seed madagascar
sustainable environment, education & development

UKaid from the British people
DARWIN INITIATIVE

A Report for

COVID-19 RAPID RESPONSE

Characterising the Elodrato and Sainte Luce Elasmobranch Fisheries

Jessica Savage

April - 2021

1 Summary

Within small-scale fisheries in the southeast of Madagascar, most fishing effort currently targets spiny lobsters. Empirical data and local fisher knowledge suggest significant declines in lobster stock and there are concerns that further decreases in lobster stock could increase fishing pressure on elasmobranchs. However, little is known about the elasmobranch fishery in this region. To gain a greater understanding of the elasmobranch fishery, a series of semi-structured interviews were carried out with fishers in the communities of Elodrato and Sainte Luce in March 2020. Interviews revealed that in these communities, elasmobranchs are caught incidentally, mainly by handlines and gill nets. The majority of fishers have perceived a decrease in their elasmobranch catch since they began engaging with the fishery. Elasmobranchs are primarily sold, rather than consumed, and the vast majority of fishers are involved in the shark fin trade. Although lobster fishing is the higher contributor to annual household income, elasmobranch fishing is an important source of income during the national closed season for lobster. Further declines in lobster stock therefore continue to pose a threat to elasmobranchs.

Recommended citation:

Savage, J. (2021). Characterising the Elodrato and Sainte Luce Elasmobranch Fisheries. A report for the Darwin Initiative. SEED Madagascar.

2 Table of Contents

3 Introduction

Across Madagascar, a country identified as a hotspot for shark and ray biodiversity, elasmobranchs (sharks, rays and skates) are heavily exploited in both industrial and small-scale fisheries (Baker-Médard & Faber, 2020; Cripps, Harris, Humber, Harding, & Thomas, 2015; Humber, Andriamahefazafy, Godley, & Broderick, 2015). In the southeast region, coastal communities are highly reliant on marine resources for livelihoods, as few alternatives exist, and poverty is widespread (Healy, 2018; Savage, 2020). Although elasmobranchs are exploited in the southeast by small-scale fishers, small-scale elasmobranch fishing is not as prevalent as in other areas of Madagascar, such as the west coast (Cripps et al., 2015). Currently, small-scale fisheries in the southeast target spiny lobsters. However, both limited empirical data and local fisher knowledge suggest significant declines in lobster stock (Long, 2017; Sabatini, Salley, & Ramanamanjato, 2008). Elasmobranchs are caught in the wider fishery and there are concerns that further declines in lobster stock could result in increased fishing pressure on elasmobranchs.

To improve the sustainability of the lobster fishery and contribute to poverty alleviation, SEED Madagascar initiated Project Oratsimba. This community-based fisheries management project is currently funded by the Darwin Initiative and has supported the communities of Elodrato and Sainte Luce to establish Locally Managed Marine Areas with periodic No Take Zones. Project Oratsimba aims to secure lobster fishing as a livelihood, which in turn will mitigate the threats posed to biodiversity, including elasmobranchs, caught within the wider fishery.

To support lobster fisheries management, it is critical to understand the socioeconomic importance of the wider fishery. However, little is known about the existing elasmobranch fisheries in these communities, the social and economic drivers of elasmobranch fishing, and how lobster management measures influence elasmobranch fishing practices. Furthermore, with Covid-19 causing significant disruptions to lobster fishing activities and the lobster value chain, it is necessary to understand how Covid-19 has impacted elasmobranch fishing activities. This study presents the results of interviews conducted with elasmobranch fishers in Elodrato and Sainte Luce to fill some of the knowledge gaps identified. This report can also serve as a baseline to determine any future changes in elasmobranch fishing practices and socioeconomic drivers.

4 Methods

This study adhered to SEED's Human Research Code of Ethics and permission was sought from community leaders. Participation was voluntary and informed consent was obtained verbally.

To increase understanding of the elasmobranch fisheries of Elodrato and Sainte Luce, semi-structured interviews were conducted with elasmobranch fishers from each community. The interview questions were designed to collect qualitative data related to elasmobranch fishing behaviour, the socioeconomic value of the fishery, the shark fin value chain, and the socioeconomic impacts of Covid-19 on the fishery. Participants were recruited at the landing site over a period of seven days in Elodrato and five days in Sainte Luce. Interviews were conducted by local data collectors using mobile data collection (Open Data Kit software) and lasted approximately 25 minutes. Qualitative data were analysed using manual thematic analysis.

5 Results

In March 2021, 49 elasmobranch fishers from Elodrato and 48 from Sainte Luce were interviewed. 100.0% of participants were male, due to sea fishing being an activity conducted exclusively by males in these communities. The mean age of fishers was 40 (range: 18 – 70). In Elodrato the mean number of years engaged in elasmobranch fishing was 21 (range: 6 – 35), and in Sainte Luce the mean number of years engaged in elasmobranch fishing was 20 (range: 4 – 36). This suggests that elasmobranch fishing may have been practiced as far back as 1975 in Sainte Luce and 1986 in Elodrato. This is further supported by evidence from the neighbouring community of Itapera

(located south of Sainte Luce), where shark fishing has been practiced since at least 2001, and possibly as far back as the 1970s (Azafady, 2002; SEED Madagascar, 2018).

5.1 Target Species

Target species were similar between communities. Few fishers, 2.0% in Elodrato and 4.2% in Sainte Luce, reported deliberately targeting elasmobranchs. Instead, almost all fishers reported that when they caught elasmobranchs, they did not have a predetermined target species but instead landed anything they caught. This was reported by 95.9% of fishers in Elodrato and 95.8% in Sainte Luce (Table 1).

Table 1. Target species identified (% of fishers) disaggregated by community.

Target	Elodrato (n=49)	Sainte Luce (n=48)
Elasmobranchs	2.0	4.2
Other marine species	2.0	0.0
No target species	95.9	95.8

5.2 Gear

A total of five categories of fishing gear used to catch elasmobranchs in Elodrato and Sainte Luce were identified: handline, net (other; deployment method not specified, consisted of both nylon nets and nets constructed from locally available materials), *jarifa* (baited gill net with larger mesh size), *palangre* (longline) and *ZDZD* (non-baited gill net with a smaller mesh size, which traps pelagic fish that subsequently act as bait) (Cripps et al., 2015). In Sainte Luce, the majority of fishers, 89.6%, reported using only one type of gear, whereas in Elodrato only a minority of fishers, 34.6%, reported using only one type of gear. In Sainte Luce, handlines were the most commonly reported gear used to catch both sharks and rays, reported by 89.6% and 85.4% of fishers respectively. The Sainte Luce fisheries *dina* (local law, legally ratified in September 2019) prohibits the use of nets for lobster fishing, which could explain why very few fishers reported using any form of net for elasmobranch fishing. In Elodrato, there was no commonly reported type of fishing gear used for both sharks and rays. However, compared to Sainte Luce, few fishers reported using handlines and the majority reported using one or more types of net (Figure 1).

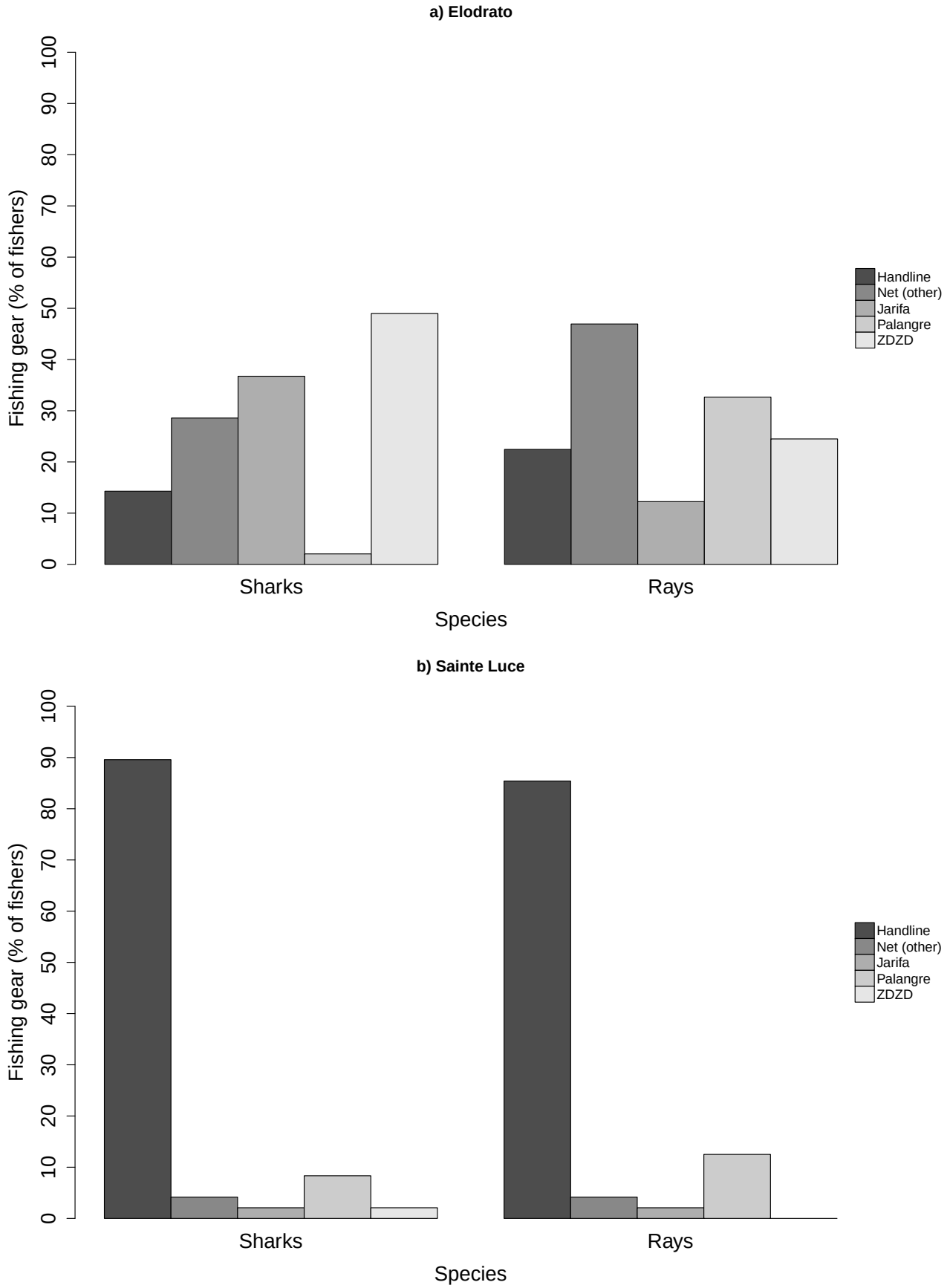

Figure 1. Types of gear used (% of fishers) diasaggregated by species for a) Elodrato (n=49) and b) Sainte Luce (n=48).

5.3 Seasonality

The majority of fishers reported seasonality in shark catch; 89.8% of fishers in Elodrato and 72.9% of fishers in Sainte Luce reported that there were certain months when sharks were caught more frequently. When asked to identify months in which sharks were caught frequently, fishers from both communities gave similar responses.

The consensus amongst fishers was that sharks were most commonly caught between October and March, with the peak being in December (Figure 2). Seasonality in ray catch was less apparent. 36.7% of fishers in Elodrato and 54.2% of fishers in Sainte Luce reported that there were certain months when rays were caught more frequently, although there was no clear consensus as to when perk months were.

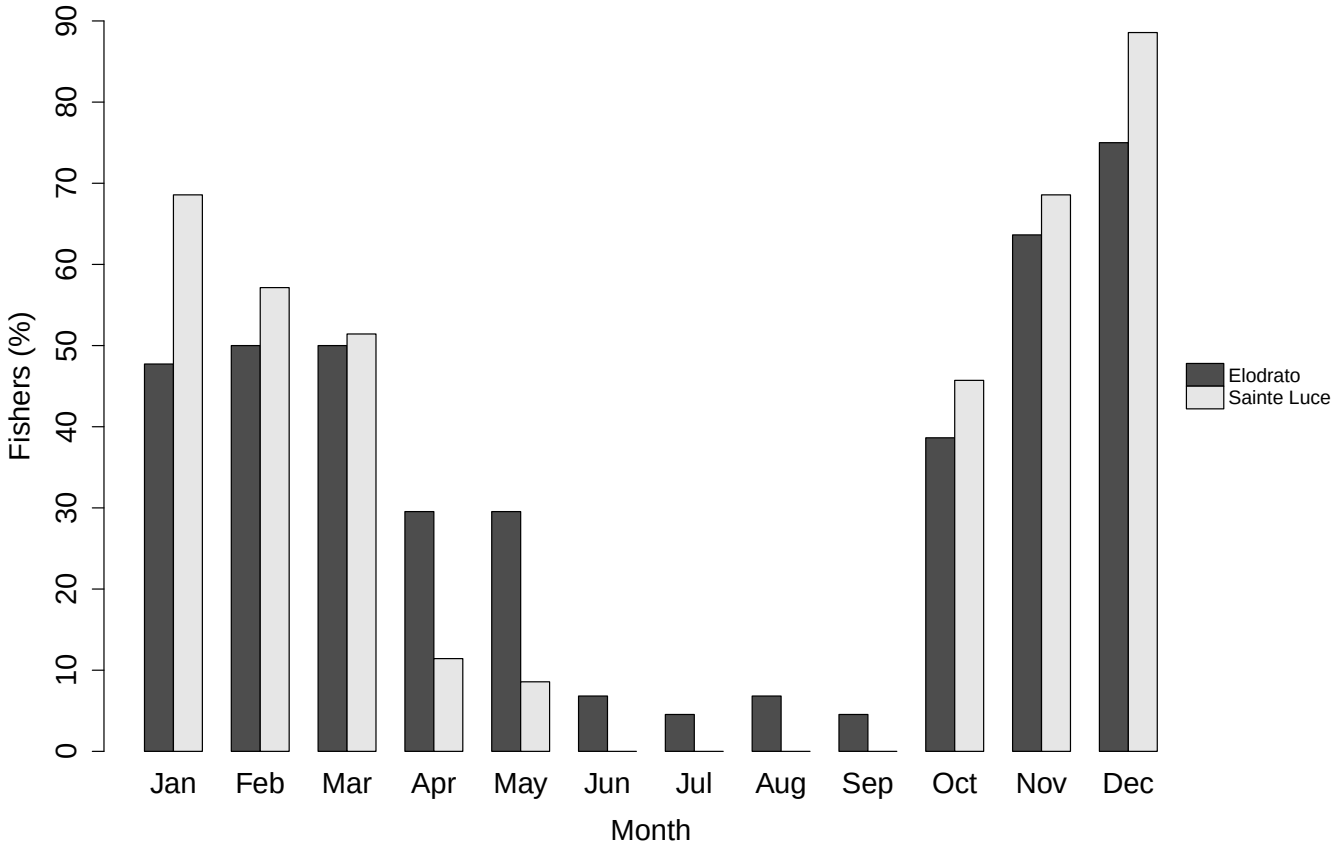

Figure 2. Identification of months where sharks were caught frequently (% of fishers) disaggregated by community (Elodrato n=44 and Sainte Luce (n=35).

5.4 Change in Catch Over Time

In both communities, the majority of fishers perceived a decrease in their elasmobranch catch since they began fishing. This was reported by 91.8% of fishers in Elodrato and by 72.9% of fishers in Sainte Luce (Figure 3). In lieu of any evidence to the contrary, it is reasonable to assume that the fishing effort exerted by individuals has not changed significantly. Thus, changes in fisher behaviour do not explain the decrease in catch that was consistently reported. Therefore the widespread perceptions of declining individual catch suggests that catch per unit effort (CPUE) has declined. Treating CPUE as a proxy for abundance, the data suggests the elasmobranch population has decreased.

There is no measure of total effort expended in the fishery (i.e. the number of fishers and time spent fishing), though it is thought that the number of fishers has increased in recent years. It is therefore unclear whether the total annual elasmobranch catch within the fishery is decreasing or increasing. This will depend on the rate at which CPUE is declining and the extent to which this is offset by increases in the number of fishers and the collective effort they expend.

The survey found that 75 of the 80 fishers who reported a decreased in their catch perceived one or more causes of decline, which were grouped into eight categories. The most commonly reported perceived cause of decline in both communities was an increased number of fishers operating within the fishery, reported by 71.4% of fishers in Elodrato and 63.3% of fishers in Sainte Luce. In Elodrato, fishing with nets was also a commonly reported perceived cause of decline, reported by 50.0% of fishers. In Sainte Luce there was no other commonly reported perceived cause of decline (Table 2).

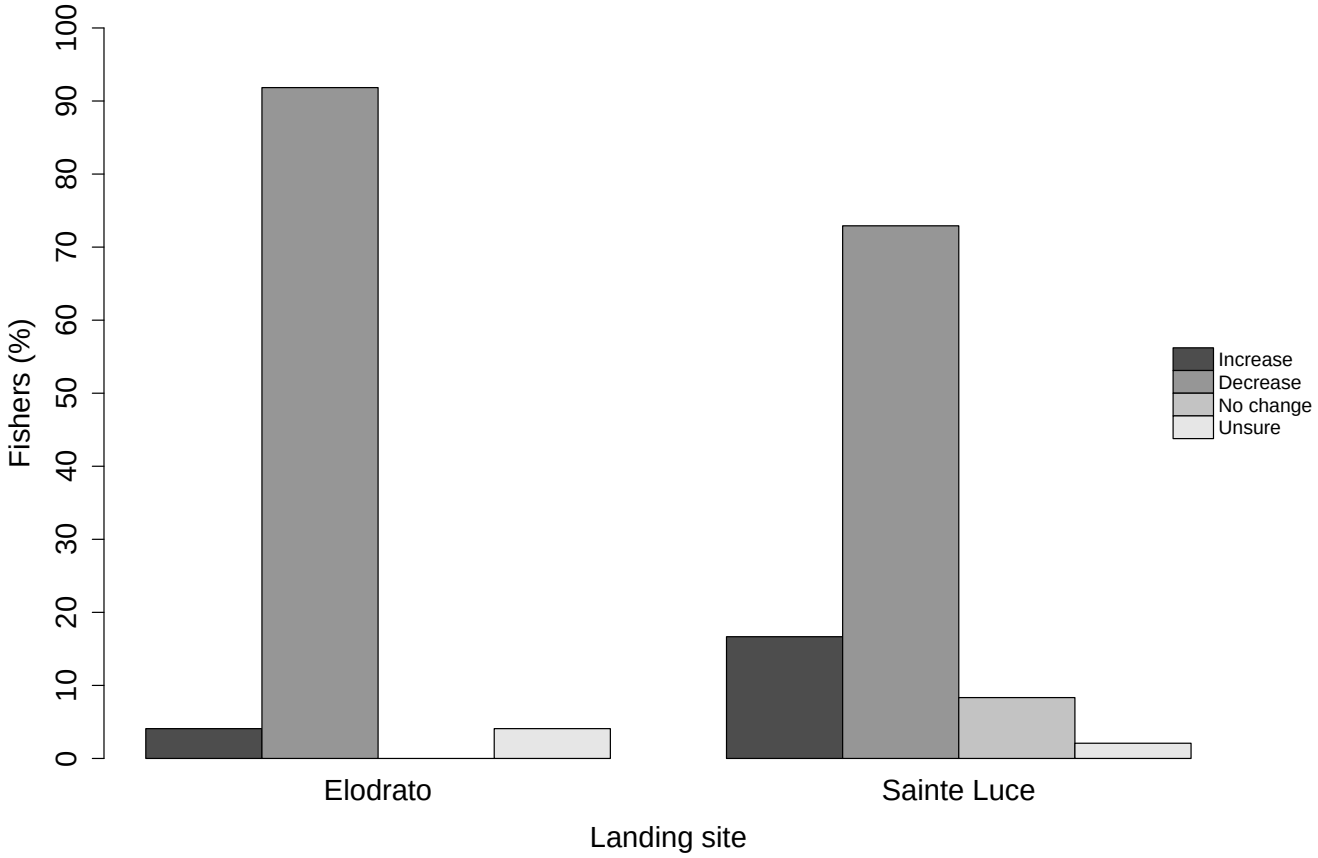

Figure 3. Perceived change in elasmobranch catch over time reported by fishers (%) disaggregated by community (Elodrato n= 49, Sainte Luce n=48).

Table 2. Perceived causes of declines in elasmobranch catch over time reported by fishers (%) disaggregated by community.

Cause	**Elodrato (n=45)**	**Sainte Luce (n=35)**
Increased number of fishers operating in the fishery	71.4	63.3
Fishing with nets	50.0	6.1
Declining elasmobranch stock	7.1	24.2
Elasmobranch behaviour (net avoidance, seeking deeper water)	19.0	3.0
Climate change or weather	0.0	15.2
Illegal fishing	2.4	9.1
Changes in fishing methods (gear, distance travelled)	2.4	6.1
Inadequate gear for elasmobranch fishing	4.8	0.0

In Elodrato, there were widespread perceptions of decreases in the size of individual elasmobranchs caught since fishers began fishing for elasmobranchs, reported by 85.7% of fishers. In Sainte Luce, perceived changes in the size of individuals were more varied. The most widespread perception in Sainte Luce was a decrease in size, reported by 50.0% of fishers followed by no change reported by 35.4% of fishers (Figure 4).

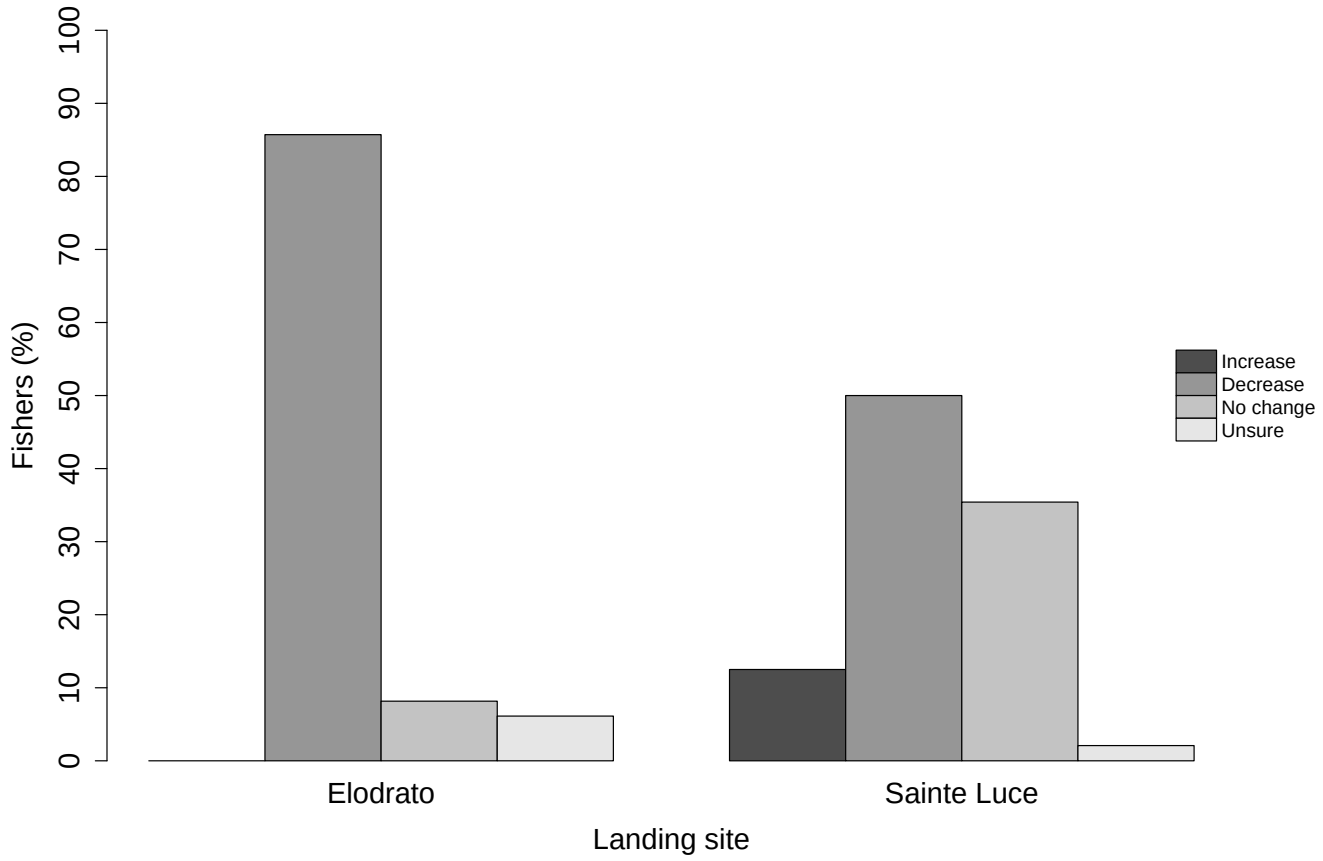

Figure 4. Perceived change in size of individual elasmobranchs caught over time reported by fishers (%) disaggregated by community (Elodrato n= 49, Sainte Luce n=48).

5.5 Income

The majority of fishers in both communities, 93.9% in Elodrato and 72.9% in Sainte Luce, reported that lobster fishing generated more income annually than elasmobranch fishing (Figure 5). Of those fishers identifying lobster fishing as generating the most income annually, 80.4% of fishers in Elodrato and 97.1% of fishers in Sainte Luce reported that this was due to the high value of lobsters. Few fishers identified elasmobranch fishing as generating the most income annually; 4.1% in Elodrato and 18.8% in Sainte Luce. However, reliance on elasmobranch fishing income was not consistent between the national open and closed seasons for lobster fishing. In both communities, reliance on elasmobranch fishing as an important source of household income was significantly higher during the national closed season for lobster fishing compared to the national open season for lobster fishing. Reliance during the closed season was similar between communities but was significantly higher during the open season for Sainte Luce. In Elodrato, 98.0% of fishers reported reliance during the closed season compared to 20.4% during the open season. In Sainte Luce, 98.0% of fishers reported reliance during the closed season compared to 52.1% during the open season (Figure 6).

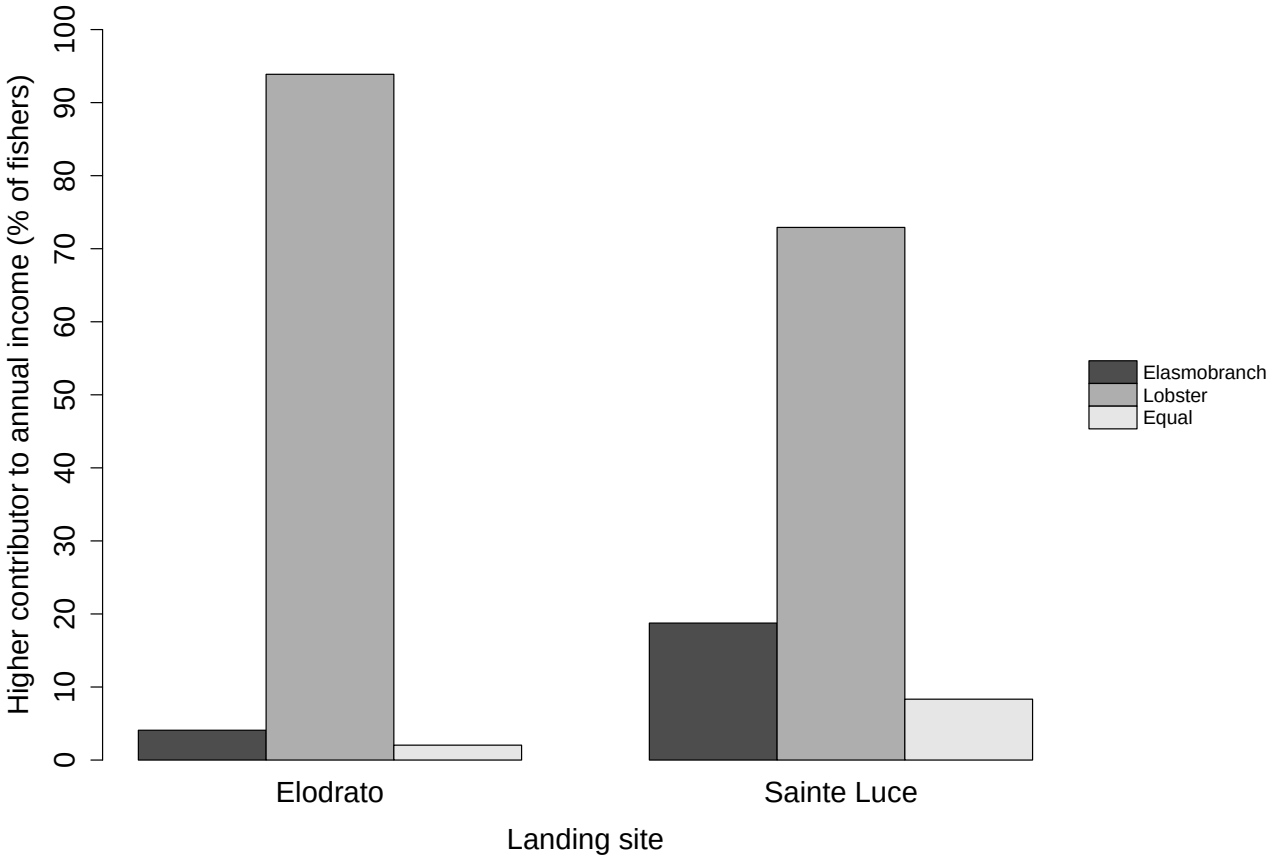

Figure 5. Identification of the higher contributor to annual household income (% of fishers) disaggregated by community (Elodrato n= 49, Sainte Luce n=48).

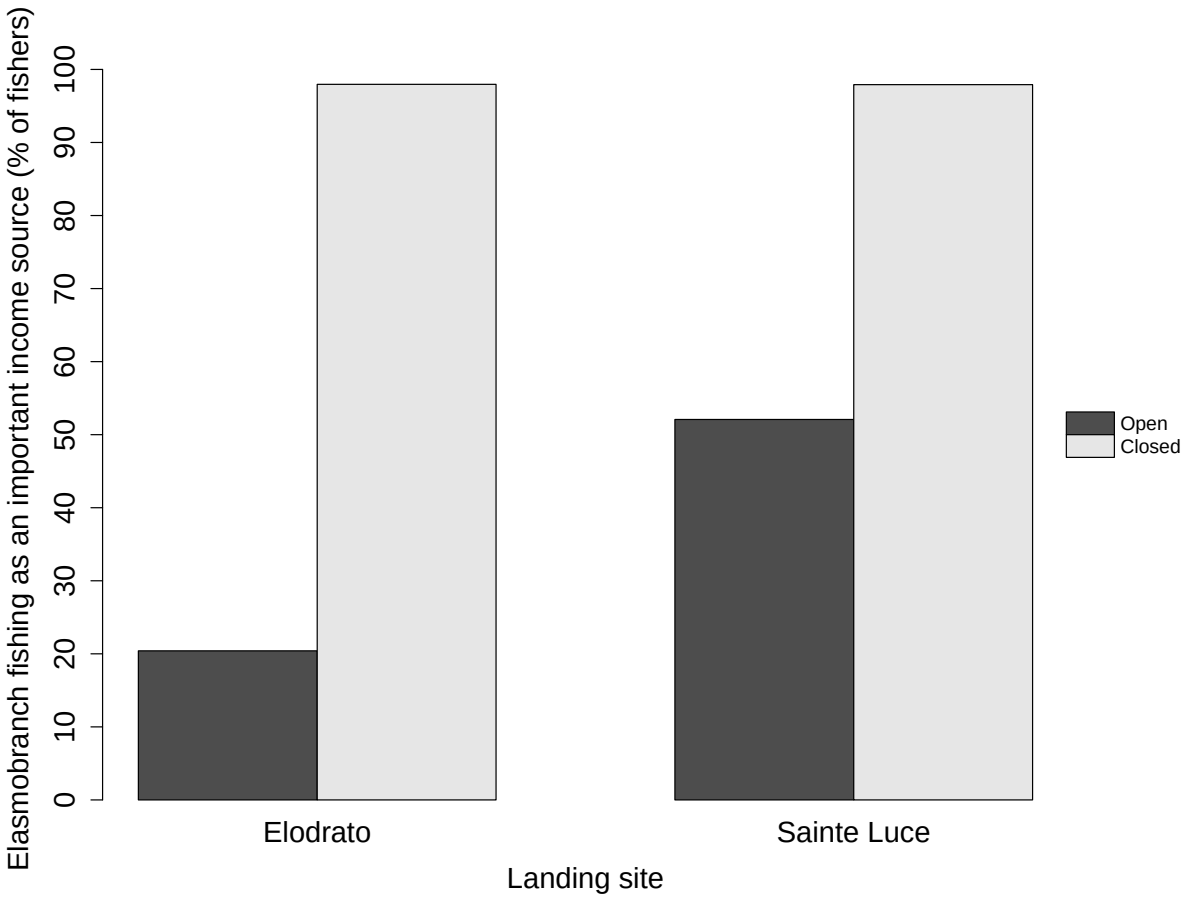

Figure 6. Identification of reliance on elasmobranch fishing as an important source of income during the national open and closed seasons for lobster fishing (% of fishers) disaggregated by community (Elodrato n= 49, Sainte Luce n=48).

The reported frequency of income from elasmobranch fishing was similar between communities. Although an important source of income, elasmobranch fishing was reported by the majority of fishers to generate income only occasionally; reported by 61.2% of fishers in Elodrato and 54.2% of fishers in Sainte Luce. Few fishers in each community reported daily income from elasmobranch fishing; 14.3% of fishers in Elodrato and 18.8% of fishers in Sainte Luce (Figure 7).

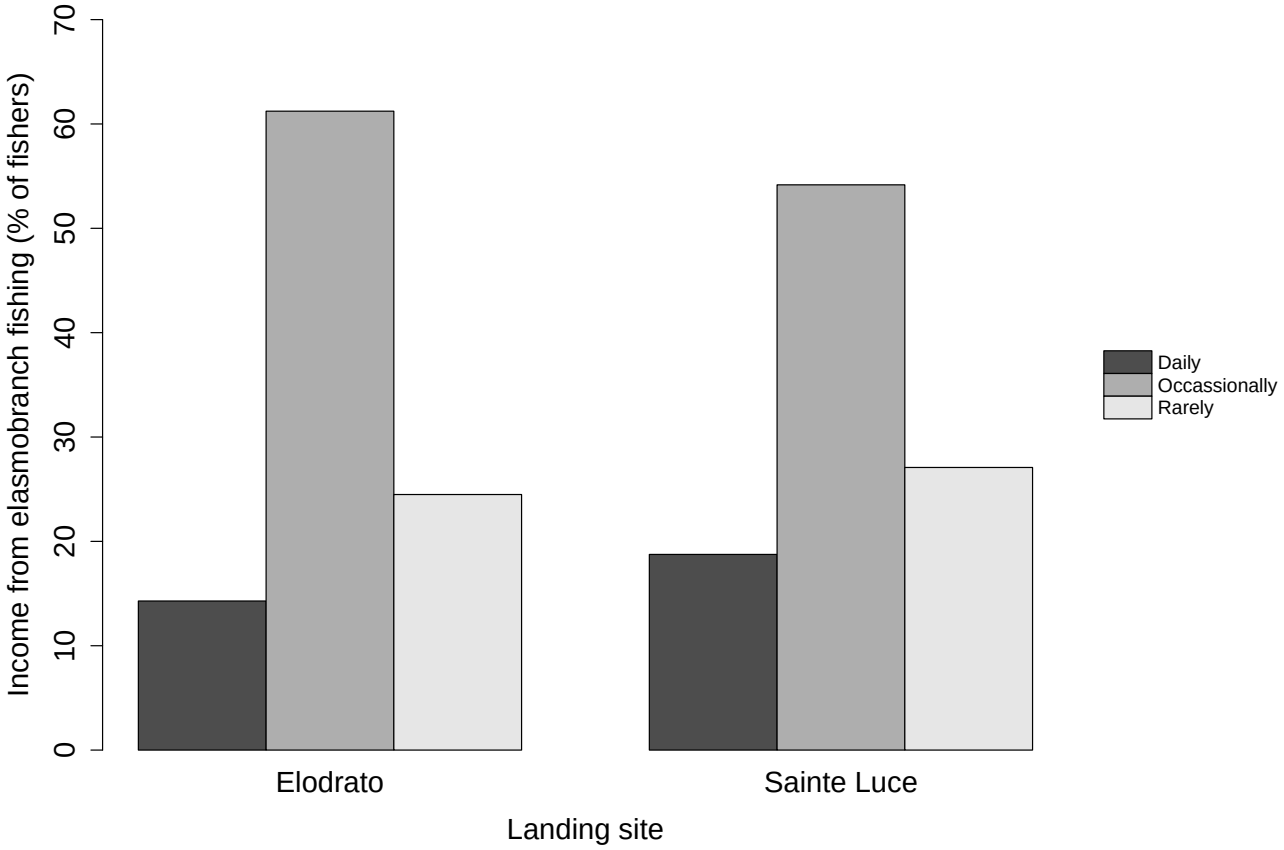

Figure 7. Frequency of income gained from elasmobranch fishing (% of fishers) disaggregated by community (Elodrato n= 49, Sainte Luce n=48).

5.6 Consumption

All fishers reported a preference for selling elasmobranchs and no fishers reported a preference for consumption. In both communities, the majority of fishers reported that the amount of food available for their household to eat did not affect their decision to fish for elasmobranchs; reported by 75.5% in Elodrato and 66.7% in Sainte Luce. Although all fishers reported a preference for selling, household consumption of elasmobranchs was reported widely, by 93.9% of fishers in Elodrato and 93.8% of fishers in Sainte Luce. Frequency of consumption was similar between communities. Daily consumption of elasmobranchs was not reported in Elodrato and was only reported by one fisher in Sainte Luce. In both communities, a slight majority of fishers reported rare consumption, 56.5% in Elodrato and 51.1% in Sainte Luce, compared to occasional consumption, 43.5% in Elodrato and 46.7% in Sainte Luce (Figure 8).

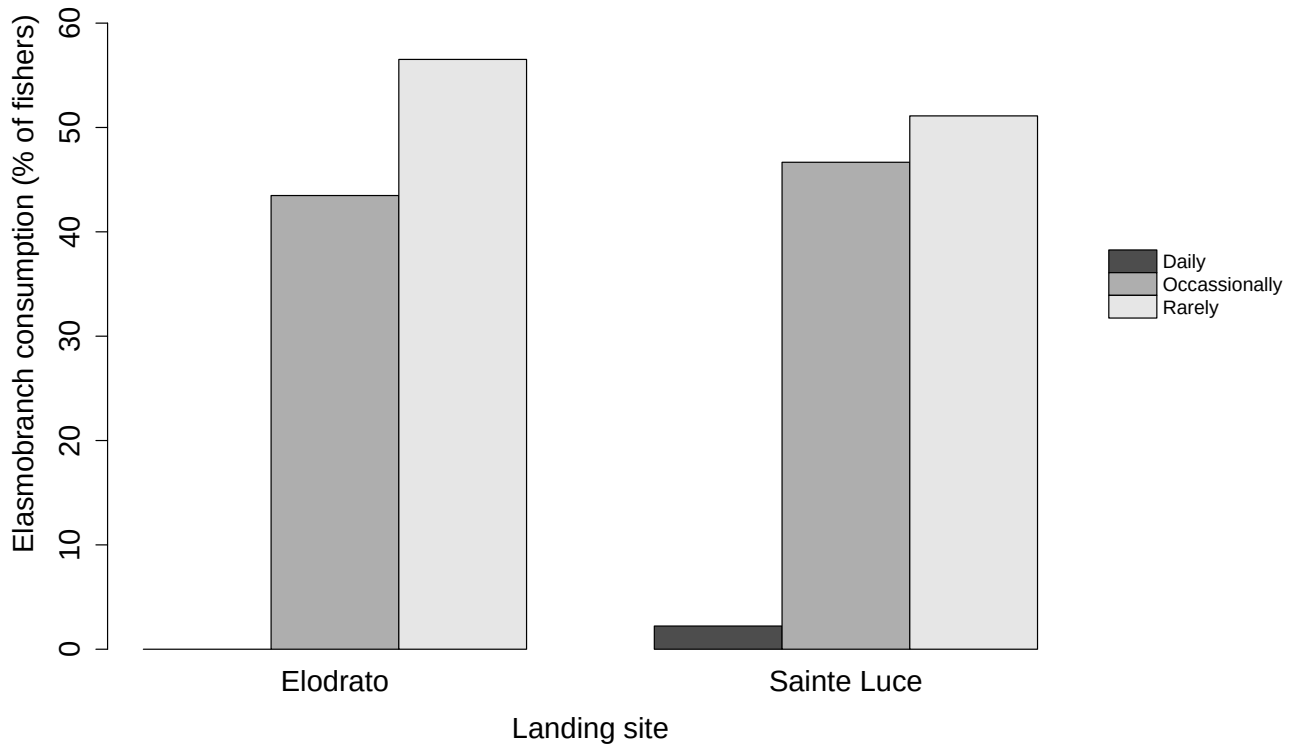

Figure 8. Frequency of elasmobranch consumption (% of fishers) disaggregated by community (Elodrato n= 46, Sainte Luce n=45).

5.7 Fin and Meat Trade

In Sainte Luce, estimates of when fishers started selling elasmobranch fins ranged from 1980-2006, with 2000 being the most commonly reported year. In Elodrato, estimates ranged from 1992-2019, with 2000 being the most commonly reported year. The vast majority of fishers were involved in selling elasmobranch fins; reported by 73.5% in Elodrato and 83.3% in Sainte Luce. Of the fishers who did not report selling fins, all reported the reason as being unable to catch individuals with large enough fins to sell. No fishers reported having an opposition to selling them. Of those fishers who sold fins, 94.4% in Elodrato and 95.0% in Sainte Luce reported a preference for selling fins as opposed to meat, with 100.0% reporting that this was due to the high value obtained for fins. In both communities the majority of fishers sold fins dried; reported by 88.9% in Elodrato and 62.5% in Sainte Luce (Table 3). Drying in the sun was the only reported method for drying fins, reported by 100.0% of fishers. The time required for dying varied from three to seven days. Five fishers also reported using salt or seawater before drying the fins.

Table 3. Reported preference for preservation status of fins sold (% of fishers) disaggregated by community.

Preference	Elodrato (n=36)	Sainte Luce (n=40)
Dried	88.9	62.5
Wet	11.1	25.0
No preference	0.0	12.5

When questioned about the prices received for elasmobranch fins, 24 fishers mentioned shark species specifically, four mentioned guitarfish (family: Rhinobatidae, a type of ray), and none mentioned other ray species. This suggests that both sharks and guitarfish fins are sold in Elodrato and Sainte Luce, with shark fins more commonly sold, and guitarfish fins rarely sold. This is supported by data from the pilot elasmobranch participatory catch monitoring programme conducted in 2019-2020, which identified that 37.2% of sharks and

3.1% of guitarfish caught would have fins sold. Therefore, it was assumed that when fishers reported on the price structure and did not specifically mention whether it applied to sharks or rays, it applied to sharks only.

The structure for the price received at the first point of sale for shark fins appears to be complex. Fishers reported that the prices for fins received was based on i) weight (kg) ii) quality, which depended on the size (height of fin) and species and iii) preservation status (wet or dry). Three quality grades were reported with first quality receiving the highest prices. Size ranges for each quality grade varied by fisher in both communities. In Elodrato, three fishers provided information on the size ranges, with first quality minimum fin size reported between 25-50cm, second quality reported between 18-30cm, and third quality reported being less than 15 or 18cm. In Sainte Luce, seven fishers provided information on the size ranges, with first quality fin first quality minimum fin size reported between 20-40cm, second quality reported between 20-25cm, and third quality (reported by only one fisher) reported as 15cm. It was not possible to identify species for each quality grade. It was also not possible to create an exact pricing structure for shark fins at the first point of sale, however, maximums and minimums reported for each quality category are given in Table 4.

44 fishers mentioned prices for both wet and dry fins, and of this 100.0% reported that dried fins received a higher price than wet fins. This was also observed across all quality categories in both communities, except for third quality wet fins where no price was reported (Table 4). This suggests that third quality wet fins in both communities are not sold (Table 4). This also suggests that the higher price received for dried fins is driving fisher preference to sell dried fins (Table 3).

Table 4. Price structure for shark fins of different quality categories at the first point of sale in Malagasy Ariary (MGA) and United States Dollar ($) equivalent, disaggregated by community.

	Elodrato (n=9)		**Sainte Luce (n=10)**	
Quality	**Wet**	**Dry**	**Wet**	**Dry**
First	100,000 – 200,000 MGA $26.67 – 53.33	160,000 – 400,000 MGA $42.67 – 106.67	70,000 – 120,000 MGA $18.67 – 32.00	120,000 – 240,000 MGA $32.00 – 64.00
Second	60,000 – 95,000 $16.00 – 25.33	90,000 – 160,000 MGA $24.00 – 42.67	56,000 – 100,000 MGA $14.93 – 26.67	20,000 - 90,000 MGA $5.33 – 24.00
Third	N/A	50,000 - 80,000 MGA $13.33 – 21.33	N/A	50,000 MGA $13.33

80.6% of fishers selling shark fins in Elodrato and 77.5% in Sainte Luce reported selling fins to one or more *collecteur*s (intermediaries who purchase fins from fishers and transport them to export companies) from the regional capital of Fort Dauphin. A total of four *collecteurs* from Fort Dauphin were identified, with three common between the two communities. Five fishers in Sainte Luce reported selling fins to a *collecteur* in their own community or a nearby community. Of these, one reported selling wet fins to a local *collecteur* who then dried and sold the fins to a *collecteu*r from Fort Dauphin. No fishers in Elodrato reported selling to a local collecteur. Only one fisher in Elodrato and two fishers in Sainte Luce were able to identify a company to which the fins were sold. They reported links to the Chinese export company Santi, who have been purchasing lobster in the communities since at least 2014 (Long et al., 2019). The majority of fishers were also unable to provide further information on the location(s) that the fins would be transported to higher in the value chain. Of those who did provide information, one fisher reported Toliara (southwest Madagascar), one reported Antananarivo (the capital of Madagascar), two reported Japan, and 11 reported China. A shark fin value chain, based on the results presented in this report, is given in Figure 9.

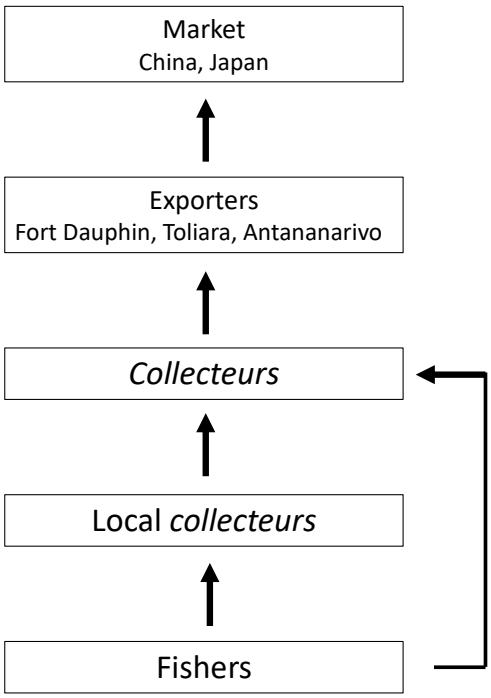

Figure 9. Shark fin value chain reported by fishers in Elodrato and Sainte Luce.

In both communities, all fishers reported that bodies (with or without fins) of elasmobranchs caught were to be sold for local consumption, and no fishers reported selling the bodies to *collecteur*s. Fishers mainly sold the meat to people from seven nearby communities within walking distance (Figure 10), reported by 98.0% of fishers in Elodrato and 100.0% in Sainte Luce. A minority of fishers in both communities reported selling the meat to people from their own community; reported by 22.4% of fishers in Elodrato and 22.9% of fishers in Sainte Luce.

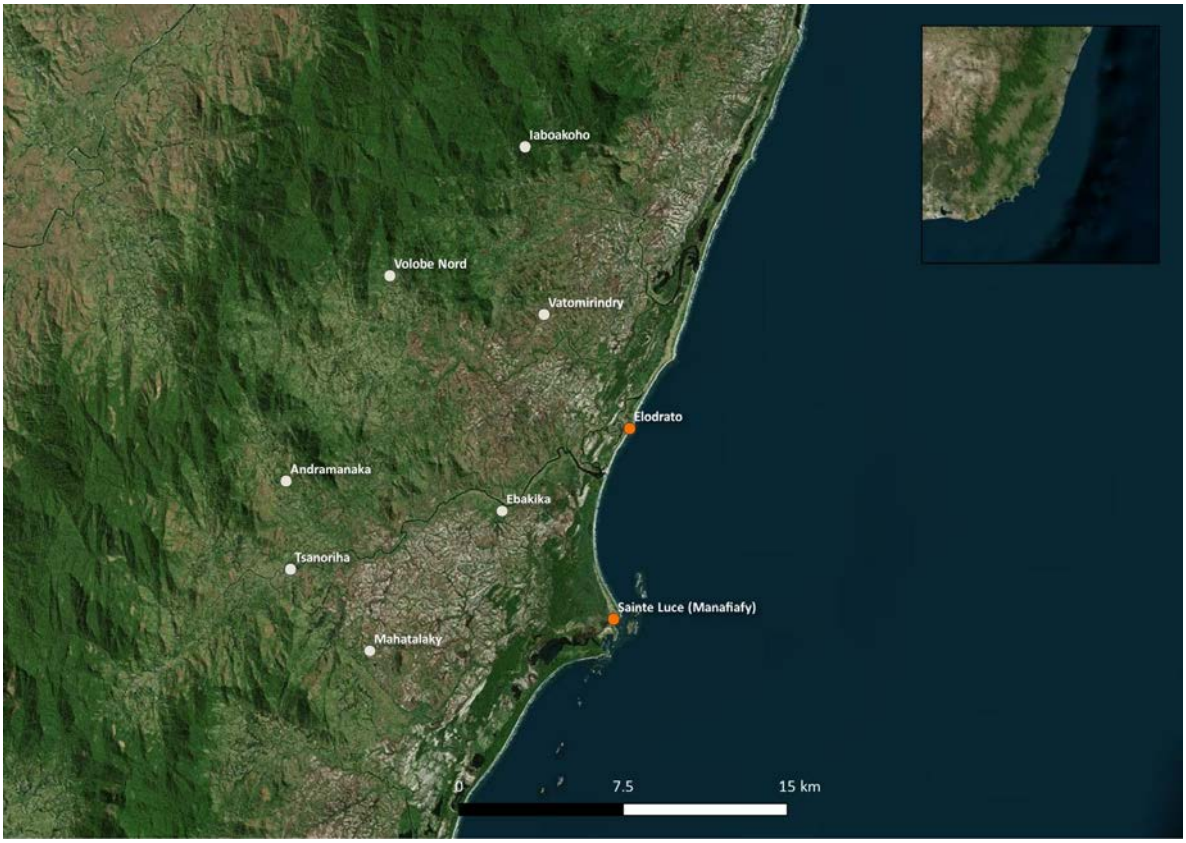

Figure 10. Map showing the small-scale fishing communities of Elodrato and Sainte Luce (red) and the surrounding communities who purchase elasmobranch meat (white) in southeast Madagascar.

5.8 Covid-19 Impacts

In both communities, 100.0% of fishers were aware of Covid-19 and 100.0% of fishers reported that their household had less food available since they became aware of Covid-19. A slight majority of fishers in each community, 53.1% in Elodrato and 52.1% in Sainte Luce, reported a decrease in fishing effort for elasmobranchs since they became aware of Covid-19 and few reported fishing more; 2.0% in Elodrato and 10.4% in Sainte Luce (Table 5). It is unclear why there has been a decrease in elasmobranch fishing effort during the Covid-19 pandemic. In July 2020, fishers in Sainte Luce reported that due to Covid-19, the lobster fishing season opening was delayed, the price for lobster at the first point of sale was significantly reduced and consequently fishing effort for elasmobranchs had increased (Savage, 2020).The results presented in this report therefore indicate that the reported increase in elasmobranch fishing effort in Sainte Luce in July 2020 was temporary.

Table 5. Reported change in fishing effort since Covid-19 (% of fishers) disaggregated by community.

Change in fishing effort	**Elodrato (n= 49)**	**Sainte Luce (n=48)**
Increased	2.0	10.4
Decreased	53.1	52.1
No change	10.2	4.2
Unsure	34.7	33.3

Fishers were also asked to list the local names of the fish they had targeted most since they became aware of Covid-19. Species' scientific names were then identified based on their local name using Henneveux (2010). In some cases, local names referred to more than one species, or identification based on the local name was not possible. In both communities, *sihely* (Indian Mackerel, locally consumed but not exported) was the most commonly reported, reported by 65.3% of fishers in Elodrato and 81.3% in Sainte Luce. The most common reason given for this in both communities was ease of catching. Guitarfish were reported by 12.2% of fishers in Elodrato and 6.3% in Sainte Luce, non-guitarfish rays were reported by 10.2% of fishers in Elodrato and 8.3% of fishers in Sainte Luce, and sharks were reported by 8.3% of fishers in Elodrato and 8.2% in Sainte Luce. A total of 17 names of fish in Malagasy were reported, with 12 common between the two communities. *Sihely* was the only widely reported fish in both communities (Table 6).

Table 6. Fish targeted since Covid-19 (% of fishers), disaggregated by community (Elodrato n= 49, Sainte Luce n=48).

Identification			IUCN Red List	Elodrato	Sainte Luce
Malagasy	Scientific name	English common name	category		
Sihely	*Rastrelliger kanagurta*	Indian Mackerel	Data Deficient[1]	65.3	81.3
Lamatra	*Acanthocybium solandri,*	Wahoo,	Least Concern[2]	4.1	33.3
	Scomberomorus commerson,	Narrow-barred Spanish mackerel,	Near Threatened[3]		
	Katsuwonus pelamis,	Skipjack tuna,	Least Concern[4]		
	Thunnus alalunga	Albacore tuna	Near Threatened[5]		
Valahara	*Trachurus delagoa*	African scad	Least Concern[6]	4.1	16.7
Fotsivody	Unknown			14.6	14.3
Lafitany	Rhinobatidae	Guitarfish		12.2	6.3
Fay		Non-guitarfish ray		10.2	8.3
Antsantsa		Shark		8.2	8.3
Ampo	*Euthynnus affinis*	Mackerel tuna	Least Concern[7]	0.0	8.3
Lazaro	Unknown			0.0	8.3
Fiandava	Unknown			0.0	6.3
Langouste	Lobster			6.1	2.1
Lavalia	Unknown			4.0	4.2
Siotsy	Unknown			2.0	4.2
Halalaza	*Siganus sutor*	Shoemaker spinefoot rabbitfish	Least Concern[8]	2.0	2.1
Vahoho	Unknown			2.0	2.1
Horoa	Rock cod			2.0	0.0
Borisa	Unknown			2.0	0.0
Sago	Unknown			2.0	0.0

The majority of fishers selling shark fins in both communities reported that they were unsure whether the frequency they sold fins or price/kg of fins had changed since they became aware of Covid-19 (Table 7).

Table 7. Change in frequency of selling fins and price/kg of fins at the first point of sale since fishers became aware of Covid-19 (% of fishers) disaggregated by community (Elodrato n= 36, Sainte Luce n=40).

		Elodrato	**Sainte Luce**
Selling fins	Increased	0.0	0.0
	Decreased	16.7	20.0
	No change	2.8	0.0
	Unsure	80.6	80.0
Fin price	Increased	0.0	2.5
	Decreased	13.9	17.5
	No change	2.8	0.0
	Unsure	83.3	80.0

[1]Collette, Di Natale, Fox, Juan Jorda, and Nelson 2011 [2]Collette, Acero, Amorim, Boustany, Canales Ramirez, Cardenas, Carpenter, De Oliveira Leite Jr., et al. 2011 [3]Collette, Chang, Di Natale, Fox, Juan Jorda, et al. 2011 [4]Collette, Acero, Amorim, Boustany, Canales Ramirez, Cardenas, Carpenter, de Oliveira Leite Jr., et al. 2011 [5] Collette, Acero, Amorim, Boustany, Canales Ramirez, Cardenas, Carpenter, Chang, et al., 2011 [6]Smith-Vaniz et al. 2018 [7]Collette, Chang, Fox, Juan Jorda, Miyabe, et al., 2011 [8]Yahya et al., 2018

6 Discussion

In both Elodrato and Sainte Luce, elasmobranchs are caught incidentally predominantly by handlines and gill nets, rather than being targeted specifically. This suggests that fishers are maximising fishing income by landing any elasmobranchs caught. Although not a daily source of income, elasmobranchs are economically important. All fishers reported a preference for selling as opposed to consumption, with elasmobranchs being a more important source of income during the national closed season for lobsters, suggesting that elasmobranch fishing effort is highest during this period. Efforts to supplement lobster fishing income during the closed season may therefore also alleviate fishing pressure on elasmobranchs, for which this report provides evidence of declining catch over time. Currently, lobster fishing remains the more important contributor to household income annually compared to elasmobranch fishing, due to the high value of lobsters. Further declines in lobster stocks or decreases in the value of lobsters (as observed during the Covid-19 pandemic, see Savage 2020) therefore pose a threat to elasmobranchs, for which local markets for meat and export markets for shark fins exist.

Although elasmobranchs are consumed widely, they are not consumed daily and are not a staple food in these communities, with fishers reporting that the amount of food available does not affect their decision to fish for elasmobranchs. Combined with fishers preferring to sell elasmobranchs, this suggests that elasmobranch fishing contributes more to food security indirectly through income, as opposed to directly through consumption. A slight majority of fishers in each community reported decreased elasmobranch fishing effort since the start of the Covid-19 pandemic, however, the reasons for this remain unclear. Elasmobranchs were not reported to be the most commonly fished species since the onset of Covid-19; instead, Indian Mackerel (a species of finfish) was reported to be the most commonly fished. This provides further evidence to suggest that elasmobranch fishing pressure did not increase during the pandemic.

This study was conducted during the national closed season for lobster fishing and during months where elasmobranchs are caught frequently, as identified by this study. This is recognised as a limitation for this study, as it may have influenced fisher responses. Further studies should aim to conduct interviews both in the open and closed season for lobster fishing, to identify any influence on fishery seasonality to responses.

7 Acknowledgements

A special thanks must go to the fishers and *collecteurs* interviewed for participating in this study. Thanks must also go to Stephen D. Long for his support in methodological design and data analysis and interpretation. This study was funded by the UK Government through the Darwin Initiative.

8 References

Azafady. (2002). *Project Fanomena Report – Marine Turtle Conservation and Research in Southeast Madagascar Report on Activities and Findings in the 2001-2002 Nesting Season.*

Baker-Médard, M., & Faber, J. (2020). Fins and (Mis)fortunes: Managing shark populations for sustainability and food sovereignty. *Marine Policy*, *113*(February 2019). https://doi.org/10.1016/j.marpol.2019.103805

Collette, B., Acero, A., Amorim, A. F., Boustany, A., Canales Ramirez, C., Cardenas, G., … Yanez, E. (2011a). Acanthocybium solandri. *The IUCN Red List of Threatened Species 2011*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2011-2.RLTS.T170331A6750961.en

Collette, B., Acero, A., Amorim, A. F., Boustany, A., Canales Ramirez, C., Cardenas, G., … Yanez, E. (2011b). Katsuwonus pelamis. *The IUCN Red List of Threatened Species 2011*. https://doi.org/https://dx.doi.org/10.2305/IUCN.UK.2011-2.RLTS.T170310A6739812.en

Collette, B., Acero, A., Amorim, A. F., Boustany, A., Canales Ramirez, C., Cardenas, G., … Yanez, E. (2011c). Thunnus alalunga. *The IUCN Red List of Threatened Species 2011*. https://doi.org/https://dx.doi.org/10.2305/IUCN.UK.2011-2.RLTS.T21856A9325450.en

Collette, B., Chang, S.-K., Di Natale, A., Fox, W., Juan Jorda, M., Miyabe, N., & Nelson, R. (2011). Scomberomorus commerson. *The IUCN Red List of Threatened Species 2011*. https://doi.org/https://dx.doi.org/10.2305/IUCN.UK.2011-2.RLTS.T170316A6745396.en

Collette, B., Chang, S.-K., Fox, W., Juan Jorda, M., Miyabe, N., Nelson, R., & Uozumi, Y. (2011). Euthynnus affinis. *The IUCN Red List of Threatened Species 2011*. https://doi.org/https://dx.doi.org/10.2305/IUCN.UK.2011-2.RLTS.T170336A6753804.en

Collette, B., Di Natale, A., Fox, W., Juan Jorda, M., & Nelson, R. (2011). Rastrelliger kanagurta. *The IUCN Red List of Threatened Species 2011*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2011-2.RLTS.T170328A6750032.en

Cripps, G., Harris, A., Humber, F., Harding, S., & Thomas, B. (2015). *A Preliminary Value Chain Analysis of Shark Fisheries in Madagascar. Report SF/2015/3*. Ebene, Mauritius.

Healy, T. (2018). *The Deep South: Socio-Economic, Historic, Cultural, Political, Anthropological and Environmental Analysis of Madagascar's Southern Region*. Antananarivo, Madagascar. Retrieved from http://documents1.worldbank.org/curated/en/587761530803052116/pdf/127982-WP-REVISED-deep-south-V27-07-2018-web.pdf

Henneveux, A. (2010). *Monographie Et Diagnostic De La Peche Maritime Traditionnelle De La Region Anosy (Madagascar)*.

Humber, F., Andriamahefazafy, M., Godley, B. J., & Broderick, A. C. (2015). Endangered, essential and exploited: How extant laws are not enough to protect marine megafauna in Madagascar. *Marine Policy*, *60*, 70–83. https://doi.org/10.1016/j.marpol.2015.05.006

Long, S. (2017). Short-term impacts and value of a periodic no take zone (NTZ) in a community-managed small-scale lobster fishery, Madagascar. *PLoS ONE*, *12*(5), 1–23. https://doi.org/10.1371/journal.pone.0177858

Long, S., Thurlow, G., Jones, P. J. S., Turner, A., Randrianantenaina, S. M., Gammage, T., … Ndriamanja, J. R. (2019). Critical analysis of the governance of the Sainte Luce Locally Managed Marine Area (LMMA), southeast Madagascar. *Marine Policy*. https://doi.org/10.1016/j.marpol.2019.103691

Sabatini, G., Salley, S., & Ramanamanjato, J. (2008). A Review of the Spiny Lobster Fishery in the Tolagnaro (Fort-Dauphin) Region. In J. Ganzhorn, S. Goodman, & M. Vinclette (Eds.), *Biodiversity, Ecology and Conservation of Littoral Ecosystems in Southeastern Madagascar, Tolagnaro* (pp. 299–308). Washington D.C., U.S.A: Smithsonian Institution.

Savage, J. (2020). *The Socioeconomic Impacts of COVID-19 on Small-scale Fishing Communities in southeast Madagascar. A report for Darwin Project 25-016.*

Savage, J. (2020). *A Baseline Socioeconomic Assessment of Lobster Fishing Communities in Southeast Madagascar.* Retrieved from https://madagascar.co.uk/application/files/7515/8684/3984/Baseline_Socioeconomic_Assessment.pdf

SEED Madagascar. (2018). Situational Analysis of the Lobster Fishing Communities of Sainte Luce, Ebakika and Itapera, *44*(0).

Smith-Vaniz, W. F., Borsa, P., Carpenter, K. E., Jiddawi, N., Obota, C., & Yahya, S. (2018). Trachurus delagoa. *The IUCN Red List of Threatened Species 2018*. https://doi.org/https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T20437678A67871525.en

Yahya, S., Borsa, P., Jiddawi, N., Carpenter, K. E., Obota, C., & Smith-Vaniz, W. F. (2018). Siganus sutor. *The IUCN Red List of Threatened Species 2018*. https://doi.org/https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T117007332A117008798.en