

ECONOMIC EFFECTS OF OVERFISHING IN SAN MIGUEL BAY, PHILIPPINES^{1/}

by

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ABSTRACT

The San Miguel Bay in Southern Luzon Island, Philippines is a large estuarine fishery with heavy concentrations of both trawl and non-trawl gears. The Bay was the site of an intensive interdisciplinary investigation by researchers in the late 1970's and early 1980's who documented the high catches from the Bay, the extreme competition that existed between large numbers of trawl and non-trawl gear types, and the concentration of benefits from the fishery in the hands of only a relatively small number of families. It was clear at that time that controls over levels of fishing effort and certain types of gears were necessary.

Five years later in 1986, the Bay still is characterized by extreme competition from an even larger number of competing vessels and fishermen. The number of trawlers has increased by over 50 percent since 1981 and non-trawl fishermen using non-motorized vessels have similarly increased. Rates of outmigration have picked up, especially amongst young adults. Fishermen organizations have become more vocal in their suggestions that the Bay be closed to all trawling. These suggestions have now been officially endorsed by the local fisheries office and for the first time it appears that legal and institutional support or measures to benefit the majority of the Bay's fishermen will now be forthcoming.

Introduction^{2/}

Competition for access to and use of coastal fish resources in much of the tropics has noticeably increased in recent decades. Areas that traditionally have been the sole preserve of artisanal or small-scale fishermen using such time-tested techniques as hook and line, traps and gillnets have come under increased pressure from modern gear types. Nowhere has the resulting competition for a limited resource been stronger than in coastal trawlable grounds where valuable shrimps are found.

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^{2/} Adapted from Smith and Pauly (1983)

Evolution of institutions capable of managing these high levels of fishing effort is slow. Certain countries (e.g. Indonesia) have decided to deal with the socio-economic problems of competition and overfishing by banning coastal trawling altogether (Sardjono 1980). Most other countries in the tropics, however, have been reluctant to take such a dramatic step. Consequently, problems of overfishing and excessive competition remain.

One such fishing ground is San Miguel Bay in the Bicol region of the Philippines (Fig.1). The Bay is a large shallow estuary, becoming shallower over the years. Until World War II it had been fished primarily by such fixed gears as filter nets and traps and a limited number of mobile fishing units that included four Japanese beam trawlers. Over the last four decades, the level of fishing effort significantly increased (Fig. 2). In part, this was from motorization of much of the non-trawl fleet and from a steady 2 percent per annum growth in numbers of fishermen. However, most was from increases in the number of trawlers; in 1981 almost 100 small trawlers were operating in the Bay; by 1986 there were approximately 150.

These "baby" trawlers, as they are called, range from two to five gross tons (GT), and most are registered as "municipal" fishing craft, hence under Philippine law are considered small-scale. Technically speaking, the upper limit to the "municipal" category is 3 GT. Commercial fishing using vessels larger than 3 GT is banned from within 7 km of the coastline in many Philippine provinces, including those of Bicol where San Miguel Bay is located. "Baby" trawlers can fish legally in waters deeper than 4 fathoms (7.3 m), but this requires permission from local municipalities. Otherwise they must stay in waters beyond 7 fathoms (12.8 m deep).

Including "baby" trawlers with their 100-150 hp diesel engines in the same "municipal" category as unmotorized gillnetters, for example, certainly masks the fundamental differences between these gear types and makes control over trawling activities extremely difficult, if not impossible. With no enforcement, however, these vessels routinely trawl throughout the Bay, regardless of depth.

The result of the historical increase in effort in the Bay is a situation characterized by:

- full biological exploitation;
- reduced profits in the fishery as a whole and even losses for some non-trawl gears;
- highly uneven distribution of catch and incomes in favour of trawlers; and
- outmigration of fishing community labour in search of higher incomes elsewhere.

Petitions by various fishermen groups have been sent to national authorities which in 1982 resulted in a Presidential decree banning all large-scale commercial trawlers (those registered as over 3 GT) from the Bay. This ban affected only a limited number of trawlers; fishermen's complaints against the "baby" trawlers have continued and been aired repeatedly in a local magazine, *Balalong*. The non-trawl fisherman are particularly critical of the common practice of registering trawlers bigger than 3 GT as municipal craft and they have threatened "to enforce the ban themselves even at the risk of violence" (*Balalong*, 3 June 1983). In mid-1986, the local office of the Bureau of Fisheries and Aquatic Resources also petitioned the Ministry of Agriculture and Food and the President to ban *all* trawling, regardless of vessel size.

San Miguel Bay was the site of an intensive multidisciplinary 3-year research project conducted by the Institute of Fisheries Development and Research (IFDR) of the University of the Philippines in the Visayas (UPV) and the International Center for Living Aquatic Resources Management (ICLARM) to document the conditions of the fisheries and fishing communities there so that these communities could be integrated into the development planning of the Bicol River Basin Development Program (BRDBP).

The research project had three parts - biology, economics and sociology - and has been reported in a number of papers, most of which are included in five Technical Reports published jointly by IFDC and ICLARM, with the United Nations University and the Philippine Council for Agriculture and Resources Research and Development providing partial funding. The research project not only documented prevailing biological and sociological conditions, but also evaluated a range of management options for the fisheries of San Miguel Bay. Summary results of this intensive study are reported in the next section of this paper.

The Bay has subsequently been revisited by one of the authors of this paper. Progress of the fishing communities towards establishment of effective management institutions to deal with persistent biological and socio-economic problems are discussed in the third section of this paper.

The fishery in 1981^{3/}

Estimation of fishing effort and catch per unit effort for all gear types by the research teams mentioned earlier led to improved estimates of catch and species caught. Catches from the Bay were found to be three to four times higher than reported in official statistics. About 60 percent of the catch, which in 1981 totalled 15,000 tonnes/year (excluding 4,000 tonnes of *balao*, a small shrimp), was taken by some 5,100 small-scale fishermen, and the remainder by 95 trawlers of various sizes (Table 1). There was considerable competition among gear types for the major species caught. Competition also prevailed between motorized and non-motorized gears, the latter making up the majority of non-trawler gears.

Historical data obtained from various research boats and commercial trawlers were also used for comparative purposes. These results showed dramatic increases in effective effort and declining trawlable biomass but are consistent with a total catch that is levelling off. (The continued high levels of catch from the Bay are possibly due to the fact that the large-size slow-turnover species have been replaced by smaller, fast-turnover species.) Detailed stock assessments using a variety of mathematical models suggested that the Bay was overfished in the sense that an increase in effort by either the trawl or the small-scale fishery would not result in an increased catch from the San Miguel Bay as a whole.

Table 1. Annual catch in tonnes by the trawl and non-trawl fisheries in San Miguel Bay, 1980-1981, as estimated by the project biologists.

Taxonomic group	Bicol name	Catch (tonnes)	
		Trawl fishery	Non-trawl fishery
Sharks and rays	<i>Pating, pagi</i>	36	9
<i>Stolephorus</i> spp.	<i>Dilis</i>	1,369	731
<i>Sardinella</i> spp.	<i>Piyak</i>	201	594
<i>Arius thalassinus</i>	<i>Ponicon</i>	6	38
Mugilidae	<i>Tabudyos, banak</i>	330	860
<i>Otolithes ruber</i>	<i>Abo</i>	409	1,595
Other Sciaenidae	<i>Arakaak</i>	313	1,155
Pomadasydae	<i>Aguot, tabal-tabal</i>	21	13
Carangidae	<i>Talakitok, malapondo</i>	57	212
Leiognathidae	<i>Sapsap, dalupani</i>	38	74
Trichiuridae	<i>Langkoy, liwit</i>	254	70
<i>Scomberomorus commersoni</i>	<i>Tangigi</i>	28	47
Miscellaneous species		3,018	1,388
Squids	<i>Pusit</i>	235	15
Crabs	<i>Alimasag</i>	120	380
Penaeid shrimps	<i>Hipon</i>	461	583
Sergestid shrimps	<i>Balao</i>	0	4,473 ^a
Total catch (excluding sergestids)		6,896	7,764
Total catch (including sergestids)		6,896	12,237

^a *Balao* are caught by mini trawlers, a small-scale gear very different in level of investment and profitability from the larger "baby" trawlers.

^{3/} Adapted from Smith and Pauly (1983), and Smith *et al.* (1983)

Extreme competition for use of the resource and uneven distribution of benefits were shown by the economic analysis. In 1981, small trawlers, representing only 3 percent of the Bay's fishing units and employing 7 percent of the fisheries' labour force, earned the largest share of catch value and 50 percent of that part of the profits from the fishery that accrue to fishermen (Table 2, Fig. 3-6).

Profitability here is defined as revenue exceeding all costs, including opportunity costs such as a "fair" return to capital. Simple profitability of vessels is not an accurate indication of their efficiency in the case of San Miguel Bay, however, because of differential taxes on the various grades of fuel used by the trawlers (diesel) and non-trawlers (regular gasoline). The national government taxes regular gasoline at a much higher rate than diesel fuel.

The government tax on fuel and the fuel suppliers-cum-fish processors also divert part of the profits from the fishermen (Fig. 7). However, trawlers, which use diesel fuel, were able in 1981 to maintain their competitive edge over non-trawl gears (which if motorized use regular gasoline) because the government tax on regular fuel (P 2.54/l)^{4/} in 1981 was five times that on diesel fuel. If trawlers had to pay the same fuel tax as the non-trawl fleet, they would have operated at a loss in 1980-81. This finding provided evidence to support the view that industrial fisheries are often subsidized directly or indirectly while small-scale fisheries are not. Though lower taxes on diesel fuel are viewed by the national government as conducive to industrialization in the economy as a whole, they have had a negative effect on small-scale non-trawl municipal fisheries. Under such circumstances, continued expansion of the trawl fleet has not been surprising.

In 1981, the ownership and earnings of the small trawlers were highly concentrated: five families owned 50 percent of the trawler fleet. In contrast, the non-trawl fleet, consisting of approximately 2,300 fishing units, was dispersed among approximately 2,000 households. The investigations also revealed that very limited alternative employment opportunities existed in the vicinity of the Bay, which explains the low earnings of labour both within the fishery and outside as well as the significant rate of outmigration from the Bicol area. Outmigration has not been sufficient, however, to offset population growth.

In 1981, all perspectives of the San Miguel Bay fisheries, including those of fishermen themselves, reached the same conclusion; the Bay was sorely in need of management. The increasing problems of overfishing and uneven distribution of benefits could only be minimized if steps were taken to limit the amount of fishing effort. Continued credit programmes were unlikely to solve the problems of the small-scale fishermen unless steps were taken to limit the amount of fishing effort. Continued credit programmes were unlikely to solve the problems of the small-scale fishermen unless steps were taken to regulate those gear types with which they compete. Even then, the growth of fishing communities and expected future entrants to the non-trawl fishery implied that any partial attempt to control fishing effort in the Bay would only "buy time". Regardless of time frame, management of the fisheries was clearly required based on catch and socio-economic data available by the end of 1981.

The fishery in 1986

Five years later, in 1986, only limited progress has been made towards management of the San Miguel Bay fisheries. Most of this progress has been in the form of efforts by municipal fishermen to organize themselves into groups, preparatory to implementation of any formal management scheme for the Bay. On an encouraging note, the local office of the Bureau of Fisheries and Aquatic Resources (BFAR) has prepared a petition which, if approved, would restrict the activities of the municipal "baby" trawlers. This petition is currently pending with the national government. In the past, numerous petitions from fishermen themselves had been submitted to the national government to no avail. Significant now with the current petition is not only the fact that the local BFAR office

^{4/} In 1981, 8.50 pesos = US\$1.00. In 1986, 20.30 pesos = US\$1.00.

Table 2. Summary of data on the San Miguel Bay fisheries (1980-1981). At time of study US\$1.00 = P8.50.

Characteristics	Small-scale fishery		Small and Medium ("baby") trawls	Total for the San Miguel Bay fisheries (all fishing units)
	Non-trawl gears	Mini trawl		
No. of fishing units	2,100	188	95	2,383
Total horsepower	2,592	3,008	13,200	18,800
No. of fishermen	4,625	376	600	5,600 in 3,500 households
No. of households owning fishing units	≈1,880	150	35	2,065
Average investment cost per fishing unit (P)	250-13,000	9,200	55-70,000	greater than 15 million current replacement cost
Percent of total catch	44	25	31	19,133 tonnes
including sergestid shrimps	59	—	41	14,660 tonnes
excluding sergestid shrimps				
Percent of total value	44	14	42	P53.5 million
including sergestid shrimps	52	—	48	P46.2 million
excluding sergestid shrimps				
Percent of pure profits (resource rents) ^a	15 ^b 23	35	50 ^c 77	P3 million P1.6 million
including sergestid shrimps	164-218	342	339-810 ^d	—
excluding sergestid shrimps				
Crewmen incomes/month (P)	(-773) ^e - 740	432	146 ^f - 1,693	—
Owner (non-fishing) incomes/month (P)				

^a Does not include resource rents earned by the government and by fuel suppliers/processors.

^b One-half of this is earned by fish corrals; 40% by motorized gillnetters.

^c Small trawlers only; medium trawlers did not cover their opportunity costs.

^d Highest incomes are earned by pilots on small trawlers.

^e Owners of stationary liftnets incurred losses.

^f Lowest incomes are earned by owners of medium trawlers.

has endorsed the petition and the proposed steps it contains to regulate trawling, but also that the change of Philippine Government in 1986 holds forth the promise of an administration more sympathetic and responsive to such local issues.

In contrast to the detailed data that are available for the Bay's fisheries in 1981, unfortunately no such comprehensive data are available for 1986. Catch data continue to be incomplete due to the shortage of financial resources for monitoring catch. Even the number of fishing vessels by type and of other fishing gears has not been monitored. Consequently, the current conditions of the fishery and fishermen can be arrived at only somewhat subjectively.

Interviews conducted with key informants in late 1986 indicate that the number of municipal (small-and medium-scale) trawlers operating in the Bay has increased by approximately 50 percent since 1981, there now being approximately 150 such vessels of various size and horsepower. The large-scale trawling fleet based in Naga City, which fishes usually outside the Bay but on occasion in the mouth, has not grown in size, however. This lack of growth in the large-scale fleet (> 3GT) is common throughout the Philippines and can be attributed primarily to increased fuel costs. Sabang, Calabanga continues to be the major trawler landing within the Bay.

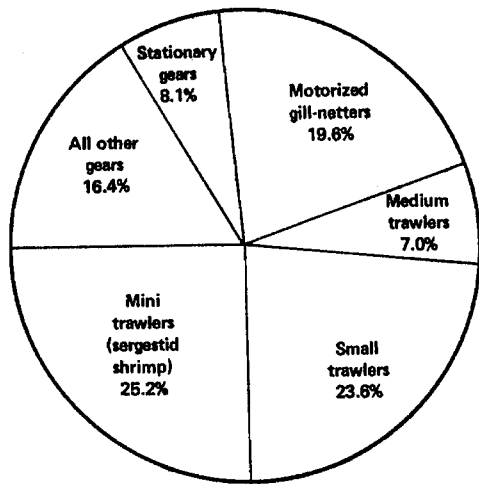


Fig. 3. Distribution of catch among the various gear types of San Miguel Bay as estimated by the project economists.

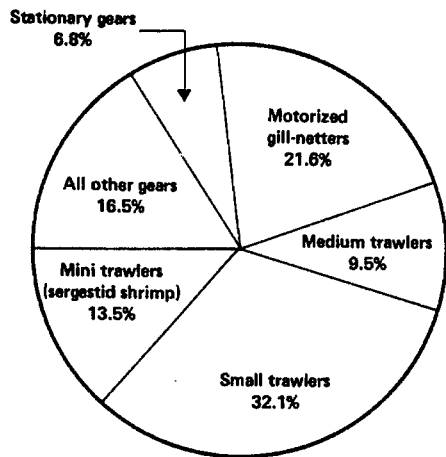


Fig. 5. Distribution of total value of annual San Miguel Bay catch (P53.5 million in 1980/81) by gear type. Not included here is the value of fishermen's take-home catch nor the oligopoly/oligopsony profits of fuel suppliers/fish processors.

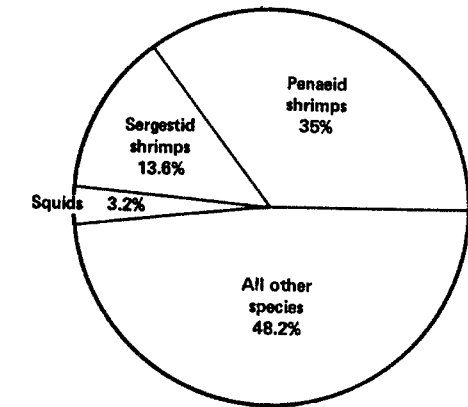
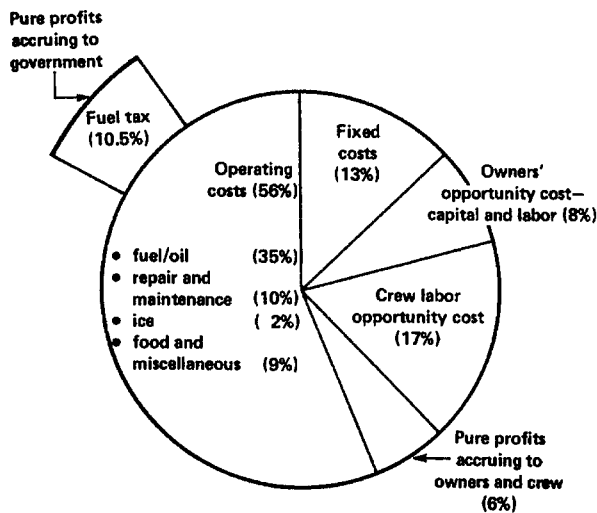


Fig.4 Distribution of total value of annual San Miguel Bay catch (P53.5 million in 1980/81) by species groups.

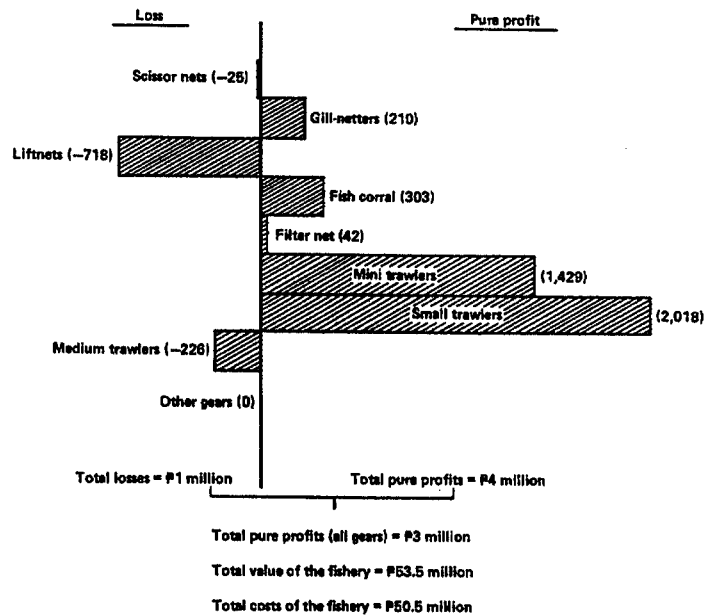


Fig.6. Distribution of annual pure profits and losses (resource rents) in thousands of pesos among the various fishing gear types of San Miguel Bay (1980/81).

Fig.7. Distribution of annual costs and pure profits in the San Miguel Bay fishery, 1980-1981 (total P53.5 million; 63% of operating costs is for fuel and oil; 30% of these expenditures are in the form of fuel taxes which represent the government's share of pure profits (resource rents).

Numbers of non-motorized gillnetters especially have increased. The growth in this fleet, accompanied by little apparent growth in the motorized gillnetter fleet, can also be attributed in part to increased fuel costs. A more important factor, however, has been the dwindling of available formal credit sources, which apparently has made a motorized vessel too expensive for many small-scale fishing households. In fact, it appears that the rapid growth in motorization of the San Miguel Bay fleet that occurred in the late 1970's and early 1980's can be attributed primarily to the availability of low-cost credit at that time. Repayment rates under these earlier national credit schemes have been extremely low, including from San Miguel Bay recipients, which may further explain why motorization was common earlier but is much less affordable currently.

While the growth since 1981 in number of trawlers operating in the Bay implies that owners of these vessels are still finding fishing financially attractive, the same cannot be said for other vessel types or for labour. Daily returns to labour have increased only slightly since 1981. For example, motorcycle (tricycle) drivers can now expect to earn P20-25 net income per day. Net mending, fish drying or crewing on a gillnetter earn approximately P15 per day. While in nominal terms these represent increases in wages/income for these activities since 1981, the rate of inflation during this period (> 200 percent) has been such that, in real terms, income from these sources has declined significantly over the past five years.

Declining real income has occurred in most sectors of the Philippine economy during this same period, so the San Miguel Bay fishery is not necessarily unique. The fact that owner/labour sharing systems for non-trawl gear types in San Miguel Bay have not changed significantly from their earlier 60:40 or 50:50 basis is further indication that owners and crewmen are suffering alike under the prevailing economic conditions in the country. Net outmigration of young people to potentially better opportunities in cities continues.

Conclusion

To the outside observer, progress towards an effective management programme for San Miguel Bay is disappointing slow. In five years, no formal concrete steps have been taken in this direction, despite the apparent need as demonstrated in the 1981 studies.

There are significant barriers to progress. First of all, the six municipalities around the Bay have not as yet identified fisheries management as being necessarily in their common interest. All municipal officials were changed in early 1986 with the change of national government, and remain uncertain in their tenure pending local elections scheduled for mid-1987. Consequently, formal political leadership to address fisheries management issues has not yet developed. Secondly, and perhaps of more importance, the potential costs of a management programme for the Bay are likely to be high (even though benefits may be higher than costs) and in the current austere economic environment probably make implementation of any comprehensive fishery management programme extremely difficult.

On the positive side, fishermen and fishing community groups have become more active and organized. Since community participation will be a necessary ingredient in any fisheries management programme for the Bay, one can take encouragement from the fact that such community groups are evolving and that the current political environment in the country is likely to encourage rather than discourage such local initiatives.

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