



Community Centred Conservation (C3)

# Using SocMon Methodology to Establish Future Management Options for Coastal Communities in Northeast Madagascar

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## **Abstract**

Madagascar is famous for terrestrial diversity and flora and fauna endemism; drawing the interest of conservation efforts and scientific focus. Consequently, Madagascar's marine environment has been largely ignored, despite its significant importance to coastal community welfare. Recent studies show that artisanal fishery catches are producing predominantly small fish, and fishing methods are increasing the scarcity of charismatic and valuable species but other studies demonstrate that conservation efforts are increasing and can be successful.

This project focuses on the socioeconomic factors of marine resource use and management in the northeast of Madagascar, a region with little previous focus in comparison to other coastal areas, as part of a community approach to conservation undertaken by the NGO C3.

Socioeconomic data was collected using SocMon methodology; 126 key informant surveys were collected in 6 regions, encompassing 25 villages, over a month.

Results indicate a lack of governance concerning coastal community marine resource use. Whilst poverty has driven communities to use fishing methods they acknowledge to be environmentally damaging for subsistence. Structured management schemes would be welcomed by coastal communities, but focus is given to Ampisikina as results show this location as potentially receiving the most benefit from C3s involvement.

Community based welfare projects are a necessary first management plan to gather trust from residents, after this the ecosystem approach is utilised in modifying marine resource use techniques.

This study concludes the most sustainable future for Ampisikina to be designating a community-based co-managed MPA; a method that involves coastal communities at all management levels to prevent alienating residents and ensures the best outcome is achieved for stakeholders and the ecosystem.

## **Introduction**

Worldwide protection of anthropogenically degraded natural resources has been biased towards terrestrial endeavours, subsequently only 1.17% of the world's oceans are protected (Toropova *et. al.*, 2010); on a local scale the same patterns are apparent.

Marine ecosystems provide some of the most important services to Madagascar's residents; especially via fishing (Davies *et. al.*, 2009). Unfortunately, despite this dependence, conservation of the marine environment has historically not been a priority; mainly because Madagascar's terrestrial ecosystems are exceedingly rich in endemic flora and fauna, attracting worldwide attention (Cooke *et. al.* 2003). Additionally, impacts to marine biodiversity are often imperceptible, resulting in several marine species' undergoing population declines that have caused them to become conservation concerns (Cooke *et. al.* 2003). Studies have begun to highlight consequences of anthropogenic impacts on Madagascar's marine ecosystems; such as heavily exploited artisanal fisheries in southwest Madagascar that yield a predominance of small fish (Davies *et. al.*, 2009), and increasing scarcity of charismatic and valuable species, including large groupers, sharks and turtles, due to incidental catch (Cooke *et. al.* 2003). Because of such studies, and growing worldwide awareness of the importance of marine conservation (Roberts, 2007a), focus on marine ecosystems has increased in recent years, but still needs to improve; particularly in artisanal fisheries, which comprise 95% of the worlds fishermen but have had little study carried out on fishing effort and catch (Moore *et. al.*, 2010).

This project focuses on socioeconomic aspects of marine resources for coastal communities in northeast Madagascar because humans are one of the most coastally dependent species in the biosphere (Weinstein *et. al.*, 2007), particularly in developing countries (Davies *et. al.*, 2009), yet the socioeconomic factors contolling community use of marine systems is poorly understood (Cinner *et. al.*, 2009a). Data collected ascertains coastal community dependence on artisanal fisheries, how the community's activities are governed and their impact on the environment. Data analysis discusses the potential of different management regimes and identifies a prime location for marine protected area (MPA) allocation; as well as providing a control dataset for any future qualitative or quantitative analysis of MPA success and impacts to be carried out.

## **Methods**

Field work was designed according to the socioeconomic manual for coral reef management by Bunce *et. al.* (2002) and the Western Indian Ocean (WIO) SocMon guide (Malleret-King *et. al.*, 2006). Study sites were located along the northeast Madagascan coast, the number of which was determined by the timeframe available (25<sup>th</sup> June - 29<sup>th</sup> July 2011) and accessibility of each community. Consequently 6 coastal community regions, totalling 25 villages, were surveyed; each one in close proximity to the coastline and identifiable on detailed maps (Table 1; Figure 1).

Table 1: Study sites along the northeast Madagascan coast (\*<sup>1</sup> 3 villages in Sambava region and 1 in Fanambana region but all are much more closely linked to each other, so they are considered a separate region; \*<sup>2</sup> GPS *n/a* as village mapping was a later addition to the methodology; \*<sup>3</sup> GPS *n/a* due to broken logger)

<b>Region</b>	<b>Village</b>	<b>GPS Location</b>
<b>Sambava</b>	Antsirabe	<i>n/a</i> * <sup>2</sup>
<b>Sambava</b>	Antembe	<i>n/a</i> * <sup>2</sup>
<b>Sambava</b>	Lavatsiraka	<i>n/a</i> * <sup>2</sup>
<b>Fanambana</b>	Fanambana	<i>n/a</i> * <sup>2</sup>
<b>Ambondrombe</b> * <sup>1</sup>	Ambondrombe	S13.71303; E050.08415
<b>Ambondrombe</b> * <sup>1</sup>	Ambodivia	S13.69585; E050.08647
<b>Ambondrombe</b> * <sup>1</sup>	Ampasimadera	S13.68934; E050.08179
<b>Ambondrombe</b> * <sup>1</sup>	Ambonihara	S13.62500; E050.08086
<b>Ampisikina</b>	Ampisikina	S12.94928; E049.80486
<b>Ampisikina</b>	Amaraty	S12.95550; E049.86713
<b>Ampisikina</b>	Rantalava	<i>n/a</i> * <sup>3</sup>
<b>Ampisikina</b>	Antafian'nyvony	S12.88588; E049.79892
<b>Ampisikina</b>	Antsampilay	S12.90613; E049.79148
<b>Ampisikina</b>	Andavak'alovo	S12.89993; E049.82780
<b>Ampisikina</b>	Anjiamangotroko	S12.88848; E049.83986
<b>Ampisikina</b>	Ankatafa	S13.01126; E049.89604
<b>Nosy Fara</b>	Nosy Fara	S12.79174; E049.82885

The Amboloboza Bay	Irodo	S12.64767; E049.52390
The Amboloboza Bay	Antafiampatsa	<i>n/a</i> <sup>*3</sup>
The Amboloboza Bay	Ankorera	S12.60728; E049.54370
The Amboloboza Bay	Bemokoty	S12.59443; E049.52922
The Amboloboza Bay	Ambolobozobe	S12.52602; E049.53077
The Amboloboza Bay	Bempingo	S12.50247; E049.54371
The Amboloboza Bay	Ampagnohara	S12.50424; E049.52790
The Amboloboza Bay	Ambolobozokely	S12.45614; E049.57357

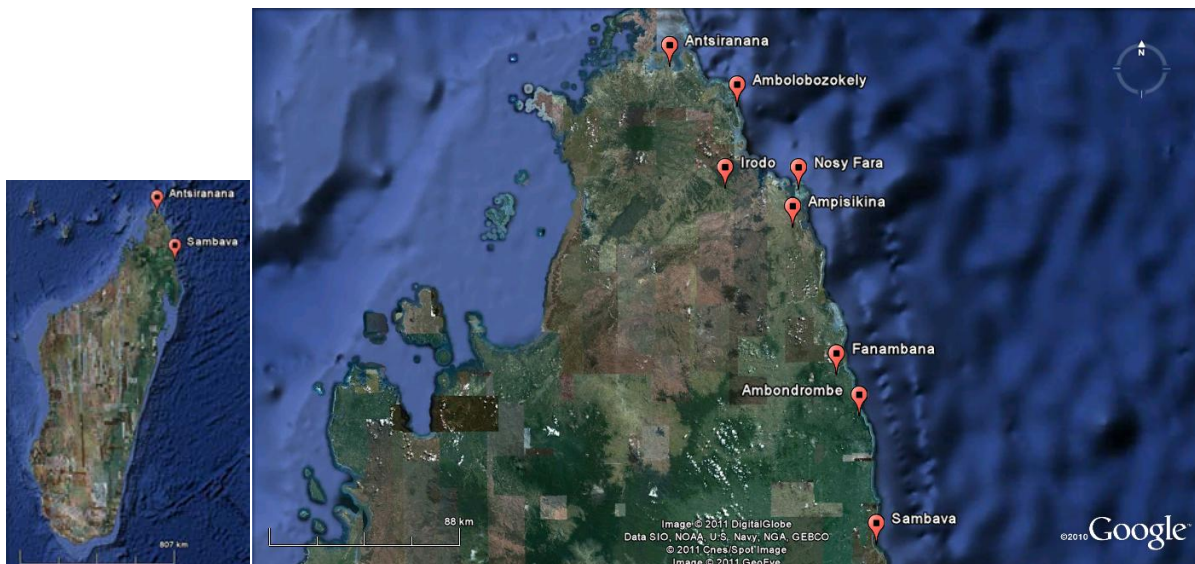


Figure 1: Northeast Madagascan study area; villages marked are base locations from which other villages were visited.

Survey questions were designed according to the WIO SocMon guide (Malleret-King *et al.*, 2006); SocMon (*Socioeconomic Monitoring*) guidelines establish a survey programme at a coastal management site within the WIO and are most appropriate for the study site level (Malleret-King *et al.*, 2006). SocMon surveys target key informants (KI) (Appendix 1) to provide detailed qualitative data on demographics, infrastructure and business, coastal and marine activities, stakeholders and governance. A KI is a person with rank, experience or knowledge providing extensive insights on socioeconomic conditions (Bunce *et al.*, 2002); occasionally one KI survey may provide all the necessary information for a site, but usually multiple KIs are needed to provide all the required data.

Snowball sampling was used, where KIs recommend other useful candidates to gather more information, until subsequent interviews generate little or no new information (Marshall, 1996). The Sambava region is considered a pilot study as the field team were getting accustomed to data collection and recording methodology; it is included in data analysis, but must be an exceptional site to receive MPA designation from this study alone. Data analysis focuses on key criteria, identified in results, but management options consider the entire relevant dataset.

Surveys were conducted in each coastal community with permission from the local chief and carried out appropriately, according to village customs and traditions. Quality control was constantly undertaken with survey responses to ensure data between each site was standardised and comparable with accurate and meaningful scales used, allowing for efficient data analysis and future comparisons between studies. Each question was chosen in order to best portray the coastal and marine activities and governance to determine how the ecosystem was managed, and how changes in management, including the establishment of MPAs, may impact on the community both positively and negatively.

## **Results**

Table 2 shows the distribution and date of 126 KI surveys completed across all locations.

Table 2: KI survey numbers and dates.

<b>Region</b>	<b>Village</b>	<b>Date</b>	<b>Number of Surveys</b>
<b>Sambava</b>	Antsirabe	28 <sup>th</sup> June 2011	3
<b>Sambava</b>	Antembe	28 <sup>th</sup> June 2011	4
<b>Sambava</b>	Lavatsiraka	29 <sup>th</sup> June 2011	3
<b>Fanambana</b>	Fanambana	1 <sup>st</sup> – 2 <sup>nd</sup> July 2011	11
<b>Ambondrombe</b>	Ambondrombe	5 <sup>th</sup> July 2011	5
<b>Ambondrombe</b>	Ambodivia	5 <sup>th</sup> July 2011	2
<b>Ambondrombe</b>	Ampasimadera	6 <sup>th</sup> July 2011	2
<b>Ambondrombe</b>	Ambonihara	6 <sup>th</sup> July 2011	2
<b>Ampisikina</b>	Ampisikina	10 <sup>th</sup> July 2011	5
<b>Ampisikina</b>	Amaraty	11 <sup>th</sup> July 2011	2
<b>Ampisikina</b>	Rantalava	11 <sup>th</sup> July 2011	2
<b>Ampisikina</b>	Antafian'nyvony	12 <sup>th</sup> July 2011	6
<b>Ampisikina</b>	Antsampilay	12 <sup>th</sup> July 2011	4
<b>Ampisikina</b>	Andavak'alovo	13 <sup>th</sup> July 2011	4
<b>Ampisikina</b>	Anjiamangotroko	13 <sup>th</sup> July 2011	2
<b>Ampisikina</b>	Ankatafa	14 <sup>th</sup> July 2011	6
<b>Nosy Fara</b>	Nosy Fara	16 <sup>th</sup> – 17 <sup>th</sup> July 2011	12
<b>The Amboloboza Bay</b>	Irodo	19 <sup>th</sup> – 20 <sup>th</sup> July 2011	8
<b>The Amboloboza Bay</b>	Antafiampatsa	20 <sup>th</sup> July 2011	5
<b>The Amboloboza Bay</b>	Ankorera	21 <sup>st</sup> July 2011	4
<b>The Amboloboza Bay</b>	Bemokoty	21 <sup>st</sup> July 2011	2
<b>The Amboloboza Bay</b>	Ambolobozobe	23 <sup>rd</sup> – 24 <sup>th</sup> July 2011	17
<b>The Amboloboza Bay</b>	Bempingo	25 <sup>th</sup> July 2011	4
<b>The Amboloboza Bay</b>	Ampagnohara	25 <sup>th</sup> July 2011	2
<b>The Amboloboza Bay</b>	Ambolobozokely	26 <sup>th</sup> – 28 <sup>th</sup> July 2011	9

Data was collated for each region as individual village datasets would be insufficiently small. Key criteria for primary management site designation from the SocMon surveys were identified as; fishing importance (Table 3), fishermen origin and residence (Table 4), level and type of fisheries impacts (Table 5), and current management level (Table 6), because they give the best overview of fishing in each region.

Table 3: Average rank (importance within the region – 1 being most important) and rank (number of KIs acknowledging presence; 1 being the most recognised – number in brackets is the total number of occupations in the region) for fishing across all regions.

Region	Average Rank	Rank
Nosy Fara	1.42	1 (10)
The Amboloboza Bay	1.94	1 (19)
Sambava	2.00	1 (20)
Ampisikina	2.24	1 (16)
Ambondrombe	3.25	3 (18)
Fanambana	4.67	12 (21)

Table 4: Origin and residence of fishermen across all regions; based on % of KIs giving each answer.

Region	Origin		Residence		
	Outside Region	Inside Region	Outside Region	Inside Region	Inside Village
Sambava	-	100	-	-	100
Fanambana	-	100	-	-	100
Ambondrombe	53	47	8	17	75
Ampisikina	60	40	37	3	60
Nosy Fara	58	42	-	-	100
The Amboloboza Bay	8	92	6	-	94

Table 5: Level and types of impacts of fishing across all regions (numbers are the number of KIs that indicated each impact; number in brackets is the number of KIs in that region - L = low, M = medium, H = high for impact level).

Region	Overfishing	Overfishing (Juveniles)	Overfishing (Fecund Fish)	Destroy Reef	Destroy Seagrass	Bycatch
<b>Sambava</b>	3 (10) H; 1 (10) L	1 (10) H	-	3 (10) H	4 (10) H	-
<b>Fanambana</b>	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>
<b>Ambondrombe</b>	3 (11) H; 1 (11) L	2 (11) H	1 (11) H	-	-	1 (11) H
<b>Ampisikina</b>	16 (31) H	1 (31) M	-	1 (31) L	-	-
<b>Nosy Fara</b>	-	-	-	1 (12) L	1 (12) H	-
<b>The Amboloboza Bay</b>	16 (51) H	2 (51) L	-	1 (51) H	-	-

Table 6: Number of KIs indicating the presence of different forms of governance across all regions (number in brackets is the number of KIs in that region).

Region	Management Body	Management Plan	Enabling Legislation	Formal Tenure	Relevant Rules and Regulations
<b>Sambava</b>	5 (10)	3 (10)	5 (10)	7 (10)	2 (10)
<b>Fanambana</b>	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>
<b>Ambondrombe</b>	1 (11)	3 (11)	-	1 (11)	1 (11)
<b>Ampisikina</b>	6 (31)	6 (31)	7 (31)	3 (31)	5 (31)
<b>Nosy Fara</b>	9 (12)	1 (12)	9 (12)	7 (12)	-
<b>The Amboloboza Bay</b>	31 (51)	8 (51)	26 (51)	31 (51)	1 (51)

Extra information was often gathered from KIs when discussing various issues of coastal and community management, providing a more detailed view of certain aspects of fisheries issues for a number of sites.

1. Ambodivia (Ambondrombe)

A fish collector stated that Jarifa<sup>1</sup> nets, catch too many large sized fish, which are relied upon to produce the next generation of fish stocks (no other KI mentioned this). Jarifas are set at night and collected in the morning; therefore, captured large fish are not released until they are dead.

2. Ampasimadera (Ambondrombe)

Fishermen willingly admitted to fishing with mosquito nets, despite being aware of overfishing and habitat destruction implications. Mosquito nets are used because alternatives are expensive and often unobtainable. The fishermen also want an association to establish a permit system and mesh size regulations, but there is no funding for such an association. Additionally, in 2009 a French marine tours worker visited the village, upon arrival he promised to bring better equipment, nets and boats, but never returned.

3. Amaraty/Rantalava (Ampisikina)

Fishermen in Amaraty admitted their activities contribute to overfishing, although they blame migrant fishermen more. Consequently, they want a management body to enforce mesh size restrictions and provide vedettes<sup>2</sup>. They also plan to stop fishing in shallow water during high tide as it catches all the fish swimming into the shallows.

Despite having no fishing management body a police woman bought a permit from Pêche Maritime<sup>3</sup> and set up the AMM<sup>4</sup> selling permits to fishermen, who then join the AMM. This process prohibits fishermen of Rantalava from using this location causing conflicts between the villages.

4. Antafian'nyvony (Ampisikina)

One fisherman stated that whilst there are no management bodies or associations in effect in the village, there is an informal rule that anyone caught using nets smaller than 3 fingers<sup>5</sup> will be asked to stop and their activities communicated to the village. Despite this, fishermen sat next to the interviewee were creating a 2 finger net in full view of the community and no one objected (Image 1).

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<sup>1</sup> Jarifa Nets: Gill nets with a particularly large mesh size designed to target sharks and large fish.

<sup>2</sup> Vedettes: Motorised boats.

<sup>3</sup> Pêche Maritime: The official Madagascan government's fisheries service.

<sup>4</sup> AMM (Association Mpanarato Mivoatra): A fishing association established in Amaraty as a way for the main permit holder to sell individual permits to local fishermen in order to fish in the area.

<sup>5</sup> # finger nets: Nets that have a mesh size large enough to fit # fingers inside.



Image 1: Fishermen creating a 2 finger net.

5. Anjiamangotroko (Ampisikina)

Fishermen had a rule placed upon them by a Malagasy non-government organisation (NGO) that 2 finger nets were banned. Fishermen witnessed flouting this rule were immediately reported to the NGO, but still continued with their illegal activity. This lack of enforcement has led the community to mistrust the NGO, whilst being wary of any future outside involvement in their activities.

6. Ankatafa (Ampisikina)

Ankatafa is extremely isolated from other communities causing fish sale issues. Fish sale price is driven down due to the time and expense collectors use in order to reach the village; which is only accessible by foot or by boat from distant towns. The community accepts these low prices as they know no one else will come or pay more. The issue is exacerbated in the dry season when windy conditions make travel in a pirogue<sup>6</sup> very slow and dangerous destroying the catch before landing.

7. Nosy Fara (Nosy Fara)

Nosy Fara, part of the Nosy Ankaon archipelago, contains numerous small villages. In 1998 an NGO set up an algoculture industry, hiring local fishermen to do the farming. There are major issues with the system that include:

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<sup>6</sup> Pirogue: Outrigger canoe.

- A small protected area was established that aimed to limit fishing to 5 months a year and ban beach seining, nets smaller than 2 fingers, small hooks on pole-and-line, octopus diving, catching juveniles and catching crabs less than 10cm long.
  - Some KIs stated there are no impacts of coastal activities because of these regulations, whilst others stated monitoring is poor and fish stocks are declining even after 1998.
- The community switched to algae farming due to declining fish stocks, which is subsequently being destroyed by an unknown disease, potentially occurring due to climate change induced sea temperature rise reducing alternative revenue options to fishing.
- International markets drive algae farming, but community value is low at 400Ar kg<sup>-1</sup> for dried algae<sup>7</sup>.

8. Ambolobozobe (The Amboloboza Bay)

Table 7: Differing information collected on fishing from the Ambolobozobe community.

KI #	Nets Used	Impact	Management Body	Net Limits	Permit Requirement	Close Season	Turtle Ban
1	N/A	Overfishing	No	No	No	No	N/A
3	2, 3, 4 fingers and Jarifa	No	VOI <sup>8</sup>	No	Yes	Jan-Mar (prawn)	N/A
4	Jarifa (fish); 1 finger (prawn)	Catch juvenile fish (prawn)	Pêche Maritimé	No	Yes	Oct-Feb (prawn, lobster)	N/A
6	3, 4, 10 fingers (fish); beach seine (lobster)	No	VOI	No	Yes	Dec-Jan (prawn, lobster)	Yes
7	4 fingers (fish); 1 finger (prawn)	No (bycatch released, mesh limits respected)	No	Ban of beach seining (informal)	No	No	N/A
8	4 fingers (1, 2 fingers seen on interviewees wall)	Overfishing (west coast migrants use 2 fingers and destroy coral)	No	Destructive gear and 2 finger or less nets banned (informal)	No	No	N/A

<sup>7</sup> Current Ariary to £ conversion rate is: ~3,000Ar = £1.

<sup>8</sup> VOI (Vondron'Olona Ifofony – Population Concerning Environment): A community group concerned with conservation of the environment.

9	5+ fingers	No (destructive gears banned)	Pêche Maritimé and CLB <sup>9</sup>	≤3 fingers banned	No	No	N/A
11	4 fingers (fish); 1 finger (prawn)	No	Pêche Maritimé and CLB	≤3 fingers banned	No	Feb-Apr (prawn, lobster)	N/A
12	3 fingers	No	VOI	No	Yes	No	N/A
13	2 and 3 fingers	No	Pêche Maritimé	No	Yes	Mar-Jun (octopus); Dec-Mar (prawn, lobster)	Yes
14	3 fingers and Jarifa	No	VOI	No	Yes	Dec-Feb (prawn)	N/A
15	3 fingers	No	Fishery Service	No	No	Dec-Feb (prawn)	N/A
16	2, 4, 5 fingers and Jarifa (fish); 1 finger (prawn and lobster)	No (because there are no fish left to impact)	VOI	No	No	Dec-Feb (prawn, lobster)	N/A
17	2, 3, 4 fingers and Jarifa (fish); 1 finger (prawn)	No (juveniles released from prawn nets)	Pêche Maritimé	No	No	Dec-Mar (prawn, lobster)	N/A

Ambolobozobe is the largest single village dataset (Table 7). There is a wide range of variation that includes contradictory evidence, for example the inconsistent information on permit requirement and closed season timing; the actual close season for prawn and lobster is Dec-Mar. Whilst the majority of KIs state there are no impacts of fishing activities on the environment they either give no reasoning, or give reasons that are then contradicted by other KIs.

#### 9. Ambolobozokely (The Ambolobo Bay)

The president of a fishing association explained they aim to stop destructive fishing methods, including beach seines and reef breaking, however these are still practised. Fishermen numbers are also increasing resulting in a 10kg day<sup>-1</sup> catch being considered high, when over 100kg day<sup>-1</sup> used to be the norm. Three fishing associations (for young, adult or old members) receive fish smoking and

<sup>9</sup> CLB (Community Local Based): A local based coalition of fishing associations who are advised by Pêche Maritimé on environmental protection.

drying equipment and a vedette from the PSDR<sup>10</sup>; but they cannot afford to purchase or store kerosene for the vedettes motor and can only catch unsuitable species for drying or smoking.

Pêche Maritimé have a strong influence and forbid activities that: break coral, turn rocks, use poison, use 2 finger or smaller nets, cut mangrove, catch turtles or use beach seines. Also a permit system and lobster, prawn and octopus close seasons are in place. However, knowledge and compliance of rules varies between KIs; extremes of a completely sustainable fishing community, and a fishing community destroying the ecosystem at a high rate were both explained by different KIs.

#### 10. Common Issues (All regions)

Village accessibility is the main issue, road infrastructure is usually in an exceedingly poor condition; meaning that during the dry season the road is impassable to all except the largest vehicles due to the rough terrain and progress can be slow, whilst the real issue is in the wet season when the roads are so muddy that progress is incredibly time-consuming (Image 2).



Image 2: A typical Malagasy road during the wet season.

Ultimately, fish catch cannot be transported great distances to the bigger markets because it is destroyed in transit, thus price is driven lower to make sure of local sale. Some locations are so inaccessible that the only way of transporting catch out of the area is by Zebu cart, which is too slow, or by boat, which is monopolised in northeast Madagascar by a handful of boat owners as no one

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<sup>10</sup> PSDR (Projet de Soutien au Développement Rural): An organisation created to fund community development projects across entire regions.

else will provide an alternative; such as in Ankorera. This issue is exacerbated by the complete deficiency of storage capabilities; ice chests are uncommon and most stock cannot survive long journeys without being dried or smoked, which again reduces the price; such as in Irodo. Lack of equipment is also a major issue across locations, forcing some communities to use equipment they know to be particularly damaging to sustain their family; such as in Ampasimadera (above).

The results indicate numerous issues with fishing across all regions and a lack of communication, compliance, governance and education has augmented the issues and their impacts, meaning that improvements in community welfare and natural resource use are not made; yet a thoroughly structured management scheme could alleviate these issues.

## **Discussion**

The choice of the primary location to pilot community-based fisheries management can be made from Table 3 – Table 6 in combination with the extra information given on a number of communities:

- The Sambava region is a pilot study and not discernible enough from the other regions, therefore it does not warrant management on this dataset alone, further research would be required.
- The Fanambana region ranked fishing as unimportant compared to the other regions (Table 3) and subsequently gave no information on impacts (Table 5) or governance (Table 6). Therefore, from a marine standpoint, Fanambana cannot be considered for management.
- Ambondrombe's communities rank fishing as less important than all regions, except Fanambana (Table 3), making marine conservation best focused elsewhere.
- Whilst Nosy Fara ranked fishing as more important than any other region (Table 3) it cannot be considered for C3 as it is the smallest region and already contains an NGO running the risk of C3 undermining the current management framework.
- The Amboloboza Bay region already has a comparatively high level of management (Table 6). Choosing a primary site elsewhere allows the current management to continue and improve; particularly in education and enforcement. C3 could work in an advisory capacity, using the primary location as an example once established.

This leaves the Ampsikina region as the most suitable location (complete dataset: Appendix 2). It is an excellent site as the communities rank fishing highly in terms of importance (Table 3) whilst also having the issue of a lot of migrant fishermen (Table 4; as described in Amaraty/Rantalava) who

would need to be fully informed of future management schemes, a process best done via a formal organisation such as C3. Overfishing recognition is high (Table 5) but current governance is low (Table 6). A potential hindrance is the presence of a Malagasy NGO already in the region. However, it is a large region and, despite poor enforcement of marine rules in Anjiamangotroko, the current NGO focuses chiefly on terrestrial work whilst C3 work largely in the marine environment, so an alliance is possible.

When managing Ampisikina it is important to always use the ecosystem approach, this deals not only with fisheries impacts on living resources and habitat, but addresses all human activities in the region (Mathew, 2011); a notion that is highly important when considering the heavy reliance of coastal communities on artisanal fisheries (Davies *et. al.*, 2009), and the need for feasible alternatives (Hauzer *et. al.*, 2008).

Initial management schemes in the area will have to be small scale and focused on community welfare to gain the trust of residents (Belle *et. al.*, 2009). The most important scheme would be transport access as KI surveys highlighted no tarmac road access to any community surveyed (which was especially detrimental to community welfare in Ankatafa). The improvement of the road will increase the access to large markets for fish sale and, consequently, the price received for stock will increase (vital as 67% of KIs stated that fish value was low in Ampisikina, including lobster, crab and prawn also being identified as low value. The target market is primarily regional and to sell on a regional level requires good transport access). The increased sale price reduces the amount of fishing effort communities must undertake to receive equal monetary benefits. However, communities want increased benefits not equal benefits, so the ecosystem also needs targeted protection; providing aid in road construction earns the trust required to attempt such protection.

Fishing in Ampisikina provides: fish, lobster, crab, prawn, octopus, shark, ray and sea cucumber. Many are charismatic species increasing in scarcity (Cooke *et. al.* 2003); attributable to activities such as illegal fishing of green turtle (*Chelonia mydas*) (Metcalf *et. al.*, 2007), and large nets targeting sharks and groupers. Whilst prawn and dogtooth tuna (*Gymnosarda unicolor*) are caught by destructive methods; small mesh size nets and beach seining respectively (Image 3).



Image 3: (left to right) Green turtle carapace, shark, groupers, prawn, dogtooth tuna and octopus.

Prohibitions on all endangered species catches and damaging methods (mosquito nets, nets smaller than 3 fingers, beach seining and poisoning) are required to conserve the ecosystem (Roberts, 2007b). However, Hauzer *et. al.* (2008) studied the Parc Marin de Mohéli MPA (PMM) in the Comoros and found gear prohibitions were identified as constraints on welfare by local communities, due to the reductions in yield causing income loss. Consequently alternatives need to be supplied, these could include: more sustainable gear (Belle *et. al.*, 2009), vedettes to move into waters further offshore to catch schools of larger species at a sustainable level (Roberts, 2007c), or compensation to the community until catches increase after target species populations have recovered (Kelleher, 1999). However, these alternatives could result in overfishing of the same or different species in the future; therefore new practises are required entirely.

Implementing these governance methods is difficult as they are, at least initially, top-down approaches, which can cause conflicts and poor compliance (Cinner *et. al.*, 2009b); Grafton (2005) found a redirection from top-down approaches towards community-based co-management regimes (hereby referred to as co-management) is required to increase community trust and responsibility. Experience has also shown top-down approaches to MPAs are often ineffective and unsustainable as they can alienate local resource users (Brown, 2002), so the ultimate aim of establishing an MPA certainly requires co-management.

Francis *et. al.* (2002) studied three categories of MPA (single-use, multiple-use and NGO managed) in the east African region, including Madagascar, and determined that no MPA can succeed without support of the local communities; likewise Gutiérrez *et. al.* (2011) studied 130 co-managed fisheries in 44 countries, including Madagascar, and found that co-management is the only realistic solution for the majority of the world's fisheries. Therefore, it is vital to use co-management in establishing and maintaining the potential Ampisikina MPA. Co-management occurs when fishers, managers, stakeholders (including NGOs) and the local community work together to improve the regulation of an MPA through a number of means (Gutiérrez *et. al.*, 2011) that includes:

1. Enhanced sense of ownership
2. Encouraging responsible fishing
3. Sensitivity to socioeconomic and ecological restraints
4. Local knowledge to improve management
5. Collective ownership in decisions
6. Increased compliance through peer pressure
7. Better monitoring and control by fishers

Despite all these advantages there is no blueprint or model for co-management to follow due to the number of people involved (Pomeroy and Rivera-Guieb, 2006). Nevertheless, French civil law and traditional customs have coexisted in Madagascar as a traditional social code known as ‘Dina’ (Rakotoson and Tanner, 2006). Using Dina in co-management results in laws being the will of the people themselves (Rakotoson and Tanner, 2006) and is recognised by national government (Cinner *et. al.*, 2009b); leading to higher compliance (McClanahan *et. al.*, 2005).

When establishing the Ampisikina MPA, lessons can also be drawn from similar MPAs; such as the Massif des Roses MPA (MDR), which was officially established in the Bay of Ranobe, in southwest Madagascar, on the 25<sup>th</sup> May 2007 (Belle *et. al.*, 2009). The site had been receiving informal protection for nearly a decade before this date but with limited success; tourist operators and fishing communities were untrusting of each other causing a strained relationship between stakeholders, overfishing and dropping of anchors on the coral reef were particularly problematic and transgressors only ever received warnings for their actions (Belle *et. al.*, 2009).

The process of establishing the MDR begun with an NGO (ReefDoctor) carrying out community projects (such as; school restoration and solar power initiatives) since 2002 and then continued until October 2006 when a meeting was organised with local fishermen to discuss the MDR (Belle *et. al.*, 2009). Consequently on the 11<sup>th</sup> April 2007 FIMIHARA<sup>11</sup> was established, and as local communities were incorporated from the beginning the MDR was recognised within local law (Belle *et. al.*, 2009). After 18 months of establishment the MDR has garnered more than €1,000 net benefit from tourist

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<sup>11</sup> FIMIHARA (Fikambanana Miaro sy Hanasoa ny Ranomasina – Association to Protect and Enhance the Marine Environment): Established on 11<sup>th</sup> April 2007 as part of a combined effort between ReefDoctor (an NGO) and local communities to protect natural resources.

ticket sales for site management and community development whilst all key stakeholders continue to be supportive of the venture (Belle *et. al.*, 2009). Whilst integrated conservation has been successful by building conservation initiatives with local communities the process could take a decade to achieve positive results (Baral *et. al.*, 2007).

By following a similar course of action to ReefDoctor, C3 could successfully establish the Ampisikina MPA, but Belle *et. al.* (2009) highlighted a few issues: steering aspirations of some community members from a fisheries focus towards sustainable resources management was particularly difficult and continual financial commitment by the NGO is vital, additionally, whilst the use of an on-site guardian to monitor the compliance of laws is essential the guardian must also be monitored by the association as they can undertake illegal activity or keep money themselves.

However, to establish a long-term sustainable MPA lessons must be drawn from other MPA examples that have been recognized for a longer period of time; one such MPA is the PMM (Hauzer *et. al.*, 2008). Originally established on the 19<sup>th</sup> April 2001 the PMM began operating at a vastly reduced capacity following an end to external funding in 2005 (Hauzer *et. al.*, 2008). Hauzer *et. al.* (2008) found that communities were still highly aware of the importance of the PMM through surveys conducted in 2006 but there was great concern over a number of issues; issues that have potential solutions (Table 8).

Table 8: Problems with the PMM arising from withdrawal of external funding and their potential solutions (Hauzer *et. al.*, 2008).

<b>Problems with the PMM at running capacity in 2006</b>	<b>Solutions available</b>
<b>Lack of sustainability or alternative livelihoods</b>	Sustainability through effective financial planning; appropriate management techniques; mobilise communities into a truly co-managed PMM
<b>Inequitable distribution of benefits</b>	Ensure tangible benefits through realistic alternative livelihoods; equitable sharing of benefits
<b>Exclusion of women</b>	Involving women in management as they are the primary local educators and motivators
<b>Continuing environmental threats</b>	<i>Solutions come by improving the other problems</i>
<b>Lack of regulation enforcement</b>	Ensure the judicial system understands and enforces PMM regulations

For the Ampisikina MPA to receive sufficient long-term funding Poonian *et. al.* (2009) suggest supplying consistent funding over several years, rather than an initial lump sum to get immediate

visible benefits for them to then deteriorate after funding ceases. Even with such funding the issues highlighted by the PMM example in Table 8 could still occur, so the solutions should be incorporated into the original management scheme to prevent the likelihood of their occurrence.

These management schemes must not only be communicated within Ampisikina, but also to surrounding regions as migrant fishermen are common in the area, (KIs identified fishing undertaken predominantly by outsiders; 20 KIs said high level of outsider use, 1 medium and 7 low). Management schemes must then be communicated to national and international levels of infrastructure (Gezon, 1997); a process most successfully done by formal organisations such as C3.

An element within co-management is ecotourism which can be an excellent alternative source of income (Stolton *et. al.*, 2010), particularly as ecotourism often generates the greatest economic activity within an MPA (Kelleher, 1999). However, ecotourism must be set up around a framework of fully trained community members to host and guide tourists and adequate accommodation with amenities (Hauzer *et. al.*, 2008). The required training would be provided by C3, whilst local infrastructure must also be improved (Hauzer *et. al.*, 2008) resulting in independent community associations, such as a pirogue tourist operators association, that receive guidance from C3 (Belle *et. al.*, 2009). KIs indicated that Ampisikina already receives occasional tourists so the location would gather interest with well publicised ecotourism practises; however, adequate transport access is often identified by tourists as imperative (Davis *et. al.*, 2008), making the initial road fixing projects even more essential.

The long-term future of the Ampisikina MPA can be ensured with careful planning carried out over a significantly long period of time, but patience in expecting community perception of MPA success is required (McClanahan *et. al.*, 2005); therefore, further work must be carried out to ensure that success is possible and benefits communicated to the coastal communities.

### **Limitations and Future Study**

This project is limited by its singularly socioeconomic focus as community awareness of natural resources and environmental impacts is variable and occasionally poor, biased or hypocritical (as in Antafian'nyvony), making SocMon data deficient for choosing a management site. Surveys that ascertain fishing effort relative to fishing ground size (Cinner and Fuentes, 2008) and composition of habitat and species structure (McClanahan and Arthur, 2001) would determine the true health of

ecosystems for comparison to the socioeconomic results and would ideally be done in all 6 regions. Unfortunately during phase 2 C3 only have the resources to undertake this in one region, the primary site is chosen from the SocMon surveys alone. Phase 3 establishes a site base from which to extend management and community development.

Once the Ampisikina management scheme, and ultimately the MPA, is established continual research is imperative to monitor progress (Pomeroy *et. al.*, 2005), in community welfare and ecosystem health equally (Christie, 2004). If any unintended circumstances arise in either of these aspects the management scheme will have to accommodate necessary alterations (Gezon, 1997).

Ecosystem health will improve naturally in a well managed MPA (Christie, 2004), but there is potential for ecological projects to be carried out to facilitate a more rapid improvement. Belle *et. al.* (2009) suggest using artificial reefs and mangrove restoration; however such projects will probably require substantial investment, most likely from government grant schemes.

## **Conclusion**

The Ampisikina MPA can become a very successful example of a co-managed MPA in action; however managing it in isolation increases vulnerability to externalities, such as: overfishing and habitat alteration or destruction in surrounding regions, water pollution (Cicin-Sain and Belfiore, 2005) and climate change (Costanza *et. al.*, 1998). Whilst abundance and distribution of marine species' is expected to alter due to global climate change (Soto, 2002), some studies suggest the coral reefs of eastern Madagascar are not expected to be strongly affected by warm water (McClanahan *et. al.*, 2009). However, if they are affected Soto (2002) suggests mitigation measures of an increase in MPA numbers, established in a network and for the MPA to be spatially sensitive, shifting location if necessary. What is certain is requirement of fisheries management outside the MPA to compliment the protection it affords (Roberts *et. al.*, 2005).

Philippine MPA analysis carried out by Christie *et. al.* (2002) determined that, whilst small MPAs benefit the local community, this is the full extent of their solitary potential. However, linking individual MPAs in a networked management scheme will improve marine conservation efforts whilst maintaining the support for co-management (Christie *et. al.*, 2002); the same situation is likely for Madagascan marine protection. Integrating the Ampisikina MPA into a network around the entire coast of Madagascar is principally important when considering the spread of key ecological habitats.

For example around 70% of Madagascar's 270 small islands are located in the north and northwest with associated coral reefs, thus the foremost concentration of coral reefs is in the northwest (578km coral cover), then the southwest (458km) and the northeast third (417km) (Cooke *et. al.*, 2003). The west coast is also the residence of 98% of Madagascar's 327,000ha of mangrove (Cooke *et. al.*, 2003). Ampisikina has the benefit of including distinct bays where individual MPAs can be established, starting a networked management plan for expanding around Madagascar's coasts (Figure 2).

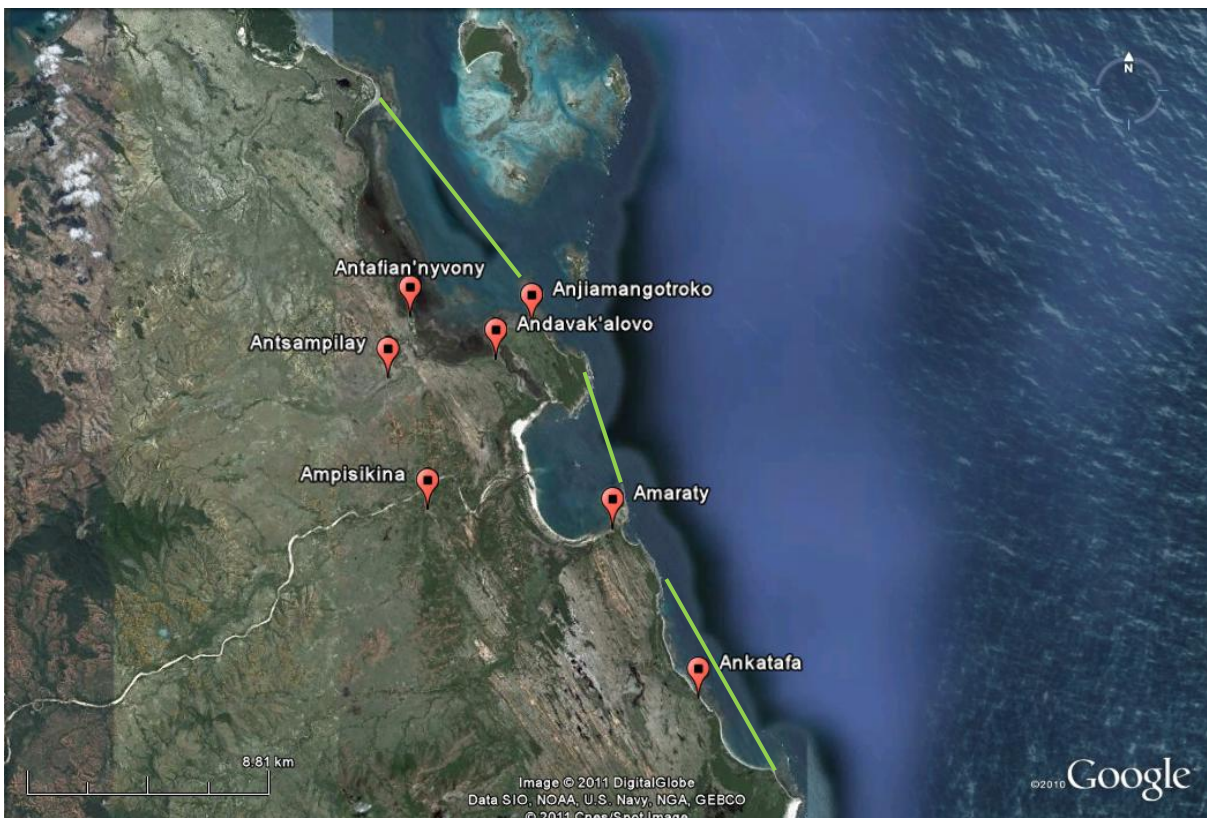


Figure 2: Ampisikina and its associated coastal layout, with potential MPA designation within the bays marked.

This project is an example of an increasingly multidisciplinary approach to conservation, including socioeconomic factors (Symes, 2006); factors that, if ignored, could otherwise prove detrimental to the progress of conservation efforts (Bunce *et. al.*, 2002; Malleret-King *et. al.*, 2006). This project also demonstrates the benefits, and limitations, of SocMon methodology in gathering socioeconomic data, allowing future studies to take these factors into account when designing and implementing their methods. Overall, this project has highlighted the potential success, in terms of community welfare and ecosystem recovery, a well implemented, long-term management scheme can provide.

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[For further information and other examples of co-management papers written by Cinner, JE., Jentoft, S., McClanahan, TR. and C3 are recommended].

## **Appendix**

### **Appendix 1: SocMon Survey**













## **Appendix 2: The Ampisikina Region Dataset**

### **Site Description:**

The Ampisikina region consists of 8 villages: Ampisikina (S12.94928; E049.80486), Amaraty (*n/a*), Rantalava (*n/a*), Antafian'nyvony (S12.88588; E049.79892), Antsampilay (12.90613; E049.79148), Andavak'alofo (S12.89993; E049.82780), Anjiamangotroko (S12.88848; E049.83986) and Ankatafa (S13.01126; E049.89604). A total of 31 surveys were carried out across the villages: Ampisikina (5), Amaraty (2), Rantalava (2), Antafian'nyvony (6), Antsampilay (4), Andavak'alofo (4), Anjiamangotroko (2) and Ankatafa (6). The surveys consisted of 7 farmers, 9 farmer/fishermen, 12 fishermen, 1 raffia weaver, 1 carpenter and 1 crystal collector.

The major coastal and terrestrial activities provide a number of goods and services for the community. Fishing provides fish, lobster, crabs, prawn, octopus, shark, ray and sea cucumber; farming provides: rice, maize, cassava, potato, coconut, banana, vanilla, zebu, goat, goose, duck and chicken; raffia weaving provides baskets; raffia collecting provides raffia; carpentry provides construction and crystal collecting provides crystal.

These coastal and terrestrial activities occur in a number of locations in and around the Ampisikina region. Fishing occurs in Ampisikina, Amaraty, Rantalava, Antafian'nyvony, Andavak'alofo, Anjiamangotroko or Ankatafa; additional locations are: Antafiona, Antambohobe, Antambohohely, Antambolava, Antevamena, Bahary, Nosy Satragna, Nosy Vahala and Nosy Fara; and in open ocean, deep sea, coastal shallow water, coral reefs, mangroves and a freshwater lake. Livestock and crop farming occur in Ampisikina, Rantalava, Antafian'nyvony, Antsampilay, Andavak'alofo, Anjiamangotroko or Ankatafa; additionally rice occurs in Antanimbaribe and rice, cassava and potato occur in Sahaka. Basket weaving and raffia collection occur in Antsampilay; crystal collecting in Antsampilay and carpentry across all of NE Madagascar.

5 out of 31 KIs said tourism occurs in the Ampisikina region. 1 said groups of 2-6 tourists pass through Ampisikina village on their way to Nosy Anakao, these tourists have been coming for at least 4 years and sometimes pay to stay in the village overnight. 1 said groups of 2-4 tourists have visited Antafian'nyvony each year since 2008 to visit the mangroves. 1 said groups of 2-6 tourists have visited Antsampilay but could not give any further details. 2 said that in 2010 a lot of tourists came to Ankatafa to take pictures of the village and forest, and to search for sea turtles; definitely a tourist group and not an NGO.

The region contains a number of different associations throughout the various villages:

- In Ampisikina there is: a formal cattle farmers association (2/5 KIs) to make the protective fences around crop land (1/5 KIs) and to arrange fair selling prices for the stock (1/5 KIs); a formal women's association to raise funds (2/5 KIs) and a formal young persons' association to raise funds (1/5 KIs).

- In Amaraty there is the Association Mpanarato Mivoatra (AMM), a formal association owned by a lady police officer who sells fishing permits on to fishermen from the one she obtained from Pêche Maritimé (1/2 KIs).
- In Antafian'nyvony there is: the Vehivavy mpAndrany Antsampilay (VAA), a formal association that brings together basket weavers to work (1/6 KIs) and a formal women's association for fund raising (2/6 KIs).
- In Antsampilay there is: a formal raffia weavers association to make products (2/4 KIs); a formal women's association to raise funds (2/4 KIs); a formal sports association to raise funds (2/4 KIs) and a formal cattle farmers association that currently undertakes no work (1/4 KIs).

Before making decisions on activities taking place in the region the Fokotany chief (14/31 KIs), the mayor (3/31 KIs), vice-mayor (1/31 KIs), village chief (4/31 KIs), village vice-chief (1/31 KIs), village elders (6/31 KIs) and parents in the village (1/31 KIs) must be consulted. Following on from this the Fokotany vice-chief (2/31 KIs), village chief (2/31 KIs), village elders (4/31 KIs) and FRAM (parents association) president (2/31 KIs) must be conferred with. Knowledge is gathered from traditional methods passed through the generations (31/31 KIs), with additions made when new equipment can be afforded (1/31 KIs).

### **Data Analysis:**

#### **K7 Occupations**

Table 1: Occupations present in the Ampisikina region as indicated by KIs. Average rank is the relative importance of each occupation within the community (1 being the most important); whilst rank is the number of KIs that actually acknowledged the presence of each occupation in the region (1 being the most recognised).

<b>Occupation</b>	<b>Average Rank</b>	<b>Rank</b>
Vanilla Farming	1.67	11
Rice Farming	1.91	2
Crop Farming	2.00	12
Basket Weaving	2.00	12
Carpenter	2.00	12
Crystal Collection	2.00	12
Fishing	2.24	1
Cattle Farming	2.56	3
Coconut Farming	2.67	5
Gargotte	2.75	7
Maize Farming	2.75	10
Cassava Farming	3.17	5
Banana Farming	3.40	9
Raffia Collecting	4.00	12
Fowl Farming	4.30	3

Potato Farming	4.83	8
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### K16 Community Infrastructure and Business Development and Ownership

Table 2: Community infrastructure and businesses present in the Ampisikina region as indicated by KIs; rank is the number of KIs that actually acknowledged the presence of each service in the region (1 being the most recognised).

Service or Business	Rank
Telephone	1
Radios	2
Primary School	3
Hospitals	4
Government School	5
Resident Doctor	5
Municipal Office	7
Secondary School	8
Gargotte	9
Religious Buildings	10
Televisions	11
Vanilla Business	11
Pirate Radio Station	13
Functioning Dispensaries	13
Food Markets	13
Private School	16
Food Stalls	16

Table 3: Origin of business workers in the Ampisikina region, as indicated by KIs. Based on % of KIs that indicated outside the region as the main origin compared to % of KIs that indicated within the region as the main origin.

Occupation	Origin	
	Outside Region	Inside Region
Doctor	100	
Teacher	67	33
Fishing	60	40
Crystal Collecting	50	50
Cattle Farming	12.5	87.5
Coconut Farming	11	89
Rice Farming	6	94
Crop Farming		100
Cassava Farming		100

Maize Farming		100
Potato Farming		100
Banana Farming		100
Vanilla Farming		100
Fowl Farming		100
Gargotte		100
Basket Weaving		100
Raffia Collecting		100
Carpenter		100

Table 4: Residence of business workers in the Ampsikina region, as indicated by KIs. Based on % of KIs that indicated outside the region as the main origin compared to % of KIs that indicated within the region or within the village as the main origin.

Occupation	Residence		
	Outside Region	Inside Region	Inside Village
Crop Farming			100
Rice Farming			100
Cassava Farming			100
Maize Farming			100
Potato Farming			100
Coconut Farming			100
Banana Farming			100
Vanilla Farming			100
Fowl Farming			100
Teacher			100
Doctor			100
Raffia Collecting			100
Carpenter			100
Gargotte		10	90
Cattle Farming	12.5		87.5
Fishing	37	3	60
Crystal Collecting	50		50
Basket Weaving		100	

K20 Methods and K23 Use Patterns (Timing)

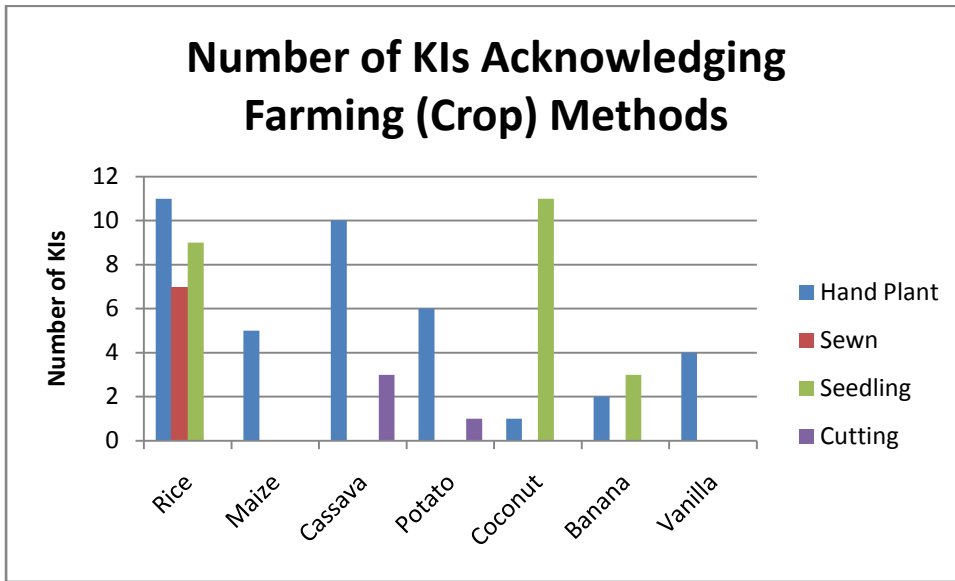


Figure 1: Planting methods for farming (crops) as indicated by KIs.

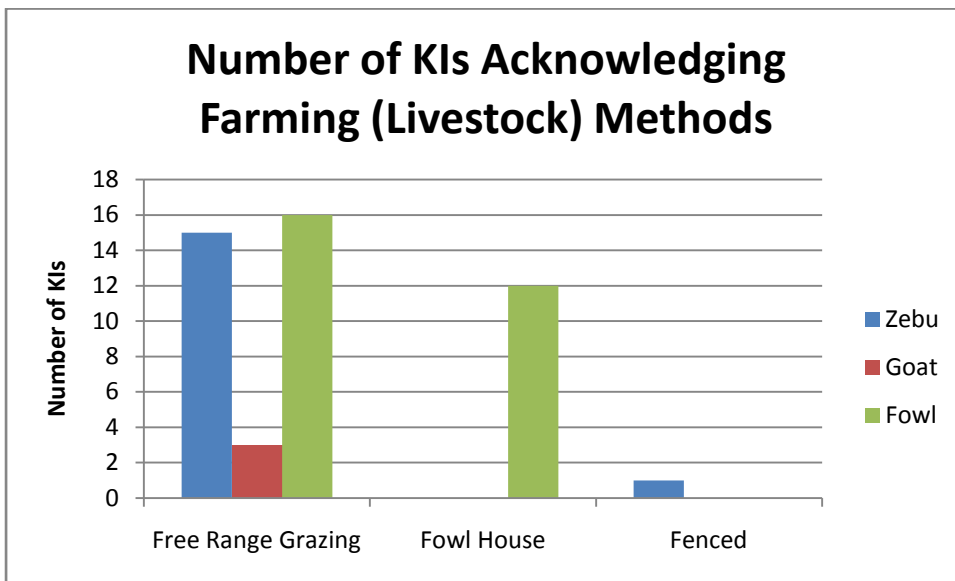


Figure 2: Raising methods for farming (livestock) as indicated by KIs.

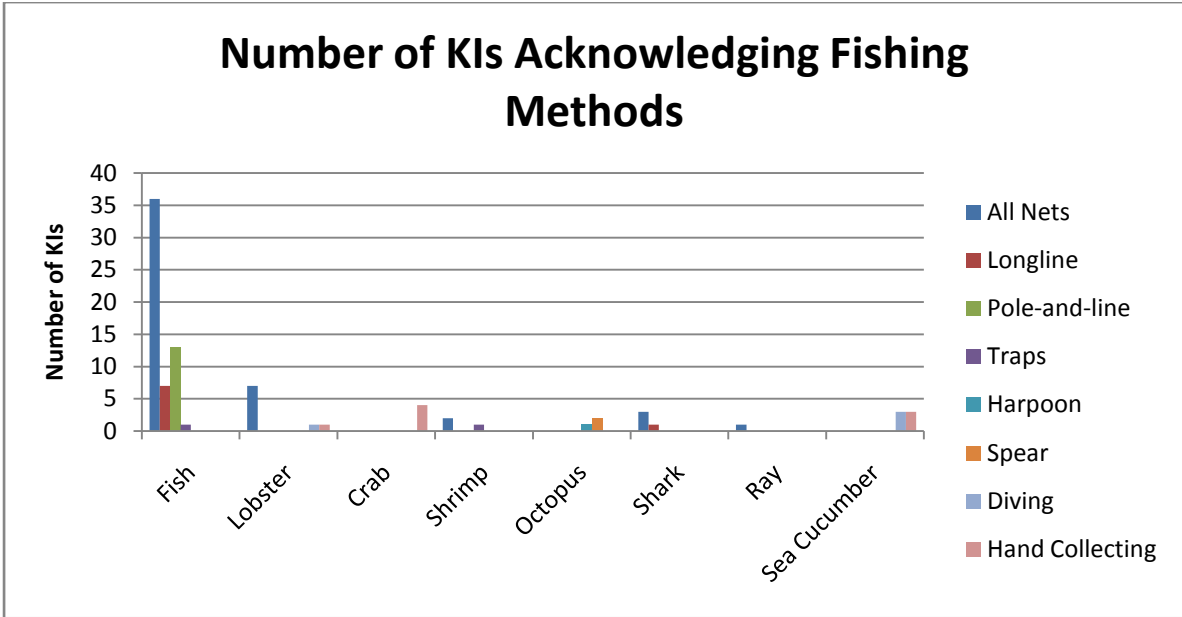


Figure 3a: Catching methods for fishing as indicated by KIs.

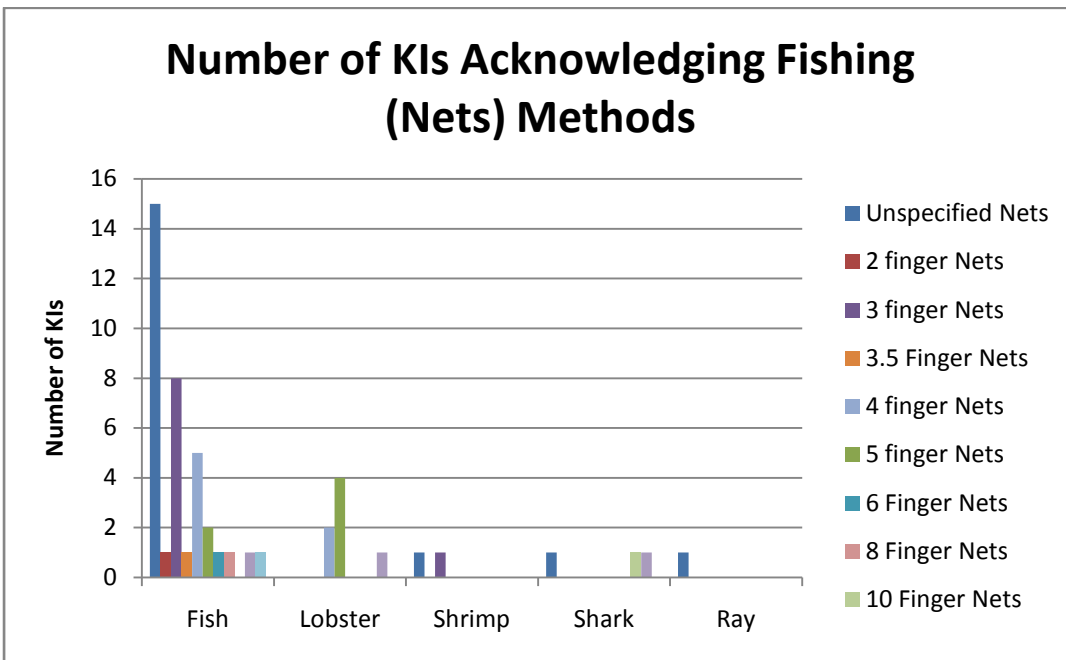


Figure 3b: Nets used for fishing as indicated by KIs.

Basket making is done by hand weaving raffia; raffia collection by retrieving from the forest; carpentry by mechanised saw mill and crystal collection by hand mining.

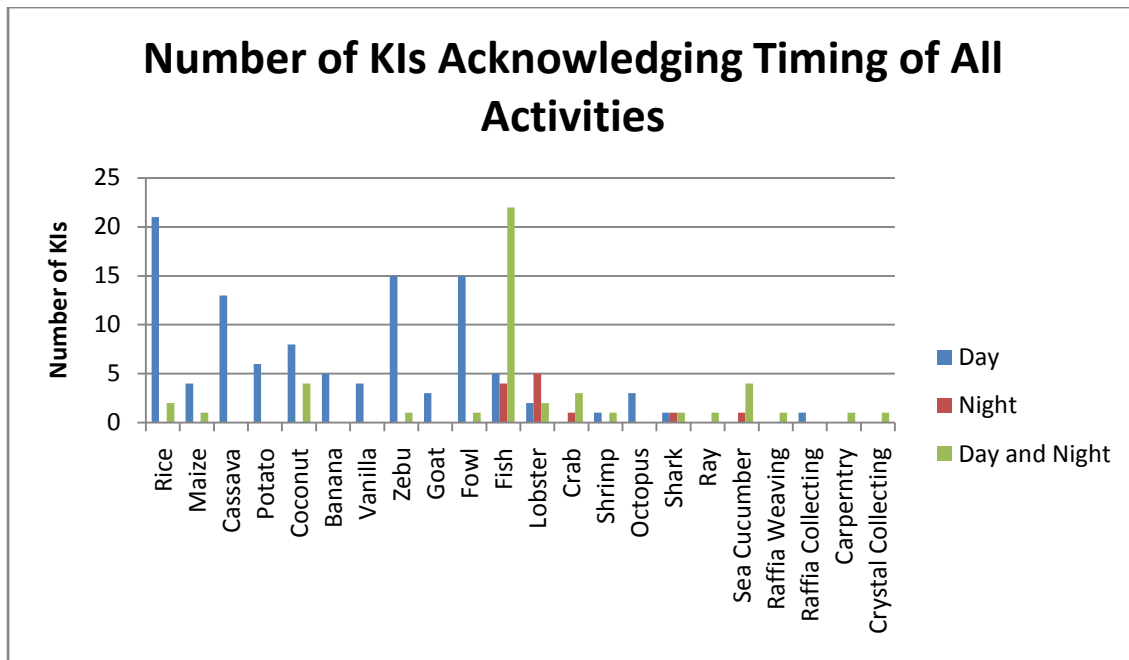


Figure 4: Timing for all activities as indicated by KIs.

**K23 Use Patterns (Season)**

Table 5: Season of each activity for the Ampisikina region; numbers show how many KIs indicated the activity taking place in each month. Green indicates peak season.

Activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rice	16	16	13	8	6	8	8	7	6	8	15	18
Maize	4	4	3	2	1	1				1	2	3
Cassava	7	7	7	7	7	10	8	6	5	7	7	9
Potato	5	5	5	5	5	7	5	4	3	3	3	4
Coconut	12	12	12	12	10	10	10	10	10	10	12	12
Banana	2	2	2	2	2	2	2	2	2	3	5	5
Vanilla	3	3	3	3	3	3	3	3	3	4	4	4
Zebu	16	16	16	16	16	16	16	16	16	16	16	16
Goat	3	3	3	3	3	3	3	3	3	3	3	3
Fowl	16	16	16	16	16	16	16	16	16	16	16	16
Fish	28	28	25	22	11	9	8	8	8	15	23	29
Lobster	3	3	4	5	5	7	7	7	7	7	3	2
Crab	3	3	4	4	4	4	4	4	4	4	3	3
Prawn	1	1				1	1			1	1	1
Octopus						1	1	1	1	1	1	
Shark	2	3	3	3	2						1	2
Ray	1	1	1	1	1	1	1	1	1	1	1	1
Sea Cucumber	5	5	5	5	4	1			1	2	3	5
Raffia Weaving	1	1	1	1	1	1	1	1	1	1	1	1
Raffia Collecting	1	1	1	1	1	1	1	1	1	1	1	1
Carpentry	1	1	1	1	1	1	1	1	1	1	1	1
Crystal Collecting	1	1	1	1	1	1	1	1	1	1	1	1

K25 Levels and Types of Impact

Table 6a: Impacts of each terrestrial activity for the Ampisikina region; numbers show how many KIs indicated each impact occurring for each activity. Green indicates least indicated impact.

Activity	Deforestation (Fences)	Deforestation (Coop)	Deforestation (Unspecified)	Deforestation (Timber)	Leaf Removal
Rice	10		10		
Maize	2		2		
Cassava	8		5		
Potato	4		3		
Coconut			4		
Banana	5				
Vanilla			1		
Zebu	8		6		
Goat	3				
Fowl	1	5	8		
Raffia Weaving					
Raffia Collecting					1
Carpentry				1	

Table 6b: Impacts of each marine activity for the Ampisikina region; numbers show how many KIs indicated each impact occurring for each activity. Green indicates least indicated impact.

Activity	Overfishing	Destroy Reef	Catch Juveniles
Fish	11		1
Lobster	1		
Crab	1		
Prawn	1		
Octopus		1	
Shark	1		
Ray	1		

Table 7: Level of impacts for the Ampisikina region; numbers show how many KIs indicated that level for each impact. Green indicates most common level of impact.

Impact	Low	Medium	High
Deforestation (Fences)	2	4	35
Deforestation (Coop)	5		
Deforestation (Unspecified)	15	5	19
Deforestation (Timber)			1
Leaf Removal	1		
Overfishing			16
Destroy Reef	1		
Catch Juveniles		1	

K24 Level of Use by Outsiders

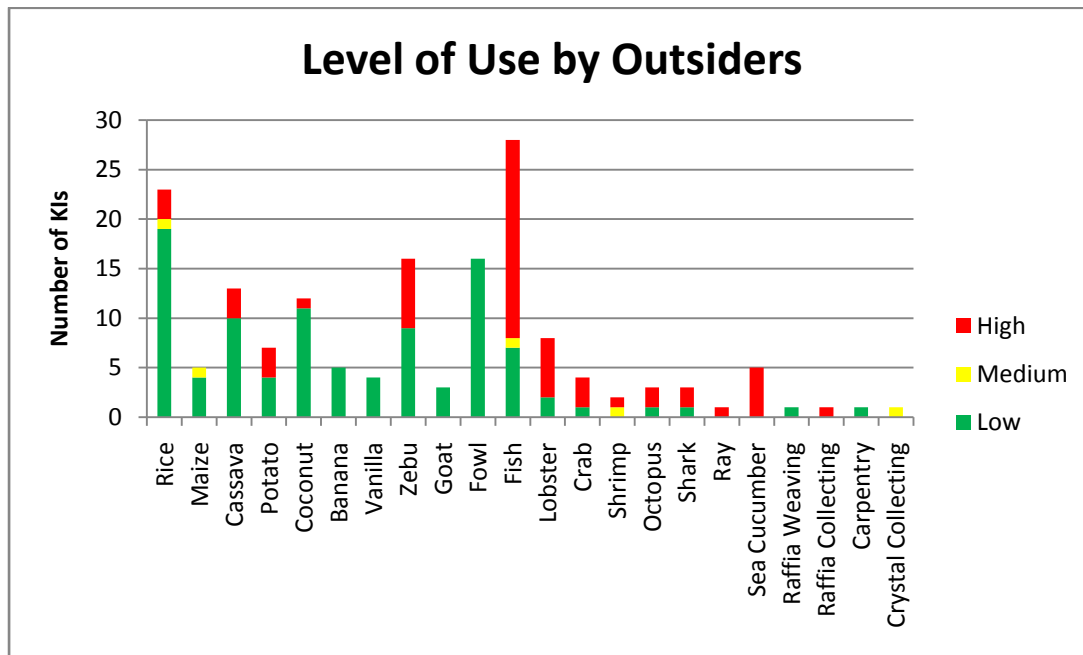


Figure 5: Outside use of each activity for the Ampisikina region; numbers show how many KIs indicated that level of use.

K21 Value of Goods and Services

Table 8: Monetary and perceived value of goods for the Ampisikina region as indicated by KIs. Green indicates most common perception of goods value.

Goods	Value Range	Value			
		Low	Medium	High	n/a; no value
Rice	300-400Ar per cup	2	4	10	6
Maize	200-300Ar per cup	1		2	2
Cassava	1,000Ar for 4; 1,000Ar per 1-6kg; 3,000Ar per 1-5kg	3	2	4	3
Potato	1,000Ar for 4; 1,000Ar per 1-6kg	4	1	2	
Coconut	400-1,000Ar for 1	5	4	2	1
Banana	1,000Ar for 12; 1,000Ar per 5-6kg	1		1	2
Vanilla	1,000-6,000Ar per kg	2			2
Zebu (milk)	n/a				13
Zebu (meat)	3,000-4,000Ar per kg	3	2	5	3
Zebu (total)	160,000-800,000Ar for 1	7	4	3	2
Goat (milk)	n/a				1
Goat (meat)	n/a				2
Goat (total)	80,000Ar for 1			2	1

Chicken	3,000-10,000Ar for 1	4	5	8	
Chicken Eggs	200-300Ar for 1		2	2	10
Duck	4,000-20,000Ar for 1	5	2	4	1
Duck Egg	200-350Ar for 1	4	2	2	3
Goose	20,000-25,000Ar for 1			3	
Goose Eggs	<i>n/a</i>				3
Duck (Dokitry)	7,000-12,000Ar for 1	2		3	
Duck (Dokitry) Eggs	250Ar for 1	1			5
Fish	500-2,000Ar per kg; 1,000Ar per 1.5-5kg; 1,000Ar for 1-20; 1,000-5,000Ar for 8; 140,000Ar for 70x70x70cm basket	19	6	3	
Lobster	6,000-10,000Ar per kg	5	2	1	
Crab	1,000Ar per 1-2kg; 1,000Ar for 5	3	1		
Prawn	500Ar per kg; 300Ar for 20	2			
Octopus	1,000Ar per 1-2kg	1	2		
Shark	50,000-160,000Ar per fin; 1,000Ar per kg	1	1	1	
Ray	1,000Ar for 1	1			
Sea Cucumber	1,000-160,000Ar per kg	1	2	2	
Raffia Basket	1,000Ar for 1	1			
Raffia Mat	3,000-4,000Ar for 1	2			
Crystal	3,000,000-20,000,000Ar per kg	1			
Chair	15,000Ar for 1	1			

K22 Target Markets and Marketing Mechanisms

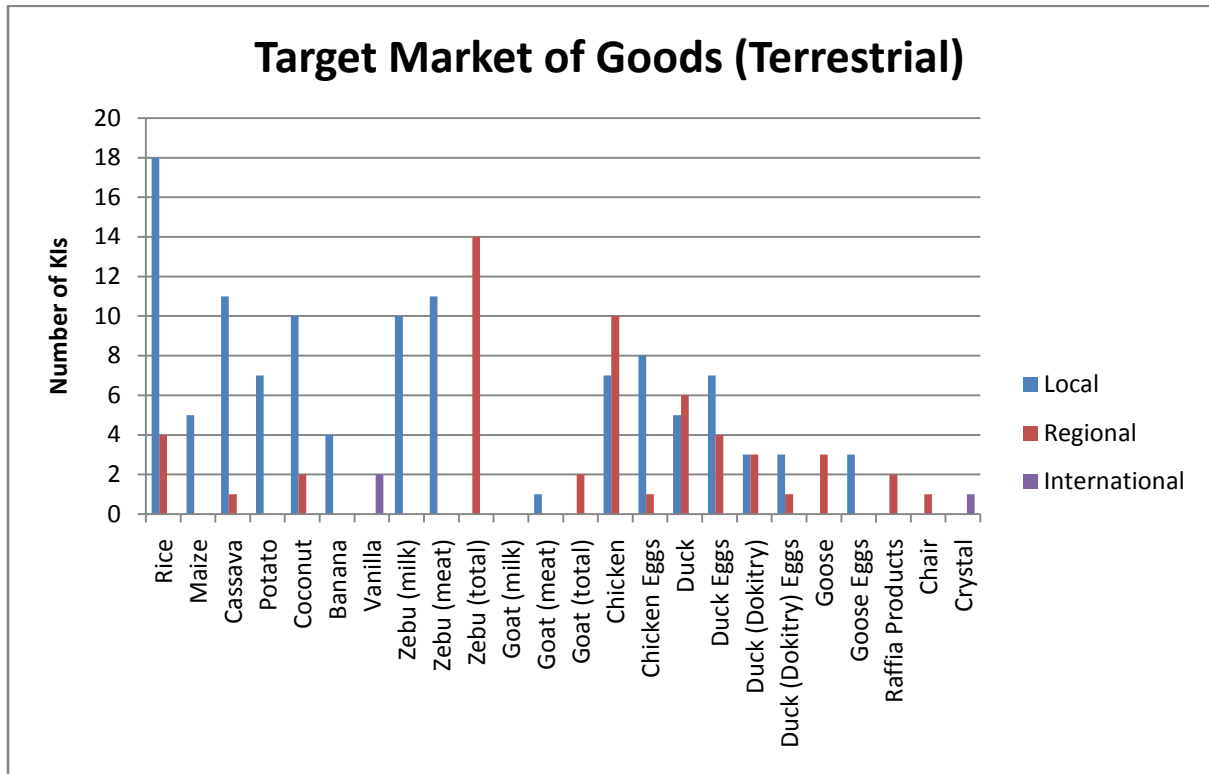


Figure 6a: Target market of each good (terrestrial) for the Ampisikina region as indicated by KIs.

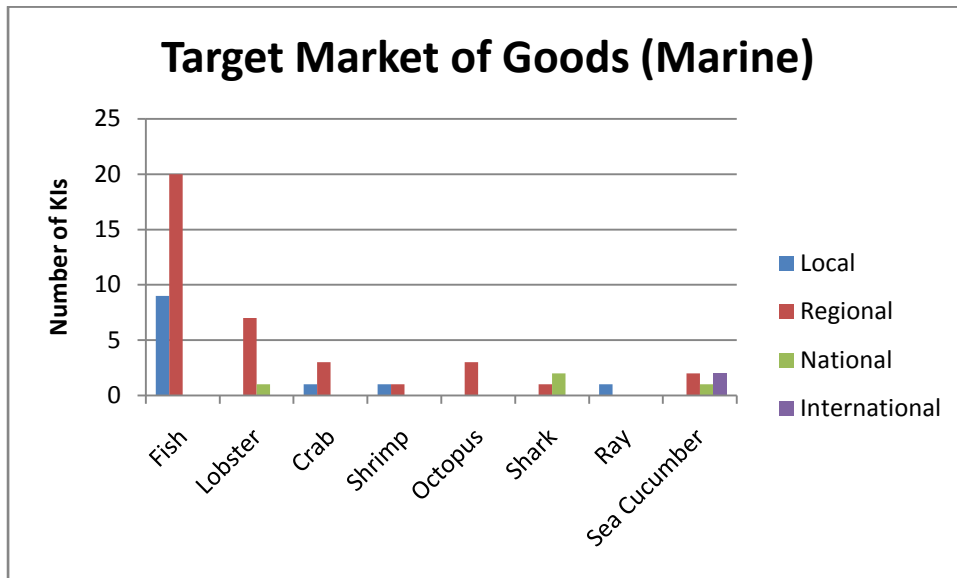


Figure 6b: Target market of each good (marine) for the Ampisikina region as indicated by KIs.

K26 Use of Goods and Services

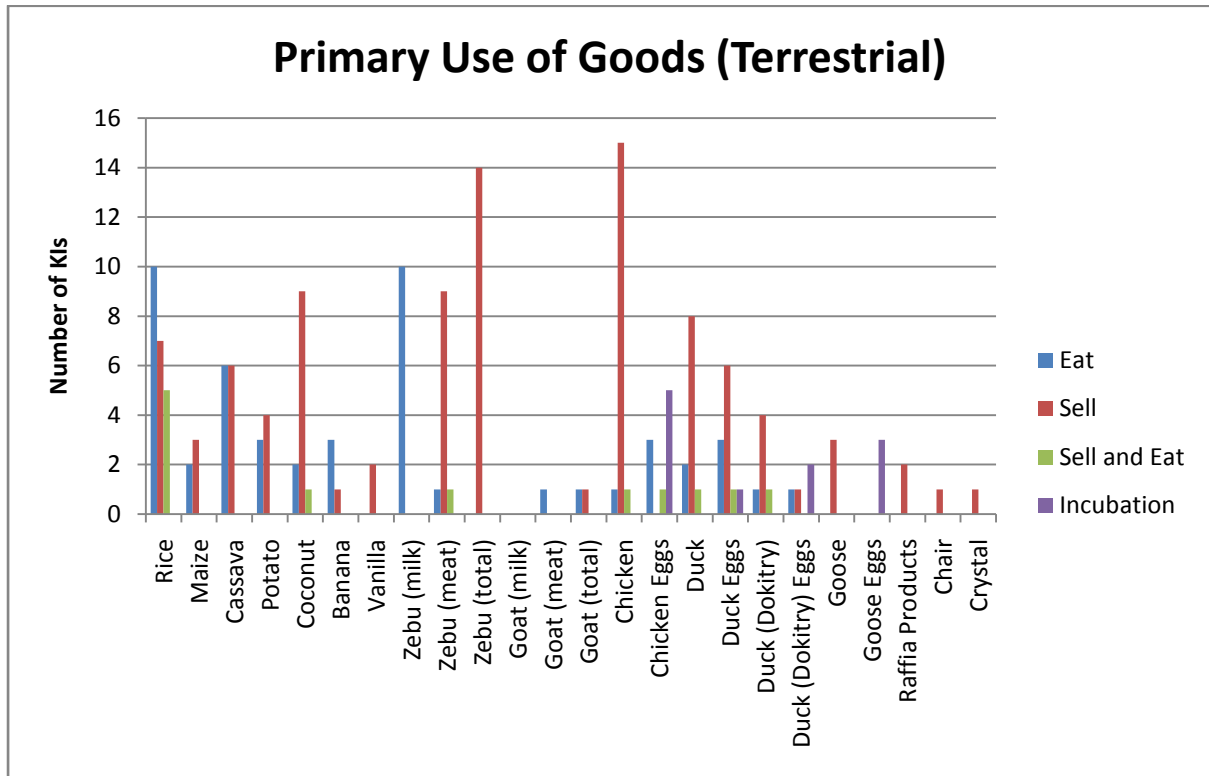


Figure 7a: Primary use of each good (terrestrial) for the Ampisikina region as indicated by KIs.

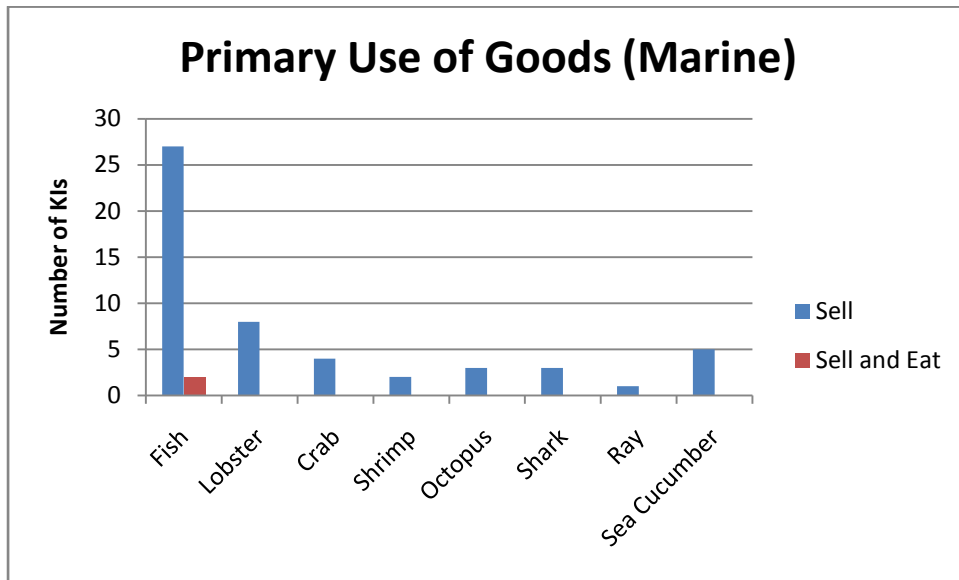


Figure 7b: Primary use of each good (marine) for the Ampisikina region as indicated by KIs.

## K2 Stakeholders

Table 9: Stakeholder line for goods produced in the Ampisikina region as indicated by KIs.

<b>Activity</b>	<b>Goods</b>	<b>Stakeholder 1</b>	<b>Stakeholder 2</b>	<b>Stakeholder 3</b>	<b>Number of KIs</b>
Farming	Crops	Farmer	Consumer		7
Farming	Rice	Farmer	Collector	Consumer	4
Farming	Rice	Farmer	Consumer		10
Farming	Rice	Collector	Consumer		1
Farming	Rice	Farmer			5
Farming	Rice	Consumer			1
Farming	Maize	Farmer	Consumer		2
Farming	Maize	Farmer			1
Farming	Cassava	Farmer	Collector	Consumer	1
Farming	Cassava	Farmer	Consumer		3
Farming	Cassava	Farmer			1
Farming	Cassava	Consumer			1
Farming	Potato	Farmer	Consumer		1
Farming	Coconut	Farmer	Collector	Consumer	6
Farming	Coconut	Farmer	Consumer		4
Farming	Coconut	Farmer			1
Farming	Banana	Farmer	Consumer		1
Farming	Banana	Farmer			1
Farming	Banana	Consumer			1
Farming	Vanilla	Farmer	Collector	Trader	2
Farming	Zebu (milk)	Farmer	Consumer		1
Farming	Zebu (milk)	Consumer			1
Farming	Zebu (meat)	Farmer	Trader	Consumer	1
Farming	Zebu (meat)	Consumer			1
Farming	Zebu (total)	Farmer	Collector	Consumer	10
Farming	Zebu (total)	Farmer	Butcher	Consumer	1
Farming	Zebu (total)	Farmer	Trader	Consumer	1
Farming	Zebu (total)	Farmer	Consumer		1
Farming	Zebu (total)	Collector	Consumer		1
Farming	Goat	Farmer	Collector	Consumer	1
Farming	Goat	Farmer	Consumer		1
Farming	Fowl	Farmer	Collector	Consumer	8
Farming	Fowl	Farmer	Consumer		7
Fishing	Fish	Fisherman	Collector	Consumer	20

Fishing	Fish	Fisherman	Consumer		8
Fishing	Prawn	Fisherman	Collector	Consumer	1
Fishing	Prawn	Fisherman	Consumer		1
Fishing	Lobster	Fisherman	Collector	Consumer	8
Fishing	Crab	Fisherman	Collector	Consumer	3
Fishing	Crab	Fisherman	Consumer		1
Fishing	Octopus	Fisherman	Collector	Consumer	2
Fishing	Shark	Fisherman	Collector	Consumer	1
Fishing	Shark	Fisherman	Collector	Trader	2
Fishing	Sea Cucumber	Fisherman	Collector	Consumer	1
Fishing	Sea Cucumber	Fisherman	Collector	Trader	3
Weaving	Raffia Products	Weaver	Buyer		1
Raffia	Raffia Materials	Weaver	Collector	Consumer	1
Carpentry	Wood Products	Carpenter	Contractor		1
Crystal	Crystal	Miner	Collector	Trader	1

K28 Management Body; K29 Management Plan; K30 Enabling Legislation; K32 Formal Tenure/Rules

Table 10: Number of KIs indicating the presence of different forms of governance.

<b>Activity</b>	<b>Management Body</b>	<b>Management Plan</b>	<b>Enabling Legislation</b>	<b>Formal Tenure</b>	<b>Relevant Rules and Regulations</b>
Farming					1
Crop Farming	3		1		1
Rice Farming		1			
Cattle Farming	3	1	2	3	
Fowl Farming			1		
Fishing	6	6	7	3	5
Raffia Weaving		1			
Carpentry		1			
Crystal Collection		1			

K33 Informal Tenure and Rules, Customs and Traditions

Table 11: Number of KIs indicating the presence of different forms of informal governance and traditions (fady's).

Activity	Customs and Traditions	Informal Tenure	Informal Rules
Farming	7		
Crop Farming	14		1
Rice Farming	3		
Cattle Farming	5		3
Fishing	21		2
Crystal Collection	1		

Table 12: Level of compliance to informal tenure and rules, customs and traditions as indicated by KIs. Green indicates the most common level of compliance.

Activity (Governance Type)	Level of Compliance			
	Low	Medium	High	n/a
Farming (Customs and Traditions)		2	5	
Crop Farming (Customs and Traditions)	2		12	
Crop Farming (Informal Rules)				1
Rice Farming (Customs and Traditions)		1	2	
Cattle Farming (Customs and Traditions)			5	
Cattle Farming (Informal Rules)			3	
Fishing (Customs and Traditions)	2		19	
Fishing (Informal Rules)	1		1	
Crystal Collection (Customs and Traditions)			1	

*[Numbers shown in tables and figures may be higher than the number of KIs actually surveyed. This is due to any KI being able to describe more than 1 method for any given coastal/terrestrial activity and then expanding these methods into different/multiple locations, times, seasons, impacts etcetera].*



## ***Infrastructure and Business***

### **K16 Community infrastructure and Business development and ownership**

Circle which services or businesses exist in the area

*Use the empty space to add any other services or businesses available*

Primary school	Secondary school	Private schools	Government school	Pirate radio station	Municipal office	Religious buildings	Banking services
Functioning dispensaries	Resident doctor	Resident nurse	Hospitals	Ice plant	Tarmac road access	Water supply to homes	Electricity
Telephone	Internet access	Timber business	Mining company	Food markets	Food stalls	Gas stations	Radios
Televisions	Newspapers	Sewage treatment plant	Banks	Specialty shops	Guest houses	Vanilla business	Clove business
Litchi business							

Occupation	Place of Origin; Place of Residence	Rank





**K2 Stakeholders**

Coastal Activity*	Stakeholder Group 1	Stakeholder Group 2	Stakeholder Group 3

\* develop list according to activities identified in *Activities* (K18) and activities observed

**K27 Tourist profile**

Do any tourists visit this site?

Please give as much detail as possible

## **Governance**

### **K28 Management Body, K29 Management Plan, K30 Enabling Legislation, K32 Formal Tenure and Rules**

Complete the following tables (see Appendix A K28-32 for examples of how to complete the table):

Coastal Activity*	Management Body(s) (Yes/No) & Name	Management Plan (Yes/No)	Enabling Legislation (Yes/No)	Formal Tenure and Rules(Yes/No)	Relevant Rules and Regulations (Yes/No)

\*develop list according to activities identified in *Activities* (K18)

### **K33 Informal Tenure and rules, customs and traditions**

Coastal Activity*	Customs and Traditions e.g. Fady	Informal Tenure Arrangements	Informal Rules	Level of Compliance (H/M/L)

**K36 Community and Stakeholder Organizations**

Complete the following table:

Community Organization	Formal or Informal	Main Functions	Influence (on coastal management; community issues; both; none)

**K37 Power and Influence**

List which organizations or individuals are involved in making decisions about your activities (i.e. where, when, how, and who can carry out this activity)?

Who (activity, age, gender) else (not necessarily part of an official process) has to be consulted for the activity to be carried out, expanded or changed?

Where do you get information from about marine and coastal resources (e.g. NGO, social group, news papers)?