



National Centre for Development Studies
The Australian National University

Islands/Australia Working Paper No. 90/11
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fisheries in the south Pacific
Gilles Blanchet

ISSN 0816-5165
ISBN 0 7315 0714 2

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Printed in Australia by Socpac Printery

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Research and development of small-scale fisheries in the south Pacific

Introduction

This survey deals with research and development of small-scale fisheries in the south Pacific, a zone of more than 30 million sq. km that spreads from the Republic of Palau in the west to the territory of Pitcairn in the east and includes 14 autonomous or independent territories and 9 dependent ones.¹ From a geographical point of view, Australia and New Zealand also belong to the zone but are only incidentally considered here because these countries are much less concerned with small-scale fisheries than tiny island communities.

The available material has generally been produced by academics, civil servants or experts working in public services or regional organizations. It is scattered through a variety of books, reports and papers and only the most accessible among them have been selected (cf. References) to provide a synthesis of commonly expressed views on the state of research related to small-scale fisheries development in the region. The following report consists of two parts. The first underlines the significant role played by small fisheries, and the second examines the trends of research in small-scale fisheries and evaluates its contribution to better resource utilization.

Background to small-scale fisheries in the region

It is difficult to make an accurate assessment of small-scale fisheries in the region because of a lack of reliable information about fish, fishing and fisheries which, until recently, reflected a lack of interest in small-scale fisheries.

A subordinated place. In quantitative terms as well as in relation to implemented policies, artisan fisheries are second to industrial fisheries. They nevertheless remain significant on a domestic scale despite the fact that their resources are limited, they have been neglected for a long time, and little is known about them. According to fishery statistics published by the FAO, landed fish registered in the world amounted to 82.4 million tons in 1984, half of that amount originating from the Pacific basin and only a small proportion from the south Pacific. Nonetheless, tuna industrial

¹The considered area extends to the Economic Exclusive Zones of the South Pacific Forum and the South Pacific Commission's members. The South Pacific Forum regroups the independent nations and autonomous territories of the region: the Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Solomon Islands, Western Samoa, Tuvalu and Vanuatu. The South Pacific Commission also includes dependent territories: Guam, North Marianas Islands, Norfolk, New Caledonia, Pitcairn, French Polynesia, American Samoa, Tokelau, Wallis and Futuna.

catches in the south Pacific region represented 20 per cent of world catches of these species. In 1984, about 150,000 tons of tuna were caught by fleets based in the region and 600,000 tons by foreign-based fleets.

Table 1 Estimated tuna industrial catches in the Pacific islands region, 1984

	Tons	Per cent
Fleets from distant-water fishing nations	600,000	80
Fleets based permanently in the region	150,000	20
Total	750,000	100

Source: Doulman, D., *Tuna Issues and Perspectives in the Pacific Islands Region*, East West Centre, 1987.

Foreign vessels numbered about 1300, mainly consisting of pole-and-liners and increasing numbers of trollers and seiners.

Tuna resources were identified at the beginning of the twentieth century but only began to be exploited in the mid 1950s by Japanese, Korean and Taiwanese companies which set up permanent fleets of pole-and-liners in regional waters as well as landing bases for shipments and transportation of collected products. In 1985, 164 pole-and-liners, sixty trollers and twenty-nine seiners were registered in the south Pacific islands and five canning industries were in operation in American Samoa, Hawaii, Fiji and Solomon Islands with a fish transformation capacity of 210,000 tons. Shipment facilities were also established in Palau and Vanuatu. Most of these activities were implemented by multinational firms like Star-Kist, Van Camp, C. Itoh, Mitsui, Mankatsu and Taiyo. Ninety per cent of the capital invested in vessels fishing in the region was owned or controlled by foreign interests. Three out of five canneries were owned by US based multinational firms and the two others operating in Fiji and the Solomon Islands resulted from a joint venture between local authorities and Japanese firms (Doulman 1987a).

Table 2 gives some idea of how important fishing is for island countries. According to the FAO, fish exports represented 28 per cent of total exports of the Solomon Islands in the late 1970s, setting the country in the fifth world position in this field. At the same time, annual fish consumption per inhabitant in Vanuatu was estimated at 76.5 kilograms, placing the country third in rank of world fish consumers. Similarly, the percentage of employment related to fishing in Tonga and the Solomon Islands (37.7 per cent of active population in the Solomon Islands and 12.7 per cent in Tonga) was among the highest in the world (Lawson 1980).

Table 2 Fish consumption and production in the Pacific islands region, 1981

Country	Fish consumption			Fish production
	Per capita (kg/year)	% total protein supply	% animal protein supply	tonnage ('000)
Fiji	26.7	12.9	36.5	23.5
Kiribati	-	-	-	19.2
Papua New Guinea	16.5	10.6	31.2	26.9
Western Samoa	24.0	-	-	3.0
Solomon Islands	21.0	15.1	47.1	27.0
Tonga	21.0	-	-	2.0
Tuvalu	-	-	-	0.1
Vanuatu	76.5	31.9	50.7	2.7

Source: FAO, *Review of the State of World Fishery Resources*, Fisheries Circular no.710, 1987.

However, these data cannot be extrapolated to the whole region. They are related specifically to an industrial exploitation of tuna and migratory movements may change from year to year. From this point of view, some countries benefit more than others because of a favourable location, as is the case for the Federated States of Micronesia, Marshall Islands, Kiribati, Nauru, Papua New Guinea and Solomon Islands (which formed the 'Nauru Group' in 1982 to protect their common interests).

Limited resources and information. Regional resources are more abundant in the open sea than near the shore. Owing to the limited extension of continental shelf and emerged land, coastal waters receive few organic materials and have a low productivity. Nevertheless, existing marine resources have a great significance and are exploited for subsistence and commercial purposes. Catches are not well recorded and estimates are obtained from scarce data on commercialized quantities and from hazardous extrapolations regarding self-consumed catches. Tuna catches using traditional methods are estimated at about 10,000 tons a year (Doulman 1987a) and overall artisan fish catches at 30,000 tons (Kearney 1980). According to these figures artisan fishing represents approximately 4 per cent of the industrial effort but it has to be related to the fact that island territories cover an area which is 300 times smaller than the area of their exclusive zones.

Table 3 Estimated tuna catches in the Pacific islands region, 1984

Method of catch	Tons	Per cent
Industrial	750,000	90
Artisan	10,000	10
Total	760,000	100

Source: Doulman, D., *Tuna Issues and Perspectives in the Pacific Islands Region*, East West Centre, 1987.

Evaluation of small-scale fisheries is not only made difficult by lack of data and disparities amongst island territories but also by differentiation of terms like 'subsistence', 'small-scale', 'artisan', 'traditional' or 'non-commercialized', not to speak of the absence of an official nomenclature concerning fish denomination (Gillett 1987). Small-scale fisheries will be defined here as activities requiring labour rather than capital and relying on non-sophisticated techniques and equipment.

In Micronesia and Polynesia where lagoons are less extensive than in Melanesia, some small-scale fishers manage to go off-shore to catch tuna, which do not venture into shallow and turbid waters; they fish surface species like skipjack and young albacore with poles and other tuna species with bottom lines. Nonetheless, most fishing is done along reefs and inside lagoons and covers a wide range of species as well as molluscs and shellfish. Fishing is performed on foot as well as from small vessels made of wood or plywood and methods range from handlines, traps and spears to a large variety of nets which are now replacing traditional methods of stone throwing or stacking up coral along fish drives to establish traps. Recorded techniques vary between islands and according to the phases of the Moon cycle. They depend on the fishers' skilfulness and good knowledge of concerned areas and are suited to local conditions. They are usually part-time and seasonal in nature, easily disrupted by bad weather and heavy swells.

Most fish catches consist of deep-bottom and secondary species such as groupers, snappers, trevally, jack or mullets which inhabit reefs (Lawson 1980). In the absence of information concerning the level of catches and resource exploitation, it is generally assumed that fishing areas close to urban zones are over-exploited and that fishing areas in rural zones are under-exploited. Unlike off-shore industrial fisheries which are export-oriented, small-scale artisan fisheries look at domestic markets. However, most island territories heavily depend on fish imports as the local supply is inadequate.

Fluctuating development policies

Regional policies. Potentialities of small-scale fisheries, even if not open to spectacular improvements, seem well above local needs. Up to the mid 1970s, modernization of artisan fishing was given priority in order to facilitate the transition towards a larger and commercialized activity and, at the same time, compensate for needs generated by growing urban centres. But, in fact, industrial fisheries continued to be promoted, as shown by agreements concluded with foreign fleets, live bait experiments, and land-based installations for fish storage and processing.

During the 1970s, many island territories gained independence while western economies, their usual capital suppliers, experienced serious difficulties. Consequently, emphasis shifted towards a more self-reliant development based on local resources. Growing importance was attached to small activities oriented towards basic needs and requiring indigenous labour rather than sophisticated techniques. Small-scale fisheries were encouraged, with a view to both promoting an import-substitution activity and favouring its passage to an industrial stage. Governments continued to pay attention to industrial fisheries as well as to prospects offered by up-to-date aquaculture farming methods.

In the late 1970s, a new international regulation known as the United Nations Agreement on Sea Law was introduced, conferring new rights to coastal states over their surrounding marine resources and modifying fishing prospects in a radical way. The new regulation extended territorial waters to 12 miles from the shoreline and defined Exclusive Economic Zones (EEZ) up to 200 miles beyond the shoreline. Such an extension of sovereignty provided island nations and territories with larger fishing zones and, as a consequence, gave them new economic possibilities, capable of reinforcing their recent political independence. It pushed them to make better use of their tuna resources by building national industrial fisheries. But fishery industrialization, even if desirable, remains risky. It seems that tuna catches - especially skipjack - could be developed but migratory movements and real stocks are still not well recorded. Tuna catching and processing require considerable amounts of capital which are beyond the capacities of most island countries. Not so long ago, the purchase value of one single seiner represented one-third of the gross domestic product in Tonga, one-fifth in Vanuatu and one-tenth in the Solomon Islands and Western Samoa (Kearney 1980). Tuna fleets are presently based in Fiji, Guam, Hawaii, Kiribati, Marshall Islands, Nauru, Papua New Guinea, Solomon Islands and Vanuatu. But, up to now, only five countries (Fiji, Kiribati, Papua New Guinea, Solomon Islands and Vanuatu) have set up national fleets with Japanese partnership. Agreements with Japanese firms

have not been renewed in Fiji and Vanuatu where fisheries, after having been placed under government control, experienced a deficit.

National policies. Up to now, the Solomon Islands is the only microstate that has made significant efforts to promote industrial fisheries. For example, it has entered into partnership with a Japanese firm and formed the 'Solomon Taiyo', an integrated company with a fleet of twenty-two trollers and one seiner and activities ranging from tuna catching to tuna canning. Also, it has launched the 'National Fisheries Development Ltd', a state-owned company equipped with twelve trollers and two seiners. Today, with assistance from the EC, it is implementing a new refrigeration complex and another canning plant and harbour.

In Fiji, artisan and industrial fisheries provide approximately the same quantities of fish and have been simultaneously encouraged. Industrial fishing is carried out by IKA Corporation, a public company which operated fourteen trollers in 1982 but only seven in 1987. Fish catches are delivered to the 'Pacific Fishing Company' (PAFCO) cannery, which was shared by Fijian private interests and the Japanese firm Itoh (until the withdrawal of the latter in 1986 when the Fijian government stepped in as a substitute). As for small-scale fisheries, they can be roughly characterized by Indian Fijian fishers depending on ethnic Fijian fish-rights owners. Official encouragement has mainly consisted of equipping fishers with more appropriate vessels allowing them to go fishing further away from urban zones, inside and outside the reef barrier.

In Kiribati, even more than in Fiji, emphasis has been put on joint exploitation of coastal and open sea resources. Agreements concerning tuna fishing have been made with foreign fleets frequenting the area. A national fishing company, the 'Te Mautari Ltd' (LTD), was set up in 1981 and was provided with four trollers with Japanese and British aid. Collected fish is conveyed to Pago Pago (American Samoa) and Levuka (Fiji) canneries. Despite commercial difficulties, the company intends to acquire four new trollers and to start up seine-fishing with the assistance of the EC. In the artisan sector, prototypes of 'doris' were tested in the mid 1970s and there was some experimentation of techniques not requiring live bait which is scarce locally. Experiments have not been conclusive however. A program to adapt the traditional canoe to be propelled by both sail and outboard motor has been more successful and is being adopted by other island territories such as the Cook Islands and the Marshall Islands.

Industrial tuna fishing in Vanuatu started in the late 1950s but is now on the wane. Annual catches made by the vessels of the south Pacific Fishing Company (SPFC) today amount to about 4500 tons after having reached a peak of 15,600 tons in 1972. Officially, emphasis is still on industrial fishing but efforts have been redirected towards small-scale

fisheries and artisan exploitation of outer-reef slopes since 1982 (David 1987).

Until now, other states and territories - the Cook Islands, Tonga, Tuvalu, Western Samoa as well as US or French dependent territories - have only developed coastal fisheries. In Tonga, two-thirds of landed fish result from daily fishing activities inside lagoons or close to the reef barrier. Development and modernization of small-scale fisheries has been given high priority there since the beginning of the 1970s in order to address over-fishing and reduce fish imports. Emphasis is now placed on exploiting outer-reef resources: deep-water fish along off-shore reef slopes and around seamounts, and surface tuna at distances less than 30 miles off the coastline and depths up to 600m. In order to meet these objectives, new 9-12m long vessels have been built enabling fishers to go off-shore and use pole-and-line, hand-line, bottom-line as well as long-line. Floating rafts called Fish Aggregating Devices (FADs) have also been anchored in specific places and one long liner has been purchased by the Tongan government to determine to what extent demersal and pelagic fish are to be found in the Kingdom's exclusive zone.

A similar orientation characterizes the Western Samoan fisheries. Because of the lack of financial resources to promote industrial fishing, the government has concentrated its efforts on developing suitable small craft designs based on traditional Polynesian concepts and encouraged the construction of 8.5m long catamarans called 'alia'. In 1984, the local fishing fleet consisted of 160 vessels and catches were 3000 tons compared to 1400 tons in 1975 (Waugh 1986).

Artisan fishing has also been promoted in French Polynesia in order to meet local needs and provide export receipts. Reef and lagoon fishing is mainly carried out in the Tuamotu atolls and the bulk of catches is dispatched to Tahiti and sold there. Efforts are focused on fish storage, processing and transportation. Tuna fishing is practised on a small scale in Tahiti and is being developed through the setting up of Fish Aggregating Devices and testing prototype vessels ('super-bonitier', 'bonitier polyvalent') which can stay at sea for several days and can employ various fishing techniques. Since 1972, fishing agreements have been concluded with Japanese, Taiwanese and Korean fleets which have to land a proportion of their catches in Papeete. In 1985, a semi-public company, the POMAFREX, was created to buy and re-sell fish caught inside the territorial exclusive zone by foreign fleets and outside by some American long-liners. The company was expected to play the role of an intervention office, serving artisan fishers as well, by keeping surpluses in stock and selling them when production falls.

In New Caledonia, little attention has been paid to small-scale fisheries in the past but that is no longer the case. Commercialization of catches is encouraged through the establishment of co-operatives and coastal fishing is aided through the construction and testing of more appropriate vessels. Industrial fishing in the territorial exclusive zone is done by half a dozen Japanese long-liners which caught about 2500 tons of tuna in 1987. Three French long-liners operated during the same year, catching 1350 tons of tuna which were exported to Japan.

Aquaculture as a special case. Policies aiming at better exploitation of marine resources are not limited to coastal artisan fisheries and off-shore industrial fisheries. They also concern aquaculture which is viewed as a small-scale activity as well as an export-oriented industry. There are few precedents in the region, apart from traditional milkfish culture in Fiji and Kiribati or giant clam gathering and culturing in New Guinea islands.

The first major impetus was given in 1971 by the creation of the short-lived south Pacific Islands Fisheries Development Agency (SPIFDA) initiated by the south Pacific Commission (SPC). It paved the way to a series of marine and freshwater cultures (clam, carp, prawn, mangrove crab, eel, molly, mussel, oyster, shrimp, tilapia, turtle) and experimental facilities have been progressively set up to test the feasibility of these cultures. Initial results were disappointing but efforts continued with varying results. In New Caledonia and French Polynesia, experiments have been taken over by the Centre National d'Exploitation des Oceans (now the Institute Francais de Recherche pour l'Exploitation de la Mer (IFREMER)) which plays a leading role at the regional level in research on aquaculture and its possible commercial applications. The more important experiments concern molluscs (Philippine mussel), shellfish (freshwater and marine shrimp) and fish culture, especially the development of live bait for tuna fishing.

With the assistance of the FAO, live bait experimental cultures (milkfish and molly) have also been undertaken in American and Western Samoa as well as in Fiji, Kiribati or Tonga. These experiments have not been successful except in Kiribati where they could rely on pre-existing traditions. Experiments continue in Tuvalu and in the Federated States of Micronesia (Kosrae, Ponape, Truk) and now extend to algae cultures (*Euchema striatum* and *Euchema spinosium*). In Fiji, oyster and mussel cultures have been no more successful and now shrimp farming is done in close association with 'France-Aquaculture', a subsidiary of IFREMER.

Pearl farming in the Tuamotu archipelago has been the most successful of all, responding to an increasing demand for black pearl on world markets. At present 2000 people work in twenty specialized companies and about one hundred co-operatives, and pearl sales rank at the

top of French Polynesia exports. However, the industry remains fragile as it depends on Japan for grafting techniques and marketing, and also depends on the culture of mother-of-pearl to replace exhausted natural deposits.

The main conclusions of a general survey of aquaculture in twenty-one countries of the Pacific islands region (Uwate 1984) do not echo the optimistic comments that were made by the media a few years previously. The conclusions stress that although many aquaculture enterprises are technically feasible and have favourable conditions as regards location and climate, results have fallen short of expectations and have not been sufficient to generate marketable production. The report concludes that aquaculture prospects in the region are more industrial than artisan. Its development rests on sustained production and successful marketing to justify the costly investments that are required for creating hatching farms and controlling the growth process of cultivated species.

Growing management of resources. Artisan fishing deals with demersal and deep-water fish which belong to a wide range of species but overall are relatively scarce. Up to now, they have mainly been exploited inside lagoons or along barrier reefs. In remote islands and rural districts, subsistence fishing continues to be practised as a part-time activity and in urban areas a growing over-exploitation has resulted, not only from population increase but also from destructive fishing methods like dynamiting or poisoning (used in some places i.e. Samoa, Tuvalu, Guam).

As a consequence, fishing policies tend to be characterized by a two-pronged approach. In urban areas, where coastal resources are on the verge of being exhausted, controls are being implemented, for example a limitation on the number of vessels in Tonga and closed areas and catch quotas in Tahiti. Fishers are directed towards under-exploited zones and resources such as deep-bottom fish on outer-reef slopes or surface pelagic fish near the coast. In rural areas, efforts are made to sustain subsistence fishing and facilitate its evolution through commercialization and more productive methods. The most usual management measures have consisted of introducing modern equipment, organizing loan schemes and providing appropriate infrastructure, including cold storage and transportation facilities. These measures have not been very successful and a major outstanding problem is to get regular fish supplies from people who are only part-time fishers. Efforts made to regulate catches have generally failed and, at times, even created conflicts within fishing communities.

Characteristics of small-scale fisheries in the region

As a whole, small-scale fishing in the region looks like small-scale fishing elsewhere in the world but, at the same time, it has peculiar aspects which have to do with existing links between resources and labour, labour and capital as well as between artisan and industrial fishing. These aspects will be addressed below.

Conflicting values and practices. To a large extent, difficulties in small-scale fishing in the region are a consequence of a progressive opening to the outside world and a growing integration with a cash economy. This trend has given birth to structures and practices which increasingly tend to clash with pre-existing traditions and customs. The most striking change arises from fast-expanding wages and cash in economies previously based on self-sufficiency and reciprocity. Consumption of imported goods is growing and money tends to become the main standard of the scale of values, replacing the traditional practice of exchanges of services which only survive amongst relatives and friends. In consequence, individualism and selfishness are taking over from the tradition of solidarity.

Small-scale fishers are immersed in this socio-cultural environment where past and present confront each other so that it is difficult to connect seemingly inappropriate behaviours to values which support them. Similarly, outsiders often consider contemporary techniques which are introduced as neutral and independent of the context from which they originate. Many failures in fishing management can be explained by the fact that local specificities are not sufficiently taken into consideration. That is underlined by some experts while others draw parallels from southeast Asian countries which offer useful precedents and points of comparison. For example, many conflicts follow from the application of traditional rights which give access to lagoons and reefs but, at the same time, limit fishing grounds (Solomon Islands) or subordinate fishing to fees payment (Fiji). 'It may result in a clash of interests which can be exacerbated when landowners refer to tradition which restricts access and fishermen to modern legislation which makes free access a principle' (Blanchet 1982). Traditional tenure systems, which formerly could extend to several miles beyond the reef and involved resource sharing among neighbouring villages, could be a good way to avoid over-exploitation problems (Johannes 1978). Their implementation may be judicious insofar as a distinction is made between 'access' and 'ownership' in order to increase the flexibility of the prevailing system. In French Polynesia, where modern legislation and customary rules co-exist, access to fishing grounds seems easier in peripheral atolls where custom prevails than in

populated areas where economic stakes override other considerations and where authorities are reluctant to impose their arbitration (Blanchet 1982).

Lack of capital and marketing facilities. Another characteristic of small fisheries is that their development is hindered by a lack of capital and marketing facilities. Fishers willing to improve their activities generally have to rely on a middle person for selling their catches as well as for supplies of equipment and consumption goods in remote places. This dependence has led to the conclusion that go-betweens hinder development as far as they exploit fishermen by extracting abnormal profits from them. As a consequence, governmental interventions are often directed towards by-passing these intermediaries and substituting civil servants for them. But official intervention concerning loans, subsidies, equipment or commercializing facilities generally falls short of expectations. Laxity in loan repayment, political interference, nepotism, incompetence, inefficiency imputable to a lack of genuine motivation as well as an overwhelming ignorance of fishers' wishes, are some of the consequences.

It has been argued that the socioeconomic role of middle-people has been misunderstood, where they have been labelled parasites without recognizing that they are also organizers and risk-takers. This over-emphasizes their exploiting power and undervalues their social and economic functions which include equipping and giving credit to fishers as well as collecting, buying and marketing fish. As it has been pointed out, 'in general, fishermen and traders financiers have a mutually beneficial, symbiotic relationship, which operates smoothly in a traditional environment. Any interference in this environment is bound to be resented by all parties' (Lawson 1980).

Some island governments encourage fishers to acquire their own vessels so as to become genuine entrepreneurs with the means of production under their own control. But it also exposes them to risks that many are not well prepared to take. They are unlikely to reinvest their possible profits in fishing as long as the pressure of their social environment pushes them to give priority to consumption and expenditure decisions which do not conform with good management principles (Lawson 1980).

Fragile balance with industrial fisheries. Similar approaches look at small-scale fishery development as a simple shift from a subsistence stage to an industrial stage characterized by specialized and commercialized activities. However, such approaches do not take into account that such a move supposes a parallel change in mentalities and behaviours which requires an appropriate educational scheme. This would involve an integration of the whole production process and its social context. These approaches often proceed from an evolutionist point of

view and are not supported by relevant data. They seem to be based on the pre-conception that small-scale fisheries have a more social than economic function and are less efficient than industrial fisheries (Weber and Fontana 1984). However, experience shows that artisan ways of fishing are less expensive to retain than efforts made to transform them into larger-scale activities.

Furthermore, relations between small-scale and industrial fisheries in the region look more complementary than exclusive. Small-scale fishing is carried out near the coast and turns to demersal species. It requires small vessels and aims at meeting domestic demand. Industrial fishing, on the other hand, is carried out off-shore and concerns pelagic species. It operates large and sophisticated vessels which sell their catches on foreign markets.

These different characteristics and orientations explain why Pacific island countries are often committed to a parallel development of artisan and industrial fisheries, even if only a few islands are able to implement the latter. The fact that small-scale fisheries require labour over capital has prompted specialists to recommend their development. Conversely, a majority of governments are inclined to put high priority on creating national tuna industries, capable of taking advantage of resources presently being exploited by foreign nations and considered as offering great potential for economic development. Owing to the lack of means, some governments have tried to negotiate fishing agreements more acceptable than those concluded before the creation of economic exclusive zones. This has developed into growing tensions between governments in the region and foreign governments, which have reverberated on the international level to the point of constituting a new stake in superpower rivalry. It has conferred to industrial tuna fishing a political dimension which has been supplemented by more favourable economic circumstances; since 1985, fuel costs have stabilized and tuna world prices have recovered (e.g. skipjack prices, after having dropped to a low of US\$660 a ton in 1985, rose to US\$1000 a ton in 1988). On a financial level, capital is still scarce in island territories but aid funding, in its various forms, is more readily available especially for large-scale projects such as port equipment or industrial fishing vessels which are easier to implement and valorize on financial and political grounds than grass-rooted micro-realizations. There are good reasons for thinking that strategic diplomacy will accompany aid from western industrialized countries. This is suggested by fishing agreements concluded between the USSR and Kiribati in 1985 and USSR and Vanuatu in 1987 and by the five years agreement concerning tuna fishing signed by the United States and south Pacific Forum members in 1988.

Research trends

Growing concern about exploitation of marine resources has encouraged more studies and experiments in this domain and has led to an evaluation of its potential and definition of appropriate means of intervention. More attention has been paid to artisan fishing since the mid 1970s but existing information is still limited. Current research appears designed to further increase knowledge and to identify fields where urgent measures need to be taken.

Island states and territories. Implementation of public services specialized in fishery development was initiated in the 1950s. Activities were first oriented towards establishing fishing grounds, identifying stocks and the testing of various fishing gear, principally for the industrial and commercial sectors. At the time, the prevailing attitude towards the artisan sector could be characterized as *laissez-faire* while the private sector was developing sporadic fisheries for tuna, lobster or prawn and depleting natural deposits of pearls and mother-of-pearl.

In the second half of the 1960s, authorities became concerned with promoting industrial fisheries which used methods and techniques more productive than those implemented by small vessels such as those which fished skipjack near the coast using cane poles fitted out with mother-of-pearl lures.

At the beginning of the 1970s, research efforts turned to pelagic species by testing out the long-line techniques that the Japanese introduced in the region in the 1950s. These experiments went hand in hand with the construction of ferro-concrete or steel prototypes of fishing vessels. At the same time, growing interest in fisheries led to the promotion of traditional methods which, as a result of their enduring importance, were now considered capable of significantly contributing to domestic economies in terms of employment, production and import-substitution. It was hoped that they could reduce rural drift at a time when growing urban population and over-fishing began to give cause for concern. In order to encourage fishing and fish commercialization in peripheral islands the first steps in the implementation of 'freezing lines' were made. Simultaneously, in order to better identify existing resources, authorities initiated various experiments and feasibility studies.

All these interventions were authoritarian and technical in their approach and very limited account was taken of the concerns of fishers who were nevertheless expected to radically modify their attitudes and practices. Resource assessment and aquaculture experiments were entrusted to biologists while technical advisers turned their attention to traditional methods in use, pin-pointing practical obstacles to development such as lack of capital, technical skills and infrastructures or vessels. Efforts were

consequently oriented towards reducing these obstacles through easier access to loans, construction of new vessels and implementation of port equipment, refrigerating plants, and warehouses.

These objectives are still topical. The problem remains of improving the supply of fresh fish to urban centres so as to provide additional protein and to reduce imports. There is also the problem of increasing employment and income levels as well as removing the infrastructure obstacles to fishing activities. At the same time, the limited success attests to the fact that formal schemes which ignore local specificities fail to deal with the complexity of the situation. All this has been progressively taken into account so that small-scale fishing and especially subsistence fishing is no longer considered as a rearguard activity destined to fade away in the short run. Its endurance - as well as the difficulties experienced in expanding commercial fisheries - indicate its continued existence at the village level. In Niue, as in many places, there is a decrease in subsistence fishing with growing salaried employment and preference for outboard motor powered dinghies. But, according to national planners, this sort of evolution offers limited scope as a basis for a cash industry.

In national planning, small-scale fishery development is increasingly examined under two separate headings: commercial and subsistence. While the latter is encouraged as well as the former, the aim is that it be eventually marketized.

Interest in small-scale fisheries also encompasses the methods used in fishing. With the impetus of the FAO and UNDP, several outrigger sailing/outboard canoes have been constructed in Kiribati, combining traditional and modern techniques. The canoes have been demonstrated throughout various islands and have proven popular. At the fishers' request, a smaller paddling/sailing version more suitable for fishing along the reef has been designed. In Tahiti, successive prototypes of polyvalent vessels have not been successful but fishers have managed to design themselves a small outboard motor-powered boat, the 'poti marara', which allows them to go beyond the over-exploited coastline (Blanchet, Borel and Paoaafaite 1987).

The difficulty of improving small-scale fisheries through new techniques and various incentives has led to a more attentive look at the human factor, which is no longer viewed as incidental in the implementation of policies. New policies attempt to closely involve fishers with the measures concerning them and to encourage their formation into groups. Such integrated approaches of small-scale fisheries have been initiated in Western Samoa, Tonga and Kiribati. In Vanuatu, a deep-bottom fishing program started in 1981 and was supported by the formation

in coastal villages of associations of fishers who were assisted in boat-building, fish preservation, transportation and marketing.

Greater attention was simultaneously paid to the economic and social environment which, it was realized, must be taken into account so as to fully understand small activities. Biologists, who are at the forefront of fishery research, have progressively integrated these aspects, broadening an approach which first appeared to be a mono-disciplinary one. It has allowed them to go beyond usual prescriptions based on simplified biological and economic models. For instance, it is now admitted that a notion like 'the yield per fishing effort unit' is not sufficient to assess potential stock, as it does not consider changes in environmental conditions, gear technology, fisher behaviour or fishery policies (Hilborn and Sibert 1985). Greater consciousness of the 'time' factor has also led to the acknowledgement that traditional fisheries will be open to development only if present obstacles can be removed or lessened and, more importantly, if the people involved want this development.

Such an evolution in policy formulation has been relatively slow and is characterized more by an expansion into human sciences than by a multi-disciplinary approach. Most fishery experts are still biologists despite the fact that, since 1972, the University of the South Pacific (USP) has been teaching an eclectic approach at the Institute of Marine Resources.

Regional organizations. Most island states and territories are small and lack capital so that research has mainly been carried out on their behalf by regional and international organizations.

Up to now, the South Pacific Commission (SPC), a regional technical body created in Noumea by former colonial powers in 1947, has played the leading role. It has brought important logistic support to island communities which had neither the skills nor the means of defining and implementing a rational exploitation of their resources. For more than 40 years, the SPC has been initiating and adapting programs in accordance with the expressed needs of its members. In the 1960s, it turned to industrial tuna fishery and, at the beginning of the 1970s, launched an ambitious aquaculture program. In collaboration with other institutions, it initiated a small-scale fishing program on outer-reef slopes so as to facilitate catches of ignored or under-exploited demersal fish species (*etelidae*, *serranidae* and *carangidae*). In addition to this program there was experimentation of new methods using hand winches as well as bottom lines anchored at 15-20m from the seaground at depths up to 300m. The program continues and aims at widening the use of fish aggregating devices, developing deep bottom fishing below 400m, and testing artisan methods for the catch of live bait. It is linked with a larger program of inshore fishing development which incorporates training courses suited to

island communities needs. Training includes fishing methods as well as fish handling and processing with a view to improving the post-collecting state of the fishing production process.

In the same way, the FAO and UNDP have also promoted small-scale fisheries. Their activities have ranged from marine resource assessment in Tonga in the early 1970s to recent demonstration of appropriate vessels in Kiribati. In one FAO scheme, small vessels about 28 feet long propelled by diesel inboard motors were constructed in Fiji but have proven to be expensive to buy and to maintain in working order. A village fishing project in Western Samoa has been more conclusive. Small-scale tuna fishing generally faces a lot of problems including a lack of live bait, high cost of vessels and high fuel consumption as well as the reluctance of fishers to stay at sea for several days. But, the Samoan program has successfully combined live bait breeding and use of locally-made fish aggregating devices and catamarans.

The implementation of economic exclusive zones has also led to the creation of a regional organization, the Forum Fisheries Agency (FFA), which is based at Honiara, the capital of the Solomon Islands. The agency was established in response to the needs of south Pacific independent nations to manage their marine resources and co-ordinate their policies and activities. The preamble of the FFA convention expresses the nations' common interest in the conservation and optimum use of the living marine resources in the region and their desire to facilitate the collection, analysis, evaluation and dissemination of information about the region's fisheries resources, especially highly migratory species. The main objectives of the agency were initially directed towards industrial fishing and tuna resource exploitation but, in a period of a few years, it has become a key institution for everything related to fishing. At present, it co-ordinates a regional program of fisheries development and closely co-operates with the Forum, the SPC, FAO, UNDP, and the EC. In 1986, it commissioned two studies, one on the management of coastal fisheries and the other on research needs in the south Pacific, both funded by the Canadian International Development Agency (Fakahau and Shepard 1986, Munro 1986). These two studies and the conclusions of a SPC workshop on Pacific inshore fisheries resources held in Noumea in 1988 point to the areas most requiring further research in order to improve small fisheries (SPC 1988).

Research needs

The importance of small fisheries in the south Pacific is related to the fact that for many islanders fishing is both a source of subsistence and one of the few resources they are able to exploit themselves. At the same time, growing over-exploitation of marine reef and lagoon potential constitutes a

problem of increasing concern for the future. It indicates the necessity of a more rational exploitation which itself depends on a better knowledge of the existing situation. It is becoming a matter of urgency that research be undertaken and the results be made easily available.

Lack of reliable information. Recent surveys of regional inshore fisheries point to a lack of awareness and management of outstanding problems. There is little reliable information, not only about fish stocks and catches, but also about fishing activities and their consequences. This situation is due less to mismanagement than to the fact that tropical waters, which shelter numerous fish species, have never been subjected to intensive studies (Fakahau and Shepard 1986). Reasons put forward include low interest taken in the small-scale fisheries in the past and absence of clearly-cut alternatives in their management. Answering these problems requires combining traditional fishing and modern intensive resource management and, in over-exploited or polluted zones, implementing controls or limitation systems which are likely to impinge on political, social and economic issues.

Other explanations can account for the lack of reliable information. Owing to the south Pacific territories' recent accession to independence or autonomy, public administrations up to now have been mainly preoccupied with organizational problems and the setting up of new services. Lack of trained staff with both practical and theoretical knowledge, as well as problems of access and communication among scattered islands, are still paramount. It is difficult to raise funds for research when immediate tasks at hand are considered more urgent, and it is even more difficult to maintain a long-term financial commitment to the collection of fishery statistics (SPC 1988).

Existing information is not only scarce but poorly disseminated. Flores (1982) states that: 'The major information-handling institutions in the area, i.e. the University of the South Pacific, the Forum Fisheries Agency and the South Pacific Commission, have few serious problems in identifying or obtaining relevant marine resource publications produced or held outside the SPC. The real problem lies in the identification, collection, organization and dissemination of relevant publications produced in or about the SPC area'.

In south Pacific islands, unlike Australia or New Zealand, there is no Aquatic Sciences and Fisheries Information Service (ASFIS) capable of centralizing information. Data, if existent, are poorly published, distributed and registered and are less accessible from within the region than from outside sources such as former colonial powers or at headquarters of international organizations. Last but not least, fishery agencies above all support specific projects and programs which, in the absence of a coherent

information policy, result in an abundance of single-disciplinary information often unsuitable for existing information systems which are themselves inadequate (Flores 1984).

The problem of lack of data and poor dissemination of those available becomes even more acute as fish exploitation intensifies. For a decade over-exploitation of lagoons and reefs in populated areas has led to the encouragement of deep-bottom species fishing but, in some places, the level of catches already threatens the resource equilibrium. Furthermore, deep-bottom fish appear to be slow-growing and have an irregular recruitment of juveniles (SPC 1988).

Questions too arise about fish aggregating devices which are increasingly in use and are generally anchored at depths from 250m to 500m. They seem effective as long as they provide fishers with an alternative to over-exploited lagoons and exempt them from wasting time and fuel in search of schools of fish. However, the question still remains whether artificial reefs really increase fish production or only aggregate already present fish. The productivity of aggregating devices is also highly variable for reasons that are still not well understood.

As for fish living in shallow waters, their growing over-exploitation makes it necessary to regulate their catch. But such a step is difficult to take insofar as fish consist of many different species. Some are over-fished because of local consumption patterns or because of their commercial value, and others are little fished or not fished at all for the opposite reasons or because of their possible toxicity, e.g. ciguatera. Over-fishing a high-value species can lead to its depletion and its replacement by another one without commercial value. Little is known about equilibrium among species and the recruitment process in coral reef waters and as a consequence, management policies remain indecisive. Also the effects of over-fishing vary between subsistence and commercial fisheries. Over-fishing can lead to an irreversible situation in a commercial fishery whereas a subsistence fishery may be able to maintain its activities insofar as its operating costs and catching capacity are low (SPC 1988).

Collection and distribution of information. Experts, advisers and managers now agree that it is necessary to expand existing information in order to manage and exploit resources without jeopardizing the future by endangering a fragile and complex ecosystem. There is a large consensus on the information required and on the gaps that need to be filled even if there is conflicting opinion about options underlying agreed priorities.

A much emphasized point is that efforts have to be concentrated on statistical data collecting and delivering. Most demands concern the need for stock assessment in order to implement appropriate fishing policies, and usually originate from island governments that generally lack accurate

information on existing resources and their potential. Such an assessment is all the more urgent as resources are limited and require immediate management. As a SPC adviser has pointed out, stock assessment is not so much predicting sustainable yield as understanding and anticipating changes in the stocks as a fishery develops. A good management policy needs information about age structure, natural mortality, average size and the migratory behaviours of fish species. If exploitation is already taking place, it is important to monitor the catch rate and spatial distribution over a period of time and to assess the abundance of the stock at different points of time. Biological as well as economic information needs to be gathered as soon as intensive fish exploitation occurs and not, as is too often the case, when stocks are already over-fished (Hilborn 1987).

Experience in the region shows how difficult it may be to maintain a long-term commitment to the gathering of statistical fishing data in island communities which mainly use them for development planning purposes. It has been suggested that it could be 'more appropriate and cost-effective to look at using one-off surveys or experimental fishing programs to gather the information needed for stock management work' (SPC 1988).

The report on research needs in the south Pacific prepared for the Forum Fisheries Agency points out that, despite a crucial lack of statistical data, countries like Fiji have succeeded in collecting valuable and regular information. Among a series of recommendations for improving management of inshore resources the report suggests:

- . that island administrations encourage co-operative work in stock assessment, statistical data collection and training;
- . that the SPC expand its program to provide advice to island fisheries departments on collection of catch statistics; and
- . that research organizations such as the USP Institute of Marine Resources in Suva and the International Centre for Living Aquatic Resources Management (ICLARM) in Townsville, Australia, be encouraged to undertake original research work on the population dynamics of inner reef fisheries (Fakahau and Shepard 1986).

More generally, it would be desirable that governments, institutions and aid agencies support the concept of an integrated multi-disciplinary and multi-media system of information which could be based in the Pacific Information Centre created in Suva at the USP in 1983. Inputs would come from the South Pacific Commission, the South Pacific Forum and south Pacific governments and outputs would go back to governments and regional bodies asking for them (Flores 1984).

In many cases, failures are less attributable to fishers than to administrations which fail to consider them; they are often steeped in an authoritarian role, hampered by their functioning deficiencies and more prone to promote small-scale fishing on a social basis than on an economic

basis. The motivations of fishers need to be taken into account in as much as social factors are decisive, even if difficult to identify. It has been suggested that, 'a hastily introduced innovation requiring human resources which have not been previously used is bound to disrupt a whole range of accepted social relationships and may, in the long run, undermine the existing social structure and be detrimental to fisheries development' (Lawson 1980).

Creating a dialogue with fishers and their communities is particularly relevant when introducing regulatory measures to prevent or restrict over-exploitation. These measures are generally graded from closed seasons or areas to catch quotas or restriction on gear but, in order to be effective, must be compatible with traditional ways of fishing. In this respect, it has been argued that the idea of free access to marine resources is a western concept foreign to Pacific island cultures. Consequently, it is tempting to refer to traditional rights as a way of regulating access to now endangered species. In Tonga, for instance, it may be stated that 'the taboos concerning violent captures and the sale of the catch provide a balance to the over-fishing now possible by the use of modern equipment' (Bataille-Benguigui 1988). Unfortunately, such practices have fallen into abeyance almost everywhere and, even if it is still possible to reintroduce them, it is less easy to give them a meaning and coherence relevant to the present context. The need for improvements in research in order to develop small-scale fisheries goes hand in hand with more controversial considerations on needed policies in the region. Scientists pin-point the vulnerability of limited and easily exhausted resources. As a consequence, they discourage over-capitalization, particularly in the early stages of development when catches are still high. The problem is that their point of view is unlikely to be shared by island governments wishing to get the most out of their fishery resources as quickly as possible and with international agencies anxious to assist them (SPC 1988).

Some scientists also propose that the best solution for most island countries would be to develop expensive off-shore industrial fisheries through agreements negotiated with foreign fleets or governments, preferably on the basis of 'fishing rights' rather than of 'joint ventures' which have a questionable added value. Such an orientation would give island governments the option of expanding their inshore fisheries which are labour-intensive and do not require large capital inputs (Waugh and Byron 1988).

This leads to the question of how industrial fisheries may affect artisan fisheries, for example, with regard to competition, with many small-scale fishermen arguing that coastal resources are depleted by industrial vessels poaching in territorial waters, or the problematic question of

reinvestment in the small-scale sector of dividends stemming from the industrial one. Is some sort of equilibrium possible between a subsistence activity and a commercial and market-oriented one or are they incompatible?

Conclusion

A survey of the recent evolution of small-scale fisheries in the Pacific islands region outlines that such activities still play a significant role in islanders' lives but are only given secondary importance by development policies.

Small-scale fisheries are over-shadowed by hopes set on industrial fisheries, and development is presently threatened with over-exploitation of limited resources, due to both rapidly evolving fishing techniques and growing population pressure especially in urban areas.

As small-scale fisheries play a basic role in satisfying domestic needs, there is an urgent need for better information that will lead to more rational exploitation of resources. Efforts need to be directed towards compiling and circulating a database as well as co-ordinating and expanding existing information, possibly through promoting a regional integrated information system, as well as paying greater attention to fishers and fishing communities.

Specialized regional organizations have a special role to play in these matters but need to be more effectively supported by national and territorial authorities.

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