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# National Fisheries Development Policy for Coastal Waters, Small-Scale Village Fishing, and Food Self-Reliance in Vanuatu

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This paper describes the national development policy of coastal fisheries in Vanuatu and its role in improving the living conditions and nutrition of the people. This policy has focused on the exploitation of deep-sea bottom-dwelling fish along the reef slope and the creation of commercial fishing associations at the village level; these associations were supposed to improve the diets of urban and rural people, to reduce the imports of tinned fish, to develop cash economies in village communities, and to create employment in order to reduce migration to cities. In view of the significant sums of money injected by international aid and the poor results achieved, this policy can be deemed to have been, so far, a failure. Though it is not encouraged by the Vanuatu Government, small-scale unstructured fishing is more efficient, in terms of both nutrition and substitution for imported fish. In the future, this fishing should not be neglected. An increase of fisheries production would appear to be possible at very little cost by equipping sailing canoes with small engines and by introducing simple and low-cost ways of preserving fish.

*Key words: developmental planning; marine resource; small-scale fishing; subsistence activity; village-level economy; Vanuatu.*

Sustainable development is currently a very fashionable concept among international agencies and NGO's dealing with development problems in the island Pacific nations, and in other tropical countries.[1)] The goal is to improve the economic viability of these countries and to decrease their dependency on (and therefore their vulnerability to) other nations, by relying on sensible management of their natural resources, land-based as well as maritime, and by avoiding ruining these resources for future generations. The problem is fundamental in the Pacific Islands, where population growth combined with the fragility of the ecosystem could easily lead to serious imbalances.

The concept of "sustainable development," by introducing an ecological dimension into development, gives new life and greater depth to the older concepts of "self-centered development" and "self-reliance" which had been a cornerstone of economic policy among the young Pacific Islands nations. Under the direction of Father Walter Lini, Prime Minister from the end of July 1980 to September 1991, Vanuatu is probably the nation which has gone the farthest in this direction. Both in its first (1982-1986) and second (1987-1991) National Development Plans, priority was given to the development of agriculture and fisheries. The emphasis was put on research

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into food self-reliance, through the implementation of small projects at the village level (motto: "small is beautiful"). These projects put the accent on labor investment over capital investment, this latter to remain of moderate size, in keeping with the scale of the socio-economic environment which forms the background to such projects.

This philosophy explains why, in the field of fisheries, the emphasis was put on the development of the coastal zone. The creation of a fleet of tuna fishing boats, one of the principal objectives of several other Pacific Island nations such as the Solomon Islands (Waugh, 1986; Doulman and Kearney, 1987; Blanchet, 1991) but which involves huge capital investment and equally large operating expenses (Kearney, 1980; Skapin and Pintz, 1987), has been postponed to a later phase of the country's economic development.

At present, coastal fishing represents a type of activity that has been around for a long time, and exists mostly in the form of subsistence fishing. It relies on a wide range of equipment and techniques and aims at catching a wide variety of species. Practiced at village level, this type of fishing lacks any kind of structured commercial organization. For this reason, we shall refer to it in the course of this paper as "small-scale unstructured village fishing." To complement this unstructured fishing, which is considered by public administrators to be rather unproductive and unlikely to lead to national self-reliance in fisheries products, a modern commercial type of fishing has been initiated, relying on technical specialization, a reduction of the number of species sought, and an extension of the fishing zone. This type of fishing, which receives technical and financial assistance both at production and at marketing levels from government agencies as a part of their fisheries development policy, will be called "structured commercial village fishing." In this paper, we propose to study the various ways in which these two types of fishing are integrated within the policies of food self-reliance. Following a brief description of the geographical and economic environment in Vanuatu, we shall assess the state of coastal fishing at the time of independence. We shall then discuss the government's policy regarding the development of structured commercial village fishing. An evaluation of the outcome of this policy will be made, and some comparisons will be made with the small-scale unstructured village fishing. The prospects for development and increase of fisheries production are considered.

## The Geographical and Economic Environment

The island group forming the Republic of Vanuatu is of both volcanic and coralline origin. It is made up of approximately 80 high islands fringed with narrow ledges of coral reef. Spreading from North to South over nearly 900 km (Fig. 1), the country covers a total area of 12,200 km$^2$.

At the time of the 1979 census, the population numbered 111,251, 93% of whom were of Melanesian origin. The birth rate was 42 per 1,000, and the mortality rate was 13.6 per 1,000, for a population growth rate of 28.5 per 1,000 (Bedford, 1989). In 1989, 142,630 people were counted in the whole of the country, representing an increase of nearly 31,500, or 28%, over the preceding 10 years. Generally speaking,

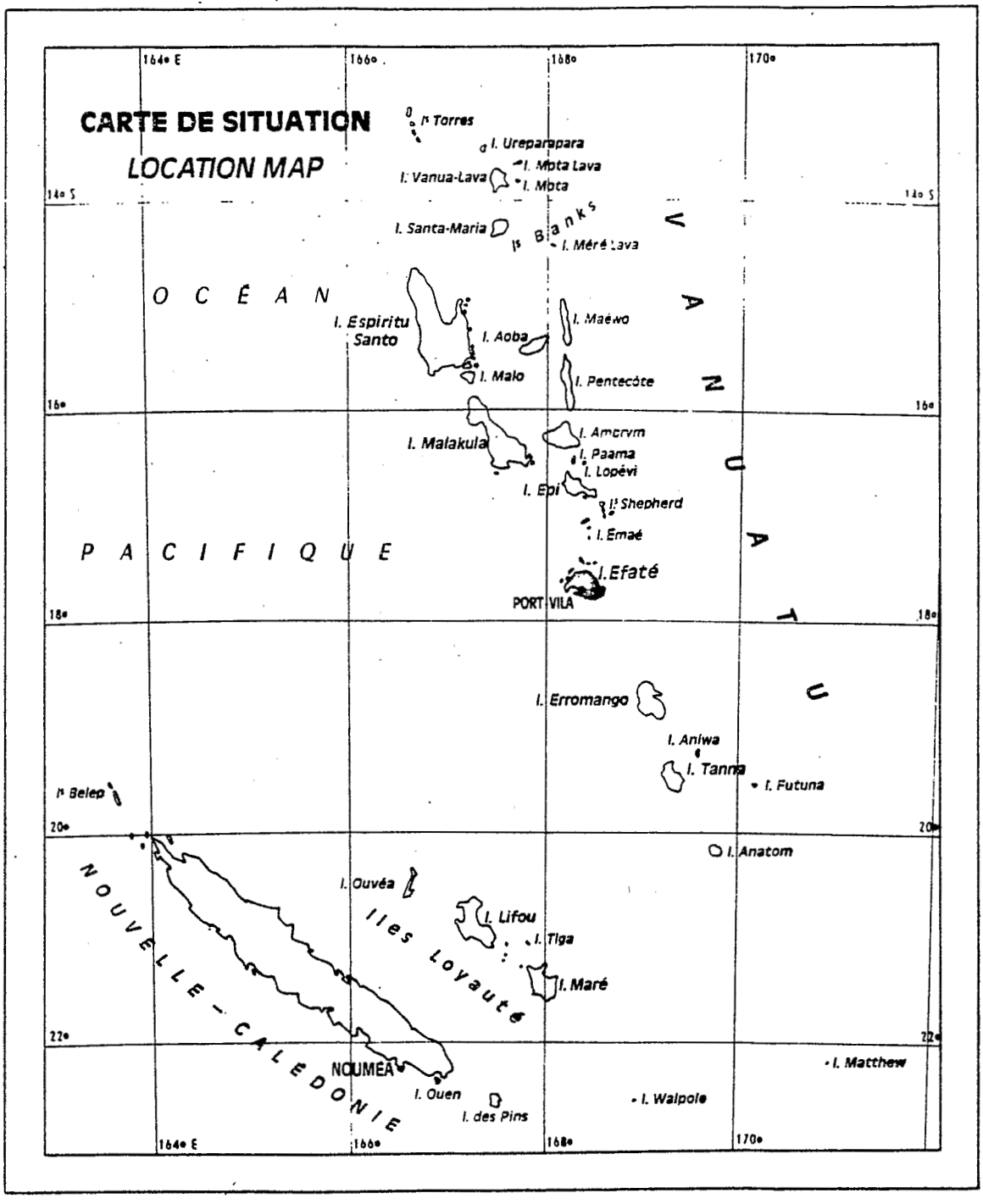


Figure 1. The Archipelago of Vanuatu.

the country is little urbanized, but this situation is changing rapidly. In 1979, 86.5% of the population was living outside the two urban centers of Port Vila and Luganville (with populations, respectively, of 9,970 and 5,160). By 1989, the urban population represented 18.5% of the total census figures. Port Vila now counts 19,040 people, a 94.5% increase over a 10-year period. The population of Luganville stands at 6,900

(with an increase of 33.5%). Roughly 70% of the population lives on the foreshore, within 2 km of the ocean. In the space of 10 years, the demographic pressure on arable land has greatly increased. The average number of hectares per household has shrunk from 26 to 22. In four out of the 11 regions, the average is even lower; each household has only 5 to 9 hectares of arable land. There is little doubt that if this population growth continues unchecked over the next few years, a number of islands will experience a serious agricultural land shortage, which could lead to grave soil erosion problems, to the beginning of malnutrition in rural areas, and to an increased population shift toward the capital, Port Vila. In fact, Vanuatu faces a critical nationwide land development problem. Within the framework of the current land ownership structure, characterized by the total refusal on the part of the traditional landowners to allow outsiders to settle on their lands, any migration from overpopulated areas, where arable land is becoming scarce, toward sparsely populated areas cannot even be considered.[2)] Such refusal, if it is allowed to continue, can only reinforce the tendency to migrate to the city, in this young state where the notion of national unity is practically nonexistent. Thus, it constitutes a very serious threat to the political and economic viability of the nation.

## State of Coastal Fishing at the Time of Independence

The analysis presented herein is based mostly on the results of the first Agricultural Census carried out in 1983 (David and Cillaurren, 1988).

Fishermen, coastal fishing activity, and fishing grounds throughout the islands of Vanuatu are still generally steeped in tradition, using age-old ways and means of fishing. This legacy is reflected first in the labor content. Fishing is seldom an exclusive activity; it is carried out in conjunction with agricultural activities, with agriculture still the main source of income. Fishing is therefore simply a sideline, either for commercial purposes—to bring in extra money for the household in order to meet particular expenses such as taxes, school fees, and celebrations—or for subsistence purposes, in which latter case fishing is a regular operation, and only the surplus is marketed.

Under these terms, only those households are considered fishermen in which one or several members are involved, either regularly or occasionally, with fishing and the gathering of aquatic products. On average, 66 to 72% of the foreshore dwellers fit within this definition. Within a single household, one must distinguish between fishing activities performed by men, those performed by women, and those performed by children. Specific types of gear, of techniques, of target species and of fishing grounds are reserved for each sex. Generally speaking, the fishing activity of adults is more regular than that of children, which is largely governed by school schedules.

Second, the legacy of tradition also is evident in terms of space. The most significant aspect is the number of landing points and consumer centers spread out along the coastline. Because of this, fishing activities are conducted at the village level; the village acts in three ways, as home base for the fishermen, as landing point for the catch, and as a consumer center. The fishing grounds are also traditionally tied

to the village location; as a rule, they adjoin to the village, and in many places they constitute an actual fishing territory, with access reserved to the villagers. Fishing operations are usually limited to the shallower areas of coastline, the intertidal zones and intratidal zones, less than 10 m deep, and to the coastal zones sheltered from the ocean swell.

## Means of Production

The means of production are also influenced by tradition. As in Papua New Guinea and the Solomon Islands (Gaigo, 1977; Pernetta and Hill, 1981; Joachim, 1986), this heritage is best seen in the diversity of fish-catching equipment, the small size of the fishing craft, and the small percentage of motorization, compared with Africa, Latin America, or such parts of Polynesia as the Kingdom of Tonga (Bataille Benguigui, 1989; Halapua, 1982).

### *Fishing Craft*

Throughout Vanuatu, the use of motorized craft for fishing purposes remains unusual. Boats equipped with outboard motors represent only 13% of the whole "fishing fleet." Most of these are used for the transport of people and goods, with fishing as a sideline.

Most fishing outings are done in small outrigger dugout canoes propelled by paddles. Their nautical performance is poor, and they are not well suited for offshore traveling. Sailing canoes are rare. These are usually larger than the other canoes, and can attain a length of up to 10 m. The greatest concentration of canoes is found on the island of Malekula, which has one third of the canoe population of the whole group. In other islands, fishing activity is often limited to wading in shallow water and to underwater spear fishing (60 to 70% of fishing outings). Less than a third of all households own any kind of craft.

### *Fishing Gear*

A wide range of implements is used. The majority are of the throwing or casting type (hand-spears, bow and arrow, casting nets, underwater spear guns) or of the passive, static type (traps, gill-nets, holding pens). This equipment is usually the property of the fisherman. Whereas the materials used in their construction are usually of industrial origin, the design remains mostly traditional. Generally, they are of limited size.

## Hand-Held Fishing Line: The Most Common Implement

Of all fish-catching implements, hand-held lines are the most versatile. They can be used for trolling or for bottom fishing, either from boats or while wading on the outer edge of the shallow coral flats. Given this versatility, it is not surprising that they should be the most common type of fishing gear. They account for 55% of all fish-catching equipment. Each household owns an average of 2.5 such hand-lines. Their design is very simple; usually, a fish hook is attached at the end of a length of

nylon line, which is then wound around a soft-drink bottle. When used for fishing on or just off the bottom, the line is weighted with a stone or an old flashlight battery.

Line fishing is hardly a traditional fishing technique in Vanuatu, and eye-witness accounts, such as that of Garanger (1972: 109), show that 20 years ago it was seldom practiced.[3)] The Banks and Torres island groups in the north of the country are an exception to this. At the close of the last century, the Rev. Codrington (1891) noted the manufacture of large numbers of mother-of-pearl and tortoise-shell fish-hooks, and the common use of surface lines for the catching of flying fish. Apart from the Banks and Torres groups, then, the hand-held line can be considered a modern development in Vanuatu, and its use began to spread only recently with the availability of monofilament nylon line and steel fish-hooks in the small general stores of the coastal villages.

## Traditional Fishing Gear: Hand-Spears, Bows and Arrows, Fish Traps

From 25 to 30% of fish-catching equipment still consists of traditional implements: hand spears, bows and arrows, and fish traps. Hand spears and bows are used exclusively by men and boys, either on foot or from canoes. The use of fish traps is reserved for women and girls.

Spears are the most common type of traditional implement. They represent 20% of all fish-catching equipment, and 74% of traditional equipment. The most frequently seen model is made of a long bamboo shaft, with four wooden spikes, 10 to 20 cm long, lashed at the end. Over the last few years, the wooden spikes have been replaced by sharpened steel ones. Fishing is done on foot, along the intratidal coral flats or tidal channels through seagrass beds, or from canoes, among mangrove swamps, over the reef at high tide, or, (less frequently) offshore in deep water. Alongside these small spears, of which every household owns from one to three, are longer spears designed for catching turtles. These are made of a shaft of heavy hardwood, fitted at the end with a sharpened metal tip. They are tied to a large plastic float with a few meters of rope, so that the flight of the harpooned turtle may be easily followed after the animal has dived.

Still widely used in certain islands, such as Mallicolo, the bow and arrow technique has completely disappeared in other places. Bows and arrows represent 5% of the fish-catching equipment used in Vanuatu. Their use is exclusively reserved to the men. Generally, bow fishermen are either older men, faithful to the old techniques, or boys and young men, for whom the bow is more of a tool for showing off their skill than a serious fishing implement. In either case, the bow is usually used while wading on the coral flats.

Fish traps are disappearing as fish-catching devices. They are made of flexible sticks, and their use is by now limited to catching small fish on the coastal reef flats, particularly in tidal pools, and at the mouths of rivers.

## Modern Implements

If we count hand-held lines in this category, modern implements represent 72% of the equipment used in small-scale unstructured village-level fishing. Fishing reels,

spear guns, and casting nets are reserved for the men; gill-nets are occasionally used by women.

*Nets*

Although it has been shown that their use was traditional in the Banks and Torres groups for cooperative fishing ventures, and Father Doucere (1922) noted their widespread use in many parts of the country, gill-nets must be classified as modern equipment. The nets currently in use, the materials they are made of, and the fishing methods and strategies used have very little in common with the traditional nets and methods of the beginning of the century. The most commonly used type of net is imported from Asia. Typically, it is roughly 10 m long, 1.5 to 2 m deep, and made of synthetic fibers. Considering its high price relative to the disposable income of the average rural household, the purchase of a gill-net represents a major investment, one that can be contemplated only by the wealthier households. Thus it is not surprising that gill-nets currently represent only 4% of all fishing equipment, and that the majority of them are found near the urban centers. Fishing with gill-nets is usually considered a man's task. They are used more often by fishermen on foot than during outings with boats. The device is laid parallel to the direction of the flow, in the breakers along the beach, at the edge of mangroves, or where the fringing reef drops off. This is an active type of fishing; the fisherman remains near his net, ready to haul it up as soon as an interesting catch has been sighted.

Trickier to handle, casting nets are less common than gill-nets, although their purchase price might be up to 40% lower. They represent only 1% of all fishing equipment. Half of the casting nets are found on the island of Efate and the nearby islets. Exclusively reserved for men, they are used on a rising or a falling tide while wading on the coral flats or at the line of breakers off the beach.

*Spear Guns*

Whereas the spread of gill-nets through the fishing community took place in a gradual manner, underwater spearfishing caught on rapidly. At this time, one third of all households engaged in fishing own a spear gun, and spear guns represent 10% of all fish-catching equipment. Alongside the standard Western-made spear guns are found some of local manufacture, very rudimentary in design, made up of a metal spear and a rubber launcher attached to a piece of wood, 10 cm long, against which rests the end of the spear. Snorkels are rare, but all divers use face masks.

Spear fishing with a gun is usually reserved for the men, but diving in shallow water for the purpose of gathering shellfish (or, more rarely, crayfish) may be done by women, as long as this is done for subsistence reasons only. This explains why diving to gather trocas and large sea snails, both valuable commercial pearl shells, is still the prerogative of the men.

*Reel-Mounted Fishing Lines*

Hand-operated reels, such as might be found on motorized craft for deep-water bottom fishing, are still rare. Only 1% of fishing households have them. These are of the "bicycle pedal" type, the first models having been brought to Vanuatu about 30

years ago. Because of the risk of corrosion, they require regular maintenance; as most users will not take this trouble, the reels seldom last more than five years. Recently, a new sturdy wooden model, introduced by the Vanuatu Fisheries Department, has taken over from, and is replacing, the older metal bicycle pedal type which is now disappearing.

*Fish-Holding Pens*

Fish-holding pens are the least numerous of the modern devices. There exist only a few dozen, most of them on Efate. The introduction of this type of equipment in Vanuatu is recent, and can be attributed to immigrants from French Polynesia. A holding pen consists of roughly 50 m of "chicken wire," about 1.5 m high, stretched on metal uprights stuck in the coral of the fringing reef, or on wooden poles driven into the mud. As wire mesh is subject to rapid corrosion, this equipment has but a short life span.

These Polynesian fish-holding pens are an improvement on the older traditional traps, which consisted of blocks of coral arranged in circular patterns on the coral flats and were designed to retain water as the tide ebbed. It does not appear that this older type is still in use anywhere, but the remains of some examples can still be seen, such as the ones mentioned by Barreau (1956) in Aliak, on the West coast of the island of Pentecost, which were still visible in 1985. These ruins are only a few centimeters high, and are able to trap only very small fish. This is more in the nature of an amusement for children than a genuine subsistence activity. Another type of construction consists of piling up stones in a tidal pool. At the scale of the pool, the construction acts as a miniature artificial reef. On a rising tide, it attracts small fish which enter it for protection, and they are trapped there at low tide. The pile of stones is then dismantled, and the fish gathered. This type of fishing has also been mostly abandoned, and is only occasionally practiced by women and children.

Multi-Purpose Equipments

Alongside implements which can be unmistakably classified as fishing gear, since the catching of sea-life is their main function, we find some devices which can have more than one purpose, and for which fishing is but one of many uses. The most common among these is the ubiquitous bush knife, at least one of which can always be found in every rural household. Fishermen often use them to "cut" fish which have been trapped by the ebb in tidal pools, or while wading on the coral flats at night. The bush knife is wielded as readily by women and youths as by men. Less common, and mostly reserved for the women, are steel rods used for catching octopus at low tide, and for looking for shells under rocks. These are often spears from a native spear-gun, when the household owns such a device.

One-Time Implements

Apart from the strictly defined fishing gear, and the multi-purpose tools used in fishing, there is a third category of fishing tools which consists of devices used only once; among others, we will note principally coconut fronds and vegetable poisons.

Coconut fronds are used as nets for community fishing. Once woven, they can be assembled to form rude nets, ten or so meters long, often used in the Banks islands to drive small fish toward the beach in narrow bays, where they are then killed with bows and arrows, hand spears, or bush knives.

Vegetable poisons are derived from the leaves of the foreshore shrubs, barringtonias and derris, which are either bruised, pounded, or shredded before being placed in pools, where they poison the whole of the fauna.

The use of explosives—the one-time device par excellence—was very popular during the first half of this century, particularly during the few years following World War II, but seems to have mostly disappeared by now, partly on account of the difficulty of supply, and partly because of the Government's efforts to ban the practice.

## Production and Its Use

In 1984, the total production for small-scale unstructured village fishing amounted to 3,674.5 tons (with a 5% risk confidence interval: 2,637 to 4,885 tons). Nearly half of this total is made up of fish, 29% of shellfish, 21% of crustaceans, and 2% of squid and octopus. Throughout the country, utilization of this production is mostly based on local consumption (75 to 90% of the fish caught, 93% of the shells collected), with only a small proportion being commercialized. Generally, the catch is sold either as the boat lands or at the fisherman's home. Most frequently, the buyers come from the same village as the fisherman. Sales are then classified as "local village consumption," which we shall distinguish from the fisherman's own domestic consumption. Outside the narrow strip of coastal land which contains the fishing communities, there are no fish distribution networks. So large segments of the rural population, particularly in the interior of the islands, have no access to fresh seafood.

Collected by the women, shells are seldom put up for sale at the village level. However, whenever they live near an urban center, the women may occasionally offer their catch on the market. Octopus, another type of catch reserved exclusively for the women, are invariably consumed within the household, frequently in the form of "lap-lap." This traditional dish, which looks like a fat pancake, is made up of grated taro, yam or manioc mixed with coconut milk and flavored with pieces of octopus, the confection then being steamed in the traditional underground earth oven. When it comes to crustaceans, a distinction must be made between crabs, fresh-water shrimps, and lobsters; the latters are the only ones to be actively marketed, with half of the catch offered for sale. The major buyers are the restaurants of Port Vila and Luganville.

As we have just seen, the integration of the village-level fishing activities within the monetary system will vary according to the type of production and the particular island involved. It will depend also on the economic strategy of the fishermen themselves. We must distinguish between fishermen who only market their surplus production over what they can consume themselves, and those who show a marked determination to produce for the market, and apply themselves to increasing the volume of their catch. Generally speaking, the productivity of these latter is roughly three times that of the former. This comparison is fundamental, as it shows that

small-scale unstructured village fishing is not bogged down in the past, and that technical or economic innovations may appear from within.

### Small-Scale Unstructured Village Fishing and Fisheries Development: The Government Point of View

Generally speaking, small-scale village fishing is poorly regarded by the authorities. Their first complaint is about the poor performance level of the equipment used, which leads to a low "catch per unit effort" ratio (CPUE), expressed in weight. Furthermore, this equipment limits the fisherman to an area extending just a few hundred meters from his village's waterfront, with most of the fishing outings taking place on foot or as free-diving spear-fishing expeditions. Thus, the fishing grounds are tiny, on the order of a few dozen hectares spread between the fringing coral flats, the mangroves, the beaches, and the first few meters of the outer reef slope. The concentration of fishing activity in such a limited area creates severe pressure on the resources, with population growth resulting in a rapid increase of this pressure on the marine environment.

The low productivity of small-scale unstructured village fishing results, at the national level, in a chronic inability of this type of fishing to satisfy the demands for seafood of the non-fishing population. Thus, the consumption of fresh fish in the urban areas and in the interior of the islands remains low, as was shown in a study done in 1983 as part of the National Nutrition Survey among a test sample of 522 pregnant or nursing women.[4)] Protein deficiencies have been seen to occur in some of the more remote areas in the country, as well as in some of the poorer districts of Port Vila (Hung, 1983). Consequently, it is not surprising to find that tinned fish is much in demand. In 1983, tinned fish imports rose to 619 tons. Tinned mackerel from Japan represented 82% of this total, accounting for 6% of the total value of food imports for that year. Between 1979 and 1984, an average of 722 tons of tinned fish were imported a year.

In the opinion of the authorities, small-scale unstructured village fishing is incapable of generating a reliable increase of seafood production. Any attempt at technological or economic innovation leads to an imbalance between the capabilities of the environment and the pressure put upon it by fishermen. According to this reasoning, to base a fishing development policy on this type of small-scale fishing would appear as a dangerous utopia. Only through the implementation of a modern structured system can the continued exploitation of the country's coastal resources be guaranteed, while at the same time fisheries production is increasing.

## The National Development Policy for Coastal Fisheries

### Exploitation Strategy

The development of small-scale fisheries has been one of the priorities in the first two Five-Year Development Plans (1982-1986, 1987-1991). This policy was implemented in 1982 with the introduction of a development program for commercial village fisheries: the V.F.D.P. (Village Fisheries Development Programme). The

emphasis was on the exploitation of new fishing zones located along the reef drop, using motorized vessels fitted with lines mounted on reels, operating at depths of 100 to 400 m, beyond the range of the traditional canoes propelled by paddle, and well beyond the narrow stretch of fringing reefs where most of the "traditional" fishing activities are concentrated if there is no lagoon available. Upon the country's achieving independence in 1980, these zones, consisting mainly of ichthyosarchotoxin-free fish,[5] —essentially Etelidae (red snapper), Lutjanidae (sea perch), Serranidae (grouper), Lethrinidae (emperor fish) and Pentapodidae (bream)—had not yet been subjected to any form of fishing. Because they are not particularly abundant, the exploitation of these stocks must be carefully supervised and managed. Brouard and Grandperrin (1984) have shown that the maximum sustainable yield (MSY)[6] would be of the order of 760 tons per year for the whole of the country's usable areas, or an average of 1 kg/ha/year. A total of 120 motorized vessels, each carrying three hand reels and going out an average of 150 times per year, would be sufficient for producing the desired quantities, with each reel being in use 4 to 5 hours at each outing and expected to bring up an average of 3 kg of fish per hour of use.

In actual fact, the object of the Village Fisheries Development Programme was to set up, alongside the small-scale unstructured village fisheries, a structured commercially oriented sector which would exploit new resources in a new fishing area, with new or upgraded techniques and modern equipment. This would require the building up of a new generation of professional fishermen, involving either "traditional" fishermen attracted by the prospect of profits or, more rarely, "small-scale businessmen" drawn to fishing.

## Objectives of the Development Plan and Logical Implications

The main purpose of the V.F.D.P. is to develop commercial fisheries at the village level, and to achieve four related objectives: to improve the nutrition of rural and urban dwellers, to reduce the imports of tinned fish, to develop a cash economy in village communities (Crossland, 1984a; Legal, 1986), and to create employment opportunities and cut down the migration into Port Vila.

Two logical tendencies follow from closer examination of these objectives.

The first is a tendency toward an outward-facing economic structure, integrated into the national and international markets, with priority given to exporting overseas and supplying the urban and tourist markets with species of fish of high commercial value. For island economies, this activity would result in cash generated from the capital, Port Vila, which in turn would lead to the development of related commercial activities and provide employment. The species marketed hold a strong appeal, and the potential demand from overseas could be seen as quite significant and likely to encourage further production in the islands, because villagers would realize that fishing can be very profitable. The object, then, will be to reach a high enough level of supply to compete for a share of the international market; once this has been secured, fishing operations will be able to continue over the long term and thus ensure the sustained development of the island economies.

Two of the four goals which the V.F.D.P. has set itself have been fulfilled. These are the development of a cash economy and a decrease in urbanward drift through

employment opportunities. The nutrition objective has been met only in a roundabout way. Because fishing production is entirely geared to the outside market, no direct contribution from fisheries development can be expected to improve levels of nutrition within the rural population. However, the income generated will enable families to increase their food expenditure, and thus to significantly compensate for the lack of a commercial supply of fresh fish. Undoubtedly, imported tinned fish is one of the products which is benefiting the most from the increase in demand. The fourth goal of the V.F.D.P., therefore, cannot be achieved and is proving to be totally opposed to the logic of the proposed development scheme.

The second development trend is absolutely in opposition to the first one. It is inward-facing by nature, its emphasis being on supplying the rural population with protein from the sea and on finding a substitute for imported tinned fish. With this tendency, small-scale fishing takes second place to agriculture, which is considered the actual force behind the island economy in that it is a source of foreign currency. Fisheries are therefore very vulnerable to any fluctuation in the agricultural sector, particularly variations in the price of copra, which is still the main source of foreign currency in rural areas. In this sense, the fishing industry is closely linked to, and dependent upon, the economic situation in the island, and has virtually no scope for autonomous growth. Because of this, its role in the development of a cash economy is limited and its contribution to controlling population drift to the city is very marginal.

A clear choice between these two development models has never really been made. Indeed, the authorities have all along endeavored to combine these two approaches, with the emphasis being placed on supplying the two local urban markets and overseas exports on the one hand, while on the other hand trying to provision the local rural market.

## Implementation of the Development Policy

Development policy evolved in two stages. The first one, from 1982 to 1989, saw the implementation of the "Village Fisheries Development Programme" (V.F.D.P.), for which the "Fisheries Extension Service and Training Center Project" has now been substituted .

### *The Village Fisheries Development Programme (1982-1989)*

Set up for an initial duration of three years, the V.F.D.P. provided for the creation of 25 Fishing Cooperative Associations, to which technical and financial support was guaranteed for the purchase of equipment, as well as providing for the training required for its handling and maintenance.

The E.D.F (European Development Fund) is the main backer of the V.F.D.P. As part of its program of aid to ACP countries between 1982 and 1985, it has provided 73 million US$, 53% of the 138 million of the total budget for the operation (Crossland, 1984a). Canada also provides a substantial contribution, amounting to 18 million US$, in the form of salaries for the "C.U.S.O." volunteers who look after the technical training and support of the fishing cooperative associations. Between 1982 and 1986, a dozen or so young Canadians worked on two-year contracts. British and Dutch

volunteers are also involved with the V.F.D.P. Few in numbers during the early years, they are gradually taking over from the Canadians.

The locations of these fishing cooperative associations are selected after an in-depth study. In addition to the applications made by motivated candidates, several economic and ecological factors are taken into account. Among these, the most important seems to be the abundance of marine resources within a short distance of the fishing village, good shelter for the fishing boats, and the proximity of a wealthy enough market within easy access range. Furthermore, the applicants must have access to sufficient capital to buy a portion of their equipment with cash, and also must be able to show alternate sources of income, so that they are able, if need be, to repay part of their bank loans. They must also agree to enroll in the fishing training courses, lasting four weeks, which are provided at the Fisheries Department Headquarters in Port Vila.

Once selected by the Fisheries Department, each fishing cooperative association is issued a boat, three or four wooden hand reels and their complete tackle, two outboard motors, (one 25 hp and the other 5 hp, to serve as a back-up in case of breakdown of the main one). The boats are either 8.6-m catamarans or single-hulled boats 5 m long. In 1984, one of these catamarans, complete with motors and fishing tackle, was worth 9,010 US$, and the price of the monohulls was 5,380 US$. The boats and the reels are built in the shipyard at Santo, which was built in 1982 and is under the authority of the Fisheries Department. In order to preserve the fish caught 14 refrigeration units were installed. Ten of these are simple refrigerators, costing 1,350 US$ each, running either on gas or on kerosene. Two fishing cooperative associations have been equipped with ice-making facilities capable of producing 400 kg of ice per day, while two others have had 22.3 $m^3$ walk-in freezers installed. The ice-making plants represented an investment of 10,400 US$ each, while the cost for each walk-in freezer was 16,600 US$. On average, the whole of the equipment for a fishing cooperative association (motorboat, fishing gear, and refrigeration equipment) costs between 9,000 and 10,000 US$. The E.D.F finances 50% and the Vanuatu Development Bank lends 40% in the form of three-year loans to the fishermen at an interest rate of 4% per annum. This leaves only 7% of the total investment to be provided in cash by the users, or 600 to 700 US$ per cooperative association. It is difficult for a single individual to find such a sum, so the majority of the fishermen pool their resources in the form of either family or village fishing cooperative associations. In the latter case, the whole of the village contributes financially to the creation of the association, of which everyone is a shareholder. The fishermen are then chosen by the chief or by the elders from among the volunteers. In some rarer cases, the association is the fruit of the grouping of several individual fishermen who are not related by family ties, and who pool the whole or a part of their personal capital. The fishermen do not receive a share of the proceeds, but rather a monthly or yearly wage. At the close of each year, any money left over is shared among the association's shareholders.

In order to sell the product of the fishing cooperative associations, two fish markets equipped with substantial cold storage capacity were opened in the two major urban centers, Port Vila and Luganville, by the Government of Vanuatu in

1983 (Crossland, 1984b).

During the first year of the V.F.D.P.'s operation, these fishing associations caught 49 tons of fish. Two years later, the production was up to 97 tons, representing a doubling of the landed quantities. Fifty-five to 60% of this catch was sold in the fishermen's own villages or in nearby communities. The selling price varied from 1 to 1.35 US$ per kg. The rest of the catch was sent to the Port Vila and Luganville fish markets, where it fetched the equivalent of 2 to 3 US$ per kg. The fish is transported by road from the fisherman's dwelling to the nearest airport, then by air to the airports of Port Vila and Luganville, where it is taken over by the delivery trucks of the Fisheries Department. During transport, the fish is kept at a low temperature in 40-kg insulated sacs. Through agreements between Air Melanesie, the national airline, and the Fisheries Department, the air-freight rates are very reasonable: the equivalent of 0.30 US$ per kg, regardless of the distance covered.

The first three years of the V.F.D.P. have been considered by the Fisheries Department to be a success (Legal, 1986). The program was meant to end in December 1985, but in view of its popularity, with the Fisheries Department receiving two to three applications per week for new associations in 1985, it was decided to extend the V.F.D.P. by another four years to mid-1989, at which date a new structure called "Extension Services" was inaugurated.

By 1983, 11 fishing cooperative associations were in operation. They were producing 49 tons of fish, i.e., almost 4.5 tons each, generating turnovers of between 4,500 and 5,000 US$. This is quite a substantial amount for rural areas, given that, in that same year, the average annual budget for a family was 785 US$ (David, 1987). Fishing therefore appeared to be a particularly viable activity; this impression, circulated through public opinion, led the political leaders on each island of Vanuatu to bring pressure to bear on the Fisheries Department to grant their constituents assistance through the V.F.D.P. By 1984, the initial target figure of 25 associations was more than exceeded. Since then, over 200 fishermen's associations have been formed. However, these figures should not be misinterpreted; they in no way indicate that the V.F.D.P. is a success. On the contrary, on balance, the eight years in which this program has been in place show it to be a failure. Two facts are evidence of this.

Since 1983, the average production volume per association has steadily dropped off. While the number of fishing associations may have increased 15 times in six years, unfortunately the same does not apply to the fishing yields. Table 1 shows briefly the situation in the landings of commercial village fisheries as monitored by ORSTOM and the Fisheries Department (Cillaurren, 1990). The overall production figures shown are probably 30 to 50% below actual yields, as the follow-up of operations has only taken into account 50 to 70% of the operational associations; this is no mean feat given the geographical dispersal of the associations and the lack of "auction centers" where landings could be grouped.

In 1983, the 11 associations produced 4.46 tons on average. In 1988, 75 associations landed 79.3 tons, i.e., an average yield of 1.06 tons per association. This evolution clearly shows that in 1983 fishermen were close to five times more productive than in 1988. Actually, the V.F.D.P. very early on suffered from its own popularity. As it was designed, the program required a strict follow-up of the fishermen

Table 1. Development of Fisheries Production Supported by the V.F.D.P. (according to Vanuatu Fisheries Department)

| | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 |
|---|---|---|---|---|---|---|
| No. of associations | 11 | 23 | 50 | 72 | 59 | 75 |
| Total yield (ton) | 49.1 | 87.9 | 97.5 | 128.9 | 93.5 | 79.3 |
| Average production per association | 4.5 | 3.8 | 1.9 | 1.8 | 1.6 | 1.1 |

in order to teach them fishing techniques, equipment maintenance, fish preservation, and management procedures. The number of young professional fishermen sent by the NGO's, who were meant to assist the 25 fishing associations as planned initially, never exceeded a dozen people, and most of the fishermen's groups dissolved after a few months of operation because of the lack of technical assistance and appropriate advice. This failure has been diagnosed as a reflection of the lack of profitability of the associations and the impossibility of ensuring their economic viability (Shepard, 1987). The government has endeavored to take this into account in the implementation of the second stage of the small-scale fisheries development policy, already in place.

*Flisheries Extension and Training Center Project*

This new program has three objectives:

1. Training of fishermen. A fisheries school has been operating in Luganville (Santo) for the past year, and seven training centers have recently been inaugurated in the main regions of the country.
2. Implementation of a "leasing program" for fishing vessels, in lieu of the previous funding program (51% in donations, 42% in bank loans, and 7% in own capital). As the EEC withdrew from directly funding the equipment and tools in order to assist with the infrastructure and budget requirements of the program, the fisheries school and the new Fisheries Department in Luganville were totally funded by the European Development Fund.
3. Diversification of the fishing fleet, with a view to tailoring the vessels more to the fishermen's needs. Now, sailing outriggers, fitted with 5-hp outboard engines, are being offered to part-time fishermen living along the coast sheltered from the trade winds. These canoes are longer and faster than those proposed originally, and cost a lot less, both to build and to operate. However, for those few motivated and expert fishermen keen to turn fishing into a full-time occupation, there will be vessels in excess of 10 m long to improve their safety at sea, extend their fishing range, and increase the time that they can spend in the fishing grounds.

Under this program, it is essential that these seven professional training centers be established and placed under the direction of qualified professional fishermen who can advise the fishermen and help them maintain and repair their gear. These centers

Table 2. Average Duration of Fisheries Projects (N=138)[1)]

| Duration (years)[2)] | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| No. of projects (%) | 0.5 | 0.5 | 3 | 4 | 13 | 26 | 53 |

[1)] Survey done on a sample of 138 projects monitored by ORSTOM between 1983 and 1989.
[2)] Mean=1.8.

must be equipped with ice-makers and cold-storage space to provide the fishermen with ice and be in a position to purchase their catch from them. This should enable neighboring associations to begin again on a better footing. In fact, this can be considered a return to the original plan, on a somewhat smaller scale. It is funded by the EEC, with the accent placed on the management of village fisheries.

## Discussion

### Evaluation of the Village Fisheries Development Program

We will limit ourselves here to a discussion of the results of the V.F.D.P. in terms of the goals which had been set for it.

#### *Creation of New Jobs and Development of Cash Earnings*

Between 1982 and 1989, over 200 fishing cooperative associations were created, each employing an average of three to five people. This would seem to indicate that the aim of generating new jobs had been fulfilled. However, this is not the case. Very few associations manage to go beyond three years of operation (Table 2), and the population of "professional fishermen"[7)] who were supposed to ensure the long-term success of the fisheries development program consists of only a few dozen persons. The jobs that should have been indirectly generated by the program, through reinsertion into the local economy of the cash profits earned by the associations through the sale of their products on the urban markets, have been all but non-existent, since the associations' commercial activity has been mostly centred on local markets. In the early years of the V.F.D.P., shipments of fish to Port Vila and Luganville certainly contributed locally to the increase in available cash, but this era is now over.

In 1987, the Fisheries Department was placing great hopes on the exportation of deep-water red snapper to high-income countries such as Australia and New Caledonia. This commercial activity was supposed to be greatly helped by the weakness of the local currency, the Vatu. Storage and conservation of the fish should not have been a problem, as can be seen in a study published by the "Tropical Development and Research Institute of London" (Ames and Curran, 1985). These hopes led the public authorities to increase the storage capacity at Natai. Unfortunately, because of a lack of regular supply, no export scheme could be implemented. Instead, the running costs at the Natai facility increased alarmingly, forcing the manager to raise his selling price to the consumer and to limit the raising of his purchase price to the fishermen. Having decided that they were no longer sufficiently compensated

for their efforts, a large proportion of the fishermen stopped sending their catch to Port Vila, preferring to concentrate on the local market. Since then, the supply of fish to Port Vila from the projects supported by the V.F.D.P. has been constantly decreasing. This situation has led to the development of a type of casual commercial fishing by game fishermen which is seriously competing with Natai for the supply of the tourist and the expatriate markets. Two fish retail outlets supplied by this game fishing have been opened in the two main supermarkets of Port Vila.

Now commercial fishing has only a small share in the influx of currency in the islands. But it is still a source of outflow of money, to pay for replacing fishing tackle, for refueling, and even for buying ice. Under the present circumstances, therefore, commercial village fishing actually increases the balance of the trade deficit in those islands of Vanuatu which have fishing associations.

*Improvement in Nutrition and Reduction of Tinned Fish Imports*

Commercial village fishing never really substituted for imported tinned fish, neither in the towns nor in rural areas. A large portion of the catch is sent to the urban markets, where it is consumed mainly by expatriates, who can afford to buy it and by tourists—two segments of the population who would not normally purchase much tinned fish in any case. On the other hand, the Melanesian population cannot aspire to this high-quality fresh fish, as it is sold on the urban market at a much higher price than these people can ever hope to afford. The only products to which ni-Vanuatu consumers may have access are the smaller pelagic fish (mainly sardines) sold from time to time by the odd fisherman door to door, or reef fish which are found occasionally in stores. As for people catching fish for their own consumption, this is extremely restricted in areas close to urban centers, as the waters there have been more or less fished out. Given these conditions, it is hardly surprising that the average yearly consumption of tinned fish among the Melanesian population should be twice that of fresh fish. The poorest families, those that earn less than 450 US$ a month,[8)] consume the largest quantity of tinned fish, 8 to 12.5 kg per year, and the least fresh fish, 3 to 4.5 kg per year (David, 1991).

In the last quarter of 1984, the family-sized tin of mackerel (425 g) was selling for 0.75 to 0.80 US$ in shops in Port Vila and Luganville. For the same amount, you could buy from Natai, the Port Vila government fish market, 400 g of skipjack (Scombridae), 320 g of reef fish or grouper (Serranidae), 275 g of red snapper (Etelidae), or 265 g of shark fillet. And for the same price, the meat lover could buy 400 g of beef stew or 172 g of tinned meat, either locally produced under the name of "tin mit," or imported from Australia as "corned beef." While you can eat all the mackerel in a tin, the same does not hold true of fresh fish, 55% of the purchased weight being scales, skin, gut, and bones (Jardin and Crosnier, 1975). By spending 0.80 US$, the "tin fis" buyer ends up with three times as much food as the buyer of red snapper (Table 3). In addition, depending on the preparation (in oil, tomato sauce, or brine), he is getting four to six times as many calories, two to three times as much protein and vitamins, and four to nine times as much iron and calcium. Of all the protein foods from the sea available on the market in Vanuatu, tinned mackerel is therefore the best choice that a consumer can make from the point of

Table 3. Nutritious Value[1] of Some Protein Foods Bought in Port Vila in 1984 for 80 Vatu[2]

| | Edible weight | Energy | | Protein | Lipid | Calcium | Iron | Vitamins |
|---|---|---|---|---|---|---|---|---|
| | (g) | (kJ) | (kcal) | (g) | (g) | (mg) | (mg) | (mg) |
| Tin fis in brine | 350 | 2580 | 620 | 70 | 35 | 133 | 4 | 29 |
| Tin fis in oil | 350 | 3240 | 775 | 65 | 55 | 665 | 9 | 31.5 |
| Tin fis in tomato | 320 | 2340 | 560 | 50 | 34 | 320 | 5 | 25 |
| Skipjack | 200 | 1475 | 350 | 40 | 20 | 75 | 2.5 | 16.5 |
| Reef fish | 145 | 630 | 150 | 30 | 4 | 40 | 1 | 9.5 |
| Red snapper | 125 | 545 | 130 | 25 | 3 | 35 | 1 | 8 |
| Shark fillet | 265 | 1155 | 280 | 50 | 6 | 75 | 2 | 17.5 |
| Neck of beef | 400 | 3065 | 730 | 70 | 50 | 40 | 10.5 | 36.5 |
| Corned beef | 130 | 1220 | 290 | 25 | 21 | 26 | 6 | 9.5 |

[1] The nutritious content was calculated with reference to the food composition tables prepared by FAO and used by Jardin and Crosnier (1975).

[2] The amount of 80 Vatu represents the officially agreed purchase price of a large tin of mackerel.

view of the cost-to-nutrition-value ratio. Of all the fresh fish sold whole, the skipjack is undoubtedly the best economic choice. In contrast to whole fish, fish fillet does have the advantage of being fully edible. However, at an average selling price of 5 to 6 US$ per kg, it is too expensive for low-income families to buy on a regular basis. The only fillet readily available to them is skipjack, at 3 US$ per kg.

However, price is not the only decisive factor in demand. Although the price is attractive, consumption of shark meat is low, as many ni-Vanuatu consider the shark a magic creature. Other aspects also enter into consumption decisions: the number of outlets selling the product, its flavor, how quickly and easily it can be prepared, etc. While consumers tend to prefer the taste of fresh fish to that of the tinned variety, the other factors undoubtedly make tinned mackerel more attractive.

In rural areas, fresh fish purchases make up an average of 2% of the annual food expenses of a household. By comparison, tinned fish represents 8%, and is the second largest expense for a single item after rice (22% of expenditures). So consumption of fish from village fishing associations remains marginal, and can in no way be seen as a viable substitute for imported tinned fish. The low level of cash income among the rural population, which in 1984 averaged 785 US$ per household per year, the lack of facilities for conserving the catch and the poor condition of the road network throughout the country are the main factors that account for this situation. The distribution networks for fish coming from structured artisanal commercial fishing are poorly developed, and are mostly limited to the coastal areas. Fish sales have probably contributed to improving the nutritional situation of such coastal households as do little or no fishing themselves, which is one positive aspect, but populations living inland could not take advantage of the program, and this is rather less positive. Of the whole

population, it is those who live inland that suffer from the greatest protein shortage, and it is to them that nutrition improvement programs should be targeted in priority.

## Prospective Roles of Small-Scale Unstructured Village Fishing and of Structured Commercial Village Fishing in Supplying the Protein Needs of the Population

In 1984, the total domestic supply of marine food products amounted to 4,322 to 4,885 tons. This represents 377 to 415 tons of protein, i.e., 16 to 18% of the protein requirements of the population, estimated to average 50 g per day for each of the 127,800 inhabitants of Vanuatu. Overall, small-scale unstructured village fishing, operating predominantly for the operators' own consumption, cover 61 to 65% of the protein supply, as opposed to 3 to 5% from structured commercial village fishing and game fishing, and 31 to 34% from tinned fish (Table 4). Clearly, small-scale village fisheries, geared essentially to the operators' own consumption play a major role in supplying the population of Vanuatu with marine food products. By comparison, structured commercial village fishing, on which the best efforts of the government have been brought to bear, plays only a negligable role.

Table 4. Composition of Protein Supply in the Whole Range of Marine Produce for Vanuatu in 1984 (in tons)

| | Unstructured small-scale fishing | Commercial fishing | Game fishing | Imports | Total |
|---|---|---|---|---|---|
| Fish | 145-159.9 | 11.5-12.5 | 5.5-6.9 | 131.3-132.0 | 293.2-310.0 |
| Shellfish | 43.8-54.0 | 0.2 | — | — | 44.5-55.4 |
| Mollusk | 38.9-49.3 | — | — | — | 38.9-50.5 |
| Total | | | | | 376.6-414.7 |

Imports of tinned fish also play an essential role in supplying the populations with their protein requirements. The amount of protein it supplies is almost equivalent to that of the small-scale village unstructured fisheries, 131.5 tons versus 145-160 tons. This result is good news: 131.5 tons of protein is a very tidy amount. It is enough to provide the needs of 7,200 people per year, at the rate of 50 g of protein per day per person. With a total population of 127,800 people in 1984, the daily needs amounted to 6.39 tons. The tinned fish imports as a whole thus were able to support the needs of the whole population for nearly three weeks. But this result is also bad news: from a strictly economic point of view, the importance taken by imported tinned fish in providing the total protein needs of the population can be considered a reflection of the blatant failure of the country's fisheries to meet the population's needs for fresh marine food products. This results in the necessity to resort to importation, the volume of these imports being a good indicator of how much the output of the various types of national fisheries falls short of what is required. To sum up: as 1 kg of protein is contained in 5.7 kg of tinned fish, or in 11.7

kg of reef fish, the national fisheries can be estimated to fall short by 1,447.3 tons (123.7 × 11.7). To reduce this shortfall was one of the main goals that had been set for the V.F.D.P. We can see that, by 1984, this goal was far from being reached. The situation has not improved much since.

Strangely enough, the large part played by tinned fish in the nutrition of the population serves to emphasize the importance of the role of the small-scale unstructured village fishing in providing substitutes for imports. When we consider all marine food products, this type of fishing provides 228 to 263 tons of protein for consumer needs. Had these small unstructured fisheries not existed, the country would have had to import 1,303.5 to 1,504 tons of tinned fish in order to provide an equivalent amount of protein, which would have represented a currency outlay 1.6 to 2 times higher than the whole 800 tons of tinned fish imported in 1984 (Government of Vanuatu, 1986). With the landed cost of tinned fish averaging 1.2 US$ per kg, the small-scale unstructured village fisheries saved the national economy 1.57 to 1.81 million US$ in imports in 1984.

For the sake of comparison, the total solid food imports into the country for 1984 amounted to 11.66 million US$, out of a total of 68.53 million US$ for all imports. Exports amounted to a total of only 43.95 million US$. The added imports of tinned fish which would have been required without the existence of the small-scale unstructured fisheries, amounting to 1,303 to 1,504 tons or 1.57 to 1.81 million US$, would have driven the cost of food imports up by 13.5 to 15.5%, while pushing the trade balance deficit up by 6.3 to 7.4%, from 24.58 to 26.15-26.39 million US$.

## Prospects for the Future

The inability of the Village Fisheries Development Programme to fulfill the objectives for which it had been created leads to questioning the validity of the exclusive support given to the catching of deep bottom species within the development policies for fisheries. This activity requires techniques and gear that are too new, too foreign to the time and space cultural parameters which are the framework of Vanuatu's village society. The simple addition of large amounts of capital is not enough to spread these new practices. In the coming years, it would be desirable to integrate the small-scale unstructured village fisheries within the coastal fishing development policies.

This small-scale fishing offers a real potential for development. It is certain, in the coming years, to play an essential role in supplying the local island markets, in improving the nutritional situation of the population, in creating new jobs and in generating cash income. It would appear feasible to increase the production of small-scale unstructured village fisheries at no great cost. The distribution of mesh nets and cast-nets could help. However, given the narrowness of the fringing reefs, the production potential of such zones could well be saturated fairly rapidly along the densely populated shores. Therefore, the development of fishing efforts should concentrate more on the resources available around the reef slope, between 10 and 100 m deep. The leeward coastlines, being sheltered, would be the most suitable for these activities as fishermen can fish from ordinary outrigger canoes. One interesting way to increase fishing efforts could be to encourage the use of sailing canoes, of the

type used in the Maskelynes islands south of Malekula, equipped with one or two handlines fitted onto reels, and, eventually, a small engine to easily travel windward.

Another means of encouraging fishing would be to introduce simple low-cost methods of preserving the fish, such as smoking and salting. This would enable those fishermen catering to their own need only to take advantage of the occasional surplus of fish, especially the smaller pelagic species, which they cannot turn to profit at the present because they have no way of keeping them. This would enable them to build up a surplus and, if they so wish, to start selling it. Because it offers the possibility of selling their fish to a large number of fishermen who do not have much in the way of financial means, the process of smoking and salting fish is a key to the development of fisheries and the distribution of fish further inland: smoked or salted items keep for several days—sometimes weeks—at ambient temperature and can easily be transported on men's backs over the islands' very poor road systems. There are difficulties with introducing a new product into the dietary habits of the Melanesian population, but there seems to be no reason, as Schoeffel (1985) quite rightly puts it, to believe that, with the appropriate information, the villagers would "disdain" smoked fish, which is no more exotic or foreigh than tinned fish, and moreover, has all its advantages: low price (with large-scale distribution, smoked fish could be sold like tinned fish in all village stores); ease of preparation (just like tinned fish, smoked fish can be eaten cold or re-heated); marked flavor (so that smoked fish could be used as seasoning with root vegetables, rice vegetables or be added to soup or to laplap).

In most tropical countries where smoking and salt drying is done on a small scale, the women are in charge of the processing and marketing of fish. The processing can be done at home, along with the women's household chores. In Vanuatu, where women, as a rule, are left out of gainful activities in rural societies, such a system would enable them to free themselves to a certain extent from the yoke of their husbands, especially financially, and thus play a greater economic role in the household and in fisheries development; it would also take advantage of their dynamic efforts and the rationality which they have gained over centuries of running agricultural subsistence activities in Vanuatu.

The small-scale unstructured village fishing can also take a place in the supplying of urban markets by offering to the less affluent urban families inexpensive products such as small pelagic species (e.g. Selar or Clupeidae) and mullets. However, this type of fishery will not be able to supply the urban market with high-price deep-bottom fish, any more than the structured commercial fisheries that we have described within the V.F.D.P. Catching these species, targeted to the tourist market and possibly to the export market, can only be done by a structured commercial sector, using more efficient boats, at least 10 or 12 m long, and capable of staying more than a day at sea.

## Notes

1) In June 1992, an international conference on this subject will be held in Brazil by the United Nations. A regional workshop for the South Pacific was convened in April 1990 to prepare for this conference (UNDP, 1990).

2) Out of the 30 major islands of Vanuatu, in 1979 12 had a density of less than 10 inhabitants per $km^2$.
3) For a discussion of traditional fishing techniques in the Pacific, the readers would be well advised to consult the work of Anell (1955).
4) During the course of this survey, 78% of urban women and 80% of those from the interior of the islands stated that they had not consumed any fresh fish during the day before the visit of the investigators. Even in the coastal districts, this percentage reached 43% (David, 1987).
5) Commonly called "Ciguatera," ichthyosarchotoxicity is caused by a toxin (ciguatoxin) produced by a dinoflagellate, "*Gambierdiscus toxicus*," found on the outer membranes of the macroscopic algae of coral reefs, particularly the ones occurring in branched and bunched form (Taylor, 1985). The ecological characteristics of *G. toxicus* are still poorly known. Scheuer and Bagnis (1985) note that its proliferation seems to be encouraged by the presence of dead coral covered with algae of a calcium-bearing or fibrous nature. Any disruption to the coral ecosystem, whether man-made or natural, which would bring about an excess mortality in the coral would therefore tend to become a factor in the proliferation of Ciguatera poisoning. The intake of *G. toxicus* by browsing fish leads to a contamination of their flesh and of their organs which will then be transmitted to their predators, be they fish or human. In man, ciguatoxin acts mostly on the nervous system and on muscle tissue (Hokama, 1985).
6) Fisheries scientists call Maximum Sustainable Yield (MSY) the maximum quantity of fish that can be taken from a particular stock without altering its demographic balance, so that exploitation may be kept at this level indefinitely.
7) "Professional fishermen" is taken to mean those for whom fishing is the major activity. They work at it full time, and thus are distinguished from "occasional fishermen."
8) These households represent half of the urban Melanesian population. In 1983, 50% of the working Melanesian population in the private sector was earning less than 160 US$ per month, with 25 % getting wages below 90 US$ (Quille, 1985).

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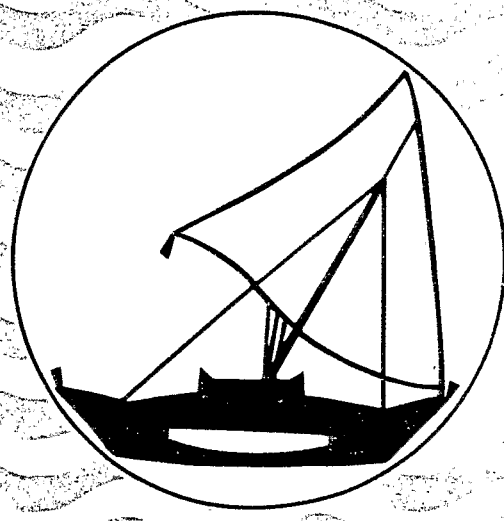

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