

## Small-Scale Fisheries in the Neotropics: Research and Management Issues\*

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### Abstract

The lack of comprehensive regional treatments of small-scale fisheries and the need for improved information for management purposes of this sector in the region are emphasized. Estimating total catches, mapping the seasonal deployment of fleets and quantifying their fishing effort as well as computing catch per unit effort and cost per unit catch for all major gears/species are crucial. In addition, the need to understand oftenly neglected issues, such as the mobility of fishers in and out of the fishery and the role of women in production, distribution and trade are emphasized. Finally, basic principles to follow in the design of policy interventions to avoid mistakes committed in other regions (notably in Southeast Asia) are suggested.

### Resumen

En este trabajo se destaca la carencia de estudios comprensivos sobre la pesca artesanal en la región y la necesidad de mejorar la información para fines de manejo. Se destaca la importancia crucial de recolectar en forma periódica datos sobre capturas totales, la confección de mapas mostrando la distribución de la flota y cantidad del esfuerzo desplegado, el cálculo de las capturas por unidad de esfuerzo y costos por unidad de captura para todas las artes y especies importantes. Se enfatiza además, la necesidad de comprender aspectos generalmente no considerados, tales como la movilidad de los pescadores hacia la pesquería o retiro de ésta y el rol de la mujer en la actividades de producción, distribución y comercialización. Finalmente, se sugieren principios básicos y simples a seguir en el diseño de políticas de intervención en la pesquería a fin de evitar errores cometidos en otras regiones (especialmente en el Sudeste Asiático).

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## Introduction

Although small-scale fisheries in developing countries may present substantial differences between one country and another or even within a particular region (Agüero 1991), several important common characteristics can be identified for analytical and management purposes. This is especially true when the ecology and hence the biological resource base and its response to exploitation, are similar between the regions that are compared (Bakun 1985). In this contribution we use Southeast Asia and the well documented fisheries in that region as "analogs" to the Neotropics (Fig. 1) and their less well studied fisheries. [We refer to Agüero, this vol., for basic information on the small-scale fisheries of the countries covered here, i.e., Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Mexico, Nicaragua, Panama and Venezuela.]

Our working experience in Southeast Asia, where small-scale fisheries play a significant social and economic role, has shown that lessons from this region may be highly relevant to the region defined in Fig. 1, particularly in view of avoiding a repetition of the errors committed in Southeast Asia (and elsewhere).

A quick review of the literature on small-scale fisheries immediately reveals that a unique and well accepted definition of the term does not yet exist, although several attempts have been made to provide such definition (Smith 1979; Emmerson 1980; Panayotou 1982). In this contribution we will not attempt to add a new one to the wide array of existing definitions and will

use "artisanal", "municipal" or "small-scale" fisheries as synonymous. In general, we will assume they all imply fishing activities involving low investment costs, small sizes and ranges of the crafts used (if any) as well as decentralized production and distribution/marketing systems. However, we will not address issues raised by purely "sustenance" fishers, who catch fish and other aquatic organisms only for their own consumption (no surplus) as these issues fall more in the area of expertise of specialists such as cultural anthropologists and sociologists. As women and children generally play an important role in small-scale fisheries, we shall use the term "fishers" instead of the restrictive term "fishermen".

## Artisanal Fisheries of the Neotropics in the Literature

Comprehensive regional treatments of the artisanal fisheries in the Neotropics seem to be absent. In fact, the basic references on this subject still appear to be a couple of now dated conference proceedings: one on "Artisan Fisheries Development and Aquaculture in Central America and Panama" (Estes 1976) and the other on "The Development of Small-Scale Fisheries in the Caribbean Region" (Higman et al. 1978). The University of Rhode Island has published results, on a country-by-country basis, of a study on small-scale fisheries in Central America (Sutinen and Pollnac 1981). Additional information of regional interest may also be obtained from various FAO or IDRC-supported projects and conferences.

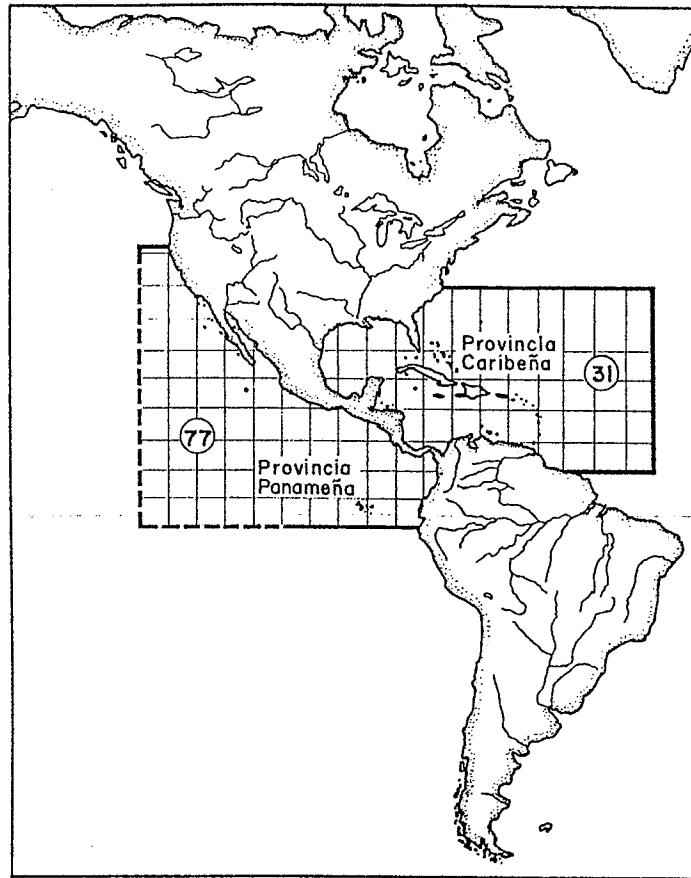


Fig. 1. Two FAO fishing areas (Western Central Atlantic [31] and Eastern Central Pacific [77]) covering the corresponding biogeographical provinces. The fisheries resources in these areas are similar in their response to exploitation to those in Southeast Asia, and commonalities also exist in the dualistic nature of the coastal fisheries (industrial *vs.* artisanal, see text). (*Dos de las áreas de pesca FAO [Atlántico Central Occidental (31), y Pacífico Central Oriental (77)], y las provincias biogeográficas correspondientes. Los recursos pesqueros en estas áreas son similares, en cuanto a su respuesta a la explotación, a los de las áreas en el Asia Suroriental; también existen similitudes en la estructura dualística de las pesquerías costeras (pesquerías industriales contra artesanales; ver el texto).*)

Yet issues pertinent to the dynamics and evolution of these fisheries (in the biological, sociocultural, technological and economic senses) must be well understood before they are subjected to any kind of "development" or "management" schemes. Interventions conducted in the absence of this information, given the complex network of cause-effect relationships prevailing in the fishery systems (not always deterministic in

nature) are likely to produce more undesirable effects than the expected benefits.

The above factors relate specifically to the renewable (but exhaustible) and common-property nature of small-scale fishery resources, the strong sociocultural determinants of production and marketing behavior of fishers, the high population growth and demand for small-scale fisheries produce and the "macro-

level" and politically oriented nature of most government interventions in this sector (Agüero and Lockwood 1986).

The point here is to avoid repeating in the tropical part of America the catastrophic development and subsequent devastation that has occurred in Southeast Asian Fisheries (Pauly et al. 1989).

What then are the issues relevant to the study of tropical small-scale fisheries in the Neotropics? We see two sets of them, one including the need of scientific research on issues common to the study of any fishery, industrial or artisanal, tropical or not, the other encompassing management problems resulting from the renewable and common property nature of small-scale fisheries and the marginalized situation of small-scale fishers in most tropical areas of the world. Both of these sets of issues are discussed below.

#### Research Needs for Artisanal Fisheries of the Neotropics

The first bit of information traditionally collected on any fishery that is the object of a scientific investigation has been the total monthly, then annual catch of that fishery (Gulland 1980). Total annual catch estimates are important because time series of such estimates can be used as input to a variety of mathematical or statistical models, e.g., production models (Schaefer 1954, 1957; Fox 1970; Pauly 1984). Total annual catch figures are also important because they offer a measure for the "size" (and gross value) of a given fishery, allowing fishery to be compared on a quantitative scale with other economic ac-

tivities, with which it may compete for resources such as infrastructural development funds.

Estimating the total catch of a given fishery, moreover, forces the investigator to *define* early in an investigation the resource complex that is studied, i.e., to define a "unit stock" and a "unit fishery", well separated from adjacent similar stock and fisheries.

This brings us to the second most important item in the study of a fishery, i.e., the spacio-temporal mapping of the distribution of fishing activities in the course of a year. What is meant here is the need to record, from the fishers themselves where, how, when, what and how much they fish during each period of the year. This information, which may be collected from unstructured interviews, should be plotted on maps [such plotting may, but need not involve the use of GIS]. Such maps, soon enough, will show patterns reflecting the seasonal distribution of the exploited resources, the fishers' own strategy over time and space, and the output of their fishing effort. These data will also allow estimation of the distribution and evolution of the value of catches as inferred by successive generations of fishers and corresponding market conditions<sup>1</sup>. To date, only site and time-specific data on these variables can be obtained from

<sup>1</sup> Recent experimental studies using satellite data on daily temperature distribution of water in small-scale fishing grounds has allowed effective prediction of fish distribution/abundance. This information transmitted to fishers has allowed them to increase the probability of encountering fish and has reduced costs associated with navigation and searching, thus increasing the net returns from their fishing activity (Barbieri 1987).

isolated or individual studies. No official statistics by government agencies of the region are collected on this basis; yet, considerable insight can be obtained from it for policy design and management purposes.

The estimation of total catch and the fishing maps both require a quantification of fishing effort, e.g., of the number of days deployed every month, and in the course of a year for every gear type. Such information is crucial to assess costs of fishing, and eventually fishing incomes. Care must be taken here, however, not to lump units of effort that have been standardized using their relative catches in cases when the sizes (or species) caught are very different (catching one tonne of 5 cm fish with a beach seine causes an impact totally different from that caused by catching one tonne of 50 cm fish with, say, drifting gill nets!). In fact, the best way to compare the relative catch efficiency of different gears is to compare their catch rates by size or age group of fish. Similarly, the best way to aggregate catches is to add numbers of fish caught, by size (or age) groups, rather than to simply add weights. (The reasons for this become evident when one analyzes catch data using length- or age-structured Virtual Population Analysis, one of the most powerful methods of fish population dynamics presently available; see Pauly 1984.)

Estimating total catches, mapping the seasonal deployment and quantifying fishing effort, as well as computing catch per effort and cost per unit catch (for all major gears) of a given fishery and by species when this fishing is a multispecies and multigear one, are activities that must be conducted whether

one investigates a large or a small-scale fishery.

Tropical small-scale fisheries require, for their understanding and effective management, two more crucial but often neglected items. The first of these is the mobility of the fishers into and out of the fishery (entry/exit patterns), both in seasonal terms and for longer periods. In many tropical developing countries, fishing is not the only activity that fishers perform. Combining agriculture or other rural activities with fishing is a common and often necessary practice (Smith 1979). Thus, the availability of alternative incomes (e.g., as workers in nearshore plantations), may determine the seasonality of fishing effort deployment, with seasonal abundance of catchable resources attracting fishers into fishing, and their decline, leading - given alternative opportunities - to movements out of fishing. Such movements, generally seasonal, are regulated by the "opportunity cost" of fishing, i.e., the income obtainable from an available alternative occupation (rural or urban) and the relative unemployment in adjacent activities such as agriculture, forestry or husbandry. Understanding the employment/unemployment cycles behind non-fishing activities adjacent to fishing communities is therefore necessary to avoid unexpected increases in effort deployment or large temporal changes in average incomes per unit of effort.

The other often neglected item that must be taken into account if fishing communities are to be well understood, is the role that women and children play in such communities.

At the production level, the quantities of aquatic organisms, e.g.,

those gleaned by women (and children) in nearshore areas often equal, and at times even exceed in bulk, the more spectacular catches made further offshore by the men. This is particularly well demonstrated in Oceania (Chapman 1987) and the Philippines (McManus 1989). Moreover, the regularity of supply derived from gleaning is an important factor which often carry households over the lean period. In addition, in many fishing communities, women are the ones that prepare the gears (cleaning and baiting hooks) before and after harvesting takes place.

Women also play a crucial role in the marketing level as well, where besides selling the catch, they may process landed fish (at least in part, e.g., by drying it) and hence stabilize supply to the market and adding value to the marketed product. They may also manage their husband's money, preventing it from being squandered on drinking, betting and other "male" pursuits. When women perform these and other related activities, their role becomes a structuring one, and ignoring it may very well lead to a failure in understanding, e.g., how decisions are made in such communities, a common reason why various "development schemes" have failed (Nauen 1989).

Although biological studies as on the migration, abundances and reproduction of the fish exploited by a given small-scale fishery are obviously necessary, they have not been previously mentioned because: (1) studying seasonal variation of catch per effort and of spacio-temporal deployment of effort is a method for studying the biology of the exploited organisms - in this case, their rela-

tive abundances and migrations. Moreover, it must be recognized that, unless carefully focused, biological studies will not provide insights into the operation of a fishery, at least not as straightforwardly as a direct study of catch, effort and related statistics will.

Thus, researchers working on artisanal fisheries should, as far as possible, attempt to use previously published information on the basic biology of the fish which form the base of a given fishery, and undertake only if these are absolutely necessary, the detailed studies on growth, mortality, reproduction, food and feeding habits, etc. often undertaken before the essential features of a fishery are understood. [A database, called FishBase is presently being created at ICLARM which contains for a large number of fishes, including hundreds of Neotropical species, the biological information (on growth mortality, ecology, feeding habit, etc.) that may be required for constructing various fishery models (Froese 1990; Pauly and Froese 1991), and the senior author may be contacted for details on its availability.]

#### **Management Issues Relevant to the Neotropics**

The basic reasons why fishery research should be conducted are: (1) to find out whether a given fishery needs to be developed, managed or otherwise intervened into, and (2) to identify and evaluate the "levers" with which such intervention can be best implemented.

Traditional approaches emphasize fish mortality as the key lever to regulate fisheries hence the emphasis in standard texts in its esti-

mation and the establishment of its relationship to fishery effort.

This approach is based upon two crucial, if tacit assumptions: (1) that fishing effort can be regulated, and (2) that regulations can be enforced effectively. Both of these tenets do not hold true in the case of most artisanal fisheries, and hence fishing effort cannot serve as the only "lever" for management in such fisheries. Rather, social and economic levers must be used. In such case, clarity must also exist as to the aims of interventions and the expected response of fishers to such interventions.

What conceivably can be reasons to intervene, i.e., to attempt to "develop", or to "manage" artisanal fisheries? Here are some commonly stated aims, not ranked in any special order:

- 1) to increase incomes or welfare within the communities;
- 2) to provide investment opportunities for entrepreneurs;
- 3) to increase fish supplies to domestic markets;
- 4) to balance regional development (resettlement programs, development poles, etc);
- 5) to reduce overexploitation of resources or conflicts with other sectors (tourism, industry, etc.);
- 6) to export high-value products to "reduce the external debt";
- 7) to provide more employment opportunities; etc.

These goals, lofty as they seem, are not all mutually compatible, and also may not be compatible with the size or status of the resource base of the fishing in question. Thus, goals (1) and (2) are incompatible with a depleted resource base, while (2) and (5), and (6) are in most cases mutually incompatible.

Thus, the first goal for anyone who wish to "develop" or "manage" an artisanal fishery, is to identify a set of goals that are mutually compatible, socially feasible and that are not at variance with the biological realities, i.e., lead to sustainable exploitation.

Particularly, it must be realized that any "development scheme" involving massive transfers of capitals is likely to result as a "side effect", in increased marginalizations of small-scale fishing communities, in exacerbation of conflicts between small-scale fisherfolk and large-scale operators and in overexploitation of the biological resource base.

Similarly, developing one's fishery such that it produces mainly for export, or to maintain tourism, will indeed on the short run contribute to foreign exchange being earned. However, on the long run, this will contribute to a distortion of the national fishery sector which, as is already noticeable in the case of several countries of the region considered here, will then fail to produce food for domestic markets.

The greatest danger of all, however, is probably to view or to use small-scale fisheries as social "dumps", into which landless farmers, unemployed youth and other marginalized people can be dropped. The notion that artisan fishing requires few skills is far from reality and therefore, landless farmers, unemployed agriculture workers or unskilled individuals often do not perform well as fishers. Indeed, the end results of such "dumping" are not only increased unemployment in the fishing sector, lower average productivity and general decrease in community welfare, but also unsustainable or destructive fishing

practices (e.g., the use of explosives and poisons), all contributing to what has been termed "Malthusian overfishing" (Pauly et al. 1989).

### Conclusion

The preceding discussion has attempted to show that information on a few but crucial aspects of small-scale fisheries is needed for effective policy design and intervention in these complex production systems. Thus, properly designed research can make a significant contribution to improved incomes of fishers without major expenses. Following established principles in designing management policies will help avoiding mistakes already committed in other regions. Moreover, there is a clear need to study not only biological and technological aspects of the small-scale fisheries but the sociocultural, institutional and economic factors as well.

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