98. Smith, I.R., A.N. Mines and G. Beñacia. 1982. The research site, data collection and methods of analysis. *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.

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).

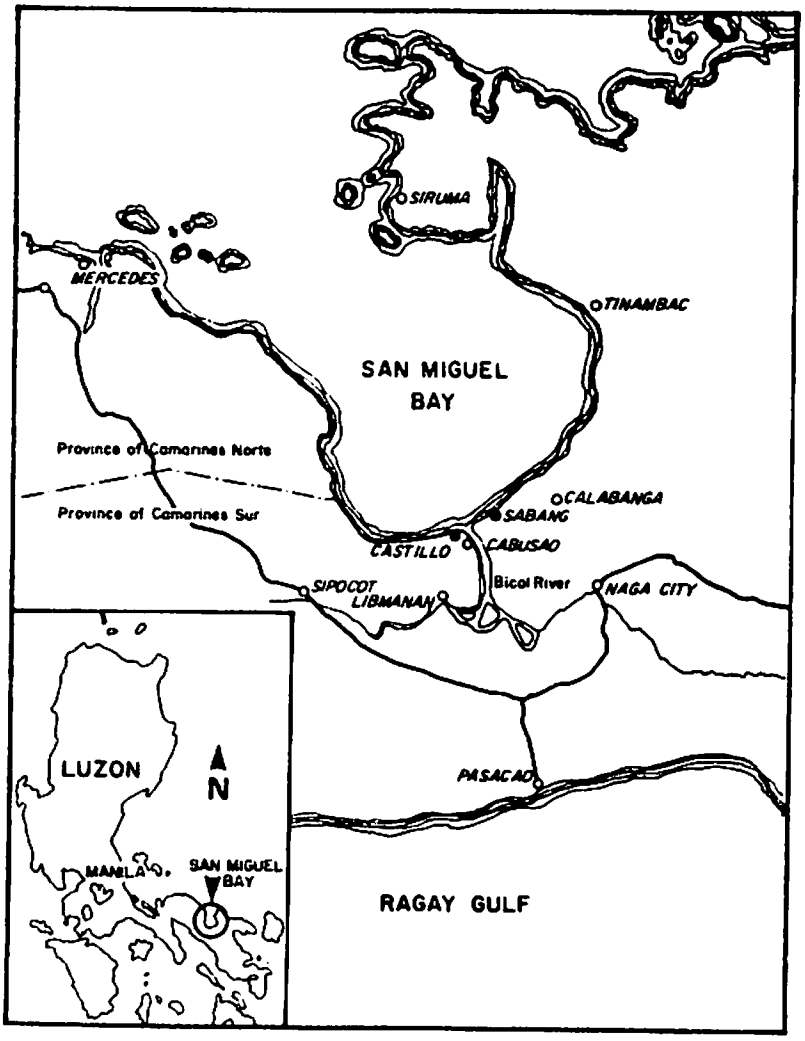


Fig. 1. San Miguel Bay, Philippines.

The preface of this technical report has outlined why the fisheries of San Miguel Bay were selected for intensive study. The specific objectives of the economics component of the IFDR/ICLARM 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, particularly 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 *(pameting)*	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.

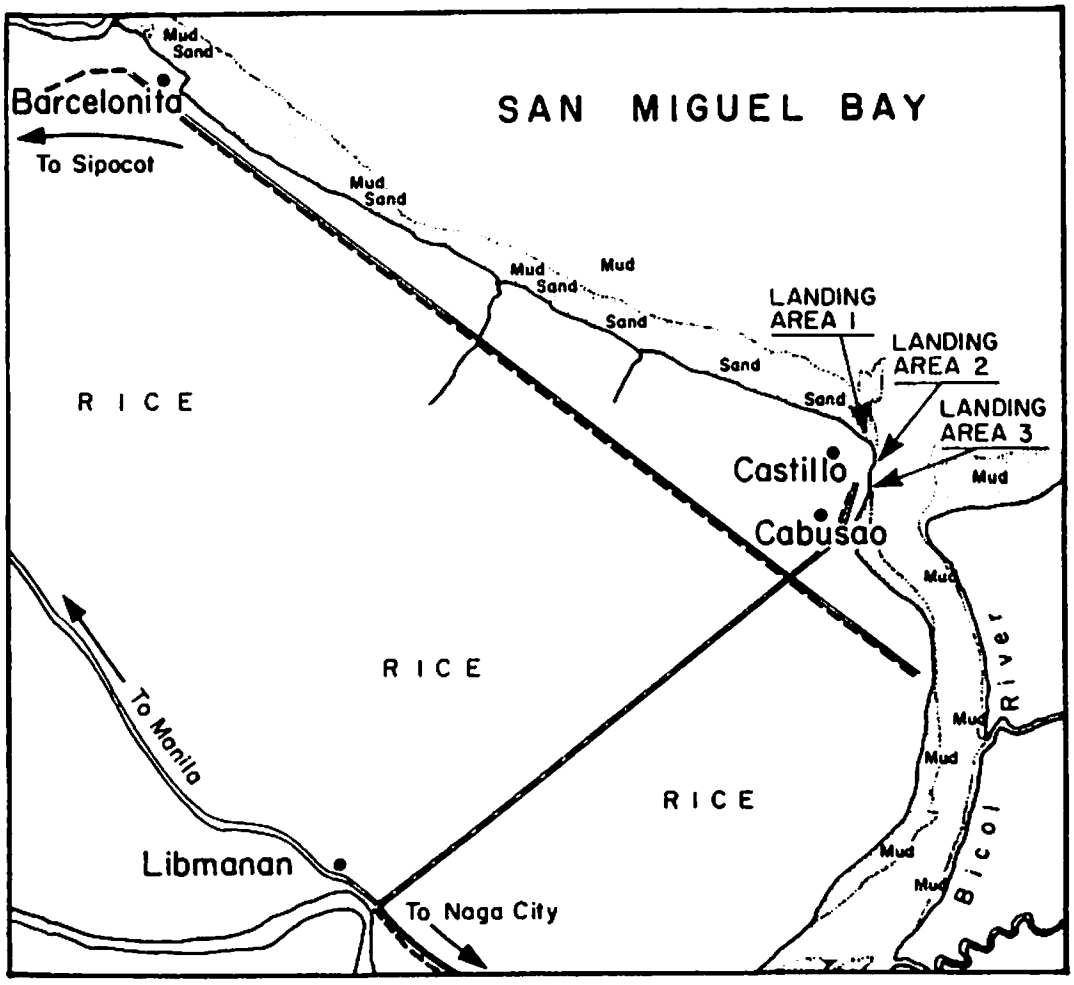


Fig. 2. Map of Cabusao Municipality showing Castillo landing areas.

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 *(pelubog:* 1st trip)
	5 p.m. – 6 p.m.	Gill-netters *(pelubog:* 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).

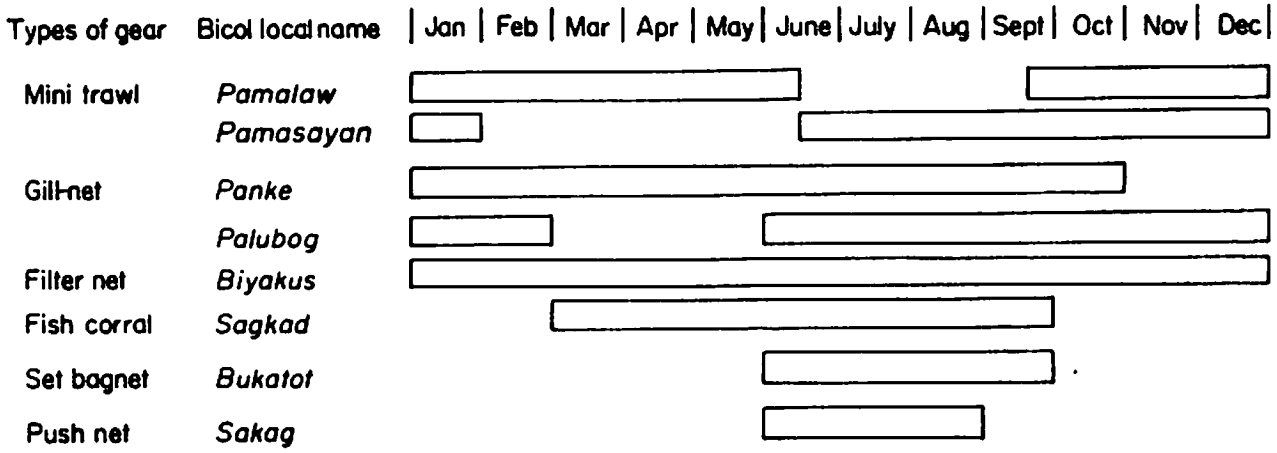


Fig. 3. Months of operation of major gears in Castillo as observed in 1980.

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).

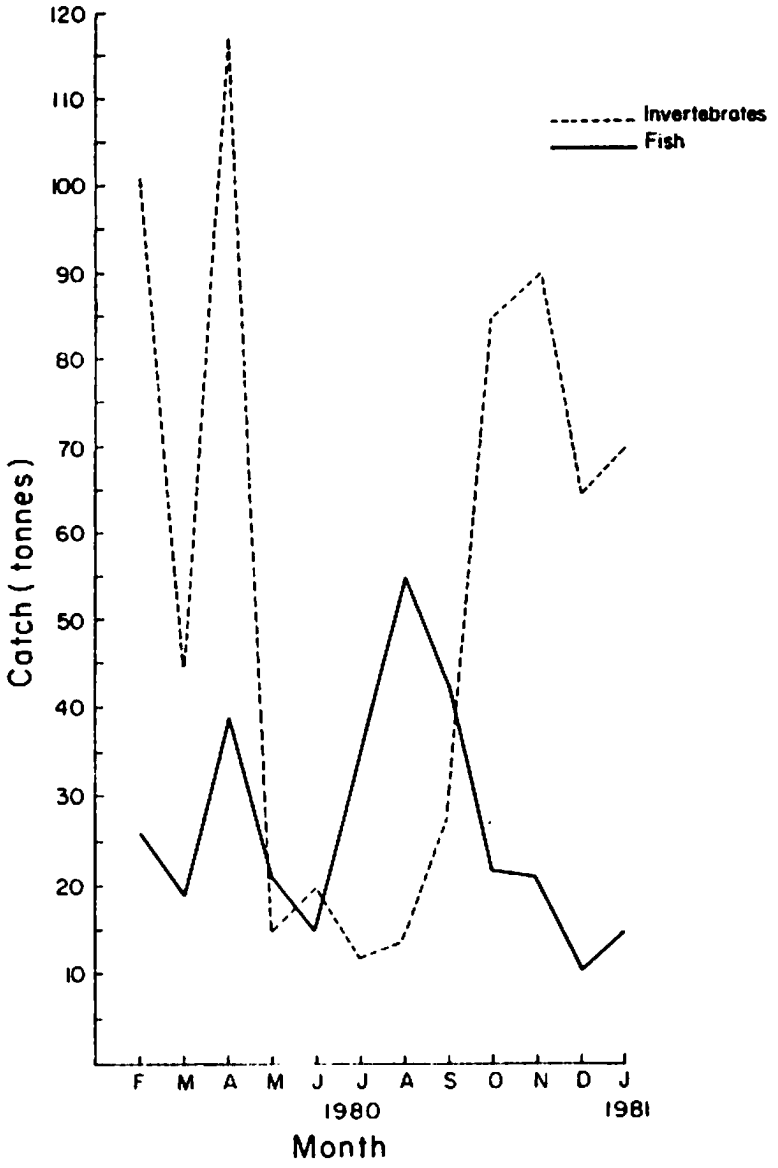


Fig. 4. Castillo landings, February 1980-January 1981.

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	1980 Feb	Mar	Apr	May	June	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	*Barara*	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	*Disco*	–	–	–	–	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	*Baleo*	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 households 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 cost Σ = ₱_____

Total annual depreciation Σ = ₱_____

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

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

(Month)	Fishing: Yes–1 No –0 Remarks	Fishing: Fishing area	Hours spent fishing: Traveling	Hours spent fishing: Actual fishing	Expenses: Gasoline	Expenses: Oil	Expenses: Repair parts	Expenses: Ice	Expenses: Food	Expenses: Others	Catch: Species code	Catch: Volume: Kg	Catch: Volume: Other units	Total value	No. of partners	Sharing %
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13																
14																
15																
16																
17																
18																
19																
20																
21																
22																
23																
24																
25																
26																
27																
28																
29																
30																
31																
Monthly totals (Σ) =		trips	hrs	hrs									kg	₱		
Average per day (Σ / #days in month) =			hrs	hrs									kg	₱		
Average per trip (Σ / #of trips) =			hrs	hrs									kg	₱		

Total monthly expenses = ₱_____ Total monthly value = ₱_____

Monthly net revenue = total monthly value minus total expenses = ₱_____
(the farmer's share only)

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	Total Purchase Volume	Total Purchase Cost	Usual or not	Total Sales 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.

Total monthly value = ₱_____

Total monthly expenses = ₱_____

Monthly net revenue = total monthly value minus total expenses = ₱_____

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:

$$\begin{aligned} \text{Total value} &= \Sigma X_i P_i \\ &= \Sigma (X_1 P_1 + X_2 P_2 + \ldots X_n P_n) \\ \text{where } X_i &= \text{weight (kg) of species i} \\ P_i &= \text{price (P) of species i} \end{aligned}$$

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	P/kg	kg	P/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	* LBL A	31 25 11	
	CL REG	31 43	
	P≠S	31 47	
	CL REG	31 43	
	STO E	33 15	
	0	00	
	ST I	35 33	
	CLX	44	
	RTN	35 22	
010	* LBL B	31 25 12	
	X ≷ Y	35 52	
	ISZ	31 34	
	RCI	35 34	
	I	01	
	0	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 + 0	33 61 00	
	CLX	44	
	RTN	35 22	
	* LBL b	32 25 12	
	0	00	
	:	81	
030	RTN	35 22	
	LBL 0	31 25 14	
	RCL E	34 15	
	RCL 0	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 = 0?	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			

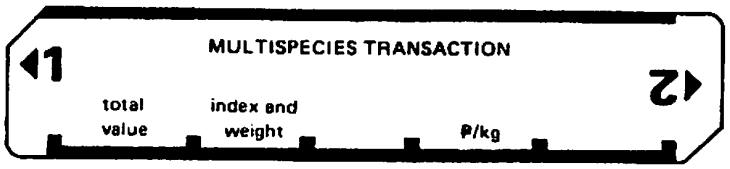
LABELS					FLAGS	SET STATUS
A STO total price of transaction	B Price-Index ↑ * weight per species	C	D Price per kg for each species	E	0	FLAGS / TRIG / DISP
a	b shows "ERROR"	c	d	e	1	ON OFF: 0 ☐ ☐ / 1 ☐ ☐ / 2 ☐ ☐ / 3 ☐ ☐ — DEG GRAD RAD — ☐ FIX ■ ☐ SCI ☐ ☐ ENGC n =
0	1 routine to present the results	2	3	4	2	
5	6	7	8	9	3	

REGISTERS

0 Σ corrected index	1 P/kg for species no. 1	2 P/kg for species no. 2	3 P/kg for species no. 3	4 P/kg for species no. 4	5 P/kg for species no. 5	6 P/kg for species no. 6	7 P/kg for species no. 7	8 P/kg for species no. 8	9 P/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 Total price of transaction	I 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.