Original Article

Improved accessibility and changing dynamics of small-scale fisheries and aquaculture activities in southwest Madagascar

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Abstract

Small-scale fishing and aquaculture activities in the village of Andrevo in southwest (SW) Madagascar was investigated to assess changing dynamics during a period of improved road infrastructure and accessibility. Socio-economic surveys and fisheries monitoring were undertaken using a simple random sampling strategy. Stakeholders involved in the small-scale fisheries and aquaculture sectors were sampled. The main types of fishing gear were hook-and-line (including longline), harpoon, speargun, gill nets, bottom seine nets, mosquito and shark nets (called ZZ or *Jarifa*). Subsectors of the fishery were boat fishers (74 %), foot fishers (18 %), and combined (8 %). On average, 236 boats fish on a daily basis, with an overall catch rate (all gears combined) of 7.5 kg/trip/gear and total catch of approx. 47 tonnes/month. Mariculture of seaweed and sea cucumber farming constitute alternative income-generating activities. The production of dry seaweed varied from 9-70 tonnes/year, and sea cucumber production depended on the number of juveniles delivered. An ecosystem-based approach to managing fisheries and aquaculture at Andrevo is recommended, using locally-based measures such as co-management and marine protected areas (MPAs). The dynamics of the small-scale fishery and aquaculture activities are also discussed in this paper in relation to improved road infrastructure and accessibility in SW Madagascar.

Keywords: southwest Madagascar, small-scale fisheries, fishing gear, mariculture of seaweed, sea cucumber aquaculture

Introduction

Madagascar is the fourth largest island in the world with a coastline of about 5000 km and an Exclusive Economic Zone (EEZ) of approximately 1,140,000 km^2 (Rabenevanana *et al*., 1990). Madagascar relies heavily on its coastal resources for food security, trade and tourism (Le Manach *et al*., 2012; Cooke, 2003; Gabrié *et al*., 2000). The fisheries sector plays an important role in the economy as an income generating activity and a source of animal protein for coastal communities (FAO, 2016; Le Manach *et al*. 2012; Donner and Potere, 2007; Newton *et al*. 2007).

Madagascar's shelf is broadest along the west coast where it borders on the Mozambique Channel. In southwest (SW) Madagascar near Toliara city, the seascape includes coral reefs (Grand Récif and Ifaty/Ranobe Reef; Thibaud, 2012) and mangroves, making it rich in marine fauna and flora, and attractive to fishers (Rejela, 1993). Fishing is a fundamental activity in SW Madagascar, known for its traditional or "small-scale" fishing practices (Noniarilala, 2010; Bemiasa, 2009). The expansion of aquaculture activities on sea cucumbers (holothuriculture) and seaweed (algoculture) in SW Madagascar provides alternatives

to fishing and an additional income stream (Todinanahary *et al*., 2017). Together, these activities generate direct and indirect employment opportunities while contributing a substantial proportion of animal protein to the diets of coastal communities (Rakotonaivo, 2012; Mills et *al*., 2011; Belle et *al*., 2009).

The transportation of fishery products to markets has been a challenge in SW Madagascar, because of inadequate preservation and transportation methods, and poorly maintained access roads. The Road Infrastructure Development Project (PAIR) on National Road 9 (RN9) has improved road access to SW Madagascar thereby promoting trade and regional development (FAD, 2013). A key aspect of the present study was to understand how the improved road infrastructure in SW Madagascar has affected fishing and aquaculture activities in coastal communities. The operational aspects of these activities are an important component of developing sustainable management practices in a shared seascape in SW Madagascar.

In light of the contextual background, a study was undertaken to examine the dynamics of fisheries and describe the development of aquaculture activities in SW Madagascar, with a focus on Andrevo village. Specific aims were to: (1) undertake a socio-economic survey to identify stakeholders in the fishing and aquaculture sectors; (2) evaluate the small-scale fishery, focusing on gears used, fishing effort, catch composition and domestic markets; and (3) review the recent development of the aquaculture industry. Trends in the small-scale fishery and aquaculture activities are discussed in relation to improved road infrastructure and accessibility in SW Madagascar.

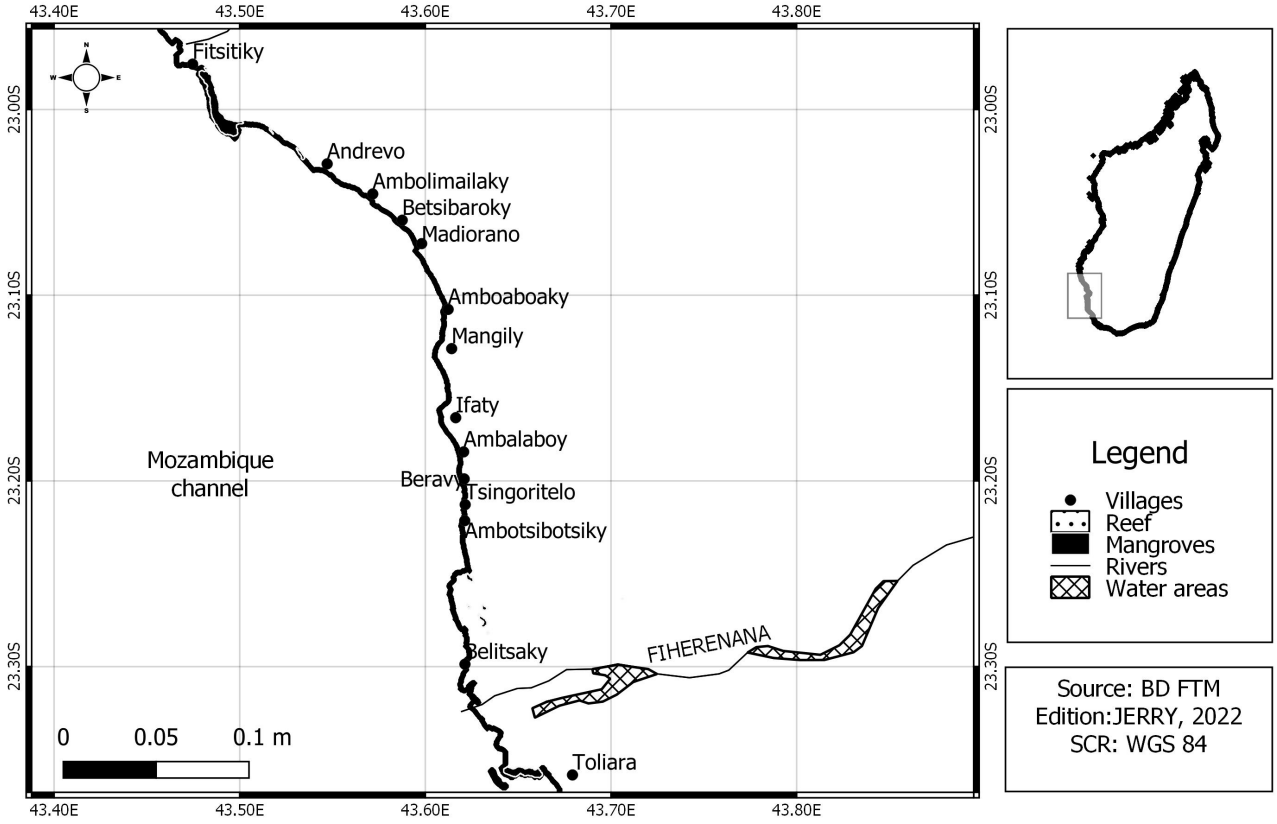

Figure 1. Location of the village of Andrevo, Madagascar.

Material and methods

Study area

SW Madagascar has a dry climate with high reliance on fishing (McClanahan *et al.*, 2014). Thirteen fishing villages surround Ranobe Bay: Belitsaky, Ambotsibotsiky, Tsingoritelo, Beravy, Ambalaboy, Ifaty, Mangily, Amboaboaky, Madiorano, Betsibaroky, Ambolomailaky, Andrevo and Fitsitiky (Belle *et al*., 2009; Davies *et al*., 2009) (Fig.1). These villages supply Toliara city and other inland markets with marine fisheries products. Andrevo village was chosen for this study because of its importance as a small-scale fishing village that supplies Toliara with

fish products, the geographical representativeness of the area, the existence of aquaculture activities that generate income for the coastal population, and ease of access.

The Vezo ethnic group is predominant among fishing communities (Laroche *et al*., 1997) in Ranobe Bay. Vezo ethnicity relates to performing maritime activities rather than to ancestry or place of origin (Astuti, 1995). The Vezo practice traditional fishing or 'small-scale fishing' (Lemahieu *et al*., 2018; McClanahan *et al*., 2014), mainly in Ranobe Bay, using fishing gear such as hook-and-line, gill- and beach seine nets and spear guns (McClanahan *et al*., 2014).

Fieldwork and data analysis

Field work took place between 28 October and 20 December 2017 and was divided into (1) a socio-economic survey and (2) a fisheries survey to obtain information on fishing methods, effort and catches.

Socio-economic survey

Semi-structured interviews were carried out in fishermen households to generate qualitative and quantitative insights into the Vezo lifestyle (Fauroux, 2002). Samplers were first introduced to the Chef de Fokontany (village head) to explain the purpose of the research and ask for guidance and suitable survey respondents, before conducting surveys. Each interview took place in a location chosen by the informant and was carried out in the Vezo dialect (Garth and Charlie, 2016; Huguenin and Richard, 2014; Barnes-Mauthe *et al*., 2013).

For the socio-economic data, the quantitative values (e.g., age of the fishers) were grouped into classes, to facilitate the statistical representation of the data, whereby class intervals were calculated according to the Sturge formula: Number of classes = 1 + (3.3 log n) where log n represents the logarithm to the base 10 and n represents the number of people in the sample. The number of classes is rounded up (Sturges, 1926). Dividing the range of variation in weight (the difference between the largest and smallest value of weight) by the number of classes found gives an order of magnitude of the class range:

$$\textbf{Class interval} = \frac{\textit{Maxim value - minimal value}}{\textit{number of classes}}$$

The data was processed and analysed in Excel.

Fisheries survey

Two main types of fishing strategy were sampled: (1) foot fishing using bare-handed collection and bottom seining as fishing techniques, with boats used only for transporting fishing products; and (2) boat fishing, in which fishing boats are used for fishing, including for transport of products. Fishing effort was expressed as the number of boats going to sea on a particular day (for boat fishing with gillnets, mosquito nets, spear guns, lines and harpoons) or as the number of foot fishers active per day or undertaking bottom seine fishing. The location of fishing sites was obtained from the fishermen and cross-checked against geographical coordinates using a GPS.

The average fishing effort per trip was calculated by dividing the total number of boat trips (or number of foot fishers) over the 30 days of monitoring. The calculation involved dividing the given value by the number of trips per day, considering the total days of monitoring. The average duration of fishing trip per fishing gear was also recorded to calculate the Catch Per Unit Effort (CPUE) (Lee *et al*., 2010).

CPUE (catch/effort) for boat fishers was expressed as kg/boat/trip for each gear, and for foot fishers it was expressed as kg/fisherman/trip. Data were available for total catch, the number of fishing boat and fishermen on board, and the average duration of a trip.

Results

Socio-economic characteristics

The village of Andrevo has 275 households composed of 1280 inhabitants (4.7 persons/household) of which 82 % (861 inhabitants) of the active population (1050 inhabitants) belong to fisher households. Of these, 180 fishers belonging to 151 registered households (54.9 %) were surveyed representing 14.02 % of the fisher population.

Most of the surveyed fishers were Vezo (91.7 %), nomadic fishers native to SW Madagascar, with small proportions of Masikoro (6.1 %), Antandroy (1.7 %), Mahafaly (0.6 %) and Bara (0.47 %). Others were traditional farmers and migrants to the coastal area (Table 1).

Most fishers were 24 to 38 years old (39.4 %), with 20 % of fishers aged 31-38 yrs and 19.4 % aged 21-31 yrs (Table 1). Children learn to fish from the age of 7 yrs, by following their parents, or by using discarded pieces of fishing gear in sea grass areas. The population of SW Madagascar is increasingly oriented towards fishing.

Table 1. Descriptive statistics of socio-economic data.

Age		Level of study			Ethnic group				Fishery											Secondary activity						
									BF				FF		BF/FF											
Class	Percentage	I	P	C	V	M	An	Ma	G	L	S	H	D	H	G	L	S	H	D	None	A	F	Ho	Co	B	Bm
[10;17[	2,22	0	3	1	4	0	0	0	2	0	1	0	0	0	1	0	0	0	0	4	0	0	0	0	0	0
[17;24[	16,11	1	22	6	29	0	0	0	14	9	0	4	0	1	1	0	0	0	0	25	1	0	0	0	2	1
[24;31[	19,44	3	26	6	32	0	2	1	21	7	1	2	0	3	0	0	0	1	0	23	0	1	5	1	4	1
[31;38[	20	1	33	1	34	1	0	0	19	0	0	2	1	13	0	0	0	0	0	30	3	0	0	0	1	1
[38;45[	15	9	17	1	22	5	0	0	14	0	0	1	5	7	0	0	0	0	0	20	1	2	0	0	2	2
[45;52[	14,44	6	19	2	24	2	1	0	16	2	0	1	2	6	0	0	0	0	0	19	4	0	2	0	2	0
[52;59[	7,78	11	2	1	12	2	0	0	7	2	0	2	1	2	0	0	0	0	0	11	2	1	0	0	0	0
[59;66[	3,89	5	1	1	6	1	0	0	5	0	0	0	1	1	0	0	0	0	0	4	2	0	0	0	1	0
[66;73[	1,11	2	0	0	2	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
Total	99,99	38	123	19	165	11	3	1	99	21	2	12	10	33	2	0	0	1	0	138	13	4	7	1	12	5
Percentage		21,1	68,3	10,6	91,7	6,1	1,7	0,6	55,0	11,7	1,1	6,7	5,6	18,3	1,1	0,0	0,0	0,6	0,0		7,2	2,2	3,9	0,6	6,7	2,8
	100		100,0			100,0							100,0							76,7			23,3			
																							100,0			

A: Algaculture
An: Antandroy
B: Breeding
BF: on Boat Fishing
Bm: Boat manufacturing
C: College
Co: Commerce
D: Draoto (small mesh net)
F: Farming
FF: on Foot Fishing
G: Gilnet
H: Harpoon
Ho: Holothuriaculture
I: Illiterate
L: Line (Handline)
M: Masikoro
Ma: Mahafaly
P: Primary
S: Speargun
V: Vezo

The education level of fishers in Andrevo was low, with only 10.6 % having reached secondary school, 68.3 % not exceeding primary school and 21.1 % illiterate (Table 1). There was no secondary school in the village, insufficient funding and a lack of awareness of the importance of school education.

Among the fishers surveyed, 76.7 % had no other activities apart from fishing (Table 1). Some 23.3 % of fishers had more than one occupation, although fishing remained the main activity. Agriculture is practiced by 6.7 % of fishers during the rainy seasons (Table 1). Other secondary occupations include 'dockers' that offload fishing boats, boat-building, trade, sea cucumber and algae farming.

Small-scale fisheries

Fishing at Andrevo covers a large area and different sites are visited depending on season, weather, means of transport, fishing gear and species targeted. Of 32 potential fishing sites, six were visited most frequently due to their proximity to town. However, regardless of the distance to the site, fishing duration lasted between 4 and 6 hrs.

As in other fishing villages in SW Madagascar, the fishers at Andrevo use a pirogue with outrigger. This traditional fishing boat is made from *Givotia madagascariensis* wood, locally called farafatsy. Propulsion is through a rectangular sail of variable size (1.75 m long for large *Lay be* and 1.0 m for small *Ana-day*).

Of 180 fishermen surveyed, 133 (74 %) were boat fishers, 33 (18 %) were foot fishers, and 14 (8 %) participated in both boat and foot fishing. Eight fishing gears were identified: handline, harpoon, gill net, speargun, bottom seine, mosquito net, shark net (ZZ or *Jarifa*) and longline, of which the first six were the most used (Ramahatratra, 2014) (Table 2). Most of the fishing gears were self-made and assembled with materials bought in Toliara (e.g., nylon thread or wood paste). Gill nets (46 %) were the most used gear in Andrevo; they are efficient, easy to use and cheaper than shark nets or fish guns (Fig. 2) Bottom-set seine nets or 'draoto' (3 %) were only used by the Masikoro ethnic group, mainly farmers who moved to the coast for fishing (Table 2).

Table 2. Description of fishing gear and percentage usage.

Gear	Construction and use	Percentage of use (%)	Illustration
Gillnet	- made of nylon thread, - 100 m length or even more and 4 m wide in general but also vary according to the requirements of the fishermen, -catch fish.	46	
Harpoon	- a kind of spear whose pointed head may or may not have one or more hooks, - length of the wooden stick depends on fisher's preference and use, - catch octopus, fish, lobsters, shrimp, sea cucumbers, bivalves, and sea urchins on the reef shelf and even offshore underwater.	29	
Longline	- made from a 5 m long nylon or Talirano line, - a rectangular wood 14 cm long, 5 cm thick and 8 cm wide serves as a support for the line on which it is wound, - A hook for the squid line and a hook for the fish line are attached to the end of the line.	16	
Bottom seine or 'Draoto'	- similar to beach seine but small in size and does not have a pocket, - 100 m long and 75 cm wide, with a 400 m rope on both ends.	3	
Mosquito net	- a very small mesh net, (2 mm) known locally as *Makarakara,* - 100 m length and as wide according to the prefence of the fishermen, with a large bag 4 m long and two wings at each side of the net, - catch small pelagics such as *Spratelloides delicatulus* (*Varilava*), *Stolephorus indicus* (*Tove*) and *Herklotsichtys quadrimaculatus* (*Geba*) (seasonal use).	3	
Speargun	- consists of a carved wooden handle on which a nail blocks the arrow, - catch fish.	1	
ZZ net and *Jarifa*	- made with a thick rope of about 6 mm, - larger mesh nets measuring 8 to 10 fingers (*nendry*), can be up to 200 m long and 7 m high, - catch shark, sea turtle and fish.	2	

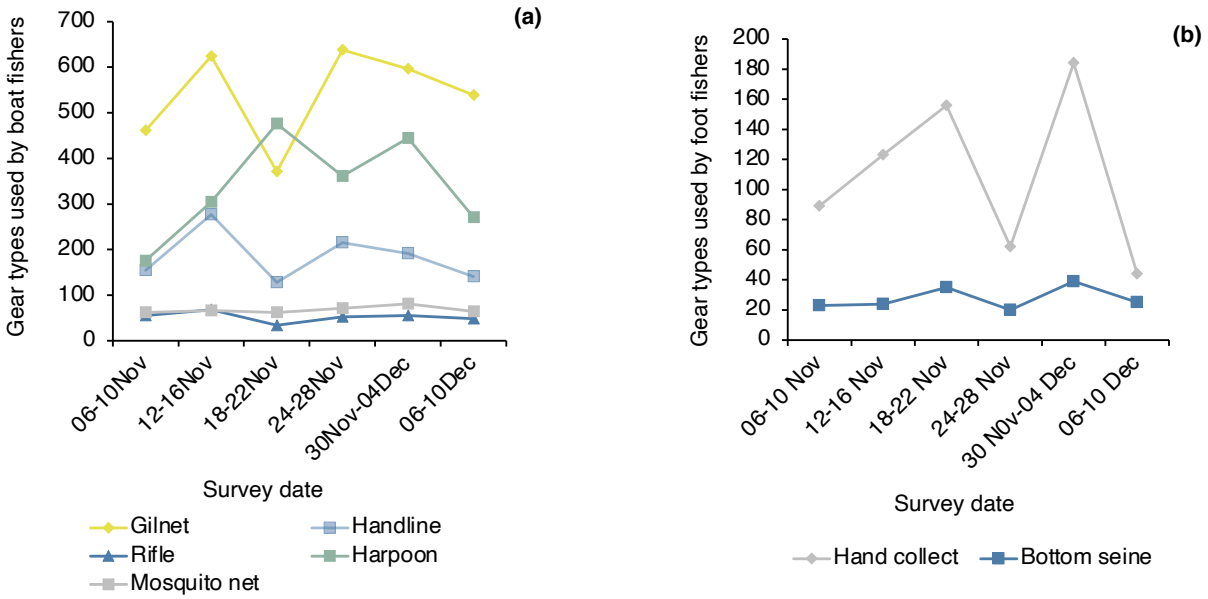

Figure 2. Weekly trends in gear types used by (a) boat fishers and (b) foot fishers in Andrevo over the sampling period

The average catch was 7.5 kg/trip ranging from 2.3 to 15.9 kg/trip (all gears combined) (Fig. 3). Daily catches varied by gear as follows: 11.2 kg/boat for gillnets, 4.8 kg/boat for mosquito nets, 3.3 kg/boat for harpoons, 1.9 kg/boat for lines, and 1.1 kg/boat for spear guns. Bottom seines (13.3 kg/trip) and foot fishing (16.9 kg/trip) were the most productive in terms of quantity.

Overall, catches comprised of 50 species belonging to 35 families (Fig. 4), including fish (50.5 %), edible shellfish (18.2 %), holothurians (19.3 %), cephalopods (7.5 %), sea urchins (2.3 %) and crustaceans (2.1 %). The composition of catches from boat fishing was dominated by Gerreidae (15.7 %), Carangidae (14.5 %) and Sphyraenidae (11.4 %). Catches by foot fishers included Holothuridae (32.2 %) and Arcidae (29.9 %), and for bottom seining Labridae (23.3 %) was most common (Fig. 4).

Based on the average number of fishing days per month over the course of a year (est. 26.5 days) the monthly and annual production of Andrevo village was estimated. The average daily catch (7.5 kg/trip all

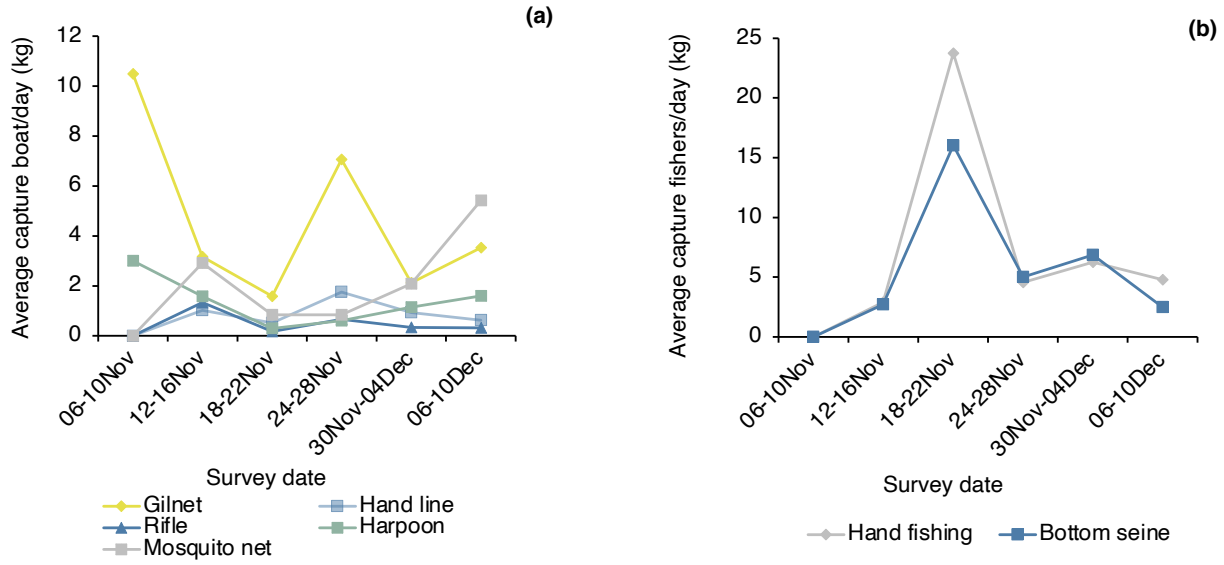

Figure 3. Weekly variation in catch per trip by fishing type, (a) boat fishers and (b) foot fishers

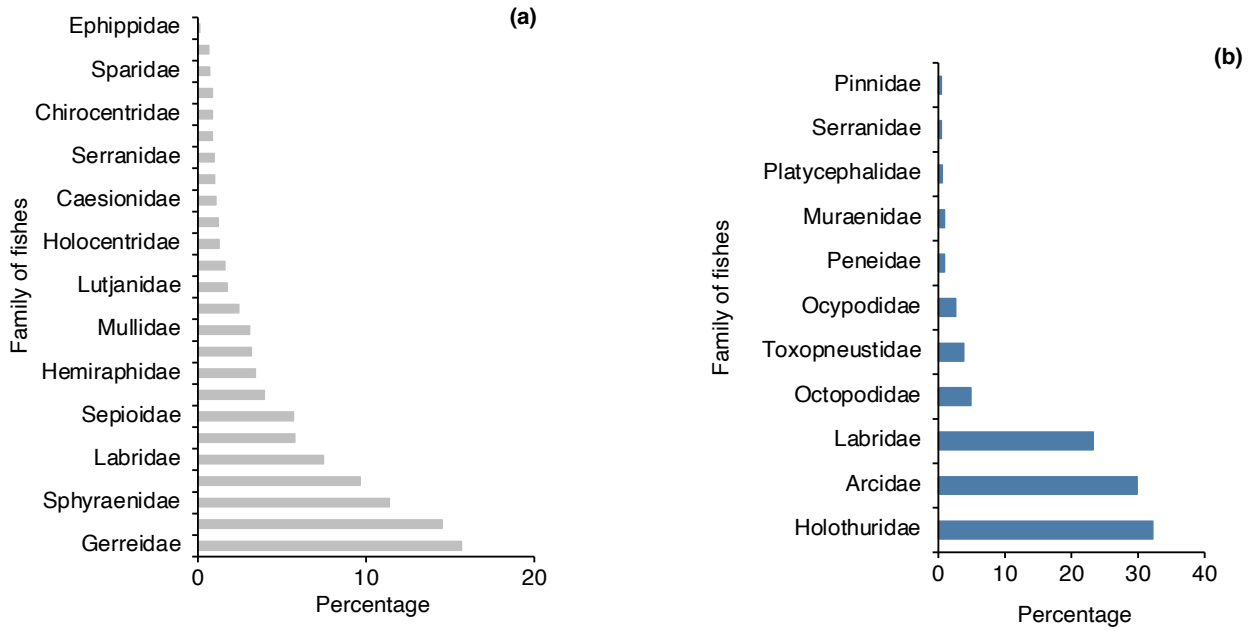

Figure 4. Main families caught by (a) boat fishers and (b) foot fishers.

gears combined) was multiplied by the average fishing effort (236.3 boats/day). The monthly production of Andrevo (i.e., 7.5 kg x 236.3 boats x 26.5 days) was estimated as 46.9 tonnes and the annual production was estimated at 563.6 tonnes. Most of the catch was sold, and the remainder consumed as food.

Discussion

Trends in small-scale fisheries

Le Manach *et al*. (2012) and Davies *et al*. (2009) reported that small scale fisheries were fundamentally important in SW Madagascar, where agriculture is largely unviable because of the dry climate. During this study, 180 fishers were surveyed, 91 % of whom were Vezo, similar to the findings of Davies (2009) and Astuti (1995). The west coast of Madagascar is home to most of the country's fishers, and therefore experiences the highest fishing pressure (Laroche *et al.*, 1997; Guidicelli *et al*., 1984; Lamahieu *et al.*, 2018), while the eastern part of the island has the highest overall human population density (Le Manach *et al*., 2012). The demographics in the coastal area of SW Madagascar have changed dramatically over the last twenty years, following migrations to the coast and an increase in both fishing villages and the number of fishers (ECN, 2012). The fishing community now comprises of several ethnic groups (Table 1).

Eight fishing gears were identified from this survey, similar to the findings of Ramahatratra, (2014) and Razanoelisoa (2008) except for the addition of bottom seines, a newly introduced technique in Andrevo, used by immigrant fishers. This shows an evolution in the use of fishing gear, when confronted with scarcity of resources and increasing demand. Several fishing areas were frequented by fishers suggesting rotation among areas when catch rates decline (Natale *et al.*, 2015; Johnson *et al*., 2017).

There is some evidence for local depletion caused by overfishing. Species that were initially discarded have now become target species, including various shellfish, sharks, moray eels and gametes of the sea urchin *Tripneustes gratilla*. According to fishers, popular species such as *Atherinomorus* and *Sphyraena* have become rare or absent from catches. Octopus were initially dried and sold in the highlands (Fianarantsoa and Antananarivo) but the advent of international markets (e.g., Mauritius, Reunion, EU) have increased the demand for octopus. Overall, high unemployment and a lack of alternative employment in SW Madagascar have resulted in increased fishing effort and the trade in marine products, with fishing becoming a remedy for unemployment, rather than a traditional occupation.

Six buyers (fishmongers) monopolise the purchase of fish in Andrevo. Each has their own clients (fishermen) with prices negotiated according to abundance of products. Fishmongers re-sell to retailers (Fig. 5) who transport catches to markets, mainly at Ankilimaliniky, Ankililoaky, Ambolomailaky and Toliara. No sorting by species or quality takes place. There are no door-to-door sales, even when catches are high. A similar system is used to supply hotels and restaurants,

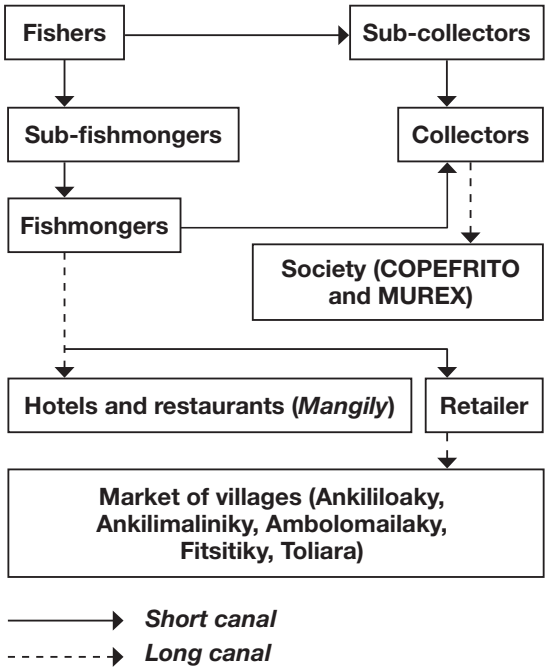

Figure 5. Market chain for fishery products.

with each fishmonger supplying their own clients. The sale is done fresh and the prices vary according to fish abundance and size. Ice is used to preserve fresh fish during transport, which is now more consistent and faster because of improved road infrastructure.

Prior to asphalting the main access road (RN9), Andrevo was less accessible and a larger proportion of fish catches were consumed locally. The remainder were processed in smoked, salted or dried form for sale in the interior, at Ankililoaky, Ankilimaliniky, Fitsitiky or even Toliara. After the asphalting of the RN9, the fresh fish products are distributed, with wholesalers and sub-collectors using ice to maintain the fish quality. Two groups of species are highly targeted by Andrevo fishermen: fish and cephalopods. The dominance of Murex and COPEFRITO in the octopus market, the primary octopus distributors in the SW Madagascar, plays a significant role in the income of this sector (Raberinary, 2015). It provides a stable environment, ensuring a consistent supply and potentially reducing market volatility. However, it may lead to limited competition, fixed prices at lower levels and reduced choices for consumers.

Development of coastal aquaculture – seaweed farming

Seaweed farming (algaculture) through wild seaweed collection cultivation in SW Madagascar creates opportunities for diversification, employment and increased income (Chaboud, 2006). The cultivation of red algae *Eucheuma striatum* began in 1991 in Madagascar, initiated by the Institut Halieutique et des Sciences Marines (IH SM) in Toliara, in association with the Biomad company.

Seaweed farming in Andrevo was initiated in 2012 by *Projet d'Appui aux Communautés des Pêcheurs de Toliara* (PACPT). By 2017, there were 116 (89 active) seaweed farmers organized into groups of villagers and fishermen. Specialized technicians trained by Ocean Farmers Society supervise farming activities. Farmers are contractors of the Society to whom they sell their harvests. The Society provides the infrastructure and buys materials.

A fixed elevation system is used for seaweed farming, with ropes or nets stretched by stakes or rock blocks. The system can be adapted to available space and depth as follows:

- "long line": 30 to 40 m long rope, immersed in water between 1 and 1.2 m deep.
- "mini long line": rope of 10 to 20 m in length and a water depth of less than 1.2 m;
- "off bottom": 2 to 5 m long rope in shallow water between 0.5 and 1 m

The system is cost-effective, easy to maintain and insensitive to surface weather conditions as the seaweed remains submerged, even at low tide. Cuttings of *E. striatum* (fragments of 70 to 100 g) are fixed to

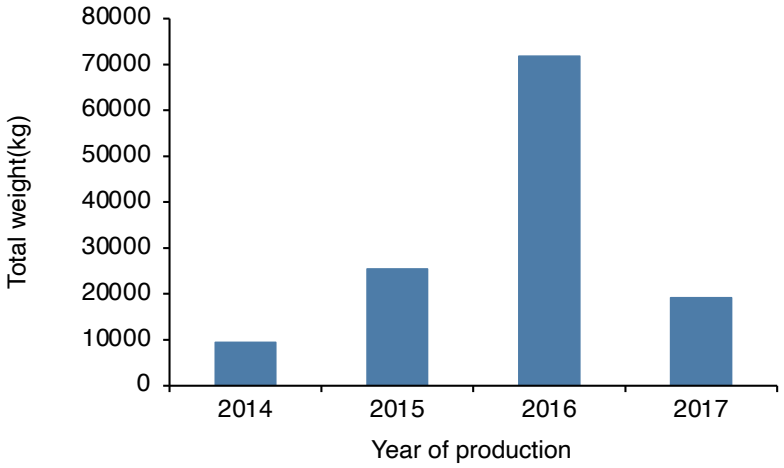

Figure 6. Annual variation of algae production in the village of Andrevo from 2014 to 2017 (COPEFRITO, 2016; pers.com.).

a monofilament nylon thread of 1-3 mm in diameter and maintained perpendicular to the current, by fixing them to stakes in the sediment.

The annual production of Andrevo varies from 9.4 to 71.8 tonnes, including 2 harvests a year or less. These values are due to the parallel increase in the number of wild seaweed farmers and the number of bags of seaweed supplied by these farmers (Fig. 6).

Sea cucumber farming

Indian Ocean Trepang (IOT) was the first industrial sea cucumber farm in Madagascar. It has a hatchery for producing larvae and post larvae and a pre-growth farm for producing juveniles (both located in Ankaloaha just behind Toliara airport) and a juvenile grow-out farm in Belaza and in the seagrass beds at Ankoronga, Toliara (SW Madagascar). IOT has been active since 2014 and has expanded its grow-out farm to Andrevo. Apart from the technical feasibility study of this expansion project in Andrevo, an environmental and social impact study was carried out in March 2017 and the Ministry of Fisheries Resources and Fisheries (MRHP) and the Ministry of Environment supported their selection.

Sea cucumber farming in Andrevo is undertaken by 25 farmers divided into 18 households, increasing from 14 farmers (7 teams of fisherman and wife) at the onset. Rearing is done in the natural environment, without addition of feed, at a density of 500 individuals/enclosure of 90 m^2. The density can be sustained by the nutritional regeneration capacity of the sediment in the enclosure. Juveniles are bought from IOT. Although the number of juveniles delivered to each farmer team is similar, the difference in production of adult sea cucumbers is determined by the technical and breeding maintenance of each team.

The prices of sea cucumbers in the Toliara region fall within a fairly wide range, depending on the quality and species (Randrianarivelo, 2008). The technical and commercial partner at Andrevo prefers to buy sea cucumbers fresh, to avoid poor quality products. The purchase price of sea cucumbers from fishermen varies according to weight.

Agencies supporting aquaculture

'*Vondronolona Ifotony*' (VOI) is an association of fishermen established in 2002. In Andrevo, it works closely with a local association called *Fikambanana Soan'Andrevo* (FIKASOA) with 232 members. FIKASOA works with similar associations around the Ranobe Bay to facilitate management of natural resources and to promote income-generating activities for improved living standards.

VOI / FIKASOA promotes seaweed and sea cucumber farming, reed farming or vondro and mangrove reforestation or *ala honko* as income generating activities for the local population. Among others, non-governmental organisations (NGOs) and fishing companies provide support for the promotion and management of fisheries and aquaculture.

Conclusion and Recommendations

The study of the dynamics of small-scale fishing and aquaculture development in Andrevo village generated important insights related to the general organisation of the villagers, the socio-economic characteristics of the fishers and especially knowledge about

fishing effort and catches. No modernisation of dugout canoes or fishing gear was observed. The fishing areas frequented are extensive, from the beach to the reef fronts; only shark or *Jarifa* nets are set offshore. The development of coastal aquaculture, targeting export products such as red algae and sea cucumbers, support livelihoods. The presence of favourable shallow areas for culture and a buoyant market through exporting companies such as IOT, COPEFRITO, makes further expansion possible. Andrevo is the third largest producer of seaweed in the region, with annual production increasing from 9.4 to 71.8 tonnes between 2014 and 2016. Logistic hurdles for small-scale fishers and aquaculture development in Andrevo are insufficient materials, scarcity of resources and low prices for products. Use of destructive techniques, market monopolization, and disrespect for local regulations have been reported. NGOs assist fishers with technical support for development and sustainable management. Spatial conflict between small-scale fishing and aquaculture appears to be negligible. Asphalting of the main road (RN9) has improved accessibility to markets, to which freshly caught fish kept on ice can now be rapidly and consistently distributed. This has in turn affected fish processing priorities and local consumption patterns in Andrevo. Improved access has also enhanced opportunities for aquaculture, including investment, technical expertise and access to markets. Care should be taken that fishing effort does not increase rapidly as a result of improved accessibility.

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