ICLARM STUDIES AND REVIEWS 4

Philippine Municipal Fisheries:

A Review of Resources, Technology and Socioeconomics

IAN R. SMITH, MIGUEL Y. PUZON
and CARMEN N. VIDAL-LIBUNAO

ICLARM INTERNATIONAL CENTER FOR LIVING AQUATIC RESOURCES MANAGEMENT

FISHERY INDUSTRY DEVELOPMENT COUNCIL

Philippine Municipal Fisheries:
A Review of Resources, Technology and Socioeconomics

Philippine Municipal Fisheries:
A Review of Resources, Technology and Socioeconomics

IAN R. SMITH, MIGUEL Y. PUZON
and CARMEN N. VIDAL-LIBUNAO

1980

ICLARM INTERNATIONAL CENTER FOR LIVING AQUATIC RESOURCES MANAGEMENT

FISHERY INDUSTRY DEVELOPMENT COUNCIL

Philippine Municipal Fisheries:
A Review of Resources, Technology and Socioeconomics

By IAN R. SMITH, MIGUEL Y. PUZON and CARMEN N. VIDAL-LIBUNAO

1980

Published jointly by the International Center for Living Aquatic Resources Management, MCC Box 1501, Makati, Metro Manila, and the Fishery Industry Development Council, 6th Floor, Philippine Heart Center for Asia Bldg., East Avenue, Diliman, Quezon City.

Printed in Manila, Philippines

Smith, I.R., M.Y. Puzon and C.N. Vidal-Libunao. 1980. Philippine Municipal Fisheries: A Review of Resources, Technology and Socioeconomics. ICLARM Studies and Reviews 4, 87 p. International Center for Living Aquatic Resources Management, Manila, and the Fishery Industry Development Council, Manila.

Cover: The four cover photographs indicate aspects of Philippine municipal fisheries: mixed gill net catch; beach landings for bancas; fishing village with little if any land ownership, and a municipal retail market where much of the municipal catch ultimately reaches the consumer, emphasizing the market rather than subsistence orientation of municipal fisheries.

ISSN 0115-4389

Contents

List of Abbreviations

ACA - Agricultural Credit Administration
ADB - Asian Development Bank
AID - Agency for International Development
BAEcon - Bureau of Agricultural Economics
BFAR - Bureau of Fisheries and Aquatic Resources
CB - Central Bank of the Philippines
DA - Department of Agriculture
DAP - Development Academy of the Philippines
DBP - Development Bank of the Philippines
DNR - Department of Natural Resources (now Ministry)
FAO - Food and Agriculture Organization of the United Nations
FIDC - Fishery Industry Development Council
FIRM - Fishery Resources Management Program
GOP - Government of the Philippines
ICLARM - International Center for Living Aquatic Resources Management
IFDR - Institute of Fisheries Development and Research
IOP - Indian Ocean Program
IPFC - Indo-Pacific Fisheries Council
ISEAS - Institute of Southeast Asian Studies
LBP - Land Bank of the Philippines
LLDA - Laguna Lake Development Authority
MLGCD - Ministry of Local Government and Community Development
MNR - Ministry of Natural Resources
MSC - Marine Sciences Center, University of the Philippines
NEDA - National Economic and Development Authority
NEPC - National Environmental Protection Council
NFAC - National Food and Agriculture Council
NMPC - National Media Production Center
NSDB - National Science Development Board
PCARR - Philippine Council for Agriculture and Resources Research
PD 704 - Presidential Decree 704, otherwise known as the Fishery Decree of 1975.
PFMA - Philippine Fish Marketing Authority
PNB - Philippine National Bank
PREPF - Population, Resources, Environment and the Philippine Future
SCSP - South China Sea Fisheries Development and Coordinating Programme
SEAFDEC - Southeast Asian Fisheries Development Center
SEARCA - Southeast Asian Regional Center for Graduate Study and Research in Agriculture
SFSCP - Small Fishermen Special Credit Fund
UNDP - United Nations Development Programme
UPCF - University of the Philippines College of Fisheries
UPLB - University of the Philippines at Los Baños
USAID - United States Agency for International Development
WB - World Bank

Preface

As part of its research program on traditional fisheries, the International Center for Living Aquatic Resources Management (ICLARM), in cooperation with other fisheries organizations, is preparing a series of publications that review research conducted to date on the problems of traditional fisheries and on development policies and programs that seek to alleviate them. The first monograph prepared in this connection, "A Research Framework for Traditional Fisheries" (Smith 1979a), serves as a theoretical backdrop against which country-specific reviews are being undertaken. Country-specific papers cover the resources, technology, and the socioeconomic and institutional aspects of traditional fisheries production and distribution.

"Philippine Municipal Fisheries: A Review of Resources, Technology, and Socioeconomics" is the first of these country-specific reviews. A joint undertaking of ICLARM and the Fishery Industry Development Council (FIDC), Ministry of Natural Resources, Republic of the Philippines, it synthesizes publicly available research studies and secondary data. As such, it is not a statement of official Philippine government policy on municipal fisheries, although conclusions of the study may have implications for such policy.

M. Y. PUZON and C. N. VIDAL-LIBUNAO, FIDC
January 1980

Philippine Municipal Fisheries: A Review of Resources, Technology and Socioeconomics

IAN R. SMITH, MIGUEL Y. PUZON
AND CARMEN N. VIDAL-LIBUNAO

Abstract

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

Recent research findings related to the technology and socioeconomics of small-scale municipal fishermen in the Philippines and the "open-access" resources they exploit are reviewed. Evidence is provided of a trend towards overfishing of Philippine coastal waters, and of a willingness among fishermen to consider alternative activities to capture fishing.

Also documented is the encouraging shift in emphasis in government programs from a resource "development" orientation to one of resource "management." The review concludes with a discussion of the implications of these research findings to fisheries management and research.

Introduction

The last decade has seen a rapidly growing interest throughout the world in the economic and social aspects of traditional small-scale fisheries development. Prior to the 1970s it was widely believed that the key to raising the living conditions of traditional fishermen could be found in improved vessel and gear technology. Development projects of the 1950s and 1960s reflected this emphasis in their concentration on improved production techniques, almost to the exclusion of other nontechnical considerations (Sainsbury 1977). As difficulties with this approach grew, despite some limited successes, it became apparent that technological change could not, to borrow a phrase from Alexander's (1975) study of Sri Lanka fisheries, take place in a cultural vacuum.

As was true in many other parts of the world, interest developed in the Philippines for socioeconomic research to precede and complement development programs aimed at the small-scale fisheries sector. The first research to result from this shift of emphasis in the Philippines were the community studies by Baum and Maynard (1976a, b,c,d,e) which, in addition to the measurement of certain social indicators (income, house ownership, and housing

standards), also assessed attitudes of municipal fishermen to occupational and geographic change.[1] Many studies similar in nature, though richer in data, have either followed or are in the planning stage.

In addition to these fishing community studies, three recent research projects have shed considerable light on the relationship of the production sector to the distribution sector, and on the "suki" relationships that link the two (Cuyos and Spoehr 1976; Jocano and Veloro 1976; Hopkins and McCoy 1976).

Other marketing studies, though only indirectly related to municipal fisheries, have broadened the perspective of fisheries development problems (Navera 1976; NORCONSULT/IKO 1976; BAEcon/BFAR 1978). These marketing studies are of interest not only for their insights but also because improvements in marketing infrastructure are now seen as an indirect means to increasing fishermen's income. The NORCONSULT/IKO report, which also contained recommendations for upgrading vessel and gear technology, presaged the expansion and improvement of the Navotas fishing port, landing and market facilities. However, only a very small proportion of landings at Navotas and other major ports in the Philippines derive from municipal fisheries, the landings from which are dispersed along the whole Philippine coastline.

Complementing the increased interest in socioeconomics, several Philippine researchers have begun to address the extremely difficult problems of stock assessment and estimates of maximum sustainable yield in this multispecies environment (PREPF 1977; Aprieto 1977; SCS/GEN/76/7; SCS/GEN/77/11; FIDC 1977b).

In short, there is a rapidly growing body of literature on the biological, technical, and socioeconomic aspects of Philippine municipal fisheries.

The purposes of this review are: 1) to consolidate and summarize and, where possible, generalize from research conducted to date and 2) to examine the general thrust of development programs aimed at the municipal fisheries sector.

This review makes no pretext of either setting priorities for fisheries research or of being a long range plan for municipal fisheries development in the Philippines. Such plans more properly result from deliberations of the Marine and Inland Fisheries Committee of the Philippine Council for Agriculture and Resources Research (PCARR), and from planning efforts of the Bureau of Fisheries and Aquatic Resources (BFAR) and the FIDC. Rather, this review will build on the earlier work of Samson (1977) and of Samson et al. (1977) by summarizing empirical data on resources, technology, and socioeconomics, much of which have been collected since that time, and by suggesting certain broad areas for research concentration. This review is based almost exclusively on previous published information despite the recognition that considerable useful knowledge and unpublished manuscripts would probably be available from entrepreneurs and employees working with municipal fisheries on a day-to-day basis. The collection, analysis, and publication of such information would be a further research project in and of itself.

There are three underlying themes to this reserach and development review. First, it appears that more information is available regarding municipal fisheries than is commonly supposed. Second, a multidisciplinary approach is necessary to appreciate the problems and potentials of municipal fisheries. Third, the search for solutions to the widespread poverty of municipal fishermen must include areas outside of capture fishing, in addition to those that are fishery specific.

After a broad overview that describes the role of municipal fisheries in the national economy and the major problems facing the sector, *the review summarizes* research on the following topics:

1. Municipal Fisheries Resources (Marine and Inland).
2. Technology of Municipal Fishermen.
3. Socioeconomics of Production and Distribution.

The paper concludes with sections on:

1. Development Programs to Aid the Municipal Fishermen.
2. Conclusion: Implications for Management and Research.

FIDC records and "Papers and Proceedings of the National Workshop on Municipal Fisheries Development," published in 1978 by FIDC, have been the primary sources of information on development programs for municipal fishermen (Section VI). These were supplemented with interviews with various government officials.

[1] In the Philippines the term "municipal fishermen" most closely approximates the more common worldwide terms of small-scale, artisanal, or traditional fishermen. Municipal fishermen are those using vessels of 3 t or less, or using gear not requiring the use of boats. All other fishermen are considered commercial fishermen. Municipal fishermen fish in both marine and inland waters.

Overview of the Municipal Fisheries Sector

A. THE IMPORTANCE OF MUNICIPAL FISHERIES[1]

As stipulated in Presidential Decree 704 (PD 704), otherwise known as the Fishery Decree of 1975, the term "municipal fisheries" refers to fishing that utilizes boats of 3 gross tons (gt) or less, or uses gear not requiring the use of boats. The area of operation, known as municipal waters, includes not only streams, lakes, and tidal waters within the municipality but also marine waters within 3 nautical miles of the municipal coastline. With the introduction of motorized boats, however, the actual area of operation of vessels registered in municipalities now extends to far beyond 3 miles (mi). Municipal fisheries thus include both marine and freshwater (inland) fishing activity and are roughly equivalent to the artisanal, small-scale or traditional fisheries referred to by other countries. All nonmunicipal marine fisheries activities in the Philippines are termed "commercial."

The contribution of municipal fisheries to annual fish production in the Philippines is significant (Table 1). While maintaining an approximate 55-60% share of total catch over the past two decades, municipal fisheries production has quadrupled from 218,983 (mt) in 1955 to 874,934 mt in 1977.[2] Of this 1977 amount, approximately 81% or 712,514 mt was caught by marine municipal fishermen, and approximately 19% or 162,420 mt was caught by inland municipal fishermen (Table 2).

Per capita consumption of marine products in the Philippines was 24.2 kg in 1972 (FAO 1973), representing approximately 54% of animal protein intake. Thus, municipal fisheries highly contribute to meet the nutritional needs of the average Filipino.

In addition to this, municipal fisheries contribute approximately 3% of the annual GNP and provide employment to about 5% of the Philippine working force of 14,000,000. Municipal fisheries are estimated to directly employ approximately 500,000 full-time and part-time fishermen who live in some 10,000 fishing barangays scattered in coastal villages throughout the country (see Table 2). The major regions where municipal fishermen are located are Southern Tagalog (Region IV-A), Bicol (Region V), and Central Visayas (Region VII), which between them account for almost 40% of the total (see Figure 1). In addition, it is thought by many that there are probably large numbers of families not included in official statistics that gather molluscs or fish for for their immediate household consumption.

In 1976 the total value of fish production was ₱7.3 billion. Despite its 55.4% share of production, however, the value of municipal fisheries catch was estimated at only ₱2.7 billion, or 37% of the total value. While the average wholesale prices for fishpond and commercial production were estimated to be ₱7.60/kg and ₱7.35/kg, respectively, the average wholesale price for municipal fisheries catch was only ₱3.50/kg.

Municipal fisheries catch is either sold fresh, consumed fresh by the household, processed by the household, or sold to local processors. It is thought that the catch, which is landed at points dispersed throughout the country, may compose a significant proportion of fishery products that move through the marketing chain to the final consumers. By no means does the catch appear to be restricted in distribution to the immediate locale where it is caught. Of course, in the more isolated areas of the country, catch distribution is more likely to be restricted. Recent marketing studies appear to indicate a surprisingly high degree of integration between the marketing of municipal and commercial catch (see Section VI for an elaboration of this point of view).

Table 1. Annual catch: municipal fishing (marine and inland), 1955-1977. Catch and value data are from Fishery Statistics of the Philippines, BFAR, Manila.

Year	Catch (mt)	Value (P1000)[2]	Value per kg[2]	As % of total catch[1]
1955	218,983	201,465	P0.92	60.3
1960	264,481	274,560	1.04	59.5
1965	303,930	328,245	1.08	45.5
1966	326,725	329,990	1.01	46.3
1967	351,229	403,914	1.15	47.1
1968	444,179	631,139	1.42	47.5
1969	477,492	709,557	1.49	50.8
1970	570,546	857,717	1.68	51.6
1971	542,904	1,123,811	2.07	53.1
1972	598,733	1,389,061	2.32	53.3
1973	639,795	1,599,487	2.50	53.1
1974	684,498	2,395,743	3.50	54.0
1975	731,725	2,561,037	3.50	54.7
1976	772,525	3,754,472	4.86	55.4
1977	874,934	4,374,670	5.00	58.0

[1]Remainder from commercial fisheries and from fishponds.
[2]Values from 1965 are computed at estimated wholesale prices.

[1]Summarized primarily from FIDC (1978). Papers and Proceedings, National Workshop on Municipal Fisheries Development, Dec. 1977, Cavite City, Philippines.
[2]For a complete discussion of the reliability of these statistics see Section III, p. 00.

Table 2. Production of municipal fishing craft and fishermen productivity by regions, 1976-1977. Catch data are from Fisheries Statistics of the Philippines, BFAR, Manila.

Region Marine	1976[1]	1977[1]	Estimated no. of fishermen[1]	Annual catch per fisherman[1]	Estimated no. of vessels[1]	Percent motorized
I	16,432	13,487	43,553	.34	13,018	47
II	3,834	6,099	11,793	.42	2,759	27
III	15,416	4,299	36,595	.27	24,926	95
IV	89,129	2,904	66,026	1.49	24,369	
IV-A		105,019				60
V	136,642	135,732	63,912	2.13	26,409	38
VI	52,319	87,040	35,865	1.94	14,506	28
VII	65,436	38,714	67,147	.78	52,770	39
VIII	73,724	73,635	46,549	1.58	18,661	48
IX-A	32,275	97,730	44,111	1.71	15,434	33
IX-B	21,020					
X	59,461	49,728	29,419	1.86	22,253	28
XI	40,303	84,795	42,536	1.47	18,158	62
XII	13,154	13,332	13,159	1.01	10,326	9
Subtotal marine:	619,145	712,514	500,665	1.33	243,589	46
Inland[2]	153,380	162,420	unknown	unknown	unknown	unknown
Total:	772,525	874,934				

[1]Estimated numbers of fishermen and vessels from BFAR Expanded Fisheries Development Program, 1977. Annual catch per fisherman is derived by averaging regional catch for 1976 and 1977 and then dividing by the number of fishermen.

[2]Excluding fishponds, but including production from Laguna de Bay fishpens.

B. PROBLEMS OF MUNICIPAL FISHERMEN

The coastal and inland fisheries exploited by municipal fishermen are "open-access" in nature; that is, the resource belongs to the fisherman who harvests the catch. When entry to fishing is not restricted or controlled, it is possible to predict the inevitability of overexploitation of the resource and overcapitalization of the fishing industry. International literature abounds with both theoretical and empirical examples of these phenomena.[3] The resulting economic and biological overexploitation leads to dissipation of rent from the resource and lower returns than could have been obtained with reduced numbers of fishermen. Even underexploited resources, such as exist in certain parts of the Philippines (primarily Palawan and Sulu), will produce low returns for the fishermen if they are so geographically isolated that the catch cannot readily be transported to markets. The "open-access" nature of the resource and the extreme perishability of the catch thus combine to create a situation where fisherman incomes are likely to be low.

The concern that President Ferdinand E. Marcos has shown for the small fisherman has brought to the forefront the extremely low levels of income of most municipal fishermen and the low standards of living that most of them enjoy. Results of recent socioeconomic surveys indicate annual per capita income levels of slightly more than ₱700 (see Section V). With an average household size of 6.3, annual household incomes average about ₱4,500. In 1974 the Development Academy of the Philippines (DAP) Social Indicators Project established a total threshold of ₱7,738 for a six-member household that "states the barest minimum by which subsistence can be theoretically achieved" (Abrera 1976, p. 244). Inflating by the cost of living index from Table 3 ("All items"), a threshold of ₱10,621 would be necessary for a six-member household in 1978. Average fishing household incomes, not counting household-produced items that are consumed by the household, thus appear to be approximately one-half of the threshold level. Of course, one can always argue about the establishment of poverty thresholds (see Abrera 1976 for a discussion of alternatives), but there seems little doubt that munic-

[3]See, for example, Chrsity and Scott (1965), Lawson (1975), Marr (1976), Yap (1977) and Smith (1979a). Copes (1970) introduces the effect of demand on levels of resource exploitation, without which any economic analysis of the fishery would be incomplete.

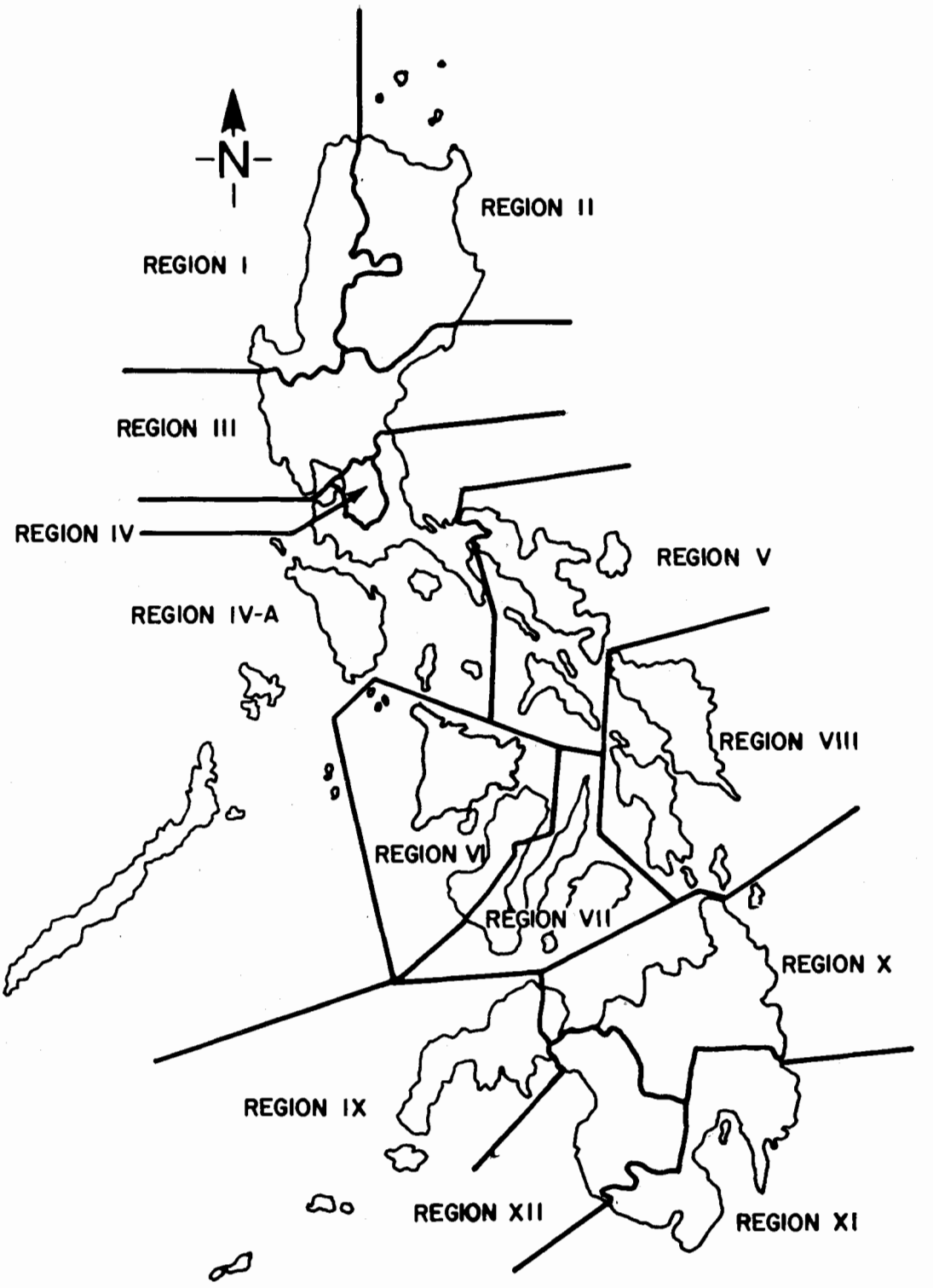


Fig. 1. The 13 administrative regions of the Philippines.

ipal fishermen are among the poorest of the poor.

One of the major causes of these low income levels appears to be the low productivity of the fishing activity. As shown in Table 2, although productivity varies from one region to another, it is uniformly low, averaging on a nationwide basis only 1.33 mt per fisherman annually. Coupled with the relatively low prices received by the fishermen (estimated to be ₱1.50 to ₱2.50/kg), income derived from fishing is low. Moreover, with the exception of baby trawls that catch shrimp and of fishermen who catch tunas, the municipal catch is composed primarily of the lower grade, and hence lower priced, species.

Incomes within fishing communities vary, however, depending upon ownership of productive assets. As further discussed in Section V, there is considerable variation in fishing incomes between boatowners and nonboatowners, and between owners of motorized boats and owners of nonmotorized boats. The ratio of municipal fishermen to boats is approximately 2:1; thus, many own no boat at all. Slightly less than half (46%) of municipal fishing craft are estimated to be motorized.

Many fishing families apparently supplement their income from other agricultural and service activities. However, "for very poor rural families (those reporting annual incomes of ₱1,000 or less), who accounted for 22% of the total in 1971, fishing activities are a more important source of income than either agricultural or nonagricultural wages" (World Bank 1976, p. 96).

A further contributing factor to the low standards of living of most municipal fishermen is inflation. While retail prices of fish have more than tripled since 1972 (see Table 3), it is unlikely that prices received by fishermen have increased three-fold in the same period. On the other hand, retail prices of food and clothing approximately tripled since 1972. Most importantly, fuel that is required by almost 50% of municipal fishing vessels had more than tripled by the end of 1979, and a further 50% increase went into effect in February 1980. The cost of regular gasoline required for the Briggs and Stratton engines used by municipal fishermen is now ₱4.30 (US$.59) per liter. Due to transport costs, the net effect of these price changes has probably been to leave the poorest rural families dependent upon fishing worse off in 1980 than they were in 1972. This conclusion is supported by a recent study of the Asian Development Bank (1977, p. 53) that observes: "there is evidence of a decline in real wages . . . brought about by the runaway inflation in the 1972-1974 period," and by Abrera (1976, p. 260) who concludes that "poverty is clearly on the rise."

Three fishing community workshops held in 1978 as a follow-up to socioeconomic research studies conducted in the same communities (see Section IV) produced a listing of problems from the perspective of the fishermen themselves. Problems raised by the fishermen include those related to the resource, to technology, to marketing, and to social conditions. As such, they are really "symptoms" of the underlying dependence of municipal fisherman on an open-access resource which is highly perishable once caught, and of the lack of or difficulty in taking advantage of alternative sources of income in communities that are geographically isolated and/or socially disadvantaged.[4]

Table 3. Price indices of selected items, 1970-1978 (1972 = 100). Data are from Central Bank of the Philippines.

Year	All items[3]	Food[3]	Clothing[3]	Fuel[2]	Fish[2]
1970	78.3	71.6	81.6	66.2	64.5
1971	90.1	87.6	92.8	84.3	86.7
1972	100.0	100.0	100.0	100.0	100.0
1973	117.0	115.8	115.7	109.3	106.4
1974	157.0	155.1	172.3	161.4	152.5
1975	167.3	163.2	186.1	186.5	169.7
1976	183.5	178.7	195.6	210.1	186.4
1977	202.4	196.3	217.2	217.7	201.6
1978[1]	217.0	208.2	237.1	221.2	221.9
1979	252.1	238.5	277.2	275.9	279.5
1980[1]	277.0	258.2	310.8	321.3[4]	340.8

[1]Thru January 1980.
[2]Retail price index in Metro Manila.
[3]Consumer price index for all income households in areas outside Metro Manila for 1972-1978. 1970-1971 is consumer price index in Metro Manila of the commodity chiefly of domestic origin (not using imported inputs).
[4]Fuel prices increased by a further 50% in February 1980.

The following problems were identified by fishermen in the three communities:

1. Related to the resource
   a. Low volume of catch thought by fishermen to be caused by overfishing, dynamite fishing, use of fine mesh nets, nonenforcement of the 7-km ban on commercial trawlers, and pollution.
   b. Competition between traditional fishing methods, e.g., fish corral, and more advanced methods, e.g., baby trawl; also loss and destruction of crab traps.
2. Related to technology
   a. Lack of gear and motorized vessels, due in part to lack of capital.

[4]In other words, the fisherman's opportunity wage (that which he could earn in the next best alternative activity) is low. The implication, which is really quite straightforward, is that fishing income could be raised, on the average, if the opportunity wage could be increased, and some fishermen thus encouraged to give up fishing (see Munro and Loy 1978 for a theoretical exposition on this point).

b. High prices of fishing equipment and inputs, especially fuel.

3. Related to marketing
   a. Fish landing area diminishing in size due to competing shore-based activities.
   b. Difficulties in preserving fish catch; spoilage.
   c. Lack of transport to market.
   d. Price uncertainty; no information on supply and prices from nearby markets; fish prices controlled by middleman.
4. Related to social conditions
   a. Unemployment and underemployment of fishermen; no alternative income sources.
   b. Catch sharing system resulting in low income to fishing laborers who own neither vessel nor gear.
   c. Poor sanitation and malnutrition; insufficient potable water; nursery schools discontinued for lack of funds.
   d. Nonownership of land; limited barrio site (squatting only).
   e. Theft and damage of gear by transients.

The workshop reports also named "lack of cooperation among fishermen" and "large families" as problems from the fisherman's perspective, but it would appear that these are more likely to reflect the points of view of government officials who were also in attendance. The National Media Production Center (NMPC) recently staged educational skits written by teenage children of fishermen in several coastal fishing communities. Of the themes chosen by the teenagers, one dealt with alcoholism; another depicted the deteriorating image of fathers in fishing households.[5]

In attempts to alleviate these problems, municipal fisheries development programs of the Philippine government have been primarily directed towards motorization of boats (bancas) and improvements in fishing gear. Programs to improve marketing and encourage alternative income sources for municipal fishermen are recent additions to the list of potential solutions.

Municipal fisheries must be viewed as part of the larger, particularly rural, economy. The World Bank (1976) points to an "increasingly important structural transformation in rural areas in the Philippines. The quick growth of (rural) service employment has clearly eased the pressures of migration in major urban areas . . . Rapid expansion of the rural nonfarm population will probably continue, thus raising the policy issue of employment prospects for this group" (p. 106). Moreover, if a reverse urban-rural migration trend is becoming established, coupled with an already rapidly growing rural population,[6] the implication is for increased numbers of households engaged in fishing. This means, then, continued strong pressure on the "open-access" fishing resource and continued low incomes, as average productivity remains low. This transformation and slowing down of rural-urban migration suggests that solutions to the poverty of municipal fishermen must be found in development programs aimed at the rural sector as a whole.

The following discussion of the resources, fishing technology, and socioeconomics of production and distribution examines each category in detail, maintaining that such an interdisciplinary approach is necessary to understanding the problems and potentials of municipal fisheries.

[5] R. Pestaño, National Media Production Center (pers. comm.).

[6] Between 1948 and 1975, rural population doubled from 14.9 million to 30.2 million (World Bank 1976).

Municipal Fisheries Resources

A. MARINE MUNICIPAL FISHERIES

An overview of total marine production is necessary to ascertain the potentials for expanding municipal fisheries production. Several attempts have been made within recent years to provide estimates, on the one hand, of Philippine marine fisheries production or levels of exploitation and, on the other hand, of maximum sustainable yield of demersal and pelagic species from Philippine waters. Taken together, these two estimates would show how close Philippine marine fisheries are to being fully exploited.

1. Levels of Exploitation

A useful assessment of the fisheries statistical base has been published by Juliano and Yutuc (1977a). The annual municipal fisheries production figures published by BFAR have long been thought to be understated. The figures reported through 1975 were based on a 1951-1958 survey in six municipalities, from which an annual production growth rate was projected. The extreme practical difficulties and costs of collecting data at the municipal level precluded any effort to improve these statistics until 1976 when, with the assistance of the South China Sea Fisheries Development and Coordinating Programme (SCSP), a more complete and representative sampling frame was designed (see Chakraborty et al. 1977). The resulting BFAR data for 1976 and 1977 (see Table 4) indicate a higher level of municipal fisheries catch than hitherto supposed. Total catch estimates of BFAR continued their steady upward climb (see Table 5).

However, using the alternative approach of estimating production by working backwards from fish consumption data implies that the improved BFAR statistics may still be understating present catch levels. The first group to estimate catch by extrapolation from consumer surveys was the NORCONSULT A.S. and IKO consulting group (1975). The NORCONSULT/IKO municipal catch estimate consisted of the residual after subtracting commercial catch and fishpond production from the estimated consumption figure, adjusted for waste in distribution and for imported marine products. Most researchers place fair confidence in the commercial catch data published by BFAR, based as it is upon adjustments (raising factors) to figures derived from enumerators' reports on fish landed and boat operators' reports of their catches. Subtracting the BFAR commercial catch data from consumption data in the manner of NORCONSULT/IKO thus appears reasonable. Somewhat less confidence can be placed in the BFAR fishpond statistics, because they do not cover freshwater ponds and because recent estimates of productivity increases from brackishwater ponds appear to have been made arbitrarily (Juliano and Yutuc 1977a). In any case, the NORCONSULT/IKO approach also resulted in a municipal catch estimate that exceeded previous estimates. However, NORCONSULT/IKO estimates show declining total production between 1970 and 1974.

In addition to the NORCONSULT/IKO report, the Philippine Food Balance Sheet, published by the National Economic and Development Authority (NEDA) since 1953, also indicates a higher level of fish supply than is estimated by BFAR. NEDA adds estimates of production from inland waters, and of crustaceans and molluscs, to marine estimates, to reach their estimated fish production figure of 2.0 million t in 1976. Comparisons of the BFAR, NORCONSULT/IKO, and NEDA estimates are shown in Table 5.

Juliano and Yutuc were quite rightly suspicious of the NORCONSULT/IKO calculations that implied declining total production. Using essentially the same approach as the NORCONSULT/IKO study, their work was conducted as part of a study entitled "Population, Resources, Environment and the Philippine Future" (PREPF 1977), conducted jointly by the DAP and the University of the Philippines School of Economics, and the U.P. Population Institute. They examined the extent to which the BFAR statistics could be used as a benchmark from which projections of the fisheries situation to the year 2000 could be made. The PREPF study, like the NORCONSULT/IKO study that preceded it, made use of consumer surveys conducted by the Marketing Research unit of the National Food and Agriculture Council (NFAC), but adjusted the consumption data to reflect an average figure for the 1973-1975 period. The PREPF study also concludes that the BFAR figures are understated for the 1970-1975 period (see Table 5) and suggests that an average annual production figure of 1,539,400 mt (net catch after deducting spoilage and waste) should be used as the benchmark for discussions that relate present production levels to estimates of maximum sustainable yield. For this suggested figure of 1,539,400 mt, Juliano and Yutuc estimate the following breakdown:

Aquaculture	156,700	mt or 10.2%[1]
Commercial Fisheries	437,300	mt or 28.4%
Municipal Marine	866,300	mt or 56.3%
Municipal Inland	79,100	mt or 5.2%
Total	1,539,400	mt

[1] BFAR estimate of production from brackishwater aquaculture is approximately 115,000 mt for the same period. The higher PREPF estimate includes brackishwater harvest of other species besides milkfish, such as shrimp and crabs, and also includes harvest of tilapia from freshwater ponds.

Table 4. Production of municipal fisheries (marine) by major groups, 1976-1977. Data are from the 1976 and 1977 Fisheries Statistics of the Philippines, BFAR, Manila.

ISCAAP Group No.[1]	Species group	1976	1977
24	Shads, milkfish	2,860	910
31	Flatfish (kalangkao, dapa, palad)	867	1,071
33	Perches, breams, snapper, eels, etc.	143,866	138,633
34	Jacks, scads, mullets, garfish, etc.	125,909	135,311
35	Herrings, sardines, anchovies, etc.	143,196	177,779
36	Spanish mackerel, tuna, billfish	102,271	165,462
37	Mackerels, hairtails	32,032	37,482
38	Sharks, rays	8,849	8,796
39	Miscellaneous marine fish	797	101
42	Crabs	8,402	9,122
43	Lobsters	153	489
44	Shrimps, prawns	27,812	17,187
47	Miscellaneous marine crustaceans	207	99
52	Molluscs	28	9
53	Oysters	-	33
54	Mussels	415	1,697
55	Scallops	4,894	4
56	Clams, cockles, and shells	631	3,030
57	Squids, cuttlefish, octopus	15,824	14,868
72	Marine turtles	57	268
75	Sea urchins, etc.	12	8
76	Miscellaneous aquatic invertebrates	4	5
94	Seaweeds and miscellaneous aquatic plants	59	150
	Total:	619,145	712,514

[1]ISCAAP grouping–includes species of fish belonging to same group and sub-class.

Table 5. Philippine fisheries production estimates (000 mt). Data are from Fisheries Statistics of the Philippines, BFAR, Manila; NORCONSULT/IKO; and PREPF as reported in Juliano and Yutuc (1977a).

Year	BFAR	NORCONSULT/IKO	NEDA	PREPF
1970	984	1,877	1,360	1,443
1971	1,023	1,907	1,405	1,457
1972	1,122	1,657	1,516	1,536
1973	1,205	1,684	1,614	1,599
1974	1,268	1,545	1,684	1,631
1975	1,337	–	1,977	1,569
1976	1,393	–	2,008	–
1977	1,509	–	–	–

Note: These estimates include commercial, municipal inland, municipal marine, and aquaculture. The NEDA production estimates of "salt water fishes, big shrimps, crabs, and squids were obtained from the BFAR. Additional data on the production of fresh water fishes, snails, clams, oysters, and other species of shrimps and crabs, as well as on other kinds of marine products that are not included in BFAR's report, were estimated on the basis of nutrition survey results conducted by the Food and Nutrition Research Institute (FNRI)" (NEDA 1979, p. 48).

NORCONSULT/IKO had concluded that total production was levelling off. Since production from commercial fisheries and aquaculture was increasing during this period, the inference is that municipal fisheries production, though averaging 866,300 mt, was declining.

Because the Juliano and Yutuc procedure appears to greatly understate the amount of spoilage and waste after catch, their estimate of total production is probably low. Their estimate of spoilage is 15,000 mt, which is less than 1% of the total catch. Although no exact measurement has been made of waste in the Philippine fisheries, estimates made elsewhere in the tropics have ranged as high as 20-40% of catch (Craib and Ketler 1978; Campbell 1975). If only one-half of this level is introduced to the Juliano and Yutuc calculations, the resulting estimate of total catch approaches 1.8 million mt.

The improved BFAR statistics for 1976 and 1977 are, nonetheless, much closer to the earlier estimates of PREPF and NEDA. One important finding of the PREPF study is that the Philippine fisheries catch remained relatively unchanged over the 1972-1975 period.

Increases in production from the commercial and aquaculture sectors were offset by a decline in marine municipal fisheries catch. Although a downward trend is not yet convincingly apparent, Juliano and Yutuc conclude that "there is possible overfishing in our coastal waters by municipal fishermen, as reflected in the declining production from this sector" (p. 1232). This levelling off of catch is generally attributed to the concentration of fishing effort by both municipal and commercial fisherman in the traditional fishing grounds near the coasts. As pointed out by Dela Cruz and Yutuc (1977), over 90% of the larger commercial vessels were used second-hand boats bought from other countries. Due to the antiquated condition and generally small size therefore of most of these commercial vessels, the fishermen tend to concentrate their fishing activity in the coastal areas inside the 100-m mark.

In summary, then, estimates of total production from all fishery and aquaculture sectors cluster in the 1.4-1.8 million mt range. Municipal fisheries catch, which is estimated to provide approximately 55% of the total, would therefore be 770,000-990,000 mt and total marine catch would be in the range of 1,162,000-1,500,000 mt. The next step is to compare this estimate with estimations of maximum sustainable yields from Philippine waters.

2. Estimates of Maximum Sustainable Yields[2]

To estimate the maximum sustainable yields (MSY) of Philippine marine waters, two different approaches have been used. One approach derives estimates of potential productivity per square kilometer of continental shelf and deeper waters and then multiplies these estimates by the total area. The second approach examines catch and effort data by species, where it is available, and attempts to estimate whether the MSY for specific species has yet been reached or surpassed. Yutuc and Trono (1977), and Juliano and Cerdena (1977), both as part of the PREPF study, and the FIDC (1977b) have brought together information from both approaches which can be summarized and critiqued here.

Estimates of average productivity per unit area for the Philippines will also be compared with estimates made for tropical waters elsewhere in the world. For comparison purposes, three variables must be considered: 1) average productivity per square kilometer; 2) area considered; and 3) mean depth of area considered. All three variables are tabulated for all MSY estimates in Table 6. Average productivity per square kilometer is plotted against mean depth of area considered in Figure 2. As will be shown, there is a consistency to average productivity estimates by depth against which recent Philippine MSY estimates can be compared.

To estimate potential yields from Philippine coastal waters, using the first approach, one needs to know 1) productivity per square kilometer of continental shelf and 2) the continental shelf area. In the Philippines, there has been considerable disagreement over both. Kvaran (1971) estimated MSY from marine waters to be 1.65 million mt by adding separate estimates of demersal and pelagic MSY from continental shelf area, and of pelagic fish MSY from deep waters. His estimate of continental shelf MSY (both demersal and pelagic) was 1,350,000 mt. By assuming that municipal fisheries can catch 55% of total production (compared to 28% from the commercial sector), and thus two-thirds of demersal and pelagic species from the shelf area, municipal fisheries MSY would thus be approximately 895,000 mt or the mid-point of the estimated range of current municipal catch established in the preceding section. Kvaran's estimates were based on a shelf area (0-200 m) of approximately 200,00 km,^{2} and translated into an average productivity of 3.5 t/km^2 (demersal) and 3.25 t/km^2 (in-shore pelagic), or a total average productivity of 6.75 t/km^2 for the continental shelf area to 200 m. Kvaran's estimate of MSY from deeper waters (300,000 mt) beyond the continental shelf was based on an assumed productivity of 0.2 t/km.^{2}

Kvaran's estimates were followed by those of Menasveta et al. (1973) and Aoyama (1973). Based on Gulland's (1971) formula,[3] and comparison with other South China Sea areas, Menasveta et al. estimated Sulu Sea pelagic productivity and continental shelf demersal productivity at 0.5-.65 t/km^2 and 2.75 t/km,^{2} respectively. MSY for Philippine fisheries was estimated at 1,024,000 mt, comprising 604,000 t pelagic and 420,000 t demersal.

NORCONSULT/IKO (1975), using a slightly smaller area of continental shelf than Kvaran (185,000 km^2) but a much higher average productivity (20 t/km^2), estimated MSY for Philippine waters to be 3.7 million mt. The NORCONSULT/IKO productivity estimate was based upon an approximate 10 t/km^2 catch level (1975) and the very arbitrary assumption that improved technology would double productivity to 20 t/km^2. They failed

---

[2] The advice of Dr. Daniel Pauly of the ICLARM staff was extremely helpful in preparing this subsection.

[3] ($C_{max} = .5M \cdot B_o$), where C_{max} = maximum sustainable yield; M = natural mortality; B_o = virgin biomass. This formula implies that the maximum yield is taken when the biomass is fished to approximately half its virgin size.

Table 6. Comparison of productivity estimates of Philippine shelf areas and tropical waters elsewhere.

Location	Source	Bottom type, depth, and estimated area	Estimated annual average productivity per km^2 (mt)	Estimate of MSY demersal and pelagic (1,000 mt)	Estimate of total MSY (000 mt)
1. Philippines	Kvaran (1971)	(a) 200,000 km^2 shelf area (0-200 m)	3.5 (demersal)	700	
		(b) 200,000 km^2 shelf area (0-200 m)	3.25 (in-shore pelagic)	650	1,650
		(c) 1,500,000 km^2 deep water (200+ m)	.2 (off-shore pelagic)	300	
2. Philippines	Menasveta et al. (1973) Aoyama (1979)	(a) Sulu Sea (200+ m)	.5 - .65 (pelagic)	604	1,024
		(b) Shelf Area (0-200 m)	2.75 (demersal)	420	
3. Philippines	NORCONSULT/IKO(1975)	185,000 km^2 shelf area (0-200 m)	20.0 (all fishes)		3,700
4. Philippines	AID (1977)	185,000 km^2 shelf area (0-200 m)	10.0 (all fishes)		1,850
5. Philippines	Yutuc and Trono (1977)	(a) 126,500 km^2 shelf area (0-100 m)	18.0 (all fishes)		
		(b) 139,500 km^2 shelf area (100-200 m)	1.8 (all fishes)		2,914
		(c) 1,500,000 km^2 deep water (200+ m)	.26 (all fishes)		
6. Gulf of Thailand	SCSP (1978c)	Shelf area (0-50 m)	3.85 (demersal only)		
7. South Jamaica	Munro (1978)	Coral reef and adjacent shallow areas	4.1 (demersal and pelagic neritic)		
8. Western Indian Ocean	FAO (1979)	Coral reef and adjacent shallow areas	5.0 (demersal only)		
9. Worldwide	Stevenson and Marshall (1974)	Coral reef and adjacent shallow areas	4.1 (all fishes)		
10. Caribbean	Gulland (1971)	Coral reef and adjacent shallow areas	4.0 (demersal and pelagic neritic)		
11. Bahamas	Gulland (1971)	Coral reef and adjacent shallow areas	2.5 (demersal and pelagic neritic)		
12. West Africa	Pauly (1976)	Coastal lagoon (ave. depth–50 cm)	15.0 (all fish)		
13. Philippines	Alcala (as reported in Marshall 1979)	Reef area (Sumilon Island Reserve)	15.0 (all fish)		
14. South Texas	Saila (1975)	Shallow bays	12.1 (all fish)		

Notes on assumptions made and method used to calculate MSY or to estimate productivity per km^2.

1. a. Assumed same producitivity as Gulf of Thailand productivity and also applied Schaefer total biomass model.
   b. 15-25% catch per unit effort reduction applied to Schaefer model.
   c. .2 t/km^2 assumed without documentation.
2. a. Based on Gulland (1971) formula (C_{max} = .5 M • B_o).
   b. Based on Gulland (1971) formula with slight modification.
3. Calculated present annual catch equal to 10 t/km^2 and arbitrarily assumed technology would double this to 20 t/km^2.
4. Assumed same productivity as richest areas of Gulf of Thailand.
5. a. Calculated present catch equal to 10 t/km^2 (0-100 m), and
   b. 1 t/km^2 (100-200 m), and arbitrarily assumed technology would increase this by 80%.
   c. .26 t/km^2 estimated from exploratory fishing.
6. Total biomass Schaefer model to estimate MSY.
7. Surplus yield model from concurrent trap fishing intensities.
8. Extrapolating from trap catch data in different areas.
9. Highest found through literature review.
10. Intuitive comparison with other Western Central Atlantic areas.
11. Intuitive comparison with other Western Central Atlantic areas.
12. Observed catch levels assumed to be optimum.
13. Unknown.
14. Unknown.

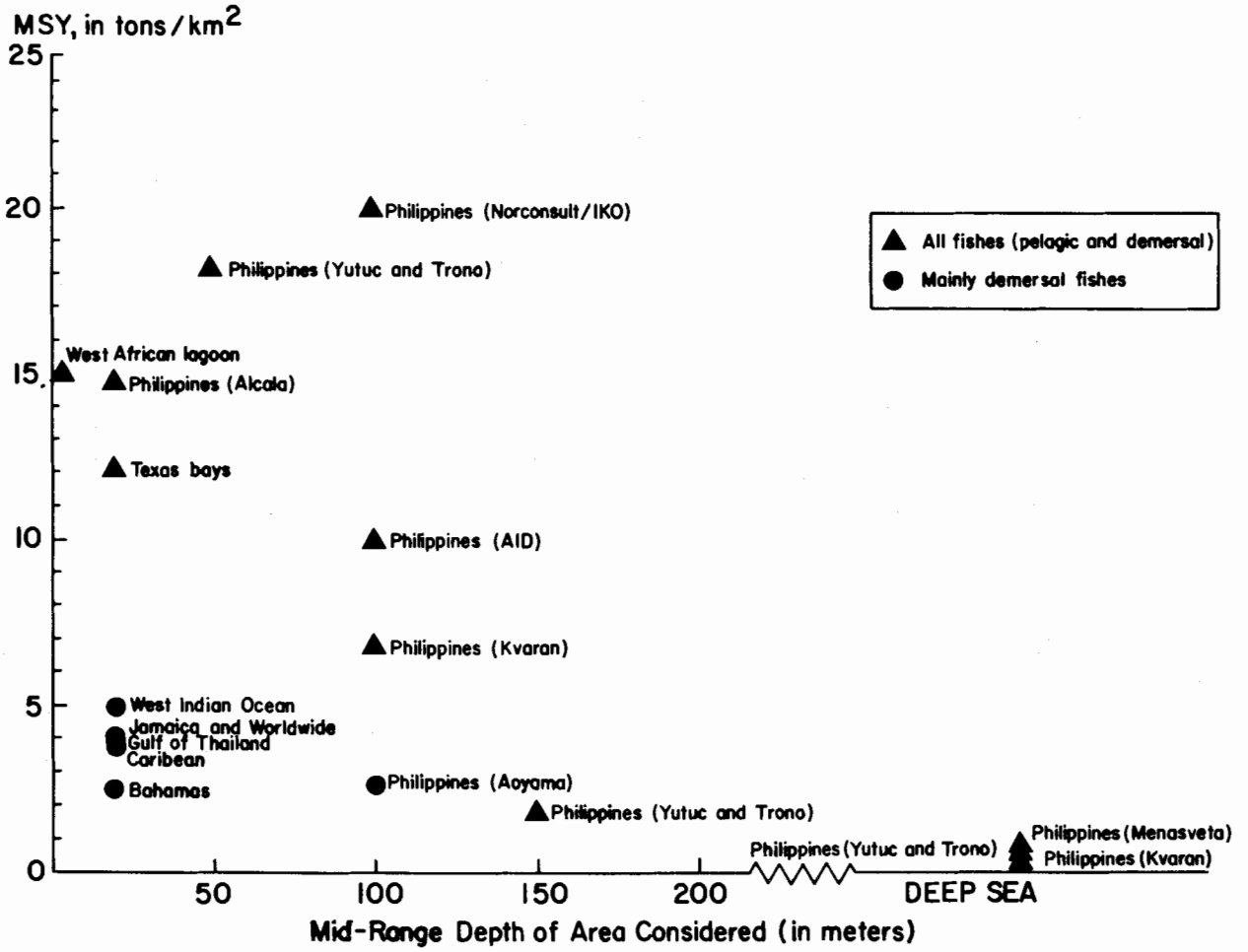


Fig. 2. Various estimates of MSY (t/km^2) in tropical and semi-tropical waters by mid-range depth of area considered. (Note: see Table 6 for details of estimates above). Figure based on a suggestion of Daniel Pauly of the ICLARM staff.

to reconcile their conflicting conclusions that, on the one hand, based on consumption surveys, total fisheries production was declining and, on the other hand, MSY was double present catch levels. Referring to Figure 2, it can readily be seen how inconsistent the NORCONSULT/IKO productivity estimate is compared to those for other similar areas and depths.

The NORCONSULT/IKO estimates were criticized by two later studies. First, a later mission of USAID (1977) pointed out that the NORCONSULT/IKO productivity estimate appears much too high as 1) it is double the productivity of the richest fishing grounds on similar shelf areas of Thailand, and 2) large portions of the Philippine shelf are coral reef areas not suitable for trawling. The AID report implied that nontrawl gears will be unable to tap the resource to the extent estimated by NORCONSULT/IKO. The report concluded that a more realistic estimate of productivity is 10 t/km^2 and that 1.85 million mt would be the MSY.

Keeping in mind that the purpose of this whole discussion is to relate marine resource assessment specifically to the municipal fisheries sector, the conclusions of the AID mission bear repeating: "It is probable that municipal fishing grounds near urban centers already suffer from intensive competition, and any additional effort would only depress catch per fisherman" (p. 21). And also: "Increased motorization of bancas operating in traditional fishing grounds would increase the catch of some fishermen, possibly at the expense of others. Motorization would not help fishermen cope with a limited and dwindling resource" (p. 22). The conclusion that traditional fishing grounds suffer from possible overfishing is the same as that reached by Juliano and Yutuc (1977a).

The second group to criticize the NORCONSULT/IKO findings was Yutuc and Trono (1977), as part of

the PREPF study. They concluded that, on the one hand, the productivity estimate was too high but that, on the other hand, the area of continental shelf used in previous studies (including NORCONSULT/IKO) was too low. They also criticized the Aoyama (1973) findings. An examination of the reasons behind their criticisms is instructive because it demonstrates the ease with which one can fall into a conceptual trap when population dynamics is not understood.[4]

First, Yutuc and Trono assumed that 10 mt/km^2 is not the potential, but the present, yield for that portion of the shelf below 100 m, and that only a 1.0-mt yield per square kilometer is being caught at depths between 100 and 200 m (Warfel and Manacop 1950). Yutuc and Trono then adopted the earlier approach of NORCONSULT/IKO of apparently arbitrarily assuming that because "modern technology could increase the present rate of production (by) 80%, the potential productivity of the coastal waters (would be) 18 and 1.8 mt/km^2 in 0-100 and 100- to 200-m depths, respectively" (p. 1171). Their estimate of a continental shelf of 266,000 km^2 came from the Bureau of Coast and Geodetic Survey, measured with a Polar Planimeter and Chart #4200, which indicates the continental shelf to 200 m. They estimated that 126,500 km^2 of the shelf was less than 100 m deep, and that the remaining 139,500 km^2 was between 100 and 200 m. Their estimate of continental shelf MSY was thus 2.6 million mt, to which they added a further 314,000 mt from deep offshore waters, for a total potential marine production of 2.9 million mt. Assuming productivity of .26 t/km,^{2} based on the earlier work of Warfel and Manacop (1950), their estimate of potential production from offshore waters was approximately the same as Kvaran's 300,000 mt.

Yutuc and Trono's disagreement with Aoyama's results was based on their observation that average production levels for the 1970-1975 period for demersal fishes exceeded Aoyama's estimated demersal MSY. They conclude incorrectly (p. 23) that Aoyama's MSY estimate must be too low. In any given year or short period, catch may exceed MSY, though it is not "sustainable." It is therefore not valid to conclude that the MSY is necessarily higher than any observed catch level. In fact, the Yutuc and Trono estimate of 18 t/km^2 productivity from shelf areas 0-100 m deep (see Figure 2) appears too high when compared with similar areas elsewhere.

It is clear from these studies that disagreement still exists regarding 1) the potential productivity per square kilometer of continental shelf, and 2) the exact area of the continental shelf that should be used to calculate potential yields. There is, however, consensus that municipal fisheries, restricted as they are to the shallower coastal areas, have most probably reached, if not surpassed, their maximum sustainable yield. The major exceptions cited are the coastal fisheries of Palawan and Tawi-Tawi.

Yutuc and Trono's claim that productivity estimates show declining productivity per square kilometer as average depth increases can be confirmed by estimates for tropical waters in other parts of the world (see Figure 2). It appears reasonable to compare estimates from the comparatively better documented Gulf of Thailand fishery with those Philippine estimates already discussed. Using the Schaefer total biomass model, which does not treat species individually, maximum productivity of demersal species for that area of the Gulf of Thailand below 50 m was estimated to be 3.85 t/km^2 (SCSP 1978c). Inclusion of pelagics would increase this, but the resulting total would still be well below Yutuc and Trono's and even further below the NORCONSULT/IKO estimate. Since the average depth of the Gulf of Thailand is less than that of the Philippine continental shelf, and thus potentially more productive, Yutuc and Trono's and the NORCONSULT/IKO estimates become even more difficult to accept.

Recent estimates from coral reefs and adjacent shallows gathered from the Caribbean and the West Indian Ocean all cluster in the 4-5 t/km^2 range. Only coastal lagoons and other estuarine areas (e.g., Texas Bays) show productivity as high as 12-15 t/km^2 and these are for even shallower areas of water. An exception is the almost 15 t/km^2 reported by Alcala (in Marshall 1979) for the Sumilon Island Reserve in central Philippines. However, Marshall (1979, p. 8) observes "that (because) the reef and reef flat area of Sumilon Island is small and thus concentration effects might be expected, I lean toward regarding his observations as unique rather than representative."

These comparisons tend not only to confirm a productivity estimate of 6-10 t/km^2 for the Philippine continental shelf of up to 200 m but also to dispute the much higher estimates of Yutuc and Trono and of NORCONSULT/IKO, both of which were based upon the very arbitrary assumption that technology would increase productivity by anywhere from 80-100%. Consequently the Yutuc and Trono, and the NORCONSULT/IKO, MSY estimates of 2.9-3.7 million mt also appear to be extremely high. The inescapable conclusion from the preceding discussion is that the MSY for Philippine marine species is being approached, if not already

[4]Yutuc and Trono (p. 1163-1164) state that they disagree with Menasveta's demersal estimates. However, since Menasveta wrote on pelagic, not demersal, species we assume that their criticism is meant for Aoyama's demersal estimates, not Menasveta's pelagic estimates.

surpassed. Since coastal waters and shallow continental shelf areas are the first areas to have been fished historically, the danger or presence of overfishing in waters fished by municipal fishermen is undoubtedly greater than in deeper waters beyond the continental shelf. If recent fuel price increases restrict commercial fishing to nearby areas, this situation would be exacerbated.

Approaches to estimation of MSY and annual catch that rely on gross estimates tend to gloss over geographic and specie distinctions that may allow a more refined estimation of present and potential catch levels of municipal fisheries. The second approach to estimating marine MSY has made use of commercial catch and effort statistics and has thus concentrated on a specie-by-specie assessment. Results relevant to the present purposes include those for anchovies, mackerels, tuna and scads, all caught by both commercial and municipal fishermen.

The fact that these species are caught by both municipal and commercial fishermen draws attention to the fact that the definition distinguishing the two sectors based on vessel size is essentially an arbitrary and artificial one. It also makes more understandable, though not necessarily more agreeable, the rationale as espoused by Juliano and Yutuc (1977b) and Juliano (1977) for upgrading the vessels and gear of municipal fishermen, thus essentially transforming them from municipal to commercial fishermen. Be that as it may for the moment, this second approach to estimations of MSY, as pointed out by FIDC (1977b), has run into difficulties because of the inadequacy of catch and effort data available for the necessary analysis. However, in the past 2 yr, significant progress in this direction has been made.

Most of the research following this specie-specific approach has been conducted through workshops sponsored by BFAR and/or the SCSP.[5] Four recent workshops which have bearing on Philippine municipal fisheries dealt with the following:

1. Fishery Resources of the Visayan and Sibuyan Sea (Philippines).
2. Fishery Resources of the Sulu Sea, Bohol Sea and Moro Gulf (Philippines).
3. Fishery Resources of the Pacific Coast of the Philippines.
4. Mackerels (*Rastrelliger* spp.) and Round Scads (*Decapterus* spp.) in the South China Sea.

Their findings are summarized here:

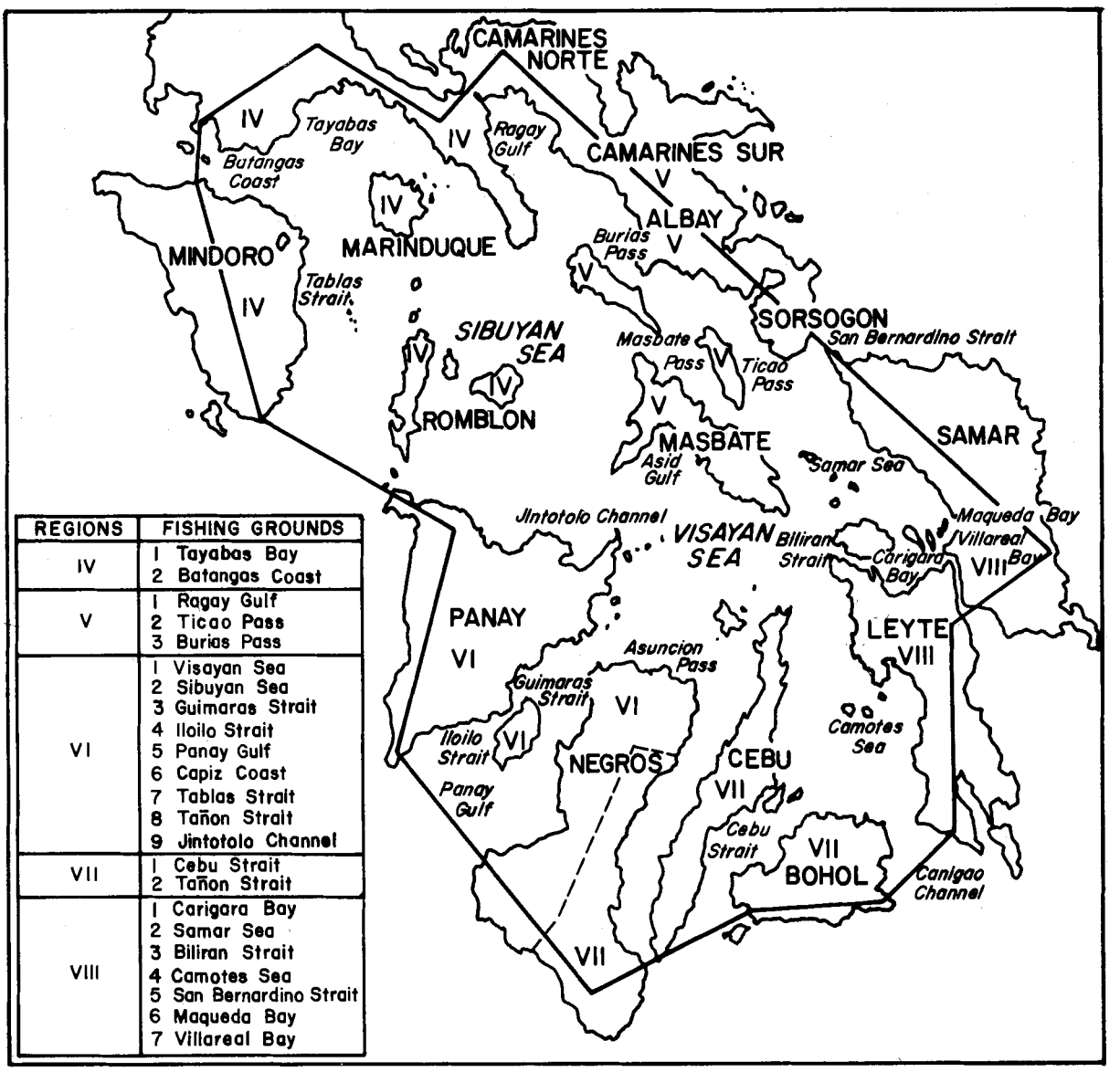
Visayan and Sibuyan Sea: As noted in SCS/GEN/76/7, almost 50% of the commercial and municipal catch of the Philippines at present comes from these two seas in the Central Philippines (see Figure 3). The workshop examined catch and effort data for demersal stocks, penaeid shrimps and each of the major pelagic fish species. The workshop assessments "indicated that there is scope for further increases in the catches of demersal fishes, shrimps and pelagic fishes in most areas, but showed clear evidence of overfishing of demersal fish and shrimps off Samar (Region VIII), and of anchovies off Tayabas Bay and Marinduque (Region IV)" (p. 21).

Sulu Sea, Bohol Sea and Moro Gulf: Workshop assessments for these areas, summarized from SCS/GEN/77/11, cover demersal and pelagic species. Distinguishing between demersal fish on trawlable grounds and those on hard bottoms including reefs (see Figure 4), the workshop concluded that potential for increasing catches of the former was slight, but that for the latter, "there is no evidence that the fisheries . . . are nearing full exploitation" (p. 3).

To date, however, very little information is available which might establish such potential from reef areas, unless one relies on the approach of Kvaran, NORCONSULT/IKO and others, as previously discussed. The workshop also examined catch and effort data for yellow fin tuna and skipjack, round scads, big-eyed scad, chub mackerel and anchovies, and concluded that, with the exception of anchovies in Sibuco Bay (Zamboanga del Norte), those pelagic species are still underexploited. Results for several areas were inconclusive, however. Regarding round scads, the workshop observed that the fishery depended upon capture of immature fish, and thus potentially better use of the stock could be made if the location of the adults could be pinpointed. Looking at a map of the area, one could be tempted to conclude that the Sulu Sea offers great potential. Because of its depth, however, the Sulu Sea is not particularly productive. The workshop report did point out: "It cannot be too strongly stressed that the assessments have been made with data which have been recognized often as only estimates and therefore some conclusions may prove to be wrong. However, it is probable that the data were not so inaccurate that the conclusions cannot be used as first approximations to the truth and, as the statistics are improved and a deeper knowledge of the fish stocks and the fisheries are brought together, improved assessments will be possible to guide the planning of fisheries development" (p. 5).

Pacific Coast: This third workshop covered the main resources of the Pacific or east coast of the Philippines, from Dapitan Bay in the North to the Sarangani Islands, off the southernmost tip of Mindanao (see Figure 5). It concluded that "owing to the fact that on the east coast as a whole the municipal fisheries catch most of the different species and that good data on catches in the

[5] Relevant workshop reports are as follows: SCS/GEN/76/7, SCS/GEN/77/11, SCS/GEN/77/12, SCS/GEN/77/13, SCS/GEN/78/17, SCS/GEN/78/18, and SCS/GEN/78/19.



REGIONS	FISHING GROUNDS
IV	1 Tayabas Bay 2 Batangas Coast
V	1 Ragay Gulf 2 Ticao Pass 3 Burias Pass
VI	1 Visayan Sea 2 Sibuyan Sea 3 Guimaras Strait 4 Iloilo Strait 5 Panay Gulf 6 Capiz Coast 7 Tablas Strait 8 Tañon Strait 9 Jintotolo Channel
VII	1 Cebu Strait 2 Tañon Strait
VIII	1 Carigara Bay 2 Samar Sea 3 Biliran Strait 4 Camotes Sea 5 San Bernardino Strait 6 Maqueda Bay 7 Villareal Bay

Fig. 3. Map of Visayan and Sibuyan Sea. Source: SCS GEN/76/7. Reproduced with permission from the South China Sea Fisheries Development and Coordinating Programme.

municipal fisheries only started in 1976, it was only possible to make meaningful assessments of the potential catches of the resources in relatively few cases" (SCS/GEN/78/19, p. 1). Of all the East Coast fisheries, only the fin fishery of San Miguel Bay and Lamon Bay area was judged to be fully exploited. The shrimp fishery in the same area was thought to be capable of yielding 13,000 t annually (recent catch levels were approximately 11,000 t). For sardines, no conclusive results could be shown. Other areas and species along the coast also showed no evidence of overfishing.

However, the major inhibition to increased fishing along the east coast is the northeast monsoon, which severely restricts fishing in exposed areas between December and March. When it examined landings by species, the workshop found that the effective fishing season is only 6 mo annually. Also, the east coast, particularly in Northern Luzon, Samar, and Eastern Mindanao, is characterized by relatively undeveloped infrastructure such as roads and ports that might facilitate marketing of an expanded fish catch.

Mackerels and Round Scads in the South China Sea: Between the two, BFAR estimates that mackerels (*Rastrelliger* spp.) and round scads (*Decapterus* spp.) comprise 14% of the country's annual municipal fisheries catch. Due to taxonomic and biological difficulties and lack of information, the workshop (SCS/GEN/77/17), though making progress in specie identification, failed to arrive at conclusions on the extent to which these stocks are shared among countries bordering the South China Sea and, thus, the extent to which species occurring in national waters would be subject to overfishing pressure elsewhere. For the Philippines, however, it

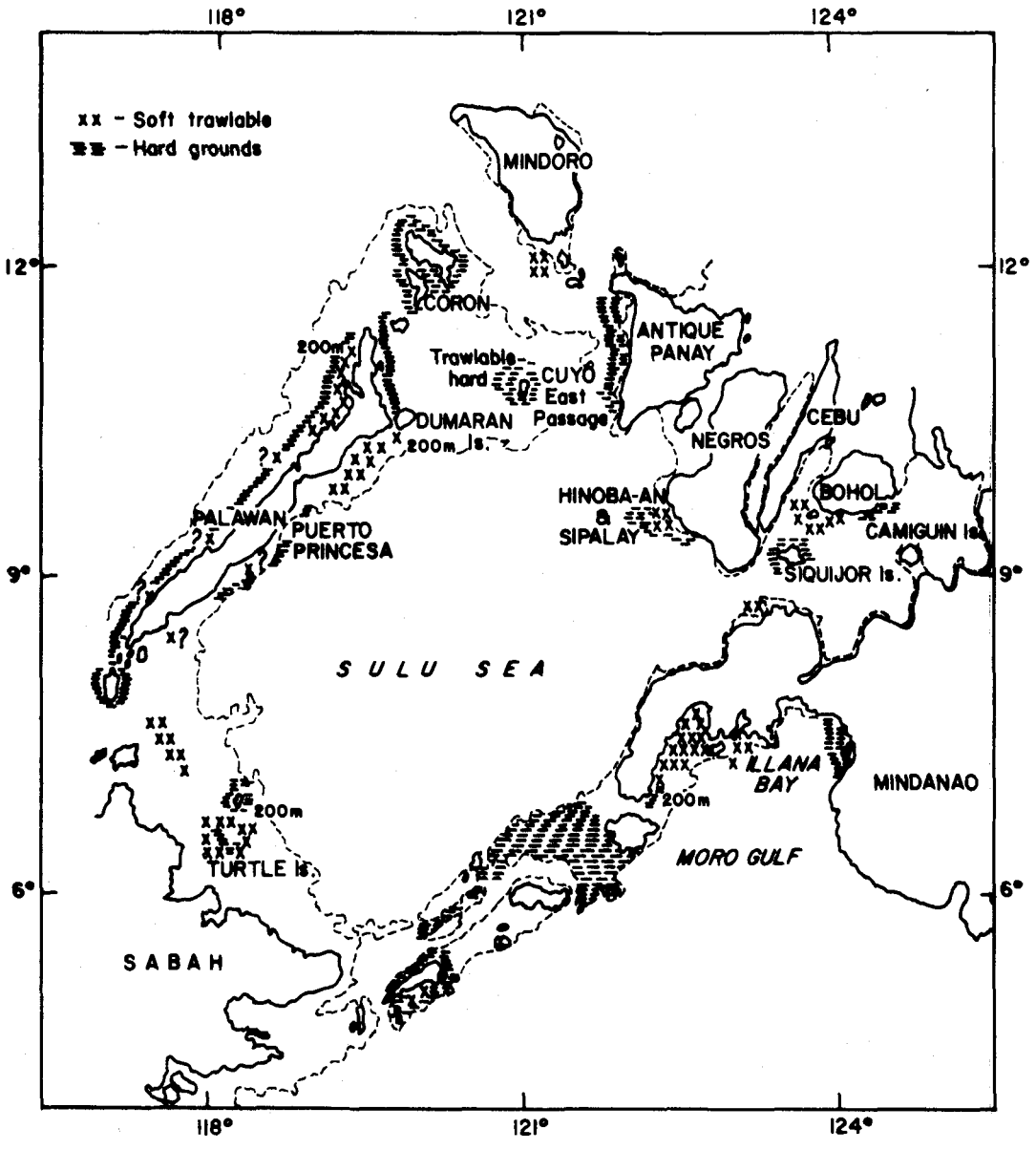


Fig. 4. Map of Sulu Sea, Bohol Sea and Moro Gulf. Source: SCS/GEN/11. Reproduced with permission from the South China Sea Fisheries Development and Coordinating Programme.

was concluded that "it may be possible that the mackerel stock in the (Northern Palawan) area may have been fully or nearly fully exploited" (p. 23). Insufficient data precluded a decision on the status of mackerel stocks occurring in the waters of Luzon and the Visayas. Regarding round scads, the workshop tentatively concluded that the MSY "could be more than 400,000 tons" (p. 24) in the Philippines and the northern coast of Sabah.

FAO statistics indicate scad catch of 426,211 t for 1976 of which 14% was estimated to have been caught by municipal fishermen. If, indeed, these stocks are shared stocks, problems of allocation of catch among nations bordering the South China Sea will arise (Hongskul 1978).

3. Summary

The overall impression given by the preceding discussion of these research studies that have examined present and potential marine fisheries production is that, in those areas where additional exploitable resources exist, they are probably beyond the present capabilities of municipal fishermen to catch. The National Environmental Protection Council (1977, p. 107-112) has reached this same conclusion. Of course, such exceptions as the squid fishery of Masbate and the tuna fishery of Mindanao can be cited and, wherever possible, these opportunities should be stimulated for the municipal fishermen.

However, the resource situation for the majority of

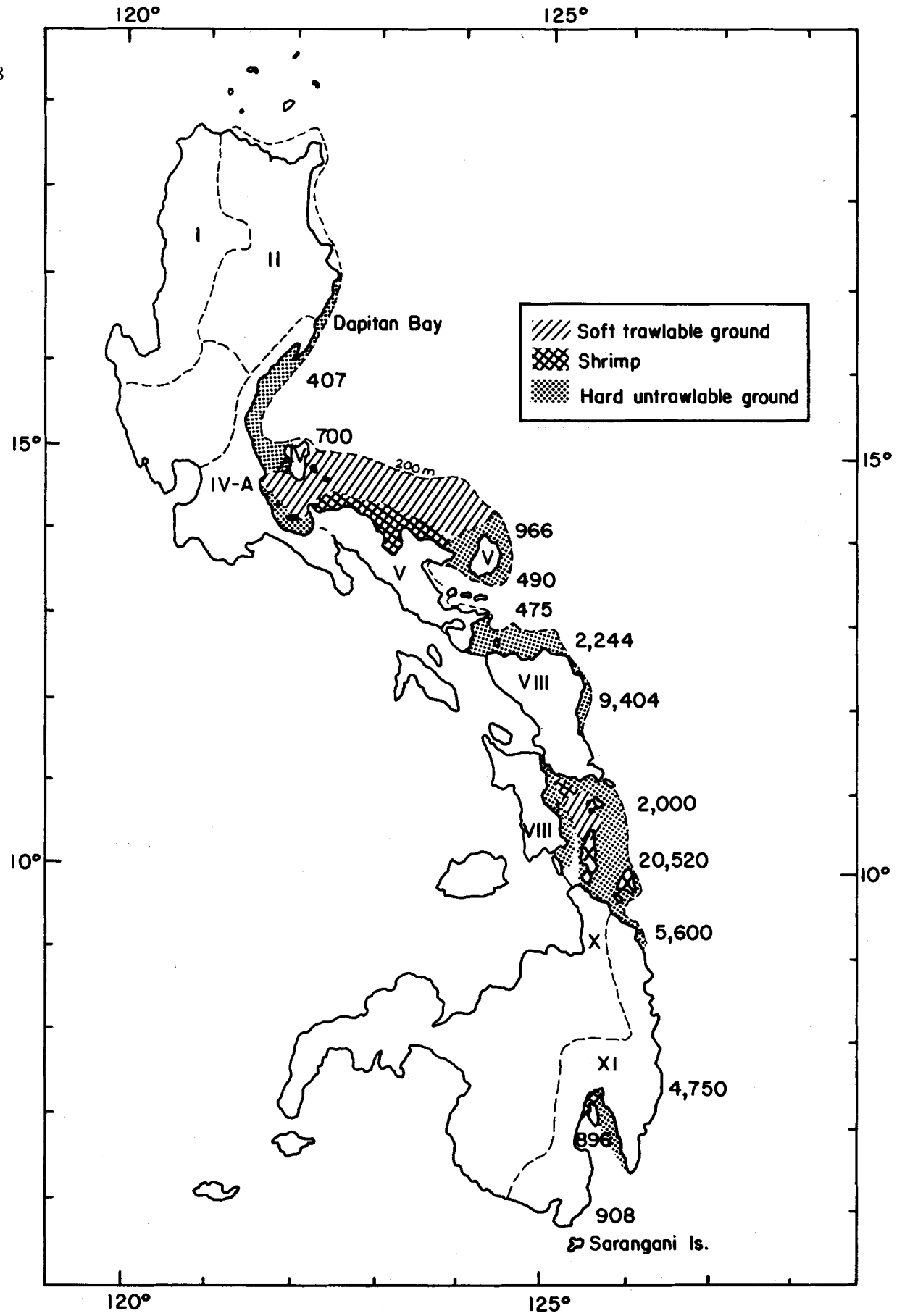


Fig. 5. Map of the Philippine Pacific Coast, showing trawlable, untrawlable and shrimp grounds under 200 m depth. Catches of demersal fish on hard untrawlable grounds by provinces (t) in 1976. Source: SCS/GEN/78/19. Reproduced with permission from the South China Sea Fisheries Development and Coordinating Programme.

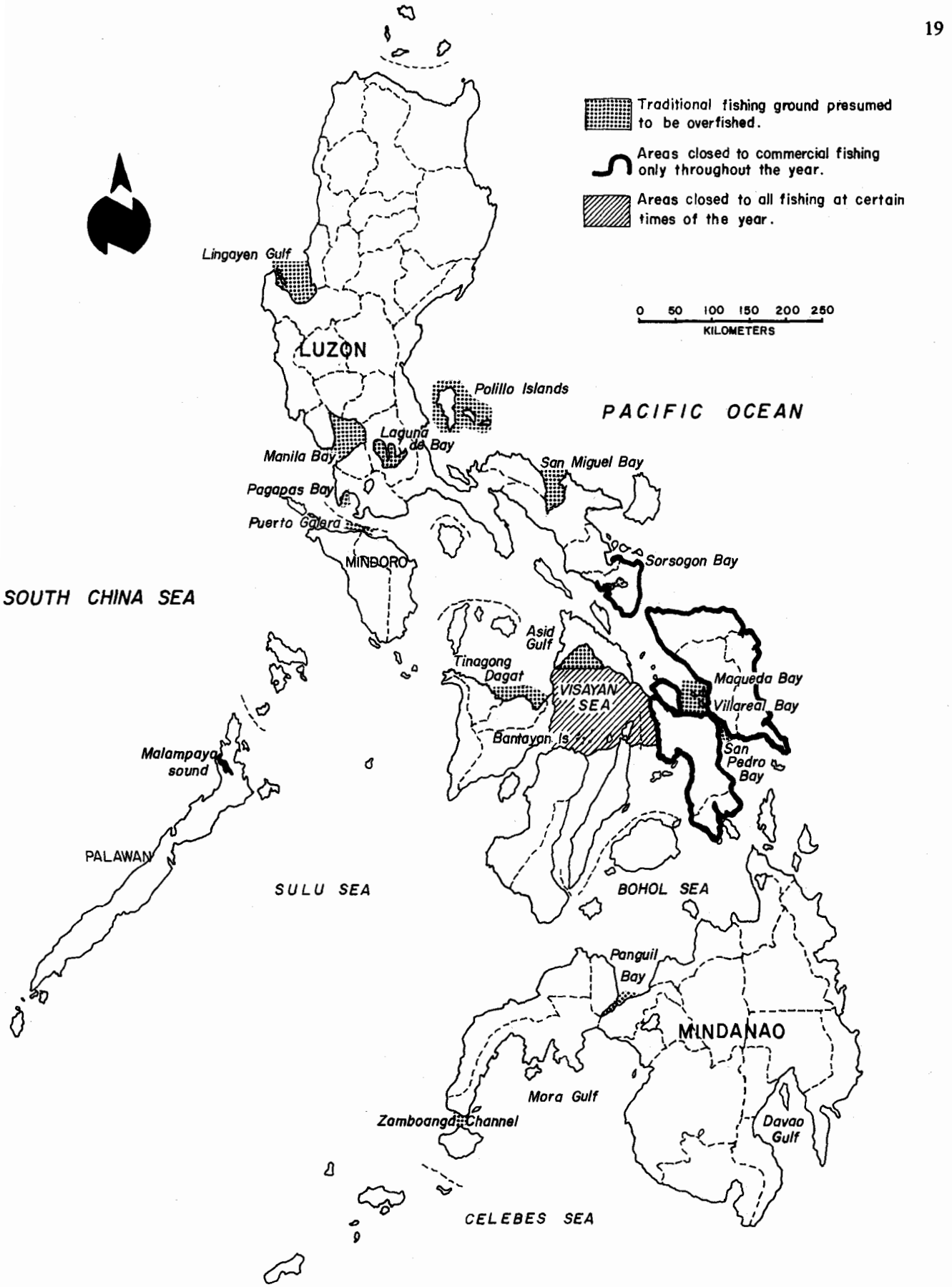


Fig. 6. Status of fishing grounds in the Philippines.

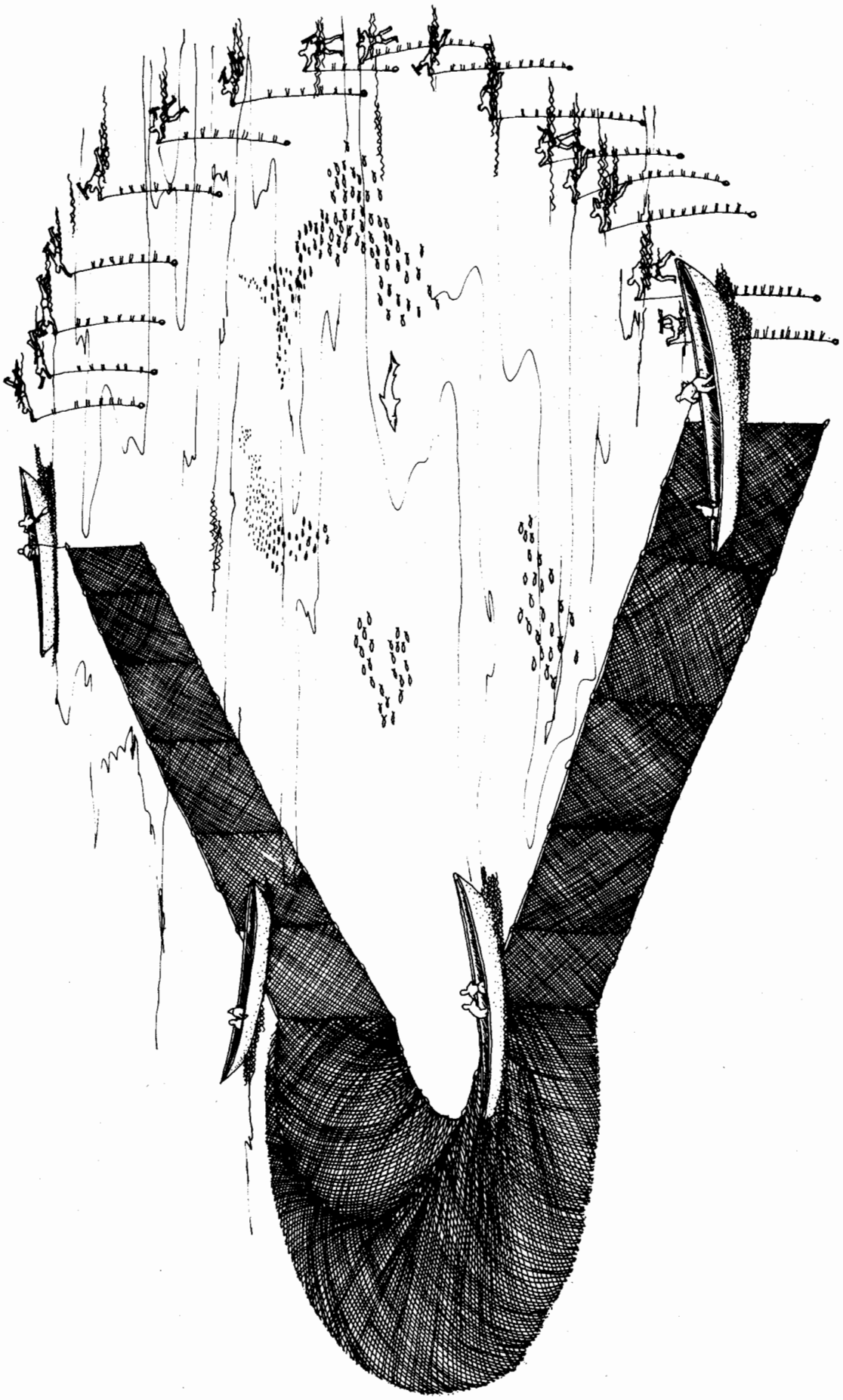


Fig. 7. Muro-ami operation. Source: Bureau of Fisheries and Aquatic Resources.

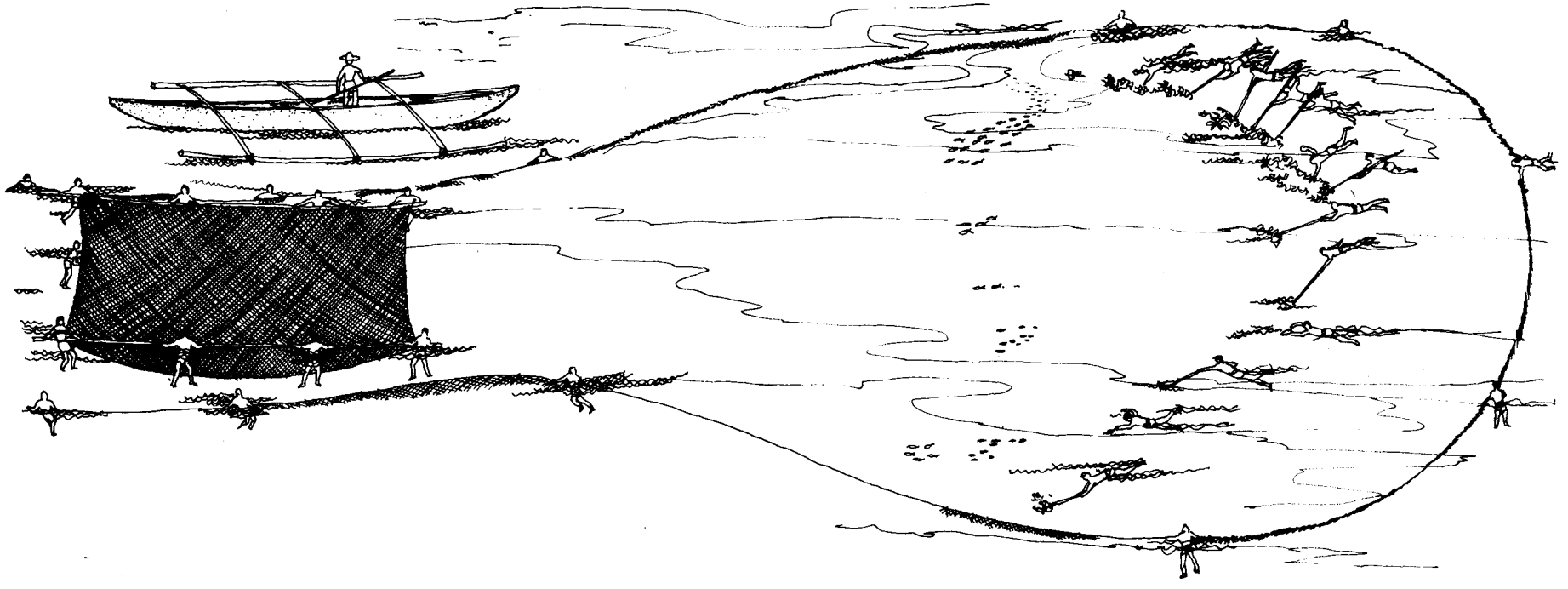


Fig. 8. Kayakas operation: Another version of a drive-in net. Source: Bureau of Fisheries and Aquatic Resources.

the municipal fishermen is probably more accurately depicted by the fact that BFAR has identified several marine areas which have shown decreasing fish yield. One of the factors identified by FIDC (1977b) as contributing to these declining yields is overfishing, "since they have once been rich fish-producing grounds" (p. 35). Traditional fishing grounds identified by BFAR as overfished (see Figure 6) are:

Manila Bay
Panquil Bay
Sorsogon Bay
Pagapas Bay
Tinagong Dagat, Capiz
San Miguel Bay
Bantayan Island, Cebu
Maqueda Bay
Villareal Bay
Zamboanga Channel (portion only)
Lingayen Gulf
San Pedro Bay
Asid Gulf
Puerto Galera, Mindoro
Polillo Island, Quezon

Due to conflicts between municipal and commercial fishermen, waters of up to 7 km off the provinces of Sorsogon, Samar, and Leyte have been closed to commercial fishing. Malampaya Sound in Palawan has also been closed to commercial fishing. Finally, a closed season for sardines, herrings and mackerel has been declared in the Visayan Sea, from November 15 to March 15.

In fact, the trend towards overfishing is most probably even more serious than official data and response indicate. Carpenter (in press) discusses the role of coral reef fisheries in Philippine fisheries, estimating that as much as 20% of municipal catch may come from this source. Coral reef areas in the Philippines, as shown in a recent study by the University of the Philippines Marine Sciences Center (MSC, 1979), are being steadily destroyed because of illegal fishing methods, including the use of sodium cyanide and dynamite, various forms of pollution and siltation, and even legal fishing methods, such as the "muro-ami" and the "kayakas" drive-in net techniques, which crush and break the corals with their lead or stone weighted scare-lines. (see Figures 7 and 8). Illegal harvesting of coral itself also persists in Cebu, Zamboanga, Sulu, and Batangas, despite a Presidential ban. The MSC estimated that "nearly 75% or three-fourths of the country's coral resources have been destroyed–and only about 10 to 15% of the destruction may be attributed to natural causes" (Bulletin Today, March 21, 1979).

Reef destruction and overfishing are symptomatic of more than simple shortsightedness; it is reflective of an underlying cause–the extreme poverty of municipal fishermen whose recurrent concern is providing the family's daily food intake. Despite his efforts, a fisherman who faces daily the prospect of not being able to adequately feed his family cannot be expected to take a long-term view. This deteriorating situation is indicative of the extreme difficulty of dealing with the underlying causes, the result being that the poverty of many fishermen jeopardizes the very resources upon which both producers and consumers depend.

B. INLAND MUNICIPAL FISHERIES

It was not until 1976 that BFAR published separate data on inland municipal fisheries. In fact, the lack of inland municipal statistics, as distinct from marine municipal statistics, has led to considerable confusion in previous research studies that often erroneously concluded that 1) inland was synonymous with aquaculture and/or 2) the municipal catch data for 1975 or earlier represented marine catch only. Neither assumption was correct.

Inland municipal fisheries catch comes from the country's freshwater lakes, rivers and reservoirs, and a breakdown by species for 1976 and 1977 is shown in Table 7. Data on production from fishponds are not included. However, production from the fishpens of Laguna de Bay are included.

The BFAR Statistics Section is careful to point out that these figures for inland production are almost certainly underestimates.[6] The estimates are compiled from field surveys of the following lakes: Laguna de Bay, Taal Lake (Batangas), Lake Bato (Bicol), and San Pablo Lake (Laguna). According to the survey, these four lakes produced approximately 127,000 mt in 1976. To this figure were added regional office estimates from Bulacan, Pampanga, Bukidnon, Agusan del Sur, and Agusan del Norte (including Lakes Mainit and Pag-usi), and other regional reports not based on actual survey work. The Statistics Section believes that inland fisheries production is probably considerably higher than is shown in the annual statistics, particularly because data are available neither from Southern and Western Mindanao, nor from major areas of the Visayas and Luzon.

A major proportion of the total inland municipal fisheries catch in the Philippines comes from the 90,000-

[6]Candido Ramos, personal interview, 2/23/79. Mr. Ramos is chief of the BFAR Statistics Section.

ha Laguna de Bay, situated south of Metro Manila (see Figure 9). A thorough study of the various fish resources and techniques used in Laguna de Bay was undertaken by the Freshwater Investigation Unit from 1961 to 1963, the results of which were reported extensively by Delmendo (1966). In 1968 a further survey was undertaken by the Philippine Fisheries Commission (Shimura and Delmendo 1969). Finally, a 10% sample survey of the 1968 respondents was taken in 1973 and results compared with the 1968 data (LLDA, 1974). These three studies, plus BFAR 1976 statistics, can be used to indicate the declining levels of productivity from this large freshwater lake. Detailed information of this nature on other inland municipal fisheries is not available.

In addition to fish and shrimp, a major crop from the lake is snails, used primarily as feed for the many duck farms that border the lake. These duck farms provide the Manila market with the popular "balut," an incubated duck egg that is cooked with the developing embryo.

Table 7. Production of inland fishery, by species, 1976-1977[1] (mt). Data are from 1976 and 1977 Fisheries Statistics of the Philippines, BFAR, Manila.

Species	1976	1977
Fish	74,379	82,834
Bangos *(Chanos chanos)*[2]	47,020	47,102
Tilapia (all kinds)	13,046	12,994
Maliputo, Aslo, Simbad (Cavallas)	114	1,624
Carp (*Cyprinus* sp., Rojo, etc)	4,090	4,873
Ayungin *(Therapon plumbeus)*	1,579	3,248
Biya *(Glossogobius gunrus, opiocara* sp)	4,385	4,873
Kanduli (*Arius* sp.)	756	1,624
Dalag *(Ophicephalus striatus)*	1,313	3,248
Hito *(Clarias batrachus)*	1,006	1,624
Eel	1,070	1,624
Others		
Crustacea	16,002	16,242
Hipon (Palaenon, Atyal)	16,002	16,242
Talangka (*Orapsus* sp.)		
Ulang (*Macrobrachium* sp.)		
Alimango		
Mollusc	62,999	63,344
Tulya *(Corbicula manilensis)*	20,237	21,115
Cabibi (*Corbicula* sp.)	6,534	6,497
Suso (*Vivipara angularia* and others)	36,228	35,732
Total:	153,380	162,420

[1]Excluding fishponds.
[2]Production of Laguna de Bay fishpens.

Since dredging for snails is an activity of many of the municipal fishermen who live around the lake, information on yields of snails is included in this brief review of the lake fishery. Although representing over 50% of harvest by weight in 1973, however, snails represented less than 3% by value. A description of the Laguna de Bay benthic fauna, of which snails are a part, can be found in Mercene and Mercene (1973).

Pertinent information on numbers of fishermen, production, and value is summarized in Table 8. The information distinguishes between capture fishery and the more recently established fishpens, in which milkfish fingerling (*Chanos chanos* Forskal, or "bangus") are reared to market size (approximately 4 pc/kg). The distinction is important because it allows a clear demonstration of the impact of overfishing of the major species in the lake. From 1963 to 1973, while numbers of municipal fishermen increased from 13,000 to 16,000 and shrimp catch increased by 25%, catch of fish from capture fishery declined by over 75%, and snail harvest declined by almost 75%.[7] Total production in Laguna de Bay declined from almost 350,000 in 1963 to only 120,000 in 1976.

While the value of production from the lake increased from ₱77.2 million in 1968 to ₱149.1 million in 1973, all of this increase in revenue accrued to the owners of fishpens. The value of the capture fishery (fish, shrimp, and snails) actually declined over the interim from ₱77.2 million to ₱72.3 million. Except on those occasions when milkfish escape from fishpens after typhoons and are subsequently caught by municipal fishermen, the fishpen business has apparently had little positive impact on the many fishermen living around the lake. Small numbers have probably been employed as caretakers and laborers.

To counter the apparent overfishing problem in the lake, a 5,000-ha fish sanctuary has been designated Southeast of Talim Island (see Figure 9). The effects of this conservation measure are not yet known, however.

C. CONCLUSION

Estimates of marine municipal catch and its potential for expansion have been made from continental shelf productivity estimates, by extrapolation from consumer surveys, and from catch and effort data in selected

[7]Delmendo reports 1,005 snail dredges operating in Laguna de Bay in 1963. The snail harvest of 247,770 mt implies an annual harvest per dredge of 246.5 mt annually. Since snail dredges operate throughout the year, daily harvest approximated 700 kg in 1963. Unfortunately, no data are available on the numbers and types of fishing gears operating in the lake today.

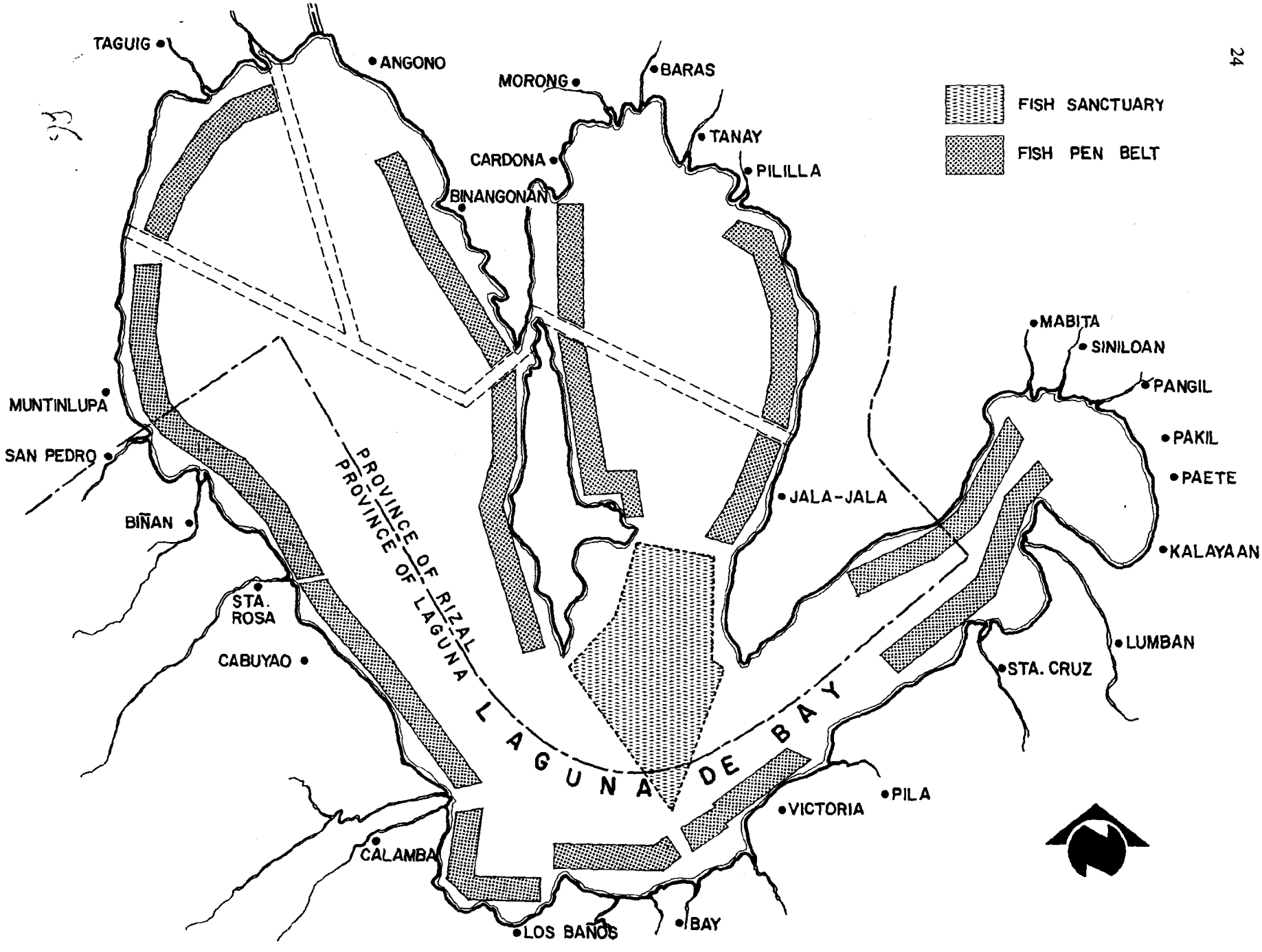


Fig. 9. Laguna de Bay, showing the fish sanctuary area and the fishpen belt.

geographic areas. The overall impression given by the first two approaches is that national municipal fisheries catch is levelling off, probably approaching if not surpassing MSY levels. The more selective approach using catch and effort data has also found evidence of overfishing in certain areas, but has revealed room for expansion, especially in certain areas of the Pacific coast, in Palawan, and in Tawi-Tawi. Evidence of possible improvement also comes from the Calamian Group north of Palawan, where present average catch per municipal fisherman is several times the national average (Baum & Maynard 1976b). In general, there appears to be more evidence of overfishing of demersal stocks than of pelagic stocks, the implication being that municipal fishermen are more likely facing an overfishing problem than are commercial fishermen who fish for demersal and pelagic stocks farther off-shore.

Belief in a vast potential for expansion of marine fisheries is based on the assumption that present catch levels are nowhere close to the MSY. However, it is apparent from the preceding discussion that 1) present catch is probably higher than current BFAR statistics show, and 2) MSY is almost certainly lower than the most commonly quoted estimates in excess of 2 million tons. Consequently, the trend towards overfishing is a matter for immediate, not future, concern.

Since access to the municipal marine and inland resource is not controlled in any way, except for two isolated areas, one can predict that the average productivity of municipal fishermen will continue to decline. As the trend toward overfishing (both biological and economic) continues, the problem becomes less one of developing the resource and more one of managing the resource. There are several management options open:

1. Continue the status quo by not limiting access.
2. Impose and enforce mandatory restriction on municipal and commercial fishing effort, through minimum mesh size, closed seasons, quotas, and restricted areas.
3. Reduce fishing effort by developing alternatives to capture fishing sufficiently attractive to municipal fishermen, so that they reduce their dependence upon fishing.

As will be discussed in Section IV, management efforts are already evolving. If overfishing is occurring, management of the resource to reduce effort could bring about a higher sustainable yield. Management of the resource could also include expanded efforts, such as those already underway, to reduce post harvest loss and

Table 8. The Laguna de Bay Fishery (1963, 1968, 1973, and 1976). 1963 data are from Delmendo (1966), 1968 and 1973 data are from LLDA (1974), and 1976 data are from the Statistics Section, BFAR, Manila.

	1963	1968	1973	1976
Number of fishing households	6,511	7,812	7,839	n.a.
Approx. number of fishermen	13,000	16,000[1]	16,000[1]	n.a.
Number of fishing gear units	9,740	n.a.	n.a.	n.a.
Capture Fishery Catch (metric tons)				
Fish[2]	82,882	39,055	20,723	36,678
Shrimp	19,096	27,552	23,597	
Snails	247,770	96,483	77,560	36,228
Total	349,748	163,090	121,880	72,906
Fishpen Harvest (metric tons)	–	–	19,204	47,020
Total Production	349,748	163,090	141,084	119,926
Production per hectare (kg) from Capture Fishery[4]				
Fish	921	433	246	426
Shrimp	219	306	274	
Snails	2,753	1,072	902	421
Total	3,893	1,811	1,422	847
Value of Production (Million pesos)	n.a.	77.2	149.1[3]	n.a.

– None
n.a. Not Available

[1]Calculated based on approximately two fishermen per household, as implied by 1963 data.
[2]Excluding fishpen harvest.
[3]51% of value comes from fishpens. Value from capture fishery declined to ₱72.3 million.
[4]Adjusted to reflect use of 4,000 ha of lake for fishpen purposes in 1973, leaving 86,000 ha for capture fishery.

spoilage. A 20% post-harvest loss is not atypical in the tropics, and a reduction in this would result in significant increases in the quantity of fish available to consumers, perhaps as high as 300,000 mt. To the extent these losses occur while the catch is handled by municipal fishermen, higher prices received by fishermen may also result. Finally, the tapping of underexploited resources could increase municipal catch in certain areas.

Technology of Municipal Fishermen

Considering its labor force of over 500,000 and its more than 50% contribution to the Philippines' annual fish production, the municipal fisheries sector was given priority in the 1976 Integrated Fisheries Development Plan (IFDP). Under this plan, one major aspect of development is technology upgrading.

At present, development of technology in the municipal fishery sector appears to occur at a relatively slower rate than in the aquaculture and marine commercial sectors of the Philippine fishing industry. It has been observed that very traditional fishing methods are still being widely used by municipal fishermen. In view of this, production per fishing banca or per fisherman is much below what some think to be possible with the application of more modern technology.

The succeeding discussion, therefore, describes the state of technology as applied by the municipal fishermen and the problems constraining its development.

A. THE STATE OF THE ART

The typical municipal fisherman operates a small reinforced dugout craft (banca) of not more than 3 gt and also other gear, such as corrals, not requiring the use of boats but still used within municipal waters. The bancas used are usually made of marine plywood and are relatively narrow and lightly constructed. Most are furnished with outriggers for stability, while some others, especially those with motors, prefer to have no outriggers for greater speed due to less water surface friction. Non-motorized bancas make use of either paddle or sail. Bamboo rafts are also used for fishing close to shore.

Originally, the bancas were propelled with paddle or sail. In recent years, however, motorization has gained increasing acceptance. The most commonly used type of engine is a Briggs and Stratton gasoline engine in the 10-16 hp range. Operators prefer this type of engine to diesel engines due to its relatively low investment cost. In 1976, BFAR recorded a total of 244,589 fishing bancas of which 113,191 (or 46%) were motorized. 131,398 bancas or 54% were non-motorized. Approximately half of the 500,000 municipal fishermen, therefore, did not own any type of fishing craft.

The Philippines, being a multispecies fisheries country, allows a varied choice of fishing gear to the municipal fishermen. During the 1940s, the Philippine Fishery Program of the United States Fish and Wildlife Service and the Philippine Bureau of Fisheries identified about 55 types of fishing gear in operation in the Philippines.[1] The gear were further classified as follows:

1. Hand instruments–instruments exclusive of those made of textile and operated by a single man.
2. Barriers and traps–all types of gear exclusive of those made of textile, which are either temporarily or permanently fixed to the bottom, and in which fish are caught in an area they have entered after having been led, enticed, or attracted into it.
3. Lines–devices consisting of baited hooks attached to a line or lines and in which fish fall victims of baits.
4. Nets–all fishing gear principally made of woven or knitted fabrics with uniform mesh size.

Figure 10 shows the different types of fishing gear in the Philippines, some of which however are considered very traditional in nature and are no longer widely used. Table 9 shows the species of fish caught and the labor requirements of the major types of fishing gear currently in use. Catch rates of individual gear, however, are not known, and will, of course, vary from area to area. The most dominant types of gear used in terms of production are shown in Table 10. Of these types, gill nets and hook and line are estimated to provide slightly more than half the municipal fisheries catch. The predominance of certain types of gear also varies from region to region, with baby trawl, longline and bag nets providing significant proportions of the catch in Regions II, IV, IV-A and IX. Figures 11 to 28, adapted from Umali (1950), depict the major gear.[2] Appendix 4 contains a detailed description of fishing gear and their methods of operation.

It has been pointed out by Spoehr (pers. comm.) that several types of gear described as "municipal" have evolved over time and that they may now be operated from vessels exceeding 3 gt, thus by the definition no longer being "municipal" per se. This evolution is particularly true for the so-called "baby" trawls, purse seines and bag nets (basnig). Rather than the arbitrary demarcation between "municipal" and "commercial" based on tonnage, Spoehr recommends a demarcation based upon management or entrepreneurship that distinguishes among "small-scale," "middle-scale," and "large-scale." These distinctions, as observed in the

[1] A part of the Philippine Rehabilitation Program authorized by the Philippine Rehabilitation Act of 1946. See Umali (1950) for the most complete documentation of the various types of fishing gear used in the Philippines.

[2] These figures have been adapted from Umali (1950) by Roberto R. Bugay, with the publisher's permission.

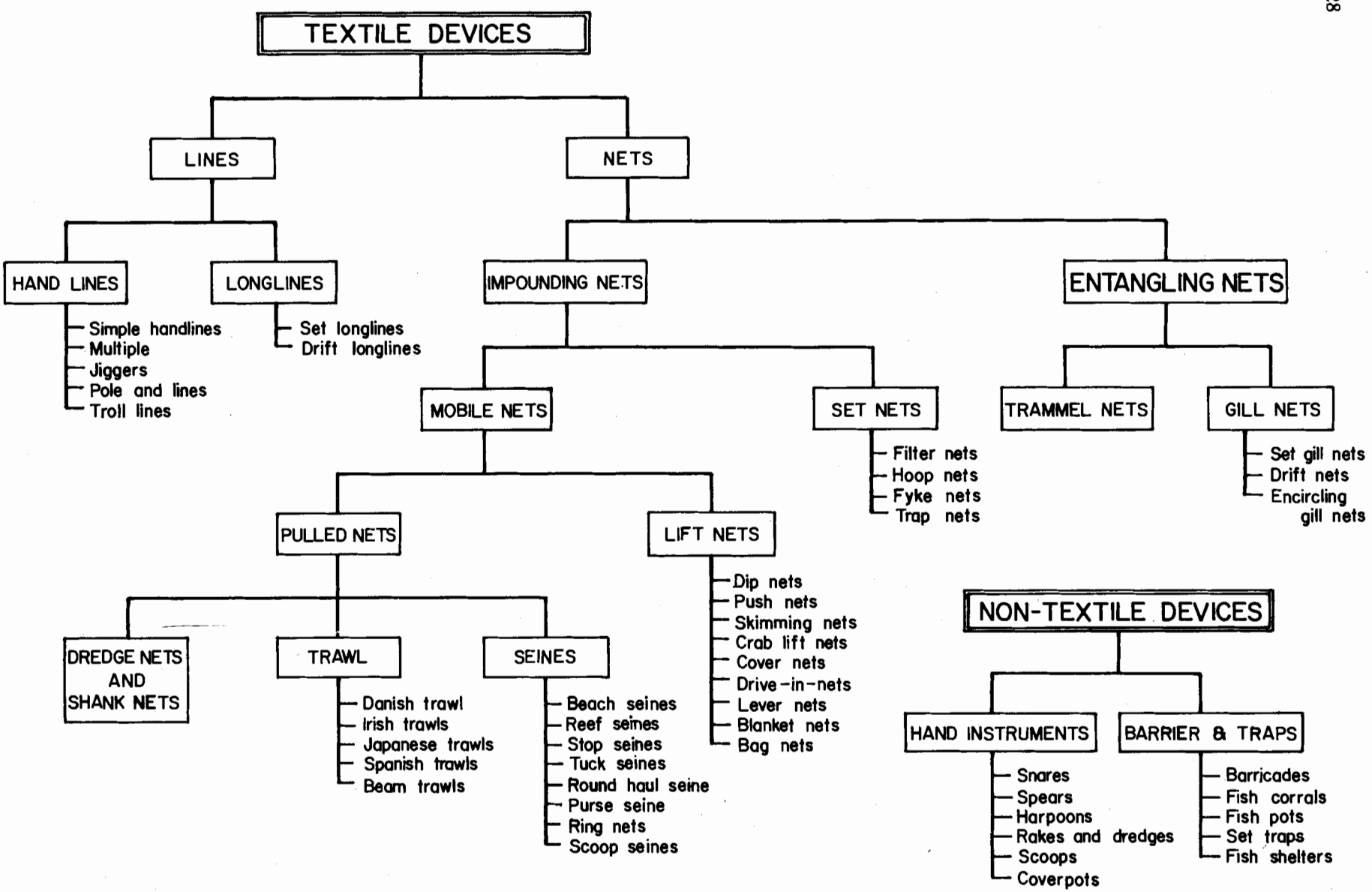


Fig. 10. Types of fishing gear in use in the Philippines. Source: Bureau of Fisheries and Aquatic Resources.

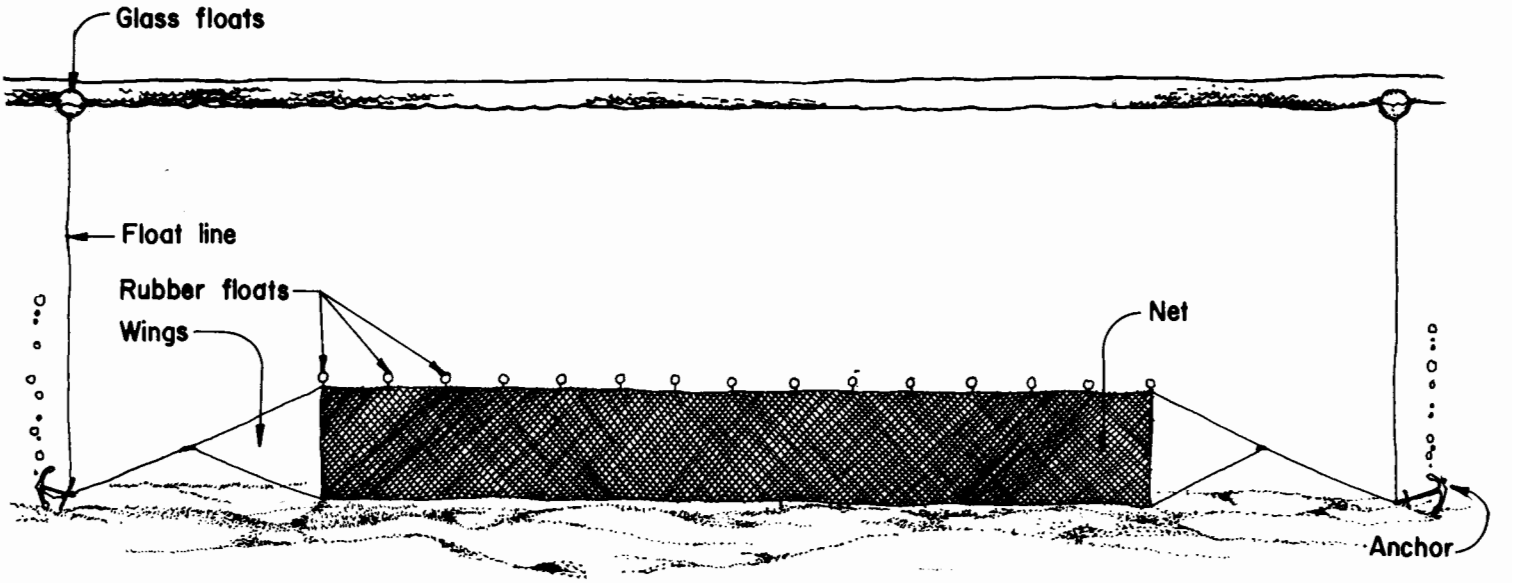


Fig. 11. A bottom set gill net.

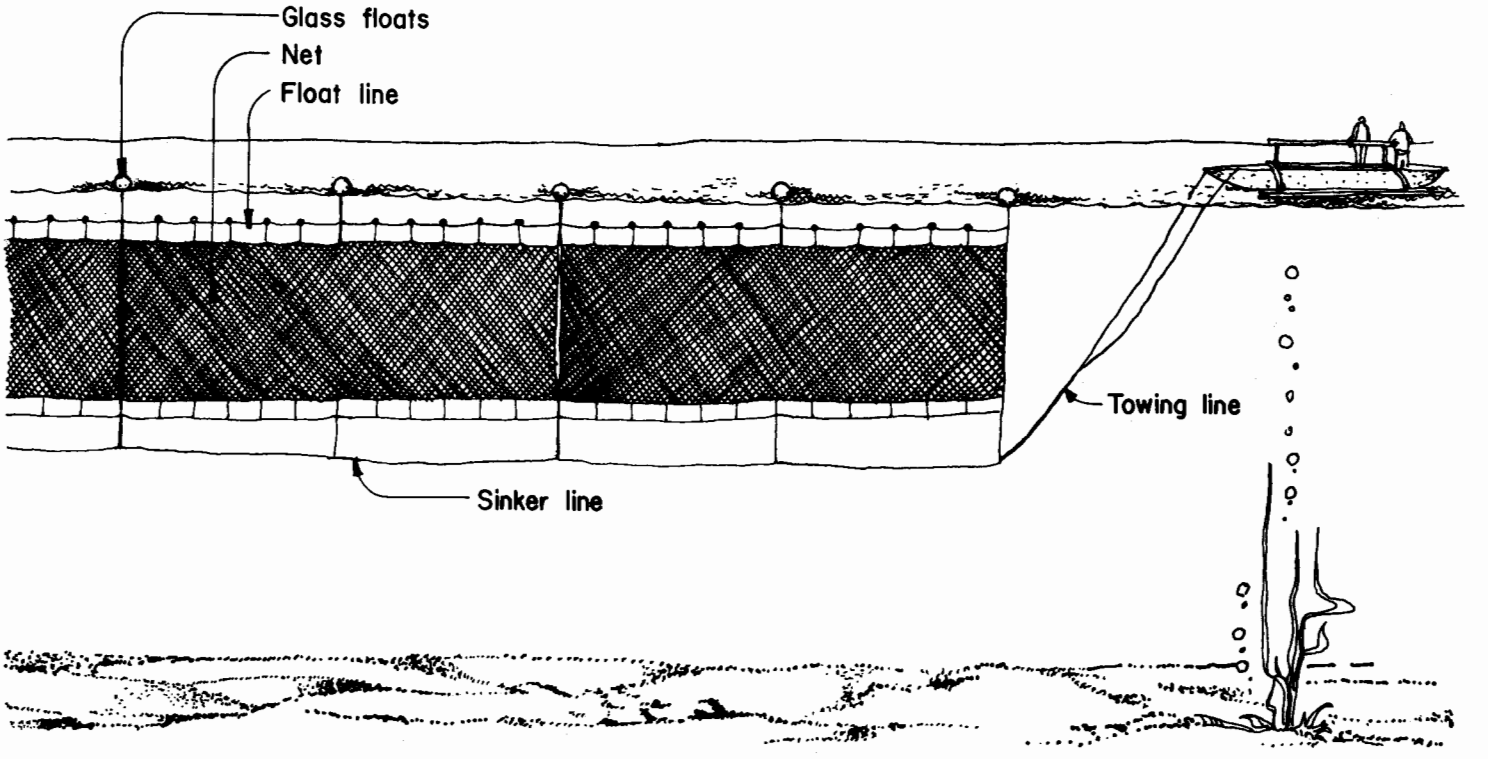


Fig. 12. A drift net.

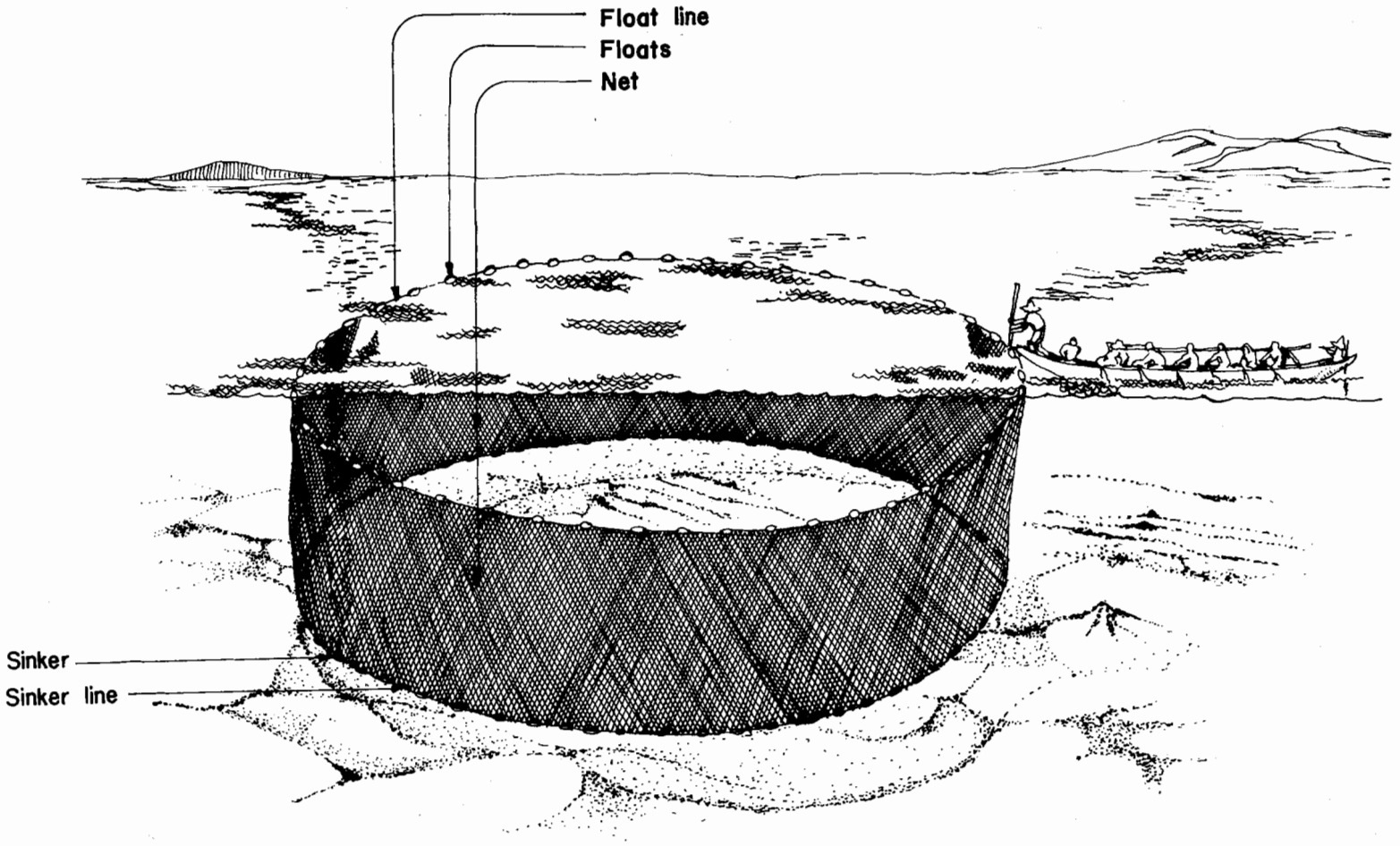


Fig. 13. Bating or halang (Tagalog), a typical encircling gill net for sardines.

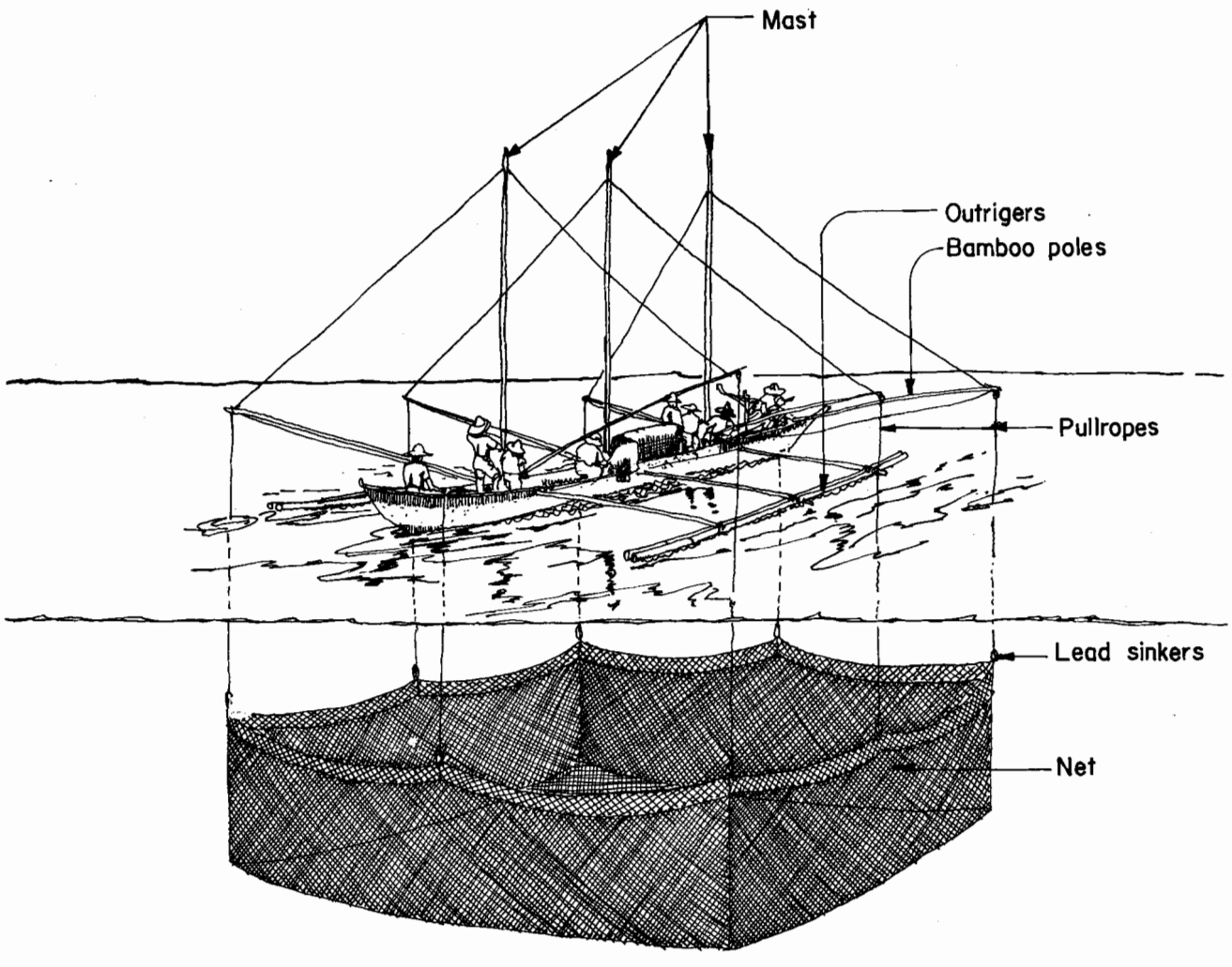


Fig. 14. Basnig (Pilipino), a typical bag net.

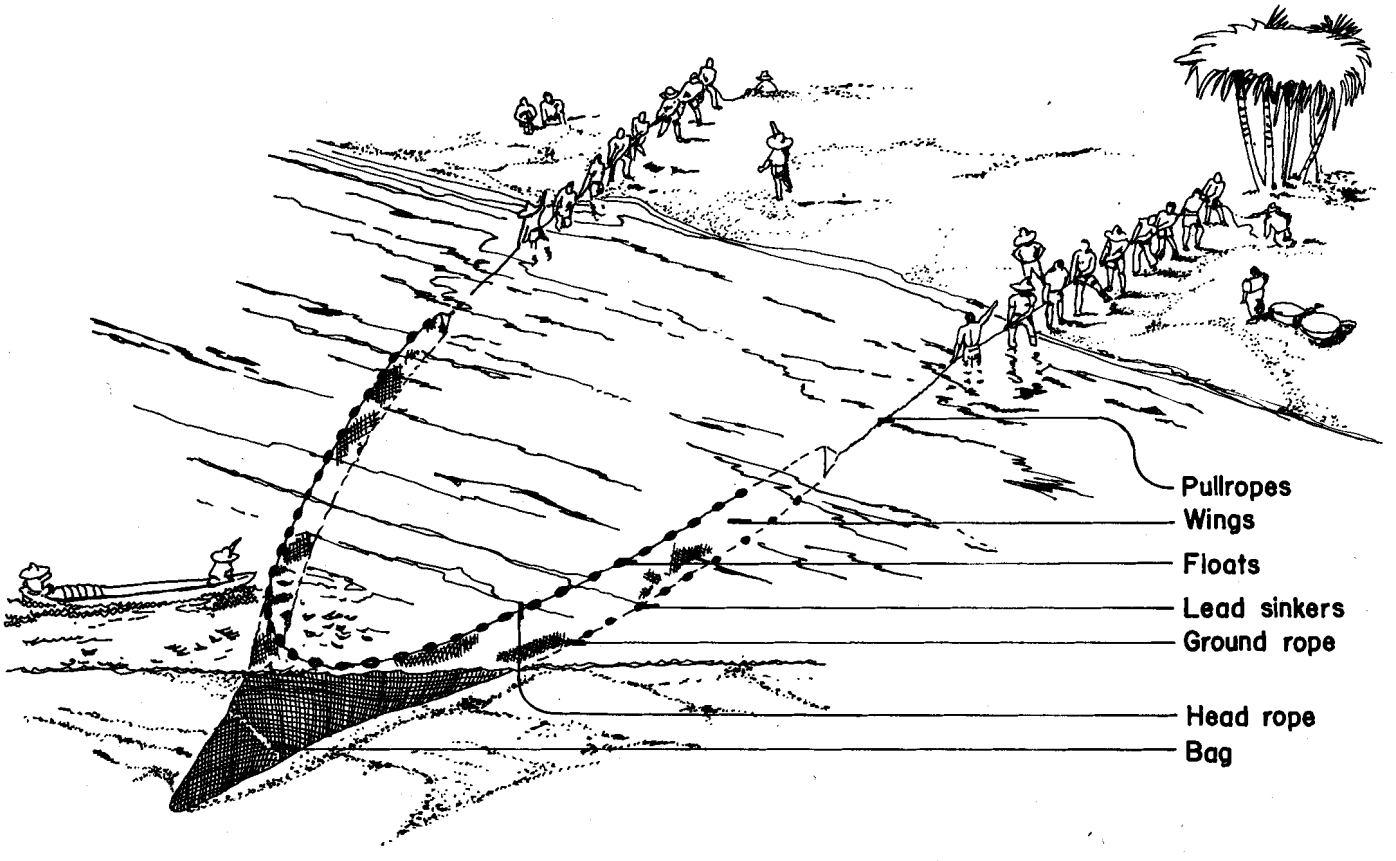


Fig. 15. Pukot (Pilipino), a typical beach seine.

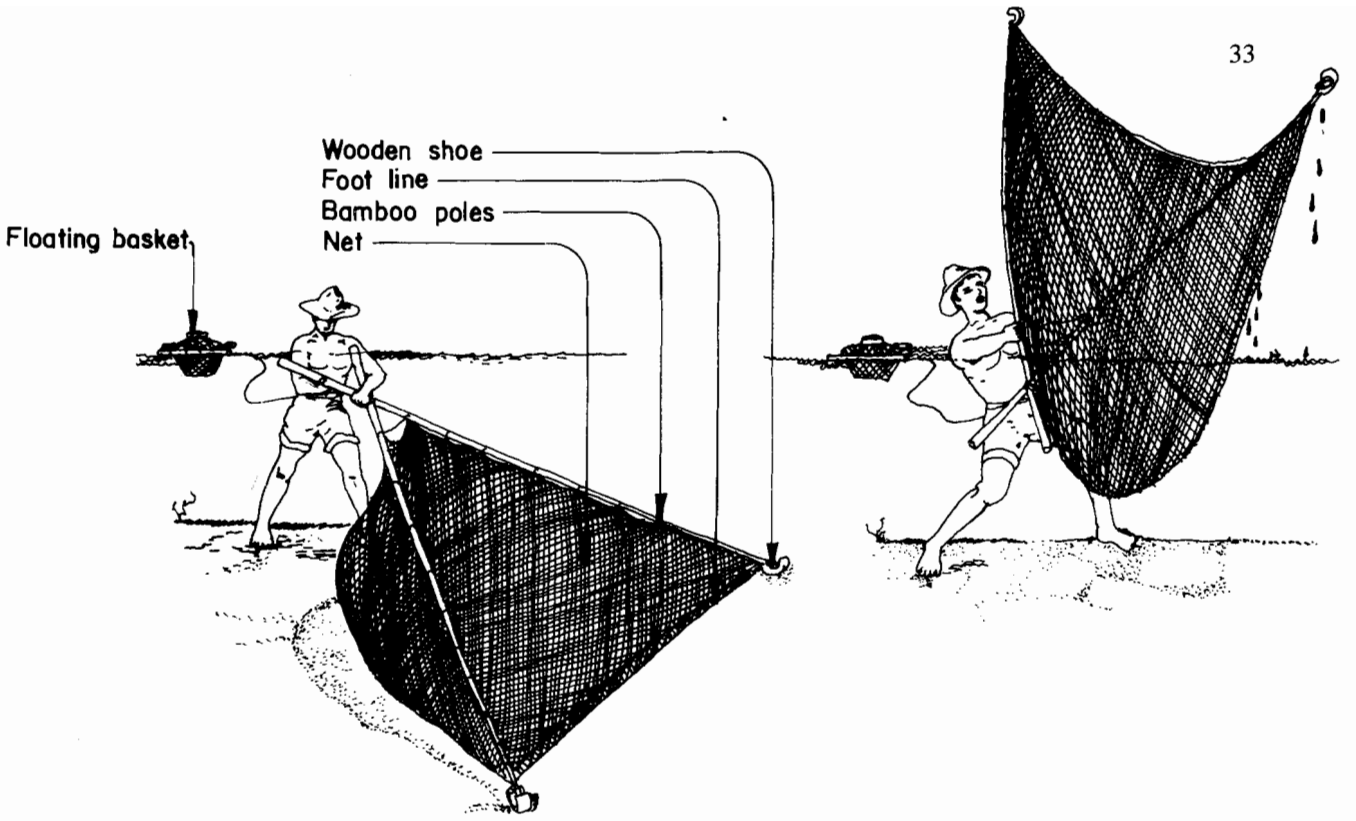


Fig. 16. Sakag (Tagalog), a push net for catching shrimps.

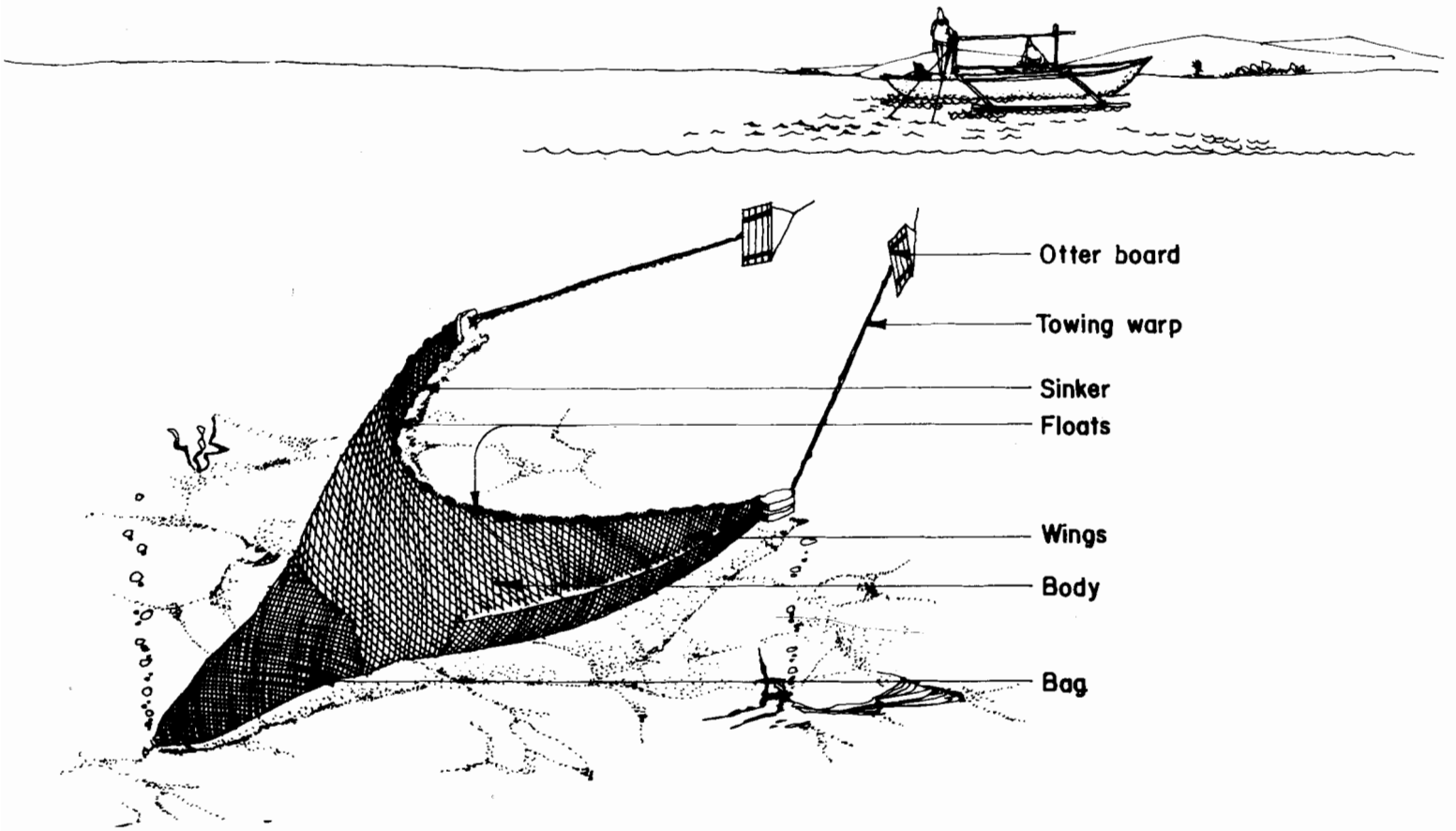


Fig. 17. An ordinary otter trawl. Baby trawls use this and other trawl gear.

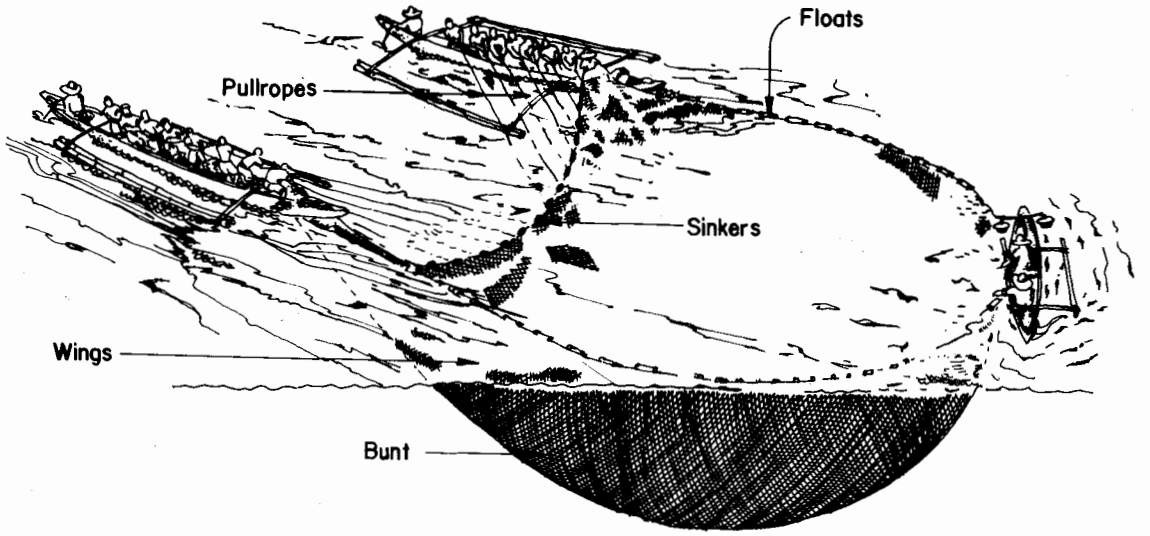


Fig. 18. Sapyaw (Tagalog), a typical round haul seine.

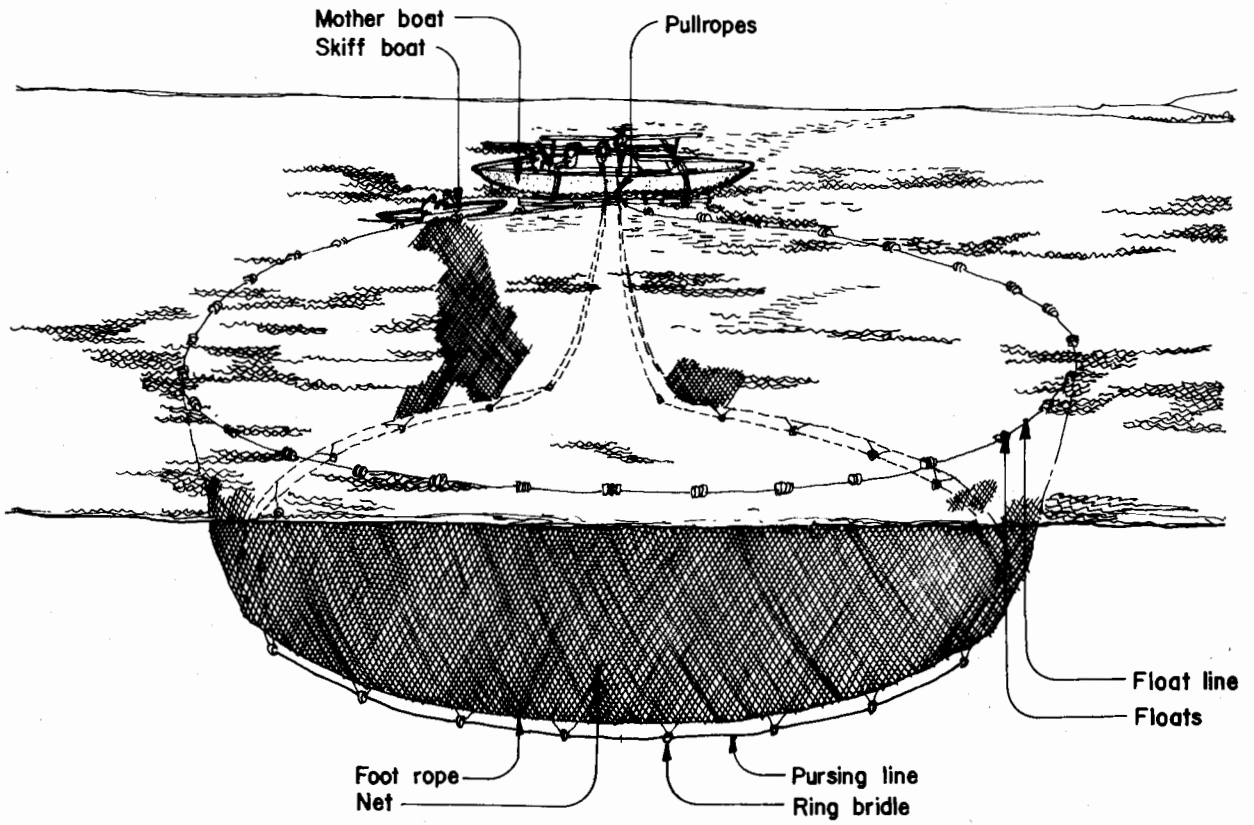


Fig. 19. A purse seine.

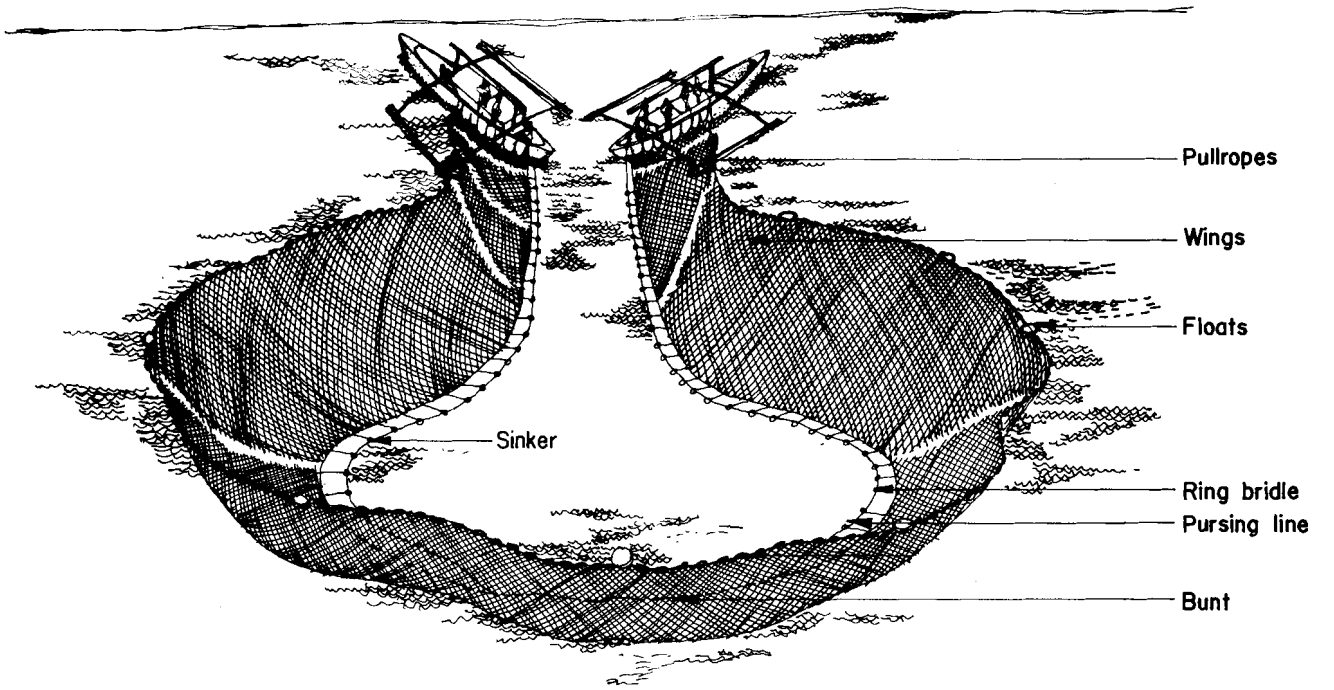


Fig. 20. An example of a ring net in operation.

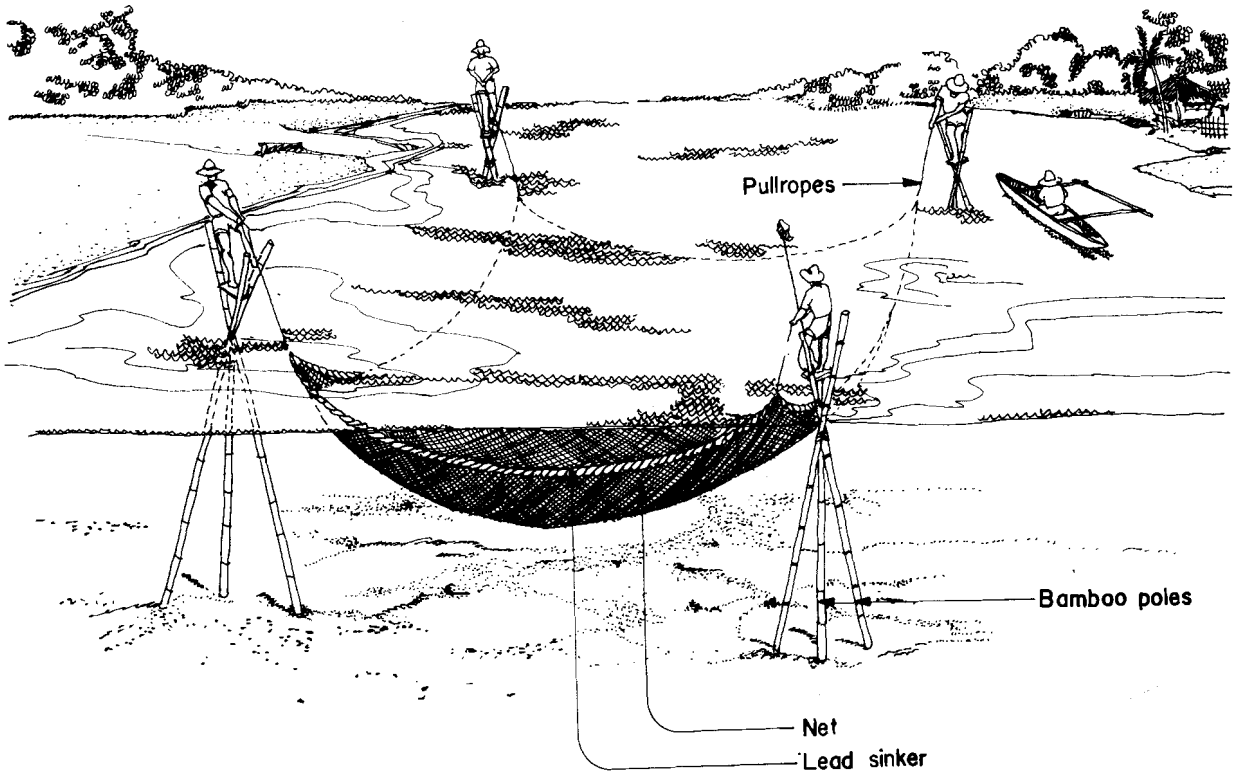


Fig. 21. Kabyaw (Samar-Bisaya), a typical example of a lift net used in rivers for catching mullets.

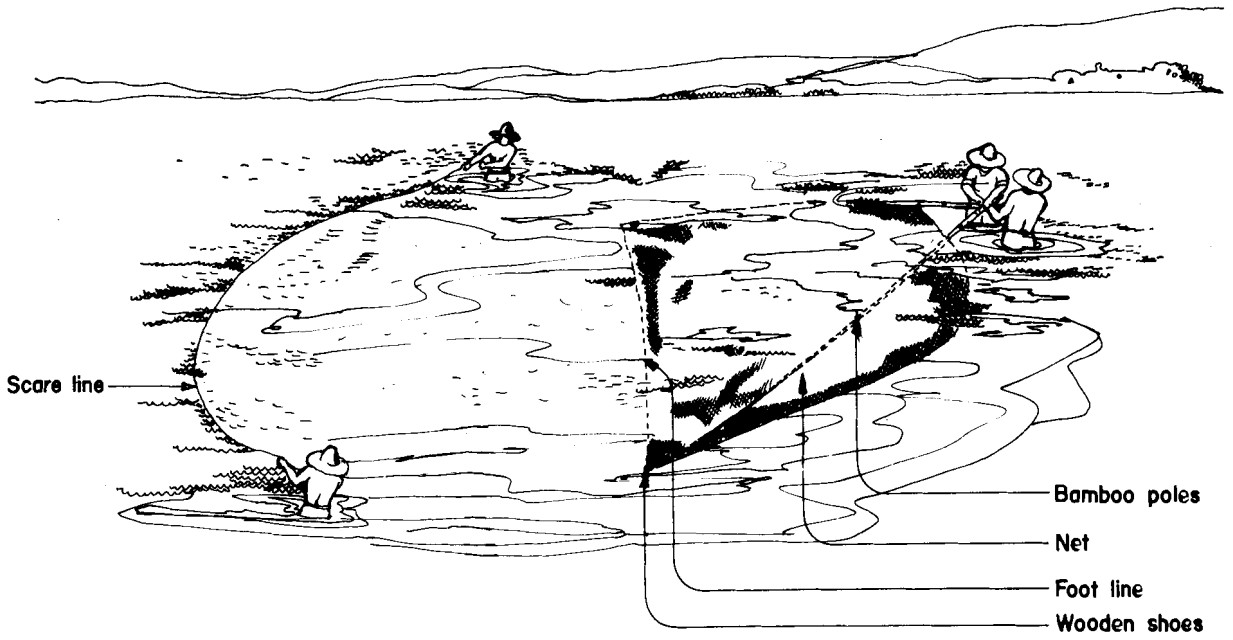


Fig. 22. Surambaw (Bisaya), an example of a drive-in net.

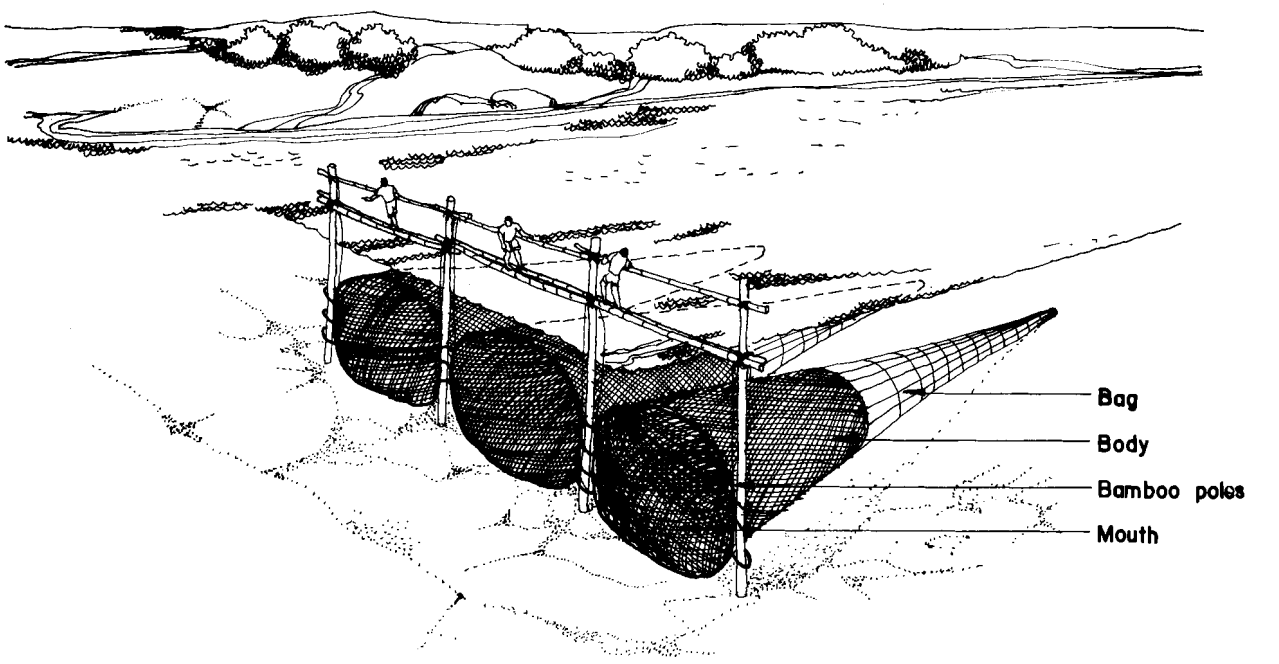


Fig. 23. Tangab (Ilongo-Bisaya), filter net in Guimaras Island, Iloilo Province, used for catching shrimp.

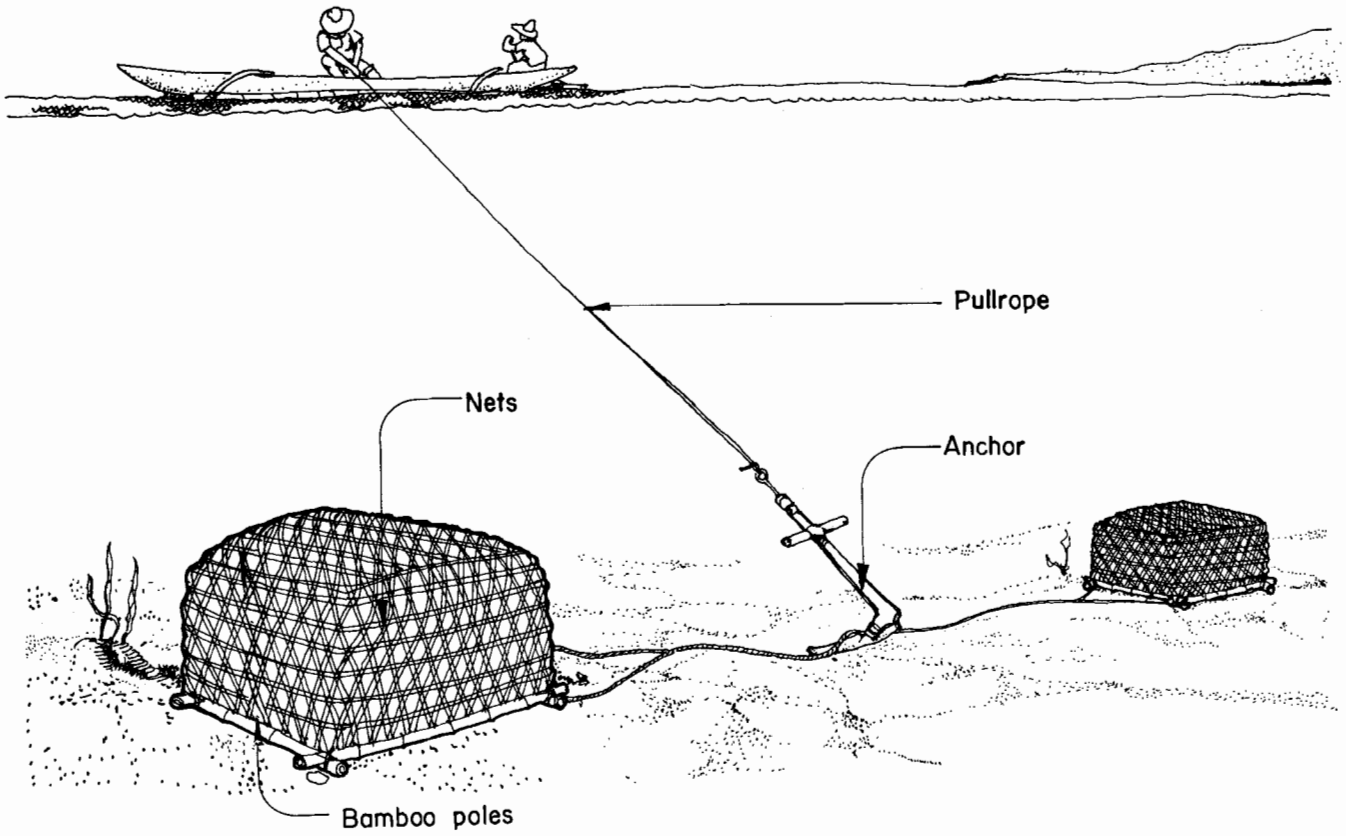


Fig. 24. Bubo (Pilipino), a fish pot for catching coral reef species throughout the Philippines.

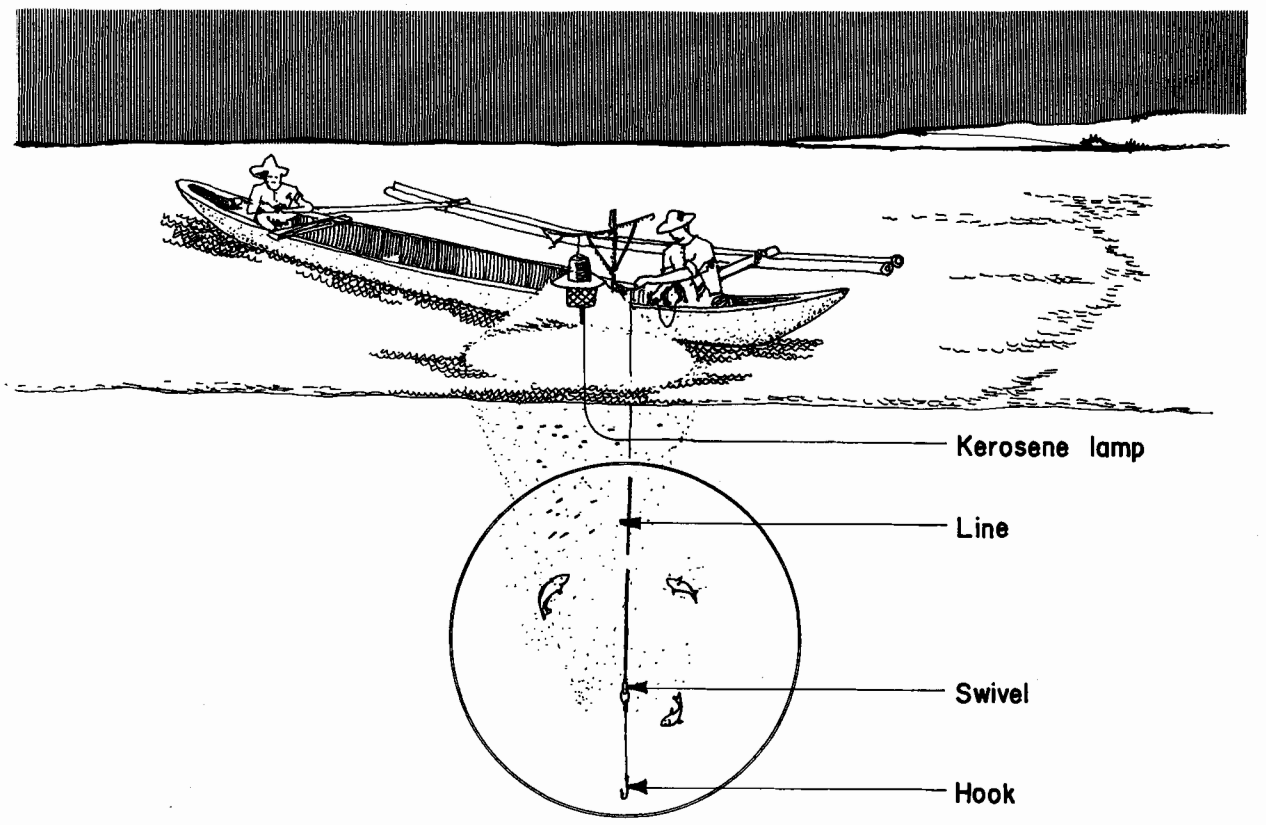


Fig. 25. Kawil (Tagalog), a simple handline for deepwater still fishing, usually used with the aid of a powerful incandescent lamp.

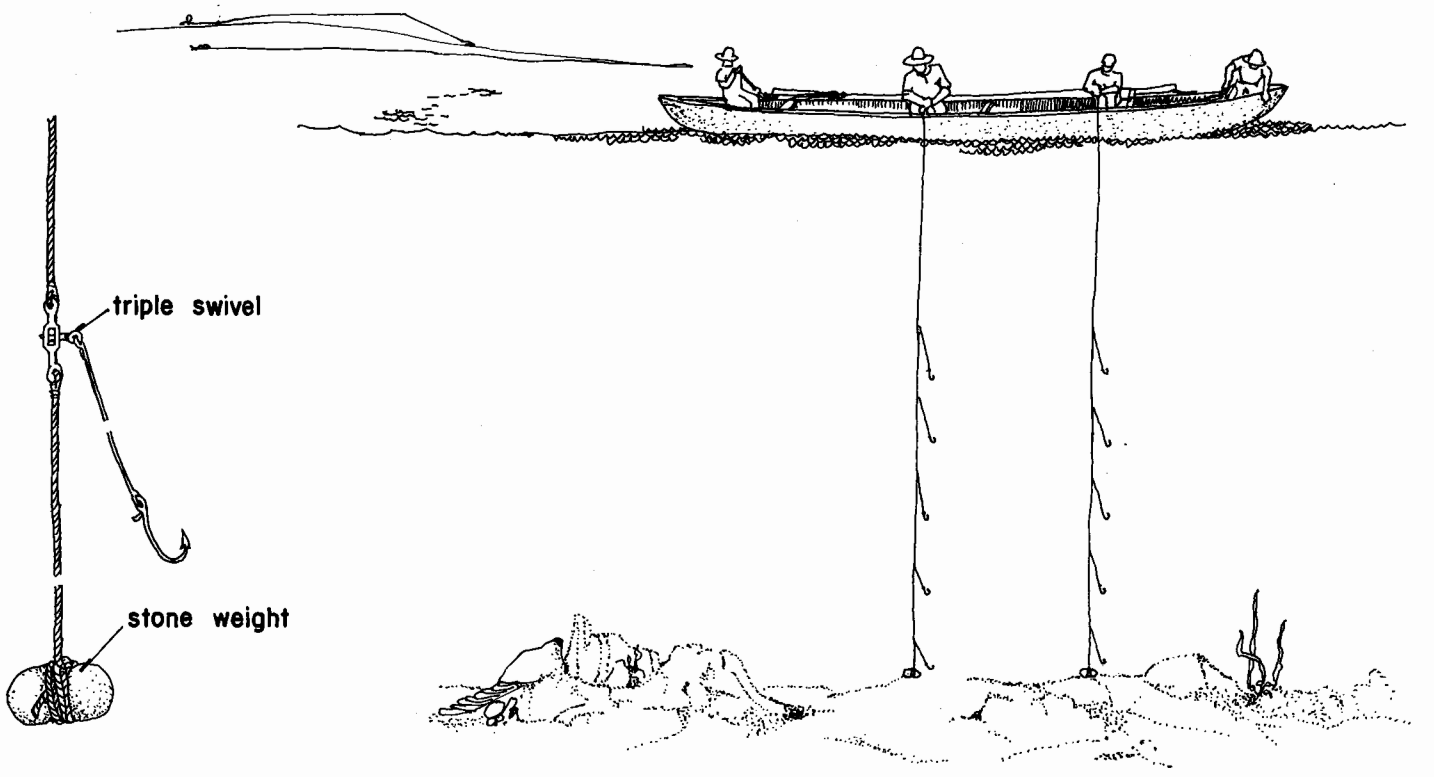


Fig. 26. Kawil-moderno (Tagalog-Spanish), a multiple handline for catching coral reef species.

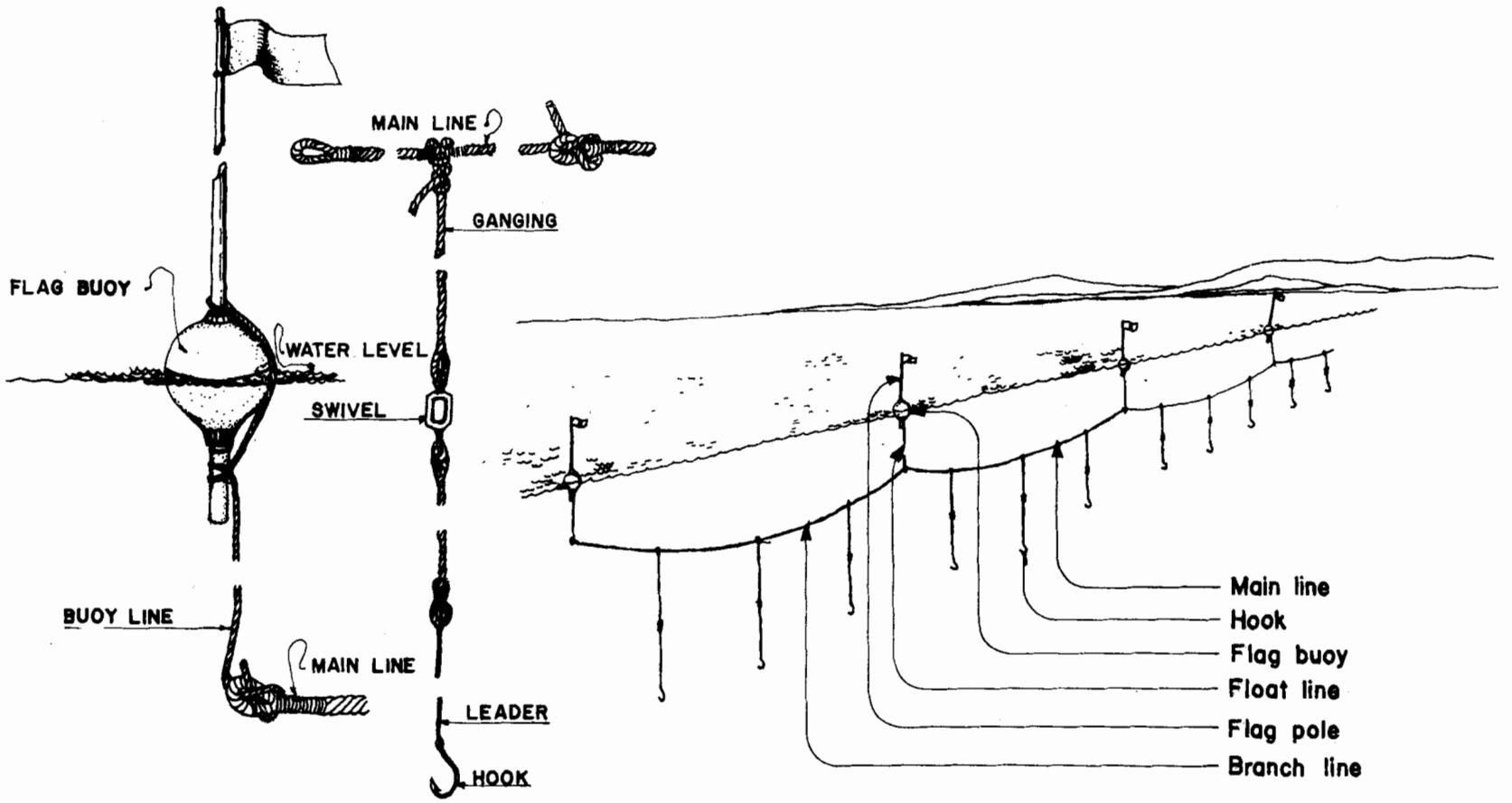


Fig. 27. Drift longline for catching tuna.

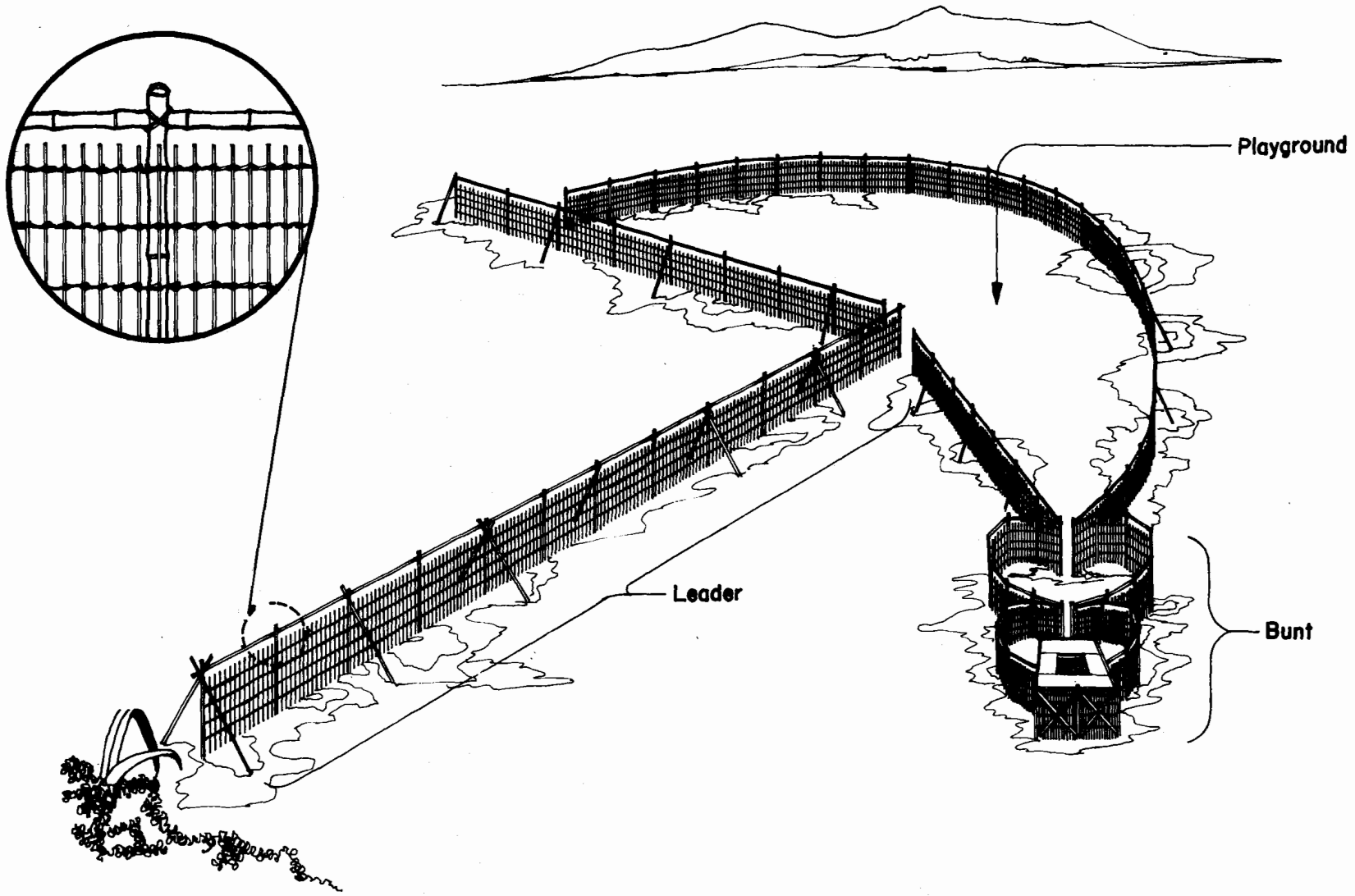


Fig. 28. Baklad (Tagalog), a typical fish corral set in the sea.

Table 9. Species of fish caught and labor requirements of each type of fishing gear.

Fishing gear	No. of fishermen required/unit	Major species caught
1. Gill net		
Bottom set gill net	3	slipmouth, goatfish, catfish, mojarras, grunts, squid, mackerel, croakers
Drift gill net	3	slipmouth, banana fish *(Caesio)*, goatfish, porgies, grunts, big-eyed scad, round scad, crevalles, cavalla, mullet, garfish, flying fish, sardines, tuna, skipjack, albacore, mackerel, swordfish, rays
Encircling gill net	4	
2. Bag net	5	anchovies, clams, round scad, cavalla, sardines threadfin, round herring, skipjack, squid
3. Beach seine	8	anchovies, spadefish, frigate tuna, slipmouth, perchlet, groupers, rabbit fish, squeaking perch, gobies, sardines, shrimps, round herring
4. Push net	1	shrimp, prawns, crabs
5. Baby trawl	4	shrimp, lizard, fish, anchovies, slipmouth, goatfish, wakers, sardines, round herring, crab, threadfin bream, flatfishes, flying fish, swordfish
6. Round haul seine	12 - 20	round scad, tuna, anchovies, sardines
7. Baby purse seine	5	round scad, anchovies, sardines, tuna, mackerel, herring
8. Ring net	6	big-eyed scad, round scad, tuna, threadfin bream, halfbeaks, flying fish, squid, anchovies, sardines, herring, mackerel
9. Lift net	5	shrimp, anchovies
10. Drive-in net	4[1]	rabbit fish, skipjack, tuna, round scad, crevalles, banana fish *(Caesio)*, halfbeaks
11. Filter net	3	prawns, slipmouth, anchovies, sardines, banana fish *(Caesio)*, parrot fish
12. Fish pot	2	threadfin bream, crab, lobsters, rabbit fish, anchovies, sardines, snappers
13. Hook and line	2	nemipterids, groupers, porgies, leather jacket, tuna, mackerel, shark, banana fish *(Caesio)*, goatfish, wackers
14. Longline	6	threadfin bream, groupers, goatfish, wackers, round scad, cavalla, hardtail, round herring, skipjacks, tuna, mackerel, snappers, scad, shark, squid
15. Fish corral	6	siganids, slipmouth, goatfish, crevalles, cavalla, anchovies, silverside, round scad, mullet, tuna, shrimp, whitings, siganid

[1]Operations using drive-in nets, such as the muro-ami, require in excess of 100 fishermen and the services of a large commercial mother-ship.

Table 10. Percent catch per gear, by region (1977 marine municipal catch). Data derived from Table 30, Fisheries Statistics of the Philippines, BFAR, Manila. Table 30 reports actual figures based on a partial census of municipal fisheries landings in all regions, except VI and XII, which are not included in the above table.

Region	Gillnet	Hook and line	Beach seine	Longline	Baby trawl	Bag net	Push net	Fish corral	Round haul seine	Ring net	Purse seine	Drive-in net	Filter net	Lift net	Fish pot	Fish carrier[1]	Others	Total
I	47	31	8	2	1	1	1	*	*	*	2	2	*	*	*	1	2	100
II	42	13	2	1	24	*	*	3	–	–	–	–	5	*	–	–	8	100
III	29	26	10	3	6	4	11	1	*	–	*	1	–	–	*	*	3	100
IV	19	–	–	–	45	–	18	4	–	–	–	–	–	–	*	–	15	100
IV-A	39	22	1	25	3	*	*	4	*	–	2	1	*	*	1	1	*	100
V	51	11	1	*	4	3	3	*	*	*	*	1	1	*	*	23	3	100
VII	28	21	7	6	1	5	*	3	4	2	14	*	*	1	2	1	4	100
VIII	20	14	3	1	7	2	*	5	*	2	2	1	1	–	–	40	2	100
IX	11	15	4	2	*	32	*	5	*	17	2	*	1	–	*	6	3	100
X	18	13	1	4	–	1	*	*	*	*	*	–	*	–	*	61	2	100
XI	11	74	2	2	*	1	–	*	*	–	*	*	*	–	*	1	9	100
% of total catch by gear	30	21	3	4	3	6	1	2	*	3	2	*	*	*	*	20	3	100%

– none
* less than 1%.
[1]Fish carriers are collector boats, not a type of gear. The gear used to catch the fish they deliver to the landings is therefore not known.

Visayas, are elaborated upon by Spoehr in a forthcoming manuscript (see Bibliography).

B. TECHNOLOGY PROBLEMS

Though the Philippines has many fishing methods that can be applied to small-scale fishing, fishermen face numerous problems related to reliance on single fishing methods, banca design, and means of propulsion. Each municipal fisherman, for example, is usually limited to a single type of fishing gear operation. On the average, effective operation of each type of gear is limited to 5-8 hr/d, for approximately 20 d/mo and a peak season of 6 mo/yr. This is mainly due to the seasonality and availability of certain species of fish during a specific period of time. Year-round, full-time fishing is therefore difficult for most fishermen to engage in.

One solution to this problem is for the fishermen to engage in multi-gear fishing operation. However, the application of this kind of operation faces two major constraints. Firstly, the use of two or more types of gear requires higher capital investment which most fishermen today cannot afford. Secondly, it is difficult to redesign a small banca to fit two or more types of gear.

The present size of most municipal fishing outfits limits their operation to areas near the coastline. With many traditional fishing grounds overfished, the result is overcrowding and low average productivity. In addition to limited range of operation, the size and design of the bancas hinder effective fishing operation, adequate fish storage after catch, and solid installation of engine and sophisticated fishing equipment. Moreover, for lack of shelter on board, fishermen are not protected from unfavorable weather, making them unable to operate in exposed conditions for a long period of time.

Jocano and Veloro (1976) have pointed out the speed with which many fishermen have adapted their bancas to motorization, while leaving the basic outrigger design unchanged. The ingenuity of municipal fishermen is certainly apparent. Szanton (1971) also describes the rapidity with which motorization was adopted by fishermen in Estancia, Iloilo. It appears, however, that the motorized banca at present, while suited for lake or coastal operation, is unsuitable for marine operation far from shore.

The most widely used means of propulsion is a gasoline engine in the 10-16 hp range. However, with rapidly rising fuel costs, diesel engines are likely to be considered as an alternative. Compared to diesel fuel, not only is gasoline fuel relatively expensive (in Manila, the February 1980 price of regular gasoline was ₱4.30/l against diesel's ₱2.25/l), its rate of consumption is also higher. Moreover, gasoline engines have a shorter life span than diesel engines.

The main reason why municipal fishermen have preferred gasoline engines to diesel has been the former's relatively lower initial cost. The government, in considering the possible economic advantages of using diesel, is now looking into the possibility of promoting this type of engine. However, no comparative cost-benefit analysis has yet been made on both types of engine to show the advantage of one over the other.

C. TECHNOLOGY RESEARCH

The preceding sections have attempted to discuss only the major and immediate technology problems faced by the municipal fisheries sector. Several underlying problems of the municipal fishermen still have to be clearly identified. Technology research for the municipal fisheries sector has been quite minimal and insufficient to solve the problems of vessel, gear, and engine limitations. Some consulting teams have, however, made recommendations on municipal fishing gear and vessels.

The Norconsult Group of Norway and the BFAR have jointly conducted a study on the existing technology in the municipal fisheries sector (NORCONSULT/IKO 1976). They confirmed the existence of technological problems. In view of this, NORCONSULT has suggested the following improvements:

1. The use of lightweight glass fiber boats, for greater efficiency and seaworthiness.
2. Increase in motorization and in the use of diesel engines.
3. Redesigning of the hull of the banca, to protect the propeller and rudder from possible damage during beach landings.
4. Promotion of round haul troll lines and baby trawl.

NORCONSULT/IKO also suggested that outfitting and demonstration of the recommended innovations be done in public. The demonstration should be held on the beaches, and the experts should follow through until it is clear to the public that the new methods and new equipment will mean higher net revenue. It should be pointed out that the baby trawl recommended by NORCONSULT/IKO is now viewed as extremely destructive because of its very small mesh nets (approx. 2 cm) which catch the juveniles of many species.

In addition, BFAR technicians have already conducted some technology research and have identified innovations for the improvement of the banca, engine and gear used by municipal fishermen. The results of their studies, however, have not been officially published.

Table 11. Costs and returns of selected small and large municipal fishing gear.

Items	Small				Large	
	Baby trawl	Drift gill net	Filter net	Hook and line	Encircling gill net	Ring net
I. Power and Crew						
Horsepower	22	14	9	12	16	16
Number of fishermen	2	2	2	2	8	5
II. Average gross income per year						
Gross catch (t)	1.8	2.2	2.7	2.2	12.2	11.1
Gross income (₱1,000)	12	12.5	15	12.4	55	50.0
III. Capital investment (₱1,000)						
Engine and boat	4.3	4.2	3.2	3.6	6.80	7.70
Gear	3.7	3.3	4.9	2.4	18.30	20.00
Accessories	–					
Total	8	7.5	8.1	6	26.16	28.84
IV. Average cost of operation per year (₱1,000)						
Fuel and oil	5	2	1	3.4	6.00	3.40
Food	1	1	1	1.3	1.00	2.00
Labor	2	3	6	4	25.85	23.00
Maintenance and repair	.3	.5	.9	.3	.80	2.00
Miscellaneous	.05	.03	.03	1	1.20	.60
Depreciation	2	1.5	2	1.3	5.00	6.00
Interest	.3	.3	.3	.2	1.05	1.05
License/Tax/Fees	.05	.05	.5	.02	7.00	5.10
Total cost	10.70	8.38	11.73	11.52	47.90	43.14
V. Average net income per year (Gross income minus total cost, in ₱1,000)	1.30	4.12	3.27	.88	7.10	6.86
VI. Rate of return on capital investment (%)	16	55	40	15	27	24

Note: Cost and income data from Dela Cruz and Yutuc (1977, p. 1283 and 1287). Rates of return on capital investment recalculated according to the following formula:

$$\frac{\text{Net income}}{\text{Capital Investment}} \times 100 = \text{Rate of return (\%)}$$

It is not known, therefore, to what extent this information has been made available to fishermen themselves.

Technology development implies increased efficiency in operation and increased output, thereby uplifting the economic standard of living of municipal fishermen able to avail of the new technology. Technology development, however, cannot be realized in a short period of time. Moreover, if resources are limited, it may even be self-defeating. Research has to be undertaken to determine the most viable innovations, and the most appropriate method of operation that can be applied. In view of this, the following activities are recommended:

1. Evaluation/analysis of the effectiveness/efficiency of existing technology, as applied by small-scale fishermen. To do this, the use of the following evaluation tools is recommended.
   a. Technology problem identification and analysis.
   b. Cost-benefit analysis.
   c. Socioeconomic analysis of technological improvements, including effect on labor intensity and employment.
2. Survey of foreign and local literature on fishing gear innovation and fishing methods.
3. Identification and testing of feasible and viable innovations and fishing methods, or those that are acceptable to fishermen and their communities.

4. Preparation of an effective technology transfer program in areas where the resource can sustain stepped-up fishing operations.

Of these proposed activities, several have been undertaken by BFAR in certain locations, although results have apparently not been published. BFAR extension workers, for example, are engaged in problem identification and testing of possible technological innovations. However, the extent to which there is consistency of data collection and methodology for cost-benefit or socioeconomic analysis is not known.

De la Cruz and Yutuc (1977) have made profitability estimates for various types of municipal fishing gear. Their sample size was small, however, so it is difficult to generalize to the nation as a whole. Municipal fishing units were classified as "small" or "large," depending upon vessel and crew size. As indicated in Table 11, net income per year for all types considered was low, ranging from ₱880 for hook and line to ₱7,100 for encircling gill netters. To calculate rates of return, De la Cruz and Yutuc used the accounting definition, which is more useful for cashflow analysis; that is, "depreciation is a part of operational cost but not actually incurred, hence it becomes a part of net income in determining the rate of return" (p. 1259). The rates of return they estimated were consequently higher than if they had used an economic definition of rates of return, in which depreciation is not added to net income. The economic definition appears to be more realistic because it assumes that capital items have to be replaced. The De la Cruz and Yutuc data presented in Table 11 have been recalculated, using an economic, not an accounting, rate of return, indicating returns on investment ranging from 15% for hook and line to 55% for drift gill-netters.

Because of the extreme variability of the resource from location to location, such costs and returns studies are generally applicable only in the geographic area from which the sample is drawn. Therefore, a concerted effort by the BFAR regional economics sections (for example), using a common format, would be necessary before broad generalizations could be made on the efficacy of certain gear types.

Socioeconomics of Production and Distribution

A. INTRODUCTION

Examination of socioeconomic aspects of municipal fishing in the Philippines has been recent in origin. To the authors' knowledge, published information on the organization of production and on fishing community social dimensions did not appear until 1971, with the publication of Szanton's (1971) study of change and development in Estancia, Iloilo. Five years later, the South China Sea Fisheries Development and Coordinating Programme published five community profiles by Baum and Maynard (1976a, b, c, d, e). Jocano and Veloro (1976) also published results of a fascinating anthropological study of the fishing barrio of San Antonio, in the municipality of Bay, Laguna, which borders on the 90,000-ha freshwater lake, Laguna de Bay. For those interested in the social and anthropological aspects of fishing activities and communities–in this case, in freshwater–the Jocano and Veloro study is invaluable for the richness of its insights.

Baum and Maynard's studies were designed to provide preliminary information on five fishing communities, prior to the possible initiation of development projects. Similarly, research conducted by various universities, as part of the PCARR/BFAR study on "Field Level (Bottom Upward) Planning and Development of Small-Scale Low-Income Fishermen Communities in the Philippines," was followed by fishermen workshops in each locale, in which fishermen and government officials together sought solutions to those problems raised by fishermen (see also Section II). The three university researches were conducted by the Department of Agricultural Education, University of the Philippines at Los Baños (Gagni and Luna 1978), the Department of Sociology, University of the Philippines at Diliman (Rubio et al. 1978), and the Research Institute for Mindanao Culture, Xavier University, Cagayan de Oro City (Herrin et al. 1978). While the Herrin et al. and the Gagni and Luna studies covered only fishing households, the Rubio et al. study also included nonfishing households. Additionally, Haque and Octavio (1977) have reported the results of a survey of municipal and commercial fishermen, which was initiated as part of a regional planning effort in Western Visayas. Other studies of interest include those conducted in Limbon-Limbon, Binangonan, Rizal (Gonzales 1977) and in Panquil Bay, Mindanao (Hopkins and McCoy 1976). Locations of completed studies are shown in Figure 29.

Several other socioeconomic studies that have bearing on problems and development prospects for municipal fishermen are underway. These studies are being conducted by various government and university organizations.

The term, "socioeconomics" has become popular of late, and it appears that the rush of enthusiasm that followed the Baum and Maynard (1976a, b, c, d, e) initiative has occasionally resulted in "research-for-research sake." While socioeconomic studies are deserving of high priority in research, when research funds are limited as they are in the Philippines, their usefulness is much reduced, unless they are preliminary to, or part of, a development program. Without meaning to appear unduly critical, it appears that several of the "socioeconomic" studies being proposed or being conducted by university groups reflect inadequate thought regarding 1) an analytical framework, and/or 2) later follow-up or integration with governmental development projects.

Indeed, it is a common criticism among BFAR personnel that socioeconomic studies are, on the whole, too long, lacking in analytic content, and too timid in their recommendations. This argument is prevalent, too, in many other settings where planners and policymakers criticize social scientists for their unwillingness to state what "should be," and instead limit themselves to descriptions of what "is." Even if social scientists prefer not to provide "normative" prescriptions, it does appear incumbent upon them to at least provide the results of their research studies in a form that can be used by decision makers.

That nothing is known about the problems, conditions, and aspirations of municipal fishermen is the assumption often made by proponents of "socioeconomic" studies. Contrary to this point of view, this section seeks to demonstrate that considerable information is available to those willing to conduct a search of the available literature.

While it would be possible to go into great detail regarding physical indicators of living standards in those communities already surveyed, this is not thought to be too useful here. Rather, this section will concentrate on findings that seem relevant to research and development programs and that indicate pressures from within fishing communities for certain types of projects, especially for production-oriented improvements of vessels and gear, and for alternative income projects.

Based on compilation of survey results in the 16 barrios covered by Baum and Maynard and by the "Field Level (Bottom Upward)..." studies, this section will also report on attempts to correlate income levels with other measured community variables, such as average fishing effort and catch, age and education levels, and willingness of fishermen to change their occupation and/or

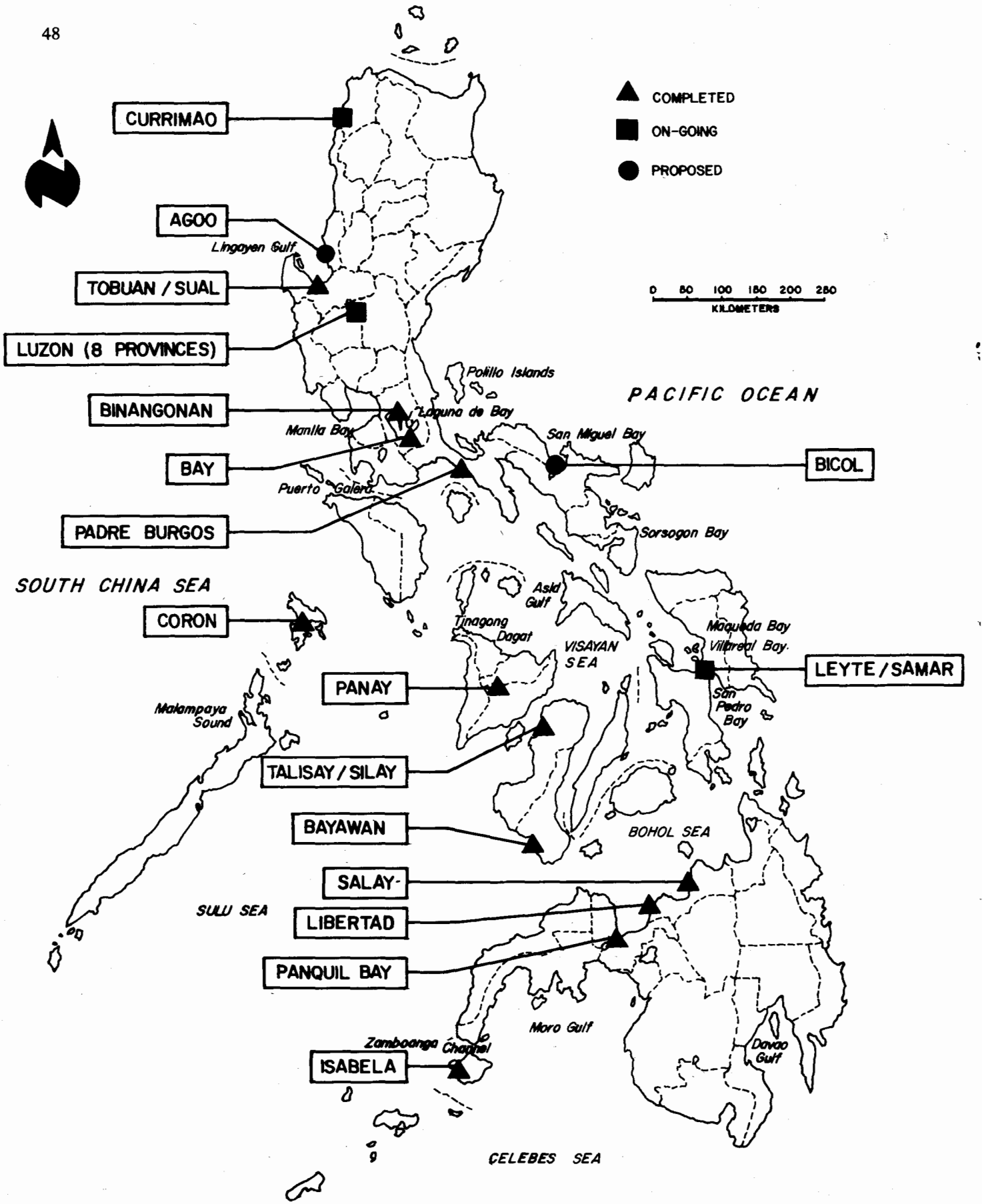


Fig. 29. Fishing community socioeconomic studies.

geographic location.

Three subsections thus follow: First, based primarily on Jocano and Veloro (1976) and Herrin et al. (1978), the organization of municipal fishermen for production purposes is described. Second, marketing of municipal fisheries catch is described. Finally, results of attempts to explain variation in per-capita income levels are reported.

B. ORGANIZATION OF PRODUCTION

Fishing activity for municipal fishermen is seasonal in nature, and many fishermen are part-time, rather than full-time. In the 16 fishing barrios discussed in Section V-C, approximately one-third of the 546 respondents were part-time fishermen (see Table 14), supplementing their income primarily with agricultural laborer work. Less than 20% of fishing households were found to own land (primarily house lots), so much of this agricultural work done by fishermen is on land owned by others. The primary reason for undertaking non-fishing work is to supplement household income during the monsoon season, when rough seas make fishing very difficult, if not impossible.

Generalizing, the occurrence of typhoon declines as one goes farther south in the country, being highest in Northern Luzon, Bicol, and Eastern Visayas and lowest in Western Visayas, Palawan, and Mindanao. Extended periods of bad weather occur between July and November each year, affecting both marine and inland municipal fishermen. Limitations to the traditional banca design are most apparent at these times, the double outriggers, though providing stability to the narrow hull, severely restricting mobility in heavy seas. Rough weather also restricts the use of cast nets as fish movements then will hardly be detected from the shoreline. Fishing families with no alternative sources of income suffer greatly and depend upon the largesse of other better-off relatives and "kumpares" (compadres), including boat owners and middlemen.

With a ratio of approximately two fishermen to each vessel in the Philippines, a large number of fishermen—probably a majority—do not own fishing craft. Some of them rent from fishermen who own more than one banca, or from non-fishermen owners. Some fish with their family members and other relatives or "kumpares," or work as laborers on the larger municipal craft. Others fish from small bamboo rafts, using hook and line or gillnet. Still others fish along the shoreline with cast nets or makeshift spear guns. Anyone who has visited small fishing barrios in the late afternoon will have noted the great variety of craft and gear lined up on the beach, in preparation for launching in the evening or early the next morning. The fleet includes large unmotorized boats manned by six or eight oarsmen who row out through the surf to set the beach seine, the motorized outrigger bancas that range much farther out to sea, and an assortment of small unmotorized bancas and bamboo rafts that are used by single fishermen closer to shore. Each craft contains a fishing net or other gear which has been carefully prepared in the afternoon. A raft fisherman may at times be taken as crew member on a larger vessel. Borrowers or renters of boats do not necessarily rely on others' vessels for their every fishing trip. Jocano and Veloro (1976) state that kinship ties are the primary determinant of crew composition, but most research studies to date offer little discussion on the intricacies of crew selection and stability, as well as on individual fishermen's decisions of whether to fish alone or with others.

Aside from borrowing boats, many fishermen borrow gear. In Libertad, Mindanao, seines were more likely to be borrowed or leased than the less expensive longlines, handlines, pole-and-line, and bag nets (Herrin et al. 1976). Often, those individuals in the community who own three or more gear were non-fishermen. It is not uncommon, therefore, to find complete separation of capital (vessels and gear) ownership from labor. While most fishing units consist of male partners, in certain cases, such as among the Bajau boat people of Sulu, husbands and wives often fish together (Nimmo 1972).

A sharing system determines the distribution of proceeds from the catch to fishing labor and to capital (Jocano and Veloro 1976; Herrin et al. 1976; Baum and Maynard 1976a; Nimmo 1972). There are many variations of the sharing system, depending upon whether or not the fishermen are members of the same household or otherwise related, and whether the vessel and gear are owned by one of the fishermen or "rented" from a third party. "Before division is made [among the fishermen and boat and gear owner], all expenses incurred in fishing, such as cost of gasoline and cost of refreshments, are deducted from the gross income. If the fishermen choose to eat their lunch or take a midnight "snack" on the boat, they bring with them the necessary foodstuffs. The amount spent for all these is again deducted from the income before it is divided" (Jocano and Veloro 1976, p. 107-108). The remaining income is then divided among the fishermen and the owner(s) of the vessel and gear.

In most of the cases reported by Jocano and Veloro (1976) for the lake fishery of Bay, Laguna, the vessel owner receives a share equal to that of each fisherman. Herrin et al. (1976), however, report a greater share accruing to the boat owner in Northern Mindanao, ranging from 50%-80% of the catch value. The share

given to the boat or gear owner apparently varies, depending upon the strength of the family or social relationship between the fishermen and the owner, and upon the level of the catch. In Bay, for example, if the daily catch is low, boat owners may decide not to collect their share on that particular day. The flexibility of the sharing system and the mutual concern for each other's welfare that exists in fishing communities is also apparent in the fact that superfluous fishermen are often taken on fishing trips, even though their presence does not increase the catch. One older fisherman interviewed by the authors in Currimao, Ilocos Norte explained that other fishermen would take him along, if he requested it, because they know that he would later on be able to help in repair work on the nets or to offer his carpentry skills for other purposes, as well. While an observer might be tempted to categorize "surplus" fishermen as wasteful of labor resources, their contribution to the fishing endeavor may come in a form other than increased production and thus still be a positive contributor to the overall activity. This type of barter activity for services also indicates the probable high degree of integration of the fish production activity with other activities in the fishing community. Researchers assessing "surplus labor" in fishing communities thus need to look beyond fishing crew composition and tasks.

Within any given municipal fishing community, one would find variations in income, depending upon ownership or use of productive assets. For example, catch and income figures collected during a recent survey in Libertad, Misamis Oriental (Herrin et al. 1978) demonstrate the inequalities that can exist in small communities due in major part to the differences in fishing vessels available to fishermen. As shown in Table 12, there are significant differences, first, between catch rates of owners and borrowers of motorized vessels, on the one hand, and owners of non-motorized vessels, on the other, and second, between incomes of vessel owners and those of non-owners (both borrowers and laborers). What is interesting from these figures, as pointed out by Herrin et al. (1978) is that while the use of a motorized vessel significantly increases catch, it does not significantly increase income. A borrower of a vessel in Libertad pays 50% share of his catch or more to the owner of the vessel. However, ownership of a vessel, though of only a non-motorized craft, does increase income. It is certainly understandable, therefore, that municipal fishermen with no vessel see ownership as the solution to their low standard of living. Indeed, slightly over 60% of the respondents in Herrin et al.'s sample cited lack of fishing vessels and gear as their major problem.

The perspective offered by Herrin et al.'s research certainly aids in understanding the pressures that originate from within fishing communities when fishermen having no vessel, or owning only an unmotorized one, see upgrading as the solution to improve their low living standards. However, a production-oriented solution will only succeed if the resources exist to support the increased fishing intensity that upgrading will bring. If unrestricted entry to the common "open-access" resource continues, resulting in overexploitation and overcapitalization, fishermen's gains will become short lived.

C. MARKETING OF MUNICIPAL FISHERIES CATCH

Very few of the socioeconomic studies mentioned have been extended to examine the linkages between the production and the distribution sectors. An understanding of these linkages is essential to appreciate the problems facing municipal fishermen because, in most cases, fishermen are dependent upon those who market their catch. The relationship between seller and buyer called "suki," has been described by Jocano and Veloro (1976), by Hopkins and McCoy (1976), and by Cuyos and Spoehr (1976). All three studies point to the mu-

Table 12. Catch and income by type of vessel ownership (Libertad, Philippines, 1978). Data are from Herrin et al. (1978), Tables 3.3, 4.15, and 4.16.

Location	Annual catch (t)			Annual household income (P)			
	Owners of motorized vessels	Borrowers of motorized vessels	Owners of non-motorized vessels	Owners of motorized vessels	Borrowers of motorized vessels	Owners of non-motorized vessels	Laborers
Barrios Gimaylan and Dulong, Libertad, Misamis Oriental	2.59	2.61	.99	5,956	3,304	4,954	3,006
Poblacion, Libertad, Misamis Oriental	2.87	2.53	n/a	6,478	2,518	n/a	2,143

n/a: There were no non-motorized vessels in the Poblacion sample.

tually beneficial aspects of the relationship, an important departure from the common conception of middlemen as "exploiters" of fishermen. Sevilleja and McCoy (1979, p. 5), however, claim that the system has "given rise to the incidence of bad debts beyond controllable proportions." An alternative selling method common in many parts of the Philippines involves sale by "whisper bidding," or "bulungan"—a silent auction, in other words. "Suki" still plays an important part in "bulungan," however.

Jocano and Veloro's (1976) fascinating study of Laguna de Bay fishing activities discusses the many variations of seller-buyer relationships and the fishermen's degree of involvement in each. It was observed that the fishermen themselves very rarely have any contact with the final consumer of their catch. Selling of the catch is always done by the fisherman's wife, mother, eldest daughter or sister. Even if the fisherman delivers his catch to the buyer, he seldom receives the actual payment which is often collected by a female member of his family.

The major buyers of catch from the lake fishery studied by Jocano and Veloro are called "rigatons." Generally female, they are supplied by a number of regular fishermen-suppliers. The "rigatons" use their capital to finance both fishermen and market vendors (tinderas). Buying wholesale, they bring the fish to market and either distribute them to various "tinderas" or sell them themselves. Not all "rigatons" provide capital to fishermen, however. Some apparently prefer to remain as wholesale buyers only (mamamakyaws). Those who do grant loans to fishermen are known as "mamumuhunans," and they are motivated not by profit from the loan, but rather by the assured supply that the indebtedness of the fishermen guarantees. In fact, "mamumuhunans" are not very much interested in having the debt repaid for, as long as the debt is outstanding, they will continue to make profit from the catch that their supplier (ka-isda) delivers to them.

Rather than being a superior-subordinate relationship, the tie between "ka-isda" and "mamumuhunan" is one of mutual dependence. Jocano and Veloro claim that it is in the self-interest of the "mamumuhunan" to pay fair prices to the fishermen; a dissatisfied fisherman can easily renounce his debt by borrowing from another "rigaton" and paying off his loan from the first. It is also to the benefit of the fisherman (ka-isda) to maintain the relationship, because he can count on the assistance of the "mamumuhunan" in times of need. Through "pakikisama," or favorable interpersonal relations, the relationship is thus extended beyond simple economic motivation and becomes known as "utang na loob," or debt within, with strong social connotations. The "mamumuhunans" may, for example, serve as sponsors at weddings or as godparents of children of their "ka-isda." Although they do not explicitly say so, Jocano and Veloro imply that "ka-isda" are generally satisfied with this form of relationship and do not attempt to disrupt it. All things being equal, however, fishermen apparently prefer that their wives do the selling in the market, thus capturing for the family the profit received by the "rigaton."

Although the "rigaton" is the major form that initial selling takes, there are many other variations that indicate the complex nature of market functions and interrelationships. A "rigaton" may hire a delivery man (tagahatid) to deliver the catch to the "tindera" (retailer) who sells the catch. Or the retailer may use a "sariling tindera," to sell exclusively for her. A "sariling tindera" is paid after a profit is made, in contrast to the regular "tindera" who, as an equal of the "rigaton," expects to pay the "rigaton" for the fish she purchases. Jocano and Veloro further classified other types of sellers, depending upon the source of their supply and the place and manner in which they sell. A "mamahagi," for example, is a wholesaler who has no regular fishermen suppliers and who may buy either from uncommitted fishermen or from the "rigaton." If she sells her fish door-to-door rather than in the market, she is known as "maglalako" (street vendor). If she sells outside the village in another town, she is known as "magluluwas." Furthermore, if she pays her supplier only after the fish is sold, she is known as "consagnitorio;" but "rigatons" apparently prefer to receive cash at time of sale from the "mamahagi," unless she is well known to the "rigaton," making this type of arrangement infrequent. "Rigaton" prefer to deal with the more established "tindera." Occasionally, the small-lake barrios may be visited by a "negosyante," who buys fish by the truckload from the "rigatons" and distributes them to public markets as far away as Manila. "Rigatons" can earn sizeable commissions from "negosyantes," based on the quantity of fish they are able to procure.

All of these complex relationships between buyers and sellers are frequently classified as "suki." According to Jocano and Veloro, the "suki" system is "a system of patronage in which a customer regularly buys from the same seller and receives special favors from her in return" (p. 125). The "tindera," for example, may reserve the best fish for her "suki." Even with the "suki" relationship, bargaining prevails, with the seller agreeing to a discount (tawad) as a means of attracting and keeping her "suki." Very rarely at this final stage does "suki" involve credit, as customers at the retail level generally pay in cash.

At earlier stages in the marketing chain, however, credit requirements are greater and moneylenders,

practicing "paluwagan," have moved to meet the need. Interest charges for these short-term loans approach 10%/mo. However, despite these high rates, the loans remain attractive because no collateral is required and because the loans can be secured in a matter of minutes.

Jocano and Veloro also point out an important aspect of the fishermen's motivation in marketing his catch. Fishermen fish primarily to sell their catch; fishing for household consumption is a secondary consideration. Hopkins and McCoy (1976) made a similar observation regarding municipal fishermen in Panquil Bay, Mindanao. It is not infrequent for fishermen to sell first or second class fish and then buy third class fish for their own consumption. In Panquil Bay, while fishermen were "selling fresh fish, the diets of their families consisted primarily of corn grits with dried or salted fish and a few vegetables." (Hopkins and McCoy 1976, p. 7) Malnutrition in coastal fishing communities has also been documented by Guthrie (1968).

Hopkins and McCoy further point out that it was the fisherman's desire for immediate cash that determined which marketing outlet was chosen, assuming the fisherman was not already tied to a particular buyer. In fact, if the fisherman and buyers could not agree on the price, the fisherman would, if he had easy access to town markets, frequently market the catch directly to consumers. This freedom of choice of market outlets contrasts with the lake fishery situation, as observed by Jocano and Veloro. Indebtedness to middlemen for vessel and gear financing seemed to be quite low in Panquil Bay, with 88% of the fishermen either self-financed or borrowing from the bank, primarily through the DBP Foreshore Fishermen Loan Program (selda). Buyers of fish from Panquil Bay extended credit, however, for such operating expenses as gasoline, bait, and food, and Hopkins and McCoy report that "due to the extended low income non-fishing period, many of the fishermen were perpetually in debt to lenders" (p. 10).

While Jocano and Veloro emphasize the mutually beneficial "utang na loob" relationship between fishermen and their "mamumuhunan," Hopkins and McCoy claim that this relationship has led to lower prices being paid to the fishermen than would be the case if the fishermen had freedom to choose his marketing outlet. In other words, while the loan is collateral and interest free, there is a hidden interest charge, in the form of lower prices received, which may be offset in part or in full by the benefits and reduced risk that the fisherman receives from his relationship to his "mamumuhunan." Unfortunately, neither study attempted to quantify the benefits received by fishermen through this relationship. It is not possible, therefore, to state convincingly whether or not the relationship is exploitive of fishermen.

Both studies hint, however, that fishermen would prefer an alternative marketing arrangement. In Panquil Bay the ties to wholesalers, who thus have first refusal of the catch, apparently prevent the fishermen from taking advantage of high local prices in times of low supply. At such times, prices paid are kept low by the wholesaler who transports the fish to provincial market centers where prices are not so volatile and are frequently lower than at the retail level in the area of catch. The "ka-isda" and "mamumuhunan" systems thus appear to lead to structural rigidities in the marketing system that prevent competitive forces from bringing prices in the various locales into line with supply and demand conditions and the costs of transporting fish between market centers.

Hopkins and McCoy outline some of the major marketing problems, from the perspective of Panquil Bay fishermen. Many fishermen, particularly those with "suki" relationships, complained about the low prices they received for their catch. These low prices were apparently caused in part by frequent gluts on the local market due to large quantities of dynamited fish. Several of the more remote villages complained about inadequate transport facilities which restricted their choice of market outlets, and of the deteriorating peace and order situation (this was in 1975). Furthermore, Hopkins and McCoy recorded that the more fortunate fishermen were often obliged to share their catch with those who had not been so lucky, making it "difficult for an individual fisherman to prosper by his own efforts" (p. 10). The study concludes that "existing practices were leading to a continual decline in their level of living . . . and a possibility that the fish stocks are severely depleted . . . could necessitate the transfer of some fishermen to other occupations" (p. 11).

Cuyos and Spoehr (1976) studied two wholesale markets in Cebu City. While the markets do not confine their transactions to municipal fisheries catch, the network of interrelationships that extend through these markets (called "suki" by the authors, thus using the generalized term) provide an explanation for the type of structural rigidities at the community level observed by Hopkins and McCoy. The types of interrelationship that exist between fishermen and wholesalers also exist between wholesalers and other marketing intermediaries, and thus extend through the marketing chain.

Fish arrive at the fresh fish wholesale market in Pasil, Cebu, in part through the use of carrier boats. Cuyos and Spoehr, reported that in 1 mo, 334 carrier boats were engaged in transporting fish to the Pasil market, mostly coming from Cebu and Bohol, with a few coming from as far away as Samar and Masbate. Of these, 153 boats (46%) were operated by buy-and-sell dealers who bought fish directly from fishermen. An almost equally large

number, 137 boats (41%), belonged to fishermen themselves who had banded together to deliver their combined catch without using the services of a dealer. The remaining 40 boats (12%) were either carrier boats delivering catch purchased from larger "basnigan" or "lawagan," or, to a much lesser extent, carrier vessels which delivered fish for a fee but did not actually buy them. The second major fish delivery method is by truck from other parts of Cebu and from Negros Occidental. The majority of fish arriving at the Pasil market from all distances are iced.[1]

Although the Pasil market operates 7 d a week, there is considerable fluctuation in the supply of fish passing through the market, depending upon the weather, the lunar cycle, seasonal variation in pelagic fishing (for instance, the Visayan Sea is closed to fishing for sardines, herrings, and mackerel from November 15 to March 15), and, to a lesser extent, upon holidays when fishing may be suspended.

The following passage from Cuyos and Spoehr (1976, p. 167) gives a vivid picture of the activity in the Pasil market as brokers arrange for sale of the fish to the vendor-retailers:

> Although at the height of activity, the market place is indeed congested, it is congestion without confusion. Everyone knows precisely what he or she is doing. Sellers do not loudly hawk their wares. There is no shouting. Bargaining between buyers and sellers is a normal feature of transactions, but such bargaining is brief, to the point, and seldom protracted. The vendors usually have little time to spare, for as soon as possible they must be off to sell their fish. Buyers and sellers alike realize they are dealing in a highly perishable commodity. Their minds are concentrated on prices, on the factors which will drive them up or push them down, on estimated profits and possible losses, on risks and gains. Yet although the atmosphere is serious, after a bit of hard bargaining, buyer and seller, if they know each other well, may part with a joke. But the principal impression made on the observer is that the participants in this scene are walking calculating machines. They have to be to make a living and a success of their endeavors.

At the time of this study, there were 35 brokers operating in the Pasil market who were charging commission on sales, ranging from 4-9%, depending on whether or not they assumed the marketing costs. Brokers formed the core around which "suki" relationships developed and were maintained. These relationships extended backwards to suppliers and forward to vendor-retailers. In the case of suppliers, while "suki" relationships included all categories of suppliers, credit was not extended to the larger "basnig" operators, but was restricted to the smaller buy-and-sell dealers and to fishermen themselves. As in Laguna de Bay, extension of credit, although an important part of many "suki" relationships, was not a necessary element. The primary purposes of "suki" appear to be to guarantee supply to the broker, to guarantee an outlet to the supplier, and to thus minimize the risks involved in marketing the catch when dealing with unknown parties. The capital requirements of brokers are thus high.

Cuyos and Spoehr stress the symbiotic nature of "suki" in describing one major broker who has 133 fishermen suppliers. "He makes no loans to them. In his own words, he holds them because they recognize his good management in selling their fish. From the suppliers' point of view, a broker who can be depended upon to sell his fish promptly at as high a price as possible, given prevailing market conditions, is to be valued. From the broker's point of view, a dependable supply of fish is desirable" (p. 178). After an initial probationary period, during which mutual trust is established, the "suki" relationship, with similar mutual benefits, can take effect between brokers and their vendor retailers. The vendor's repayment record establishes her integrity. Unlike fishermen who may depend primarily on a single broker, vendors may establish "suki" ties with several brokers, thus assuring themselves of steady supply and variety of fish.

Cuyos and Spoehr also studied the Taboan fish wholesale market in Cebu, which deals in dried and salted fish. In place of brokers, the central figures in the Taboan market are the wholesale traders who actually take title to the fish in their own name. Like the broker, however, the trader fills the role of provider of credit to those from whom he buys and to whom he sells. Thus, in this case, the trader is the focal point for the "suki" relationships, spreading backwards and forward in the marketing chain, like the ripples from a stone dropped in a pond, and reaching as far as the fishing communities—such as those studied by Jocano and Veloro, and by Hopkins and McCoy—part of whose catch eventually reaches wholesale markets either fresh, dried, or salted.

Cuyos and Spoehr conclude:

> For the Pasil Market broker and the Taboan Market trader, the 'suki' relationship is an important means allowing him to cope with the uncertainties inherent in his role, granted the risks of default by 'suki' partners. Lastly, 'suki' relations operate in an exhange system in which liquid capital funds are insufficient or scarce. (p. 194).

Prior to the completion of the three market-related studies discussed extensively above, very little research

[1] On-the-spot interviews with Pasil consumers in May 1979 indicated that the presence of ice is often interpreted as lack of freshness in the fish. Consumers apparently prefer some species (e.g., milkfish) to be uniced because they then assume that the fish have been recently harvested.

had been directed towards those marketing activities bearing on municipal fisheries. Navera (1976) completed a thesis that studied buying and selling activities at the Navotas Fish Landing in Rizal, the largest wholesale market in the country. Municipal fishermen's access to this market was minimal, however. Of 1,081 vessels registered at the landing, only nine were municipal fishermen. Municipal fishermen had very little chance of entering the market, because the 24 licensed brokers only dealt in large volumes. Consequently, many disposed of their catch through the smaller wholesale markets in nearby Malabon, where the marketing procedure is similar to that in Cebu, as described by Cuyos and Spoehr. It is interesting to note that "whisper bidding," the prevalent selling technique used by brokers in Navotas and Malabon, is not used in Cebu.

The Navera study was extended in 1977 to cover wholesale markets in Iloilo, Bacolod, and Zamboanga, through a joint undertaking of BFAR and the Bureau of Agricultural Economics (BAECON). The Iloilo market was supplied almost exclusively by commercial fishermen, and the Zamboanga market predominantly by municipal fishermen. While exceptions were found in which retailers bought directly from fishermen, the majority of the catch in Iloilo and Bacolod moves through brokers in a manner similar to that in Cebu, as described by Cuyos and Spoehr. In Iloilo, a large proportion of the catch was sold by fishermen directly to wholesale traders, without using brokers. Given the fact that Iloilo suppliers were all commercial fishermen with relatively large catches (as compared to municipal fishermen), this bypassing of the broker is not surprising.

In contrast, brokers in Zamboanga handled only 15% of the catch passing through the wholesale market, with wholesalers handling most of the remainder. "Suki" relationships between fishermen suppliers and brokers and wholesalers were common. In all three areas, the extreme competition among intermediaries in the wholesale markets was noted. Recommendations of the BFAR/BAEcon study centered on: 1) cooperatives for fishermen-suppliers, 2) provision of price information by a market intelligence service, 3) additional ice-cold storage and transport facilities (Iloilo), and 4) centralization of wholesale markets to reduce marketing costs.

Fresh fish marketing studies conducted by the National Food and Agriculture Council (NFAC) have concentrated on those species, primarily milkfish (*Chanos chanos* Forskal), produced in brackish water fishponds, rather than on municipal fisheries (see Valiente 1975; Vera Cruz and Carlos 1974a). NFAC also completed several studies on smoked fish marketing in Central Luzon (Medina et al. 1976) and in Southern Tagalog (Guerrero and Medina 1976), and on dried fish marketing in the Greater Manila area (Guerrero et al. 1976), and in Panay Island (Guerrero et al. 1977). Because these studies concentrated on processors and the subsequent marketing arrangements, they provide few insights into marketing as it affects the municipal fishermen.

Smoking fish is a seasonal activity dependent upon the supply of preferred species, such as round scad (galonggong), various herrings (tamban, tunsoy, lapad, silinyasi), mullet (alugasin), milkfish (bangus), gizzard shad (kabasi), mackerel (alumahan) and tuna (tulingan). Of these, "galonggong" and "tamban" make up over 90% of the fish smoked, by volume. Both are among the major species caught by municipal fishermen. Because most of the smoked fish processors are small (annual purchases of less than 13.5 t), it is presumed that they are located close to areas where the fish are caught. Prices paid of about ₱2.00/kg would tend to confirm their closeness to the source. It is not clear from the NFAC studies, however, whether smoked fish processors buy directly from municipal fishermen or whether dealers are involved.

On the other hand, dried fish processors on Panay Island in areas outside Iloilo City were generally part-time, small-scale fishermen themselves, who supplemented their own catch with purchases from other fishermen. But for the closure of the Visayan Sea to sardine, herring, and mackerel fishing from November 15 to March 15, dried fish processing would be a year-round activity. Of the processors surveyed, approximately two-thirds (17 t annually) of the average volume dried was caught by the processors and one-third (9 t annually) was bought directly from fishermen. In Panay, 65% of the processors caught all the fish they dried, most often through fishermen hired mainly for this purpose, using vessels owned by the processor. After deducting all fishing expenses, fishermen fishing for processors received approximately ₱1.00/kg. Those working independently, who sold their catch to processors, received approximately ₱2.

In contrast to Panay, dried fish processors in the Manila area were not fishermen. They instead bought all their fish at the Navotas fish landing. Also, they operated 12 mo/yr because there was no closed season to contend with. Processing, however, was found to be generally unprofitable when the prices of fresh fish were high. Guerrero et al. (1976) note that production of dried fish increases substantially when supply is high and prices low, despite the fact that the processor is then required to hold quantities in cold storage until later sale. Economic forces that are at play here apparently make such seasonality of operation profitable in the long run.

Indeed, processing into smoked or dried fish plays a very important function of allocating the supply of a very perishable commodity through time.

Although Cuyos and Spoehr (1976) mention that dynamited or spoiled fish are confiscated by market inspectors in Cebu, none of these studies discuss waste and spoilage in marketing. The NFAC studies indicate a conversion factor of fresh to smoked or dried fish of approximately 50% by weight, but it is not clear how much of the weight loss is due to processing and/or spoilage. Thus, a major area of possible inefficiency in fish marketing has not been examined in any research studies to date. Nor has research addressed the issue of whether improvements in marketing and reductions in waste will result in benefits to municipal fishermen.

D. SOCIOECONOMIC INDICATORS

Of the recent community socioeconomic studies, 16 barrios have yielded sufficient comparable data to allow some preliminary analysis of the relationship between various fishing, socioeconomic, and attitudinal variables. The data from the 16 barrios are shown in Tables 13, 14, and 15.

The barrio locations are shown in Figure 27.

Total households interviewed in the 16 barrios was 546. The authors of this review, however, did not have access to the 546 household questionnaires; hence, the analysis that follows is based on the weighted barrio averages for 15 of the 16 barrios in question. One of the 16 barrios–Guinhalaran, Silay City, Negros Occidental–was not included in the analysis because the respondents, though classified as municipal fishermen by the researchers who collected the original data, primarily operated otter trawls with vessels exceeding 3 gt and thus were not, strictly speaking, municipal fishermen. Nor, on the basis of household income, can the Guinhalaran respondents be considered small-scale fishermen. Annual household income of the Guinhalaran respondents exceeded ₱17,500, more than four times the average of the remaining 15 barrios. The net effects of reducing the sample size from 16 to 15 can be seen in the differences between "totals or weighted mean" and "weighted mean without case 4 (Bo. Guinhalaran)" in each of Tables 13, 14, and 15, for each of the 18 variables measured.

To achieve a more representative stance for the data from the 15 barrios when computing means (average), observations were weighted according to the respective sample size, consequently giving a higher weight to barrios which had been more thoroughly surveyed. This was thought necessary, in light of the low per capita income observed in the Isabela City area (the opposite extreme from Bo. Guinhalaran), where the samples were all small. The overall picture that emerges is as follows.

Average annual per capita income for municipal fishing households (non-cash net income included) is approximately ₱725 (Tables 13 and 14).[2] The average fisherman household head is slightly over 40 yr old, has received almost 5 yr of formal education and has an average household size of 6.3 family members, of whom 1.8 are contributing cash income to the household. Approximately 20% of the fishing households own land, either the lot on which their house is built and/or agricultural land. A total of 80% of the fishing household own no land. As evidenced by the extreme range of the percentages of households in the communities engaged in fishing (from less than 1% in Silay, Misamis Oriental to 100% in the Isabela area), not all fishing communities are physically or economically isolated from other economic sectors. As we shall see, geographic and economic isolation may explain a large part of the variability in per capita income of municipal fishing households.

Regarding the fishing activity (see Table 14), approximately two-thirds (65.8%) of the respondents were full-time fishermen, the rest part-time. While 74% owned their own gear, only 40% owned their own boat. The average fishermen in these 15 barrios made approximately four trips per week on a year-round basis, and had an annual catch of 2.33 mt. The average catch figure, however, was skewed upwards by the inclusion of the per fisherman annual average catch of 11.7 mt in Coron, Palawan. Note that the Coron fishermen were able to convert these much higher catch rates into only slightly higher incomes, which reflect the marketing problems in Coron. Excluding Coron catch data, the remaining 14 barrios would have an average annual catch per fisherman of only 1.45 mt, very close to the presumed national average of 1.33 t, as reported in the Overview of Municipal Fisheries (Section II).

Regarding fishermen's attitudes (see Table 15), it was observed that fishermen are generally dissatisfied with their family condition. As much as 65% expressed dissatisfaction, and almost four out of five believed that their personal living standards were no better, or even worse, than they were 5 yr earlier. Only 21% indicated

[2]Gonzales (1977) found an average annual per capita income of approximately ₱900 in a Laguna de Bay barrio. In Region VI Haque and Octavio (1977) observed an average per capita income, from fishing only, of ₱925 annually, but the extreme variability from province to province leads one to question the reliability of their data or their method of distinguishing between "sustenance" and "commercial" fishermen.

Table 13. Community and household information: Socioeconomic survey results.

Case No.	Community	Sample size	% of community households engaged in fishing	Average annual per capita income (₱)	Average age of fisherman[1]	Average education of fisherman[1]	Average household size	Average number of working members	% of households owning land
			X_{17}	X_1	X_8	X_{19}	X_{16}	X_{18},	X_3
1.	Bo. Gimaylan/Dulong, Libertad Misamis Oriental	59	10	747	39.1	5.7	6.5	1.6	46
2.	Bulok-bulik, Libertad, Misamis Or.	68	31	674	36.4	4.4	5.8	1.4	6
3.	Bo. Balaring, Silay City, Negros Occ.	37	70	504	43.0	4.0	6.2	1.8	8
4.	Bo. Guinhalaran, Silay City, Negros Occ.	37	40	2,783	35.0	6.0	6.3	1.8	11
5.	Bo. Bubog, Talisay, Negros Occidental	37	40	890	37.0	6.0	5.2	1.8	11
6.	Bo. Marao, Padre Burgos, Quezon	28	71	693	47.0	5.0	5.7	1.1	23
7.	Bo. Danlagan, Padre Burgos, Quezon	30	67	618	44.0	5.0	5.5	1.3	11
8.	Bo. San Vicente, Padre Burgos, Quezon	29	52	554	42.0	5.0	5.6	1.3	12
9.	Tobuan, Labrador and Sual, Pangasinan	43	24	590	38.0	5.3	5.7	1.8	21
10.	Bo. Tagumpay and Poblacion, Coron, Palawan	39	53	1,251	42.4	6.3	6.6	2.2	8
11.	Salay, Misamis Oriental	45	1	981	45.2	6.2	7.9	2.1	43
12.	Bayawan, Negros Oriental	37	2	991	40.9	4.9	6.8	2.2	14
13.	Bo. Panigayan, Isabela City, Basilan	18	100	340	38.2	2.2	6.9	2.4	25
14.	Bo. Lampinigan, Isabela City, Basilan	19	100	528	38.2	2.2	6.9	2.4	25
15.	Bo. Baluk-baluk, Isabela City, Basilan	12	100	106	38.2	2.2	6.9	2.4	25
16.	Bo. Mungal, Isabela City, Basilan	8	100	147	38.2	2.2	6.9	2.4	25
	Totals or weighted mean[2]	546	–	865	40.1 yrs	5.0 yrs	6.3	1.8	19.5%
	Weighted mean w/o case 4 (Bo. Guinhalaran)	509	–	725	40.5 yrs	4.9 yrs	6.3	1.8	20.1%

[1]Household head.
[2]Weighted by sample size.

Table 14. Fishing activity: Socioeconomic survey results.

Case no.	Community	Average annual per capita income (₱)	% of fishermen full time	% owning gear	% owning boat	Effort trips per year	Average annual catch per fisherman (mt)
		(X1)	(X2)	(X4)	(X5)	(X6)	(X7)
1.	Bo. Gimaylan/Dulong, Libertad, Misamis Oriental	747	79	68	46	141	2.26
2.	Bulok-bulok, Libertad, Mis. Or.	674	88	34	41	162	2.69
3.	Bo. Balaring, Silay City, Negros Occ.	504	92	–	14	307	.96
4.	Bo. Guinhalaran, Silay City, Negros Occidental	2,783	97	–	32	260	10.80
5.	Bo. Bubog, Talisay, Negros Occ.	890	87	–	7	312	1.20
6.	Bo. Marao, Padre Burgos, Quezon	693	65	–	44	140	.79
7.	Bo. Danlagan	618	64	–	35	177	.84
8.	Bo. San Vicente, Padre Burgos, Quezon	554	13	–	42	250	1.17
9.	Bo. Tobuan, Labrador and Sual, Pangasinan	590	65	74	58	202	.46
10.	Bo. Tagumpay and Poblacion, Coron, Palawan	1,251	23	90	41	212	11.70
11.	Salay, Misamis Oriental	981	49	98	71	225	1.84
12.	Bayawan, Negros Oriental	991	65	76	38	204	2.86
13.	Bo. Panigayan, Isabela City, Basilan	340	67	94	50	132	.77
14.	Bo. Lampinigan, Isabela City, Basilan	528	67	95	32	178	.77
15.	Bo. Baluk-baluk, Isabela City, Basilan	106	67	92	8	84	.77
16.	Bo. Manangal, Isabela City, Basilan	147	67	100	25	98	.77
	Weighted mean[1]	P 865	67.9%	73.7%	39.3%	202 trips	2.90
	Weighted mean w/o case 4 (Bo. Guinhalaran)	P 725	65.8%	73.7%	39.8%	198 trips	2.33

[1]Weighted by sample size.

Table 15. Fisherman attitudes: Socioeconomic survey results.

Case no.	Community	% Willing to change occupation	% Willing to change location	% Belonging to fish organization	% Belonging to other organization	% Believing personal living standard same/worse	% Dissatisfied with family condition
		X10	X11	X12	X13	X14	X15
1.	Bo. Gimaylan/Dulong, Libertad, Misamis Oriental	–	–	12	58	90	–
2.	Bulok-bulok, Libertad, Misamis Oriental	–	–	27	21	93	–
3.	Bo. Balaring, Silay City, Negros Occ.	–	–	38	54	–	–
4.	Bo. Guinhalaran, Silay City, Negros Occ.	–	–	0	20	–	–
5.	Bo. Bubog, Talisay, Negros Occ.	–	–	0	5	–	–
6.	Bo. Marao, Padre Burgos, Quezon	–	–	0	79	–	–
7.	Bo. Danlagan, Padre Burgos, Quezon	–	–	0	57	–	–
8.	Bo. San Vicente, Padre Burgos, Quezon	–	–	0	59	–	–
9.	Bo. Tobuan, Labrador and Sual, Pangasinan	61	65	19	30	81	93
10.	Bo. Tagumpay and Poblacion, Coron, Palawan	54	31	18	10	62	59
11.	Salay, Misamis Oriental	20	11	0	73	56	84
12.	Bayawan, Negros Oriental	43	19	0	5	87	62
13.	Bo. Panigayan, Isabela City, Basilan	56	6	78	11	39	28
14.	Bo. Lampinigan, Isabela City, Basilan	63	26	11	11	68	37
15.	Bo. Baluk-baluk, Isabela City, Basilan	67	8	75	11	92	25
16.	Bo. Manangal, Isabela City, Basilan	88	75	38	11	100	50
	Weighted mean[1]	49.5%	29.4%	15.2%	35.1%	78.1%	64.6%
	Weighted mean w/o case 4 (Bo. Guinhalaran)	49.5%	29.4%	15.2%	36.2%	78.1%	64.6%

[1]Weighted by sample size.

that their personal living standards had improved over the last 5 yr. Nearly 50% indicated their willingness to change their occupation from fishing. As one would expect, fishermen were somewhat less willing to change their location. Potential occupational mobility thus appears to be higher than potential geographic mobility. Finally, the majority of fishermen were neither members of fishing-related organizations nor of other social, civic, and religious organizations. One more encouraging note is that while only 15% of all the fishermen belonged to fishing organizations, in those nine barrios where Samahang Nayons had been formed, the participation rate rose to 27%.

Although the description to this point is interesting, it offers little insight into the problems of municipal fishermen. Neither does it lead to identification of development alternatives that might alleviate them. What is required is to extend the "description" to "analysis." Only within an analytic framework will stereotypes about fishermen be dispelled, and their social and economic environment be truly understood.

The purpose of preparing a matrix of correlation coefficients (r) is to determine the existence of a linear relationship between two variables. "In order to decide whether, for a sample of size n, a given correlation coefficient indicates a linear relationship, we test the hypothesis that the sample is chosen from a population for which $p = 0$ and, therefore, determine the probability that from such a population, a sample of size n is taken for which the correlation coefficient equals or exceeds the absolute value of r calculated for the given sample. Here, we use a two-tailed test. If the probability is less than 5% (or whatever other level of significance is chosen), we reject the hypothesis that the sample is taken from a population in which there is no linear relationship. The value of (r) then indicates that the X- and Y-values can be assumed to be linearly related" (Alder and Roessler 1972, p. 213).

In other words, the probability of exceeding (r) is the same as the significance level. As can be seen from Tables 13, 14, and 15, not all communities had a complete set of observations. Observations were thus paired, ignoring missing observations and reducing the sample size. Hence, in some cases, an r value of .60 could be insignificant, while in other cases with more observations, a lower r of .50 could be significant. Significance at the 5% or the 1% level is thus a function of (r) and of the sample size, n (or the degrees of freedom, n-2).

A matrix of correlation coefficients among the 18 observed variables was calculated and is shown in Table 16. Since a matrix of correlation coefficients is summetric, only those below the diagonal are shown. A significance level of 5% was chosen, higher than which the null hypothesis of no linear relationship was not rejected, equal to or lower than which, the null hypothesis was rejected. In other words, rejection of the null hypothesis means there is a significant linear relationship between the two variables in question.

Of the 162 possibly significant correlation coefficients, 28 are significant at 5% or below (14 at 5%, and 14 at 1% or better), shown in dark print and asterisked in Table 16. Of these 28, 20 involve only four variables:

X_1 : Anual per capita income
X_9 : Education of fisherman
X_{10} : Percent willing to change occupation
X_{15} : Percent dissatisfied with family condition

All 28 significant correlation coefficients can be accounted for by including:

X_{13} : Percent belonging to other organizations
X_{16} : Household size
X_{17} : Percent household in community fishing (a proxy for isolation)
X_{18} : No. of working members

Three variables are not significantly correlated with any of the others:

X_2 : Percent of full-time fishermen
X_{11} : Percent willing to change location
X_{14} : Percent believing same/worse living standards

Given these results, it is possible to organize the subsequent discussion into the following categories: 1) income variability, 2) occupational mobility, 3) isolation, 4) dissatisfaction, and 5) education. These five categories were chosen because of the rank frequency of the respective variable being highly correlated with others. Correlation coefficients involving these five variables have been encircled in Table 16. A reminder: Correlation does not imply causation.

The mathematical statisticians might argue for subjecting the data to regression or factor analysis. However, the varying conditions under which the data were collected, the necessary aggregation of the data by barrio and the consequent limited sample size suggest that applying sophisticated methods of analysis would be unwise. Such methodologies, however, could be most fruitful in future socioeconomic studies. Juanite (1978), in his application of a "social inventory system" in Puerto Galera and Puerto Princesa, provides a good example of the additional insights that can be gained by extending simple examination of correlation coefficients to factor analysis, in order to supplement other multivariate techniques.

Table 16. Matrix of correlation coefficients: Socioeconomics survey results (Bo. Guinhalaran excluded).

Average annual per capita income (X1)	X1																
Percent of fishermen full-time (X2)	−.27	X2															
Percent of households owning land (X3)	−.12	.04	X3														
Percent of fishermen owning gear (X4)	−.20	−.56	.37	X4													
Percent of fishermen owning boat (X5)	.37	−.39	.43	−.11	X5												
Effort (no. trips per year)(X6)	.52*	−.03	−.42	−.11	−.11	X6											
Average annual catch (X7)	.66**	−.47	−.26	−.03	.12	.12	X7										
Average age of fisherman (X8)	.35	−.38	.06	.43	.32	.19	.13	X8									
Average education of fisherman (X9)	.85**	−.24	−.05	−.31	.37	.55*	.43	.41	X9								
Percent willing to Δ occupation (X10)	−.70*	.36	−.35	.14	−.70*	−.74*	−.18	−.82*	−.68	X10							
Percent willing to Δ location (X11)	−.18	.09	−.20	−.15	−.03	−.07	−.06	−.34	.01	.60	X11						
Percent belong to fish organization (X12)	−.67**	.23	.05	.20	−.28	−.48	−.11	−.43	−.72**	.48	−.21	X12					
Percent belong to other organization (X13)	.12	−.14	.32	−.07	.42	.14	−.23	.76**	.42	−.68	−.11	.42	X13				
% Believe same/worse living standard (X14)	−.27	.49	−.12	−.42	−.54	−.39	−.19	−.43	−.07	.54	.55	−.12	−.12	X14			
% Dissatisfied with family condition (X15)	.57	−.29	.13	−.46	.73*	.74*	.12	.50	.82**	−.46	.41	−.71*	.64	.05	X15		
Average household size (X16)	−.04	−.14	.60*	.73*	.29	−.35	.14	.06	−.31	−.49	−.55	.32	−.12	−.41	−.18	X16	
% of community households fishing (X17)	−.71**	.03	−.15	.48	−.49	−.40	−.21	−.14	−.81**	.75*	.03	.60*	−.27	−.11	−.84**	.14	X17
Average no. working members (X18)	−.20	−.01	.23	.89**	−.15	−.23	−.15	−.40	−.52*	−.39	−.34	−.53*	−.68**	−.34	−.92**	.74**	.32

1. Income Variability

As expected, average annual per capita income (X_1) is positively and significantly correlated with average annual catch (X_7), with fishing effort (X_6), and with average education of fishermen (X_9). If one assumes that the percentage of community households dependent upon fishing (X_{17}) is a proxy for geographic and/or socioeconomic isolation of that community, one might expect income (X_1) to decline as isolation increases. The highly significant negative correlation ($r = -.71$) between X_{17} and X_1 supports this observation. As indicated by the highly significant correlation coefficient of $-.67$, communities that have higher annual per capita incomes (X_1) are less likely to have high percentage membership in fishermen organizations. However, this result is probably merely because in the first place, Samahang Nayons are more likely to have been organized in the poorer, rather than the better-off, communities. Finally, and of real import, a highly significant negative relationship ($r = -.70$) is found between per capita income (X_1) and willingness to change occupation (X_{10}). Contrary to common allegations in the fisheries literature regarding resistance to change among fishermen, it appears that willingness (as distinct from ability) to change from fishing to another activity is highest among the poorest fishing barrios.

2. Occupational Mobility

This desire for occupational change (X_{10}) is highest in fishing barrios characterized by lower income levels (X_1), by lower percentage of boat ownership (X_5), by lower levels of fishing effort (X_6), and by younger fishermen (X_2). The willingness to change occupations is also apparently highest in the more isolated communities where a higher percentage of the community households depend on fishing (X_{17}).

3. Isolation

The more isolated the community in terms of lack of alternative income activities, as reflected in a higher dependence on fishing (X_{17}), the lower is average annual per capita income (X_1). The lower, too, is average educational achievement (X_9), and the higher is membership in fishermen organizations (X_{12}). Paradoxically, while the more isolated communities have indicated a greater willingness to change their occupations (X_{10}), the levels of dissatisfaction with the family condition (X_{15}) are lower than in those communities which depended less on fishing.

4. Dissatisfaction

Expressions of dissatisfaction with family conditions (X_{15}) appear to cut across all income levels, and bear no apparent relation to lack of improvement in living standards over the past five years (X_{14}). The more educated the fishing barrio (X_9), the more dissatisfied. Moreover, dissatisfaction is higher in fishing barrios with higher incomes ($r = .57$, positive but not highly significant), with higher percentage of boat ownership (X_5), and with higher levels of annual fishing effort (X_6). Dissatisfaction was found to be significantly negatively correlated with membership in fishermen's organizations (X_{12}), with degree of barrio dependence upon fishing (X_{17}), with the average number of working members in the household (X_{18}), and finally with isolation (X_{17}). These paradoxical results can perhaps best be explained by "rising expectations," in which the greater one's expectations of and exposure to alternatives, the more dissatisfied does one become with one's family condition.

5. Education

In addition to the significant positive correlation between education level (X_9), on the one hand, and per capita income (X_1) and level of dissatisfaction, on the other, the more educated fishing barrios apparently fish more often (X_6). Increased fishing intensity may, of course, result from a host of factors, such as proximity to markets (note that $r = -.40$ for X_6 and X_{17}), and other motivations, including declining catch. Finally, the more educated the barrio fishermen, the lower the number of working members per household (X_{18}), and—though not significantly—the lower the household size (X_{16}).

The remaining significant correlations, while gratifyingly demonstrating the direction of correlation (positive or negative) expected and thus lending some authority to the data's reliability, are not terribly interesting from the development policy point of view. Average household size was found to be positively correlated with land ownership (X_3), gear ownership (X_4)—perhaps larger families, with more working members (X_{18}), could more easily justify the purchase of gear, most of which require more than one to handle—and of course, with the number of working members (X_{18}). The more the working members, the less was the likelihood of membership in social, civic, and religious (non-fishing) organizations (X_{13}). And finally, the higher the average age of the fishermen (X_8), the more likely were they to be members of social, civic, and religious organizations.

A brief comment is necessary on those three variables

found to be not significantly correlated with any of the others. Geographic mobility, as expressed by willingness to change location (X_{11}), was only closely related to two variables: positively correlated (r = .55), with belief in no better living standards (X_{14}), and negatively correlated (r = -.55), with household size (X_{16}). A higher proportion of full-time fishermen in the community (X_2) is also positively correlated (r = .49), with the belief that living standards have either remained the same or deteriorated over five years ago (X_{14}), perhaps reflective of over-fishing pressure.

Two earlier studies (Emmerson 1978 and Smith 1979a) had hypothesized that a high degree of willingness to shift to another occupation (X_{10}) could be a reflection of a high proportion of full-time fishermen (X_2), at present faced with no alternative activities. While the correlation based on the 15-barrio data is positive (r = .36), it is not significant, thus failing to convincingly support the earlier hypothesis. Because of the limited resource base, it clearly makes no sense to encourage part-time fishermen to revert to full-time status. However, it does not necessarily follow that the presence of a larger proportion of full-time fishermen is evidence of a more apparent willingness to shift occupations. Occupational mobility appears to be more related to lower age and income levels.

DISCUSSION OF RESULTS

The foregoing analysis is based upon a static situation; each of the fishing barrio socioeconomic surveys collected information at a point in time. A dynamic view of change in municipal fishing communities is thus absent. There are, however, some positive implications for policy alternatives, heavily dosed with common sense, that can be obtained from research conducted to date.

First, the more successful fishermen and the households with higher annual per capita incomes tend to be better educated than their poorer brethren. With education, however, comes an increasing dissatisfaction with the living conditions of the household. The challenge to Philippine society is to make this dissatisfaction a positive constructive force.

Second, municipal fishing barrios can be either physically isolated, such as those in Palawan and Tawi-Tawi, or socially and economically isolated, such as those near the larger cities. Heavy dependence upon fishing by community households, and the apparent lack of alternative income-generating activities that this implies, could be due to either physical isolation, or social and economic isolation, or to some combination of all three. Only in the rare case does a heavy dependence upon fishing imply abundant resources, a readily accessible market, and consequent above-average income levels for municipal fishermen. In other words, the generally low standards of living of municipal fishermen appear more related to socioeconomic (rural development) and biological (resource) constraints than to a lack of access to the resource because of inadequate vessels and gear.

Finally, a surprisingly large number of municipal fishermen—almost half of those responding—have indicated a willingness to shift from fishing to another occupation. Here, there is both an opportunity and a potential stumbling block. On the one hand, the high degree of willingness to shift from fishing bodes well for those promoting alternatives. On the other hand, it is the marginal, not the more successful fishermen, who are apparently most willing to shift from fishing. Those seeking a change are the younger, less educated, and poorer ones—those less able to take the risks that a new activity implies. Thus, the key to capitalizing on these positive attitudes will most probably be supplementing, rather than replacing, the fishing activity.

Municipal Fisheries Development Programs

A. INTEGRATED FISHERIES DEVELOPMENT PLAN (IFDP)[1]

Presidential Decree 704 (PD 704), or the Fisheries Decree of 1975, revised and consolidated all laws and decrees affecting fishing and fisheries. It declared that "the policy of the state [is] to accelerate and promote the integrated development of the fishery industry and to keep the fishery resources of the country in optimum productive condition through proper conservation and protection. . . . In this connection, the fishery industry shall be considered as a preferred area of investment" (Chapter I, Section 2). Of importance to municipal fisheries, PD 704 reiterated the authority of municipalities over waters 3 nautical miles from the coastline, and over streams, rivers and lakes within municipal boundaries. Fishpens and seaweed culture in municipal centers, however, are under the jurisdiction of BFAR or, in the case of the Laguna de Bay fishpens, under the jurisdiction of the Laguna Lake Development Authority (LLDA).

P.D. 704 also set up the FIDC and the Philippine Fish Marketing Authority (PFMA). The FIDC, with both governmental and private representation, and chaired by the Minister of Natural Resources, was charged with implementing government policy, as stated in PD 704. One of its first initiatives was the preparation of the Integrated Fisheries Development Plan (IFDP), completed in 1976 and then updated in 1977. On September 6, 1976 the President approved the plan and issued Letter of Instruction 459, directing the participation of 16 government agencies in the implementation of the IFDP and delineating their roles and responsibilities. An important input to the IFDP was the Expanded Fish Production Program (including the Fisheries Extension Program) that had earlier been developed by BFAR. As of 1978, BFAR had assigned 145 extension workers to the marine fisheries sector, of which 90% direct their attention to municipal fisheries.

The IFDP enunciated the policies on fishery resources embodied in PD 704 and laid down the following specific development objectives:

1. To attain and maintain self-sufficiency in fish.
2. To optimize utilization of fish and other aquatic resources, and reduce wastage.
3. To promote import-substitution and increase exportation.
4. To achieve and maintain the optimum productive condition of the country's fishery resources.

The two major thrusts of the IFDP are thus increased production for domestic use and export, and improved marketing and distribution. To attain these goals, the underlying policy is one of improving existing production units–e.g., fishing vessels, bancas and fishpond areas–through effective technology transfer and the provision of inputs. Under this policy, new production units will only be added if necessary and found consistent with ecological balance.

Programs designed to increase production and to improve marketing both have bearing on the municipal fisheries sector. A discussion of relevant programs follows.

B. INCREASED PRODUCTION

It is possible to classify programs designed to increase fisheries production into those that improve technology of municipal "capture" fishing, on the one hand, and those that introduce "culture" to municipal fishing communities, on the other hand. The means by which productivity from capture fisheries is to be increased center upon 1) provision of credit to municipal fishermen and 2) their organization into Samahang Nayons (pre-cooperatives), cooperatives or associations. Because the introduction of mariculture activities to fishing communities is more recent in origin, BFAR's present activities center upon demonstration sea farming sites. ADB has been recently arranged, however, to give Laguna de Bay fishpen ownership to municipal fishermen who live around the lake.

1. Credit Assistance

The primary aim of the many credit programs for municipal fishermen has been to facilitate acquisition of improved vessels, engines and gear. To date, the various credit programs have involved the Central Bank (CB) and rural banks, the Land Bank of the Philippines (LBP), the DBP, the Philippine National Bank (PNB) and the Agricultural Credit Administration (ACA). Other government agencies have been involved to provide seed money (NFAC) and in a supervisory capacity, as in the case of the DAP and its Fishery Industry Resources Management (FIRM) program. The status of these various credit

[1]Background information on government development thrusts and programs comes primarily from FIDC (1979), particularly pp. 11-12, 21-22 and 27.

programs is shown in Table 17. Difficulties with these programs have led to a complete revision of the concept of nationwide package credit programs (see FIDC 1979, p. 59-62). A brief summary description of each program follows.

The Small Fishermen Special Credit Fund (SFSCF) was set up with a ₱2-million seed fund from the NFAC to finance the acquisition of boats of not more than 3 gt, fishing gear, and equipment. Rural Banks serve as the lending institutions. The ₱2-million seed fund also covers the Special Fisheries Credit Program with an amount of ₱1 million. As of December 1977, a total of ₱862,000 had been lent out to three fishermen organizations/associations. The SFCP is a joint project of the CB, LBP, NFAC, and DAP. The program aims for an integrated approach to development of the municipal fishing industry, by financing the long-term innovation package (LTIP) of DAP-FIRM. LTIP projects include the acquisition and/or construction of fishing equipment and infrastructure, including marine diesel engines, fishing gear and paraphernalia, fishing boat/hull, ice plants and cold storage, and other related marketing facilities. It also extends operating capital for at least 1 mo to qualified fishermen associations or cooperatives. As of November 30, 1977, a total of ₱650,000 had been lent out by CB through rural banks to three organized DAP-FIRM fishermen associations.

The most ambitious credit program to date was the DBP's Small Foreshore and River Fishermen program. Out of its own capital resources, DBP extended loans to finance the acquisition of bancas, marine engines, fishing gear and accessories, and other items related to fishing. Before acquisition of a loan, the fishermen were required to form a liability group or "selda." Each "selda" was composed of five fishermen, each one in effect a "co-signer" with the other four. Each member secured his own loan for purchase, or improvement, of his own vessel or gear. Repayment, though an individual responsibility, was to be encouraged by the moral persuasion of "selda" membership.

As of June 1978, loans granted under the program reached ₱279 million, covering 70,828 fishermen beneficiaries. However, only 596 borrowers, or less than 1%, were paying regularly. The rest were in arrears. The program has been suspended indefinitely. Some factors behind the low repayment rate were the following:[2]

1. Many areas, particularly in Luzon, were already overfished. Hence, catch rates were too low to allow repayment.
2. Many fishermen who received loans through "seldas" may have had no intention of fishing. Others sold their new bancas back to suppliers who then resold them to another borrower.
3. Some fishermen moved to new locations and DBP could no longer find them.
4. DBP was unable to exercise adequate supervision of the credit program.

One apparently exceptional area was Coron and Tagum-

[2]Personal interviews with officials of Agriculture Division, DBP (8/25/78) and of BFAR (8/24/78).

Table 17. Loans granted to municipal fisheries. Data are from FIDC (1978); DBP Agricultural Division, Status of Loans; and PNB, Status of Loans.

Source/program	No. of accounts	Amount released (₱)	Amount in arrears
CB-DRBSLA			
a) Small Fishermen's Special Credit Fund (SFSCF) as of Nov, 1977	3 associations	862,000	not available
b) Supervised Fisheries Credit Program (SFCP) as of Nov, 1977	3 associations	650,000	not available
DBP			
Small Foreshore and River Fishermen (as of June 30, 1978)	70,828 fishermen	279,125,521.62	₱266,380,615.64
PNB			
Small Foreshore, Offshore & River Fishermen (1974-78)	not available	49,031,000	not available
ACA			
Small Fishermen's Loan (as of Dec. 31, 1976)	22 associations	3,305,404.41	2,420,605.65
Total loan released		₱342,228,926.03	

pay where, of 300 loans granted, only 16% were in arrears (Baum and Maynard 1976b, p. 24). It is probably no accident, because Coron and Tagumpay have average annual per fisherman catches several times the national average.

The Small Foreshore, Offshore and River Fishermen credit program of the PNB included loans for municipal and commercial fishermen to finance the purchase and/or repair of fishing equipment as well as other expenses. From 1974 to 1978, PNB released total loans of ₱49,031,000 to all fisheries sectors. Data on loans granted specifically to municipal fishing, however, are not available. The repayment rate on the loans granted, on the other hand, was observed to be very low.

Finally, the Small Fishermen's Loan Program of ACA, funded by NFAC, extended credit to fishermen's associations and/or cooperatives, to finance the acquisition of bancas, motor engines and spare parts, and fishing nets. As of December 31, 1976, a total of ₱3,305,404 had been lent to 22 organized fishermen's associations, involving 513 fishing vessels, 553 engines, and 511 nets and accessory items. The program has been suspended, however, due to lack of funds and a very low repayment rate (22.4%).

From this discussion of the major programs, it is apparent that low repayment rates have characterized all attempts to extend credit to municipal fishermen. FIDC (1979) has listed the factors believed to contribute to this situation. They are:

1. High administrative costs of extending so many small loans.
2. Not enough technicians to supervise the credit utilization.
3. The lack of coordination between BFAR and financing institutions.
4. The inherent high risk of capture fisheries.
5. Not enough marketing facilities.
6. Not enough benchmark information on fisheries, which has resulted in credit programs applied on a national scale, without taking into account the particular characteristics of specific fishing areas.
7. The lack of an effective repayment design.

These shortcomings, which are common to small-scale fisheries credit programs in many other countries (Lawson 1975), are widely appreciated among Philippine government planners. To hopefully circumvent these shortcomings, an area-specific credit program, with more thorough loan supervision, was implemented in 1979. Designed by the FIDC Technical Committee on Credit, this new program is based on "an exhaustive study of the Masagana 99 concept [and a] consensus that unlike the experience in rice production, fishing is not adaptable to single-project financing for nationwide promotion because of varied types of culture and capture, varied resource endowments and market opportunities in each area, and the need to encourage indigenous technology" (FIDC 1979, p. 60). Key features of this "Biyayang Dagat" program are:

1. Specific areas to be selected, based on resource availability, existence of cooperatives, market accessibility, etc.
2. BFAR to identify fishing projects suited to each area.
3. Eligible borrowers will be fishermen's cooperatives, Samahang Nayons, or members thereof.
4. Total institutional support from FIDC for overall coordination, BFAR for extension and active assistance in evaluation of borrowers and loan collection, PFMA for marketing, Ministry of Local Government and Community Development (MLGCD) for organization of cooperatives, and the DBP, PNB, CB-rural banks and other financial institutions, for granting loans.
5. On collateral/guarantee, loans to individual fisherman/borrower and members of the cooperative will require the co-guarantee of the cooperative; cooperatives directly borrowing must meet the bank's debt equity ratio requirement; the asset financed will be held under chattel mortgage by the bank.
6. As conditions for cooperative guarantee to member-fishermen, member/fishermen will deposit daily amortization with the cooperative; cooperatives have the right to take over the operation of the fishing unit financed in the event that required amortization rate is not met, and cooperatives will handle the marketing of the produce in the absence of an area marketing cooperative.

The new credit program thus places a heavy burden upon BFAR to provide the necessary loan supervision. It also anticipates a more prominent role for cooperatives than they have played to date. The extension of cooperatives into marketing activities implies the hope that municipal fishermen can be weaned away from the middlemen, upon whom so many of them currently depend. It also indicates considerable faith in an organizational concept (coops) that has been unfortunately known more for its failures than its successes, both in the Philippines and elsewhere in the world. Moreover, several of the target provinces, particularly in Luzon and Eastern Visayas, are adjacent to fishing grounds designated by BFAR as overfished.

The FIDC has completed its evaluation of the sites recommended for credit. The initial target areas under the new program are indicated in Figure 30. Several of

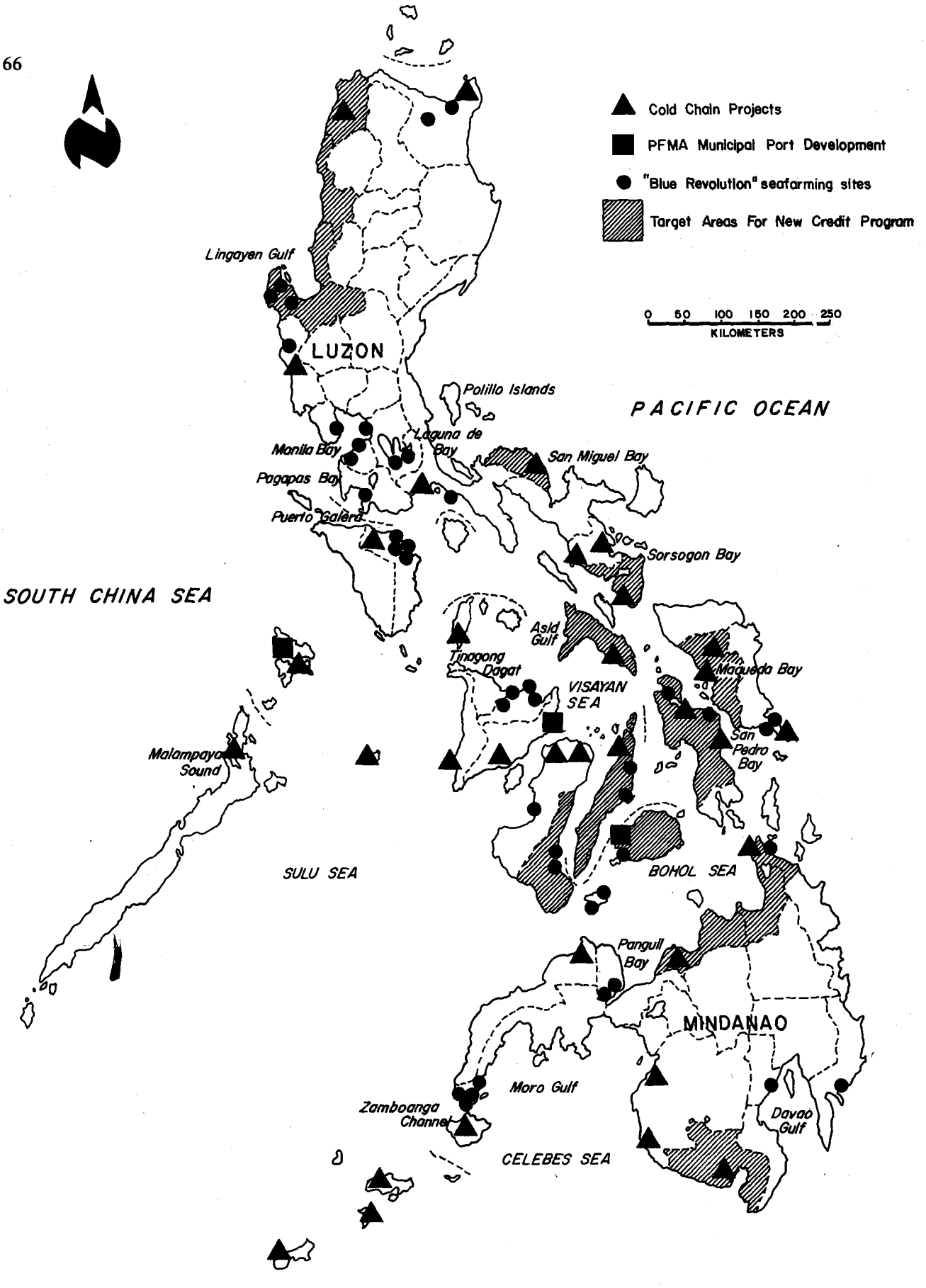


Fig. 30. Locations of development projects and "Blue Revolution" sites.

these sites will be recommended for inclusion in the municipal fisheries component of the World Bank (WB) credit line, now being considered by the DBP, and in the rural credit project administered by the CB (FIDC 1979).

2. Fishermen Organizations

An integral aspect of government programs, which aim to raise the standard of living of municipal fishermen is organizing fishermen into Samahang Nayons, cooperatives and associations (see Table 18). Samahang Nayons are pre-cooperatives, in that the capital requirements for cooperative status have not yet been fully subscribed. Associations of municipal fishermen, on the other hand, are being organized by the DAP's Fisheries Resources Management Program (Project FIRM).

Samahang Nayon for Fishermen is a BFAR program coordinated by the MLGCD. It aims to organize municipal fishermen towards eventually joining the cooperative development program of MLGCD. The purpose is to enable municipal fishermen to secure services and goods with their own capital, so as to increase their production and income. Training has been conducted by MLGCD for BFAR personnel and, as a result, many Samahang Nayons have been set up and are in operation throughout the country. As of December 31, 1978 BFAR records indicate that there were 610 organized Samahang Nayons throughout the country (see Figure 31). Many of the organized Samahang Nayons for fishermen, however, are facing problems which cause their weakening. The major problems are insufficient capital aid for the acquisition of new boats and of effective fishing gear, and for the motorization of bancas; limited technical assistance, and inadequate marketing schemes and infrastructure. It is not known how many of the 610 Samahang Nayons are still active.

A measure of the extreme difficulties that this program potentially faces is that despite a decade of organizational effort, there are only eight fishing cooperatives in the country today. Sandoval (1978), in describing the time-consuming but eventually successful efforts to organize a fisherman's cooperative in Initao, Misamis Oriental, brings attention to the many frustrations and suspicions from previous failures, both from within fishing barrios and from without, that must be overcome, and to the crucial role that was played by the parish priest. Initially organized around a gasoline station, the cooperative in Initao also apparently benefitted from the extension services of nearby Xavier University. As Sandoval observes, the biggest change in Initao is one of attitude of the fishermen towards themselves and their future. Reasons for the relative success of the small number of fishing cooperatives have not been generally addressed by researchers, however.

Along a somewhat different line, the Fishery Resources Management Program (FIRM), a joint undertaking of DAP-MNR-BFAR, is intended to organize fishermen into associations operating along corporation, rather than cooperative, principles and practices. It aims to optimize the production potentials of the municipal fishermen, by giving them technical, economic and other services. This is to enable them, in the end, to properly use their resources which, through joint ownership of larger vessels, essentially transforms them into commercial fishermen.

FIRM has three phases: 1) Human Resources Development, 2) Short-Term Innovation Package (STIP), and 3) Long-Term Innovation Package (LTIP). Under the first phase, over 3,000 municipal fishermen and their association officers have been trained in such topics as technical skills, management procedures, communication principles, and human relations. The STIP emphasizes improvement of fishing methods and gear, of existing marketing processes and facilities, and continues training for the development of human resources. The LTIP consists of capital intensive projects, such as commercial fishing vessels; trap nets (such as otoshi-ami); fish processing plants; cold storage; and related marketing facilities. Management and technical skills training programs are also extended to the fishermen members.

Table 18. Summary of organized Samahang Nayon, fishermen's associations, cooperatives and/or other fishermen's associations, by region, 1978.

Region	Samahang Nayon[1]	Fishermen's Association[2]	Cooperatives/ Others[3]
I	2	4	
II	14		
III	22		
IV	3		
IV-A	69	35	2
V	160		
VI	31		1
VII	35		2
VIII	89	5	
IX	88	12	
X	9		1
XI	55	4	2
XII	33	11	
Total	610	71	8

Source of data:
[1]BFAR (Extension) List of SN for Fisheries and BFAR Provincial Data.
[2]DAP-FIRM Status Report as of November, 1978.
[3]DLGCD Lists of Organized Cooperatives.

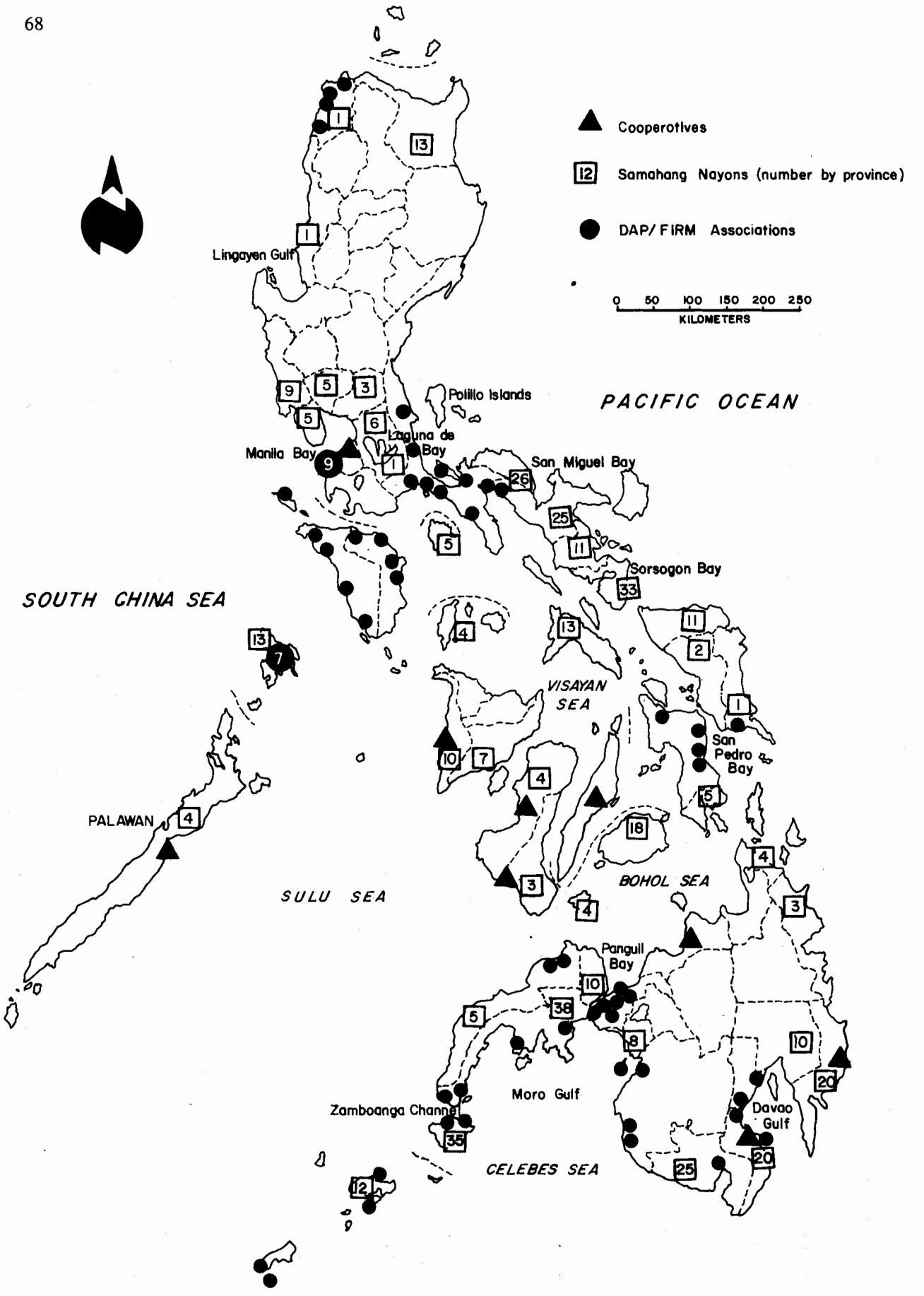


Fig. 31. Locations of active cooperations and "Samahang Nayons" and DAP/FIRM associations.

As of November, 1978, there were 71 fishermen's associations dispersed in 6 regions, 18 provinces and 6 cities, with a total membership of 3,843. A total of 23 associations have embarked on their STIP projects, 14 of which report positive net income. Four fishermen's associations in Pasuquin, Ilocos Norte; Bongo Island, Maguindanao; Sta. Cruz, Davao del Sur; and Tacloban, Leyte are now implementing their LTIP projects.[3] Sta. Cruz and Bongo Island have concentrated on commercial ringnet fishing, Pasuquin on a tuna drift gill net operation, and Tacloban on a commercial bagnet operation.

The fishermen's associations, despite the assistance of FIRM personnel, still have difficulties in securing collateral-free loans from the rural banks concerned. Likewise, FIRM management officials face problems because of the low repayment rate on the loans. Overall progress of the program is consequently slower than initially anticipated.[4]

3. Mariculture and Fishpen Projects

Under the Blue Revolution program of BFAR, pilot mariculture projects aim to cultivate marine species in sheltered bodies of water, such as coves, and near islets. The projects are meant to stimulate municipal fishermen towards shifting their efforts from purely fish capture activities to fish culture methods, so as to give them another source of income. There are 45 seafarming projects in the country today. Another 15 were targeted for 1979 (see Figure 28). The projects are still in the pilot demonstration stage, although for several years commercial oyster and mussel farms have been in operation in Bacoor Bay, Cavite, Sapian Bay, Capiz and Maqueda Bay in Samar. It is not known, however, to what extent these mussel farmers are former municipal fishermen.

The MNR has also designated the following five areas in the country as priority seafarming areas. 1) Padre Burgos, Quezon; 2) Bolinao, Pangasinan; 3) Sapian Bay, Capiz; 4) Biliran Bay, Leyte; and 5) Davao Bay, Davao.

Seaweed farming is also being promoted by BFAR, and the industry benefits from an aggressive private sector that, through demonstration farms operated by the major seaweed (primarily *Eucheuma*) buyers, has stimulated commercial production by former municipal fishing households in Tawi-Tawi and Bohol.

On the freshwater side, the Laguna de Bay Fishpen Development Project of the LLDA, to be funded by an ADB loan, has the following objectives:

1. To help municipal fishermen of Laguna de Bay improve their socioeconomic condition, by giving them the chance to go into fishpen and cage culture of milkfish and tilapia.
2. To improve fish supply in the Laguna de Bay area, including Metro Manila.

The project, which began in 1980 under the overall management of LLDA, consists of two parts. The first part is the provision and administration of sub-loans to fishermen for the development of 2,500 ha of fishpen modules of 2.5, 5 and 10-ha sizes in Laguna de Bay, to be constructed within the LLDA fishpen belt (refer back to Figure 9). Milkfish are to be grown in fishpens while tilapia are to be cultured in cages within the fishpen.

The second part is the construction and operation of a hatchery/nursery complex, and of other facilities and services, all aimed to produce 136 million fingerlings (100 million milkfish and 36 million tilapia)—which would be required, in turn, to stock the 2,500 ha of fishpen and cage modules.

The fish hatchery/nursery and supporting laboratory complex will be built near the lake. Initially, tilapia will be produced in the hatchery while milkfish fry will be bought by LLDA on the open market, until milkfish hatchery production is developed and perfected. The project also includes giving credit, marketing and technical assistance to the former municipal fishermen. Construction of the modules is set to start by 1980, after the hatchery/nursery complex is completed. In the first year, 400 ha of 88 modules will be completed, followed by 176 modules covering 800 ha in 1981, and 286 modules covering 1,200 ha in 1982.

C. IMPROVED MARKETING

The second major thrust of the Integrated Fisheries Development Plan, as it affects municipal fisheries, is that of improving marketing and reducing post-harvest losses. The emphasis of programs in this area is upon: 1) marketing infrastructure, particularly landing, ice and cold storage facilities and 2) handling and processing. The BFAR Cold Chain Project is designed to install and operate a nationwide network of icemaking, freezing and cold storage, to speed up fish marketing and distribution, reduce fish wastage and spoilage, stimulate production for both domestic and foreign consumption and, in the process, increase the return on investment made in fisheries.

There are 16 existing BFAR ice plants and cold storage units. Besides these, 18 new plants are to be built and be in operation by the end of 1979 (see Table 19

[3]Source of Project FIRM data is DAP-FIRM Status Report for November, 1978.

[4]Personal interview with DAP-FIRM officials (9/8/78).

and Figure 30). BFAR estimates that total cost of this project will exceed ₱22 million.

Rehabilitation of existing plants, to improve their operations, has been given emphasis. The BFAR cost estimates for rehabilitation of 16 plants amount to ₱4,869,540. To date, however, only ₱1,395,000 has been released for nine of the ice plants and cold storage facilities (Table 19). Two of these 16 plants have been recommended for relocation: Barugo, Leyte and Panitan, Capiz to Tacloban City and Ponteverde, Capiz, respectively. This is to make the plants better serve municipal fishermen.

Performance of the 16 ice plants has been generally poor, according to BFAR. This is due to:

1. Low production, due to frequent breakdown of machinery.
2. Poor location of several of the plants in terms of fish landings, market and, in some cases, in the

Table 19. DNR-BFAR cost estimates and actual cost released for the rehabilitation and construction of the ice plants and cold storage. Data are from Cold Chain Status Report (1978) (FIDC Record File).

Ice plant/cold storage	Capacity (t)	BFAR cost estimates	Amount released*
16 plants for rehabilitation		P 4,869,539	P 1,395,000
Guiuan, Samar	6F	250,000	250,000
Dalahican, Lucena	10F	165,000	
Pio Duran, Albay	10F	256,000	
Magallanes, Sorsogon	6F	624,024	130,000
Barugo, Leyte	10F	230,000	130,000
Old Sagay, Negros Occidental	5B	642,129	195,000
Sarabia, Negros Occidental	5B	400,000	130,000
Panitan, Capiz	10F	566,000	
Masinloc, Zambales	5B	247,111	
Mercedes, Camarines Norte	10F	267,755	233,000
Pala-Pala, Iloilo	10F	121,572	46,000
Sta. Ana, Cagayan	3B	41,268	
Jolo, Sulu	10F	176,679	200,000
Batu-Batu, Tawi-Tawi	40B	490,000	
Liminangcong, Palawan	40T	390,000	81,000
Siasi, Sulu	10F	no estimate available	
18 new plants		17,450,000	12,750,000
Basilan City	10F	600,000	350,000
Cuyo, Palawan	10F	600,000	760,000
Daanbantayan, Cebu	10F	600,000	760,000
Placer, Masbate	5F	550,000	760,000
Dipolog City	5F	550,000	760,000
Kalamansig, Sultan Kudarat	10T	650,000	900,000
Opol, Misamis Oriental	10T	650,000	900,000
Looc, Romblon	5F	550,000	760,000
Tabaco, Albay	10T	650,000	900,000
General Santos City	40F	2,800,000	–
San Jose de Buenavista, Antique	10T	650,000	900,000
Catbalogan, Samar	10T	650,000	900,000
Surigao City	40F	2,800,000	–
Tacloban City	40F	2,800,000	920,000
Cotabato City	10T	650,000	900,000
Coron, Palawan	10F	600,000	760,000
Laoag City	5F	550,000	760,000
Calapan, Oriental Mindoro	5F	550,000	760,000

*BFAR Capital Outlay for the Cold Chain Project.

Note: B: Block
F: Flake
T: Tube

supply of crucial raw materials, such as water and diesel fuel.

3. Difficulties in buying spare parts and delivery trucks. The 16 existing plants are operating at approximately 40% of their productive capacity.

The Municipal Port Development Program of the PFMA aims at developing quality-conscious fish marketing practices. The program stresses provision, or improvement, of landing and berthing facilities, sites for onshore facilities, ice plants, cold storage units, and mechanically refrigerated carrier vessels, vehicles, and plastic boxes. The activities include the collection of fish, icing it in especially designed plastic boxes, temporary stocking of the product in chill storage and transhipment into target markets.

At present, three potential project areas have been identified as suitable for ADB-financed municipal port development. They are Maribojoc, Bohol; Estancia, Iloilo; and Coron, North Palawan. The reasons for choosing them follow:

1. Bohol–because of the many fishermen, underexploited tuna resources on its southern coast, and the nearness of the Cebu market for potentially high-value demersal catches on the northern coast.
2. Estancia–due to its high area concentration of fishermen, a clearly defined market problem and intensive aquaculture development in the vicinity with similar marketing constraints.
3. North Palawan–because of its very high percentage of fishermen, fishing being almost the only livelihood; resources believed to be abundant, and extreme marketing problems due to long distance to the nearest major market in Manila. It will be recalled from Section V that Coron in North Palawan had a low average per capita income, despite high annual productivity per fisherman.

A total of 30 more locations have been selected for municipal port development. These are, however, still tentative, pending completion of investigations, to determine the type of facilities needed.

Finally, on handling and processing, the Bureau of Fisheries is conducting research, extension services and training on improved methods of fish handling and processing. Demonstrations on fish processing and handling techniques and methods have been given by BFAR's fish processing technologists to interested persons, mostly housewives, teachers and retired employees.

Fish processing methods demonstrated were mainly fish canning, fish sausage making and pickling, etc. There are six BFAR pilot fish processing plants and 72 extension workers assigned to this work. The University of the Philippines College of Fisheries also conducts research and demonstration programs on how to improve handling and processing.

D. SUMMARY

Despite the apparent emphasis in the IFDP on production-oriented development programs, the encouragement of alternative sources of income for municipal fishermen, and of improvements in marketing and post-harvest handling and processing, are playing an increasingly important role in future programs meant to help upgrade the low standards of living of the municipal fishermen. There is still, however, a critical shortage of information on the effects of these development alternatives or, indeed, on the extent to which programs are actually operating in the field. For example, as already pointed out, many Samahang Nayons are thought to be already inactive although their names continue to appear on various lists of functional organizations. There seems no question, though, but that municipal fisheries and fishermen have attracted the attention and concern of government policymakers, and that more area-specific plans are being produced as a result. The receptivity is thus high for complementary technical and social science research that can offer possible insights into, or solutions to, the problems of the low living standards of municipal fishermen.

Conclusion: Implications for Management and Research[1]

A. SUMMARY

The preceding sections, which presented a multi-disciplinary view of municipal fisheries resources, technology, and socioeconomics, demonstrate the interrelatedness of these three aspects. It is clear that no one aspect of the municipal fisheries sector can be considered in isolation from the other. Two findings of this FIDC-ICLARM research review stand out above all others: 1) the municipal fisheries resource is in most likelihood fully exploited and 2) municipal fishermen express a surprisingly high degree of willingness to shift from fishing to alternative activities.

The interdependence between fishermen and fisheries resources is obvious. Short-term perspectives, however, often overlook how fragile this interdependent relationship is. For example, at a recent symposium on marine conservation, evidence was presented of widespread coral-reef destruction in the Philippines (MSC 1979). Much of the deterioration of this marine coastal resource has been caused by the actions of fishermen themselves. Dynamite fishing, use of sodium cyanide, in-shore trawlers, and traditional drive-in nets with stone-weighted scare lines all contribute to destruction of the coral reef environment, which is estimated to be the source of up to 20% of Philippine municipal catch (Carpenter, in press).

While reef resources are receiving increased attention, they are only part of the resource problem as it affects municipal fishermen in the Philippines. Contrary to earlier points of view that almost unlimited resources were available to municipal and commercial fishermen, there is increasing evidence of overfishing in many traditional fishing grounds and, at best, of a levelling off of nationwide marine and inland municipal fisheries catch. Moreover, estimates of marine MSY based on average productivity of 18-20 t/km^2 of continental shelf appear to be unrealistic.

Simultaneously, real incomes of the municipal fishermen are deteriorating. Recent socioeconomic survey results show average cash income levels for municipal fishermen to be roughly half the poverty thresholds established by the DAP (Abrera 1976). Rapid inflation since 1972 has been a major cause of declining real incomes (WB 1976), exacerbated primarily by increased fuel costs. There is thus both a biological and a human resource component to the problems facing the municipal fisheries sector.

[1]This section includes conclusions that were presented in part at the Vth International Symposium of Tropical Ecology, Kuala Lumpur, Malaysia, 16-21 April 1979 (see Smith 1979b).

1. Resources

To say anything sensible about the degree of exploitation of the fisheries resources, one must first be able to approximate the maximum sustainable yield (MSY) and, then, be able to estimate current catch levels, so that comparisons between the two can be made. Estimates of marine MSY in excess of 2.5 million metric tons (Yutuc and Trono 1977 and NORCONSULT/IKO 1976) are based on average productivity per square kilometer of continental shelf. These estimates appear to be unrealistic, if compared to estimates made for tropical waters elsewhere in the world. A more realistic estimate is probably in the range of 1.5-1.8 million metric tons, of which perhaps 50-55% can be caught by municipal fishermen. In 1979, through sampling at municipal fish landings, the BFAR reported 1977 marine and inland municipal fisheries catch totals of 712,514 mt and 162,420 mt, respectively, totalling 875,000 mt or 58% of Philippine fisheries and aquaculture production in that year. Other estimates of municipal fisheries production, based on consumption surveys for the 1970-1975 period, have resulted in a higher estimate, averaging 950,000 mt and more importantly, indicating a levelling off of municipal catch (DAP 1977). Given this recent production data, it appears that the maximum sustainable yield has already been reached. The designation by BFAR of an increasing number of traditional fishing grounds as overfished, based on declining yields, lends support to the latter conclusion. However, several areas of the country, particularly Palawan and Southwest Mindanao, offer potential for expanded catch if the isolation of these areas from markets can be reduced by providing them with ice/cold chain facilities and marketing infrastructure and services.

2. Technology

The half million Philippine municipal fishermen rely on approximately 250,000 vessels (bancas), of which slightly less than half are motorized. As in other parts of the world, programs aimed at raising municipal fishermen income levels have emphasized the application of standardized, production-oriented technology, to upgrade vessels and gear. To facilitate upgrading, credit in

excess of ₱340 million (US$46 million) has been given to individuals and groups of fishermen over the past several years. Repayment rates have been extremely low, ranging from 1% to 34%. An ongoing study of credit to fishermen and fish farmers will undoubtedly uncover some of the reasons for these low repayment rates, but it is thought that they are due primarily to the extreme difficulties of providing adequate loan supervision to such a large group of heterogeneous, mobile borrowers. In response, the "Biyayang Dagat" program, designed to account for locale-specific resource and socioeconomic variations, was implemented in 1979, with the FIDC as lead agency. The program will require the BFAR to provide loan supervision, and cooperatives to guarantee the individual loans to fishermen and to provide marketing. A measure of the extreme difficulties this program potentially faces is that despite a decade of organizational effort, there are today only eight fishing cooperatives in the country. Although over 600 pre-cooperatives (Samahang Nayons) have been formed, it is not known how many of these are active. An alternative approach being implemented by the DAP relies on formation of fishermen associations and group purchase of larger vessels, thus essentially transforming municipal fishermen into commercial fishermen. However, in these increasing number of areas with resource limitations, only limited numbers of fishermen can be accommodated by this capital-intensive technological transformation. Certainly this approach makes sense in those areas where new resources or resources further off-shore can be tapped by the new vessels. If they continue to fish in traditional fishing grounds, either because of familiarity or because of necessity due to rising fuel costs, the purpose of upgrading will have been defeated. Technological innovation must therefore be selective, depending upon resource availability.

3. Socioeconomics

An appreciation of socioeconomic and institutional aspects of the production and marketing sectors is essential, if attempts to improve municipal fisheries marketing and to develop alternative or supplementary sources of income for municipal fishermen are to succeed.

The production and distribution sectors of municipal fisheries are linked through an elaborate web of interpersonal relationships, generally called "suki." "Suki" has mutually beneficial aspects, involving extension of credit and guaranteed outlets and supply, but municipal fishermen are often perpetually indebted to middlemen and boat owners, particularly at non-peak fishing periods. The belief that fishermen would prefer, and benefit from, an alternative marketing arrangement has led to an increased emphasis on developing marketing infrastructure and institutions. Although "suki," as exploitive of fishermen, remains to be seen, this research review found evidence in several community studies to support the view that fishermen themselves are receptive to change in the organization of both production and marketing.

In fact, almost 50% of municipal fishermen in 16 fishing villages surveyed since 1976 indicated their willingness to change their occupation from fishing; 30% were willing to change their locations. Potential occupational mobility thus appears to be higher than potential geographic mobility. Regarding underlying attitudes, 65% of municipal fishermen were found to be generally dissatisfied with their family condition. Only one out of five believed that his personal living standard was better than it was five years earlier.

A matrix of correlation coefficients among relevant socioeconomic indicators found that desire for occupational change is highest in those fishing villages characterized by lower income levels ($r=.70^*$), by lower percentage of boat ownership ($r = .70^*$), by lower levels of fishing effort ($r = .70^*$), and by younger fishermen ($r = .82^*$).[2] Importantly, desire for occupational change was highest in communities with the highest percentage of households dependent upon fishing ($r = .75^*$).

There is both an opportunity and a potential stumbling block here. On the one hand, the high degree of latent occupational mobility should encourage those promoting alternatives. On the other hand, it is the marginal, not the more successful, fishermen who are most willing to change. They are located, moreover, in the more geographically and/or economically isolated communities, where fewer alternatives now exist. Those seeking a change are the younger, poorer and less educated ones, who probably are the ones less able to assume the risks that a new activity implies. The key to capitalizing on these positive attitudes in a way that encourages income diversification, while minimizing risk, is therefore supplementing, rather than replacing, the fishing activity; or that is, encouraging full-time fishermen to become part-time fishermen.

B. IMPLICATIONS FOR MANAGEMENT

Because of trends towards overfishing of these "open-access" resources, and conflicts between municipal and commercial fishermen in some locations, steps are being initiated by the Philippine government to restrict fishing effort. In other words, a "management" dimension is

[2] *significant at 5% level.

beginning to supplement the "development" dimension in planning efforts. A development perspective stresses increased production from the fishery resource. A management perspective, on the other hand, recognizes limitations to "open-access" renewable resources and the potential problems of overfishing and overcapitalization that result when entry is unrestricted. It thus emphasizes the achievement of optimum sustainable yields. This shift in emphasis is crucial because it means that a long-term, rather than a short-term, perspective of the biological and human resources of fisheries is developing.

A short-term perspective of municipal fishermen problems places emphasis on "development" rather than on "management," of the resource. It seeks solutions to reef destruction, for example, by legislating against symptoms (e.g., dynamite fishing) rather than dealing with underlying causes. It emphasizes vessel and gear upgrading, without considering resource availability. The poverty of municipal fishermen who resort to the use of blasting caps, sodium cyanide, and small-mesh to satisfy daily good requirements, demands a long-term "management" approach that paradoxically places emphasis on reduced fishing effort.

Reductions in fishing effort can be achieved, either through disincentives or incentives. Examples of disincentives already in effect include restrictions on certain types of vessels or gear and closed seasons. In response to conflicts between municipal fishermen and trawlers, vessels in excess of 3 gt are excluded from waters within 7 km of the coasts of Samar, Leyte and Sorsogon provinces, and from waters shallower than 7 fathoms in the rest of the country. The Visayan Sea is closed to fishing for sardines, herrings, and mackerels from November 5 to March 15.

Incentives, on the other hand, include alternative income sources sufficiently attractive to reduce full-time fishing. Seaweeds, oysters, and mussels in marine waters, and cage culture in both marine and inland waters, are seen as the most promising fisheries-related activities. Rural development schemes that might stimulate opportunities for fishermen outside of fish capture and culture are still in their infancy.

Failure to emphasize, and experiment with, incentives aimed at reducing fishing effort will lead either to continued depletion of coastal and inland fisheries resources, or to necessary adoption of more drastic disincentives–and consequently, to more rapid displacement of large numbers of marginal fishermen. Both results further impoverish municipal fishermen. Municipal fishermen appear to welcome the potential benefits from incentives that a "management," rather than a "development," approach would bring. Consistent with the underlying rationale of ecological balance expressed in the Integrated Fisheries Development Plan (IFDP), the first encouraging steps have been taken in this direction.

C. IMPLICATIONS FOR RESEARCH

As the preceding section on management aspects indicates, it is tempting to draw broad generalizations from the research that has been conducted to date on municipal fisheries and fishing communities. The fact is that much work remains to be done so that the various alternative measures designed to improve the quality of life in fishing communities can be evaluated vis-a-vis each other.[3]

While this review provides evidence of an increasingly complete picture of the municipal fisheries sector and its problems, it is apparent that most research, particularly that on socioeconomic aspects, has been limited to description only. It is opportune for researchers to now move to the next phase in their work on municipal fisheries by applying their analytic tools. An analytic framework is essential to understanding the dynamics of change in fishing communities and the resources upon which they depend, and to the discovery of solutions to the biological and human resource problems of the municipal fisheries sector.

Statistics are a key element of any successful management and research program. It is widely acknowledged that until 1977, municipal fisheries statistics were inadequate to the task. Recent improvements in municipal statistics, however, have ushered in the beginning of an adequate data base. It will be possible, for example, within the next several years to calculate time-series catch and effort data, so that preliminary assessments of sustainable yields can be made. To date, municipal fisheries research has relied almost exclusively on the collection of primary data. In years to come, analysis based on secondary data will become more prominent.

In the area of resources, stock assessment work based on exploratory fishing, length frequency measurements and analysis of statistics, for both marine and inland waters, must continue to receive priority. Regarding technology, innovations such as the "payao" (rafts for attracting fish) need to be documented. Cost-benefit analysis on various gear, vessel, and engine combinations would be helpful, as would be energy-related research (e.g., gasoline vs. diesel power for bancas) that seeks to reduce the cost of fishing.

---

[3]See Smith (1979a) for a theoretical evaluation of the alternatives of vessel and gear improvement, marketing improvement, institution building and effort reduction.

It is in the area of socioeconomics that research can perhaps make the greatest contribution to the solution of problems facing municipal fishermen. Socioeconomic research, in isolation from resource considerations or from development programs, however, fails to meet the urgency with which municipal fisheries problems must be addressed. With diverse government programs–ranging from market infrastructure to gear improvement, and to institution building–there is no lack of challenging research topics at hand, dealing with the effects of externally promoted change for municipal fishermen and their communities.

As the national research coordinating agency, PCARR has established priority areas for research related to marine and inland fisheries and to aquaculture. Appendices 1 and 2 list the priority areas for marine and inland fisheries. Emphasis is given to improvements in the statistical base, to technological improvements, to stock assessment, and significantly, to development of resource management and conservation programs. The distinction that PCARR makes among marine, inland, and aquaculture fisheries draws attention to the artificial boundary that exists between commercial fisheries and municipal fisheries. Not only do municipal fishermen now range far beyond municipal waters, they also catch many of the same species caught by commercial fishermen. A management perspective, therefore, requires that commercial and municipal fisheries be treated together, rather than separately, when biological issues are being considered. This is the PCARR approach. The human issues, however, make it possible to separate the two–commercial and municipal–based upon scale considerations and upon levels of living. There is no question but that municipal fishermen are poor. The challenge to researchers is to shed light on why these conditions prevail and what can be done to solve them.

It is apparent that a multidisciplinary perspective of the municipal fisheries sector is necessary. It helps pose the major questions related to each alternative method of raising fishermen household incomes as indicative of working hypotheses that might be adopted by researchers.[4]

The questions:

1. Vessel and gear improvement. Will the resources permit the expansion in effort that improved production technology implies? What are fishermen attitudes toward technological change? What forms are most "appropriate?" To what extent does technological innovation displace fishermen? To what extent does it disrupt community social structure and create more unequal income levels within and among communities? How broadly based can participation in technology advances be?

2. Marketing improvement. Will reductions in marketing inefficiencies (technical and price) result in higher prices received by fishermen, in lower prices paid by consumers, or some combination of both? Will the benefits be captured by intermediaries in the form of higher profits? Will the provision of intermediate processing technology allow fishermen to capture some of the profits previously received by middlemen? Will the development of alternative market outlets (e.g., frozen, dried, processed) or improved infrastructure result in higher fishermen incomes? What is the most appropriate form of management and/or guidance for the marketing system? What, if anything, should be the government's role? Will a more efficient distribution system increase the fishing pressure on the resource?

3. Institution building. Will the formation of fishermen cooperatives, associations or other formal and informal groupings increase production and/or increase prices received? Will it reduce dependency of fishermen on middlemen, boat owners, and input suppliers? How broad can participation be in the new or adapted institutions? What will be the effects of institutions on levels and equity of community income? What role should the government play in institution building? Will fishermen organizations encourage conservation and management of the resource?

4. Effort reduction. Will reduced fishing effort, either through disincentives or incentives, result in higher catch and income for those that remain? What are the attitudes of fishermen towards effort reduction? What attractive alternative activities are available to fishermen to encourage them to reduce their fishing effort? Can reduced fishing effort be achieved by encouraging full-time fishermen to become part-time? What is the extent and cause of occupational and/or geographic mobility among fishermen? Can non-fish capture sectors, such as aquaculture and agriculture, absorb fishermen displaced by programs that limit fishing effort? Will education and training programs designed primarily for children of fishermen result in reduced fishing effort? What management tools can be developed to limit fishing effort? How can they be implemented and enforced? What management schemes can resolve the conflicts between municipal and commercial fishermen? What criteria should be used to allocate rights to the use of the fisheries resource?

In conclusion, this research review has shown that much information on municipal fisheries is available. However, research to date has not directly addressed the central issue, which is the low standards of living of municipal fishermen. Neither have analytic method-

[4]From Smith (1979a)

ologies been generally adopted.

Of course, it is much easier to give suggestions and pose hypotheses than to provide definitive answers. The issues involved with municipal fisheries and fishing communities are extremely complex. There are no easy solutions. It is hoped, however, that the preceding review has shed sufficient light on the interrelationships among the resources, technology, and socioeconomics of production and distribution of municipal fisheries, to encourage analytical research on these topics.

Acknowledgments

The authors express their deep appreciation to the following colleagues who kindly provided very helpful comments on draft versions of this monograph: Rogelio Juliano, Virginia Aprieto, Florentina Tan, Elvira Tan, Alexander Spoehr, and Marilou Urbino. Also, we are grateful to the many staff members of the Fishery Industry Development Council (FIDC), who assisted us in the collection of basic data. The permission of the U.S. Fish and Wildlife Service to adapt gear figures from Umali (1950) is also appreciated.

Bibliography

Abrera, A. S. 1976. Philippine poverty thresholds. p. 223-273. *In* M. Mangahas, Editor. Measuring Philippine development: Report of the social indicators project. Development Academy of the Philippines. Manila.

A.D.B. 1977. Rural Asia: Challenge and opportunity. Asian Development Bank. Praeger Special Studies. New York. 489 p.

A.I.D. 1977. The Philippines: Fisheries sector study. Report of the USAID/Philippines Fisheries Mission, 1-31 August, 1977. Manila. 79 p.

Alder, H. L., and E. B. Roessler. 1972. Introduction to probability and statistics (5th Edition). W. H. Freeman and Co. San Francisco. 373 p.

Alexander, P. 1975. Innovation in a cultural vacuum: The mechanization of Sri Lanka fisheries. Human Organization 34 (4): p. 333-344.

Aoyama, T. 1973. The demersal fish stocks and fisheries of the South China Sea. SCS/DEV/73/3. FAO/UNDP. Rome. 80 p.

Aprieto, V.L., and E.P. Villoso. 1977. Fishes caught by otter trawl in Visayan Sea. Fish. Res. J. Philipp. 2(2): 40-49.

BAECON/BFAR. 1978. Fish Marketing in three landing areas: Iloilo, Bacolod and Zamboanga. BAECON/BFAR survey report. February 1978. 133 p.

Baum, G. A., and J. A. Maynard. 1976a. Bayawan municipality: A socioeconomic study and development proposal. SCS/76/WP/42. South China Sea Fishery Development and Coordinating Programme. Manila. 67 p.

_____. 1976b. Coron/Tagumpay: A socioeconomic study and development proposal. SCS/76/WP/33. South China Sea Fishery Development and Coordinating Programme. Manila. 112 p.

_____. 1976c. Panigayan, Lampinigan, Baluk-baluk, Managal: A socioeconomic study. SCS/76/WP/23. South China Sea Fishery Development and Coordinating Programme. Manila. 62 p.

_____. 1976d. A socioeconomic study: Salay Municipality. SCS/76/WP/29. South China Sea Fishery Development and Coordinating Programme. Manila. 47 p.

_____. 1976e. A socioeconomic study: Tobuan/Sual. SCS/76/WP/22. South China Sea Fishery Development and Coordinating Programme. Manila. 44 p.

BFAR. In press. 1977 Fisheries Statistics of the Philippines. Preliminary tables. Bureau of Fisheries and Aquatic Resources. Manila.

BFAR. 1978. 1976 Fisheries Statistics of the Philippines. Bureau of Fisheries and Aquatic Resources. Manila. 115 p.

BFAR/DNR. Fisheries Extension Program, 1977-1981. Bureau of Fisheries and Aquatic Resources, Department of Natural Resources. Manila. 52 p.

Campbell, M. 1975. Stable tropical fish products: Report of a workshop held in Bangkok, Thailand, 8-12 October 1974. International Development Research Centre. Ottawa. 27 p.

Carpenter, K. E. In press. Philippine coral reef fisheries resources: Part I. A preliminary assessment. Philippine Journal of Fisheries. 28 p., plus tables.

Castillo, G. T. 1977. Beyond Manila: Philippine rural problems in perspective. Volume I. University of the Philippines at Los Baños, College, Laguna, Philippines. 361 p.

Central Bank of the Philippines. Consumer price indices, 1949-1980. Department of Economic Research. Manila.

Chakraborty, D. 1976. Fisheries statistics in the Philippines: A plan for a new and expanded data collection programme. SCS/76/WP/44. South China Sea Fishery Development and Coordinating Programme. Manila. 61 p.

Chakraborty, D., C. M. Ramos, and L. R. Bautista. 1976. Municipal Fishery Statistics in the Philippines. Bureau of Fisheries and Aquatic Resources. Mimeo. 13 p., plus appendices.

Christy, F.T., and A.D. Scott. 1965. The commonwealth in ocean fisheries. The Johns Hopkins Press, Baltimore.

Copes, P. 1970. The backward-bending supply curve of the fishing industry. Scottish J. Political Economy. Vol. 17. pp. 69-77.

Craib, K. B. and W. R. Ketler, Editors. 1978. Fisheries and aquaculture collaborative research in developing countries: A priority planning approach. Resources Development Associates, Los Altos, California. 266 p.

Cuyos, N. A., and A. Spoehr. 1976. The fish supply of Cebu City: A study of two wholesale markets. Philippine Quarterly of Culture and Society. University of San Carlos, Cebu City, Philippines. 4 (3): 160-198.

DAP. 1977. Population Resources, Environment and the Philippine Future (PREPF). Volume II-3B. p. 1138-1387. Development Academy of the Philippines. Manila.

De la Cruz, J., and S. Yutuc. 1977. A cost and earning study of fishing and pond culture in the Philippines, p. 1248-1307. *In* PREPF, Volume II-3B. Development Academy of the Philippines. Manila.

Delmendo, M. N. 1976. An evaluation of the fishery resources of Laguna de Bay. The Philippine Journal of Fisheries. 14 (2). July-December 1976. p. 213-231.

Emmerson, D.K. 1978. The Development of Artisanal Marine Fisheries: Some Lessons from Experience in Tropical Asia and the Pacific. Unpublished Manuscript.

FAO. 1973. The Economic and Social Effects of the Fishing Industry–A Comparative Study. FAO Fisheries Circular No. 314. Rome. FAO.

FAO. 1979. Report of the FAO/IOP Workshop on the Fishery Resources of the Western Indian Ocean South of the Equator. FAO Indian Ocean Programme Development Report no. 45. 102 p.

FIDC. 1977a. Integrated Fisheries Development Plan: Executive Summary, June 1977. Fishery Industry Development Council. Quezon City. 22 p.

FIDC. 1977b. The assessment of fishery resources in the Philippines: A situation report prepared by Resources Studies Project Staff of FIDC. July 1977. 85 p., plus figures and bibliography.

FIDC. 1978. Papers and Proceedings, National Workshop on Municipal Fisheries Development. 18-22 December 1977. Cavite City, Philippines. Fishery Industry Development Council, Quezon City.

FIDC. 1979. Philippine fisheries: Major developments in the 1970s and directions for the 1980s. Policy Research Paper. Fishery Industry Development Council. Quezon City. 72 p., plus annex.

FIRM. 1978. Fishery Resources Management Program. Descriptive brochure. Development Academy of the Philippines. Manila. 33 p.

Gagni, A. O., and A. C. Luna. 1978. Field Level (Bottom upward) Planning and Development of Small-Scale Low-Income Fishermen Communities in Negros Occidental. Re-

search Report of the Department of Agricultural Education, University of the Philippines College of Agriculture at Los Baños, Laguna.

Gonzales, E. R. 1977. A preliminary socioeconomic study of Limbon-Limbon, Binangonan, Rizal: A sample fishing village bordering Laguna de Bay. Freshwater Aquaculture Program, SEAFDEC Aquaculture Department. Manila. 20 p.

Guerrero, C. V., A. O. Tayag, L. O. Sabaldan, and L. S. Fabia. 1978. Mussell marketing in Cavite, Capiz and Samar. Market Assistance Section, Bureau of Fisheries and Aquatic Resources. Intramuros, Manila. 27 p.

Guerrero, C. V., and P. M. Medina. 1976. Processing and marketing of smoked fish. Part II: Southern Tagalog. NFAC 76-24. Special Studies Division, Planning Service, Department of Agriculture. Quezon City. 28 p.

Guerrero, C. V., P. M. Medina, E. G. Tanyag, and E. L. San Jose. 1976. Processing and marketing of dried fish. Part I: Greater Manila Area. NFAC 76-12. Special Studies Division, Planning Service, Department of Agriculture. Quezon City. 26 p.

Guerrero, C. V., P. M. Medina, M. M. Salisi, and N. R. Atienza. 1977. Processing and marketing of dried fish. Part II: Panay Island. NFAC 77-1. Special Studies Division, Planning Service, Department of Agriculture. Quezon City. 26 p.

Gulland, J. A. 1971. The fish resources of the ocean. Fishing News (Books) Ltd., West Byfleet. 255 p.

Guthrie, H. A. 1968. Nutrition in a fishing community, p. 129-148. *In* Modernization, its impact in the Philippines III. Bello, W. F., and A. de Guzman II, Editors. Institute of Philippine Culture (IPC) Papers No. 6. Ateneo de Manila University Press, Quezon City.

Haque, F., and G. Octavio. 1977. An economic analysis of sustenance and commercial fishing in Western Visayas. 16 p. Proceedings, Agricultural Economic Society of Southeast Asia. 3-6 Nov. 1977, Iloilo, Philippines.

Herrin, A. N., M. L. Fabello, C. E. Fabello, and L. C. Palma. 1978. A social and economic study of selected municipal fishing communities in Misamis Oriental, Philippines. Research Institute for Mindanao Culture, Xavier University, Cagayan de Oro City.

Hongskul, V. 1978. The allocation of scads and mackerels. Paper presented at the Law of the Sea Workshop, sponsored by the Institute of Southeast Asian Studies and the International Center for Living Aquatic Resources Management. November 1978. Manila. 24 p.

Hopkins, M. L., and E. W. McCoy. 1976. Marketing of fisheries products by municipal fishermen in Panquil Bay, Philippines. Auburn University Research and Development Studies #1. Auburn, Alabama. 11 p.

IPFC. 1978. Country Statement–Philippines: Indo-Pacific Fishery Commission, 18th Session, Manila, Philippines. 8-12 March 1978.

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

Juanite, T. R. 1978. Social inventory system: Its application prior to planned area change. Technical Report No. 1. Asian Research Institute for Social Development. Manila.

Juliano, R., and Cerdena. 1977. The Philippine fisheries in the year 2000, p. 1360-1387. *In* PREPF, Volume II-3B. Development Academy of the Philippines. Manila.

Juliano, R., and S. Yutuc. 1977a. An evaluation of fishery statistics toward the construction of statistical benchmark data for fish production, p. 1201-1247. *In* PREPF, Volume II-3B. Development Academy of the Philippines. Manila.

_____. 1977b. The present and future technological requirements of Philippine fishing industry, p. 1308-1359. *In* PREPF, Volume II-3B. Development Academy of the Philippines. Manila.

Kvaran, E. R. 1971. Marine fisheries potential in the Philippines and Southeast Asia. Fisheries Newsletter. Philippine Fisheries Commission. July-December 1971. Manila. p. 8-17.

Lawson, R. M. 1972. Report on credit for artisanal fishermen in Southeast Asia. FAO Fisheries Reports No. 122. Rome. 63 p.

Lawson, R.M. 1975. Interim report on socio-economic aspects of the development of artisanal fisheries on the east coast of Malaysia. SCS/75/WP/15. South China Sea Fisheries Development and Coordinating Programme. Manila.

LLDA. 1974. Survey of 1973 fishery catch in Laguna de Bay. LLDA Technical Paper No. 1. Laguna Lake Development Authority. Manila. 13 p., plus appendices.

Marine Sciences Center, University of the Philippines. 1979. Investigation of the coral resources of the Philippines (Phase II: final report). Diliman, Quezon City. (Approx. 300 p.)

Marr, J.C. 1976. Fishery and resource management in Southeast Asia. RFF/PISFA Paper 7. 62 p. Resources for the Future, Washington, D.C.

Marshall, Nelson. 1979. Fishery populations of coral reefs and adjacent shallow water environments. International Workshop on Tropical Small-Scale Fishery Stock Assessment. 19-21 September 1979. University of Rhode Island, Kingston. 14 p.

Medina, P. M., E. G. Tanyag, and C. V. Guerrero. 1976. Processing and marketing of smoked fish. Part I: Central Luzon. NFAC 76-2. Special Studies Division, Planning Service, Department of Agriculture. Quezon City. 29 p.

Menasveta, D., S. Shindo, and S. Chullasom. 1973. Pelagic fishery resources of the South China Sea and prospects for their development. SCS/DEV/73/6. FAO/UNDP. Rome. 68 p.

Mercene, E. C., and F. S. Mercene. 1973. Ecology of the benthic fauna of Laguna de Bay. The Philippine Journal of Fisheries, Vol. II, Nos. 1 and 2. January-December 1973. p. 51-60.

Munro, G. R., and Chee Kim Loy. 1978. The economics of fishing and the developing world: A Malaysian case study. Penerbit Universiti Sains Malaysia. Pulau Pinang. 139 p. and supplement, 22 p.

Munro, J. L. 1978. Actual and potential fish production of the Coralline Shelves of the Caribbean Sea. FAO Fisheries Report No. 200. Rome.

Navera, E. 1976. Fish marketing at the Navotas Fish Landing and Market Authority in Navotas, Rizal, 1973-1974. Unpublished M.S. Thesis. University of the Philippines College of Agriculture at Los Baños, Laguna, 1976.

NEDA. 1979. Philippine Food Balance Sheet 1976. Manila.

NEPC. 1977. Philippine environmental quality. First annual report, 1977. National Environmental Protection Council. Manila. 251 p.

Nimmo, H. A. 1972. The sea people of Sulu: A study of social change in the Philippines. Chandler, San Francisco. 104 p.

Norconsult/IKO. 1975-1976. Philippine fish marketing and distribution study. 7 Volumes. Published by BFAR. Manila.

Ordonez, J. A. 1973. The status of marine fisheries research. p. 9-18. First National Agriculture System Research Congress. University of the Philippines at Los Baños, Laguna. 12-17 February 1973. 106 p.

Pauly, Daniel. 1976. The biology, fishery and potential for

aquaculture of *Tilapia melanotheron* in a small West African Lagoon. Aquaculture 7 (1976): 33-49.

Rubio, C. A., D. Briones, J. Sison, and L. Villa. 1978. Field level (Bottom upward) planning and development of small-scale low-income fishermen communities in the Philippines: Padre Burgos, Quezon. University of the Philippines Department of Sociology. Quezon City.

Saila, S. B. 1975. Some aspects of fish production and cropping in estuarine system, p. 473-493. *In* Cronin, L. E., Editors. Estuarine research, Vol. I (Chemistry, Biology and the Estuarine System). Academic Press. 738 p.

Sainsbury, J. C. 1977. Practical technology transfer in small-scale fisheries. Paper prepared for USAID. International Center for Marine Resource Development, Kingston, Rhode Island. 26 p.

Samson, E. D. 1977. Recent, current and proposed research by social scientists on small-scale fisheries development in the Philippines. p. 177-184. *In* B. Lockwood and K. Ruddle, Editors. Small-scale fisheries development: Social Science Contribution. East-West Center, Honolulu. 215 p.

Samson, E. D., F. A. Tan, and A. R. Librero. 1977. The socioeconomic research studies to complement fisheries development plan in the Philippines. p. 185-202. *In* B. Lockwood and K. Ruddle, Editors. Small-scale fisheries development: Social Science Contribution. East-West Center, Honolulu. 215 p.

Sandoval, M. F. 1978. Awakening of a Fishing Village. Impact. Vol. 13, No. 10. October 1978. p. 340-345.

SCSP. 1976. Fishery resources of the Visayan and Sibuyan sea areas. Report of BFAR/SCSP workshop, 18-22 October 1976. SCS/GEN/76/7. South China Sea Fishery Development and Coordinating Programme. Manila. 26 p.

SCSP. 1977. Fishery resources of the Sulu Sea, Bohol Sea and Moro Gulf areas. Report of BFAR/SCSP workshop, 25-29 April 1977. SCS/GEN/77/11. South China Sea Fishery Development and Coordinating Programme. Manila. 23 p. plus appendices.

SCSP. 1978a. Pelagic resource evaluation. Report of the workshop on the biology and resources of mackerels (*Rastrelliger* Spp.) and round scads (*Decapterus* Spp.) in the South China Sea–Part I. 7-11 November 1977. Penang, Malaysia. SCS/GEN/78/17. South China Sea Fishery Development and Coordinating Programme. Manila. 46 p., plus figures.

SCSP. 1978b. Report of the BFAR/SCSP workshop on the fishery resources of the Pacific Coast of the Philippines, 18-22 September 1978. Naga City, Philippines. SCS/GEN/78/19. South China Sea Fisheries Development and Coordinating Programme. Manila. 48 p.

SCSP. 1978c. Report of the workshop on the demersal resources of the Sunda Shelf. Part I–SCS/GEN/77/12. South China Sea Fishery Development and Coordinating Programme. Manila. 51 p.

Sevilleja, R. C., and E. W. McCoy. 1979. Fish marketing in Central Luzon, Philippines. Research and Development Series No. 21. International Center for Aquaculture, Auburn University, Auburn, Alabama. 23 p.

Smith, I. R. 1979a. A research framework for traditional fisheries. ICLARM Studies and Reviews No. 2. International Center for Living Aquatic Resources Management. Manila. 45 p.

Smith, I. R. 1979b. Traditional fisheries development in the Philippines. Paper presented at the Vth International Symposium of Tropical Ecology. Kuala Lumpur, Malaysia. 16-21 April 1979. 7 p.

Spoehr, A. In press. Protein from the sea: Technological change in Philippine capture fisheries. Ethnology Monographs, No. 3. Department of Anthropology, University of Pittsburgh.

Stevenson, D. K., and N. Marshall. 1974. Generalizations on the fisheries potential of coral reefs and adjacent shallow-water environments. Proc. Second International Coral Reef Symposium, p. 147-156.

Szanton, D. L. 1971. Estancia in transition: Economic growth in a rural Philippine community. Institute of Philippine Culture (IPC) Paper No. 9. Ateneo de Manila University Press, Quezon City. 110 p.

Umali, A. F. 1950. Guide to the classification of fishing gear in the Philippines. Fish and Wildlife Service, United States Department of the Interior, Washington, D.C. Research Report 17. 165 p.

Valiente, A. M. Jr. 1975. Marketing of major agricultural products in Iloilo province. NFAC 75-11. Special Studies Division, Department of Agriculture, Quezon City. 154 p.

Vera Cruz, W. C., and I. P. Carlos. 1974a. Marketing of major agricultural products in Lanao del Sur. NFAC 74-27. Special Studies Division. Department of Agriculture. Quezon City. 59 p.

Vera Cruz, W. C., and I. P. Carlos. 1974b. Marketing of major agricultural products in Lanao del Norte. NFAC 74-32. Special Studies Division. Department of Agriculture. Quezon City. 75 p.

Warfel, H., and P. Mannacop. 1950. Otter trawl exploration in Philippine waters. Research Report No. 25. Fish and Wildlife Service, United States Department of the Interior, Washington, D.C.

World Bank. 1976. The Philippines: Priorities and prospects for development. The World Bank, Washington, D.C. 573 p.

Yap, C.L. 1977. Trawling: its impact on employment and resource use on the west coast of Peninsular Malaysia, p. 29-55. *In* B. Lockwood and K. Ruddle (eds.) Small-scale fisheries development: social science contribution. East-West Center, Honolulu.

Yutuc, S., and G. Trono. 1977. A review of the Philippine fisheries resources and their productivity, p. 1138-1200. *In* PREPF, Volume II-3B. Development Academy of the Philippines, Manila.

Appendix 1. PCARR Marine Fisheries Research Priority Areas (as of July 1978)

Rank	Research Area
1	Improvement of sustenance and commercial fishing craft, method and gear
2	Stock assessment
3	Exploratory fishing
4	Biological and oceanographic studies
5	Fishery resources management and conservation
6	Fish, invertebrate and seaweed processing and utilization
7	Biology and ecology of invertebrates, with emphasis on the commercially important species
8	Seaweed biology and ecology
9	Economics and management practices
10	Fish marketing systems
11	National sampling survey of marine fisheries statistics
12	Sociological studies of fishing villages/communities
13	Pollution studies
14	Marine pharmacology

Source: Fisheries Division, PCARR, Los Baños, Laguna.

Appendix 2. PCARR Inland Waters Research Priority Areas (as of July 1978)

Rank	Research Area
1	Physical inventory and classification of inland waters
2	Stock assessment
3	Limnology of inland waters
4	Development and evaluation of management techniques
5	Biology and ecology of economically important fish species
6	Conservation and utilization of swamps and mangroves
7	Pollutants and sedimentation, in relation to biota
8	Hydro-meteorology
9	Biology and ecology of economically important invertebrates and vertebrates, other than fish
10	Handling, processing, transport and marketing of harvest from inland waters
11	Socioeconomic studies in inland waters fishing communities
12	Improvement of fishing gear
13	Parasites and diseases of economically important species in inland waters
14	Biology and productivity of alga important in fish production
15	Biology, ecology and utilization of aquatic vascular plants

Source: Fisheries Division, PCARR, Los Baños, Laguna.

Appendix 3. Descriptions of the Major Municipal Fishing Gear

1. GILLNET

Description: These are curtain-like nets consisting of a set of one or more pieces of rectangular nets made usually of cotton or nylon twine. Fish capture is effected by gilling or entangling the fish in the net. There are three kinds of gillnet, depending upon method of operation; namely, bottom set gillnet, drift gillnet, and encircling gillnet.

a. Bottom Set Gillnet (Figure 11)

Operation begins early in the morning, for about 4 hr. The net is set at the bottom floor, perpendicular to the flow of current, with weights at both corner ends of the lower part of the net and floats tied to the float line. Using wooden plungers, the fishermen then drive the fish toward the set net. Hauling operation starts as soon as enough fish have been gilled. This is accomplished by retrieving both the float line and the sinker line. While the net is being hauled, the gilled fish are collected.

b. Drift Gillnet (Figure 12)

The main difference between the operation of a drift gillnet and the bottom gillnet is that the former is free to move with the current while the latter is set at the bottom floor. The drift gillnet operates at a deeper depth of about 5 to 7 fathoms. The gear is set late in the afternoon before sunset, leaving the net drifting horizontally according to the direction of the current. Two lighted kerosene lamps are attached to both ends of the gear, with one end tied to the banca. To check possible catch, scouting along the set gear is done. Unusual movement of the floats on any portion of the net indicate fish catch. The gilled fish are detached from the net during hauling operation, which is done by retrieving both the float line and the sinker line.

c. Encircling Gillnet (Figure 13)

This is operated near the coast early in the morning, in an operation which lasts about 4 hr. This type of gillnet is laid out in a circle or an arc of a circle, and the catching process is hastened by frightening the fish with various devices. The catch is hauled by first retrieving the sinker line, followed by the float line.

2. BAG NET (Figure 14)

Description: The bag net is a boxlike net operated from outriggers of a banca, known as "basnig." The net is a big bag with a wide open mouth made of cotton or nylon nettings. The gear resembles an inverted mosquito net when set under the "basnig." Attached to the corners of the net are pull ropes with lead sinkers, which serve as weights during operation.

Method of operation: Operation of the bag net usually lasts from 1800 hr to 0500 hr during the dark phase of the moon. Upon reaching the fishing ground, the banca is anchored and the lights are put on to attract schools of fish. Fish attraction usually lasts for about 2 hr. The lights' intensity is reduced when enough fish have been detected. Reducing light intensity encourages the fish to move nearer the surface of the water towards the light. When enough fish have been attracted, the net is dropped below the school of fish. During this stage, light intensity is again increased, to let the fish move inside the net. Hauling the net is simply done by retrieving the pull ropes all at the same time. If the net will be hauled at the port side, the pull ropes at the starboard side will have to be transferred to the port side, passing under the banca one after the other. The net is retrieved to a certain level where it will be possible to scoop the fish, using a brail.

3. BEACH SEINE (Figure 15)

Description: The shape and design of a beach seine is similar to the gillnet. However, this gear is much bigger in size and the fish is captured while the net is being dragged towards the shore. The gear is made either of sinamay cloth, cotton or nylon nettings. It consists of a bait or bag, with two wings on both sides. The gear is made up of the head rope, ground rope, pull rope, floats, sinkers and nets.

Method of operation: The beach seine is usually operated early in the morning near the shore. Upon reaching the fishing ground, the fishermen scouts for a school of fish. When a school has been detected, the boatman runs in a semicircle course while the net is being paid out. Upon encircling the fish, the pull ropes at both ends of the net are dragged manually towards the shore. This needs, of course, a large number of fishermen or of other household members.

4. PUSH NET (Figure 16)

Description: The gear consists of a triangularly framed, collapsible net. The net is made of sinamay cloth or cotton netting; it is mounted on two bamboo poles, crossed over the other, thereby forming a triangle. Both ends of the bamboo poles are fitted with wooden shoes, to allow easy sliding of the gear along the bottom during operation.

Method of operation: The gear is operated by one man during low tide. The coralling of fish is effected by a forward, horizontal motion along the bottom of shallow waters within wading depths. The fish are captured by a vertical lifting motion of the gear.

5. BABY TRAWL (Figure 17)

Description: The gear consists of nylon twine nettings constructed in the form of a conical bag and with wings at both sides. The gear is provided with two otter boards attached by a towing line at some distance from the tip of the wings. The otter boards act as kites, to open the mouth of the net and increase the effective fishing width of the gear. Floats and sinkers are also provided, to keep the gear mouth open during operation.

Method of operation: Upon reaching the fishing ground, the gear is paid out, with the net, sinker and floats, towing line, and otter boards thrown overboard accordingly. The boat continues to run at a very slow speed while the gear is being set. When the gear has been finally cast to the water, the banca goes full speed to stretch the towing line and to allow the gear to take its correct shape. The entire gear is dragged at a low speed for about half an hr, after which gear is hauled manually. The engine is stopped during the hauling operation. Total trawling time per day is approximately 45 hr.

6. ROUND HAUL SEINE (Figure 18)

Description: The gear consists of nylon nettings with a bunt at the center and wings at both sides. When paid out, the gear is of bowl shape. Floats and sinkers are provided to keep the gear in correct shape while in operation. Pull ropes are attached at both ends of the wings.

Method of operation: Round haul seine is operated during the dark phase of the moon and using three bancas. Lights ("lampara") are used to attract schools of fish. When enough fish have been attracted, the net is laid out in a circle. At this stage, a banca is stationed at each wing and another one at the middle of the net. The bancas keep the net in round shape. Finally, the pull ropes attached at both wings of the net are immediately retrived to impound the school of fish at the bunt. The catch is then brailed out with the use of a scoop net.

7. BABY PURSE SEINE (Figure 19)

Description: The gear is a large rectangular net, held vertically in water by floats attached at the float line and by sinkers at the sinker line. The gear has the bunt or landing piece at one end, and the whole net is provided with a pursing device. The latter consists of a series of pursing devices attached to the footrope by straps or ring bridles. A pursing line through the rings closes the bottom of the seine when pulled, thereby forming a trap or purse.

Method of operation: The gear is operated during the dark phase of the moon and with the use of two bancas, namely, the motherboat and the skiffboat. Schools of fish are attracted with the use of fish shelter, or "payao," and lamps. The skiffboat pays out the net in a circle around the attracted school of fish. During the setting, one end of the net is tied to the motherboat and the other to the skiffboat. When the skiffboat has completely encircled the school of fish, the sinkerline is retrieved by the motherboat to close the bottom of the seine and thus prevent possible escape of the fish. Before the net is completely hauled out of the water, the catch is brailed, using a scoop net.

8. RING NET (Figure 20)

Description: A ring net is a tuck seine which, in structure, combines the features of the round haul seine and the purse seine. The gear is a strip of long webbing of net and, like the round haul seine, has the bunt at the center and wings flanked at both ends. Similar to the purse seine, the ring net has a pursing device which closes the bottom of the net during operation, thereby impounding the school of fish.

Method of operation: Fishing operation is done from late in the afternoon up to midnight. Schools of fish are attracted with the use of fish shelters, or "payao," and lighted lamps. Divers constantly observe the behavior of fish beneath the fish shelter. Two bancas are needed during the fishing operation. During the setting, the gear is horizontally laid out in a circle (in contrast to the vertical setting of purse seine), with each end tied to each of the boats. When the school of fish is right above the bunt part of the net, the two purse lines are retrieved to close the openings of the net and thereby trap the fish. The fish are then brailed, using a scoop net.

9. LIFT NET (Figure 21)

Description: The gear is square shaped and consists of fine meshed nylon net. Attached to the four square ends of the net are pull ropes, which are then tied to bamboo poles planted at the bottom sea floor.

Method of operation: The gear is operated at a depth of 5 to 7 fathoms during the dark phase of the moon. Lighted kerosene lamps, meant to attract the schools of fish, are placed at the center above the set net. When enough fish have been attracted, the gear is lifted up by retrieving the four pull ropes. The catch is brailed with the use of a scoop net.

10. DRIVE-IN NET (Figure 22)

Description: The gear has two main components, namely, the net and the scare line. The construction and design of the net is similar to that of the push net. It consists of the footline, the main body and a bunt, to where the catch is concentrated. The net is structurally supported by bamboo poles attached to both sides of the net. On the other hand, the scare line consists of a long chain brailed with buri or banana leaves. Towing ropes are attached to both ends of the chain. Drive-in nets can also be much larger, requiring the combined efforts of even over 100 fishermen (see Figures 7 and 8).

Method of operation: Drive-in nets are usually operated during day time from 0700 hr to 1300 hr. The net is set at 1 to 3 fathoms deep, with the scare line about 600 m away from it. The scare line is dragged by two bancas toward the net thereby, as the name implies, scaring and guiding the fish towards the net. The moment the chain hits the footline, the net is immediately lifted, to prevent possible escape of fish. The catch is brailed with the use of a scoop net.

11. FILTER NET (Figure 23)

Description: Filter nets are conical in shape, with the mouth at one end and the bunt at the other end. Mesh webbing of the bunt is smaller in size, compared with that of the main body. The net is set with the mouth facing the water current. The net is supported by wooden poles which are fixed at the bottom sea floor. The gear has no nonreturn valve.

Method of operation: The gear is usually operated along mouths of rivers. It is set where the current is sufficiently strong, to activate the filtering action of the gear.

12. FISHPOT (Figure 24)

Description: Fishpots are usually baited enticing devices made of bamboo, rattan or chicken wire in the form of regular receptacles and with a nonreturn valve, which provides easy entrance but difficult exit. Attached to the gear is a pull rope, for hauling use.

Method of operation: The gear with bait on it is just dropped in the water. It is provided with a cork float which serves as a marker. The fishermen haul the gear about 6 to 10 times in one night.

13. HOOK AND LINE (Figures 25 and 26)

Description: A single vertical line carrying one or more barbed and baited hook. The line and hook are usually made of nylon and steel, respectively.

Method of operation: Upon reaching the fishing ground, the banca is anchored and lights are put on, to attract fish. The lines with baited hooks are simply dropped in the water. Constant pulling of the line is necessary to effectively attract fish. Catch is easily detected when the line becomes heavy enough due to the struggle of fish. At this stage, the line is pulled by a sudden jerk to set the hook. The gear is hauled by simply retrieving the line.

14. LONGLINE (Figure 27)

Description: The longline consists of a multiple series of baited hooks and is set to drift at the subsurface level of the sea. For convenience, the longline is divided into units called baskets, each of them one complete unit of a longline gear. The baskets are joined together to form one set. Each basket consists of the following parts:

a. Mainline. This is the part of the gear that is suspended horizontally below the surface of the water. To this part, the lower end of the float line and the upper end of the branchline are attached.

b. Float Line. This part holds the mainline horizontally below the surface of the water. A glass float and flagpole are attached to the upper end of each float line. There are two regular float lines in one basket, one at the head of the mainline and the other at the end.

c. Branchline. The section of a basket where the hooks are connected and suspended in the water.

Method of operation: The line is set usually in early dawn, at about 0100 or 0200 hr. Operations usually last for about 3 to 4 hr. Setting of the line is done by basket. The float line, with its glassfloat and flagpole, is first shot overboard, followed by the mainline and the

branchline, with its baited hooks. Before the coils in the basket are cast overboard, the tail end of the line in the first basket should have been already joined with the end line of the next basket. This is done continuously until the last basket has been cast overboard. Another flagpole is attached to the tail end of the last basket.

After setting the line, the banca moves some distance away from the longline. Abnormal movements of the float indicate presence of catch. Patrol units then proceed to determine the possible catch that can be hauled immediately, so as to prevent damage to the catch by sharks. Manual hauling of the line is done after 4 hr of operation. As the mainline is pulled overboard, the float line and the branchline, together with the catch, are detached. The gear is always hauled from the direction perpendicular to the longitudinal axis of the boat.

15. FISH CORRAL (Figure 28)

Description: Fish corrals are permanently fixed to the bottom. They consist of a guiding barrier (constructed of bamboo, branch or chicken wire), three playgrounds and a bunt. The gear is of such a shape as to direct the voluntary movement of fish into the bunt.

Method of operation: Fish corrals are set in well-sheltered waters along seashores and rivers. They are constructed in such a way that fish are led to the mouth of the corral by the current and into a succession of enclosures until they reach the terminal pound or the bunt. Hauling is done by scooping the catch concentrated at the bunt.

INTERNATIONAL CENTER FOR LIVING AQUATIC RESOURCES MANAGEMENT

The International Center for Living Aquatic Resources Management (ICLARM) is an autonomous, nonprofit, international scientific and technical center which has been organized to conduct, stimulate, and accelerate research on all aspects of fisheries and other living aquatic resources.

The Center was incorporated in Manila in 20 January 1977 and its operational base was established in Manila in March 1977. Although the interests of ICLARM are worldwide, initially the organization's primary attention is being directed to problems in Southeast Asia and the Southwest Pacific.

ICLARM is an operational organization, not a granting or funding entity. Its program of work is aimed to resolve critical technical and socioeconomic constraints to increased production, improved resource management, and equitable distribution of benefits in economically developing countries. It pursues these objectives in the fields of aquaculture, traditional fisheries, resource development and management, fisheries affairs, and education and training through cooperative research with institutions in developing and developed countries.

Policies are set by a Board of Trustees with members drawn from the international community. Direction of ICLARM, under the policies set by the Board, is the responsibility of the Director General. Advice on programs is received by the Director General from a Program Advisory Committee composed of scientists drawn from the international community.

The ICLARM core staff consists of internationally recruited scientists drawn from the areas of aquaculture, fishery biology, population dynamics, economics, anthropology, and international law. In addition, provision is made for interns, consultants and visiting fellows, contributing to breadth of competence and flexibility. The core program and core staff are supported by private foundations and governments.

FISHERY INDUSTRY DEVELOPMENT COUNCIL

The Fishery Industry Development Council (FIDC) of the Ministry of Natural Resources, Government of the Philippines was created by Presidential Decree 704 (Fisheries Decree of 1975) to formulate and establish comprehensive policy guidelines for the management, protection, conservation and utilization of the fishery/aquatic resources of the country and for the creation of a healthy investment climate for the development of the fishery industry. In pursuit of these objectives, FIDC's responsibilities are: the preparation of the Integrated Fisheries Development Plan, policy research and formulation, program/project initiation and development, program and project monitoring and evaluation, coordination and review of activities of government fishery agencies, research and academic institutions and industry.