

The Past and Present of the Coral Reef Fishing Economy in Madagascar : Implications for Self Determination in Resource Use

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The Past and Present of the Coral Reef Fishing Economy in Madagascar: Implications for Self-Determination in Resource Use

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1. INTRODUCTION

Traditional use rights in fisheries (TURFs) has been an important focus in the study of small-scale fisheries resource management since the end of the 1970s. For example, Johannes underlines its importance for vulnerable natural environments and economies in the small islands in Oceania, where fishing grounds are limited and people rely on economically sensitive industries such as tourism. Particularly because of limitations in fishing grounds and biomass, local fisheries have been severely depleted by overfishing, the inevitable result of “money-based economies, governed ultimately by decisions made in market centers thousands miles away” [JOHANNES 1978]. In this situation, revival of traditional “conservation” strategies, intentional or not, and their modification to contemporary contexts can be an effective means to encourage native people’s involvement in resource management. This proposition remains significant today, nearly 30 years after Johannes’s publication.

Following on Johannes’s concerns, many studies have documented TURFs throughout the world [RUDDLE and AKIMICHI 1984; CORDELL 1989; POGGIE and POLLNAC 1991]. The late 1980s saw interdisciplinary attention to common property resources [BERKES 1989; MCCAY and ACHESON 1987], resulting in the popularity of the concepts of community-based management and co-management even among specialists in regional development [ACHESON 1989; JENTOFT 1989; PINKERTON 1989]. As a result of these discussions, systematic manuals on small-scale fisheries resource management and development are now available for practical use [BUNCE et al. 2000; BERKES et al. 2001].

However, many problems remain unresolved. One is the management of migratory species,

as discussed in some of the other chapters in this volume, and another is the management of sedentary species but by migratory fishermen, the focus of this article. In both cases, users have difficulties sharing ideas about who has the rights to use which resources [STERN et al. 2002: 462]. This is the case with post-independence southwestern Madagascar, where, as a “money-based economy” penetrated fishing villages, fishermen became more involved in seasonal fishing in remote areas hundreds of kilometers away, leading to significant changes in resource use and contributing to the depletion of resource stocks. Although the issue of who has local rights over reefs and lagoons has yet to be settled (and this matter seems to be of the utmost urgency), it can potentially narrow fishermen’s choices of migration to other areas.

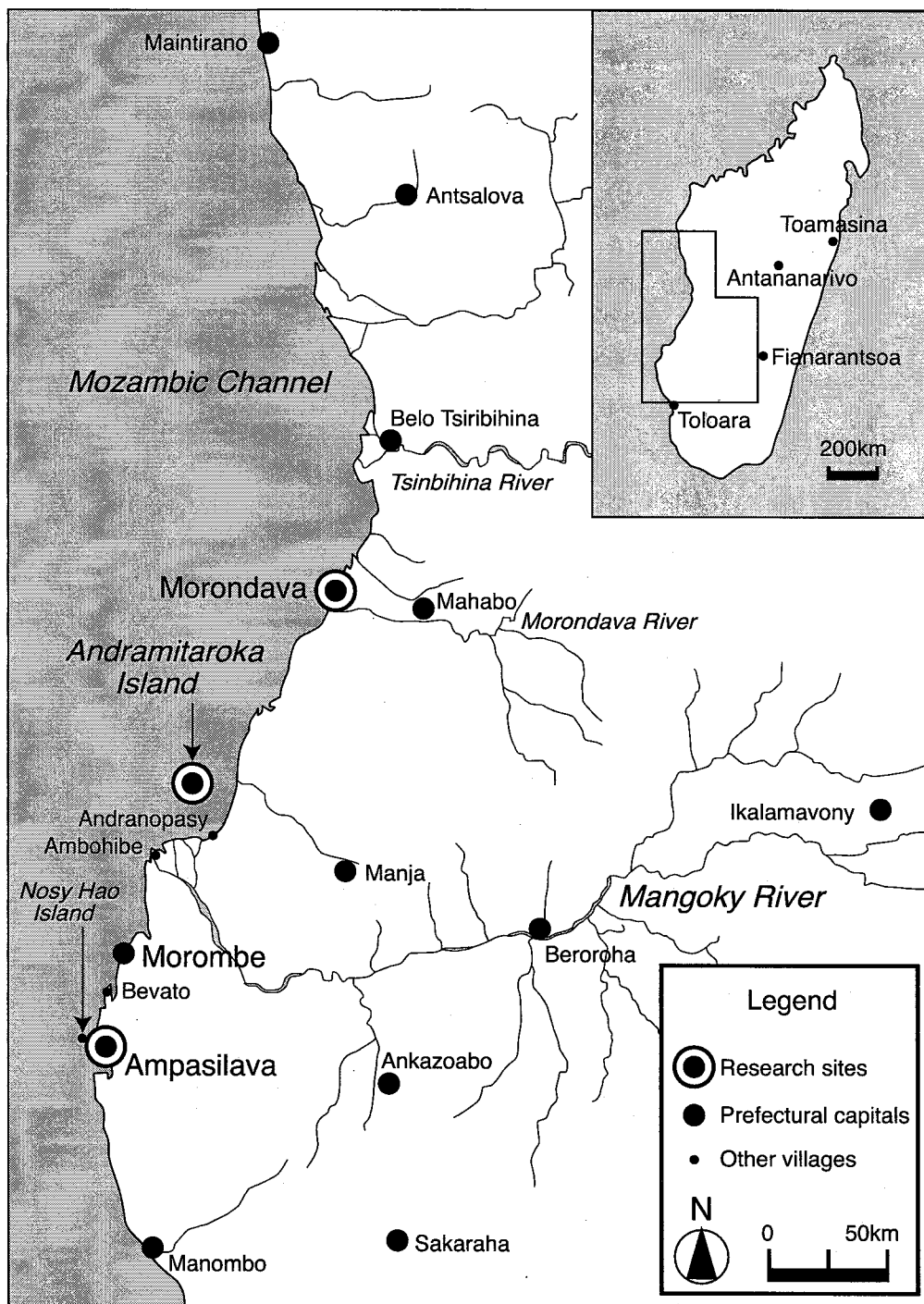
This paper aims, first, to describe the present situation of fishing activities in southwestern Madagascar, based on long-term participant observation. Particular attention will be paid to the composition of household economies, which is important to understanding why fishermen are motivated to migrate. Second, it tracks the history of local fisheries in the context of the dynamics between coral environments and fishing economies during the past few decades. Finally, it concludes with suggestions intended to facilitate the future of fishermen’s self-determination in fisheries management.

2. RESEARCH SITES: PEOPLE, THE NATURAL ENVIRONMENT, AND THE ECONOMIC UNIT

The Vezo are residents of the southern and western coast of Madagascar. This population is regarded as an ethnic group by the Vezo themselves, as well as by neighboring peoples [GRANDIDIER and GRANDIDIER 1908: 250; KOEHLIN 1975: 23; MARIKANDIA 2001]. Even recent studies that have taken a critical view of Vezo identity [ASTUTI 1995a, b] agree that the Vezo construe their identity through the so-called *habitus* of living on the coast and practicing a lifeway based on capturing, consuming, and marketing fish. According to my experience too, the term “Vezo” indicates proficiency at fishing and sailing, and is used to indicate admiration in someone’s fishing or seafaring skills. All these things reflect the heavy dependence of the Vezo on fishing for their livelihood.

My field research, which took place for various periods between 1995 and 2002, was concentrated on three sites. One was the peasant village of Ampasilava, and the other two were seasonal campsites of Ampasilava villagers. Ampasilava belongs administratively to the commune of Befandefa, in the prefecture of Morombe, in the province of Toliara. It is located on the coast, about 50 km south of the city of Morombe, a local administrative and commercial center (Map 1). Ampasilava villagers frequently travel to Morombe by ocean-going canoes 8 to 9 meters in length. The canoe is a dugout type with planks attached to extend upward, and with a single float outrigger [HORNELL 1920; FAUBLÉE and FAUBLÉE 1950]. It is used for transporting goods and people, and as a floating platform for fishing on the barrier reef and the seaward slope. Smaller canoes, 3 to 4 meters in length, are used for regular fishing in the calmer waters between the reef and the shore. Outboard engines and motorized vessels are not yet in popular use. The population of Ampasilava in 1996 consisted of 38 households totaling approximately 200 people.

The southwestern part of the island of Madagascar, where Ampasilava is located, is an



Map 1 Reserch Area
 Source: after Foiben-Taosarintanin' i Madagasikara 1990 [first published in 1966]

arid area hardly influenced by the trade winds or monsoons. For example, the annual precipitation in Morombe is no more than 453.7 mm, with only 32 rainy days on average per annum. The rainy and the dry seasons are distinct. The rainy season is limited to four months from December to March, when the monthly precipitation reaches 30 mm [GRIFFITH and RANAIVOSON 1972]. Because of the limited rainfall and the slight grade of the western slope of the island, the shore is a side shelf with few rivers flowing into the Mozambique Channel. As a result, except for a few areas near the river mouths with mangrove forests, coral reefs are widespread [PICHON 1972]. At Ampasilava, fringing reefs develop near the coast and barrier reefs 5 km off the coast, including the coral island of Nosy Hao (or Nosao according to vernacular pronunciation). The diverse marine microenvironments—channels, reef flats, the lagoon, and reef slopes—provide the Ampasilava fishermen with a wide variety of fishing grounds.

The smallest unit in Vezo economic life is the household, whose members share a house and food cooked in a common kitchen. Although there is no vernacular term for household, the Vezo express it as “we who are parents and children (*zahay mianake*)” or “we who share a house (*zahay miharo tsano*).” In actual practice, households are usually nuclear families, a married couple and their children¹⁾, and thus include one adult male and one adult female as the practical labor, in most cases. The practical labor in a household will be more than two when the couple has many children, but it rarely exceeds four because boys and girls are inclined to get married soon after they master adult subsistence tasks.

In Ampasilava, the household is the unit of consumption but not necessarily that of production, because household labor alone is not sufficient to organize a productive fishing team. Thus, several households typically prefer to make up a larger unit of production. It will be called here a complex household (CH). All the households in the CH share harvested fish almost every day, even when some of them do not offer any labor or fishing gear. Labor and capital as well as production are shared in the CH²⁾. From this viewpoint, the 38 households in Ampasilava could be grouped into 17 CHs: 2 consisting of 5 households; 1 of 4 households; 3 of 3 households; 4 of 2 households; and 7 of 1 household.

The households in a CH are affiliated with each other over long-term periods, because the ties are based on kinship relations. Figure 1 indicates the genealogies of two sample CHs whose economies are examined below; one person in any given household has a parent, child or sibling in another household of the same CH. This provides an ideal lifecycle for the CH. In the first stage, a young person as a member of a household marries and builds a house near that of his/her parents³⁾, after which he or she is regarded as having established an independent household. However, the new household is dependent on the parents in that they exchange labor or fishing gear, and share their harvest from the sea. In other words, the new household is independent from the viewpoint of consumption, while, from that of production, it functions as a part of a CH consisting of the households of parents and siblings. Such cooperation among households of siblings is sustained even after the parents have died. However, by the time the third generation has developed as the dominant part in the household economy, the relationship among the former households eventually becomes less intimate, resulting in the split of the CH. Because this model applies to all the CHs in Ampasilava, 16 out of 17 CHs consisted of a couple's (or a widow's or a widower's) household and those of their direct descendants. The only exception consisted of the households of a brother and a sister, whose parents were dead. Thus, in this

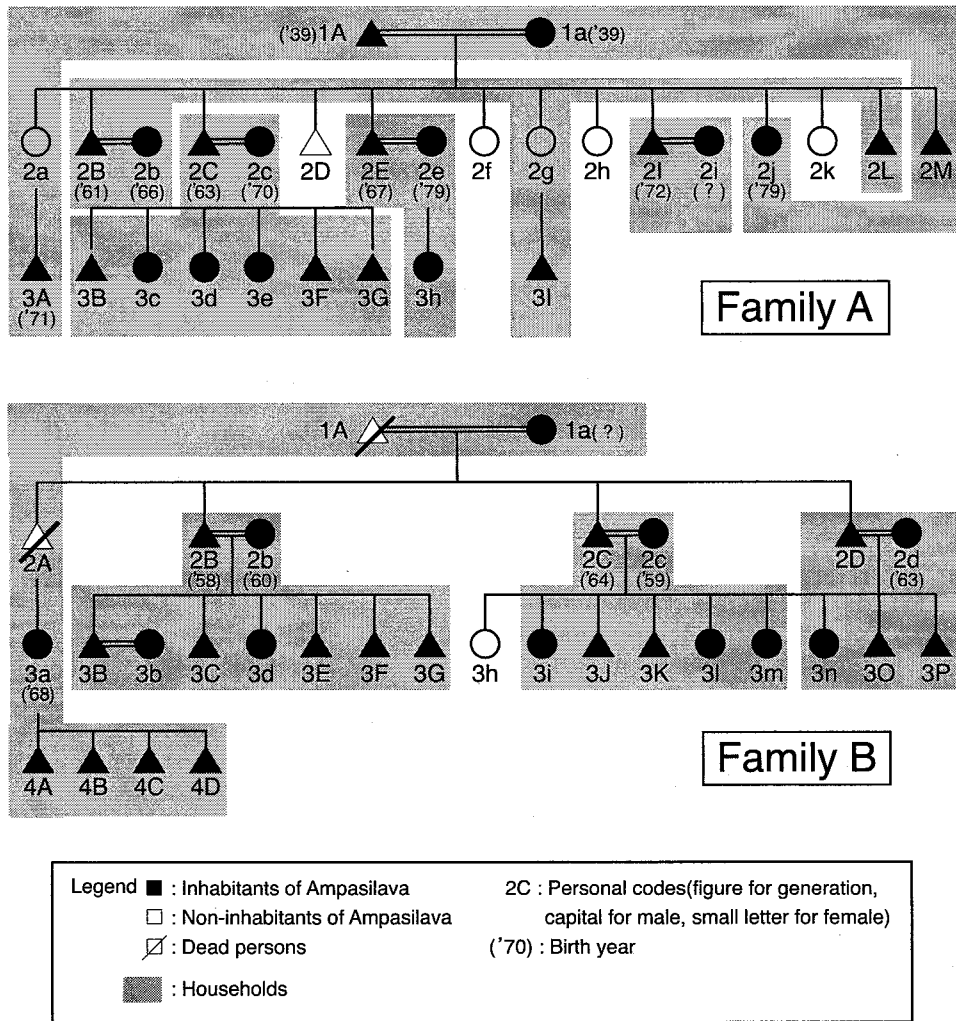


Figure 1 Genealogies of sample families

paper, the CH corresponds to the extended family, whereas the household corresponds to the nuclear family. Hereinafter, a “family” will refer the extended family, which is economically the CH.

Most of the adult males in Ampasilava not only fish near the village but also travel to remote areas for seasonal fishing. Their two seasonal campsites are in the city of Morondava, 240 km from Ampasilava, and on Andramitaroke Island, 140 km from Ampasilava (Map 1). In 1996, 20 of the 36 male adults⁴⁾ in the village (55.6 %) visited at least one of these two places. Figure 2 shows the seasonal fishing periods of these locations for each fisherman. The average was 86.15 days per annum, although the period varied with the individual ($s=51.85$). The fishing period for each fisherman was set according to various factors such as health, family events, and the availability of fishing partners or travel allowances. However, all the fishermen avoided

1995		1996											
NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT		
≡												≡	Shark hunters of family A
	≡									≡			Other shark hunters
								≡		≡			Sea-cucumber collectors of family B
													Collectors following family B
								≡	≡	≡	≡	≡	Other sea-cucumber collectors
							≡	≡	≡	≡	≡	≡	

Figure 2 Periods when Ampasilava villagers were in the remote fishing camps (one individual in one row)

the period from the end of December to the beginning of March when the northwest monsoon prevails. During this season, fishermen were worried about intermittent showers and, especially, unstable winds which make it difficult to sail back and forth to the fishing grounds. There were two kinds of fishing methods employed in remote areas in the dry season, in 1996: sea cucumber spearing and shark netting, both high-productivity activities.

3. METHODS

The data were collected through participant observation during the author's stay, covering 13 months from 1995 through 1996, 2 months in 1998, and 3 months from 2001 through 2002. Information on the historical development of fishing activities was collected through interviews, particularly in 1998, 2001 and 2002. Quantitative data were collected during specific periods, which overlap with the interviewing periods, using the following procedures.

To document fishing near Ampasilava, interviews were held with members of all the households in the village, every day for 14 days during two seasons: from 1 to 14 August 1995 (the dry season), and from 24 January to 6 February 1998 (the rainy season). They were asked if any of their household members had been to the sea for fishing, and which kind of fishing methods they had employed. Activities of all the married males and females were recorded, except for those who had been absent for more than 7 days out of 14, including how often each fishing method had been applied. When a person had employed two different methods on the same day, it was recorded as 0.5 days for each method.

To clarify the budget of the fishing household or the CH, two families were selected as samples for budget analysis. Their genealogies are shown in Figure 1 and their profiles in Table 1. They are of similar size. Family B possessed no fishing nets in 1996 but purchased two in 1997, whereas Family A had long possessed nets. During 14 days from 9 to 22 June 1996 (the dry season) and 28 days from 12 January to 8 February in 1998 (the rainy season), the author spent most of each day with one of the two families, and the next day with the other, collecting 7 days of data for each family in the dry season and 14 days of data for each family in the rainy

Table 1 Profiles of the sample families

	Family A	Family B
No. of members	22	27
Adult males	6	4
Adult females	6	6
Juveniles (6–14 yrs)	4	10
Infants (< 6 yrs)	6	7
Possession of fishing nets	Yes	No (1996) / Yes (1998)

season. Whenever the members went to sea for fishing and returned home, the time was recorded, as were the number and the weight of the harvest by species, and how it was distributed (i.e. whether it was sold, cooked, or transferred, and who processed it for consumption, storage, or transfer). At the same time, recorded were the kinds and the quantity of such other 'staple' foods as cassava, rice and maize, cooked by the households.

Finally, fishing activities in remote areas were observed and recorded. The time of the activities, the harvest, and how it was distributed were recorded for 14 days from 12 to 25 October 1996 on Andramitaroke Island, and for 14 days from 27 October to 9 November in Morondava.

4. REGULAR FISHING NEAR THE VILLAGE

Fishing methods observed in Ampasilava are listed in Table 2. They can be roughly classified into three categories: net fishing, line fishing, and spearing or harpooning. The first two correspond to vernacular categories, which are expressed as verbs, *mihaza* and *maminta*, while spearing or harpooning is not a comprehensive category for the *Vezo*. Many fishing methods in Ampasilava are employed only in limited conditions of the tide and water level, as a result of adaptation to the shallow water environment on coral reefs.

Table 3 shows the frequency, expressed as a percentage, with which the villagers employed each fishing method during 14 days. The sex differences are especially evident. Males concentrated on driving fish into gill nets and employed a wide range of methods, whereas females specialized almost exclusively in gleaning activities across the reef flats. This reflects the sexual division of labor: males engaged in fishing, and females in domestic duties: cooking, keeping house, fetching water etc. Females are allowed to go to sea only for limited hours, leading to the difference in days spent fishing⁵), as shown at the bottom of Table 3. In this regard, gleaning on the reef flats is suitable for females because the reef flat becomes dry and is good for gleaning only for a limited number of hours in a month. In addition, gleaning above sea level does not require the difficult grasp of the maps of fishing grounds as other fishing methods do, so that even females busy with childcare and household maintenance tasks can easily become skilled in harvesting resources in these habitats.

A seasonal difference is evident in the frequency of working days. Men go to sea more frequently during the rainy season, and women less frequently⁶). This is not because of resource conditions but because of the fishermen's schedule: during the dry season, men in their prime

Table 2 Fishing methods found in Ampasilava

Category	Method (vernacular)	(description)	Frequency	water level / tide
Net fishing (<i>mihaza</i>)	<i>manao harata</i> <i>talirano (mihaza)</i>	Gill net for moat fish driven by a canoe	++	low / spring tide
	<i>manandrake harata</i>	Fixed gill net shutting fish into tide pools	+	flood / spring tide
	<i>manao drañoke</i>	Fixed gill net in lagoon	+	any / neap tide
	<i>manao harata be</i>	Seine net in lagoon	+	low / spring tide
	<i>manao jarifa</i>	Large gill net for sharks	-	
	<i>mandaro</i> *	Gill net for fish paralyzed by poison	-	low / spring tide
Line fishing (<i>maminta</i>)	<i>maminta</i>	Line fishing in lagoon	++	
	<i>maminta hale</i>	Line fishing at night	+	
Spearing and harpooning	<i>mañirike</i>	Diving in lagoon with a spear	++	
	<i>mihaky</i>	Gleaning on reef flat with a spear	++	low / spring tide
	<i>mila zanga hale</i>	Gathering sea cucumbers at night	+	low / spring tide
	<i>mitinotino</i>	Gleaning from canoe in moat	+	low / spring tide
	<i>mive fano</i>	Harpooning turtles	-	

* This method can be classified both as spearing and as net fishing. In this method, fish are encircled by a net and frequently caught with spear.

Table 3 Proportion of each fishing method for 14 days

	Male		Female	
	Dry season	Rainy season	Dry season	Rainy season
Gill net for driven fish	44.0 %	43.0 %	12.9 % *	11.1 % *
Gill net fixed in tide pool	1.9	3.6	-	-
Gill net fixed in lagoon	3.2	-	-	-
Seine net in lagoon	15.7	13.6	-	-
Line fishing in lagoon	16.7	1.3	-	9.3
Line on reef slope at night	-	4.5	-	-
Diving in lagoon	8.3	31.1	-	-
Gleaning on reef flat	6.9	3.0	87.1	79.6
Gleaning from canoe	3.2	-	-	-
Total	100 %	100 %	100 %	100 %
No. of sample individuals	23 people	40 people	25 people	39 people
Total fishing days	108 days	235 days	85 days	81 days
Average fishing days per capita	5	5.88	3.96	2.37

* Females were accompanied by males in all the cases.

go to fish in remote areas, which reduces the time they spend within the village. This is reflected in the seasonal difference in the proportion of diving, an activity that requires physical ability and is preferred by men in their prime. This difference is statistically significant (χ^2 -test. $\chi^2=20.96$, $df=1$, $p<0.001$). Women, who rarely go to remote areas, frequently leave the village to visit their relatives during the dry season when their husbands are absent. However, the reason for the women's vigorous activity in the dry season is less evident. It may be attributed to their freedom in the dry season when their husbands are away but, more appropriately, it may be attributed to irregularity in their time spent for fishing, caused by such events as the birth of a baby or sickness. In any case, the seasonality of resource availability is not conspicuous, largely because, in the coral-reef environment, sedentary species are more important than migrant species.

Sample family A put 111.03 man-hours of labor into fishing in two weeks⁷⁾ during the dry season, with an additional 8.13 man-hours of outside help⁸⁾, and 81.28 man-hours in the rainy season, with 13.53 man-hours of help from other families. Sample family B put in 51.1 man-hours with no outside help in the dry season, and 41.96 man-hours with no outside help in the rainy season. Because there is little difference in the input between families and between seasons, the output is similar when converted to FMG, the Malagasy currency⁹⁾, although a significant part of the harvest was not sold but consumed by the family themselves. Family A harvested the equivalent of 67,580 FMG in the dry season and 50,993 FMG in the rainy season; and family B 46,340 FMG in the dry season and 50,093 FMG in the rainy season. These figures will be examined later in comparison with seasonal fishing in remote areas.

Here, the productivity of different fishing methods are compared. Table 4 summarizes

Table 4 Comparison of productivity by fishing method, family and season

Methods	Family	Season	Sex	No. of trips ^{*1}	Productivity (FMG/man-hours)	
					Mean	SD
Gill net for driven fish	A	Dry	M, F	5	1,557	689
	A	Rainy	M, F	8	1,073	423
	B	Rainy	M, F	11	1,014	433
Seine net in lagoon	A	Rainy	M	5	1,158	1,145
Gill net fixed in tide pool	B	Rainy	M	5 ^{*2}	2,945	2,436
Line fishing in lagoon	B	Dry	M	6	739	387
Diving in lagoon	B	Dry	M	5	1,297	748
	B	Rainy	M	1	1,064	—
Gleaning on reef flat	A	Dry	F	5	323	193
	A	Rainy	F	1	150	—
	B	Dry	F	2	97	64
	B	Rainy	F	3	527	574

^{*1} For 7 days in the dry season and for 14 days in the rainy season

^{*2} In these cases, nets were fixed at night so I couldn't observe it. In the calculation of productivity, it was estimated to have taken 20 minutes, according to other observations, to fix nets.

productivity by fishing method, family and season. The most obvious result of the comparison is that the productivity of gleaning is lower than that of other activities. Statistically, differences in productivity among all the methods, families, and seasons were significant (Kruskal-Wallis's test. $\chi^2=25.60$, $df=11$, $p<0.01$), whereas there was no difference when gleaning was excluded ($\chi^2=9.01$, $df=7$). Thus, men restrict their activities to those of high productivity, while gleaning activities by women is less productive.

5. SHARK NETTING AT ANDRAMITAROKE ISLAND

Andramitaroke Island is located about 30 km off the mainland coast and 140 km north of Ampasilava. Ampasilava fishermen travel by sailing canoe from the village, and build tents using a canoe mast, spears and punting poles for the frame and a sail for the cover. According to the census I took on 18 and 19 October 1996, there were 135 people camping in 25 groups¹⁰, consisting of 106 males, 20 females, and 9 infants who were not part of the labor pool. Only one group was from the village on the opposite side of the strait, ten from the city of Morombe (85 km away), and the others from villages 20 to 70 km farther than Morombe. That is, with only one exception, the fishermen were outsiders from 85 to 155 km away, including Ampasilava.

Though it is difficult to say when shark netting began at Andramitaroke, it was apparently around 1990. Before that, at Ampasilava, sharks were caught only as a by-product of small nets¹¹ [cf. KOECHLIN 1975: 42]. In 1991, villagers made a large gill net specialized for sharks for the first time, having heard that the price of shark fins was very high. This first net was constructed from twisted nylon cords and secondhand fishing nets and this initial design was improved gradually through a process of trial and error. In 1993, a member of family A (2I in Figure 1) traveled to the Maintirano, 500 km north of Ampasilava, for shark netting. As they caught many sharks on that occasion, the villagers learned that netting was easier in the northern region than near their village and they subsequently concentrated their shark harvesting at Andramitaroke Island.

Life on Andramitaroke Island is, as Ampasilava fishermen say, less comfortable than in their home village for many reasons, two of which seem to be the most important: the many taboos¹² set by spirits¹³, and the unavailability of water. For these same reasons, the island has remained uninhabited. According to Ampasilava fishermen, the spirits selected a tamarind tree on the island to be dedicated to them, and the spirit mediums, who usually live in the village on the opposite side of the strait, organize ceremonies from time to time which are celebrated at the base of the tree. For this reason, the spirits are regarded as the owners or masters (*tompo*) of the island, and the violation of taboos is believed to make spirits angry, which could cause a disaster. For example, it is a taboo to play musical instruments and radios on the island, to urinate or to defecate near the tamarind tree, or to wash pots and pans on the beach. It used to be prohibited to stick a spear upright on the land, although it is allowed now that people have placated the spirits with gifts for this allowance. Most surprisingly, it is prohibited to surprise animals, especially rats which run about through the tents at night. The people, even those whose bodies become a playground for the rats, have to drive them away gently by hand. Killing them is out of the question. As a result, the population of rats is so great that people have to protect

their baggage.

The other problem, water unavailability, can be attributed to the fact that Andramitaroke is a coral island with no fresh water springs. For this reason, the fishermen have to fetch water for drinking and cooking from the mainland every several days. The trip takes half a day by sailing canoe and the water is carried in plastic containers of 50 to 100 liters. If the container should be nibbled at and damaged by rats, the fishermen are obliged to return to their villages earlier than planned. Fresh water is so valuable on the island that fishermen bathe in the sea, and leave their clothes unwashed. Firewood has to be brought from the mainland as well, although less frequently than water.

Fishermen sail out from their island once a day in order to check the gill nets that are suspended in waters of around 70 meters in depth. Sample family A, four of whose members (2B, 2C, 2I and 3A in Figure 1) were camping on the island in 1996, used a gill net of 5 meters in height, more than 180 meters in length, and with a mesh size of about 18 cm. Their targets included several species such as requiem sharks (*Carcharhinus* spp.; *akio foty* in the Vezo dialect), hammerhead sharks (*Sphyrna tudes*; *akio viko*), and guitarfish (*Rhynchobatus djiddensis*; *soroboà*). The meat of the sharks, except one cooked for the fishermen's own consumption, is cut into long blocks and salted for sale. However, the most valuable part is the fin, which is exported to Singapore or Hong Kong as a delicacy in Chinese cuisine. One large shark provides five fins that can be sold: a first dorsal fin, a pair of pectoral fins, an anal fin, and a tail fin.

Table 5 shows the quantity and the sales of shark fins harvested by the men of family A for two weeks during the research period. All the fins were classified into four groups according to size (the length between the tip and the middle of the joint) and then sold to a middleman in Morondava. The biggest (1st) fins, which were taken from only three sharks¹⁴⁾ and formed only 8% of the total number of fins, made up 53% in weight and 74% in price. Thus, a large shark is more valuable than a dozen small sharks.

Table 5 Shark fins harvested by family A for two weeks

Rank	Size	Number	Weight (kg)	Unit price (FMG/kg)	Price (FMG)
1 st	25cm –	8	4.28	225,000	963,000
2 nd	20–25 cm	8	1.37	150,000	205,500
3 rd	15–25 cm	46	1.95	60,000	117,000
4 th	– 15cm	37	0.50	30,000	15,000
Total	–	99	8.10	–	1,300,500

During the two weeks, family A made 10 trips for netting sharks, putting in 109.70 man-hours of labor. In addition, they made 11 trips for fishing with small gill nets (*drañòke* in Table 2) which were necessary in order to obtain the bait to attach to the shark nets, putting in 66.57 man-hours. As a result of both shark netting and small gill netting, the net return was equivalent to 1,932,638 FMG, only 4.9% of which was consumed by the family themselves. Even compared to this amount, the eight fins of the three large sharks formed 50% of the total value of the harvest.

6. SEA CUCUMBER HARVESTING AT MORONDAVA

The other seasonal camp used by the Ampasilava villagers is the city of Morondava, the capital of Morondava prefecture in the province of Toliara. The population of the urban center is estimated to be over 20,000. The distance from Ampasilava is 240 km. Here, Ampasilava villagers were engaged exclusively in sea cucumber harvesting. Because this city is connected to Antananarivo, the capital of Madagascar, many middlemen wanting to purchase sea cucumbers in bulk visit the city. Thus, for the fishermen of Ampasilava, Morondava provides both fishing grounds and market opportunities. The city is so large that it was difficult to determine how many fishermen were camping there during my research. However, fishermen from Ampasilava camped together and were clearly separated from other fishermen in 1996. They were 26 in number: a child and a woman, 18 men living in Ampasilava, 4 men born in Ampasilava but living in other villages, and 2 male in-laws of Ampasilava villagers but who were from other villages. They comprised 6 groups, each sharing food, canoes, tents, etc.

Although sea cucumbers are also collected on the reefs near Ampasilava, the quantity there is limited because of overexploitation, as is discussed later. In 1992, one year before the first attempt by family A to net sharks in Maintirano, some Ampasilava fishermen once again began intensive sea cucumber collection in remote areas. The men of family B, having heard that there were abundant sea cucumbers in Maintirano, succeeded in establishing a route to reach that area and were able to obtain many sea cucumbers with a diving mask and a spear. A few years later, the fishermen changed their campsite from Maintirano to Morondava and Andramitaroke Island, which are closer to their home village. Unlike Andramitaroke, there were already many fishermen living in Morondava [ASTUTI 1995a]. However, Morondava fishermen's diving skills were said to be limited, because the clear water necessary for diving was a considerable distance off the coast. Instead, they caught Spanish mackerel (a high-priced item of European cuisine served at restaurants) with a hook and line [ASTUTI 1995a: 27]. Thus, Ampasilava fishermen succeeded in finding an unoccupied niche for sea cucumber spearing.

Unlike Andramitaroke Island, drinking water is easy to obtain in Morondava, as is firewood, although the latter is usually purchased. There are no difficult taboos to observe, and shopping on the main street is attractive. Nevertheless, the lives of the fishermen are hard mainly because the fishing ground is 30 km from the coast, so the fishermen have to sail for at least 5 hours to get there and back. They get up around 4 a.m. and immediately, without having breakfast, set sail for the fishing ground. Because the breeze is gentle in the morning, it usually takes more than 3 hours to arrive, favorable winds permitting. When the seas are too calm or the winds unfavorable, they have to go back before reaching the fishing grounds (without any harvest) even if they have sailed for hours. If they do arrive at the fishing ground successfully, they return to their camp around 2 o'clock in the afternoon. They then preserve the sea cucumbers in salt, and go to town to have some doughnuts with tea or coffee, which is their first food of the day. It is after the sunset that they have their only substantial meal of the day. Salted sea cucumbers are boiled every 10 days or so, usually on a windy day when voyages to the fishing ground are impractical, and sold to middlemen living in Morondava or from Antananarivo. The bulk may then be relayed to other middlemen in Antananarivo or in Toamasina, the largest port in Madagascar, and exported to Singapore or Hong Kong.

Despite the difficulty of the commute, Ampasilava fishermen tolerate the camping life in order to obtain the valuable sea cucumbers. Species collected in Morondava include black teatfish (*Holothuria nobilis*; *zanga benono*), prickly redfish (*Thelenota ananas*; *zanga borosy*), and brown fish (*Actinopyga echinites*; *zanga rorohankena*) [cf. CONAND 1999]. In Ampasilava, they are not only rarely found but also so small that the price per piece is lower. For example, brown fish, about 12,000 FMG in unit price in both Ampasilava and Morondava, were 10 to 15 cm in length and sold for 150 to 400 FMG per piece in Ampasilava; most of them were more than 20 cm in length in Morondava and sold for 2,000 to 3,000 FMG per piece. Black teatfish, whose unit price differs according to the size, sold for 5,000 to 15,000 FMG/kg and 100 to 500 FMG per piece in Ampasilava, but 30,000 to 39,000 FMG/kg and 10,000 to 20,000 FMG per piece in Morondava. During the two weeks, four members of family B (2B, 2C, 2D and 3A in Figure 1) made 16 trips in two canoes to harvest sea cucumbers, putting 321 man-hours of labor into the enterprise. As a result, they obtained the equivalent of 1,315,060 FMG, only 0.91% of which were ichthyic fish consumed by the family themselves.

7. COMPOSITION OF THE FISHING ECONOMY

Fishing activities in remote areas, shark netting and sea cucumber spearing, bring in more cash than does regular fishing near the village. Table 6 compares the productivity between fishing in remote areas and fishing near the village. Near Ampasilava, labor input, fish catch and productivity do not vary greatly according to the family or to the season, as discussed earlier. Immediately evident are 1) the high levels of catch and productivity in remote areas¹⁵, although fishing at Andramitaroke Island includes small fixed gill net for bait, as well as shark netting, and 2) the high ratio of sales to the whole catch in remote areas. These two points illustrate the general characteristic of fishing in remote areas: it is a good opportunity to obtain a sizable sum of cash.

Table 6 Comparison of production for 2 weeks

Family	Fishing grounds	Season	Labor input (A) (man-hours)	No. of trips	Catch (B) (FMG)	Ratio of sales (%)	Productivity (B/A) (FMG/m-h)
A	Andramitaroke I.	Dry	176.27	21	1,932,638	95.1	10,964.08
	Ampasilava	Dry*	119.17	20	135,160	49.7	1,133.61
		Rainy	94.82	14	101,986	49.9	1,075.58
B	Morondava	Dry	321	16	1,315,060	99.1	4,096.76
	Ampasilava	Dry*	102.2	26	92,680	60.3	906.85
		Rainy	83.92	20	100,185	22.6	1,193.82

* In Ampasilava in the dry season, the data were collected only for 7 days for each family, so that the original figures were doubled in these rows.

When the total catch figures in Table 6 are compared to the values of family consumption of staples in Table 7, the difference between fishing near the village and one in remote areas is clear. Actual consumption for two weeks reached around 150,000 to 200,000 FMG in both

Table 7 Family consumption of staples for 2 weeks

Family	Actual consumption		Estimated minimum consumption ^{*2}
	Dry season ^{*1}	Rainy season	
A	231,300	169,310	108,889
B	187,060	147,200	126,583

^{*1} Calculated by doubling the data collected for 7 days.

^{*2} Calculated assuming that all the members take in necessary calories by eating only maize, the cheapest staple (700 FMG/kg, 3,600 Cal/kg). Adult males are assumed to consume 2,500 Cal/day, adult females 80% thereof, juveniles 70% thereof, and infants 40% thereof.

families, whereas the total catch near the Ampasilava village was lower, no more than 100,000 to 150,000 FMG. This value is almost the same as the estimated minimum consumption. Moreover, the actual daily expense becomes greater if they buy other daily necessities and luxuries, and the actual cash income is much less than the total catch. In general, regular fishing near the village cannot bring in enough catch for the whole family to live on.

On the other hand, the value of catches in remote areas reach well over ten times those near Ampasilava village: 1,932,638 FMG at Andramitaroke Island and 1,315,060 FMG at Morondava. These values are around eight times higher than the actual consumption of the same period. Thus, the large amounts of cash income from seasonal fishing in remote areas, although used to buy various kinds of luxuries as well, is indispensable to make up and sustain the fishing household economy and enable the household to purchase necessities through the year.

It is apparent then that the remote-area fishing is necessary for the economic survival of Ampasilava families. However, remote-area fishing began only after 1992. This brings up an interesting question: how could the fishermen make their livelihood before they exploited remote fishing opportunities? The fishermen's lives before that must have been based on different economic activities, and the following section discusses the pre-1992 Ampasilava economy.

8. THE DEVELOPMENT OF FISHING ACTIVITIES SINCE 1970

Before 1970, the Ampasilava people caught fish near the village, and bartered them for agricultural crops from inhabitants of the upper Mangoky River, approximately 200 km away from Ampasilava. It was not fresh but dried fish that was bartered. Nearby farmers were not good partners for barter, due to ecological reasons, because their production was much lower than that of remote-area farmers [TUCKER 2000].

However, the importance of barter to the Ampasilava economy gradually diminished as the cash economy became increasingly important during the 1970s. During this period, some fishermen began to buy fish from other fishermen in order to sell as much salted fish as possible to merchants in the cities. Such mobile retailing is still common 30 years later. Concurrently, new materials such as monofilament nylon nets were introduced, resulting in an increase of fishing productivity. Although the cause of these phenomena could not be identified from the interviews, one of the most important factors must have been development of inland transportation.

That is, road reconstruction between Morombe and Toliara, 250 km from Ampasilava, and the spread of truck usage among the Morombe merchants stimulated the demand for processed fish, and facilitated the introduction of new materials at the same time.

In inland cities farther than Toliara, demand has grown not only for fish but also for other sea products. Among them are various kinds of sea cucumbers¹⁶). According to a middleman who began to buy sea cucumbers in Ampasilava around 1979, sea cucumbers were so plentiful on the reef that fishermen could fill a seven-meter canoe with them in a day. At that time, they sold for 5 FMG per piece, which was as cheap as 25 g of cassava (the most popular staple in the regular diet), while they now sell for 50 to 250 FMG, the price of 200 to 1,000 g of cassava. As a result, the fishermen seem to have enjoyed the increased income. An ethnographic study by Koechlin [1975: 111–114] also supports this prosperity; It states that a family's harvest of sea cucumbers for one month amounted to 400 FMG, while the crop consumed for the same period cost less than 100 FMG.

Several kinds of shellfish such as horse conch (*Pleuroploca trapezium*; *bozike*) and branched murex (*Chicoreus ramosus*; *dronka*), whose tops (*fimpy*) are processed into incense and exported to India, became a commodity in this period, as did spiny lobsters (*Panulirus* spp.; *tsitsike*). As in the case of sea cucumbers, the price of spiny lobster was much lower than at present, but lobster were abundant on the reef near the village. They were consumed mainly by Europeans living in the nearby cities, or by visitors. The Ampasilava people used to sail for hours to sell lobsters, and returned to the village on the following day. In other words, such long trips were worth the effort given the monetary return.

Among the newly commercialized products is a kind of anchovy (*Stolephorus* or *Thryssa* according to Bauchot and Bianchi 1984) called *tove* in the Vezo dialect. I myself have not been able to identify this species yet, because it stopped migrating to the Ampasilava coast in 1995¹⁷). Though ignored before 1970, some fishermen say that in the 1970s and the 1980s, a school of *tove* filled the waters between the cities of Morombe and Toliara for 300 km along the coast from September to December. In that season, *tove* was said to have been so plentiful that it was impossible for the villagers to exhaust it with seine nets. Thus, this species was also an important source of cash income.

However, these resources experienced various degrees of degradation during the 1980s. For example, the abundance of sea cucumbers, especially large ones, decreased in shallow waters. This is apparently a typical symptom of resource degradation, and fishermen themselves recognize it, saying that sea cucumbers were "finished up" (*lany* or *fonga*), which are exactly the same words used to express when food or fuel in storage has been used up. As a result, the sea cucumber collection near the village now plays just a minor part in the Ampasilava economy. Lobsters and shellfish have apparently decreased in abundance as well, although quantitative data is lacking. *Tove*, an extreme case, seems to be extinct in these waters. A similar crisis seems to have occurred with larger fish. Fishermen themselves report that fish have become fewer in number, although quantitative data is lacking. If the fishermen's accounts are accurate, the resource degradation was possibly caused by increase in fishing pressure related to population growth¹⁸) and technological innovation.

As a result of this decline in resource stocks, coastal fisheries near the village began to diminish, and each fisherman had to individually seek cash income to supplement the fishing

harvest near the village: some lived on canoe craft, some lived on subsistence farming, some moved seasonally to the city where the market price of fish is high, and some occasionally visited isolated islands where resources were still abundant.

In summary, the Ampasilava fishing economy has experienced great changes since the 1970s. Initially the commercialization of marine products brought advantages to the fishermen, but was short-lived because of resource degradation, which may have been accelerated by population growth and technological innovation. Resources were not managed sustainably. Fishermen, however, solved this problem by seasonal migration to remote areas. Remote-area fishing afforded an opportunity to compensate for the diminishing local fishing household economy. This compensation was made possible only by the freedom of long-range mobility of the Ampasilava villagers.

9. TOWARDS SELF-DETERMINATION

Mobility is not an ideal solution to resource degradation, because it can cause further degradation in remote areas. When I visited Ampasilava in 1998, people were planning to go fishing grounds further away than Morondava, where, just as at Andramitaroke Island, large sea cucumbers were decreasing in abundance in shallow waters. This plan was abandoned and no one had yet done it prior to 2002, but the resource problem seems to be becoming increasingly severe. Moreover, the market economy continues to extend its influence and reduce the fishermen's independence. In 1996, according to an Ampasilava fisherman, a middleman apparently from the capital introduced a hookah, a device for pumping air to the diver by a compressor, and hired a fisherman to collect sea cucumbers with this device. This was in a mainland village between Andramitaroke Island and Morondava, but this type of device was also introduced at Andramitaroke Island in 2001. All the fishermen I met complained that the fishermen with a hookah harvested so efficiently that they would possibly wipe out the resource. Evidently national law should ban hookah use, but resource problems will be more and more accelerated nonetheless. So, what is the ideal solution?

The most preferable direction may be to take advantage of customary use of the sea. TURFs are truly vague among the Vezo, but they seem to have established an informal territoriality for technical and social reasons. Because fishermen usually travel to fishing grounds by paddling canoes, the usual fishing area barely extends beyond 3 km from the village. Sailing canoes would reach farther, but they are less maneuverable and thus less desirable for fishing inside the reef. As a result, fishermen from Ampasilava, about 5 km distant from the nearest village, rarely compete with fishermen from other villages. It is true that fishermen often sail to a distant village which is used as a base of fishing. However, in order to do so, the fishermen must request permission from the village assembly, or one of the fishermen must be a relative of a villager. This explains why Ampasilava fishermen selected Andramitaroke Island and Morondava, both very inconvenient places, for their campsites. That is, they avoided waters where other fishermen would compete with them¹⁹). In Morondava, although there are many fishermen, they are not used to diving into the sea, because, as noted previously, the clear water for diving is far off the coast. Andramitaroka is uninhabited because of its isolation and shortage of water and firewood. The Ampasilava fishermen's campsite selection implies an informal regulation of territorial

control, which can be favorably applied to resource management. Thus, national legislation to authorize this customary law might pave the way for community-based resource management.

However, if the customary law is to be authorized as a community-based institution for resource management, it has to be instituted in a formal way. At minimum, rigid boundaries of management areas and the groups of users must be defined. This implementation, to a certain degree, means the exclusion of outsider fishermen suffering from resource depletion in their home villages, or the limitation of fishermen's freedom to migrate to other areas, which has hitherto been an option. Mobility and migration have been important strategies since long before the 1990s. According to my interviews with village elders, Ampasilava was formed, supposedly around the 1920s, by inland farmers, neighboring coastal villagers, and seasonal migrants from a coastal city of Ambohibe (Map 1). Migration has thus always been a coping strategy so I do not think the dilemma of overfishing should be met by narrowing the fishermen's mobility. Instead, it appears to me that it should be left up to the fishermen themselves to develop a solution.

Thus there is a collective-action problem [RUNGE 1992]. Vezo societies, having lacked politically powerful agents or institutions, seem to have difficulties negotiating such complicated decisions. However, various kinds of decisions will be more and more important for Vezo fishermen in the present rapidly changing circumstances. Decisions on boundaries and mobility are no more than a beginning. Once they decide to establish boundaries and settlement rights, they will have to continue to make further decisions in order to carry out community-based management. Their decisions will relate to questions such as when to close the fishing grounds, what kinds of fishing gear should be prohibited, and what large fish take should be permitted. Even if they intentionally decide to respect freedom of mobility, or if they avoid the initial decision, it does not mean that they will continue to live in the same manner as before. They are becoming so involved in national and global economies that they will have to learn how to deal with unprecedented interdependence on other societies within Madagascar and the rest of the world, and unprecedented internal population growth. They will have to make their own choices, collectively or individually. In any case, they will have to make a series of decisions on how to keep or shift relations with external economies. Otherwise, they will lose their independence and control over their own lifeway.

The most desirable initial step should be the establishment of a new decision-making institution which would act as a preventative measure against negative future changes. However, in some cases reported in the study of common property, too rapid establishment of institutions prevents local people from autonomous decision-making. For example, it was reported that in a natural resource co-management project in Botswana, where the local people were expected to share the decision-making rights as members of various institutions, encouraging the people's voluntary participation met with failure. As a result, this project is planner-centered, and the people have played no decisive role [TWYMAN 2000].

To return to the Vezo case, I propose here a preparatory step for a new institution, rather than a rapid step; that is, to institute open village- or regional-level public meetings for fishermen to learn about and discuss their own situations. It is true that the Vezo do learn and discuss their own situations in their daily lives. They discuss their business opportunities, education, poverty,

and so on. However, most of their informants, or people whom they converse with, are also local fishermen, who have so little information on a wider social or economic context that their perspectives are inevitably restrictive. For example, most of the fishermen I met had difficulty understanding the relationship between oversupply and drop in price. If they are more conscious of this principle, it will be easier for them to take collective action, or establish an institution, in order to control the supply of products. Elsewhere, fishermen may individually try to improve the quality of products rather than increase the harvest. In other words, the sharing of information with a wider society broadens their options in ways to adapt to a wider society. These options include, of course, the establishment of an institution for resource management [KOTTAK and ALBERTO 1993].

There will be many problems concerning the establishment and maintenance of village and regional public meetings, but they can be solved through trial and error. The organizer can be a third party rather than fishermen. The topics should be something familiar to the fishermen, such as long term resource degradation, the use of hookah, recreational use of the sea surface by outsiders, fishing in other provinces or countries, and economies in other provinces or countries. This should allow fishermen to understand their situation, and enable informal decisions and actions to be undertaken. *Another advantage of this meeting format is that it can be carried out with flexible membership.* This point is important for such a high-mobility society as the Vezo villages, which can be defined only ambiguously. Moreover, such meetings could offer an opportunity for outsiders as well to learn and to discuss matters with the fishermen, thus enabling development planners to obtain useful local information. However, we have to keep in mind that the meetings cannot be expected to operate in the context of imposed-format functioning agencies, even for resource management. Unless these meetings are given meaning and purpose by the fishermen themselves, they will become nothing other than an agent of outsiders.

10. CONCLUSIONS

In the first part of this article, I stressed the fishermen's great dependence on the international economy. In the second part, after describing the resource degradation they confront, I underlined the significance of their traditional migratory forays as a way to successfully adapt to international economic realities. However, their traditional solution is contrary to the idea of community-based resource management as an appropriate solution. I thus proposed that fishermen at the local and the regional levels meet to learn and discuss their own situations. This will be not only a probable first step to an appropriate solution, but also undoubtedly an ideal opportunity to acquire materials necessary for decisions and actions, collective or individual.

This paper began with resource management and is ending with community empowerment. These topics may seem to have little in common, but I believe they are intertwined: both concern sustaining fishermen's livelihood and independence. Commercialization in the 1970s brought in many positive options for fishermen's livelihood, but it has had a negative impact on resources through technological innovation and population growth. The recovery of fishermen's independence will be achieved through resource management, but this alone may not be sufficient. We must remember that fisheries are exposed to both environmental and economic uncertainties

[ACHESON 1981]. While environmental risks became evident through fishermen's gradual involvement in national and global economies, so will the economic risk in the longer term, because the fishermen are, to a certain degree, "at the end of a long and expensive supply line—not only for manufactured goods, but also, today, for much of their food," as Johannes [1978] has stated about Oceania. In order to maximize the fishermen's independence and self-sufficiency, we have to keep in mind conserving the diversity of local people's choice, as well as local biodiversity.

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NOTES

- 1) Households with a widow, a single mother, or a divorced woman are exceptions. Vezo women who have children but no husband often live with their parents, so that their households include three generations. Another exception is the household of 2B of family A shown in Figure 1. 2L, who is 2B's unmarried brother, and 3I, who is 2B's unmarried sister's son, should naturally belong to the household of 1A. To adopt them, 2B had to beg their ancestors, offering a sacrifice [*soro anake*, literally "a sacrifice for a child"; see KOECHLIN 1975: 133; ASTUTI 1995a: 92].
- 2) In the same way, there is a frequent transfer of goods and services within the CH, rather than between CHs. For example, old clothes are easily passed on to members of the same CH; money is transferred with expectations of very long-term return; and so on. Most conspicuously, in several CHs, all the men have meals together, each bringing food cooked in their respective households. Thus, the CH can be regarded as a residential sector where generalized reciprocity is dominant [SAHLINS 1972: 193], though it differs in degree among different CHs.
- 3) In most cases, this young person is male, making the Vezo residence virilocal, though this virilocal tendency is not so rigid as to be called a rule.
- 4) Here, an adult is defined as a married person as of 1998, in accordance with Table 3.
- 5) This difference is statistically significant only in the rainy season (Mann-Whitney's *U*-test. $U=303.5$, $n_1=40$, $n_2=39$, $z=-4.67$, $p<0.001$). However, if fishing hours were compared between both sexes, there would be significant difference even in the dry season.
- 6) In particular, seasonal difference in women's fishing activities is statistically significant (Mann-Whitney's *U*-test. $U=267.5$, $n_1=25$, $n_2=39$, $z=-3.03$, $p<0.005$).

- 7) As indicated in the methods section, the quantitative research period was 7 days for each family in the dry season, and 14 days for each family during the rainy season. To make the comparison easier, labor input and the yield are standardized into values for two weeks.
- 8) All of this labor was provided by agnates of family A, living in other villages, with the exception of one case.
- 9) FMG, the Malagasy currency, stands for *Franc Malgache*. In 1996, 10,000 FMG was equivalent to about US \$2.10.
- 10) A group was defined here as a unit of sharing cooked food. Although the author was not included in the visitors, the author's two guides from the Morombe, who bought sea cucumbers from the fishermen, were included.
- 11) During the last period of fieldwork in 2003, I was informed that, before factory-made hooks were introduced, fishermen used to hammer iron into large hooks for sharks.
- 12) In Madagascar, the word taboo (*fady* in standard Malagasy, or *faly* in the Vezo dialect) has various meanings such as food avoided for folk-genetic reasons, relatives of the opposite sex with whom sexual relations are avoided, deviation from the norm, and mere impoliteness [RUUD 1960].
- 13) This spirit is called *tromba* in standard Malagasy, or *doany* in the Morombe Vezo dialect. When people have problems supposedly due to a supernatural reason, they ask mediums to call a spirit and implore him or her [ESTRADE 1985; SHARP 1993].
- 14) The three sharks were estimated to weigh 163 kg, 84 kg, and 38 kg.
- 15) The difference in productivity would have been significant only if the catch in each trip had been calculated and analyzed statistically. This was not done because the shark fins had become mixed up with each another, making it difficult to tell that a particular fin had been caught in a particular trip.
- 16) Sea cucumber collection by the Vezo was reported in the beginning of 20th century for the first time [GRANDIDIER et GRANDIDIER 1908: 377; BARBIER 1908: 41]. These reports seem to be based on observations near Toliara, while Koechlin's report [KOECHLIN 1975: 43, 57, 114] describes the situation in which sea cucumber collection had just been introduced in Morombe region.
- 17) During the last fieldwork in 2003, I found dried *tove* which had been caught in December, 2002. It is probable that the resource stock is recovering. Identification was difficult because of transformation, although it seemed to be a *Stolephorus*.
- 18) The population growth rate for the whole of Madagascar from 1980 to 1996 is estimated to be 2.8% per annum [THOMPSON 2000]. The rate in Vezo fishing villages would be much higher.
- 19) One factor contributing to this avoidance is fear of sorcery. Fishermen who became sick in remote areas, after having returned home for treatment, are often diagnosed as being the victims of sorcery.

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