FOOD SECURITY AND VILLAGE FISHERIES

IN VANUATU

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ABSTRACT

The produce from fishing plays an important part in the protein content of the Vanuatu population's diet in that it meets 16% to 18% of their yearly protein requirements. Three major consumer areas have been identified : the urban area, the coastal area and inland area in rural zones. Each one is dependent on the nature of supply and demand, and the particular constraints affecting these two factors. In the country as a whole, imported products (mostly tinned fish) account for 32% to 35% of the fish supply.

In order to give more priority to local products in the protein supply, the Government has introduced an ambitious development programme for artisanal commercial fisheries at village level.

The purpose of this paper is to establish whether this programme is likely to improve food security in the country and to outline some prospects of increasing the role of fisheries in population nutrition.

KEY WORDS

Coastal economy, Consumer patterns, Dietary habits, Fisheries development, Food security, Pacific Islands, Vanuatu, Village fisheries.

INTRODUCTION

Like most small island nations in the Pacific, Vanuatu is faced with powerful socio-economic, cultural and population changes. These changes are reflected in the field of nutrition through a combination of six factors (Fig. 1) : rapid increase in number of consumers (1); shift in consumer focal points from a rural environment to urban areas (2), which is followed by a rapid change in dietary habits; a gradual but steady regress of the subsistence sector, which is reflected in a drop in subsistence production per capita (3); inability of the local commercial sector to offset this phenomenon (4); increase in food imports which jeopardises the balance of trade in the country, when it is already heavily in deficit, and which increases the food dependency and the food vulnerability of the country.

Fig. 1 - Factors jeopardising Vanuatu's nutritional independence

For HEYWOOD (1991) "*food dependence occurs when a country becomes dependent on imported food. The greater the proportion of total food consumption which comes from imported food the greater is the extent of food dependence*". Food dependency, much like famine or malnutrition, is one of the components of nutritional vulnerability, which we shall define, following a systematic approach, as : "*The lack or inadequacy of adaptation responses and regulatory mechanisms of any food-production system to the constraints and unbalances occasionally generated by its environment*". Nutritional vulnerability and nutritional security are the two poles of this concept. Nutritional

security could thus be defined as the absence of nutritional vulnerability. We shall define it as "*the presence in a food-production system of adaptation responses to constraints and external unbalances, through which the population's nutritional needs can be guaranteed in a durable manner.*" So we see that the concept of nutritional security can be separated from that of food self-reliance, this latter being but a limited variable of the former. Food self-reliance can be defined as "*the durable satisfying of the population's nutritional needs through a rational exploitation of the country's natural resources*". In a small, economically fragile, nation such as Vanuatu, copra exports and tourism, the two types of economic activity capable of generating the bulk of needed foreign currency, are vulnerable to world economic fluctuations, and have to be backed by food self-reliance.

Extending over 12,200 sq.km, the Vanuatu archipelago is made up of a Y-shaped chain of some eighty mountainous islands located in the South Pacific Ocean (Fig. 2). Most of the islands are of volcanic and coralline origin. They are surrounded by a narrow strip of fringing reefs. There are few lagoons, and the outer reef slop drops rapidly, which means that deep ocean borders the coast. The country is well endowed with soils. About 41 % of the land area of Vanuatu is regarded as being cultivable and 44 % of this cultivable area is covered by good fertile soils. It is the reason why traditionnally the population of Vanuatu is agriculturally oriented. According to the agricultural census of 1983, over 80 % of the population are dependent on agriculture for their food and as the main source of their income (MARSHALL, 1986). In rural areas each household has a garden which provides a large amount of starchy food such as yam and taro, or green vegetables and fruits. Many of them keep chichens and pigs and have their own small coconut or

cocoa plantations where they work when they need money. Throughout the archipelago of Vanuatu, agriculture remains mostly subsistence in nature and very often the cash economy still plays a minor role in the rural villages.

Fig. 2 - Map of Vanuatu

Although subsistence agriculture holds the major role in providing the nation's nutritional security, fishing is becoming an essential element, particularly in the supply of proteins. This derives partly from the length of coastline (approx. 3000 km) and the density of the coastal population, which, in 1979, accounted for 74% of the country's rural population (DAVID 1991).

Until 1986, a fleet of tuna long-liners operated out of a base at Pallicolo, in the island of Santo. The fleet belonged to the South Pacific Fishing Company (S.P.F.C), with the Vanuatu government owning 9% of the stock. The vast majority of the catch was put in cold storage and exported to canneries in Japan and the United States. Between 1978 and 1986, 47455 tonnes of tuna were exported, accounting for 26% of the total value of exports for the period (DAVID *et al.*, 1987). Since May 1986, the long-line fishing base of Pallicolo has been totally idle. The tuna-fishing fleet has shifted to Pago-Pago, in American Samoa. Thus the whole of the fishing activity in Vanuatu today rests on coastal fishing. This type of fishing is done at village scale and village level.

We can identify two types of village fishing. The first derives directly from traditional fishing. It makes use of a multitude of devices, craft

and techniques, and is aimed at a wide range of fish species, as well as shellfish, octopus, crustaceans (notably lobsters), such as are found in the shallow coastal waters, usually within a depth of 10 meters. The reef flat is the most intensively fished area, providing two thirds of the total catch. The hand-line, the hand-spear, and the spear-gun are, in decreasing order, the most common devices. Gill-nets and throw-nets are still scarce (5% of the gear recorded in 1983), but they are gaining ground rapidly (DAVID and CILLAURREN, 1988). Between 60 and 70% of fishing outings are done on foot, or in underwater free dives. The use of motorised fishing craft remains rare. Most of the fishing expeditions undertaken in boats are done in outrigger dug-out canoes propelled by paddled. This type of fishing activity 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".

The second type of village fishing is more representative of a modern commercial sector activity. The reef flat is the most intensively fished area. It relies on technical specialization - using engine-powered vessels -, on a reduction of the number of species sought, and on an extension of the traditionnal fishing zone, the new fishing grounds being located along the outer-reef slope at depths between 100 m and 400 m. This type of fishing activity, which receives technical and financial assistance both at production and at marketing levels from Government Agencies as a part of their fisheries development policy, shall be called "artisanal commercial fishing".

This article intends to study the ways in which these two forms of village-level fishing contribute to the food security of the nation. A first part will briefly discuss the major trends in the evolution of

dietary habits, in the city as well as in the rural districts, during the last thirty years. In the second part, we will observe more closely the consumption of foodstuff of marine origin. There we will distinguish between the urban area, the coastal rural districts, and the landlocked districts. For each of these zones, we will study the constraints that apply to the balance of supply and demand for the fishermen's catch. In a third part we shall address the issue of development policy in respect of commercial village fishing and examine how this activity can contribute to the development of the population's eating habits and to the country's food security. The last part will suggest certain recommendations aimed at improving the contribution made by village-level fishing to national food security.

The analysis presented herein is based mainly on the results of various statistical surveys carried in Vanuatu between 1983 and 1985, i.e the agricultural census (MARSHALL, 1986 ; DAVID & CILLAURREN, 1988), the national nutrition survey (HUNG, 1983; DAVID, 1987), the Vanuatu / SPC dietary study in 1985 (LUND et al, 1988), the family income and expenditure survey of urban areas (ANONYMOUS, 1986a; SINGLETON, 1987; DAVID, 1991) and the monitoring of landings in the commercial village fishing by ORSTOM and the Vanuatu Fisheries Department (CILLAURREN, 1990a).

A. MAJOR TRENDS IN THE EVOLUTION OF DIETARY HABITS

1. RURAL / URBAN AND URBAN / RURAL RELATIONSHIPS

With regard to dietary habits, it is important to distinguish between the rural population and the urban dwellers. In town, nutrition is an

integral part of the cash economy and a greater percentage of the food is imported from overseas. Outside Port Vila and Luganville, the two urban centres in the country, nutrition still remains, however, linked to the traditional economic structure. Cash economy plays virtually no part in nutrition, based mostly on local produce. Nevertheless, despite these fundamental differences in the urban and rural lifestyles, there are also powerful ties between the two.

It must be remembered that town dwellers in Vanuatu are a fairly new breed, most of them having been born in rural areas. Their original dietary habits, therefore, were influenced by rural ways and their current eating habits are a combination of this heritage and the nutritional changes brought about by urban living, affecting both the frequency of meals and the quality and quantity of their food.

Whereas there is a definite relation in respect of nutrition "Rural environment I------> Urban environment", the opposite is also true. As a result of cash economy having an increasing impact on village economy, rural patterns of eating are becoming infected with food originating from town. One of the best examples of this is the way the rural population has taken to tinned foodstuffs. In fact, the food link "Urban environment I-------> Rural environment", extends well beyond tinned foods alone on the islands of Efate and Santo, which include Port Vila and Luganville respectively, in the main missionary centres and Council headquarters. Communications and the administrative and religious function of rural villages play a major part in the development of dietary habits.

2. CHANGES IN TOWN

The main difference to be noted in the dietary habits between the rural sector and the urban areas lies in the poor share of local produce, traditionally originated from subsistence economy, in the daily diet of city people. These products have been replaced by imported foodstuffs, products of Western and Asian agro-food industries. Rice has become the most common carbohydrate. Tinned fish or meat figure quite significantly in the protein intake, while the supply of fresh fish, mollusc and shellfish is very irregular and costly, which is the reason for the low priority given to these products. In the space of ten years or so, the consumption of fresh meat has increased by leaps and bounds, one because of the price, attractive, and two because of the regular availability of the product.

The changes in the diet have also seen a change in the pattern of meals during the day, reflecting a growing 'specialisation' of meals : for instance, breakfast has lost its importance. It is more French in style, with bread dipped in tea or coffee now being the major component, as pointed out by B. JABRE *et al* (1976) and M. HUNG (1983). It is quick to prepare and swallow, no small factor in the case of families with a lot of children of school age. Although much more copious than the previous meal, lunch is also marked by the speed of preparation of the components (tinned meat, fish, rice). However, supper often includes traditional foods requiring longer cooking time, especially root vegetables which are boiled or ground-oven-cooked. Where the housewife is not gainfully employed, she may serve laplap (5). B. JABRE and his team observed, however, that due to the length of time required, laplap is more often than not reserved for Sunday. Without a

doubt, the eating habits of ni-Vanuatu living in town are geared to gainful employment and school attendance, two key aspects of a Western life-style.

T.G. MacGEE *et al* (1980) gave seven explanations of the growing significance of imported food in the diet of ni-Vanuatu (6) living in town, namely :

a) lack of space for establishing family gardens in town, compelling urban households to buy most of their food;
b) high cost of the local produce on sale at town markets;
c) low cost of widely consumed imported foodstuffs;
d) variety of tinned food available at the stores;
e) children's schooling which, on the one part, influences their tastes towards imported foods, and on the other, disrupts the mother's daily pattern of life and that of her children, inducing in particular the cut-back on breakfast time;
f) working women, leaving them too little time and availability to prepare traditional meals;
g) urban life-style which leads to a break with tradition and the introduction of a new diet consisting of a significant portion of foodstuffs which can be made ready rapidly, the classic example being tinned food.

The figure 3 shows the main relations between these various factors and elements.

Fig. 3 - Causal relationships showing the major place taken by imported food in the diet of low -income urban families

The rapid increase of the urban population can only accelerate the process of change in eating habits. From 1979 to 1989, Port Vila and Luganville, the two urban centres in the country, went from 9,970 to 19,040 inhabitants and 5,160 to 6,900 respectively, which corresponds to growth rates of 90% and 33% respectively in ten years. In these circumstances, it is becoming more and more difficult for new arrivals to find space available to plant their own subsistence garden and the share of production for self-consumption in urban families' nutrition is tending to drop dramatically.

3. CHANGES IN RURAL AREAS

In rural areas, the share of imported foods in the daily diet is far less than in town (7). However, it is increasing steadily and gradually a combined diet of local produce and rice and tinned food is taking over from the traditional protein diet which was solely made up of fresh food, especially fish, served with root vegetables, fruit or vegetables from subsistence gardens. Meat consumption has always been severely constrained by supply, or lack thereof, because cattle and pigs are only slaughtered on festive occasions or for custom ceremonies. Thus, the only fresh source of protein which is in regular supply is produce from fishing.

The massive impact of urban consumer patterns is reflected in the shift toward imported foodstuffs and new eating patterns in rural communities in Vanuatu. This is mainly due to the increasing influx of money in the islands. This has been extraordinary over the last twenty years. With the increasingly wide-spread use of money, a solvent demand has developed. This is reflected in the purchase of rice, tinned

protein and bread, food known and enjoyed by the islanders through their contact with missionaries, European settlers, and American soldiers during the last world war, and later, through the school kitchens under the Condominium rule, where they figured predominantly on the menu (Fig. 4). As shown by J. BONNEMAISON (1986), school and church, both described by the same term of 'skul', soon became a symbol of modern life, as opposed to 'custom' and tradition. The eating habits acquired at school then took on the prestige attached to the establishment. In many instances, the desire for modernism took shape and reality, whether it be deliberately or unconsciously, by adopting the 'skul' men's food. As noted by P. HEYWOOD (1991, p. 77) "*because of their association with expatriates, tourists and urban residents imported foods may be regarded as superior goods even in rural areas. This will often be important in determining the positive attitudes toward imported items*".

Fig. 4 - Causal relationships showing food imports in the rural areas

Vanuatu's rural population is at present going through a population and economic transition stage which will inevitably affect the basic eating habits in the future.

The first factor of change is the dynamics of population growth. Between 1979 and 1989, the country grew by some 31,500 people, from 111,250 to 142,630 inhabitants, or 28 % . The natural growth rate is 28 per thousand, with a birth rate of 42.1 per thousand and a death rate of 13.6 per thousand (BEDFORD, 1989). In the space of 10 years, the

demographic pressure on cultivable lands has greatly increased. The average number of cultivable hectares has shrunk from 26 to 22. In 4 out of the 11 regions of Vanuatu, this value is well below the average figure : each household only enjoys 5 to 9 hectares of cultivable land. In an increasing number of settlement areas, population density exceeds the viability threshold of the traditional agricultural system. This phenomenon leads to grave soils erosion, to an increasing malnutrition and to the beginning of undernutrition which compels the population to migrate, which is exclusively towards town, because it is virtually impossible for migrants to move to the numerous underpopulated rural areas (8) due to land ownership customs and systems, characterised by the total refusal on the part of the traditional land owners to alow outsiders to settle on their lands. Such refusal , if it is allowed to continue, can only reinforce the tendency to migrate to the city. Thus , it contitues a very serious threat to the political and economical viability of the nation.

The other factor of change is the extremely low price of copra, the main economic activity of rural areas, which has gone from US$ 600 per ton in 1984 to $ 300 in 1988 and 1989, to an all-time low of $ 100-150 in the first quarter of 1991 (Anon. 1990). This evolution has two consequences : one, a return to subsistence agriculture and a drop in cash flow in the islands, and two, a search for other, more lucrative commercial activities. This is why the collection of troca shells (*Trochus niloticus*), a mother-of-pearl shell in great demand on world markets, has escalated significantly along the coastlines, and owners of mesh nets or cast-nets are trying to develop small-scale commercial fishing operations. If the negative trend of copra prices

continues in the next few months, there is a serious risk that the urban drift towards Vila will intensify yet further.

From this brief review of the changes in eating habits, it appears that food security is a complex issue which cannot be considered separately from the economic, social and cultural background of the country, and this has to be understood at different levels of space : on the scale of the country, the island and the town.

B. CONSUMPTION OF FISHING PRODUCE, TYPOLOGY OF SPACE AND CONSTRAINTS

Depending on whether considering imported products or fresh produce from local production, there are significant differences in terms of nature of the product, its origin and the daily quantities consumed or available for consumption between urban areas and rural areas on the one hand, and on the other, within the rural areas themselves, between the coastal areas and inland. Three patterns of consumption are clearly defined, with the consumers having their own particular eating habits :

- rural consumption pattern in coastal areas,
- rural consumption pattern inland,
- urban consumption pattern, the main quantitative aspects of which are shown in Table 1 which represents the supply of marine products in Vanuatu in 1984. In this table, the term "seafood" denotes octopus and marine shellfish, mainly bivalves, gasteropods and lobsters.

Table 1 - Supply of marine produce in Vanuatu in 1984

Whereas eating habits can be easily distinguished in terms of spacial distribution, not all distinctions can be reflected in this way. In urban areas, differences in income play a significant part. In this case, consumption (C) is related to income (I). Spatial differences then only apply where people of similar income dwell in the same district. Following the typology applied for budget surveys by the National Planning & Statistics Office (Anon., 1986), three classes of income have to be considered :

- households with less than 45,000 vatu per month (US$450),
- households earning between 45,000 and 100,000 vatu per month (US$450 to US$1,000), and
- the wealthier people with more than 100,000 vatu per month.

In this class a difference should be made between the ni-Vanuatu population and the expatriates who enjoy a greater purchasing power than the ni-Vanuatu population.

1. URBAN CONSUMPTION PATTERNS

There are five main typical points (Table 1a) :

- the existence of a tourist-related consumption, to be found in restaurants, in addition to the local consumers;
- the importance of shell fish in the tourist market, with consumption levels 4 to 7 times greater than fresh fish;
- the scarcity of mollusc and shell fish on the local consumer market as opposed to fresh fish with a supply 4 to 9 times greater;

- the significance of consumer income and price of product as a major factor determining local consumption, both in terms of quantities and type of product;
- the high demand for tinned sea produce on the local market, the consumption of which equals that of fresh fish. For the main part, these products consist of mackerel, known throughout Vanuatu by the bislama expression 'tin fis'.

The differences in income among the urban population lead to totally different eating behaviours between the expatriate urban population and the ni-Vanuatu urban population, not only in respect of quantities but also of type of product consumed. For this reason, we will consider these two categories as separate entities.

1.1 Expatriate urban consumer patterns

Because of the high purchasing power among these consumers, whether tourists or residents of Port Vila or Luganville, a wide range of produce is available for consumption, the most common being fish and shell fish. As a rule, prices are high. As shown under Table 2a, most of the products consumed come from the rural coastal areas as fresh fish, followed by fish, mollusc and shell fish imported from overseas, either frozen or tinned. There is a small volume of tuna and deep-sea fish consumed out of small-scale game fishing operations. Compared to fresh produce, the consumption of tinned products is insignificant and comprises mainly highly priced goods such as tuna and shell fish.

The major constraint on consumer demand is the lack of availability both of fresh fish and of shell fish. Fresh fish arrivals from the rural

coastal zones are fairly erratic and the quantities are often too small. Hotels and restaurants often suffer shortages and the shelves are empty at "Natai", the state-controlled fishmonger in Port Vila which markets the catch from the small-scale fisheries associations formed under the fisheries development programme. The main cause of this lack of supply is the low level of production and the inefficient distribution networks, compelling the consumer to fall back on imported fish or more often to turn to the local fresh meat which, in addition to its very competitive price, is of excellent quality and regularly available.

Table 2 - Main patterns of consumption of marine produce in Vanuatu

1.2 Ni-Vanuatu urban consumption patterns

The most distinctive trait of urban ni-Vanuatu patterns of consumption is the high consumption of tinned mackerel and a definitely smaller demand for fresh produce. Fresh products from the coastal areas are high value-added products, sold on the urban market at a much higher price than the potential ni-Vanuatu consumers can afford. Population needs cannot be met by the supply of marine produce, which is too expensive having regard to the low purchasing power of the urban population. 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 from door to door, or reef fish which is found occasionally in stores. As for production for own consumption, it is extremely restricted because the waters close to urban areas, which is where people go fishing, have been more or less exhausted.

Table 2b clearly illustrates the situation. The high price of fresh fishing produce compared to the consumers income leads to a fierce competition from tinned fish at a lower sales price. And now lower quality fresh meat is competing strongly with tinned fish. In the last quarter of 1984, the large tin of mackerel, 425 g contents, was selling for 75 to 80 vatu in shops in Port Vila and Luganville, i.e. 0.8 US$. For the same cost, you could get from Natai, the Port Vila Government fisheries market, 400 g of skipjack (Scombridae), 320 g of reef fish or grouper (Serranidae), 275 g of red snapper (Etelidae), 265 g of shark filet. And for the same price, the meat lover could also purchase 400 g of beef stew or 172 g of tinned meat, produced locally under the name 'tin mit' or imported from Australia as 'corned beef'.

Whilst you can eat all of the mackerel out of a tin, the same does not apply to fresh fish, 55% of the body mass being scales, skin, gut and bone (JARDIN & CROSNIER, 1975). In spending 80 vatu, the 'tin fis' consumer ends up with three times as much food as the purchaser 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 many proteins and vitamins, four to nine times as much iron and calcium. Of all the protein food from the sea available on the market in Vanuatu, the tinned mackerel is therefore the best choice a consumer can make from the point of view of the ratio nutritional value to cost. Tinned fish is a much more economical food than fresh fish and given that 50 % of the working Melnesian population, in the private sector, was earning in 1983 les than 16,000 vatu per month (i.e. 160 US$), with 25 % getting wages

below 9,000 vatu (QUILLE, 1985), it is no wonder that "tin fis" so popular !

Table 3 - Nutritious value of some protein foods bought in Port-Vila in 1984 for 80 vatu

Of all the fresh fish sold whole, the most economic choice is undoubtedly the skipjack. As opposed to whole fish, filet does have the advantage of being fully edible. However, at an average cost of 500 to 600 vatu per kilo, its sale price is too high for low-income families to be able to buy it on a regular basis. The only filet readily available to them is shark filet, at 300 vatu per kilo. However, in spite of the attractive price, consumption of shark is low because many ni-Vanuatu consider it a magic animal.

However, price is not the only decisive factor for demand. Other aspects enter into it : the number of outlets selling the product, its flavour, how quickly and easily it can be prepared. Whilst fresh fish is usually better liked by consumers than tinned fish, the other factors undoubtedly make tinned mackerel more appealing.

2. COASTAL RURAL CONSUMPTION PATTERNS

There are three main differences between the pattern in coastal rural areas and that of urban areas :

- general consumption of marine produce caught locally (Table 1c);
- fairly significant consumption of tinned mackerel, representing 27% to 30% of the consumption of fresh fish;

- the irrelevance of consumer income as a factor having a bearing on the quantity (i.e. quantities consumed); however, income does have a bearing on the choice of consumed product, for instance the consumption of deep-sea bottom-dwelling fish is closely related to solvent demand, i.e. availability of cash, whereas sole self-consumption is generally indicative of low income.

Table 2b shows that the constraints on supply are closely linked to the constraints on demand. Supply is the main factor restricting demand, whereas demand always appears as the constraint impeding expansion of supply. Overall, supply is considered to be quantitatively inadequate, because too low, especially with respect to fresh fish. This inadequacy affects equally commercial demand and own-consumption requirements. In the first instance, the low number of commercial fishermen and low levels of production are to be blamed; in the latter instance, often it is a matter of limited area of the fishing zone and lack of resources therein having regard to the effort put into it. Either way there is the additional problem of preservation and distribution of the marine produce which does not really encourage fishermen to improve their fishing efforts. In the particular case of shell fish, the low volume of supply along the coast (Table 1b) is mainly due to the fact that lobster is sent to the urban markets. As for tinned products, the main constraint on supply stems from distribution problems, due in particular to poor communications and transport facilities in the islands.

Aside from supply, the main constraint on demand in coastal areas is the shortage of available cash among rural households and the resulting low purchasing power. In 1984, the agricultural census gave an

estimate of the average annual budget for rural households as being 78,540 vatu (US$ 785). About 8% of this is spent on buying tinned mackerel; 3.5% on tinned meat and 2% on fresh fish (DAVID, 1991). Such economic constraints undoubtedly represent an inherent obstacle to any improvement of commercial production.

3. RURAL CONSUMPTION PATTERNS INLAND

The main traits of rural patterns of consumption inland are as follows :

- own-consumption of marine produce is virtually non-existent;
- income as the major factor determining consumption, which is a logical consequence;
- low consumption of marine produce (Table 1d), because of the low purchasing power among the population;
- consumption of tinned fish as a substitute for fresh produce because of distribution problems inland.

The main constraint on demand stems from the lack of cash income inland, where coconut plantations are scarce by comparison to the coastal areas. The limited range of supply is another constraint. To improve this situation would require:

- increasing production, not only the commercial production from the coastal areas, but also local production for own-consumption;
- developing means of preserving the catch to at least enable the product to keep its quality and appeal during the transport from the landing points to the centres of consumption;
- organising distribution networks in order to reduce transport time.

The last two conditions are very much dependent on the state of communications within the islands. Roads suitable for motor transport are few. Apart from the nation's two urban centres, they are not tarred but are made up of crushed coral. This type of roadway is very vulnerable to erosion by rain, and it isn't unusual for roads which had been perfectly adequate during the dry season to become entirely unmanageable a few months later, by the end of the rainy season. The upkeep of the road network is thus a major expense for the Vanuatu government, and it is frequently neglected on account of other financial constraints. The Public Works department only acts when a road has become completely unuseable.

Out of this brief review of the various patterns of fish consumption and their constraints, some important facts arise:

a) two main factors of constraint on demand :
   - household incomes and the budget they are prepared to allocate to fresh fish;
   - the competition between fresh fish and tinned fish;

b) three main factors of constraint on supply :
   - limited nature of production, especially commercial production;
   - lack of means of preserving fresh produce;
   - poor distribution networks.

C. VILLAGE FISHERIES DEVELOPMENT PROGRAMME

1. EXPLOITATION STRATEGY AND MONITORING OF PRODUCTION

The development of small-scale commercial fisheries (9) 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 programme for commercial village fisheries : the V.F.D.P. (Village Fisheries Development Programme). The emphasis is on the exploitation of new fishing zones located along the reef drop, using motorised vessels fitted with lines mounted on reels, 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 achieving independence in 1980, these zones, consisting mainly of ichtyosarchotoxin-free fish (10), essentially Etelidae (red snapper), Lutjanidae (sea-perch), Serranidae (grouper), Lethrinidae (emperor) and the Pentapodidae (bream), were still virgin of any form of fishing. Because they are not particular abundant, the exploitation of these stocks must be carefully supervised and managed. BROUARD & GRANDPERRIN (1984) have shown that the maximum sustainable yield (MSY) - which is 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 - would be of the order of 760 tonnes per year for the whole of the country's usable area, or an average of 1 kg/ha/year. A total of 120 motorized vessels, carrying each 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 is to set up, alongside the small-scale village unstructured fisheries, a structured commercially oriented sector which would exploit new resources, in a new fishing area, with new or upgraded techniques and modern equipment. To achieve this end requires constituting a new generation of professional fishermen comprised either of 'traditional' fishermen attracted by the profits to be made or, less likely, of 'small -scale businessmen' to whom fishing appeals.

The monitoring of the development of fishing and of marine food production must be an essential component of any future strategy. Through this monitoring, it will be possible to determine the parameters for dynamic equilibrium, or Maximum Sustainable Yield, which form the basis of any rational resources management. This data will also be used to assess the effects on the fishing fleet and on the resources of the measures taken by the government within their fisheries development policies, and, if need be, to amend or redirect these measures for greater efficiency. Since the launching of the V.F.D.P. (Village Fisheries Development Programme) in 1982, data concerning the development of fishing and production of deep bottom-dwelling fish have been collected by ORSTOM, in close collaboration with the Vanuatu Fisheries Department. At present, the data gathering process is divided into three levels, each corresponding to one of the stages of fish production : landings, rural fish sales, and the urban market. The three questionnaires which make up this data gathering system are shown in an appendix to this article.

The monitoring of the landings covers, depending on the year, 50 to 70% of village co-operative fishing associations. This represents the oldest system, having been in existence since 1982. It is also the most complete. Every time they go out to sea, the fishermen fill in a form indicating the fishing area, the depth at wihch fish are caugh, the duration of the expedition, total catch, and the measurements of all fish belonging to 12 main species. In return the fishermen get tax-free petrol and a sum of 0.5 US$. Between 1982 and 1989, some 13 ,000 fishing outings were recorded (CILLAURREN, 1990) .

Data gathering regarding the marketing of fish in the rural districts is accomplished using as a base the nation's seven fisheries extension centres. It is mostly concerned with fishing development and fish production within the village fishing co-operative associations located in the vicinity of these extension centres, but it also documents the production costs and the income derived by the fishermen from the sale of their catch. This system has been in place since 1989, and deals with a much smaller number of village co-opeative associations than the monitoring of the landings.

Data gathering in the urban zones centers around the two government fish markets at Port-Vila and Luganville. The data consists mostly of the tonnage sold and the selling price of the commercial species.

Together, these three systems of data collection provide information on stocks biology. The entering and processing of statistics is centralized and is organized as follows : entry of data, correction, detection of systematic and random biases, classification, evaluation

of dynamic parameters, adaptation to existing models, choice of appropriate predictive model.

Apart from the data collection system, a major problem in the management of the fish resource in Vanuatu and other Pacific Islands archipalago concerns the question of wether determining a maximum sustainable yield for the whole archipelago is a satisfactory method of resource mangement. In fact, the bentic nature of the deep-bottom dwelling fish, located in an environment of high islands separated by deep seas limiting their extension, may be the reason for the existence of separate stocks each with distinc demographic features dependent on the area which they have colonized (CARLOT, CILLAURREN, 1990). This hypothesis needs to be tested, but its implications for resource management are clear. Although overall fishing activity may decrease or may keep inchanged at the scale of the whole archipelago, occasional intensive periods of fishing activity may occur. These may lead to localised over-fishing due to insufficient renewal of stock, which exhibits a limited migration pattern.

2. OBJECTIVES OF THE DEVELOPMENT PLAN AND LOGICAL IMPLICATIONS

The main purpose of the V.F.D.P. is to develop commercial fisheries at village level, and to achieve four associated objectives :

- to improve the nutrition of rural and urban dwellers;
- to reduce the imports of tinned fish;
- to develop the cash economy in village communities (CROSSLAND, 1984a; LE GAL, 1986);

- to create employment opportunities and cut down the urban drift into Port Vila.

Two logical orientations follow from closer examination of these objectives :

The first would tend toward an extravert 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 with 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 associated 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 will realise that fishing can be very profitable. The object then will be to reach a high enough level of supply in order to compete for a share in the international market place and once this has been secured, it will enable the fishing operations to continue over the long term and thus ensure the long term development of the island economies.

Within this trend, 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 the drop in urban drift through employment opportunities. The nutrition objective has only been met in a round-about way. Because the fishing production is entirely geared to the outside market, no direct contribution from the 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 significantly compensate for the lack of commercial supply of fresh fish.

Undoubtedly, imported tinned fish is one of the products which is benefiting the most from the increase of available demand. The fourth goal of the V.F.D.P. therefore, i.e. to reduce the imports of tinned fish, cannot be achieved, and is proving to be totally opposed to the logic of the proposed development scheme. The solution to avoid this contradiction is simple : a model of dual development could have been planned, whereby a 'modern' and structured sector devoted exclusively to deep-sea fishing for the urban and export markets would coexist with a commercial sector concentrating on small-scale fisheries. The role attributed to this small-scale fishing, old-fashioned and inexpensive, is to supply island populations with shallow-dwelling reef species. As opposed to the structured commercial fishing, this form of fishing, informal, requires little financial assistance to develop and the action of Government can be restricted to the duty-free sale of lines and nets and to encouraging simple and cost-effective methods of preserving the fish, such as smoking or a combination of salt-drying.

The second development trend is absolutely in opposition to the first one. Self-centered by nature, emphasis is on supplying the rural population with protein from the sea and import substitution of 'tin fis'. Under this scheme, small-scale fishing takes second place after agriculture which, in that it is source of foreign currency, is the actual motor of island economies. Fisheries are therefore very vulnerable to any fluctuation in this sector, particularly variations in the price of copra which is still the main source of foreign currency in rural areas. Under this scheme, therefore, the fishing industry is

closely linked to and dependent upon the island economic situation and has virtually no scope for autonomous growth. Because of this, its role in the development of cash economy is limited and its contribution to controlling urban drift is very marginal.

It should be noted, for both development models, that neither consider the improvement of the nutritionnal status of ni-Vanuatu low-income urban households. This section of the population has been left out of the fisheries development plan, so it is hardly surprising that consumption of fresh fish in this area is insignificant, whereas it draws heavily on tinned fish. Nevertheless, there is no reason why the supply of fresh marine produce at a cheap price cannot be increased, as a substitute for tinned fish, unless the only aim is to fish for deep-sea bottom-dwelling species, the operating costs of which are very high. To solve the problem, simply :

- change targets; in this respect, shallow-dwelling reef fish, the smaller deep-sea species (Clupeidae or selar for instance), and the skipjack caught around the fish aggregating devices offer very interesting prospects;
- restrict the production area of deep-sea bottom dwelling fish to the relevant consumer island, i.e. Efate and Santo;
- organise a mobile collection unit in rural areas in order to provide the fishermen with a regular outlet for their fish and thus stimulate their commercial fishing activities.

Finally, none of the objectives set by the V.F.D.P. would appear to be inherently opposed to the others. Contradictions arise solely out of the choice of focusing fisheries development exclusively on the exploitation of deep-sea bottom-dwelling species along the reef slope.

In this regard, the extravert development scheme, tending towards exports and supply of urban markets, which was favoured by the Fisheries Department in the early stages of the V.F.D.P., has been slightly altered to include a form of self-centered development in order to meet the necessity of improving the levels of nutrition in rural communities et reducing the importation of tinned fish. This combination has not proved fruitful so far and the initial development scheme has gradually given way to to the second scheme, which is now predominant.

3. IMPLEMENTATION OF THE DEVELOPMENT PLAN

Set up for an initial duration of three years, the Village Fisheries Development Porgramme provided for the creation of 25 Fishing Co-operative Associations, to which technical and financial support were 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 aid to ACP countries between 1982 and 1985, it has provided 73 million US$, 53% of the 138 million of the total budget for the operation (CROSSLAND, *op. cit.*). Canada also provides a substantial contribution, amounting to 18 million US$, in the form of salaries for the "C.U.S.O." volunteers who look after the technical training and support of the fishing co-operative asociations. Between 1982 and 1986, a dozen or so young Canadians followed each other, working 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 location of these fishing co-operative associations is decided after an in-depth study. Alongside the applications made by motivated candidates, several economic and ecological factors are taken into account. Among these, the most important seem 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. Furthermore, the applicants must both have access to sufficient capital to buy a portion of their equipment cash, and be able to show alternate sources of income, so that they may be able, if need be, to repay a part of their bank loans. They must also agree to enroll in the fishing training couses, lasting four weeks, which are provided at the Fisheries Department Headquarters in Port-Vila.

Once selected by the Fisheries Department, each fishing co-operative association is issued a boat, three or four wooden hand reels and their complete tackle, two outboard motors, one of 25 hp, and the other of 5 hp, to serve as back-up in case of break down of the main one. The boats are either 8.6 meter catamarans, or single hulled boats 5 meters long. In 1984, one of these catamarans, complete with motors and fishing tackle, was worth 9,010 US$, and the price of the monohulls 5,380 US$. The boats and the reels are built in the shipyard at Santo, built in 1982 and under the authority of the Fisheries Department. In order to provide for the preservation of 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 co-operative associations have been equipped with ice-making facilities capable of producing 400 kg of ice per day, while two others have had 22.3 m3 walk-in freezers installed. The ice making plants represented an investment of 10,400 US$ each, while the cost for each walk-in

freezers was 16,600 US$. On an average, the whole of the equipment for a fishing co-operative association (motor boat, fishing gear and refrigeration equipment) cost between 9,000 and 10,000 US$. The E.D.F finances 50% and the Vanuatu Development Bank loans 40% in the form of three year loans to the fishermen at the 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 fishing co-operative association. It is difficult for a single individual to find such a sum, so the majority of the fishermen pool their resouces in the form of either family or village fishing co-operative 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 to production of the fishing co-operative associations, two fish markets equipped with substantial cold storage capacity were opened in both major urban centres, 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 tonnes of fish. Two years later, the production was up to 97 tonnes, representing a doubling of the landed quantities 55% to 60% of this catch was sold in the fishermen's own villages or in nearby communities. The selling price varied between 1 to 1.35 US $

per kilo .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 kilo. 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 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 kilo, regardless of the distance covered.

The first three years of the V.F.D.P. have been considered by the Fisheries Department as a success (LEGAL, *op. cit.*). The programme was meant to end in December 1985, but considering the programme's popularity, with the Fisheries Department receiving 2 to 3 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, date at which a new structure called "Extension Services" was inaugurated.

By 1983, 11 fishing co-operative associations were in operation. They were producing 49 tonnes of fish, i.e. almost 4.5 tonnes each, generating turnovers of between 4500 and 5000 US$. This is quite a substantial amount for rural areas, bearing in mind that for the same yeari, the average annual budget for a family was 785 US$. 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 and electors assistance through the V.F.D.P. By 1984, the initial 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 the balance, the eight years in which this programme has been in place show it to be a failure. Two facts evidence this .

Since 1983, the average production per association has steadily dropped off. Whereas the number of fishing asociations may have increased fifteen times in six years, unfortunately the same does not apply to the fishing yields. Table 4 shows briefly the situation in the landings of commercial village fisheries as monitored by ORSTOM and the Fisheries Department. 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, which is no mean feat given the geographical dispersal of the associations and the lack of "auction centres" where landings could be grouped. In 1983, the 11 associations produced on average 4.46 tonnes. In 1988, 75 associations landed 79.3 tonnes, i.e. an average yield of 1.06 tonnes per association. This evolution clearly shows that in 1983, fishermen were close to five times more productive than in 1988.

Table 4 - Development of fisheries production supported by the VFDP

Very few village fishing co-operative associations manage to go beyond the level of three years of operation (Table 5), and the population of "professional fishermen" which were supposed to ensure the long-term success of the fisheries development programme consists only of a few dozen persons. Actually, the V.F.D.P. very early on

suffered from its own popularity. As it had been designed, the programme required a strict follow-up of the fishermen in order to teach them fishing techniques, equipment maintenance, fish preservation, and management procedures. The young professional fishermen sent by the NGO's which were meant to assist the 25 fishing associations as planned initially, never exceeded a dozen people and most of the fishermen groups disolved after a few months of operation because of the lack of technical assistance and appropriate advice.

Table 5 - Average duration of fisheries projects

This failure has been diagnosed as a reflection of the lack of profitability of the fisheries asociations, and of the impossibility of ensuring their economic viability (SHEPARD, 1987). The government has endeavoured to take this into account for the implementation of the second stage of the small-scale fisheries development policy, already in place now. This new programe has three objectives.

. Training of fishermen : A fisheries school has been operating in Luganville (Santo) for the past year, and seven training centres have recently been inaugurated in the main regions of the country.

. Implementation of a "leasing programme" for fishing vessels, in lieu of the previous funding programme (51% in donations, 42% in bank loans, and 7% own capital). As the EEC withdrew from funding directly the equipment and tools in order to assist with the infrastructure and budget requirements of the programme, the

Fisheries school and the new Fisheries Department in Luganville were totally funded by the European Development Fund.

. 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 meters long to improve their safety at sea, extend their fishing range, and the time that they can spend on the fishing grounds.

Under this programme, it is essential that these seven professional training centres 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 centres 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 neighbouring associations to begin again on a better footing. In fact, this can be considered as 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.

4. THE RESULTS OF THE DEVELOPMENT PROGRAMME

After nine years of village commercial fisheries exploitation in Vanuatu, it appears that fishing activity is in decline and that stocks of deep-bottom dwelling fish are generally underfished. In 1987 and 1988, the level of production in Efate was equivalent to 50 % of the maximum sustainable yield (CILLAURREN, 1989). Given that yields on the whole archipelago have never exceeded 200 tons and have had a tendency to drop off over the last few years, the main consequent objectives set by the V.F.D.P. have not been met.

Generally, whereas employment opportunities have been numerous - bearing in mind that over 200 fishing co-operative associations were created - and could have led to believe that the goal had been achieved, upon considering the life expectancy of the associations (Table 5) it appears that these opportunities were too short-lived to properly stabilise the population and reduce the urban drift. In addition, it could be said that, having known productive fishing expeditions in the first successful years of the V.F.D.P., and got used to enjoying a good income, the young fishermen may well be reluctant to go back to subsistence agriculture or fishing and therefore decide to migrate into town, seeing it as the carrier of the consumer society.

As opposed to unstructured commercial village fisheries, commercial village fishing never really played its role as substitute for imported fish, neither in town nor in the rural areas. A large portion of the catch was sent to the urban markets where it is consumed mainly by expatriates who have the means to buy fish and by tourists, two

sections of the population who normally do not eat any or much 'tin fis'. The supply of fresh fish in rural areas has always be small and has never, in any way, been a serious competitor of tinned fish.

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 cash flow available. Because of problems associated with air freight and the price paid to the fishermen by "Natai", this era is now over and commercial village fishing has only a small share in the influx of currency to the islands. But it is still the source of outflow of money, to pay for replacing fishing tackle and refuelling, possibly even ice. Under the present circumstances, therefore, commercial village fishing actually increases the deficit in the balance of trade in those islands of Vanuatu where there are associations.

The assessment of the V.F.D.P. is no more conclusive in the field of nutrition. As we have noted, part of the production is exported to the urban centres where it has hardly contributed anything to those people most in need of it : the low-income ni-Vanuatu population. In rural areas, the lack of communication infrastructure led to fish distribution networks developing mostly within coastal areas only. The additional supply of fish has probably benefited mostly households who had a limited fishing activity for own consumption or none at all, which is one positive aspect. However, the fact that the populations living inland could not take advantage of it is less of a positive point. Of the whole of the population in Vanuatu, it is those who live inland who in fact suffer from the lowest satisfaction of the protein needs and they should be the ones to focus on in priority if the nutrition status of the islanders is to be improved.

D. CONCLUSIONS AND RECOMMENDATIONS

The 4322 to 4885 tonnes which represent the supply of fisheries produce for the whole of Vanuatu in 1984 (Table 1) provide 377 to 415 tons of protein, i.e. 16 to 18% of the population protein requirements, estimated to average 50 g per day for the total of 127,800 inhabitants of Vanuatu. Overall, small-scale village fisheries, predominantly for own consumption, cover 61 to 65% of protein supply, as opposed to 3 to 5% from commercial village fishing and game-fishing and 31 to 34% through tinned fish (Table 6). Clearly, small scale unstructured village fisheries, geared essentially toward the operators' own consumption, play a major role in supplying the population of Vanuatu with marine food products. By comparison, the artisanal commercial village fishing, on which bear the best efforts of the government, plays only a negligeable role. Imports of tinned fish play also 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 tonnes versus [145 - 160] tonnes.

Table 6 - Composition of protein supply in the whole range of marine produce for Vanuatu in 1984

This result is good news : 131.5 tonnes of protein is a very tidy amount. It is enough to provide the needs of 7200 people per year, at the rate of 50 g of protein per day per person. With a total population of 127800 people in 1984, the daily needs amounted then to 6.39 tonnes. The whole of the tinned fish imports 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 as the 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, 1 kilo of protein being 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 1447.29 tonnes (123.7 x 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 hasn't 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 tonnes of protein for consumer needs. Had these small unstructured fisheries not existed, the country would have had to import 1303.5 to 1504 tones 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 tonnes of tinned fish imported in 1984 (Anon. 1986b). 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$, out of a total of 68.53 million for all imports. Exports only amounted to a total of 43.95 million US$ (Anon., *op. cit.*). The added imports in tinned fish which would have been required without the existence of the small scale unstructured fisheries, amounting to 1303 to 1504 tonnes or 1.57 to 1.81 million US$, would have driven the cost of food imports up by 13.5 to 15.5%, while pushing the trade balance deficit up by 6.3 to 7.4%, from 24.58 million US$ to [26.15-26.39] million. .

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 calls on 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 isn't 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 from small scale unstructured village fisheries at no great cost. The distribution of mesh nets and cast-nets could help. However, having regard to the

narrowness of the fringing reefs, the production potential of such zones could well be satured fairly rapidly along the densely populated shores. Therefore, the development of fishing effort should concentrate more on the resources available around the reef slope, between 10 and 100 metres deep. The leeward coastlines, being sheltered, would be the most suitable for these activities as fishermen can fish from an ordinary outrigger canoe. One interesting solution to increase fishing efforts could be to encourage the use of sailing canoes, of the type used in 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 methodes of preserving the fish, such as smoking and salting it. It would provide those fishermen catring 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 they offer the possibility of selling their fish to a large number of fishermen who do not have much in 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, as most islands have very poor road systems, if any, because smoked or salted items keep for several days, sometimes weeks, at ambiant temperature and can easily be transported on men's back. With regard to difficulties with introducing a new producti into the dietary habits of the melanesian population, 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, holds all its advantages, namely : low pricing; large scale distribution, smoked fish could be sold like tinned fish in all village stores; easy and quick to prepare, just like tinned fish, smoked fish can be eaten cold or re-heated; marked flavour, thus 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, in addition to 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 husbans, especially financially, and thus play a greater economic role in the household and in fisheries developpment, adding 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 its place in the supplying of the 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 fisheries won't be able to supply the urban market in highly priced deep bottom fish, any more than the village commercial fisheries that we have described within the V.F.D.P. Catching these species, targetted 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 meters long, and capable of staying more than a day at sea. In

view of the current inter-island transport problems, it is recommended that such a sector be confined, at this stage at least, to Efate and Santo, with good access to the two main consumer markets. To supply the urban market, this structured commercial sector may also exploit pelagic fish, mainly tuna fish. The extreme mobility of the shoals is a severe constraint due to the amount of time devoted to following up and seeking the fish. The establishment of fish aggregating devices (FAD's) provides an interesting solution to the problem (CILLAURREN, 1990b). The viability of fishing around an FAD is closely related to the location of the raft, especially in respect of the time required to reach it (CILLAURREN, 1990c). Given the costs involved in manufacturing and installing a raft (3,000 US$ in 1983), particular attention has to be devoted to the strength of the materials and their assembly, because the zones frequented by tuna, the most appropriate for FASD's, are always very exposed to the winds and the currents (CILLAURREN, 1988). The most commonly caught species arounds FAD's in Vanuatu are the skipjack (*Katsuwonus pelamis*) and the yellow-fin tuna (*Thunnus albacares*). Whereas the yellow-fin tuna is a high price fish, which may be targetted to the urban expatriate market and to the tourist market, it is not the case of the skipjack. A large proportion of the skipjack caught by the village fishing co-operative associations is kept for fishbait to be used for fishing deep bottom-dewelling fish. The skipjack costs less than 1 US$ per kilo for this purpose, so it is an economically depreciated fish, although a great nutritional value. If the landings of skipjack could be increased for urban market, the price maintained at this low level and a campaign launched to explain its nutritionnal qualities, this could be a way of developing popular consumption of fresh fish in Port-Vila and Luganville.

Considering its importance within their economy, fishing should naturally be included in any development plan concerning the coastal districts. With this in mind, it is essential that fishing be considered as an integral part of the coastal economy, and that the relationships between this fishing activity and the other sectors of the economy, particularly agriculture, be the subject of careful studies. One must also remember that fishing is not limited simply to the catching of marine foodstuff, but includes as well numerous economic inter-relationships, the whole forming a complex system. Any alteration applied to one element of the system is highly likely to be reflected, directly or indirectly, on all the other elements. This is shown in very schematic form in Figure 5. The monitoring of these alterations becomes a fundamantal concern for the decision maker whose task it is to prepare a fisheries development plan, or to assess the effects of such a plan on an existing village fishery. Out of the 13 elements affecting the fisheries system listed in Figure 5, seven can be measured during the course of statistical enquiries in the field. These seven elements constitute the indicators for internal alterations of the fisheries system. Three further indicators apply to the production system : the number of fishermen, the number of items of fishing tackle, and the frequency of fishing outings. One indicator concerns the resources system : the size of the fish caught, which supplies demographic distribution information on the stock. Three indicators concern the distribution and consumption system : information on landings, selling price of the products, and dietary habits of the consumers.

Fig. 5 - Monitoring of the evolutions in the fishing system

Out of these seven indicators, five can be manipulated up or down in order to control the evolution of the fisheries system. Thus, the planner, by making use of taxes and grants, can affect the selling price of fish. Through relevant information being spread through the media, or a well targetted advertizing campaign, he may also be able to influence the evolution of dietary habits among the population. Through legislation, particularly through the issuing of fishing licences or the establishing of quota, he may exercise some control over the number of fishermen and the frequency of their fishing trips. Finally, through control of available bank credit, he may direct the evolution of the fishing equipment.

We will conclude this discussion by repeating that we are convinced that in Vanuatu, as in other Pacific nations, village-level fishing offers a real potential for development. The resources are there, as are men and women capable of innovation and adaptation. This potential for development must be tapped for the improvement of nutritional security in the country, by inserting fishing development alongside that of farming and cattle raising. Taking into account the specific socio-cultural aspects of small Pacific island nations, any development model that would be rigidly based on fostering specialization among the fishermen, and that would aim at an in-depth and rapid alteration of their social and economic organization through massive capital investment, is doomed to failure.

Any innovation proposed by the planners can only be adopted if it fits within the individual or communal aspirations and strategies of the "populations to be developed". Development programmes, therefore, must be conceived around the existing forms of village-level fishing

activities. Such programmes will require also to be kept flexible and adaptable, so that their goals and their means of execution can be re-targetted according to the reactions of the existing village fisheries system to their application.

Notes

1) The Pacific nations, together with Africa, constitute the portion of the planet where we observe the highest demographic growth. Out of the following 22 nations and territories of the Pacific - French Polynesia, Federated States of Micronesia, Marshall Islands, Solomon Islands, Tuvalu, Vanuatu, Wallis and Futuna, American Samoa, Cook Islands, Niue, Northern Marianas, Tokelau, Tonga, Western Samoa, Fiji, Guam, Kiribati, Nauru, New Caledonia, Palau, Papua New Guinea, Pitcairn - the first seven double their population in under 25 years, while the last 8 take between 25 and 35 years to do so (Bakker, 1991).

2) In a span of twenty years, from 1980 to 2000, the United Nations anticipate a doubling of urban population in Melanesia and Micronesia. Growth is expected to be slower in the Polynesian nations, on account of the sizable emigration which affects some of them, notably the Cook Islands, Tonga and Western Samoa (Pool, 1991).

3) This evolution can be attributed to a decrease in soils fertility brought on by a shortening of fallow periods, and by the change away from the subsistence agriculture system. Both of these processes frequently occur together. The traditional crops, mostly yam and taro, which normally used the slash and burn method over short periods of one to three years, followed by the land being allowed to lie fallow for 15 to 30 years, are now often being replaced by less labour-intensive crops such as manioc (Thaman, 1991), or by crops which offer in theory a better yield per hectare such as sweet potato (Kuchikura, 1990). Within this new system, the fallow periods are becoming shorter and shorter, not allowing enough time for a layer of tree-humus to accumulate, and for the soil to recover its fertility. In the fallow process, it is the trees which perform the task of soils regeneration. Their roots draw from deep under the soil the nutrients that have been leached there by water run-off, transform them into vegetable matter, and deposit them back on the surface as leaf mould.

4) Smallholder agrigulture is a sector which has long been thought to have a major role in the economic development of the small Pacific island nations. The hopes of the various governments have often been disappointed, regarding traditional cash crops activities as well as new agricultural exports activities (Flemming et al., 1991).

5) Laplap is the national dish of Vanuatu. It is in the form of a big pancake made up of grated root vegetable (taro, yam or cassava) mixed with coconut milk and cooked or braised in a ground oven.

6) The term "ni-Vanuatu" denotes the Melanesian inhabitants of Vanuatu.

7) According to the results of the National Nutrition Survey (Hung, 1983; David, 1987), tinned food accounted for 18% of the meals where protein foods were consumed. In the city, 30% of such meals featured tinned products.

8) Out of the thirty major islands of Vanuatu, in 1979 twelve had a density of less than 10 inhabitants per km2.

9) As noted by RODMAN (1989, p. 58) "Fishery is the term used to describe a complex system involving, first, fishermen using similar techniques; second, a resource consisting of particular kinds of fish in the same ecological niche; and, third, a market".

10) Commonly called "ciguatera", ichtyo sarchotoxicity is caused by a toxin (ciguatoxin) produced by a dinoflagellate, "*Gambierdiscus Toxicus*", found on the outer membrane of the macroscopic algae of coral reefs, particularly the ones occuring in branched and bunched form (TAYLOR, 1985). The intake of *G. Toxicus* by browsing fish leads to a contamination of their flesh and of their organs which 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).

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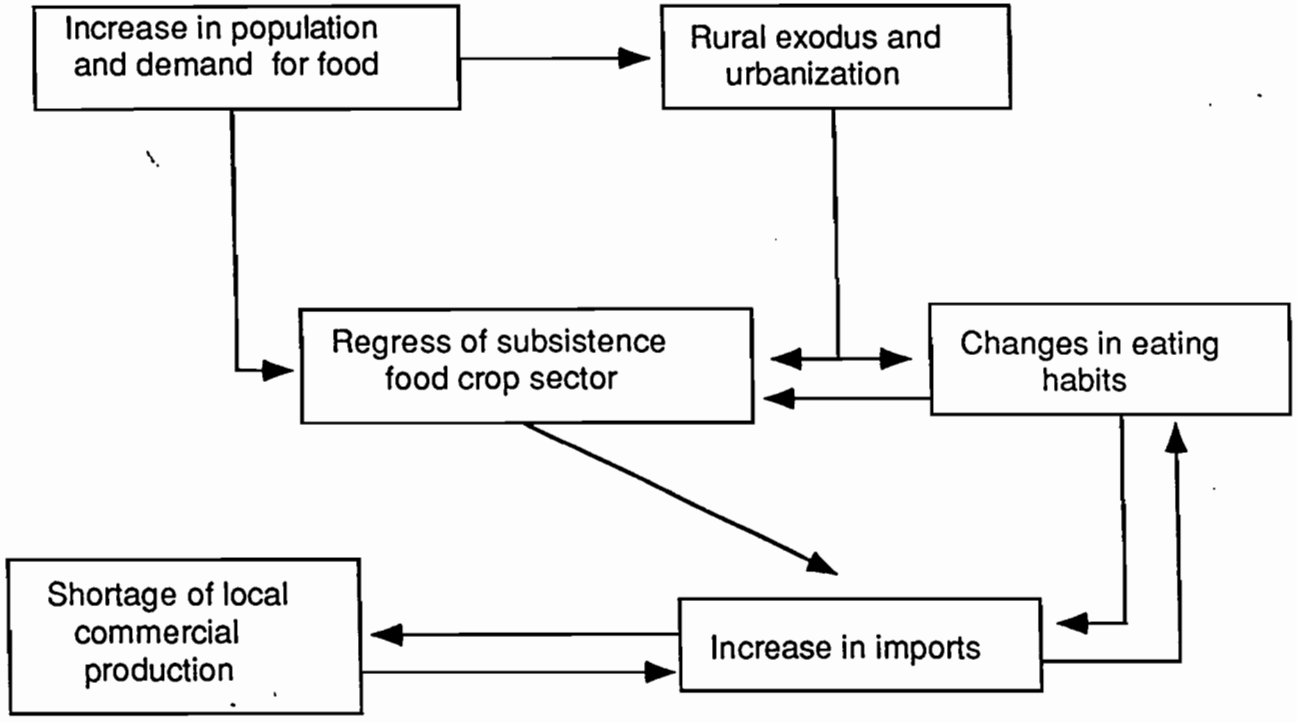

Fig. 1 - Factors jeopardising Vanuatu's nutritional independence

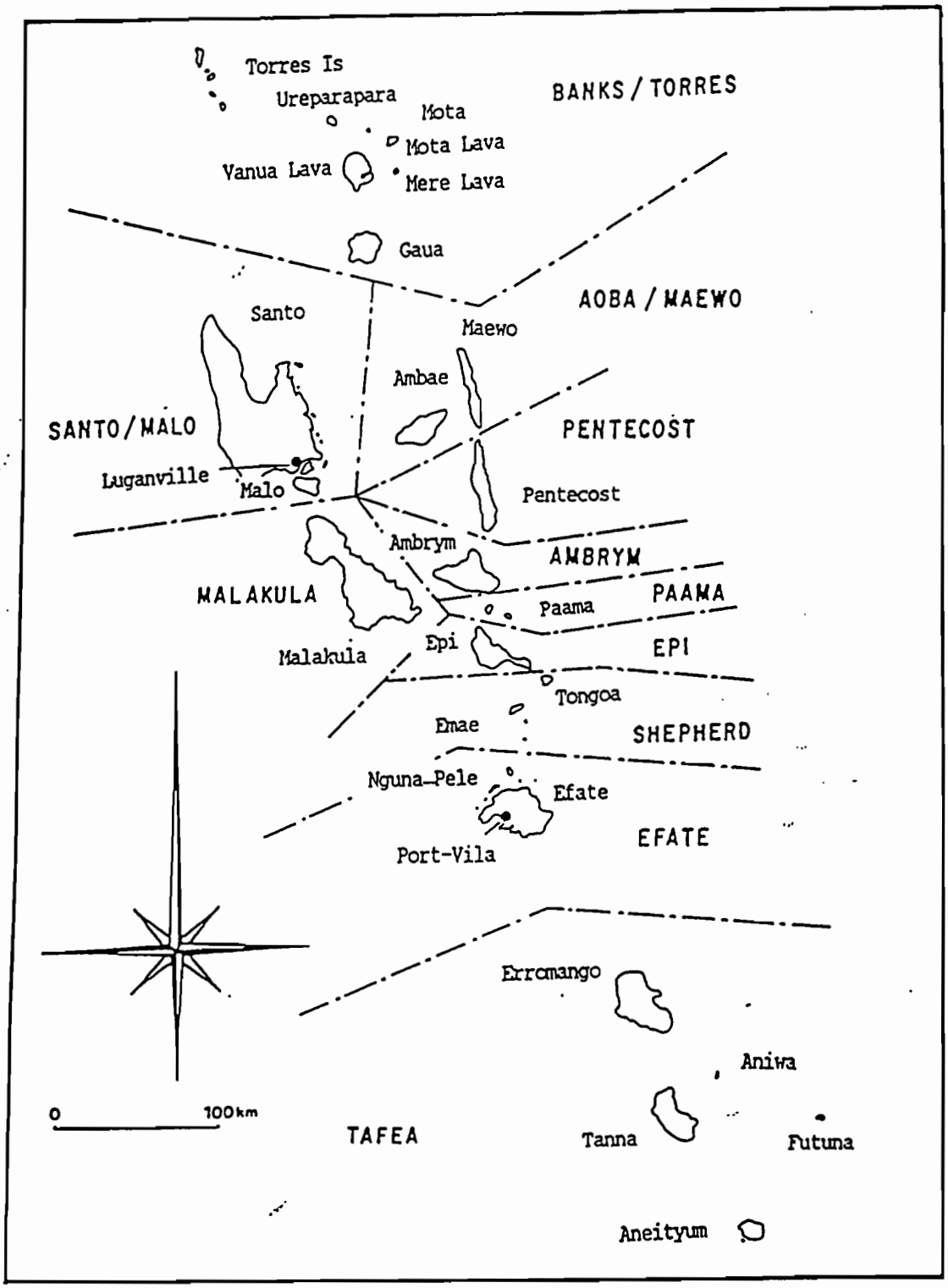

Figure 2 - Vanuatu and its eleven Local Government Regions

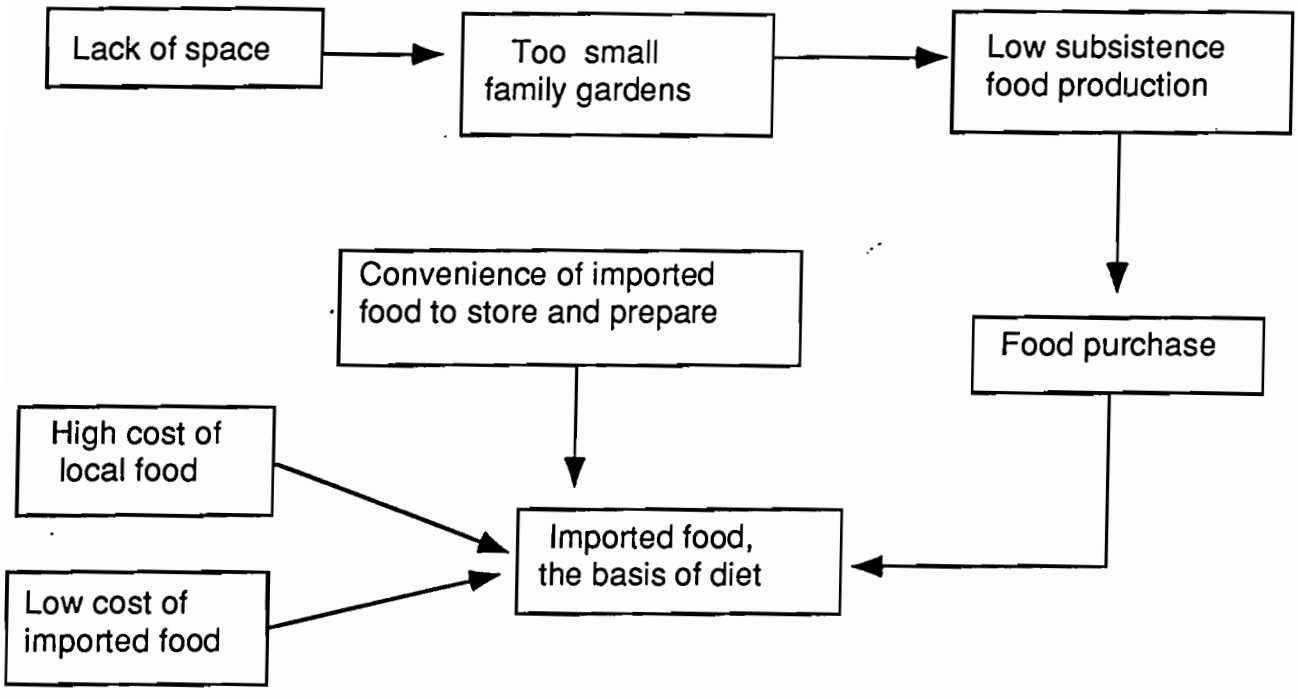

Fig. 3 - Causal relationships showing the major place taken by imported food in the diet of low-income urban families

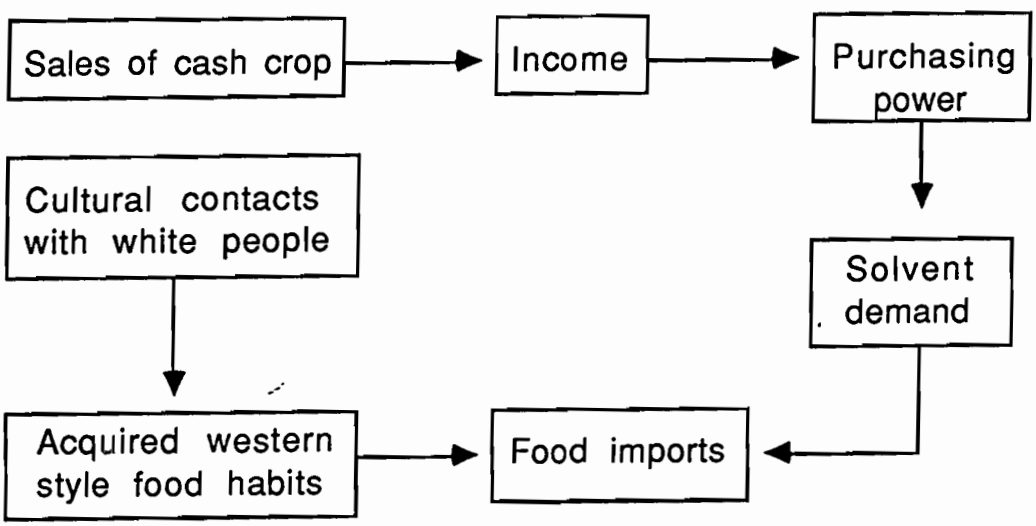

Fig. 4 - Causal relationships showing food imports in the rural areas

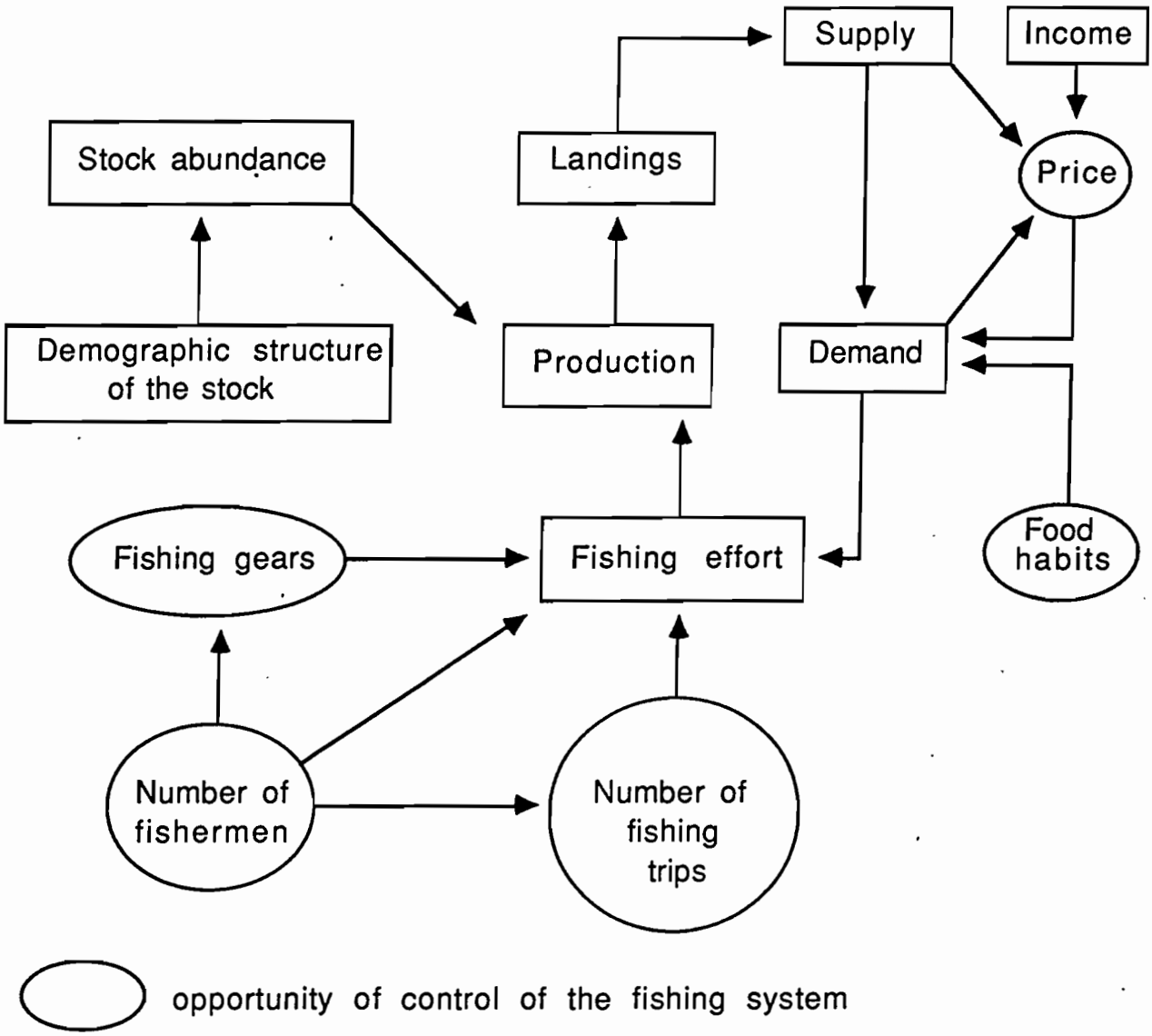

Fig. 5 - Monitoring of the evolutions in the fishing system

Table 1 : Supply of marine produce in Vanuatu in 1984

a) Tonnage in urban areas

EXPORTS	IMPORTS			Local Consumption		Tourist Consumption		TOTAL
	Tin fis	Other Fish	Seafood	Fish	Seafood	Fish	Seafood	
3	127.5 - 199	37.5	16.4	144.3 - 183.3	15 - 45.16	40.8 - 85.1	295.6 - 343	677.1 - 909.5

b) Tonnage for the whole of the rural area

Imported products (tin fis)	Fresh Produce		TOTAL
	Fish	Seafood	
536 -568	1677 - 1774	1364.7 - 1659.7	3569 - 4076

c) Tonnage in the coastal zone

Imported products (tin fis)	Fresh produce		TOTAL
	Fish	Seafood	
476.5	1536 - 1774	1119 - 1659.7	2704 - 3505

d) Tonnage inland

Imported products (tin fis)	Fresh produce		TOTAL
	Fish	Seafood	
77.25	14.4 - 150	16 - 298.7	106.45 461.25

Table 2 : Main patterns of consumption of marine produce in Vanuatu

a) Nature and origin of the products included in the supply of marine produce (1)

Consumer Sector	Para-meter	Nature of Products			Origin of Products		
		Imported	Consumed	Exported/ distributed	Imported	Consumed	Exported/ distributed
URBAN EXPATRIATE	1 2 3 4	Fresh fish Shellfish Tinned fish Mollusca	Fresh fish Shellfish Tinned fish Mollusca		Coast Overseas	Coast Overseas Local (Game fis.)	
URBAN NI-VANUATU	1 2 3 4	Tinned fish Fresh fish Mollusca Shellfish	Tinned fish Fresh fish Mollusca Shellfish	Tin. fish Fresh fish	Overseas Coast	Overseas Coast	Overseas
COASTAL	1 2 3 4	Tinned fish	Fresh fish Mollusca Shellfish Tinned fish	Shellfish Fresh fish Tin. fish	Overseas	Local Overseas	Local Overseas
INLAND	1 2 3	Tinned fish Shellfis.Mol. Fresh fish	Tinned fish Shellfis.Mol. Fresh fish		Overseas Coast	Overseas Coast	

b) Constraints

Consumer Sector	Para-meter	Constraints affecting supply			Constraints affecting demand		
		Tinned fish	Fresh fish	Shellfish & mollusc	Tinned fish	Fresh fish	Shellfish & Mollusc
URBAN EXPATRIATE	1 2 3 4	Demand	Production Distribution Preservation means	Production Distribution	Competition from fresh products (fish, meat)	Lack of supply Competition from fresh meat	Lack of supply
URBAN NI-VANUATU	1 2 3 4	Demand	Demand Production Distribution Preservation	Demand Distribution	Price/Income Competition from fresh meat	Price/Income Competition from tin fish Lack of supply	Price/Income Competition from tin fish
COASTAL	1 2 3 4	Distribution Demand	Production Means of preservation Distribution Demand	Export to town Resources Demand	Lack of supply Lack of income (2) Price/income	Commercial supply Own consumption Lack of income	Lack of supply Resources Lack of income(2) Price/Income
INLAND	1 2 3	Demand Distribution	Demand Distribution Com. prod.	Demand Distribution Com. prod.	Lack of income Supply Price/Income	Lack of income Price/Income Lack of supply	Lack of income Price/Income Lack of supply

1) Each parameter is represented in decreasing order of importance, 1 (the highest) to 4 (the lowest).

2) The expression 'lack of income' means consumer income, not the earnings the fishermen generate from selling their marine produce commercially.

Table 3 : Nutritious value (1) of some protein foods bought in Port Vila in 1984 for 80 vatu (2)

Product	Total weight (g)	Edible content (g)	Energizing content (kj)	(kcal)	Protein (g)	Lipid (g)	Glucid (g)	Calcium (mg)	Iron (mg)	Vitamin (mg)
Tin fis in brine	450	350	2580	620	70	35	0	133	4	29
Tin fis in oil	45	350	3240	775	65	55	0	665	9	31.5
Tin fis in tomato	425	320	2340	560	50	34	12	320	5	25
Skipjack	400	200	1475	350	40	20	0	75	2.5	16.5
Reef fish	320	145	630	150	30	4	0	40	1	9.5
Red snapper	275	125	545	130	25	3	0	35	1	8
Shark fillet	265	265	1155	280	50	6	0	75	2	17.5
Neck of beef	400	400	3065	730	70	50	0	40	10.5	36.5
Corned beef	170	130	1220	290	25	21	0	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 macquerel.

Table 4 : Development of fisheries production supported by the VFDP (Ref.: 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

Table 5 : Average duration of fisheries projects (1)

Duration (Years)	Number of projects (in %) n=138
7	0,5
6	0,5
5	3
4	4
3	13
2	26
1	53
Mean 1,8	Total 100

(1) Survey done on a sample of 138 projects monitored by ORSTOM between 1983 and 1989.

Table 6 : 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	Shellfish	Mollusc	Fish	Shellfish	Fish		
145-159.9	43.8-54	38.9-49.3	11.5-12.5	0.155	5.54-6.88	131.3-131.96	376.6-414.7

Overall	Fish	Shellfish	Mollusc	TOTAL
	293.2 - 310	44.5 - 55.4	38.9 - 50.5	376.6 - 414.7

VILEJ FISING PROJEK

REKOT BLONG FISING LONG WAN TRIP

Nem blong kampani : .....

Nem blong bot : ..... Hamas man i stap long bot : .....

Deit yu ko aot : ..... Taem yu ko aot : .....

Deit yu kam bak : ..... Taem yu kam bak : .....

Fising eria : ..... Fising depth : .....

Hamas line yu usum : ..... Hamas line yu usum : .....
long dip solwota long trolling

Hamas kilo fis yu kasem : .....kg Hamas kilo fis yu kasem : .....kg
long dip solwota long trolling

Taem yu start bottom fising : ..... Taem yu start troll : .....

Taem yu stop bottom fising : ..... Taem yu stop troll : .....

Wanem kaen beit yu usum : ..... Hamas kilo beit yu usum : .....kg

---

INCOME

Hamas mane yu kasem long fis sales : ..... VT Nara income : ..... VT

HAMAS MANE YU USUM

Benzene/oel : ..... Repair mo maintenance : .....

Samting blong fising : ..... Freight : .....

Pay : ..... Ol nara expense : .....

Nem blong fis	Mesament blong fis (length long cm)
Etelis coruscans	
Etelis carbunculus	
Etelis radiosus	
Pristipomoides multidens	
Pristipomoides filamentosus	
Pristipomoides flavipinnis	
Epinephelus magniscuttis	
Epinephelus morrhua	
Epinephelus septemfasciatus	
Lutjanus malabaricus	
Aphareus rutilans	

REMARKS

VILEJ FISING PROJEK

REKOT BLONG FISING LONG WAN TRIP

Nem blong kampani : .....

Nem blong bot : ..... Hamas man i stap long bot : .....

Deit yu ko aot : ..... Taem yu ko aot : .....

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Fising eria : ..... Fising depth : .....

Hamas line yu usum : ..... Hamas line yu usum : .....
long dip solwota long trolling

Hamas kilo fis yu kasem : .....kg Hamas kilo fis yu kasem : .....kg
long dip solwota long trolling

Taem yu start bottom fising : ..... Taem yu start troll : .....

Taem yu stop bottom fising : ..... Taem yu stop troll : .....

Wanem kaen beit yu usum : ..... Hamas kilo beit yu usum : .....kg

INCOME

Hamas mane yu kasem long fis sales : ..... VT Nara income : ..... VT

HAMAS MANE YU USUM

Benzene/oel : ..... Repair mo maintenance : ....

Samting blong fising : ..... Freight : .....

Pay : ..... Ol nara expense : ....

Nem blong fis	Mesament blong fis (length long cm)
Etelis coruscans	
Etelis carbunculus	
Etelis radiosus	
Pristipomoides multidens	
Pristipomoides filamentosus	
Pristipomoides flavipinnis	
Epinephelus magniscuttis	
Epinephelus morrhua	
Epinephelus septemfasciatus	
Lutjanus malabaricus	
Aphareus rutilans	

REMARKS

"NATAI"

PORT VILA FISHERIES LIMITED
P.O. Box 883, Port Vila — Telephone : 23344
P.O. Box 211 — Luganville, Santo — Telephone : 36841

GOOD RECEIVED NOTE No 11563

Date : .....

Received from : .....

AWB No : .....

Bag No's : .....

CODE

Grade A - First Grade
B - Second Grade
C - Third Grade
IKE - Killed
HIG - Headed & Gutted
H/G - Head Off
G&G - Gilled & Gutted
WH - Whole
L - Live
D - Dead
F - Frozen

Description of Goods	Code	Kgs	Price	AMOUNT Vts

VOID

24/1/92

Total Kgs | **Sub Total**

Goods Received Signed : ..... **Freight Ded**

Approved Payment Signed : ..... **Other Ded**

Till Cash ..... Cheque No. ..... **Total Payable**

REPUBLIC OF VANUATU

FISHERIES EXTENSION SERVICE
RESEARCH UNIT ORSTOM - FISHERIES DEPARTMENT
GOODS RECEIVED NOTE

GRN № 2951

Extension Centre ..... Date .....

Fishing Project ..... Procode .....

Fishing Area ..... Trip Length ..... Hours

PIECES	SPECIES		KILOS	PRICE	VALUE
.....	E. carbunculus	(Red Short Tail)	.....	.....	.....
.....	E. coruscans	(Red Long Tail)	.....	.....	.....
.....	E. radiosus	(Silver Jaw)	.....	.....	.....
.....	P. multidens	(Large Scaled Jobfish)	.....	.....	.....
.....	P. flavipinnis	(Yellow Jobfish)	.....	.....	.....
.....	P. filamentosus	(White Poulet)	.....	.....	.....
.....	L. malabaricus	(Red Snapper)	.....	.....	.....
.....	A. rutilans	(Green Jobfish)	.....	.....	.....
.....	S. rivoliana	(Amberjack)	.....	.....	.....
.....	E. magniscuttis	(Spotted Loche)	.....	.....	.....
.....	E. morrhua	(Brn. Striped Loche)	.....	.....	.....
.....	E. septemfasciatus	(7 Banded Loche)	.....	.....	.....
.....	G. unicolor	(Dog Tooth Tuna)	.....	.....	.....
.....	T. albacares	(Yellow Fin Tuna)	.....	.....	.....
.....	K. pelamis	(Skipjack)	.....	.....	.....
.....	T. alalunga	(Albacore)	.....	.....	.....
.....	C. hippurus	(Mahi-mahi)	.....	.....	.....
.....	M. seheli	(Mullet)	.....	.....	.....
.....	S. crumenophtalmus	(Mangreau)	.....	.....	.....
.....	Clupea sp.	(Sardine)	.....	.....	.....
.....	Mixed Reef Fish		.....	.....	.....
.....	Other Species		.....	.....	.....
				TOTAL	

Received from Fisheries Extension Service ..... VT.

Signed .....