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A preliminary assessment of fisheries in Lake Andranobe-Est in the Vakinankaratra Region, Madagascar

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Introduction

Inland fisheries in Madagascar catch about 30,000 MT fish per year (FAO, 2008; Breuil & Grima, 2014). However, freshwater and its fisheries resources are poorly studied and seem to be marginal compared to marine fisheries (Hantanirina *et al.*, 2019). The protein source and revenues from inland fisheries are important to the economy as well (Rakotoambinina *et al.*, 2009). In the Central Highlands, the freshwater fish demand is unmet due to the limited availability of natural waters. For the Antananarivo market itself, the deficit in fresh fish has been estimated at 2,000 T per year (DPRH, 2007).

Inland fishery resources in Madagascar are mostly based on lacustrine fisheries which cover a total surface area of close to 1,500 km² (Breuil & Grima, 2014). Andranobe- Est, a small volcanic lake located in Region Vakinankaratra, is a rare water body in the central region with high fish productivity (ONE, 2004). This lake ensures the subsistence of the local communities and provides almost all the fish consumed in the city of Antsirabe. However, data on the long-term management of the site and associated resources is quite scarce. For this reason, a preliminary study on the fishing practices and fisheries management was mooted. The objective of this study was to determine the profile of fishermen, harvested species, harvesting methods, and production.

Material and Methods

The present study was carried out in Lake Andranobe-Est (Fig 1). Located 14 km Northwest off the town of Antsirabe, the lake is of volcanic origin with a tentacular shape (Ferry *et al.*, 1995). The watershed covers an area of 696.90 ha, of which, 79.36 ha is occupied by the lake self. Between January and March 2021, surveys were carried out with 120 fishermen from the villages of Avarabohitra, Ambohitsokina, and Tsarafara. Survey questionnaire was on fishermen profiles and fish exploitation. An interview was held with the chairman of the fishermen cooperative to collect data on fish catches. The collected data was processed and analysed in Microsoft Office Excel 2016.



Fig 1. The Eastern shore of the Lake Andranobe-Est (Pic credit: ANDRIANTAHINA)

Results and Discussion

Fisheries management

In Lake Andranobe-Est, fishing is done exclusively by men (100%). The fishing community was comprised of adults 40 years and above on an average, most of them (98%) were married. Like elsewhere in Madagascar, the fishermen were relatively young (Failler *et al.*, 2011). The educational background of the fishermen was below par with most of them educated only up to the primary school level.

The main activities of the population are agriculture, husbandry, and fishing. The professional fishermen took to it as their main activity. Most of them (141 individuals) were part of the fishermen association called "TAMIA" and the cooperative called "FIFIMPAVA" which manage the lake and its watersheds. This community-based management is efficient in the Lake as the minimum mesh size of the gear and the closed season are strictly respected. Moreover, they organize fries' restocking once a year. Despite the reforestation effort, the Lake Andranobe-Est is faced with serious environmental problems like erosion and siltation as a result of increased deforestation and agriculture development in the basin areas (Breuil & Grima, 2014). Nowadays, the fishing pressure is not yet high in Lake Andranobe. However, poverty might push the population to exploit fishery resources to ensure their subsistence.

The members sell their fish to the cooperative, which distributes them to their sales network in Antsirabe. The occasional fishermen do not have any organization structure. Their catches are self-consumed or directly sold to the consumers. The majority of fishers are professionals in Ambohitsokina (57.14%) and Avarabohitra (60.87%). The opposite case is assessed in Tsarafara where occasional fishermen dominate (Fig 2).

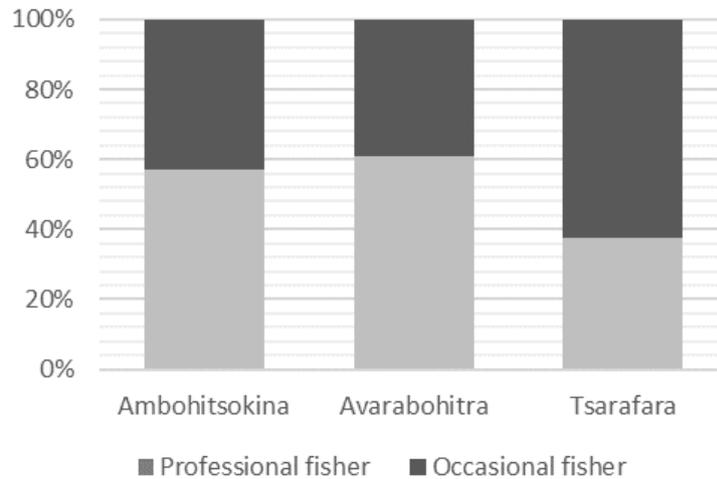


Fig 2. Typology of the fishers in Lake Andranobe-East

Fishing gear and fish production

The fishermen of Lake Andranobe-Est use metal pirogues of 3 m in length and 0.8 m in width as their means of transportation. They fish individually with gillnets, traps, hand lines, harpoons, and metal pirogues (Fig 3). In Ambohitsokina, each fisherman owns an average of 8 gillnets. Only 15% of them use traps and hand lines while 30% use harpoons. In Avarabohitra, each fisherman uses on average 4 gillnets, 43 traps, and 40 hand lines. In the village of Tsarafara, a fisherman owns on average 6 gillnets, 16 traps, and 16 hand lines. Only 25% of fishermen use harpoons.

In Lake Andranobe-Est, there are 7 fish species targeted for fisheries (Table 1.). Small species like *Xyphophorus helleri* (Green swordtail) and *Gambusia holbrooki* (Mosquitofish) are also present. They are mostly caught by women using mosquito nets and consumed locally. No endemic fish were assessed in the Lake. The daily catch of the fishers varies from 300 g to 5 kg; with an average of 1.22 kg in Ambohitsokina, 1.15 kg in Avarabohitra, and 1.11 kg in Tsarafara. In all three villages, Tilapia remains the most frequently recorded and abundant taxonomic group. The largemouth black bass takes second place except in Avarabohitra, where the common carp predominate. The goldfish takes third place in the three villages.



Fig 3. Fishing gears: (a) metal pirogues, (b) gill net, (c) fish trap. (Pic credit: RASOLOARINIAINA)

Table 1. Average of the catch per fisherman in Lake Andranobe-Est

Family	Species	Fish catch per fisherman (in gram)		
		Ambohitsokina	Avarabohitra	Tsarafara
CICHLIDAE	<i>Oreochromis niloticus</i> (Tilapia)	614.3	395.5	553.3
	<i>Coptodon zillii</i> (Tilapia)			
CIPRINIDAE	<i>Cyprinus carpio</i> (Common carp)	240.0	236.4	160.0
	<i>Carassius auratus</i> (Goldfish)			
OSTEOGLOSSIDAE	<i>Channa maculata</i> (Snakehead)	0.0	100.0	0.0
ANGUILLIDAE	<i>Anguilla mossambica</i> (African longfin eel)	0.0	0.0	0.0
SALMONIDAE	<i>Micropterus salmoides</i> (Black bass)	166.7	218.2	255.6
TOTAL		1221.0	1150.0	1108.9

In Lake Andranobe-East, the fishing period lays from 15 September to 15 November. The daily catches of each fisherman were weighed and registered at the cooperative. For the year 2020, the total catches showed monthly variations (Fig 4). From November to January, catches were high. As soon as February arrived, the catches started to decrease and reached the minimum level of 536 kg in April. As it was the rainy season, the bad weather and the high-water level make difficult the fishing activity. From June, fish production raised constantly and reached its highest level in August. The water level decreased during this season making fish catch easily.

According to the cooperative statistics, the total annual catch varies also yearly. The highest value was recorded in 2016 (16.40 T) while the lowest value was collected in 2017 (10.35 T). These values are largely underestimated as they include solely the cooperative members' catch. Moreover, fishes self-consumed or directly sold to consumers were not considered.

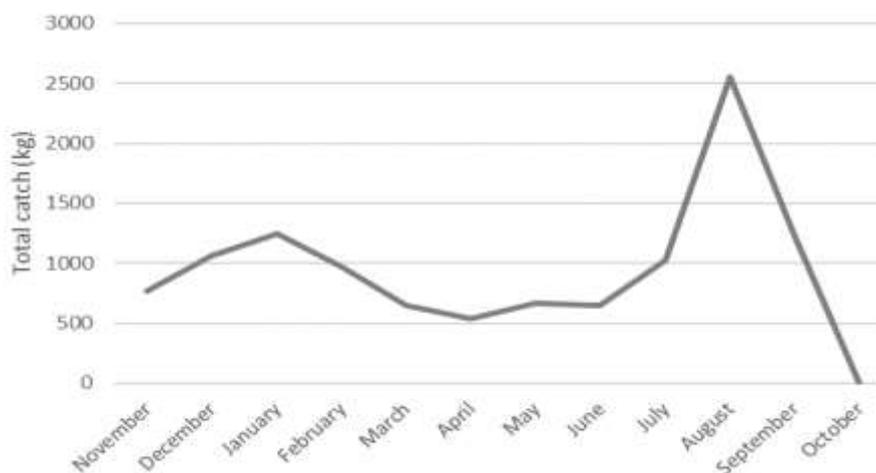


Fig 4. Total catch per month in 2020

Conclusion

This study provides basic information about the fishery in Lake Andranobe Est. It shows that the fishery in this Lake is still traditional. This activity is practiced by young men using traditional fishing gear like gillnets, traps, fishing lines, harpoons, and metallic canoes. Target species are composed of seven fish species but tilapias are the most abundant. The local management of the Lake is efficient as the technical regulations including the minimum mesh size of gear, the minimum size of fish, and closed areas are largely respected. Besides, the fishermen associations introduce fries in Lake Andranobe- Est every year. However, this water is still subjected to erosion and siltation caused by deforestation and agriculture in the basin areas. The reforestation of the watersheds must be reinforced to stabilise the soil. Environmental awareness is also necessary to promote good practices as Lake Andranobe is also used for drinking water in Antsirabe.

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