

A Research Framework For Traditional Fisheries

Ian R. Smith



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**INTERNATIONAL CENTER FOR LIVING AQUATIC RESOURCES MANAGEMENT
MANILA, PHILIPPINES**

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By IAN R. SMITH

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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 fishermen and alternative development policies and programs that seek to alleviate them. These reviews seek to summarize and generalize from previous research results and development experience in the belief that valuable insights can be gained by taking stock of what is already known. Moreover, the reviews seek to address the broad issues of development and management policies regarding the traditional fisheries sector and to encourage a research and development climate in which meaningful discussion and analysis of alternative policies are possible.

This monograph, *A Research Framework for Traditional Fisheries*, which concentrates on Southeast Asia is the first prepared in this connection. It was written during my first year as an ICLARM staff member and serves as a backdrop against which country-specific research reviews are being undertaken. Country-specific

papers, although of course varying in scope and underlying theme, cover resource, technological, socioeconomic, and institutional aspects of traditional fisheries production and distribution, and are joint projects of ICLARM and institutions in the country concerned.

A primary purpose of this monograph is to identify those areas of traditional fisheries research which have the greatest potential for contributing to the solution of problems facing traditional fishermen and their communities. To achieve this purpose, this monograph draws on both theoretical and empirical considerations available in the widely scattered literature of traditional fisheries. The conclusions of this monograph establish priority areas that will guide the traditional fisheries research program of ICLARM, details of which can be found in ICLARM's program statements.

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ICLARM, Manila
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There is an explicit link between development programs and supportive research endeavors. If the goal of development programs is to raise the standard of living of traditional fishing communities, the goal of research should be to expand and clarify the alternative choices available to decision makers, be they government policy makers or project managers, private entrepreneurs, or fishermen themselves.

A primary purpose of this monograph is to identify those areas of traditional fisheries research which have the greatest potential for contributing to the solution of problems facing traditional fishermen and their communities. To achieve this purpose, the monograph draws on both theoretical and empirical considerations available in the widely scattered literature of traditional fisheries. Following an overview which examines the goals and potentially conflicting objectives of development planning, a categorization of problems of traditional fisheries as either empirical or suppositional is proposed. The former involves the concrete difficulties facing fishermen such as limited 'open-access' resources, inadequate vessels and gear, lack of market power, lack of alternative income sources, and inflation. The latter, on the other hand, involves the assumptions that decision makers bring to bear on matters of development policy, planning, and research. It is argued

that fishermen and fishing community oriented perspectives are essential to understanding the problems and prospects of development in this sector.

After tracing the changing emphasis of past development programs, the paper discusses alternative development strategies, analyzes the relevant theoretical predictions and research issues associated with each, and concludes that long-term solutions to problems of low standards of living lie in reducing rather than in increasing fishing effort.

The futility of relying on approaches that directly or indirectly intensify the level of fishing effort (except in those decreasing number of cases where the resource remains underexploited) implies that priority for development and research should be given to those programs that reduce fishing intensity. The following four general research areas are therefore suggested:

1. Assessment of stocks exploited by traditional and industrial fishermen and estimation of maximum sustainable yields;

2. Development of management tools and programs appropriate for limiting fishing effort in the multispecies fisheries exploited by traditional and industrial fishermen;

3. Reduction of waste in the distribution system and exploration of ways in which resulting benefits can be

channeled to traditional fishermen; and, most importantly,

4. Development of alternative or supplementary income sources for traditional fishermen and their households.

Complementing these priority areas, indeed to some extent a necessary precondition of their application, is the requirement to develop an understanding, on the one

hand, of the resource/fisherman/distribution continuum and, on the other hand, of the linkages among fisheries, fishing communities, and other rural sectors and institutions, including government. The former is a vertical concept and the latter an horizontal concept, which taken together imply the necessity for an holistic perspective of fisheries and fishing communities.

Introduction

The general conditions of poverty characteristic of traditional fishing communities around the world have increasingly drawn the attention of governments and other change agents in recent years, and have led to the initiation of development programs of varied hue and form. These programs, although expressing a variety of specific objectives, have as their urgent goal, implicitly if not explicitly, the raising of the standard of living of these communities. This objective is a recent addition to those generally ascribed to national fisheries development policies, which have on the whole concentrated on increasing production. This redirection of emphasis is important because it permits the search for solutions to the problem of low standards of living in fishing communities to expand beyond those areas which are fishery-specific.

An emphasis on technological solutions that sought to improve vessels and gear has declined as the fundamental biological constraint of the 'open-access' resources exploited by traditional fishermen has been appreciated and as both biological and economic overfishing have been documented.¹ Moreover, as evidence mounted that technology-based development programs frequently exacerbated income inequalities within and between communities, the relevant constraints to raising the standard of living came to be recognized as primarily socioeconomic and institutional in nature. Consequently, solutions are beginning to be sought within the context of rural development programs that have as their objective a general uplifting of rural areas. Fisheries should be seen as encompassing input supply, production, and distribution sectors, each with linkages to other sectors in rural areas, thus necessitating an appreciation by planners and managers for the broad economic and social impact of fisheries programs that they may recommend. Despite

the generalized approach implied by rural development schemes, however, there is a need to retain flexibility in programs and projects designed for fishing communities. Variability in resource availability and the heterogeneity of fishermen and fishing communities imply the necessity for projects that are locale-specific, that take into account the needs that fishermen themselves identify, and that appreciate the vertical and horizontal linkages that traditional fisheries and fishing communities have with other sectors and institutions.

There is an explicit link between development programs and supportive research endeavors. If the goal of development programs is to raise the standard of living of traditional fishing communities, the goal of research should be to expand and clarify the alternative choices available to decision makers, be they government policy makers or project managers, private entrepreneurs, or fishermen themselves.

The purpose of this paper is to examine the problems of traditional small-scale fisheries and to establish a generalized framework for productive research in this field. Following an overview of the sector, which concentrates on the Southeast Asian region, and which examines the goals and potentially conflicting objectives of development planning, a categorization of problems of traditional fisheries as either empirical or suppositional is proposed. The former involves the concrete difficulties facing fishermen such as limited resources, inadequate vessels and gear, lack of market power, lack of alternative income sources, and inflation. The latter, on the other hand, involves the assumptions that decision makers bring to bear on matters of development policy, planning, and research. It is argued that fishermen and fishing-community-oriented perspectives are essential to understanding the problems and prospects of development in this sector.

After tracing the changing emphasis of past development programs, the paper discusses alternative development strategies and raises the relevant research issues associated with each. The paper concludes with a discussion of alternative approaches to traditional fisheries research and with recommendations for areas of concentration.

¹See Ciriacy-Wantrup and Bishop (1975) for the useful distinction between 'open-access' resource and 'common property' resource. An emphasis on 'open-access' would center on the fact that "the natural environment is available for use by whoever chooses to use it" (Bromley 1979), that is, upon use rather than ownership. 'Open-access' rather than 'common-property' will be used in this monograph.

An Overview of the Traditional Fisheries Sector

Discussions of development and research alternatives for traditional fishermen inevitably begin, and not infrequently end, with the question 'who are the traditional, or small-scale fishermen?' While a broad concept of the sector is necessary for further discussion, specific definitions appear to provide a less than satisfactory base from which to begin.

Classifications of fishing activities into small-scale or large-scale, inshore or offshore, artisanal or commercial have been made by numerous national bodies in attempts to define the target group for development purposes and for collection of statistics. Most often, the separation into groups has been made by vessel size or power unit, by type of gear, by distance from shore, or by some combination of these (SEAFDEC 1978). For example, Indonesia makes distinctions based on vessel size and whether or not the vessel is motorized. In the Philippines, all fishermen using vessels over 3 t are considered commercial; all fishermen using vessels of less than 3 t or no vessel at all are considered municipal fishermen. While Hong Kong and Singapore distinguish between inshore and offshore fisheries, Thailand's distinction between small-scale and large-scale is based upon type of gear used. Malaysia takes into account vessel displacement, type of gear used, and area fished. Because of these differences, one will find that what is considered small-scale in one country is large-scale in another; what is inshore in one is offshore in another.

While such distinctions are practical and indeed useful within a national framework, narrow definitions are not so useful when attempting to gain a broad understanding of the traditional fisheries sector. Rather than attempting to be specific, therefore, one could more usefully talk about ranges or rough categorizations of the technical and socioeconomic characteristics of the fishing activities of fishermen. For example, Kesteven (1973, 1976), using such an approach, distinguishes among industrial, artisanal, and subsistence fishermen. He considers both industrial and artisanal fishermen to be commercially oriented, while the catch of subsistence fishermen does not enter the market economy but is primarily for their own consumption or for barter trade. The vast majority of fishermen in the world fall into the artisanal and subsistence categories forming a continuum which in practice is difficult to separate in time and in space. It is to these two groups, which together shall be considered traditional fishermen, that the following discussion is addressed. Departing from Kesteven's distinction, the traditional fisherman category thus overlaps the commercial category, with a resulting distinction between industrial fishermen and traditional fishermen, rather

than between commercial and subsistence. The distinction between industrial and traditional fishermen is therefore primarily one of scale and management and income levels, rather than of market orientation.

Table 1 classifies industrial and traditional fishermen according to the characteristics established by Kesteven which are: fishing unit, boat and equipment, fishing practices, investment level, catch per fishing unit, productivity per fisherman, disposal of catch, economic standing, and social condition. To these components have been added: ownership to reflect owner-operator relationships; time commitment to reflect the time spent by the fisherman in his fishing activity; and processing of catch to indicate degree of processing and type of end user. Of significance is the fact that this categorization is only indirectly related to the resources exploited by the fishermen, reflecting Kesteven's point of view that "artisanal fishermen can participate in the exploitation of most resources, and are favorably placed for the exploitation of certain of them" (1976, p. 132). This categorization of traditional fishermen is not resource-specific and therefore covers those involved in both marine and inland fisheries.

Summarizing from Table 1, traditional fisheries are carried out by small-scale fishing units, often consisting of kin groups using small, occasionally powered-boats or none at all. The fishing activity is often part-time, and household income may be supplemented by other non-fishing activities of the fisherman. Payment to fishermen is on a share basis and vessels and gear are usually owner operated, as distinct from industrial fishing where there is more distance between owners and fishermen. Gear, which may be machine made such as nylon netting, is usually operator-assembled and requires minimal or no machine assistance to operate. Investment levels are low, with capital often borrowed from those who market the catch. Catch per fishing unit and productivity per fisherman range from medium to very low. Catch most often does not enter large organized markets, but is sold at dispersed points of landing or even at sea. Part or all of the catch is operator- and family-consumed. Traditional fishing communities are frequently isolated, both geographically and socially, and the standard of living of traditional fishing households is low to minimal.

The usefulness of this distinction between 'traditional' and 'industrial' can be recognized through an example. A commonly used reef fishing method in the Philippines is the muro-ami, or drive-in net. The method uses up to 200 swimmers who drive the fish into the temporarily placed net with the use of scare lines. While the technique appears to be 'traditional' and reminiscent of

Table 1. Comparison of technico-socioeconomic situations of industrial and traditional fishermen. Categories (1), (4)-(10), (12) and (13) are from Kesteven (1973). Phrases in parentheses are additions to or changes in Kesteven's characteristics.

	Commercial		Subsistence
	Industrial	Artisanal	Traditional
(1) Fishing unit	Stable, with division of labor and career prospect	Stable, small, specialized with no division of labor	Lone operators, or family or community group
(2) Ownership	Concentrated in few hands, often non-operators	Usually owned by senior operator, or operators jointly	Widely dispersed among participants
(3) Time commitment	Usually full-time	Frequently part-time	Most often part-time
(4) Boat	Powered, much equipment	Small; inboard motor (or small outboard)	None, or canoe
(5) Equipment	Machine-made, other assembled	Partly or wholly machine-made materials, operator assembled	Hand-made materials, operator assembled
(6) Practices	Machine-assisted	Minimal machine assistance	Hand-operated
(7) Investment	High; large proportion other than by operator	Low; entirely by operator (frequently borrowed from buyer of catch)	(Extremely low)
(8) Catches (per fishing unit)	Large	Medium or low	Low to very low
(9) Productivity (per fisherman)	High	Medium to low	Low to very low
(10) Disposal of catch	Sale to organized markets	Unorganized local sale, significant consumption by operator	Exclusively consumed by operator, his family, and friends; exchange by barter
(11) Processing of catch	Considerable for fishmeal and other nonhuman consumption	Some drying, smoking, salting; primarily human	Little or none; all for human consumption
(12) Operators's economic standing	Often high	Lowest brackets	Minimal
(13) Social condition	Assimilated	Often separated	Isolated communities

similar methods used by whole communities in the South Pacific, the Philippine operation is supported by a large mother ship (up to 500 t), making the operation clearly 'industrial' by our earlier categorization. A similar technique on a smaller scale, not supported by a mother ship, would be 'traditional.' Distinctions that center on combinations of technical and socioeconomic characteristics rather than specific definitions appear to provide the broadest framework for our understanding of the sector and to shed the most light on the immediate problem at hand, which is the low standard of living of traditional fishing communities.

Although the concept of a 'standard of living' has

many facets including income levels, infant mortality rates, nutrition, incidence of disease and sickness, and educational achievement generally grouped among others as 'quality of life,' the major dimension by which the standard of living of traditional fishermen can be readily measured is income levels. Above all, it is low income levels that set traditional fishermen apart from owners of industrial fishing vessels.

Despite the fact that information from the Southeast Asian region is neither complete nor consistent, it is possible to provide a broad picture of problems of low income from a few countries. Selected information from Indonesia, Philippines, Malaysia, and Thailand are pre-

sented in Table 2. Annual per capita incomes of fishermen are lower in all countries than average national per capita incomes. Income levels of fishing laborers, those who own no boat of their own, are particularly low, and, since the majority of traditional fishermen probably fall into this category (the ratio of fishermen to boats appears to be roughly 2.5:1), are more representative of the sector as a whole than are the higher income levels of boat owners. There appears to be rough equivalence between the extremely low levels of fishing laborers' per capita incomes in both Indonesia (\$56) and the Philippines (\$60). The higher household income of boat owners in the Philippines (\$821) than in Indonesia (\$455) is probably traceable, at least in part, to the higher percentage of motorized vessels in the Philippines (46%) than in Indonesia (2%). Annual household income of Philippine fishermen using nonmotorized vessels was \$677 while per capita income was \$106 (Herrin et al. 1978), both closer to the Indonesian boat operators' household and per capita averages of \$455 and \$81, respectively.

In addition to being absolutely low, fishermen's incomes exhibit marked seasonality. For example, on the east coast of Peninsular Malaysia, the northeast dry monsoon reduces the number of fishing days per month from 21 to 6 and the number of fishing hours per trip from 14 to 6 (Siwar and Ngah 1977). Fishing effort is thus reduced to one-eighth of nonmonsoon levels, and the result is that during the monsoon period, 94% of fishermen have household incomes below the M\$230 monthly poverty income level arbitrarily established by the government. This compares to 77% below this poverty level during nonmonsoon months.

Regardless of absolute levels of incomes, changes in purchasing power provide a more accurate indication of the seriousness of the situation in most developing countries. According to the Asian Development Bank in almost all developing countries, "there is evidence of a decline in real wages in the 1970's... brought about by the runaway inflation in the 1972-1974 period" (1977, p. 53). Traditional fishermen, despite the higher prices that their catch may bring, are on balance probably adversely affected due to the higher costs of fuel and other inputs. Fishermen themselves indicate in personal interviews that their standard of living is worsening. For example compilation of responses from 16 barrios surveyed since 1975 in the Philippines shows that only 22% of respondents believe their economic condition has improved within the last 5 yr (Baum and Maynard 1976a, b,c,d,e; Herrin et al. 1978; Gagni and Luna 1978; Rubio et al. 1978). Even if one treats these results with some reservation, the situation is clearly alarming.

Because incomes are low throughout the rural sector, it is not low fishing incomes alone that have attracted the attention of national governments. These traditional fisheries are important to national economies most frequently measured by the contribution to GNP, by reference to nutritional aspects, such as annual per capita fish consumption or the percentage of protein intake contributed by fisheries products, or by the numbers of fishermen employed. With regard to the first two criteria, it should be pointed out that industrial and traditional fisheries' contributions are usually combined, and disaggregation is difficult. In addition to the above quantifiable aspects, fishing and other rural activities are viewed as important contributors to the stability of rural com-

Table 2. Fishing household income levels (\$US) in Southeast Asia.

	Fishermen				Annual average national per capita income (1974)
	Operator	Laborer	Operator	Laborer	
Indonesia	\$455	262	81	56	95
Philippines	\$821	340	127	60	370
Malaysia	498			92	716
Thailand	210-374			n.a.	280

n.a.: Not available

Sources of data:

Indonesia : Atmowasono (1977)

Philippines : Herrin et al. (1978)

Malaysia : Labon (1974). Family size of 5.4 for Trengganu (Siwar and Ngah 1977) used to estimate per capita income.

Thailand : Cole and Anand (1975).

National per capita income figures from Gale Research Co. (1975).

munities. Raising the standard of living of traditional fishing communities is thus seen in part as a means of slowing rural-urban population drift.

Unfortunately, it must be emphasized that reliable statistics regarding traditional fisheries are notoriously hard to come by. In Southeast Asia, however, it is possible to develop an appreciation for the significance of traditional fisheries through an examination of the role of fisheries, including industrial and traditional, in terms of percentage contribution to GNP, of contribution to nutrition, and of employment. As indicated in Table 3, fisheries employ from 0.5% (Singapore) to 5.5% (Vietnam) of the economically active population and contribute from 0.3% (Singapore) to 6.7% (Kampuchea) of the value of GNP. A further indication of the important role of fisheries in terms of nutrition of the region is a range of 7.6 kg (People's Republic of China) to 48.1 kg (Hong Kong) annual per capita fish consumption. Additionally, fish makes up over 40% of the animal protein intake in most countries in the Southeast Asian region.

Traditional fishermen far outnumber industrial fishermen. Estimates of the numbers of traditional small-scale fishermen in developing countries worldwide reach as

high as 15 million (URI 1975). If this estimate is taken to cover those who are essentially full-time, and this certainly appears reasonable, the inclusion of those who are part-time would raise the estimate significantly. The sector's contribution to employment is further increased by inclusion of those input suppliers, processors and other middlemen also dependent upon the resource for their livelihood.

Moving from a worldwide perspective, it is possible to make some very rough estimates of numbers of traditional marine fishermen in the Southeast Asian region based in part upon extrapolation from published information on catch and gear types (SCS 1973). It is estimated that 45% of the South China Sea catch is from trawls, purse seines, and drift nets. An additional 4% is such locally important gear as longlines, bagnets, muro-ami, liftnets, and trolling and 6.4% from sea mussel collecting. The remaining 45% or 2.1 million mt (of which 0.93 million mt are estimated to come from the People's Republic of China), is caught by 'other fisheries,' which one can presume to be primarily traditional, or small-scale. Expanding the scope of available statistics beyond the South China Sea to include Indonesia and catch from those countries in the region that fish beyond

Table 3. Selected indicators of the role of fisheries (industrial, traditional) in national economies.

Country/region	Employment fisheries	Fisheries employment as % of labor force	Fisheries as % of GNP	Per capita fish consumption kg/yr	% of animal protein derived fish
Brunei	360	1.4 ^a	N.A.	N.A.	N.A.
China	N.A.	N.A.	N.A.	7.6	N.A.
Hong Kong	45,000	3.1 ^a	N.A.	48.1	29.7
Indonesia	1,081,000	2.4	3.4	10.2	65.3 ^b
Kampuchea	40,600	1.2	6.7	25.4	68.0
Malaysia	81,700	1.9	2.2	25.7	47.6
Philippines	687,900	4.8	3.6	24.2	54.0
Singapore	2,200	.5 ^a	0.3	41.5	42.8
Taiwan	298,000 ^d	5.2	2.4	39.1 ^d	N.A.
Thailand	64,277 ^e	1.7	3.2	19.1	50.4 ^f
Vietnam	317,400 ^g	5.5 ^a	5.2 ^g	15.1 ^g	67.2

N.A.: Not available.

Source: Except where noted, FAO (1973) Fisheries Circular 314. Labor force figures, from which the fisheries employment as % of labor force was computed, are from ADB (1978), except as noted below. Note the extremely high protein consumption of Hong Kong and Singapore. The estimate for Hong Kong appears questionable.

^aBased on estimates of economically active population as reported in ILO Yearbook of Labor Statistics (1970).

^bHadiwidjaja and Sumintawikarta (1970) estimate 81.3%.

^cMahmud (1970) estimates 69.1%.

^dChang (1976).

^eFisheries Record of Thailand (1975).

^fChakrabandhu (1970) estimates 53.9%.

^gSouth Vietnam only. Per capita fish consumption is average of North and South Vietnam as reported in Marr (1976).

the South China Sea increases the percentage share of total catch from traditional fisheries to 58% and allows an estimate of approximately 3.5 million traditional small-scale marine fishermen in the Southeast Asian region (see Table 4 for derivation of this estimate).

It should be pointed out that these estimates are based on extrapolation using two figures: (1) the estimated percentage of total marine catch caught by traditional fishermen and (2) the estimated weighted average annual catch per fisherman (1.33 mt) derived from numbers of traditional fishermen based on numerous and occasionally conflicting sources for 6 of the 11 countries in the Southeast Asian region. Consequently it is important to stress that the resulting figures should be viewed as only a rough guide.

Constructing similar data for the Southwest Pacific is much more difficult. FAO catch data for this region are incomplete and understated due to the nonreporting of subsistence catch data from outlying islands where fish, molluscs, and crustaceans are used almost exclusively for home consumption. Since no reliable estimates are available on numbers of fishermen, I have made what is probably a conservative estimate of 5% of the population or 230,000 traditional fishermen engaged at least part-time in capture or gathering. The total for the two regions thus approaches 4 million.

The number of traditional fishermen within the Southeast Asian and Southwest Pacific regions is thus extremely high, ranging on a national basis from lows of a few hundred in Brunei and Singapore, to hundreds of thousands in the Philippines, the Southwest Pacific, Taiwan, and Vietnam, to almost a million in Indonesia and over 1.5 million in China. If one assumes an average family size of six, there are approximately 25 million people in these two regions alone directly dependent upon traditional marine fisheries for their livelihood. The inclusion of traditional inland fisheries and of collectors of molluscs (e.g., Thailand) for which few statistics are available would further increase these estimates.

In addition to numbers of fishermen, the importance of the traditional fisheries sector is apparent from the goal-setting that results from national planning exercises. As observed by Lawson (1974, 1978), Lampe (1976), and Engvall (1978), the most common objectives of fisheries development plans are (1) to increase output; (2) to increase export earnings; (3) to raise income levels; and (4) to maintain or increase employment.

The first objective is based primarily upon a desire to meet nutritional requirements of rapidly expanding populations. The second objective reflects an interest primarily in development of industrial fisheries for export purposes. However, there are cases consistent with Kesteven's earlier point regarding access of traditional

fishermen to most resources, where traditional fisheries can benefit from the expansion of export markets. For example, a significant proportion of the shrimp that is destined for export from Indonesia is caught by traditional fishermen. In the Philippines, those traditional fishermen catching tuna species often sell their catch at sea either directly to Japanese vessels or to larger industrial vessels operating out of the major ports who in turn sell their catch to exporters. The third and fourth objectives have direct bearing upon the traditional fisheries sector which has been shown to be the major employer in most national fisheries, and in which income levels are universally low.

It would be a simple world indeed if these major objectives could be simultaneously achieved. Unfortunately, there are inherent conflicts among them, the reconciliation of which requires the setting of priorities by national fisheries planning bodies. For example, if one assumes that output increases are to be achieved through modernization of fishing fleets, the labor input will be reduced and employment will decline. Trends around the world have demonstrated the inevitability of the capitalization process in 'open-access' resource exploitation. In response, deliberate steps such as closure of coastal areas to trawlers are undertaken to maintain more labor-intensive operations, that is, to legislate inefficiency.

Additional conflicts are also apparent between a consumer orientation and a producer orientation. Often implicit in the first objective of increasing output is the desire to increase the availability of cheap protein. If one assumes that increases in total output are possible through expansion of the industrial fishing fleet (and as shall be shown, this is not necessarily a valid assumption), prices will be lower than they otherwise would have been had reliance remained on the traditional fishing fleet, and output therefore not increased. The lower prices imply a lower income for the fishermen.² In other words, what is best for the national economy in the form of increased fish production and protein availability may produce better incomes for only a small number of fishermen and could actually reduce those of many more (Crutchfield et al. 1974). As in agricultural settings in other parts of the world, the government may choose to subsidize either producer or consumer or both. Short of such direct intervention in the market process, however, priorities must be established among these various conflicting objectives.

²This is an oversimplification because the change in revenue (income) resulting from the increased supply depends upon the elasticities of demand and supply, and upon whether the maximum sustainable yield (MSY) has already been surpassed. See pages 25-27 for elaboration of this point.

Table 4. Estimated numbers of traditional fishermen (marine) and annual catch per fisherman in the Southeast Asian and Southwest Pacific regions.

Country	Total marine catch (mt) ^a	% from small-scale fisheries ^d	Marine catch small-scale (mt)	Estimated no. of small-scale fishermen	Annual catch per fisherman (mt)
Southeast Asia					
Brunei	1,561	28 ^b	437	325 ^l	(1.33)
China	2,312,000	98 ^c	2,265,760	1,678,000 ^l	(1.33)
Hong Kong	152,699	7	10,689	7,900 ^l	(1.33)
Indonesia	1,039,354	98 ^e	1,018,567	860,800 ^g	1.18
Kampuchea	10,800	20	2,160	1,600 ^l	(1.33)
Malaysia	513,059	23	118,004	65,000 ^h	1.82
Philippines	1,206,654	55 ^f	663,660	500,665 ^f	1.33
Singapore	15,775	29	4,575	650 ⁱ	6.98 ⁱ
Taiwan	531,000	46	244,260	181,000 ^l	(1.33)
Thailand	1,464,396	13	190,371	60,000 ^j	3.17
Vietnam	837,200	25	209,300	187,500 ^k	1.12
Subtotal or weighted average	8,084,498	(58)	4,727,783	3,543,440	1.33
Southwest Pacific ^m					
Papua New Guinea	63,029 ⁿ	25 ⁿ	15,757	230,000 ^o	(?)
Solomon Islands	18,600	N.A.	12,500		
New Hebrides	8,000	N.A.			
Fiji	5,456	N.A.			
French Polynesia	2,826	N.A.			
Trust Territory	6,053	N.A.			
Others	5,104	N.A.			
Subtotal or weighted average	109,068	25	27,267	230,000	(?)
Totals or weighted average	8,193,566	(58)	4,755,050	3,773,440	1.33

^aEven though separate national statistics are available in a few cases, for consistency, marine catch estimates are compiled from FAO (1977), except for Taiwan data which originate from Table 1, Marr (1976).

^bBased on average of Sarawak and Sabah from Table 1, SCS (1973).

^cMy estimate based on Solecki (1966). SCS (1973) estimate is 100% for 1971.

^dBased on 'other fisheries' category, Table 1, SCS (1973), unless noted otherwise. Malaysia includes lift nets.

^eSidarto and Atmowasono (1977).

^fSamson (1977). SCS (1973) estimate is 59% for 1970.

^gFisheries Statistics of Indonesia (1972).

^hSCS (1973) reports 26,000 vessels in coastal fishing. Assuming ratio of fishermen to vessels of 2.5:1, estimated number of fishermen is 65,000.

ⁱSCS (1973) reports that one-third of Singapore's 794 vessels in 1971 were engaged in coastal fishing. Assuming 2.5 fishermen per vessel gives an estimate of 650 fishermen. Note, however, that the results in an average catch of 6.98 mt per fisherman, a figure that subjectively appears to be too high.

^jAubray and Isarankura (1974) report 36,000 fishing craft, all but 3,200 devoted to artisanal fishing, and a fisheries population of 270,000. Fisheries Record of Thailand (1975) reports 64,277 fishermen. The number of traditional fishermen is probably around 60,000, not including sea mussel collectors whose number is not known.

^kSCS (1973) reports 75,000 vessels in coastal fishing. Assuming ratio of 2.5 fishermen per vessel, estimated number of fishermen is 187,500. URI (1975) estimates number at 300,000, including inland water.

^lNeither estimates of numbers of small-scale fishermen, nor annual catch estimates per fisherman are available for Brunei, China, Hong Kong, Kampuchea, and Taiwan. Numbers of fishermen are estimated for these countries using the weighted average catch of 1.33 mt per fisherman for other countries in the region.

^mFigures for total marine catch are FAO estimates of total catch. Freshwater catch is assumed negligible. Australia and New Zealand are excluded.

ⁿFAO (1977). Pownall (1972) and ADB (1978) estimate a higher figure of 80,000 t.

^oMy estimate, assuming 5% of the population of 4.6 million involved in fishing and gathering, at least part-time.

The conflicts among stated objectives arise in part due to the inherent divergent interests of various groups, including rural poor producers and urban poor consumers, and in part because of naive views or tacit assumptions regarding the limitlessness of the fisheries resource. These views of unlimited fishery resources have persisted for hundreds of years and were apparent in fisheries development programs and projects as recently as the early 1970s.

Our present interests are somewhat more parochial than an examination of ways and means to reconcile

these conflicting objectives, although their outline aids in understanding the importance of the fisheries sector. As stated in the introduction, the purpose of this presentation is to examine the major problems of the traditional fishermen and the contribution that research can make to their resolution. Implied, therefore, is the belief that a priority of research must be to aid in the development of programs that seek to raise income levels and the standards of living in traditional fishing communities.

The Problems Facing Traditional Fishermen: The Fisherman's Perspective

FACTORS CONTRIBUTING TO LOW STANDARD OF LIVING

To this point, it has been emphasized that the problem of traditional fishermen is that of a low standard of living, or more specifically, low incomes. There are, of course, many contributing factors to this general problem, and an examination of the major factors will assist in identifying possible solutions to which research thrusts can be related.

When examining traditional fisheries, it is useful to distinguish between two kinds of factors contributing to the low standard of living. Empirical factors, on the one hand, involve the concrete situation faced by fishermen and the communities in which they live. Suppositional, or analytic factors, on the other hand, involve the assumptions and approaches that decision makers use when defining and trying to solve empirical problems.

To a certain extent, empirical and suppositional factors are related in that empirical problems can flow from suppositional problems. For example, the lack of adequate vessels and gear or lack of market power which are classified here as empirical problems result in part from national development priorities and their attendant assumptions. The best example of the causal relationship relates to the 'open-access' nature of the fishery resource. By tacitly assuming unlimited resources, governments have been able to rationalize the issuing of licenses to industrial fishermen in some countries on such a scale that contributes to conflicts with traditional fishermen.

There are three kinds of empirical problems—biological, technological and socioeconomic—that face the traditional fishermen. These areas have often been treated separately by the respective disciplines involved. Instead, they should be treated as complementary and interacting. For example where overfishing already occurs, policies aimed at increasing fishing effort in a traditional fishery may be self-defeating. At the same time, the lack of more

and better information about biological aspects of a fishery should not be allowed to postpone attention to the socioeconomic and institutional problems of traditional fishing communities.

The major empirical problems that contribute to low incomes and low standards of living are limited fisheries resources, inadequate vessels and gear, lack of alternative income sources, lack of market power, and inflation (Figure 1). While, for sake of simplicity, Figure 1 indicates these as separate contributing factors, there is clearly interaction and reinforcement among them, making the figure reminiscent in some aspects to the 'vicious circle of poverty' identified by Nurkse (1953) as an explanation for agricultural stagnation. For example limited resources of an 'open-access' nature by themselves do not lead to low incomes unless entry of fishermen is unchecked. The lack of alternative income opportunities in the rural sector which intensifies fishing effort then couples with limited resources to reduce income levels. We will return to a discussion of solutions after examining these empirical problems, or contributing factors in detail.

Empirical problems must be put into a human context. What do they mean to the poorest of fishing households? On extreme days when bad weather precludes any fishing from the small barrios of Ilocos Norte, Philippines, for example, it means that the day's meals consist of rice and salt and nothing more. Even on good days the catch is so low that it does not go far when sold in order to purchase other necessities. It means that some families have never consulted a doctor, even though several are located only a few kilometers away, because they can not afford the nominal fee. It means that the family's sole possessions, besides its single room nipa palm house and the clothes they are wearing, are cooking utensils and some sleeping mats. It means that with no savings and no material possessions, the poorest fishing families