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Status of landing-based data collection from longline vessels in the Atsinanana region, Madagascar, in 2025: implications for a national standardized protocol

Satila Gilberte NARIVOLA[1,*] & **Jean Jacques BE**[2]

[1]*Directorate of Studies, Statistics and Planning Departement*

Ministry of Fisheries and Blue Economy_Madagascar

E-mail : narivola.satila@gmail.com

[2] *Directorate of Studies, Statistics and Planning Departement*

Ministry of Fisheries and Blue Economy_Madagascar

E-mail : bejeanjacques@moov.mg

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Abstract

Sound information on catch, fishing effort, and size composition is vital for managing tuna and related species sustainably in the Indian Ocean. This study describes a landing-based data collection system used in 2025 for five national longline vessels operating in Madagascar's Atsinanana region, and develops the groundwork for a standardized national protocol that can be applied across all tuna fisheries.

The vessels carried out 137 trips lasting 2-7 days (mean 5 days), totaling 667 sea days with 524,570 hooks set. For each landing, we noted the dates, the number and landed weight by species, and the individual weight of each fish sampled. Fork length (FL) was measured for most species, and lower jaw to fork length (LJFL) for billfishes, following a nominal sampling rate of 30% of individuals per species, rounded up. Of the 4,367 fish landed, 1,490 were measured, representing 34%.

Total landings reached 133.3 t, comprising 62% tunas (Albacore, Yellowfin, big eye, Skipjack) and 38% tuna-like and associated species. This corresponds to a CPUE of 973 kg per trip and 25 kg per 100 hooks. The results show that the system operates effectively and provides a solid platform for a national protocol, with short-term benefits for IOTC reporting and monitoring of fishing yields, and longer-term benefits including the development of comparable time series and extension to artisanal and small-scale fleets.

Keywords: landing-based data collection; fishing effort; length-frequency; longline; tunas; IOTC; Madagascar; standardized protocol.

1. Introduction

Madagascar oversees an extensive maritime domain that includes 5,600 km of coastline, a continental shelf of 117,000 km², and an exclusive economic zone of 1,140,000 km². Industrial tuna operations are conducted by five domestic longliners, each 14 to 17 m in length, working along the east coast with landings in Toamasina. To keep catches fresh, these vessels undertake short trips and set between 800 and 1,300 hooks per set. As a Contracting Party to the Indian Ocean Tuna Commission (IOTC), Madagascar reports annual catch, effort, and size composition data in line with Resolutions 15/01 and 15/02. Since 2014, a combined system of fishing logsheet collection and port sampling has supported these submissions.

The Atsinanana arrangement is therefore a strong foundation. If it is codified in a national protocol that is standardized and applicable to all fisheries (industrial, artisanal, and small-scale marine), it will help disseminate good practice, ensure spatial and temporal comparability of data series, and reinforce Madagascar's standing within the IOTC scientific processes.

First, landing data constitute the primary source of information on catches and length structure for this fishery, supplemented by fishing logbooks. Second, the year 2025 provides a complete annual reference cycle, with 137 trips, compared with 40 in 2023 and 140 in 2024. Third, no national document currently harmonizes sampling intensities, recorded variables, and validation procedures across all tuna fisheries, despite the presence of more than 40,000 small-scale fishing vessels along the coast (MPEB, 2013).

The overarching aim is to lay the empirical groundwork for a national standard protocol for tuna fishery data collection in Madagascar. The intermediate aim is to describe the current landing-based data system in Atsinanana.

According to the national system, data collection is based on company logsheet submissions that are cross-checked through landing-site sampling. In the small-scale sector, a computerized system built on landing-site surveys with random sampling in space and time is being expanded nationwide through a network of local enumerators . The National Plan for the Conservation and Management of Sharks and Rays (2022–2026) further enhances data collection on sharks, which represent 17% of longliner catches.

Length-frequency data are central to growth and stock structure analyses. As noted by Sparre and Venema (1998), achieving representativeness requires a known sampling rate, recorded totals of individuals landed and measured, and a consistent measurement protocol (FL for tunas and LJFL for billfish).

This work delivers the first quantified assessment of a full annual cycle of landing-based data collection, grounded in primary data, which can support the development of a unified national protocol.

2. Materials and methods

The analysis focuses on the national longline fishery in the Atsinanana region on the east coast, where Toamasina serves as the sole landing site. The fleet consists of five pelagic longliners (SEBAE VII, VIII, IX, X and XI), 14 to 17 m in length, operating exclusively within Madagascar's EEZ. Under national legislation (Law No. 2015-053 on the Fisheries and Aquaculture Code; Decree No. 2016-1492), these vessels are classified as industrial.

2.1. Landing-based collection system

The collection team in the DRPEB Atsinanana is present at landings to observe species-specific weighing and length measurements, using calibrated measuring boards, scales, and species identification guides. Two instruments are used.

- First, the landing report (procès-verbal, PV) is completed and signed by the second captain, the company's weighing manager, and the DRPEB Atsinanana officer on site.
- Second, the sampling form records the vessel name, departure, arrival and landing dates, and, for each species, the total quantity and number of individuals landed, the number of individuals sampled, and the weight of each measured individual.

Data are entered and processed in Excel. Fishing effort, expressed as number of hooks deployed and number of trips, is obtained from vessel logbooks and submitted to the IOTC together with catch statistics.

2.2. Sampling rule

The samplyng rule at each landing, a nominal sampling rate of 30% of the number of individuals landed is applied for each species, rounded up to the next whole number, with a minimum of one measured individual for any species present. Individuals are chosen systematically at random from the landed lot. Length is recorded as fork length (FL) for all fish, except for billfish groups (swordfish, marlins, sailfish, spearfish), for which lower jaw–fork length (LJFL) is taken.

The morphomertic parameters to be recorded also depend on the condition in which each sampled individua lis presented (LD1,….)

2.3. Data and analyses

Are the analyses draw on the 2025 landings and catch reports submoitted by the company. A trip is defined from a vessel's departure from port to its return and landing. The sampling rate is the share of landed individuals that were measured. Nominal CPUE is expressed as total catch divided by effort, using hooks, trips, or days at sea as the effort metric.

3. Results

3.1. Activity, fishing effort and CPUE

In 2025, the fleet of five longliners carried out 137 trips lasting from 2 to 7 days (average 5 days), for a total of 667 sea-days. Activity was distributed across the year, with clear peaks in April, November and December. Logbooks record 524,570 hooks set, which corresponds to about 3,800 hooks per trip. All 137 trips are documented in the landings database, which lists 22 species or species groups. Total landings reached

133,3 t, giving nominal CPUEs of 973 kg per trip and 25 kg per 100 hooks (Table 1).

Table 1. Summary of landing-based data collection, DRPEB Atsinanana, 2025.

Indicator	Value
Active vessels	5 (SEBAE VII–XI)
Fishing trips	137
Trip duration	2–7 d (mean 5 d)
Days at sea	667
Hooks deployed	524,570
Total catch	133.3 t
Tunas fish	82 t (62%)
Tuna-like and associated species	51 t (38%)
Species or species groups recorded	22
Individuals landed	4,367
Individuals measured (achieved rate)	1,490 (34%)
CPUE	973 kg/trip; 25 kg/100 hooks

3.2. Catch composition

Tuna species account for 62% of landings, led by *Thunnus alalunga* (29.4 t), Thunnus albacares

(27.3 t), Thunnus obesus (25.0 t) and Skipjack (0.3 t). The remaining 38% comprises tuna-like and associated species: sharks make up 17%, billfish represent 14%, and a mixed group contributes 7% (Table 2).

Table 2. Landed catch by species (main species), 2025

Species	Catch (kg)	%	Individuals	Mean weight (kg/ind.)
Yellowfin tuna	27 324,30	20,5%	571	44,70
Albacore	29 409,70	22,1%	1191	22,81
Big eye	24 957,70	18,7%	655	36,43
Skipjack	335,50	0,3%	54	6,07
Swordfish	15 396,10	11,5%	447	32,20
Black marlin	1 890,10	1,4%	40	46,19
Sailfish	916,10	0,7%	30	27,68
Spearfish	549,60	0,4%	42	13,09
Blue shark	21 655,60	16,2%	482	41,94
Whitetip shark	532,30	0,4%	16	33,27
Mako shark	484,70	0,4%	8	60,59
Blacktip shark	331,80	0,2%	9	36,87
Tiger shark	197,00	0,1%	3	65,67
Hammerhead shark	97,90	0,1%	1	97,90
Other species	9 225,80	6,9%	818	44,21
Total	**133 304,20**	**100%**	**4 367,00**	**40,64**

3.3. Seasonality and effort

Landings are concentrated in April (20.5 t), December (18.9 t), November (17.7 t), February (15.7 t) and January (15.5 t). November and December together supply 27% of the annual catch and 57% of albacore, with the highest monthly yields of the year at 42 and 46 kg per 100 hooks, compared with 12 to 17 kg from June to October (Table 3; Fig. 1). This seasonality is consistent with the presence of tropical tunas in the EEZ from November to May.

Table 3. Monthly fishing effort (fishing logbooks), catches and CPUE, 2025.

Month	Trips	Hooks	Catch (kg)	CPUE (kg/100 hooks)
January	9	39,780	15,518	39
February	12	56,160	15,738	28
March	13	21,060	7,273	35
April	15	97,110	20,527	21
May	13	53,820	12,447	23
June	3	11,700	1,785	15
July	12	52,650	9,050	17
August	10	42,120	5,084	12
September	10	46,800	6,738	14
October	5	19,890	2,557	13
November	16	42,120	17,738	42
December	19	41,360	18,851	46
Total	**137**	**524,570**	**133,304**	**25**

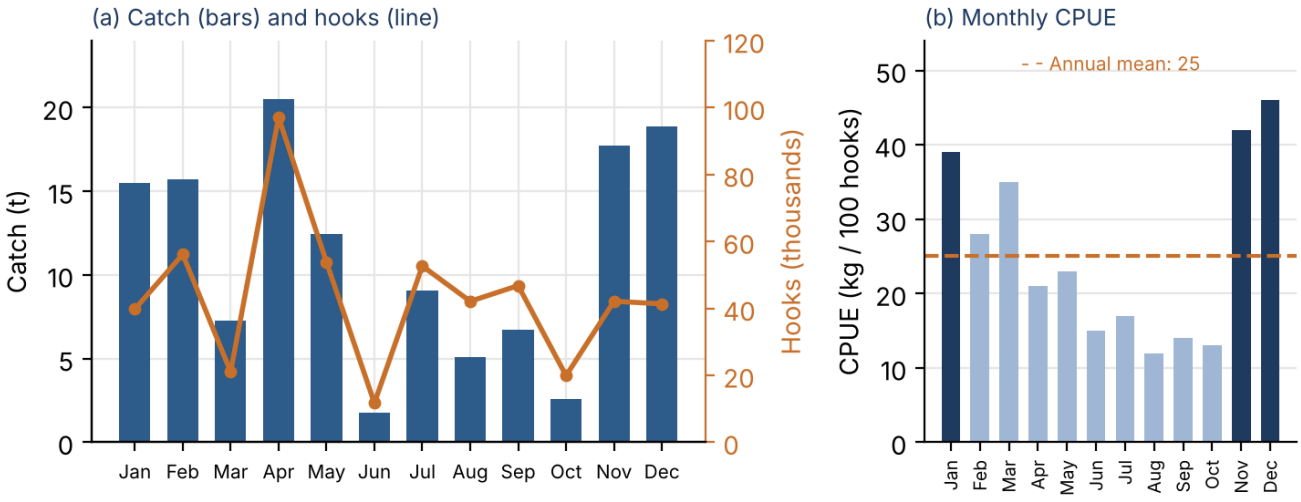

Figure 1. Monthly catches and effort in hooks (a); monthly CPUE (b), 2025.

3.4. Sampling and size data

Of 4,367 individuals landed, 1,490 were measured. 34%, which exceeds the 30% target. Rounding up ensured a minimum of one specimen per species. Measurements cover a broad range of sizes, from juveniles to large adults (Table 4; Fig. 4): albacore 87–136 cm, yellowfin 54–199 cm, bigeye 82–196 cm, swordfish 52–225 cm (LJFL), and blue shark 89–334 cm.

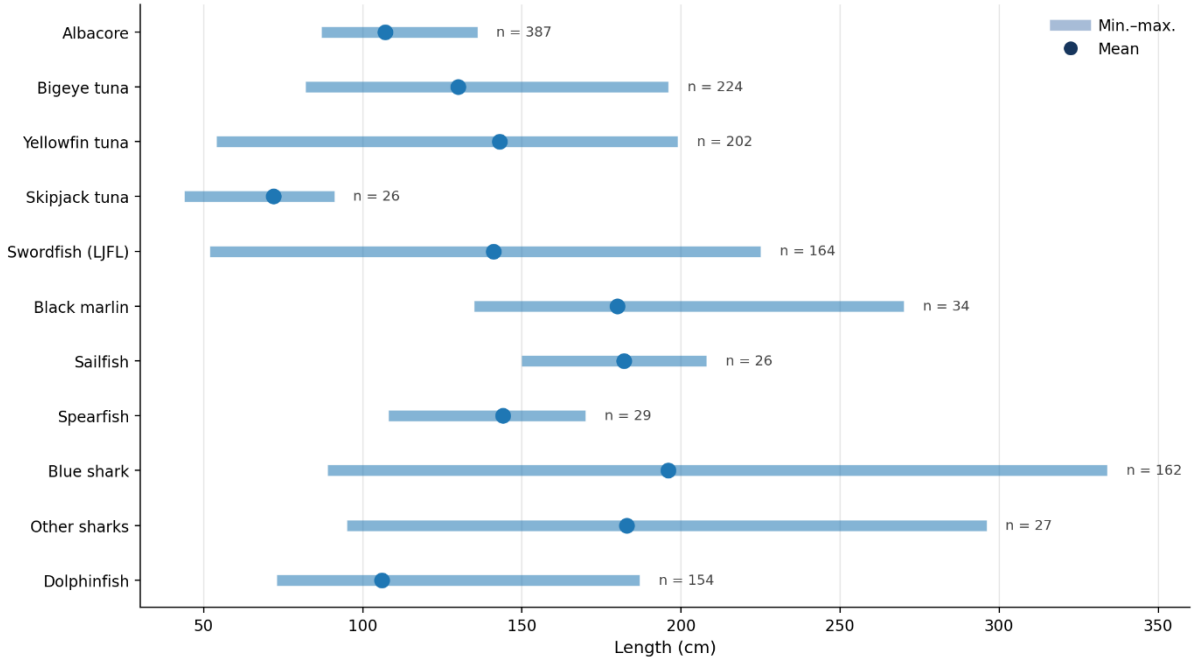

Figure 4. Range of measured lengths (minimum, mean, maximum) by species, 2025.

3.5. Coverage and effort by vessel

The collection covers the entire fleet (Fig. 3). The five vessels made 22 to 33 trips and spent 102 to 171 days at sea; their CPUEs range from 174 to 226 kg per day at sea (fleet mean: 200 kg/d). Since the number of hooks is recorded monthly in the fishing logbooks, breaking it down by vessel and by trip is a natural consolidation step.

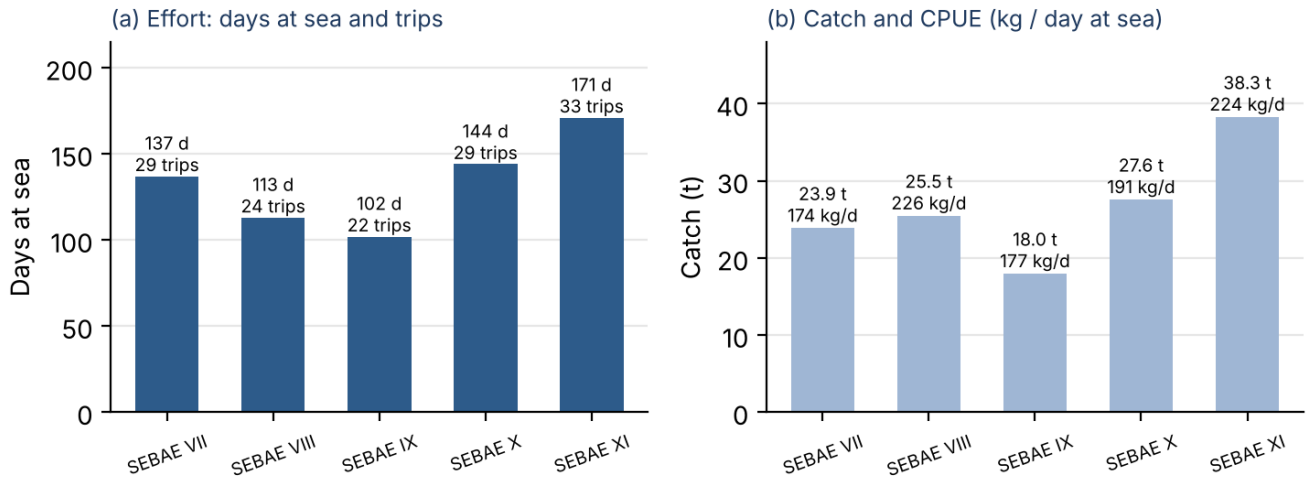

Figure 3. Coverage and effort by vessel: days at sea and trips (a); catches and CPUE per day at sea (b), 2025.

3.6. Place of 2025 in the national series

Since 2020, the national longline fleet has consisted of five vessels, and landings-based monitoring has been implemented since 2014. Activity has again reached full capacity: 137 trips in 2025, after 140 in 2024 and 40 in 2023 (Table 5). Producing consistent annual time series for catches, effort and sizes is a central expected outcome of a national protocol.

Table 5. Vessels, trips and catches of the national longliners, 2020–2025

Year	Licensed vessels	Trips	Catch (t)
2020	5	95	140
2021	5	125	193
2022	0	0	0
2023	5	40	66
2024	5	140	244
2025	**5**	**137**	**133**

4. Discussion

4.1. An operational and comprehensive system

For the 137 trips, the 2025 collection produced directly usable data on catches, effort and sizes, demonstrating that a dedicated regional team can monitor all landings from a five-vessel fleet. The 34% sampling rate surpassed the 30% objective, confirming the value of rounding up to guarantee at least one individual per species is measured (Sparre and Venema, 1998). Combining landings information (catches, numbers, sizes) with logbooks (hooks, trips) enabled the calculation of nominal CPUEs by month and by vessel and revealed a strong seasonal pattern, with the highest yields from November to January.

4.2. Short- and long-term contributions

Table 6. Expected contributions of a standardized national protocol.

Area	Short term (1 to 2 years)	Long term (3 to 10 years)
IOTC data	Harmonized catch, effort and size reports submitted on time (30 June, 30 December)	National series comparable over time and between regions, usable for CPUE standardization and IOTC analyses
Fishery monitoring	CPUE by month and by vessel; calendar of best catches (November–January) useful to fishers and fishing company.	Monitoring of the size structure of catches and of fleet productivity; support for tuna fishery planning
Organization	Common tools (forms, coded species list, identifiers); training of officers and enumerators	Integrated national system covering industrial, artisanal and small-scale fisheries, with reduced consolidation costs
Governance	Complementarity with on-board observers (4 deployments, 67 days in 2025)	Increased credibility of Madagascar within the IOTC scientific bodies and evidence-based management (national shark plan 2022–2026)

4.3. Adaptation by type of fishery

The protocol relies on a shared core : species identification, catch by species, sampling and measurements, while effort variables are adjusted to the gear used. Effort in coastal small-scale fisheries is already recorded at the national level, which facilitates scaling up the system (Table 7).

Table 7. Effort variables by type of fishery and order of magnitude of effort in 2025.

Fishery	Gear	Effort variables	National effort 2025
Industrial	Longline (SEBAE VII–XI)	Hooks deployed, trips, days at sea	524,570 hooks; 137 trips
Artisanal and small-scale fishing	Coastal longline	Hooks, canoe trips	78.3 million hooks; 487,425 trips
Small-scale fishing	Line	Hooks, canoe trips	9.4 million hooks; 329,640 trips
Small-scale fishing	Gillnet	Cumulative fishing days, trips	12.5 million net-days; 255,069 trips
Small-scale fishing	Spear gun	Active gears, trips	26.0 million gears; 119,595 trips

4.4. Avenues for consolidation

Several improvements would further consolidate the system. Maintain coverage of all landings, including late arrivals, through an on-call roster. Record the number of hooks per vessel and per trip on the landing form, in addition to the logbooks. Systematically note, for every species, the numbers of individuals landed and measured. Introduce quality control before national consolidation, including unique identifiers, standardized names and plausible length ranges. These measures are included in the proposed protocol.

5. Conclusion and recommendations

Landing-based monitoring of the Atsinanana longline fleet in 2025 delivered a complete and usable dataset. It provides a solid basis for a standardized national protocol that will secure IOTC reporting in the short term and, in the longer term, support comparable series across all tuna fisheries. We recommend the following:

- **Adopt a standard national protocol** specifying a sampling rate of 30% rounded up with a minimum of one individual per species, a systematic-random method for selecting individuals, the measurement units (FL; LJFL for billfish), and the recording of numbers landed and measured.
- **Integrate fishing effort** (number of hooks and trips for longline; gear and fishing duration for small-scale fishing) into the landing form, by vessel and by trip.
- **Aim for 100% coverage of landings** of industrial vessels, with a catch-up procedure for late landings.
- **Extend the protocol to artisanal fishing and small-scale marine fishing** through the network of enumerators of tuna small-scale fishing, adapting the effort variables to the type of gear.
- **Submit the protocol for validation by the WPDCS** and incorporate it into the next national tuna fisheries strategy for Madagascar.

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