

Satellite view of the Bicol region, with San Miguel Bay to the right of center. The sea appears black in this picture; white patches are scattered clouds over the land masses. Photo by NASA, U.S.A.

# Resolving Multigear Competition in Nearshore Fisheries

IAN R. SMITH  
and  
DANIEL PAULY  
ICLARM

**C**ompetition 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.

## San Miguel Bay

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 4 Japanese beam trawlers. Over the last 4 decades, the level of fishing effort significantly increased. In part this was from motorization of much of the non-trawl fleet and from a steady 2% per annum growth in numbers of fishermen. However, most was from increases in the number of trawlers; there are currently almost 100 small trawlers operating in the Bay.

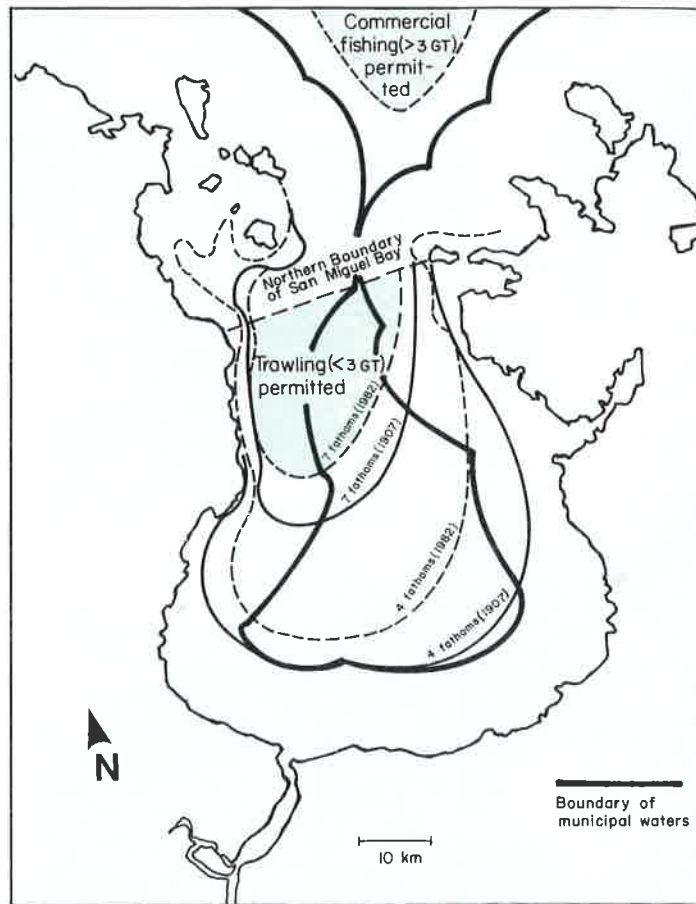
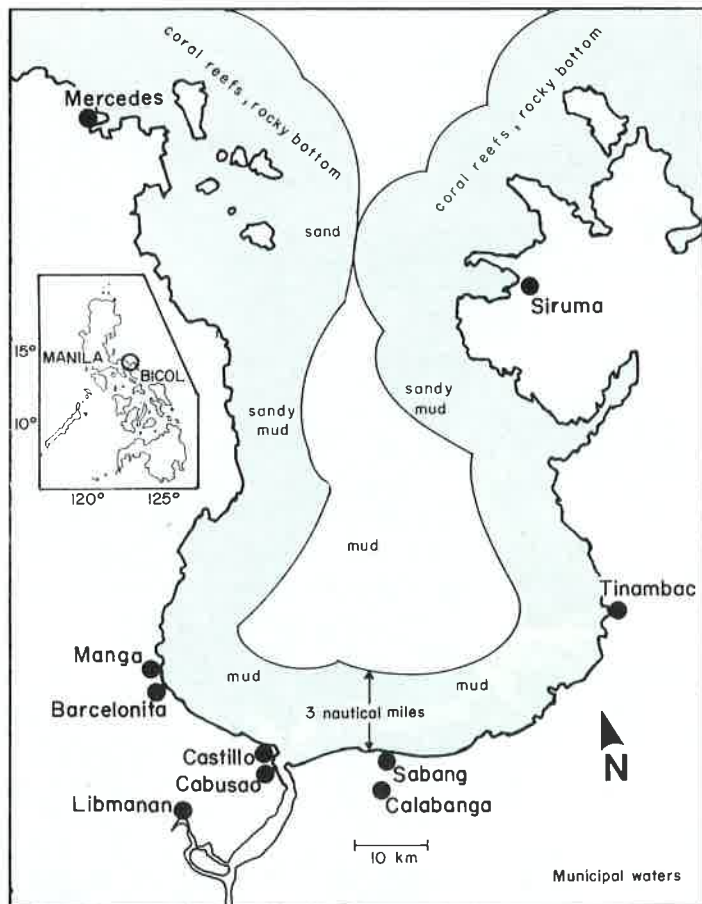


Fig. 1. *Left*: San Miguel Bay showing bottom features and major towns. Municipal waters are shaded. Central portion of the Bay is under jurisdiction of national fisheries authorities. *Right*: Delineation of areas where trawling is permitted is complicated by the gradual shallowing of the Bay which puts most of the trawling grounds outside the municipal waters.

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), and this requires permission from local municipalities. Otherwise they must stay in waters beyond 7 fathoms (12.8 m) deep.

Including “baby” trawlers with their 100-125 hp diesel engines in the same 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, they

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 favor of trawlers; and
- outmigration of fishing community labor 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, *Batalong*. The non-trawl fishermen 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." (*Batalong*, June 3, 1983)

### Research Study

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 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 (BRBDP) (see ICLARM Newsletter, April 1980: 14-16).

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 IFDR and ICLARM, with the United Nations

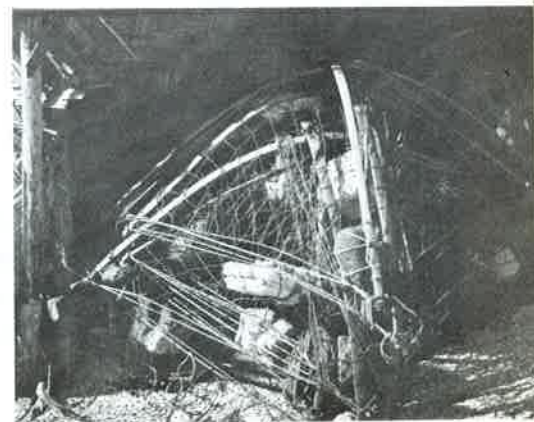
University and the Philippine Council for Agriculture and Resources Research and Development providing partial funding. The research project not only documented prevailing biological and sociological conditions, but also evaluated a range of management options for the fisheries of San Miguel Bay.

### Results

The biological part of the project involved estimation of fishing effort and catch per effort for all gear types, leading to reliable 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% of the catch, which presently totals 15,000 tonnes/year (excluding 4,000 tonnes of *balao*, a small



*Above left:* The Bicol river enters the southern end of San Miguel Bay. *Above right:* At Barcelonita, broad mud flats make landing of the catch difficult. *Below left:* Gillnetters are the most prevalent small-scale non-trawl gear used in San Miguel Bay. *Below right:* A specialized gear, the crab trap, used for catching swimming crabs.



shrimp) is taken by some 5,100 small-scale fishermen, and the remainder by 95 trawlers of various sizes (Table 1). There is considerable competition among gear types for the major species caught. Historical data obtained from various research boats and commercial trawlers were also used for comparative purposes (Fig. 2). These results show dramatic increases in effective effort and declining trawlable biomass but are consistent with a total catch that is levelling off. (The continued high catch from the Bay is 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 suggest that the Bay is 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.

Extreme competition for use of the resource and uneven distribution of benefits were shown by the economic

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 <sup>a</sup>
Total catch (excluding sergestids)		6,896	7,764
Total catch (including sergestids)		6,896	12,237

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

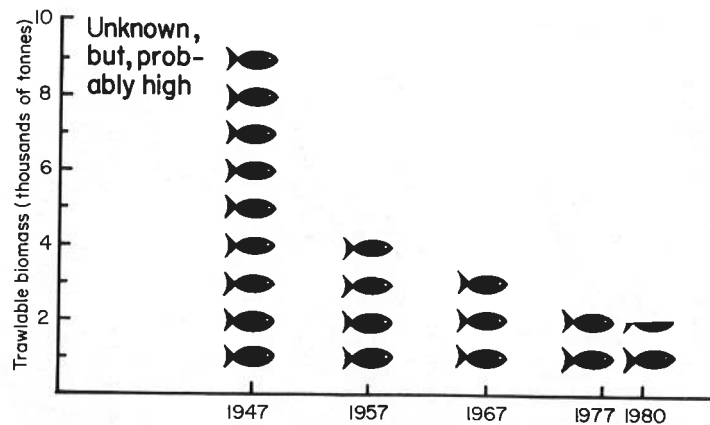
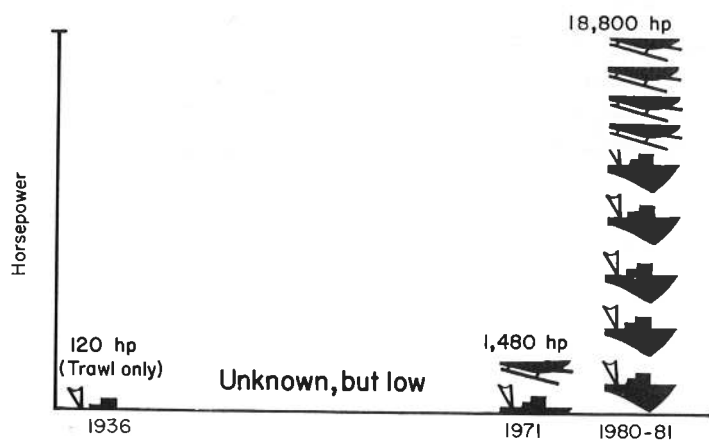


Fig. 2. The evolution of effort (horsepower only) and stock size (trawlable biomass only) from 1936 to 1981 (based on various sources).



In terms of catch, gillnetters are the most important non-trawl gear type. They include motorized, outriggered *bancas* shown here.



Other gillnetters are not motorized and some vessels are simple, hollowed-out logs.

Table 2. Summary of data on the San Miguel Bay fisheries (1980-1981). At time of study US\$1.00 = ₱8.50.

Characteristics	Small-scale fishery		Small and medium ("baby") trawls	Totals for the San Miguel Bay fisheries (all fishing units)
	Non-trawl gears	Mini trawl		
No. of fishing units	2,100	188	95	2,382
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 (₱)	250-13,000	9,200	55-70,000	greater than 15 million current replacement cost
Percent of total catch including sergestid shrimps	44	25	31	19,133 tonnes
excluding sergestid shrimps	59	-	41	14,660 tonnes
Percent of total value including sergestid shrimps	44	14	42	₱53.5 million
excluding sergestid shrimps	52	-	48	₱46.2 million
Percent of pure profits (resource rents) <sup>a</sup> including sergestid shrimps	15 <sup>b</sup>	35	50 <sup>c</sup>	₱3 million
excluding sergestid shrimps	23	-	77	₱1.6 million
Crewmen incomes/month (₱)	164-218	342	339-810 <sup>d</sup>	-
Owner (non-fishing) incomes/month (₱)	(-773) <sup>e</sup> -740	432	146 <sup>f</sup> -1,693	-

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

<sup>b</sup> One-half of this is earned by fish corrals; 40% by motorized gillnetters.

<sup>c</sup> Small trawlers only; medium trawlers did not cover their opportunity costs.

<sup>d</sup> Highest incomes are earned by pilots on small trawlers.

<sup>e</sup> Owners of stationary liftnets incurred losses.

<sup>f</sup> Lowest incomes are earned by owners of medium trawlers.

analysis. Small trawlers, representing only 3% of the Bay's fishing units and employing 7% of the fisheries' labor force, earn the largest share of catch value and 50% of that part of the profits from the fishery that accrue to fishermen (Table 2).

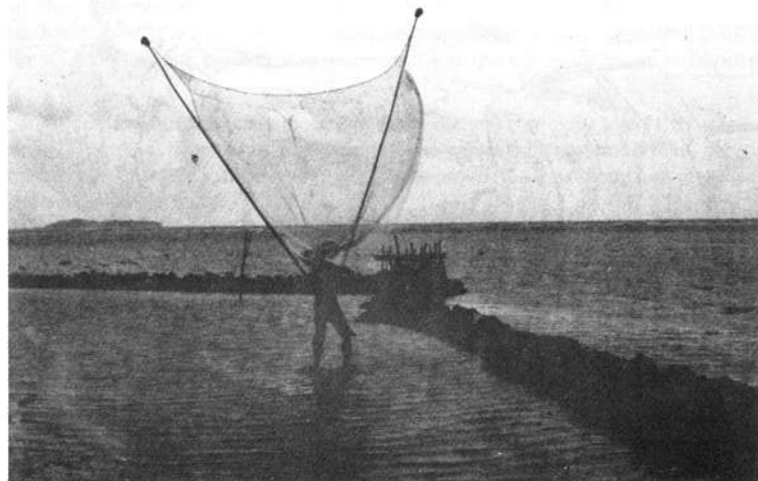
We define profitability here as revenue exceeding all costs, including a "fair" return to capital.

The government tax on fuel and the fuel suppliers-cum-fish processors also divert part of the profits from the fishermen. However, trawlers, which use diesel fuel, were able to maintain their competitive edge over non-trawl gears (which if motorized use regular gasoline) because the government tax on regular fuel (₱2.54/l)\* at the time of the study 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 provides 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. Adding to the problem is that continued expansion of the trawl fleet can be expected as long as the average trawl unit continues to be profitable, as was the case in 1980/81.

\*₱8.50 = US\$1.00 in 1980.



A "baby trawler" docked beside drying fish in Cabusao. Some communities have sheltered landing areas.



The scissor net is used in shallow waters, pushed ahead of the fisherman. Main catch is *balao* (small sergestid shrimp) and other small shrimp. About 500 tonnes of these shrimp are caught annually by this gear.

The sociological analyses indicated that the ownership and earnings of the small trawlers are highly concentrated: five families own 50% of the trawler fleet. In contrast, the non-trawl fleet, consisting of approximately 2,300 fishing units, is dispersed among approximately 2,000 households. The investigations also revealed that very limited alternative employment opportunities exist in the vicinity of the Bay, which explains the low earnings of labor 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.

All perspectives of the San Miguel Bay fisheries, including those of fishermen themselves, reached the same conclusion; the Bay is sorely in need of management. The increasing problems of over-fishing and uneven distribution of benefits can only be minimized if steps are taken to limit the amount of fishing effort. Continued credit programs are unlikely to solve the problems of the small-scale fishermen unless steps are 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 imply that any partial attempt to control fishing effort in the Bay will only be "buying time." Regardless of time frame, management of the fisheries is required.

### Management Options

If steps are taken to limit fishing effort in San Miguel Bay, not all current users can be accommodated. Any management intervention and reallocation of use rights will be inherently political in nature because management would redistribute current and future incomes earned from the San Miguel Bay fisheries. Such a move is likely to be objected to by those among the current users who would be adversely affected.

Because of the sensitive nature of these issues, the San Miguel Bay research team evaluated a full range of management options. Provided here are several options with their advantages and disadvantages (see Table 3). Any management measure adopted would depend upon the prior selection of the management objectives. If the major objective would relate to maintaining or even increasing incomes of the majority of the Bay's users, rather than promoting the most economically efficient (i.e., profitable) gear type, some limitation on small trawlers should be considered.

Although a whole range of management interventions was considered, most did not seem appropriate or enforceable for a multispecies multigear fishery such as in San Miguel Bay. For example, fleet or individual quotas, taxes, seasonal closures and price controls were all viewed as impractical for one reason or another. Mesh-size restrictions (i.e.,

increasing mesh size), while potentially useful in the short run, were thought to be difficult to enforce and because they control only one component of fishing effort, are not a long-term solution to the Bay's problems. Finally adjusting the diesel/regular gasoline fuel tax differential would not be practical given the government's broader development objectives for non-fishing sectors.

Trawlers presently pay only nominal license fees. One option for limiting their activities would be to increase these fees, either setting them higher or auctioning them off with limits to the number any one individual can take. This option, coupled with strict enforcement of existing area restrictions, would probably be most effective for reducing trawl fishing effort. Also, a licensing scheme could earn significant income (resource rents) for the licensing authorities which could (should) be used for income-generating activities in the coastal communities of the Bay. There is evidence that non-trawl gear types would fill the niche vacated by any trawlers that may be excluded, thus increasing non-trawl catch and incomes in the short-term at least.

Longer-term solutions that would deal with the problem of population growth and thus growing numbers of non-trawl fishermen necessitate looking outside the fisheries sector.

One of the major constraints to management of the Bay is the overlapping jurisdiction of local and national authorities and legislation. Confusion over *who* potentially controls *what* has been the result. Treating small trawlers as a distinct gear type separate from non-trawl gears, and then controlling their activities, would be a good first step to reduce this confusion.

### A Management Partnership

However, more than this is necessary to guarantee success of any attempt to manage the fisheries of San Miguel Bay. If fishermen themselves do not participate in any aspect of the planning or implementation of management of the fisheries, one can be certain that circumvention of any regulations chosen will be the rule. It is critically important in this fishery, as elsewhere, that a management partnership be forged between fishermen and the local and national



Table 3. Alternative management objectives for San Miguel Bay and alternative interventions needed (if any) to address each objective.

Objectives	Interventions
A. Objectives related to harvest sector	
● Maximize sustainable yield	Probably achieved under current conditions, but stabilization of effort or control over size at first capture (e.g., increase minimum mesh size) required to avoid long-term decline in trawlable biomass and further changes in species composition.
● Maximize economic efficiency (i.e., resource rents)	Encourage innovation to reduce fishing costs; reduce effort. Numerous specific interventions can be considered. A detailed discussion of the various options is given in ICLARM Technical Report 11.
● Maximize employment in fishing	Restrict capital-intensive gear types; increase mesh sizes; allow continued entry of non-trawl fishermen.
● Provide conditions conducive to more equitable distribution of income	
(a) between labor (crewmen) and capital (owners); and	(a) No intervention in current sharing arrangements necessary as present systems appear responsive to respective opportunity costs; labor share can be increased by increasing labor opportunity costs; encourage owner-operator fishing and discourage multiple ownership.
(b) among competing gear types	(b) Restrict certain gear types, especially small trawlers; introduce parity in taxes on inputs, especially gasoline and diesel fuel.
● Minimize conflicts between the trawl and non-trawl sectors	Enforce existing legislation; redefine 'municipal' fisheries to exclude small trawlers, then limit small-trawler numbers or areas of operation or ban them; establish trawling obstacles in areas off limits to trawlers.
● Guarantee incomes above the poverty threshold to fishing households	Guarantees not possible given prevailing low incomes throughout Bicol; long-term increases in fishing household incomes possible only through combination of (a) limited entry that excludes some fishermen thus benefitting those that remain, (b) alternative/supplementary income generation; short-term increases possible by subsidizing inputs or reducing taxes thereon (e.g., gasoline tax) used by non-trawl fishermen; and (c) education programs that increase skills and mobility of fishing families.
● Minimize environmental impact of activities in and near the Bay	Siltation inflows, while causing gradual shallowing and reduction in Bay's area, also bring nutrients of probable benefit to the fishery; halt conversion of mangroves to alternative uses (e.g., fishponds).
● Maximize government revenues from the fishery	Increase municipal license fees, taxes on inputs, catch and/or incomes so as to extract maximum resource rent in favor of the government (municipal, provincial, regional or national).
● Maximize production of exportable species to earn foreign exchange	No intervention necessary; present conditions (e.g., siltation, fishing out of predators and trawling) are favorable to shrimp production.
B. Objectives related to fisheries inputs and marketing sectors	
● Improve technical and economic efficiency of input supply, processing and marketing sectors	Numerous interventions possible, ranging from encouragement to use standard weights and measures, increase flow of price information from local markets to beach landings through channels other than those controlled by middlemen, improve landing and auction facilities, better product handling and processing techniques, improved fuel supply (including group purchase of fuel to circumvent present fuel suppliers) and market roads to more remote communities.
● Increase opportunities for village employment in the input supply, processing and marketing sectors	Decentralize and increase number of processing establishments; provide credit to small-scale processing entrepreneurs; encourage community organizations to undertake group processing and marketing and organize the appropriate group (i.e., women, not men) to undertake these activities.
C. Objectives related to the regional economy	
● Provide sufficiently attractive alternative income sources . . . so as to reduce dependence upon fishing	Requires general economic development and diversification in the Bicol region to increase the presently low opportunity costs of fishing labor and capital; land reform for rice and non-rice land; investment incentives to decentralize Manila-based development; strengthening of local and regional institutions and delegation of authority to them. Specific activities for fishing communities may include pig raising and cottage industry.
● Maintain social and political stability in the fishing communities surrounding San Miguel Bay	Generate employment opportunities to affect rural-urban migration; restrict certain efficient capital-intensive gear types viewed by the majority of fishermen as detrimental to their interests; either strengthen military presence to keep "peace and order" or establish management institutions that permit fishermen involvement in decisionmaking regarding resource use and allocation.



### The Broader Problem

The general features of what the research team has learnt about the San Miguel Bay fisheries apply to a large number of other fisheries throughout the Philippines, various Southeast Asian countries and, to a lesser extent, to many other tropical developing countries.

It was conflict of interests similar to that in San Miguel Bay, but involving much larger numbers of trawlers and small-scale fishermen, which prompted the Indonesian government to ban trawling in that country (see ICLARM Newsletter, Oct. 1980, p. 3). Other conflicts of this kind, often violent, have been reported from various parts of the Indo-Pacific. The lesson seems to be that in tropical demersal fisheries—because they generally involve shrimps that are caught inshore—conflicts between trawl operators and small-scale fishermen are almost unavoidable in the long run; projects of the type conducted in San Miguel Bay are indispensable for clarifying the issues involved and outlining some of the possible remedies.

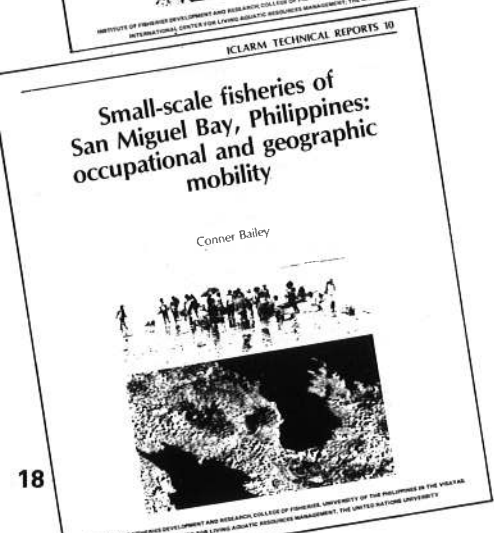
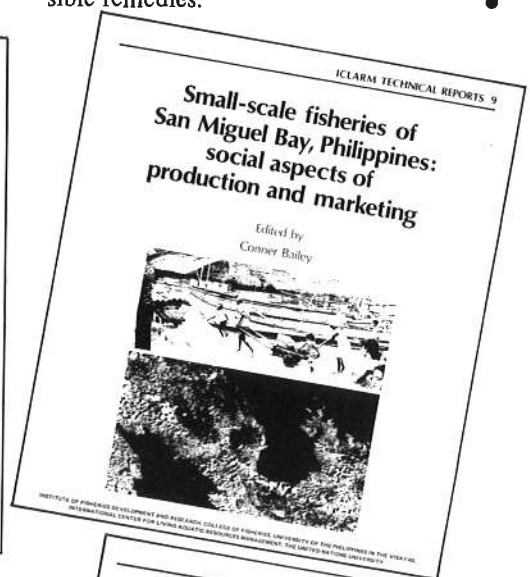
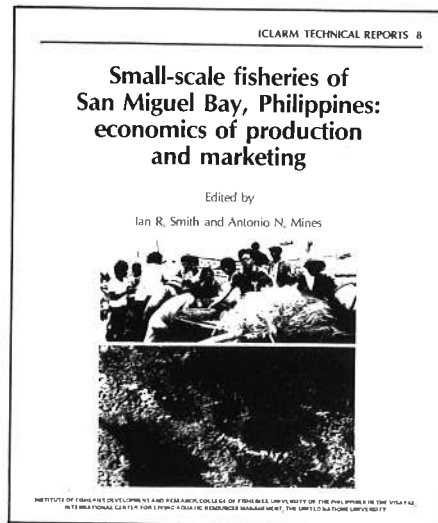
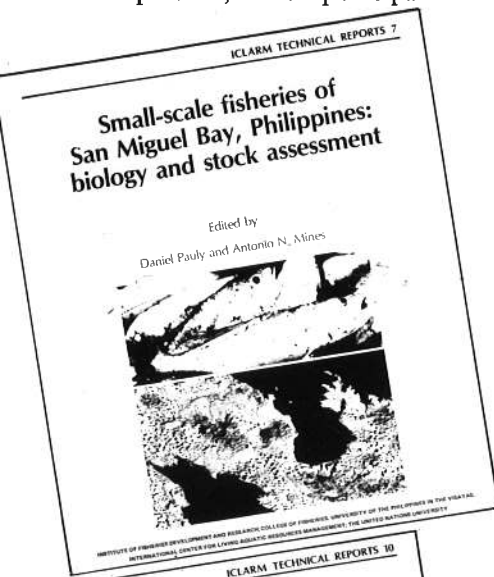
officials with responsibilities in the fisheries sector. The research team's proposed solution is the creation of a San Miguel Bay Fisheries Authority.

Such an Authority would have responsibility for setting management objectives for the whole Bay, collecting the background information necessary for selecting management steps, as well as implementing, monitoring and enforcing them.

The fishermen, both small-scale and trawler operators, must participate in

decisionmaking by this Authority if it is to deal successfully with the twin problems of overfishing and inequitable distribution of benefits that currently exist in San Miguel Bay.

Lack of fishermen's participation will most likely subvert any management plan; indeed, some measure of local decisionmaking and enforcement offer much better hope for fisheries management than do nationally centralized attempts at regulation.



These are the five reports of the San Miguel Bay project. Numbered as ICLARM Technical Reports 7-11, limited numbers are available to researchers within the Philippines from the Director, Institute of Fisheries Development and Research, University of the Philippines in the Visayas, Diliman, Quezon City.

The reports are also being sold by ICLARM to cover production and postage costs at US\$9, \$12, \$8, \$7, and \$6.30, respectively for surface mail and \$16, \$25, \$14, \$11.50, and \$9.50, respectively for airmail. Domestic prices P65, P88, P55, P45, P40, respectively. See foot of p. 5 for ordering details.

