Mines, A.N., I.R. Smith and D. Pauly. 1986. An overview of the fisheries of San Miguel Bay, Philippines, p. 385-388. In: J.L. Maclean, L.B. Dizon and L.V. Hosillo (eds). The First Asian Fisheries Forum. Asian Fisheries Society, Manila, Philippines.

An Overview of the Fisheries of San Miguel Bay, Philippines[a]

ANTONIO N. MINES
Department of Marine Fisheries
College of Fisheries
University of the Philippines
in the Visayas
Diliman, Quezon City

IAN R. SMITH
DANIEL PAULY
International Center for Living
Aquatic Resources Management, Inc.
MC P.O. Box 1501, Makati, Metro Manila
Philippines

MINES, A.N., I.R. SMITH and D. PAULY. 1986. An overview of the fisheries of San Miguel Bay, Philippines, p. 385-388. *In* J.L. Maclean, L.B. Dizon and L.V. Hosillos (eds.) The First Asian Fisheries Forum. Asian Fisheries Society, Manila, Philippines.

Abstract

The paper presents a brief account of a multidisciplinary study from 1979 to 1982 in the 840-km^2 San Miguel Bay, Camarines Sur, Philippines, which covered the biological, economic and sociological aspects of the fishing industry.

A total annual fish production of about 20,000 t was recorded from the Bay. About 64% of this was contributed by some 5,100 small-scale fishermen, while the rest was landed by 95 commercial trawlers of varying sizes.

Economic analysis revealed the existence of strong competition among the different fishing sectors over the use of the Bay's resources and income is unevenly distributed in favor of the commercial trawlers, which employ only 7% of the total number of fishermen in the area. Ownership and earning of the trawlers were concentrated in 35 families, while the small-scale fishing gears were distributed evenly among 2,000 families. The sociological study revealed that there are very limited alternative employment opportunities around the Bay which results in the low income of the households and significant out-migration from the area.

Several alternative management measures were analyzed to help resolve the growing conflicts between the small-scale and commercial fishermen, whose landings were declining while fishing effort was increasing. The project proposed the establishment of the "San Miguel Bay Fisheries Authority" which should be responsible for defining management objectives for the Bay, collecting background information necessary for selecting appropriate management measures, as well as for ensuring their implementation.

Introduction

The present paper is based on the research project "Small-scale Fisheries of San Miguel Bay: A Multidisciplinary Analysis", which was conducted jointly by the Institute of Fisheries Development and Research (IFDR) of the University of the Philippines in the Visayas-College of Fisheries and the International Center for Living Aquatic Resources Management (ICLARM) from November 1979 to 1981.

The primary objective of the project was to conduct a multidisciplinary study in the 840-km^2 San Miguel Bay with emphasis on the problems of the "municipal" fishery and the fishing communities around the Bay (small-scale fishermen are in the Philippines, licensed by their municipalities, hence the name). It was recognized that biological, technological, economic and sociological factors all influence the income of municipal fishermen, and in order to fully understand their problems, the interrelationships of these factors must be determined. The project was the first attempt to use multidisciplinary approach in fisheries research in the Philippines. It was envisioned that such an approach could subsequently be used in other areas and that the results of the present study could serve as basis for government policymakers and planners to integrate the development of the fisheries of San Miguel Bay in its development program for the Bicol Region.

The Bay is characterized by a sandy mud substrate, with average depths of 5.25 m. The whole area is trawlable. Fishing is carried out all year, using different gears seasonally.

The overall project was divided into three distinct, but complementary modules: a) biology (stock assessment), which assessed physical constraints to fishing and the status of the fishery resources of the area; b) economics, which examined the catch, effort and incomes of the municipal and commercial fishermen as well as costs and returns for the major municipal fishing gears and economic efficiency of the marketing and distribution systems in the area; and c) sociology, which determined the nature and extent of the flow of human resources between municipal fisheries and other rural sectors; assessed the potential of programs that seek to reduce the dependence of households on capture fishing; examined the factors that influenced sharing systems for major gear types; and described the sociological aspects of the marketing systems.

Materials and Methods

Fourteen research personnel were fielded by the project, consisting of six members for the biological team, four for the economic team, and four for the sociology team. Three senior researchers guided the field personnel.

Some biological and hydrographic data were collected as background information on the assessment of the fisheries of the area. Available secondary hydrographic data were also used to describe the Bay's ecological character. A portable echosounder mounted on a motorized banca was used for a one-day bathymetric survey of the Bay.

The catch-per-effort by gear type was obtained by direct monitoring of fishing activities at selected landing places over a 12-month period. A team of research assistants also boarded trawlers twice each month to gather catch data during actual fishing operations.

An inventory of the fishing gears being used in the area was conducted by actual physical count of the larger gears, e.g., fixed gears, "baby" trawlers, etc., and through household surveys, using questionnaires and personal interviews of respondent fishermen in the case of smaller gears, like push nets and handlines.

Surveys of all possible sources of primary and secondary data, including published and unpublished reports, theses and raw data reports from various institutions were conducted to gather historical data on the Bay and its resources.

The data collection activities of the economic study team were divided into four phases: household inventories, landing and market surveys, costs and return record-keeping, and middlemen/processors survey. Either census or random sampling technique was used, depending on the size of the respondents.

Data for the sociological study were gathered over an 18-month period from 22 communities (total population = 40,000 or 3,690 households) bordering the San Miguel Bay area, involving a sample survey of 641 households and in-depth interviews of respondent active fishermen, fishing consumers, middlemen and processors. Data analysis was conducted mainly through cross tabulations of variables.

Results and Discussion

Pauly (1982) grouped the fish fauna of San Miguel Bay according to their types of habitats into:

a) Soft-bottom demersals inhabit the shallow, soft muddy portion of the Bay. This group of species predominates in the catch (55%). Examples are the Leiognathidae, Sciaenidae and Mullidae.

b) Hard-bottom demersals are associated with reefy/rocky substrates. About 20% of the ichthyofauna identified are probably inhabitants of the reef areas and rocky outcrops near the entrance of the Bay. Examples are the Serranidae, Lutjanidae and Chaetodontidae.

c) Coastal pelagics use the Bay as nursery area and comprise about 22% of the fish species found there. Examples are the Clupeidae and Engraulidae.

d) Oceanic pelagics enter the Bay occasionally for food or shelter but their young do not use it as a nursery area. Only 3% of the fish species caught belong to this group. Example are the large Scombridae.

The fish resources of San Miguel Bay are being fished by both commercial and municipal fishermen. The commercial fishermen mostly use trawlers of varying sizes. Vakily (1982) found there were 30 large trawlers ranging from 27 to 117 gross tons (GT) (which operated only occasionally inside the Bay) and are excluded from further consideration here; 20 medium trawlers, ranging from 3 to 6 GT; and 75 small trawlers ("municipal baby trawls") ranging from 2.5 to 2.9 GT.

The municipal fishermen were using a variety of non-trawl fishing gears (Table 1) and nearly 200 minitrawls. During the one-year period covered by the investigation, 19,133 t of fish, molluscs and crustaceans were landed from the Bay. Among the catch of the municipal fisheries are sergestid shrimps locally called "balao". These small crustaceans, represented in Philippine waters by *Acetes* sp., possibly *A. erythraeus* (Omori 1975), are caught by a special gear, the minitrawl, operated mainly from December to May. The "balao" fishery contributes about 23% (4,470) of the San Miguel Bay fishery.

About 64% (12,237 t) of the catch, including sergestid shrimps, were contributed by about 5,100 small-scale fishermen, while the remaining 36% (6,896 t) were landed by 95 trawlers, owned by 35 operators. The average catch of small-scale fishermen was thus 2.37 t while each commercial trawl operator took some 197 t yearly. The trawler catch had a total market value of ₱22 million while that of the small-scale fishing gears amounted to about ₱31 million (Smith et al. 1982).

The distribution of pure profits, defined as "resource rents above all costs" (Smith et al. 1982) from the catch (including "balao") by the different competing gear types in the Bay indicated that half the total pure profit of ₱3 million was earned by the trawlers alone, and the other half was distributed among the scale-fishing gears with the minitrawls getting the biggest share of ₱1 million, and the rest were shared proportionately by the gill netters (₱156,000), fish corrals (₱216,100) and filter nets (₱54,000). The Philippine government also earned a share of the resource rents amounting to ₱5.5 million in the form of its taxes on fuel. This tax was higher on nontrawl gears

and minitrawls using regular gasoline than on trawlers which used diesel.

The study shows that the ownership and earnings of the trawlers were concentrated in only a few operators/families, while those of the small-scale fishing gears, including the mini-trawls were distributed rather evenly among a large number of families. Thus, the distribution of benefits from the Bay's fish resources is skewed in favor of the trawlers. The sociological study (Bailey 1982) revealed that there are very limited employment opportunities around the Bay, which results in low earnings of the households, prompting out-migration from the area. An annual increase of 2% in the number of fishermen around the Bay, was estimated, nevertheless.

Due to a rise in fuel costs, some commercial fishing boat operators shifted their operations to nearshore areas using smaller boats. It became apparent that the small-scale fishermen are faced with competition both from amongst themselves, as their number increases, as well as from trawlers.

Status of the San Miguel Bay Fisheries

The earliest survey conducted on the fishery resources of San Miguel Bay was done in 1935 (Umali 1937). Warfel and Manacop (1950) in their demersal otter trawl survey in 1947, found the highest density of fish among Philippine trawling grounds in San Miguel Bay. On this basis, they suggested that four to five trawlers could be maintained by the resources without any adverse effect. Following their survey, several fishing vessels started to operate in the Bay. Eventually, their number increased up to present levels, where the combined power of all crafts operating in the bay is 18,000 hp of which 13,200 hp are small and medium trawlers and 5,600 hp are small-scale crafts, including minitrawls and gill netters. The trawlable biomass in the Bay has declined to only 1,800 t, equivalent to a density of 2.13 t/km^2, only about 20% of the biomass that can be estimated from the data in Warfel and Manacop (1947) and Pauly (1982).

Pauly (1982) concluded that there is "ecosystem overfishing'" in the Bay, a condition in which the decline through fishing of the originally abundant stock is not fully compensated for by the increase of the biomass of other exploitable species. Thus the sharks, rays and slipmouths, which were once the major components of the trawl catch in San Miguel Bay, have now been largely replaced by croakers, squids and shrimps (see Belnas 1980 for catch effort data on the latter) which have smaller biomass than the group they replaced.

The following threats to the viability of the fishing industry of San Miguel Bay were identified:

1. There is biological overexploitation of the resources of the Bay, in the sense that an increase in fishing effort would not produce a corresponding increase in total catch.

2. Economic overfishing occurs in the Bay as evidenced by the fact that the rent represents only 6% of the gross value of the catch.

3. There is growing competition between the different fishing sectors in the Bay, which are exploiting the same resource. The trawlers, representing only 3% of the Bay's fishing units and employing only 7% of the total fisheries labor force in the area, are getting the largest share of the catch and 50% of the profit.

4. The entry into the fishery of both trawlers and the small-scale fishermen remains unregulated, resulting in declining catch per fisherman.

5. There are very few alternative employment opportunities for the fishermen around the San Miguel Bay area.

Management Options

The study revealed that there is a pressing need for management schemes for the fisheries of the Bay. The growing problem of overfishing and uneven distribution of incomes can only be minimized by limiting the amount of fishing effort. Increasing the 2-cm mesh size used by the trawlers and banning of commercial trawlers from municipal waters are considered useful measures, but enforcement of these restrictions appears difficult. 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.

It is critically important in this fishery that a management partnership be forged between the fishermen, local officials and concerned national government officials. The research team proposed the creation of a "San Miguel Bay Fishery Authority" (SMBFA) which would be responsible for setting management objectives for the whole Bay, collecting background information necessary for selecting management steps as well as implementing, monitoring and enforcing them. All fishermen would be encouraged to participate in decisionmaking by the SMBFA.

References

Bailey, C., editor. 1982. Small-scale fisheries of San Miguel Bay, Philippines: social aspects of production and marketing. ICLARM Tech. Rep. 9. 57 p. Institute of Fisheries Development and Research, 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.

Belnas, A.L. 1980. A preliminary study of the shrimp catches in the Visayan Sea, San Miguel Bay and Manila Bay, p. 86-92. *In* Report of the workshop on the biology and resources of penaeid shrimps in the South China Sea. Part I. SCS/GEN/80/26. South China Sea Fisheries Development and Coordinating Programme, Manila, Philippines.

Omori, M. 1975. The systematics, biogeography and fishery of epipelagic shrimps of the genus *Acetes* (Crustacea, Decapoda, Sergestidae). Bull. Ocean Res. Inst. Univ. Tokyo 7. 91 p.

Pauly, D. 1982a. The fishes and their ecology, p. 15-33. *In* D. Pauly and A.N. Mines (eds.) Small-scale fisheries of San Miguel Bay, Philippines: biology and stock assessment. ICLARM Tech. Rep. 7. 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. 1982b. History and status of the San Miguel Bay fisheries, p. 95-124. *In* D. Pauly and A.N. Mines (eds.) Small-scale fisheries of San Miguel Bay, Philippines: biology and stock assessment. ICLARM Tech. Rep. 7. Institute of Fisheries Development and Research, College of Fisheries, University of the Philippines in the Visayas, Quezon City, Philippines the International Center for Living Aquatic Resources Management, Manila, Philippines; and the United Nations University, Tokyo, Japan.

Smith, I.R., A.N. Mines and G. Banacia. 1982. The research site, data collection and method of analysis, p. 1-26. *In* I.R. Smith and A.N. Mines (eds.) Small-scale fisheries of San Miguel Bay, Philippines: economics of production and marketing. ICLARM Tech. Rep. 8. 143 p. Institute of Fisheries Development and Research, University of the Philippines in the Visayas, Quezon City, Philippines; the International Center for Living Aquatic Resources Management, Manila, Philippines and the United Nations University, Tokyo, Japan.

Umali, A.F. 1937. The fishery industries of San Miguel Bay, Philipp. J. Sci. 63(2):227-258.

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

Warfel, H.L. and P.R. Manacop. 1950. Otttertrawl explorations in Philippine waters. Fish Wildl. Serv. (U.S.) Res. Rep. 25. 49 p.

[a]ICLARM Contribution No. 319.

Table 1. Small-scale gears used in the San Miguel Bay, with their Tagalog and Bikol names.

Gear type	Tagalog name	Name in San Miguel Bay area
Non-textile devices:		
Spear gun	salapang, panibat	antipara
Fish trap	bubo	bubo
Fish weir	pangharang	sabay
Stationary tidal weir		ambak
Fish corral	baklad	baklad, sagkad
Textile devices:		
Lines		
Pole and line	kawil	banwit
Longline	kitang	kitang
Nets		
Liftnets	panadiyok	bukatot
Scissor net	sakag	sakag
Crab liftnet	bintol	bintol
Filter net	dayakus	biakus
Beach seine	pukot	sinsoro
Minitrawl	—	itik-itik
Drift gill net	panti, paanod	panke
Drift gill net		palataw
Drift gill net		pamating
Crab gill net	—	pangasag
Bottom-set gill net	palagiang-paningahan	palubog