. Only in Sabang, Calabanga was there a higher daily opportunity wage of ₱15. This was offset by lower wages in communities such as Siruma, and the ₱10 daily opportunity cost of labor was used throughout this study as a reasonable average.

Depending upon location and the level of their capital assets, owners of fishing units have varying options for alternative investment. One option is to deposit their capital in the local rural bank and earn interest on their savings. This may be the only alternative for those with limited capital while those with more could consider a wide range of productive investments, such as fish processing, pig farming or public transportation. Opportunities for alternative investment are greater in those communities such as Sabang, Calabanga which have more varied economic sectors and are close to markets. Because opportunity costs of capital are a function of the level of capital available, ideally a different opportunity cost should be used for all gear types. In the absence of sufficient data to allow this more refined estimation, the 9% rural bank savings rate was used for analysis of all gear types. It should be kept in mind that to the extent that this rate understates the return that could be earned outside fishing (e.g., trawler operators with their high capital assets may be able to earn more than 9% elsewhere), it results in an overestimate of the pure profits of that gear type.

For discussion of economic efficiency and equity issues in San Miguel Bay, it will thus be necessary to look at both pure profits (or loss) and actual incomes derived by owners and crewmen of each gear type.

A second major point concerns the extrapolation of costs and earnings from the survey sample to the fishery as a whole. For cost reasons, the sample was drawn entirely from the two communities of Castillo, Cabusao and Sabang, Calabanga. The earnings of fixed gears are certainly location specific and this sample of them may not have been representative. For example, it is believed that the earnings of stationary liftnets were underestimated (see Supanga and Smith, this report). The mobile gears based in these communities, such as small and medium trawlers, mini trawlers and gill-netters all range throughout the Bay and thus are believed to be representative of the fishery as a whole. The majority of trawlers are, in fact, based in these two communities. Gill-netters in other communities which do not land their catch in Sabang and Castillo may have lower operating costs but it was assumed that these are offset by the lower prices that prevail in those more isolated communities and that their net revenues before sharing approximate those of the sample. These mobile gears caught 75.4% of the total catch of the Bay in 1980-1981. The survey data covered approximately 11,250 fishing trips. Consequently, it is concluded that extrapolation from the sample is reasonable as long as the reader recognizes the possible sources of bias.

Summary of Costs and Earnings by Gear Type

INVESTMENT COSTS

Eight gear types representing 1,587 (or 67%) of the 2,382 fishing units in San Miguel Bay were monitored on a daily basis for 12 months (June 1980-May 1981). These eight gears represent the extreme range of investment levels and degrees of capital intensity that prevail in the small-scale or municipal fisheries of San Miguel Bay (Table 1), and thus indicate the inappropriateness of placing all these gear types under the "municipal fisheries" label. This argument is set out in Smith et al. (this report) and Pauly and Mines (1982).

CAPITAL:LABOR RATIOS

As can be seen from Table 1, there are really three distinct categories of gear used in the Bay. At the lowest extreme are gears such as scissor nets, cast nets, fish pots and hook and line that have investment costs of less than ₱1,000 and low capital:labor ratios. Next is a mid-range group that includes the most important of the small-scale gears, with investment costs of ₱3,500-13,000 and capital:labor ratios of 2,300-4,600:1. At the highest extreme are small trawlers (classified in the Philippines as "municipal" trawlers because they are less than 3 GT) and medium trawlers (classified as "commercial" trawlers) which require investments of more than ₱50,000 and have capital:labor ratios of 11,000-12,000:1. Capital intensity increases with the level of investment required per fishing unit. Trawlers are thus labor saving when compared to other small-scale municipal gears.

Table 1. Investment costs, labor requirements and capital/labor ratios of major gear types in San Miguel Bay.

	1981/82 investment costs (₱)	Average labor requirements	Capital intensity[1]
Scissor net	250	1	250 : 1
Gill-net (motorized)	13,000	3	4,333 : 1
Mini trawler	9,200	2	4,600 : 1
Stationary liftnet	12,200	4	3,050 : 1
Fish corral	9,100	2	4,550 : 1
Filter net	3,500	1-2	2,333 : 1
Small trawler	55,000	5	11,000 : 1
Medium trawler	70,000	6	11,667 : 1

[1]Capital/labor ratio which shows investment cost per unit of labor.

DISTRIBUTION OF CATCH

The catching power of these diverse gears follows the same pattern (Table 2), and it is interesting to note how the total annual catch of San Miguel Bay is distributed among the major gear types. All catch (including *balao*) is included in these computations. Trawlers of all three types harvest almost 56% of the total catch; only gill-netters, among the non-trawl gears, have a significant share (19%) of total catch. Biologists argue for the exclusion of the *balao* catch from total catch when discussing distribution among gear types because it is a very distinct fishery and is not characterized by a high degree of competition among various gear types as are the other fisheries in the Bay (Pauly and Mines 1982). Gill-netters and small trawlers, for example, compete for many of the same species. If *balao* (and hence mini trawlers) are excluded from the total, trawlers catch 41% of the Bay's catch with non-trawl gears catching the remainder. Stationary gears catch less than 10% of the total. For purposes of comparing the value of catch and pure profits by gear types, *balao* (and mini trawlers) will be included in the subsequent calculations.

DISTRIBUTION OF THE VALUE OF CATCH

The total annual value of the San Miguel Bay fishery during the 1980-1981 period was over ₱53 million (Table 3). Fifty five percent of this total value was earned by the three categories of trawlers. Small trawlers, which represent only 3% of all fishing units, alone earned almost one-third of total catch value, an increase over their one-quarter share of total catch by volume because of

Table 2. Catch per trip, average effort and total catch of major gear types in San Miguel Bay, June 1980-May 1981.

Gear type	Av. catch/trip (kg)	Av. no. of trips/year	Total no. of fishing units	Total catch[3] Tonnes	Total catch[3] % of total		
Scissor net	6.0	44	634	167	0.9		
Gill-net (motorized)	45.3	234	350	3,710	19.6		
Stationary liftnet	69.0	55	171	649	3.4		
Fish corral	32.0	209	89	595	3.1		
Filter net	22.8	225	60	308	1.6		
Mini trawler	136.0	187	188	4,781	25.2	55.8	30.6
Small trawler	470.0[1]	127	75	4,477	23.6		
Medium trawler	520.0[1]	128	20	1,331	7.0		
Other gears[2]			795	2,949	15.5		
			2,382	18,967[2]	100		

[1]Vakily (1982) estimated medium trawler catch based upon a power factor of 1:1.5 over small trawler catch for the period 1979-1980. During the record keeping study, June 1980 to May 1981, the value of the catch/trip of medium trawlers was 11% higher than the value of the catch/trip of small trawlers. Since they caught the same species in the same proportion and sold in the same market, it was assumed in the above table a power factor of only 1:1.11. The figures differ from those in Pauly and Mines (1982) because the catch/trip for trawlers was based on a different time period.

[2]Based on Pauly and Mines (1982) but adjusting for our lower catch of medium trawlers.

[3]Includes *balao* catch of mini trawlers.

Table 3. Annual value of catch in pesos by gear type, San Miguel Bay, 1980-1981.

Gear type	Annual value of catch per fishing unit	Total number of fishing units	Total value of catch (all units) ('000 ₱)	Value per gear type as % of total value		
Scissor net	607	634	385	0.7		
Gill-net (motorized)	32,900	350	11,515	21.6		
Stationary liftnet	10,000	171	1,710	3.2		
Fish corral	16,200	89	1,442	2.7		
Filter net	7,700	60	462	0.9		
Mini trawler	38,500	188	7,238	13.5	55.1	41.6
Small trawler	228,700	75	17,153	32.1		
Medium trawler	254,400	20	5,088	9.5		
Other gears[1]		795	8,464	15.8		
		2,382	53,457	100		

[1]Based on average annual catch from Pauly and Mines (1982) and an assumed average price of ₱2.87/kg (from Table 4).

the more highly priced shrimps that they caught. In value terms, the share of mini trawlers was lower than their volume share because of the low price of *balao* at the landings (Table 4).

The level of investment cost per fishing unit is a significant determinant of that unit's annual value of catch (Fig. 2). Due to variation in operating costs (especially for medium trawlers) this same relationship does not hold for pure profits (Table 5) nor for cash incomes of owners and crew.

FACTOR PRODUCTIVITIES

Two commonly used measures of factor productivity are the volume or value of catch per unit of capital or labor input (Kurien and Willmann 1982). Since prices vary depending upon the species caught, measuring capital and labor productivities in value terms is preferable to measuring them

Table 4. Average price of catch received at landings in San Miguel Bay by gear type, 1980-1981.

Gear type	Average price (₱/kg)
Scissor net	2.30
Gill-net (motorized)	3.15
Stationary liftnet	2.53
Fish corral	2.47
Filter net	1.47
Mini trawler	1.53
Small and medium trawlers	3.83
Weighted average prices	
all gears	2.32
all gears except mini trawlers	3.37
all gears except trawlers	2.87

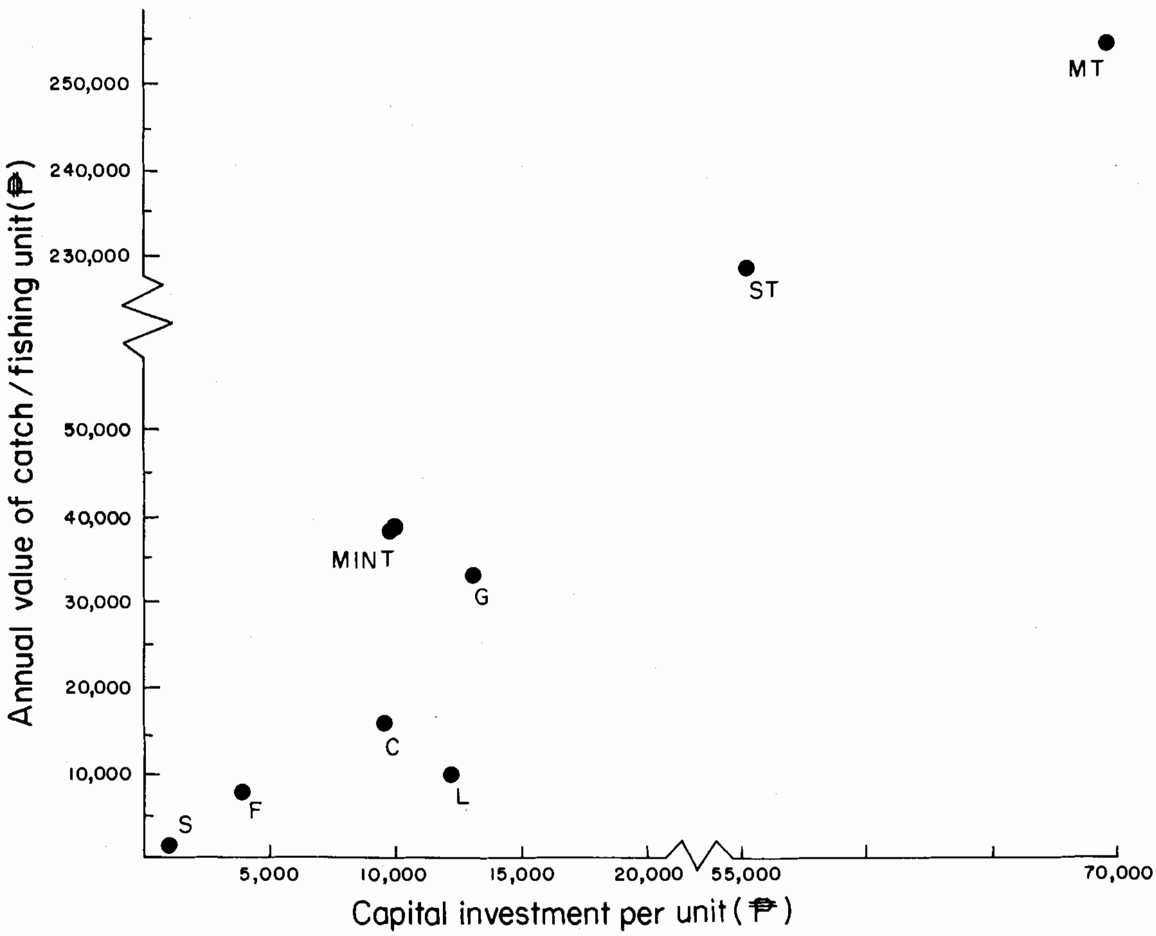

Fig. 2. Relationship between capital investment and annual value of catch for various gear types operating in San Miguel Bay. Note: S — scissor net; F — filter net; C — corral; L — liftnet; G — gill-netter; MINT — mini trawler; ST — small trawler; MT — medium trawler. The relationship between annual value of catch per fishing unit (V) and capital investment (I) can be expressed as V = −11,497 + 3.95 I with $R^2 = 0.96$.

solely in volume terms, because the former indicate the "value added" by capital and labor inputs. The differences between volume and value measurement of factor productivities can be seen in Table 5.

Of all the gears studied, the mini trawlers exhibited the highest capital and labor productivities in volume terms. Of the medium investment gears, the liftnets had the lowest capital and labor productivity. In value terms, small and medium trawler labor contributed the greatest "value added" in the fishery. Along with mini trawlers, they also showed the highest catch value per peso invested. Although it was not a strong degree of correlation (r = 0.45), there was a positive relationship between capital intensity (from Table 1) and capital productivity in value terms. A positive relationship was also found between capital intensity and labor productivity in value terms (r = 0.89). Finally in value terms, there was a positive relationship between the capital and labor productivities (r = 0.78).

Table 5. Capital and labor productivities of major gear types, San Miguel Bay, 1980-1981.

Gear type	Annual value of catch per fishing unit (₱)	Annual volume of catch per fishing unit (kg)	Volume of catch per ₱ operating cost (kg)	Capital productivity: Value per ₱ invested (₱)	Capital productivity: Volume per ₱ invested (kg)	Labor productivity: Value per labor unit (₱/man-yr)	Labor productivity: Volume per labor unit (kg/man-yr)
Scissor net	607	264	1.8	2.43	1.1	607	264
Gill-net (motorized)	32,900	10,600	0.6	2.53	0.8	10,972	3,533
Stationary liftnet	10,000	3,795	0.8	0.82	0.3	2,494	949
Fish corral	16,200	6,688	1.2	1.78	0.7	8,087	3,344
Filter net	7,700	5,130	4.7	2.17	1.5	5,121	3,420
Mini trawler	38,500	25,432	1.2	4.19	2.8	19,252	12,716
Small trawler	228,700	59,690	0.5	4.16	1.1	45,741	11,938
Medium trawler	254,400	66,560	0.4	3.63	1.0	42,393	11,093

Although these factor productivities are important measures of cost effectiveness, they do not account for differences in operating costs. In particular, in the motorized fisheries of San Miguel Bay, it is important to examine energy efficiency. Energy costs include gasoline, diesel, kerosene, LPG (for lights) and oil. The advantages of stationary gears, especially fish corrals and filter nets, are immediately apparent (Table 6). Even with their higher priced catch, the small and medium trawlers ranked among the lowest in terms of energy efficiency. With further increases in fuel prices inevitable and fuel comprising a major operating cost, the advantage should shift further in favor of stationary gears, excluding liftnetters which have high LPG expenses.

Table 6. Energy efficiency of major gear types, San Miguel Bay, 1980-1981.

Gear type	Fuel expenses per trip[1] (₱)	Value of catch per ₱ fuel expenditure (₱)	Volume of catch per ₱ fuel expenditure (kg)
Scissor net	–	–	–
Gill-net (motorized)	52	2.71	0.9
Stationary liftnet	7	2.41	0.9
Fish corral	8	9.67	4.0
Filter net	0.5	83.00	51.3
Mini trawler	94	2.19	1.4
Small trawler	707	2.55	0.7
Medium trawler	1,019	1.95	0.5

[1] Includes expenses for gasoline, diesel, kerosene, LPG and oil.

The ultimate measure of the economic health of the fisheries, however, is the presence of profits. Here, mini and small trawlers substantially outperformed all other gear types (Table 7).

Table 7. Average annual value of catch, net revenue before sharing and pure profit (loss) in pesos per fishing unit; San Miguel Bay, 1980-1981.

Gear type	Value of catch	Operating costs	Net revenue before sharing	All "other" costs[1]	Pure profit (or loss)[2]
Scissor net	607	150	457	497	(40)
Gill-net (motorized)	32,900	16,900	16,000	15,400	600
Stationary liftnet	10,000	4,750	5,250	9,450	(4,200)
Fish corral	16,200	5,350	10,850	7,450	3,400
Filter net	7,700	1,100	6,600	5,400	1,200
Mini trawler	38,500	21,800	16,700	9,100	7,600
Small trawler	228,700	123,200	105,500	78,600	26,900
Medium trawler	254,400	167,800	86,600	97,900	(11,300)

[1]Includes fixed and variable costs borne by owners after sharing, opportunity costs of owners' investment capital and labor and opportunity costs of all crewmen (including pilot and machinist on trawlers). For further details, see preceding papers in this report.
[2]Net revenue before sharing less "all other costs".

DISTRIBUTION OF PURE PROFITS (LOSSES)

Not all gear types earned pure profits during the 1980-1981 period, although there was ₱3 million overall in pure profits shared among five gear types. All other gears incurred losses or broke even, though as noted earlier this does not mean they earned no incomes for their owners and crewmen. It simply means that the sum of all costs, including opportunity costs, was higher than the value of their catch. There was a very skewed distribution of these pure profits (Table 8) even more so than the distribution of catch by volume and value. Over 85% of the pure profits of the San Miguel Bay fisheries are earned by the mini and small trawlers. If mini trawlers are excluded, small trawlers earned 77% of the pure profits, with gill-netters, fish corrals and filter nets sharing the balance.

As discussed in detail in Villafuerte and Bailey (1982), there is a higher degree of concentration of ownership in the trawler fleet than among other gear types of lower investment cost. This concen-

Table 8. Pure profit (loss) by gear type in pesos in the San Miguel Bay fisheries, 1980-1981.

Gear type	Pure profit (loss) per fishing unit[1]	Total number of fishing units	Pure profit (loss) for all units	Pure profit (loss) per gear type as % of total	Pure profit per gear type as % of pure profits only (₱4,030,900) (excluding losses)
Scissor net	(40)	634	(25,360)	(0.8)	–
Gill-net (motorized)	600	350	210,000	6.9	5.2
Stationary liftnet	(4,200)	171	(718,200)	(23.5)	–
Fish corral	3,400	89	302,600	9.9	7.5
Filter net	1,200	60	72,000	2.4	1.8
Mini trawler	7,600	188	1,428,800	46.7	35.4
Small trawler	26,900	75	2,017,500	65.9	50.1
Medium trawler	(11,300)	20	(226,000)	(7.4)	–
Other gears[2]	0	795	0	0	–
Totals		2,382	3,061,340	100	100

[1]From Table 7.
[2]Pure profit of other gears assumed to be zero on average.

tration of asset ownership results in significant concentration of the benefits of the fishery in the hands of a few. The ₱1.8 million pure profits earned by the 75 small and 20 medium trawlers was earned by approximately 35 families. Almost one-half of these pure profits were earned by five families. In contrast, the ₱0.25 million pure profits earned by the gill-netters were shared among 350 fishing units owned by several hundred families.

In contrast to the mini and small trawlers, medium trawlers were unable to cover all of their costs. This was primarily due to their larger engines and higher operating costs (see Navaluna and Tulay, this report). Because of these losses by medium trawlers, there was no correlation between investment costs (or capital intensity) and pure profits (Fig. 3).

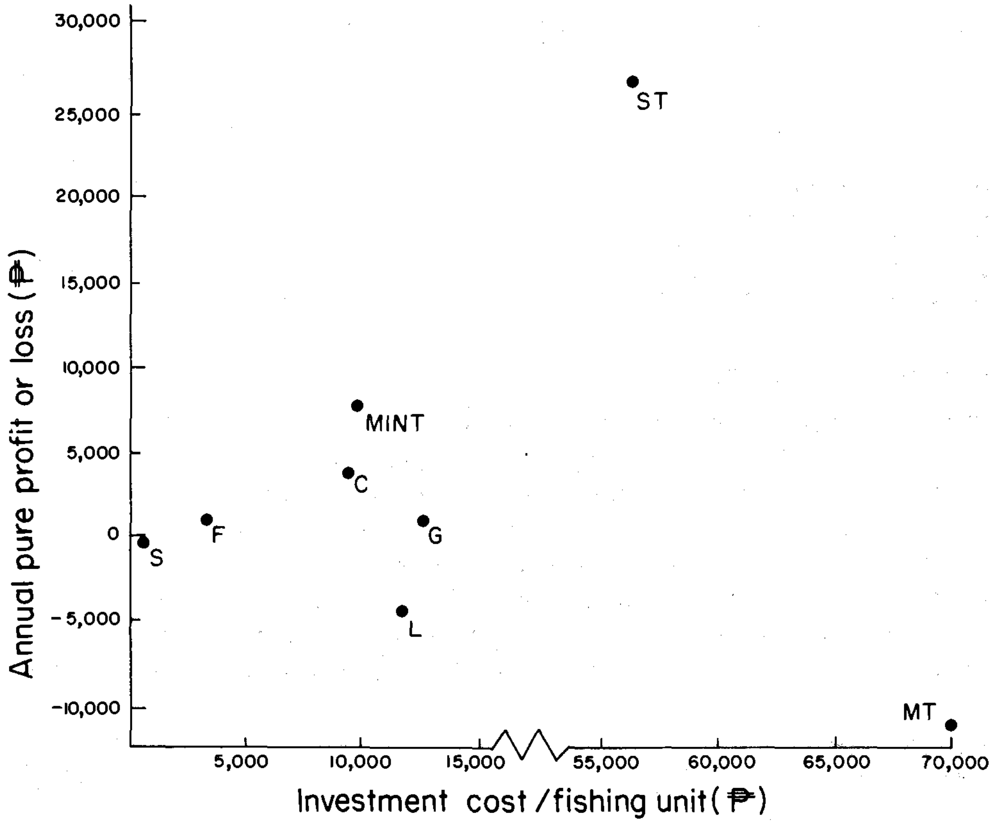

Fig. 3. Relationship between investment costs and pure profits (or losses).
Note: S – scissor net; F – filter net; C – corral; L – liftnet; G – gill-netter; MINT – mini trawler; ST – small trawler; MT – medium trawler.

Fuel Expenditures, Government Taxes and Resource Rents

Annual fuel and oil expenditures by the various fishing units of San Miguel Bay were approximately ₱18.5 million in 1980-1981. These expenditures were split almost evenly between diesel fuel for the small and medium trawler fleets on the one hand, and gasoline for non-trawl fishing units on the other. These expenditures represented 62% of the operating costs of all fishing units (68% for gill-netters and 61% for small trawlers) and 37% of the entire costs of the fishery during the period under study.

These costs are based upon actual fuel expenditures by fishermen. However, a significant part of the price of regular gasoline and diesel fuel to a lesser extent represents government taxes (Table 9). Consequently, to call the full fuel expenditures of fishermen a "cost" is not strictly correct; rather the tax represents a share of the resource rent (or pure profit) that accrues to the Philippine government. This tax is used by the government in part for road construction, energy exploration and special projects; part is also rebated to the oil refineries to cover currency devaluations and increased crude oil costs (the wholesale prices of all fuels are controlled by the government).

Not only is the government's share of the resource rent quite high (approximately ₱5.5 million) and more than the pure profits earned by the San Miguel Bay fishermen, it is derived primarily from sales to non-trawl and mini-trawl fishing units, because the tax is higher on the regular gasoline that they use than on diesel fuel. The non-trawl fishermen are paying a disproportionate share of the fuel taxes, a fact that further skews the distribution of benefits from the fishery in favor of the small and medium trawlers.

Moreover, the price that the gill-netters and the mini trawlers pay for gasoline (₱5.55/l) does not reflect its true cost to most of these fishermen. As pointed out in Yater (this report) and Tulay and Smith (this report), fishermen who obtain fuel on credit often receive lower prices for their catch when selling to the middleman who provided the credit. The data tend to illustrate excessive oligopoly/oligopsony profits in the provision of fuel. Therefore, fuel dealers are also earning part of the resource rents over and above the ₱53.5 million value of the fisheries, which reflects prices actually received by fishermen. The exact amount of these oligopoly/oligopsony rents cannot be determined. However, if the gill-netters and mini trawlers received on average 10% less for their catch than they would have done under a more competitive environment, these profits could be as high as ₱1.9 million, less the cost of the credit provided by the gasoline dealers.

Incomes

Cash incomes of owners and crewmen are determined by the sharing system in use for the gear in question, and are a function of the catch value and costs. During the period observed, monthly cash incomes of non-fishing owners ranged from ₱146 to ₱1,693 and those of ordinary crewmen ranged from ₱164 to ₱599 depending upon the gear type used (Table 10). These cash incomes are the net revenues to owners and crew after sharing, less the fixed and variable costs (including opportunity cost of capital) borne by owners out of their share. These incomes can be compared with labor opportunity costs to determine if labor is making a greater contribution to the national economy by

Table 9. Gasoline and diesel expenditures and taxes for all fishing units, San Miguel Bay, 1980-1981.

	Approximate fuel price per liter San Miguel Bay (1981)	Total tax per liter[1] (₱)	Tax as % of fuel price (%)	San Miguel Bay fishery fuel expenditures (1980-81)[2] (₱)	Total tax revenues (₱)
Regular gasoline	5.55	2.52	45	9.2 million	4.18 million
Diesel	3.20	0.46	14	9.4 million	1.35 million
Total					5.53 million

[1]Source: Caltex Head Office, Manila. Fuel tax is imposed at the wholesale level.
[2]Extrapolated from operating expense data monitored by the project's economics module. Please refer to the preceding papers in this report for additional details on fuel expenditure as percent of operating expenses for each of the major fishing gear types.

Table 10. Average *monthly* cash incomes in pesos of owners and crewmen by gear type after sharing and payment of all fixed and variable costs[1], San Miguel Bay, 1980-1981.

Gear type	No. of months operated	Income of owners[2] Non-fishing	Income of owners[2] Owner-operator[3]	Income of pilot *(maestro)*	Income of machinist	Income of ordinary crewman[4]
Scissor net	3	n/a	133	n/a	n/a	n/a
Gill-net (motorized)	12	271	516	245	n/a	218
Stationary liftnet	4	(773)[5]	(543)[5]	230	n/a	164
Fish corral	7	740	947	n/a	n/a	207
Filter net	12	175	348	n/a	n/a	173[6]
Mini trawler	12	432	877	445	n/a	342
Small trawler[7]	12	1,693	n/a	810	698	599
Medium trawler	12	146	n/a	482	400	339

[1] Opportunity costs of owner's labor and capital and opportunity costs of crewmen (labor) not yet deducted. Based on average number of months of operation.
[2] After deducting fixed and variable costs that must be borne by owner. This is owner income per fishing unit.
[3] Owner-operator receives owner's share plus one crew share (pilot's share if applicable).
[4] Ordinary crewmen who own no fishing assets, except in the case of gill-netters, where ordinary crewmen may contribute nets.
[5] Loss.
[6] Part-time only.
[7] Weighted average of Sabang- and Castillo-based trawlers.

being used in fishing rather than in some alternative activity. With the exception of liftnets, ordinary crewmen on all other gear types earned at least their opportunity costs. Because the absolute incomes earned are low (with the possible exception of small trawler crew), this is a reflection of the fact that low opportunity wages prevails in the area (Bailey 1982).

It is worth noting that the incomes reported here are not household incomes, which may be higher depending upon the number of fishing units owned or used and the number of working members in the household. These monthly cash incomes do, however, provide an indication of the extent of low incomes in the capture fishery sector, and are most certainly below the poverty threshold established by the Development Academy of the Philippines.[1]

Discussion of Implications

The key points in the preceding sections of this paper can be summarized in three figures that depict the distribution of total annual catch (Fig. 4), total annual value of catch (Fig. 5), and pure profits (Fig. 6) among the various gear types used in San Miguel Bay. The shares of resource rents accruing to the government and gasoline dealers are not shown. The dominance of the trawlers in all three distributions is readily apparent. Small trawlers in particular earn large shares of total catch, value and pure profits, and since they catch many of the same species as other small-scale non-trawl gear, these shares are earned at the apparent expense of the other gears.

The trawlers are also the most efficient of all gears used in San Miguel Bay, their capital and labor productivities are the highest of all gears. If the management goal of the San Miguel Bay is to maximize economic efficiency, every effort should be made to encourage the continued operation of trawlers, although a limit on their numbers would probably have to be considered so that the rent (pure profits) they presently earn would not be dissipated with the entry of excessive trawlers.

However, it is clearly not equitable that 75 small trawlers owned by approximately 35 families and employing 375 crewmen earn more pure profits than the remaining 2,300 fishing units used by

[1] The DAP poverty threshold for a family of 6 in 1971 was ₱5,000 (Abrera 1976). In current terms, adjusting for inflation, the 1980 threshold would be just over ₱15,000.

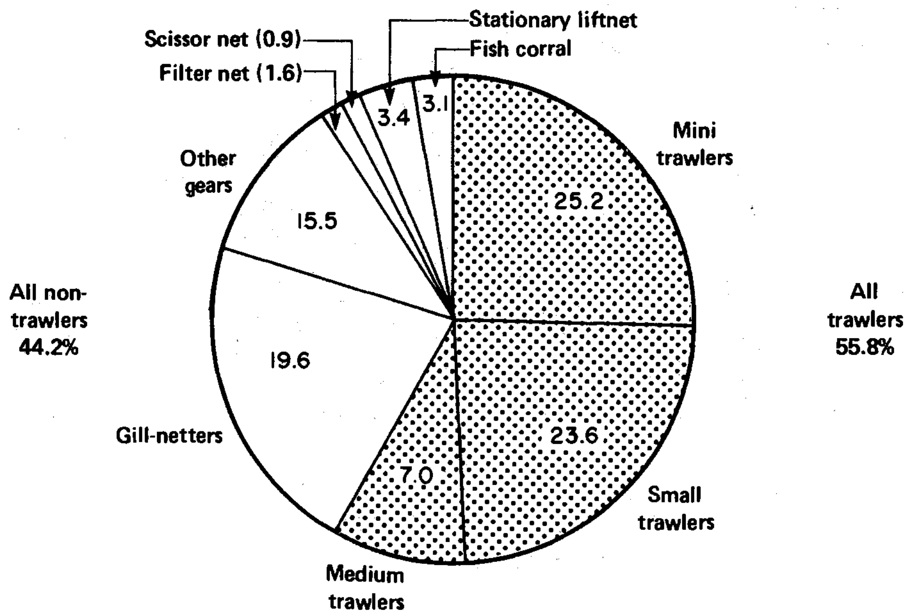

Fig. 4. Distribution of total annual catch (19,000 tonnes) by major gear types (including *balao*), San Miguel Bay, 1980-1981.

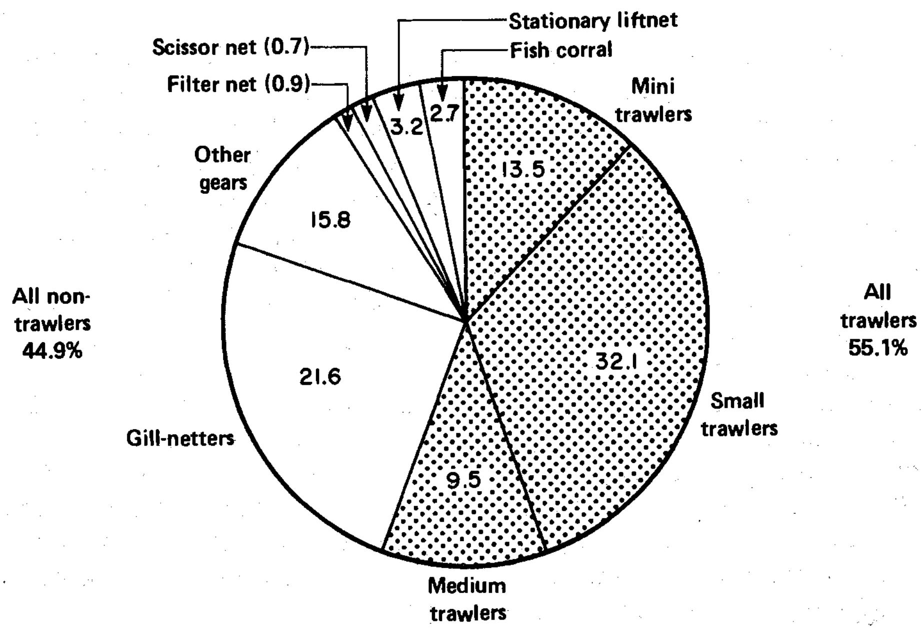

Fig. 5. Distribution of total annual value of catch (₱53.5 million) by major gear types (including *balao*), San Miguel Bay, 1980-1981.

5,100 fishermen. Whether or not this highly skewed distribution of benefits should continue is clearly a political decision. The final project report of San Miguel Bay fisheries (Smith et al., in press) explores management options in considerable detail; it fully integrates the biological, economic and sociological aspects in discussion of the management alternatives that might be considered by policymakers. The only point needing emphasis here is that there is a marked divergence between goals of economic efficiency and equity in multigear fisheries such as San Miguel Bay.

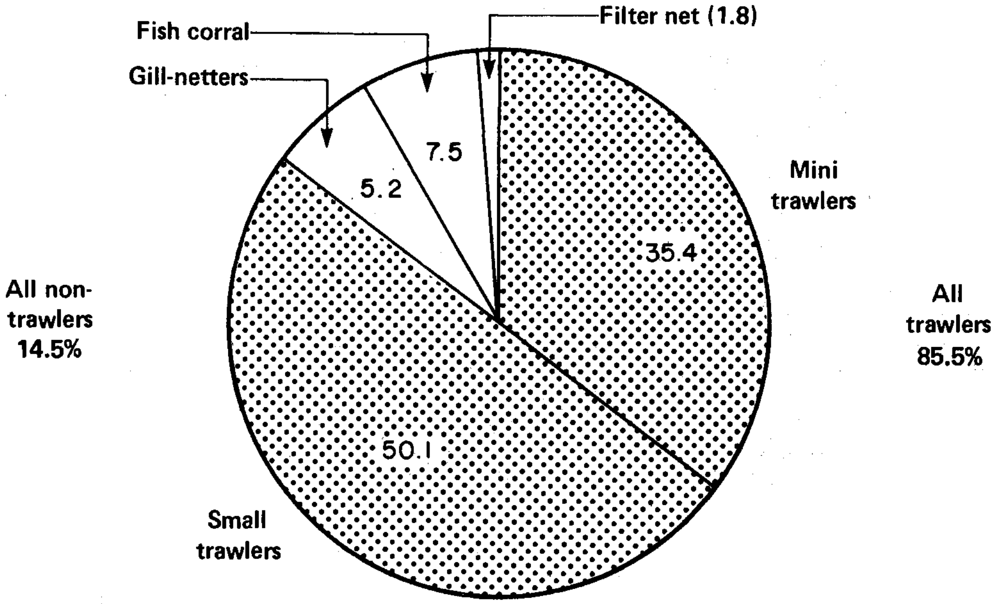

Fig. 6. Distribution of pure profits (₱3 million) among competing gear types, excluding those that incurred losses (i.e., medium trawlers, scissor nets and stationary liftnets), San Miguel Bay, 1980-1981. Also excluded is the ₱5 million share of the resource rents earned by the government through taxes on regular gasoline and diesel fuel.

The distinction being drawn here is somewhat of an oversimplification because although these pure profits are retained by a small group of trawler owners, much may in fact be reinvested in the local economy, generating additional employment for the community as a whole. However, shifting the distribution of benefits in favor of the majority may not have a significant negative impact on this multiplier effect. A definitive answer to this question requires an examination of capital flows, investments and savings patterns among the Bay's fishermen, a study which has not yet been conducted. Nevertheless, as pointed out by Pearce (1978), "employment in secondary and tertiary occupations is generally related to the level of the catch, and is not necessarily affected by the organization of the fishery itself".

What are the implications of the preceding economic analysis for management of San Miguel Bay fisheries? Based on 1980-1981 conditions, the results show that open-access equilibrium has not been reached because pure profits are being earned on average by gears that exploit the Bay. However, in absolute terms, the value of pure profits (₱3 million) is small relative to the total value of the fisheries (₱53 million). There has also been a considerable increase in effective fishing effort in the Bay over the past decade in the rapidly expanding trawler fleet, motorization of gill-netters and the introduction of mini trawlers. Despite this increase in effective effort, some pure profits are still being earned, but there is little room for further expansion.

Because there are no historical data on costs and earnings in San Miguel Bay fisheries, it cannot be determined definitively if the Bay is economically overfished. However, it is believed that further increases in effective fishing effort will certainly reduce economic efficiency and resource rents by raising costs and will ignore the equity issues raised here. Consequently, the major decision that must be faced by those responsible for managing the Bay is how to allocate the benefits from this fishery among the competing users. A positive step in this direction should include the recognition that the present "municipal fisheries" label is inadequate to reflect the diversity of economic conditions found among the various diverse gear types lumped in this single category. Increasing loans to small-scale non-trawl fishermen without simultaneously reducing effort among other gears will have only a negative effect. What is needed is an approach that limits the effective fishing effort in the Bay, and which addresses questions of overfishing and equity simultaneously.

References

Abrera, A.S. 1976. Philippine poverty threshold, p. 223-273. *In* M. Mangahas (ed.) Measuring Philippine development: report of the social indicators project. Development Academy of the Philippines, Manila.

Bailey, C. 1982. Small-scale fisheries of San Miguel Bay, Philippines: occupational and geographic mobility. ICLARM Technical Reports 10, 57 p. Institute of Fisheries Development and Research, College of Fisheries, University of the Philippines in the Visayas, Quezon City, Philippines; International Center for Living Aquatic Resources Management, Manila, Philippines; and the United Nations University, Tokyo, Japan.

Kurien, J. and R. Willmann. 1982. Economics of artisanal and mechanized fisheries in Kerala: a study on costs and earnings of fishing units. Working Paper No. 34. 112 p. FAO/UNDP Bay of Bengal Programme, Madras and Programme for Community Organisation, Trivandrum, India.

Ovenden, A.E. 1961. Costs and earnings investigations of primary fishing enterprises: a study of concepts and definitions. FAO Fish. Stud. No. 10. 72 p.

Panayotou, T. 1981. Cost structure and profitability of small-scale fishing operations: methodological framework. Paper presented at the IDRC small-scale fisheries workshop, May 1981. Singapore. (Mimeo)

Panayotou, T., S. Wattanutchariya, S. Isvilanonda and R. Tokrisna. 1982. The economics of catfish farming in central Thailand. ICLARM Technical Reports 4, 60 p. Kasetsart University Research and Development Institute, Bangkok, Thailand and International Center for Living Aquatic Resources Management, Manila, Philippines.

Pauly, D. and A.N. Mines, Editors. 1982. Small-scale fisheries of San Miguel Bay, Philippines: biology and stock assessment. ICLARM Technical Reports 7, 124 p. Institute of Fisheries Development and Research, College of Fisheries, University of the Philippines in the Visayas, Quezon City, Philippines; International Center for Living Aquatic Resources Management, Manila, Philippines; and the United Nations University, Tokyo, Japan.

Pearce, P.H. 1978. Approaches to economic regulation of fisheries. CIDA/FAO/CECAF workshop on fishery development planning and management, Feb. 6-17, 1978. Lomé, Togo.

Smith, I.R., D. Pauly and A.N. Mines. Small-scale fisheries of San Miguel Bay, Philippines: options for management and research. ICLARM Technical Reports 11. Institute of Fisheries Development and Research, College of Fisheries, University of the Philippines in the Visayas, Quezon City, Philippines; International Center for Living Aquatic Resources Management, Manila, Philippines; and the United Nations University, Tokyo, Japan. (In press)

Squire, L. and H.G. van der Tak. 1975. Economic analysis of projects. A World Bank Research Publication. The Johns Hopkins University Press, Baltimore.

Vakily, J.M. 1982. Catch and effort in the trawl fishery, p. 65-94. *In* D. Pauly and A.N. Mines (eds.) Small-scale fisheries of San Miguel Bay, Philippines: biology and stock assessment. ICLARM Technical Reports 7, 124 p. Institute of Fisheries Development and Research, College of Fisheries, University of the Philippines in the Visayas, Quezon City, Philippines; International Center for Living Aquatic Resources Management, Manila, Philippines; and the United Nations University, Tokyo, Japan.

Villafuerte, E.D. and C. Bailey. 1982. Systems of sharing and patterns of ownership, p. 25-41. *In* C. Bailey (ed.) Small-scale fisheries of San Miguel Bay, Philippines: social aspects of production and marketing. ICLARM Technical Reports 9, 57 p. Institute of Fisheries Development and Research, College of Fisheries, University of the Philippines in the Visayas, Quezon City, Philippines; International Center for Living Aquatic Resources Management, Manila, Philippines; and the United Nations University, Tokyo, Japan.