Centro Terra Viva
Estudos e Advocacia Ambiental

The Impact of Artisanal and Subsistence Fishing on Coastal and Marine Biodiversity and Ecosystems

Advocacy Document – 2025

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The Impact of Artisanal and Subsistence Fishing on Coastal and Marine Biodiversity and Ecosystems

TITLE:

The Impact of Artisanal and Subsistence Fishing on Coastal and Marine Biodiversity and Ecosystems in Two Communities in Nampula Province – APAIPS Advocacy Document

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1. Introduction and Context

Mozambique's coastline stretches for approximately 2,470 km, encompassing a wide range of ecosystems that support exceptional biodiversity and hold significant potential for economic and social development.

Among the economic activities that directly depend on these ecosystems, fishing plays a central role. It is carried out across the industrial, semi-industrial and artisanal sectors, with artisanal fisheries accounting for around 95% of national catches (Simbine, 2015; Bilika et al., 2019; Capaina, 2021).

In recent years, catches have shown a steady increase, with an average annual growth of 11.8%, peaking at 16.8% in 2017, compared to 4.9% in 2013.

Mozambique's total fishery potential is estimated at 332,000 tonnes with key species including shallow-water shrimp, deep-water crustaceans in the central-southern region, scads and mackerel in the Sofala Bank, and various demersal fish species in the northern and southern zones. Artisanal fishing plays a critical role in the subsistence of coastal and inland communities, serving as a major source of protein and livelihood.

The data presented in this advocacy document are based on an impact study conducted in two communities in Nampula Province, within the framework of the project "Clima de Mudanças: Caminho para a Criação e Reforço de uma Gestão Ambiental Consciente em Moçambique," co-financed by the European Union.

1.1 Coastal Communities in Focus

Nampula Province comprises eight coastal districts and 227 fishing centres, representing a 16.4% increase compared to the 2012 census, which recorded 195 centres. The district of Moma was the only one to record a 60.5% decrease in fishing centres, linked to administrative restructuring that transferred several centres to the district of Larde.

The province also has 15,346 artisanal vessels, reflecting a 70.5% increase compared to 2012. According to the National Fisheries Institute (INOM), in 2014 total catches in Nampula were estimated at around 56,000 tonnes, with the highest yields recorded for encircling nets (86 kg/gear/day).

Artisanal and Subsistence Fishing Vessels in Nampula

The impact study consolidated data from field surveys, with the overarching objective of promoting good environmental governance in Mozambique. These data are essential for supporting sustainable management and for clearly understanding the impacts that artisanal and subsistence fishing activities have on the biodiversity and coastal and marine ecosystems of the communities covered.

Marine Fishing Vessels

District	Log canoe	Moma-type canoe	Small wooden canoe	Flat-bottomed boat	Motorized boat	Raft	Total
ANGOCHE	443	3216	0	36	60	14	3769
ISLAND OF. MOZAMBIQUE	803	15	0	0	87	0	905
LALUA	0	318	0	0	0	0	318
LARDE	0	0	0	0	0	0	0
LIUPO	15	281	0	0	11	0	307
MEMBA	2568	78	0	36	514	0	3196
MOGINCUAL	64	329	0	5	49	1	448
MOMA	113	489	0	0	2	0	604
MONAPO	0	0	0	0	0	0	0
MOSSURIL	3594	42	0	2	198	2	3838
MUECATE	0	0	0	0	0	0	0
NACALA-PORTO	830	27	0	5	243	0	1105
NACALA-VELHA	262	27	0	15	107	2	413
TOTAL	8692	4822	0	99	1271	19	14903

Fig. 1 – Total number of marine fishing vessels: 14,903

Inland water fishing vessels

District	Log canoe	Moma-type canoe	Small wooden canoe	Motorized boat	Raft	Total
ANGOCHE	0	0	0	0	0	0
ISLAND OF MOZAMBIQUE	0	0	0	0	0	0
LALUA	0	0	0	0	40	40
LARDE	0	59	0	0	0	59
LIUPO	0	0	14	6	20	20
MEMBA	180	0	6	2	18	206
MOGINCUAL	6	0	18	0	0	6
MOMA	0	0	18	0	0	18
MONAPO	32	0	12	0	13	57
MOSSURIL	0	0	0	0	0	0
MUECATE	16	0	10	11	0	37
NACALA-PORTO	0	0	0	0	0	0
NACALA-VELHA	0	0	0	0	0	0
TOTAL	234	59	78	19	91	443

Fig. 2- Total number of inland water fishing vessels: 443

1.2 Study Objectives

The impact study aimed to describe artisanal and subsistence fishing effort, identifying active fishing units and gear types, as well as characterizing the species composition of catches. Analyses included catch per unit of effort (CPUE), species composition by gear type, and annual and gear-based variations in the size of the most frequently caught species.

The study also assessed catch sustainability, estimating the Maximum Sustainable Yield (MSY) and the Maximum Sustainable Fishing Effort (FMSY). Based on these results, the study proposed management measures to promote the sustainable use of fishery resources and to strengthen participatory governance in the sector.

1.3 Geographic Scope

The impact study focused on the coastal zone of Nampula Province, with particular emphasis on the district of Larde. This region has a semi-humid dry climate, with a hot and humid season from November to April and a cool and dry season from May to October. Coastal districts are classified as medium-to-high cyclone risk areas (MICOA, 2009), highlighting the vulnerability of local ecosystems and communities to climate change.

Nampula's coastline forms part of the coral coast, extending from the Rovuma River in the north to the Primeiras and Segundas Archipelago in the south. The combination of numerous islands, an indented shoreline, and narrow continental shelves, together with mangrove forests at river mouths, creates high-biodiversity habitats (Barbosa et al., 2001).

The district of Larde, covering 2,458 km², lies along the southern coastal zone of the province, bordered to the north by Angoche, to the southeast by the Meluli River and the district of Moma, and to the east by the Indian Ocean. It also includes parts of the Primeiras and Segundas Archipelago, designated as an environmental protection area, which hosts a rich diversity of marine and coastal species (Boletim da República, No. 50).

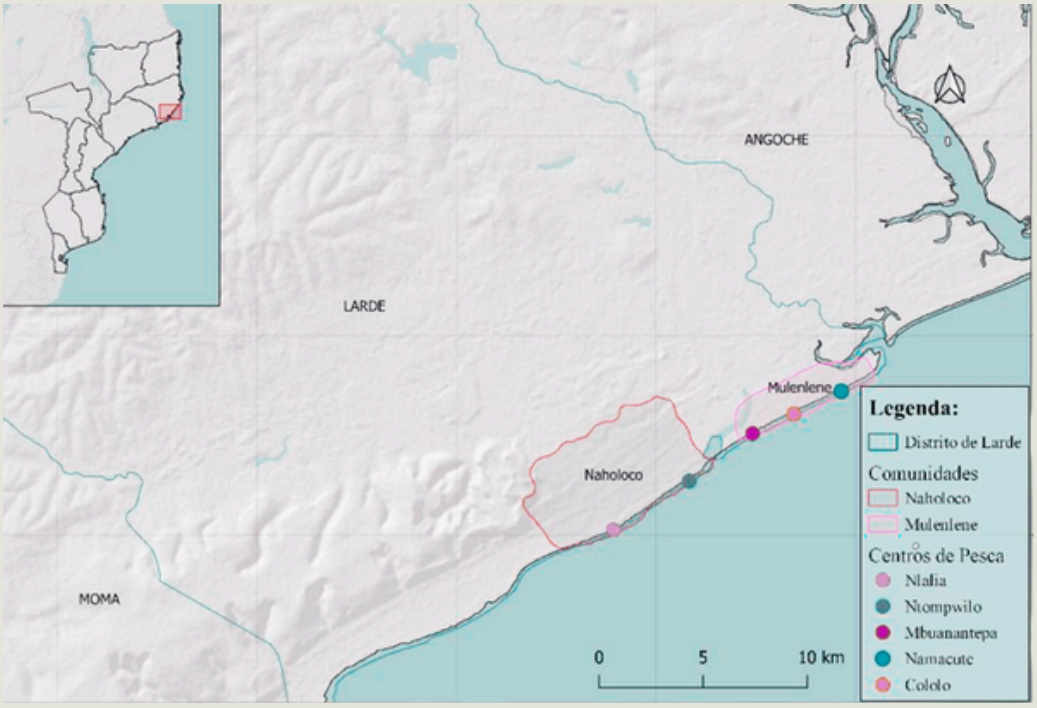

Fig. 3 – Location of the districts, communities, and fishing centres covered

2. Scientific Evidence for Action

According to data from the National Institute of Oceanography of Mozambique (INOM), in 2014 the total catch in Nampula Province was estimated at around 56,000 tonnes, with the encircling net being the most productive fishing gear, yielding 86 kg per day of use.
This document consolidates the field survey results and the methodology applied in the impact study, serving as an essential foundation for defining sustainable management strategies. The information presented is critical for understanding the impacts of artisanal and subsistence fishing on biodiversity and marine and coastal ecosystems in the studied communities, and thus provides a sound basis for public policy and investment decisions.

2.1 Applied Methodology

The collection of qualitative and quantitative information was exploratory and descriptive in nature, combining an in-depth literature review with interviews of local authorities, economic operators, members of the Community Fisheries Councils (CCPs), and community representatives. This approach ensured the robustness and relevance of the evidence produced.
Fieldwork was conducted from 27 October to 3 December 2024, with a temporary interruption due to post-election demonstrations, and resumed from 16 February to 7 March 2025.
The research took place in two communities in Larde District—Mulenlene and Naholoco—covering five fishing centres: Mbuanantepa, Cololo, and Namacute (north), and Nlalia and Ntompwilo (south). Daily sampling was carried out by trained technicians using mobile devices, allowing for the collection of reliable, real-time data on vessels, number of fishers, fishing gear, total catch weight, and distribution by size and species.
Data collection was supported by the Kobo Toolbox digital platform, whose customized application for artisanal fisheries enabled the recording of photographs, videos, and GPS coordinates, enhancing transparency and traceability of results. This database structure aligns with the Peska Mozambique system, developed by the WorldFish Center in collaboration with INOM.
Data analysis was performed in the R environment, using statistical and scientific graphics packages, ensuring rigor and quality in the presentation of results. To assess catch sustainability, the TropFishR package (Mildenberger et al., 2017) was employed, based on the FAO manual Introduction to Tropical Fish Stock Assessment (Sparre & Venema, 1998; 1999). This methodology enabled the estimation of critical parameters, such as Maximum Sustainable Yield (MSY) and Maximum Sustainable Effort (FMSY), providing solid scientific evidence to support fisheries management decisions and public policy in Mozambique.

3. Results: What the Data Reveals

A total of 281 samples were collected over a period of five months, corresponding to 48 effective fieldwork days. November 2024 recorded the highest number of sampling days (29), followed by December 2024 (10). However, as noted previously, activities were temporarily interrupted during December. Fieldwork resumed in February 2025 (5 days) and March 2025 (2 days). Additionally, ad hoc observations were conducted on two days in October 2024.
This methodological continuity, despite social disturbances, demonstrates the resilience and commitment of the field team.

Month	Days	Number of catches	Zero-catch samples	Sample with a recorded-catch
October	2	10	0	10
November	29	173	74	99
December	10	55	37	18
February	5	28	15	13
March	2	15	7	8
Total	48	281	133	148

Figure 4 – Sample size

Over the course of the study, the Nlalia fishing centre stood out for the highest intensity of activity (39.9% of trips), followed by Nbuanantepa (16.2%), Cololo and Namacute (13.5% each), and Ntompwilo (14.2%). boat-operated seines was practiced in all villages, but handlines and gillnets were observed only in Nlalia.
The beach seine was the predominant gear, accounting for 76.4% of recorded trips, followed by gillnets (16.2%), handlines (4.7%), encircling nets (1.4%), and finally fish traps (0.7%). Catches were particularly high in beach seines, averaging 65 kg per trip in Nlalia, 63 kg in Namacute, 52.5 kg in Cololo, 42 kg in Ntompwilo, and 40 kg in Nbuanantepa.
Although encircling nets were less frequently used, they showed significantly higher CPUE values: 4 kg per fisher in Cololo and 6.6 kg per fisher in Nlalia. Handlines and gillnets yielded lower catches, with 0.6 kg and 2.6 kg per fisher, respectively.

Main Artisanal and Subsistence Fishing Techniques Used

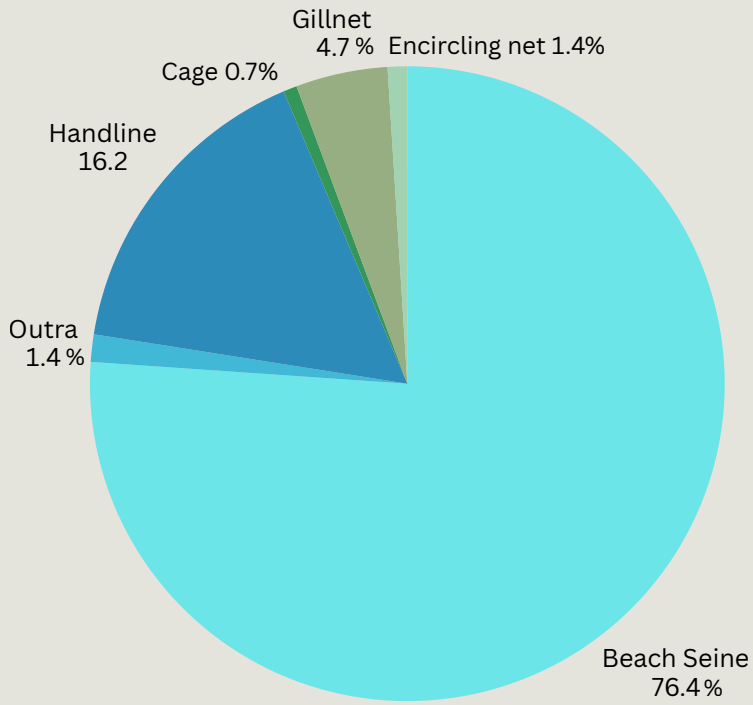

Figure 5 – Main artisanal and subsistence fishing techniques used

Proportion of Activity by Fishing Centres

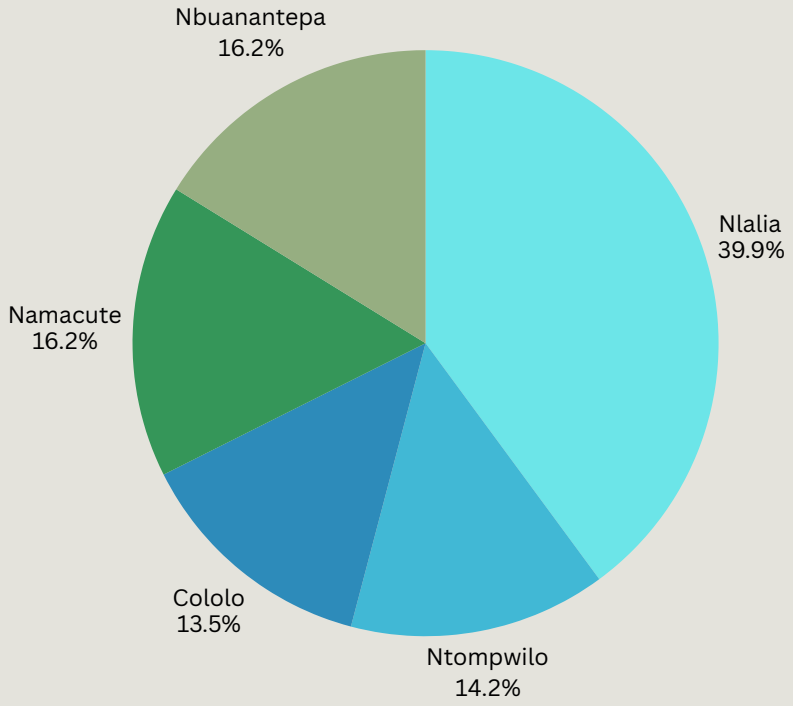

Figure 6 – Proportion of activity by fishing centres

3.1 CPUE by Fishing Gear

The results show that average catch per trip is highest in boat-operated seines, ranging from 65 kg per trip in Nlalia, 63 kg per trip in Namacute, 52.5 kg per trip in Cololo, 42 kg per trip in Ntompwilo, and 40 kg per trip in Nbuanantepa.

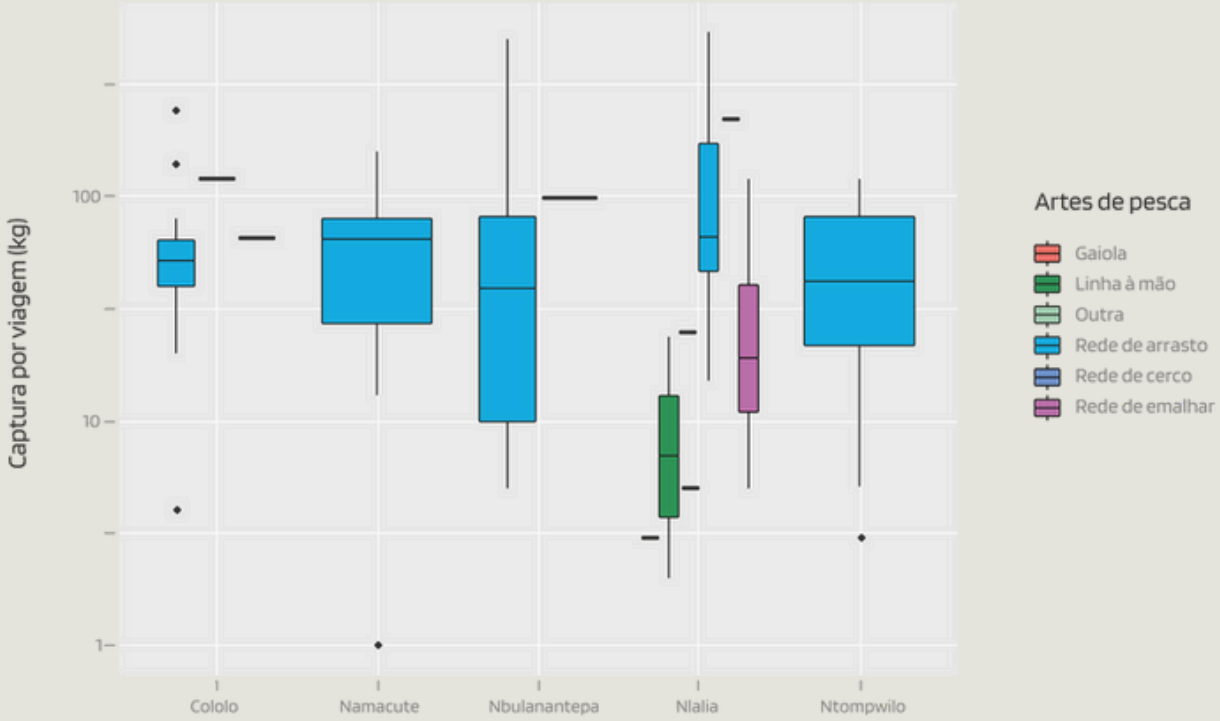

Figure 7 – Catches by gear type per fishing centre

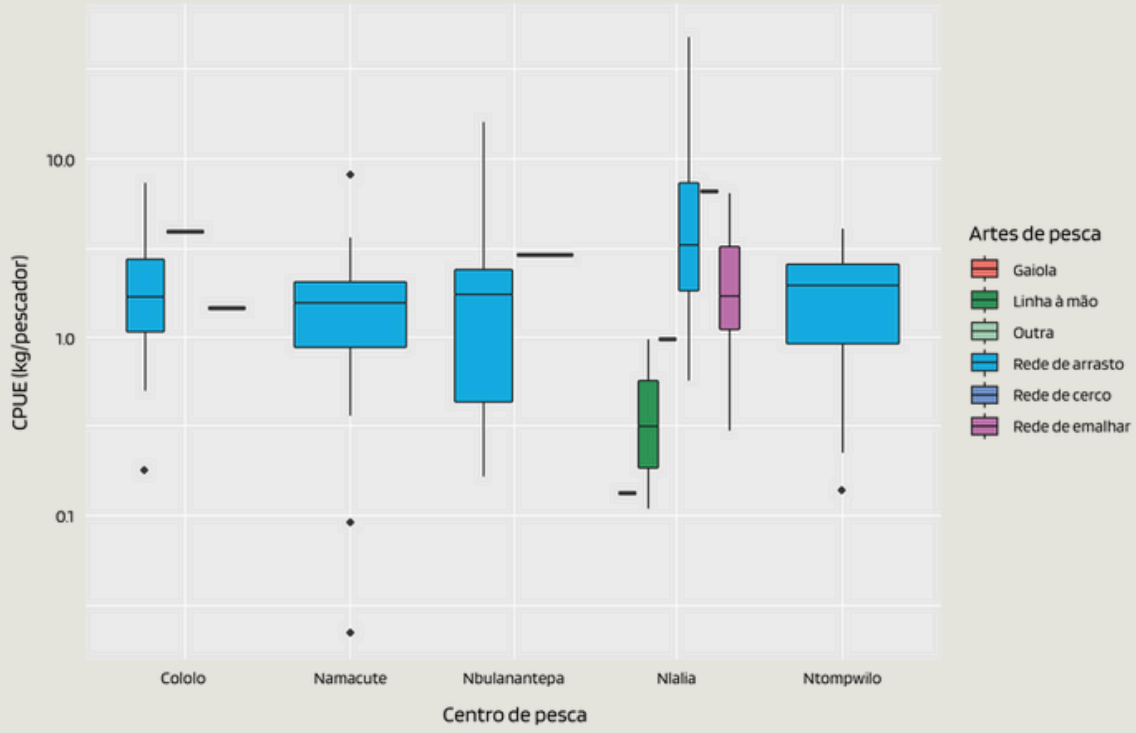

Figure 8 – CPUE by gear type and by fishing centre

When considering the number of fishers involved, a significant reduction in individual productivity is observed, reflected in the CPUE values (catch per unit of effort, in kg per fisher): 2.1 kg/fisher in Nlalia, 1.74 kg/fisher in Cololo, 1.64 kg/fisher in Namacute, 2.01 kg/fisher in Ntompwilo, and 1.82 kg/fisher in Nbuanantepa.

In contrast, encircling nets show higher individual productivity, with 4 kg/fisher in Cololo and 6.6 kg/fisher in Nlalia, providing greater direct returns to fishers, although this gear type is less frequently used. Handline and gillnet fisheries exhibited lower productivity, with 0.6 kg/fisher and 2.6 kg/fisher, respectively, in Nlalia.

These results suggest that, although beach seine yields higher total catches, individual returns are lower, which may have important socioeconomic implications for artisanal fishers and underscores the need to promote more sustainable and equitable fisheries exploitation practices. The impact study confirms that high total volumes do not necessarily translate into higher individual earnings. This pattern, also reported in studies from Mozambique and East Africa, highlights the economic unsustainability of beach seine and the need to promote fishing gears that maximize benefit per fisher.

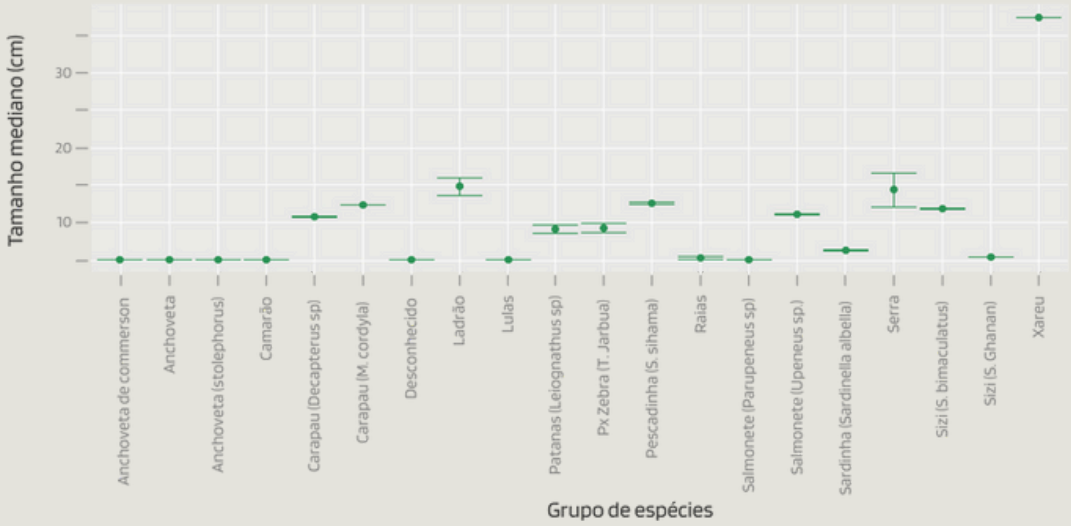

Fig. 9- CPUE (Kg/fisherman)

Figure 10 – Total weight by species

The analysis of catch distribution around the median confirms that the same species continue to dominate landings, all primarily originating from boat-operated seines fisheries. However, the average sizes observed are well below levels considered biologically healthy. The most frequent species — namely anchovetas (Thryssa setirostris and Stolephorus indicus) and scads (Decapterus russelii) — have average sizes equivalent to roughly one-third of the maturation size reported by FishBase (Froese & Pauly, 2000). This pattern indicates that a significant proportion of individuals is captured before reproduction, compromising stock replenishment and, consequently, the long-term sustainability of the fishery.

These results reinforce the urgency of reviewing boat-operated seines practices and fishing effort, promoting management measures that limit the capture of immature individuals and encourage the use of more selective and sustainable fishing gears and strategies. On the other hand, fish caught with gillnets and encircling nets, such as the Ladrão (Lethrinus lentjan), exhibit sizes closer to maturation parameters, indicating a lower impact on immature individuals and potentially more sustainable fishing. Nevertheless, the limited number of samples reduces the statistical robustness of this observation, highlighting the need for continuous monitoring to confirm this trend and support evidence-based management decisions.

Specie	TM(Fishbase)	T	Fishing Technique
Anchoveta - Thryssa setirostris	16 cm	5 cm	Boat-operated seines
Anchoveta - Stolelphorus indicus	9 cm	5 cm	Boat-operated seines
Scad - Decapterus russelii	16.1 cm	10.7 cm	Boat-operated seines
Ladrão - Lethrinus lentjan	24.1 cm	14.8 cm	Gillnetting / Purse Seining

Fig. 11 – Size-at-maturity curves for the species most frequently caught in the project, adapted from FishBase (Froese & Pauly, 2000).

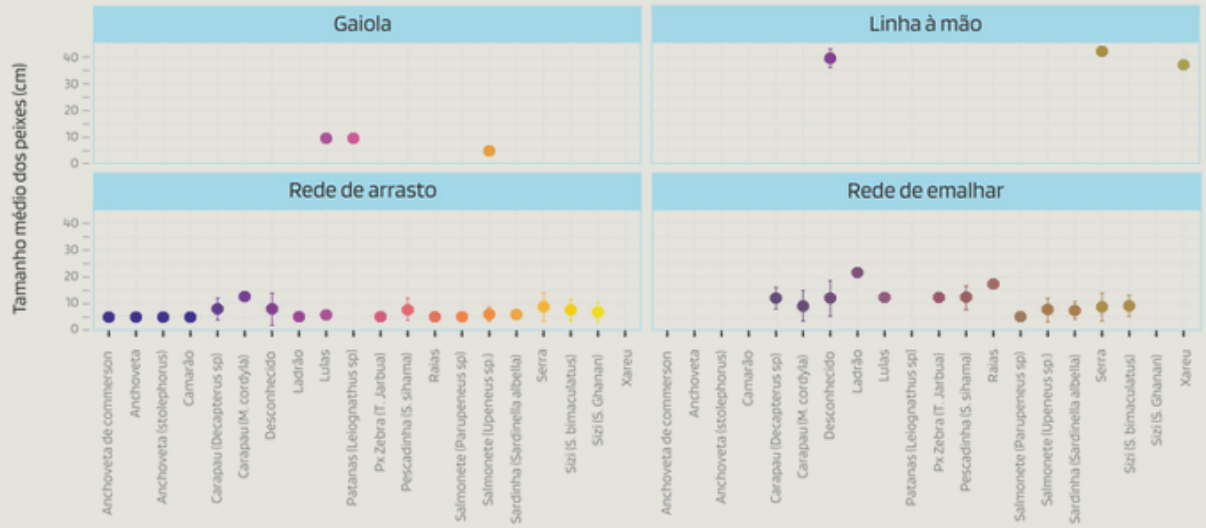

Fig. 12 – Average sizes of the 10 main fish species caught by fishing gear.

3.2 The Beach Seines Crisis: Risks to Ecosystems and Communities

The application of the TropFishR package (Mildenberger, Taylor & Wolff, 2017) enabled the first estimates of recruitment, mortality, and exploitation for the most representative species in the catches — scads (Decapterus spp.). Although anchovetas were more numerous, their dispersion across different genera made them unsuitable for calculation.

The small sample size — only 30 observation days spread over four months — limited statistical robustness, producing inconsistent results. The regression curve, built with only two reference points, does not provide sufficient precision for definitive conclusions.

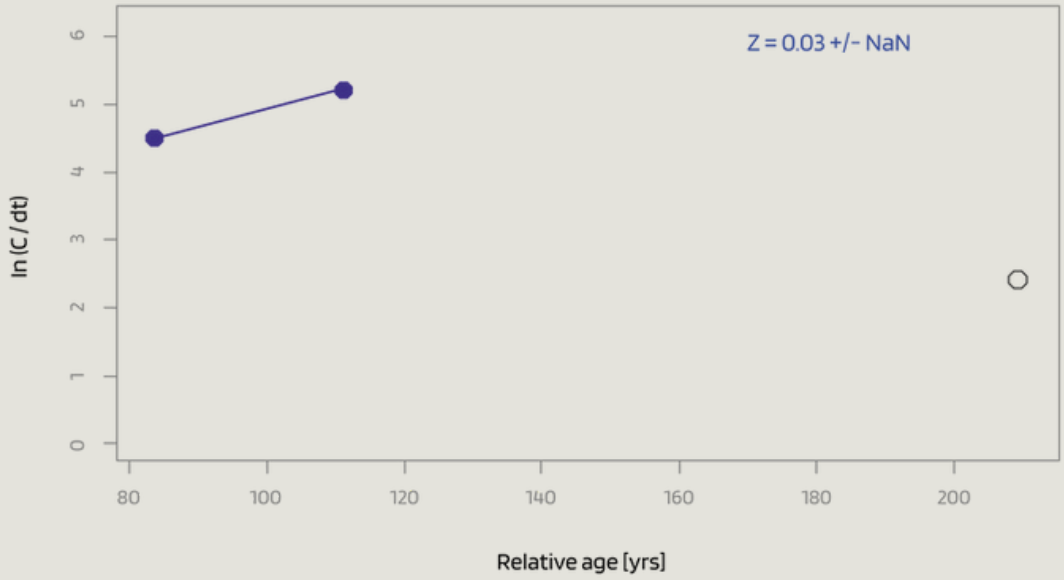

Fig. 13 – Regression curve for estimating harvested population parameters, output from TropFishR

Despite these limitations, the size data of the captured species allow for important preliminary considerations: the high frequency of immature individuals highlights significant pressure on stocks and suggests a real risk of overfishing.

The lack of long-term data is not unique to this study. In Mozambique, stock assessments, including those for scads (Decapterus russelii), remain incomplete and insufficient (INDP, 2018). Experiences in Tanzania and Kenya confirm this trend, showing how the scarcity of detailed data, combined with increasing levels of exploitation, hinders reliable assessments (Mgaya, 2004; McClanahan, 2009).

Even so, although current estimates should be interpreted with caution, the evidence collected — particularly the predominance of catches below maturation size — provides clear signals of ecological and socio-economic vulnerability. These results underscore the urgency of investments in systematic, long-term monitoring, an essential condition for guiding effective public policies and ensuring the sustainability of artisanal fisheries in Mozambique.

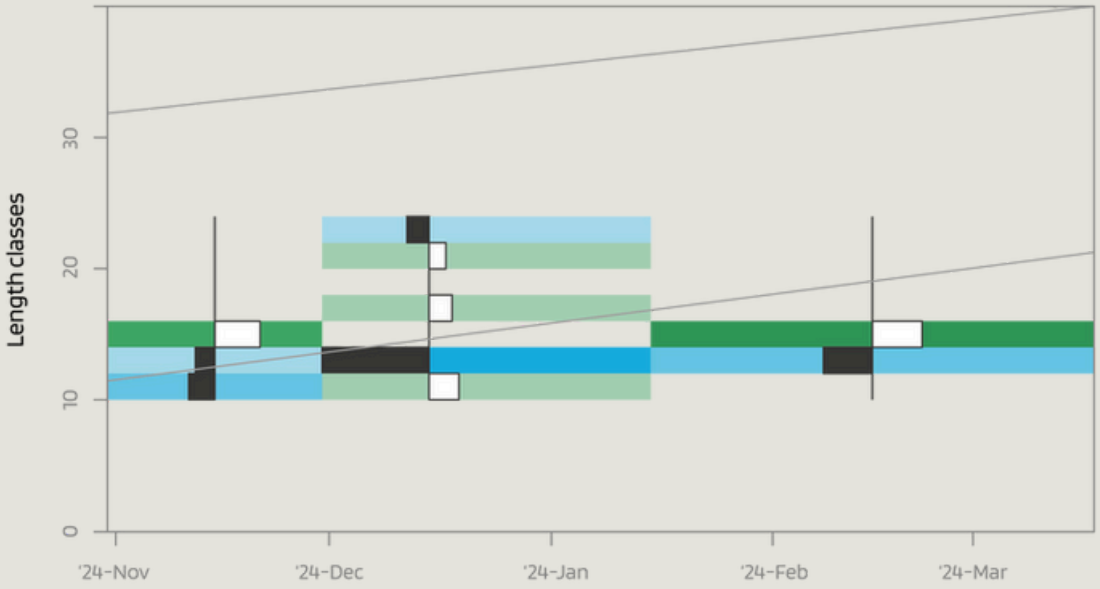

Fig. 14 – Size classes by month, output from TropFishR

4. Conclusions: A Vital Resource at Risk

The extensive analysis of data collected in Larde reveals an unequivocal picture of overpressure on artisanal fishery resources, dominated by the widespread use of beach seines (76.4% of boat trips) — a practice that is not only prohibited under REPMAR regulations but also environmentally destructive and socially inefficient.

Although total catch per trip reaches significant levels (averaging 40 to 65 kg), the distribution of fish among a large number of fishers drastically reduces individual yield (1.6 to 2.1 kg/fisher), compromising economic sustainability and perpetuating livelihood precariousness. In contrast, less predatory gears, such as encircling nets and handlines, demonstrate higher individual efficiency (4 to 6.6 kg/fisher for encircling nets), while also capturing larger individuals closer to maturation size.

The capture of immature species, particularly anchovetas and scads, at average sizes far below those reported in the scientific literature as necessary for reproduction, constitutes an alarming signal of erosion in the biological resilience of stocks. Observed patterns align with documented trends in East Africa, where excessive effort and the use of non-selective gears have led to persistent declines in biomass, diversity, and ecological productivity.

In this context, the continuation of the current exploitation model poses not only an environmental risk but also a direct threat to food security, coastal household incomes, and social stability. International experience demonstrates that, without prompt intervention, unsustainable practices such as artisanal boat-operated seines inevitably lead to stock collapse and irreversible degradation of strategic ecosystems, including coral reefs and seagrass meadows.

5. Recommendations: Paths to Change

To ensure the sustainability of artisanal fisheries and promote truly resilient development for Mozambique's coastal communities, it is imperative to adopt a set of structural measures based on solid scientific evidence and aligned with international best practices. The first priority is the gradual elimination of artisanal boat-operated seines, through effective enforcement of the legal ban and strengthened monitoring, particularly in critical areas for reproduction and juvenile growth. This measure should be accompanied by the installation of artificial reefs in sensitive zones, which not only physically prevent boat-operated seines activity but also contribute to the regeneration of marine habitats.

At the same time, it is essential to encourage a transition to more sustainable and equitable fishing gears, notably encircling nets and handlines. For this shift to be feasible, fishers need technical and logistical support, access to credit tailored to their realities, and ongoing training programs. An innovative approach could also involve reusing materials from the seines to construct alternative fishing gears, reducing waste and fostering creative solutions from existing resources.

Long-term sustainability also requires the diversification of economic opportunities. The use of Fish Aggregating Devices (FADs) can expand areas accessible to artisanal fisheries, distributing fishing effort more evenly. Simultaneously, support for creating alternative employment opportunities for coastal youth is crucial, reducing their exclusive dependence on fishing and promoting greater socio-economic resilience within communities.

Another fundamental pillar is the strengthening of community governance. Consolidating participatory co-management mechanisms ensures greater legitimacy for management decisions and promotes fairness in the distribution of revenues. Special attention should be given to the role of women, who are often responsible for fishing and invertebrate collection — activities that provide a vital source of protein and income but remain undervalued and poorly integrated into formal resource management frameworks.

Continuous monitoring, both scientific and community-based, is an indispensable condition for effective governance. Digital tools such as Kobo Toolbox and Peska Mozambique can ensure real-time data collection, while regular programs for biological, socio-economic, and ecological monitoring provide the empirical foundation necessary for evidence-based policy decisions.

Finally, it is necessary to integrate artisanal fisheries more consistently into national ecosystem conservation policies. Connections with marine protected areas, such as the Primeiras and Segundas Archipelago, should be strengthened through mechanisms that reconcile community livelihoods with conservation objectives. Such mechanisms should include tangible compensations that ensure direct benefits for those who depend on the sea, reinforcing community commitment to biodiversity preservation.

Summary of Recommendations

The results of this study constitute an unequivocal warning: maintaining the status quo in artisanal fisheries in Larde will accelerate ecosystem degradation, reduce fish availability for human consumption, and exacerbate the socio-economic vulnerability of coastal communities. The immediate adoption of transition measures — based on robust science, community co-management, and targeted investment in economic diversification — is not only an environmental imperative but also a strategic opportunity to ensure food security, social justice, and sustainable competitiveness in Mozambique's fisheries sector.

This is a critical and urgent choice: either action is taken now, with courage and vision, or the future of thousands of families who rely on the sea as their primary source of livelihood and dignity will be irreversibly compromised. It is time to act!

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