

Diagnosing Artisanal Small-Pelagic Fisheries in São Tomé and Príncipe: Key Findings and Management Implications

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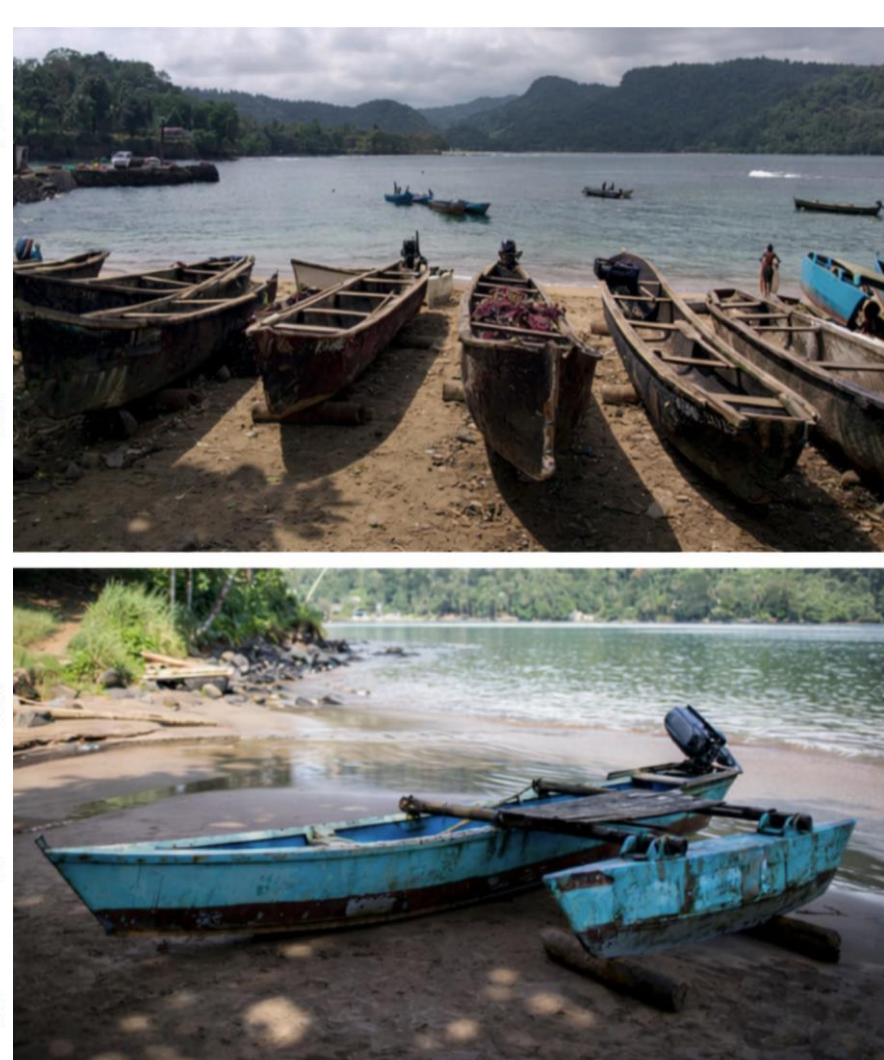
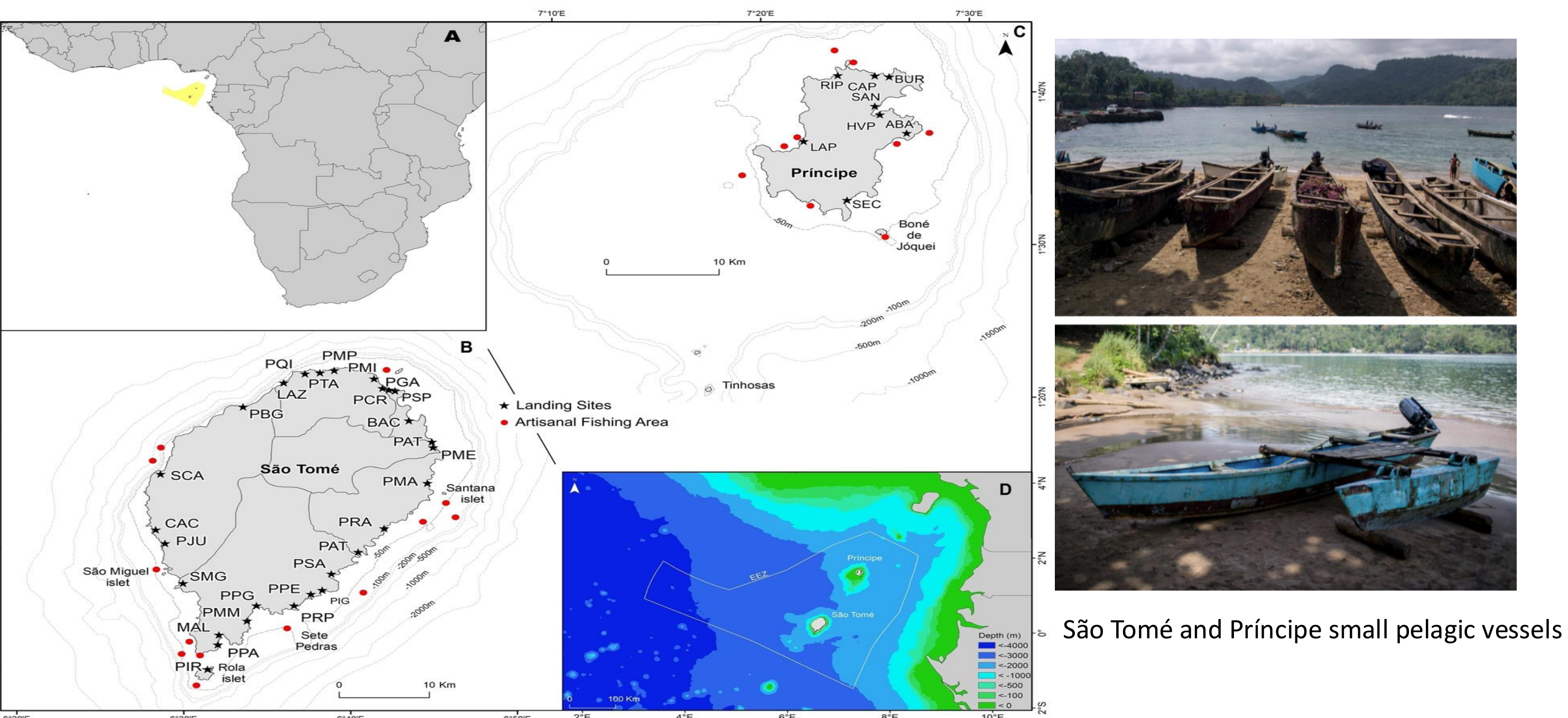
Introduction

Small-scale fisheries are essential for food security, livelihoods, and employment, particularly in low- and middle-income countries. Small-pelagic fisheries play a key role by providing affordable protein and supporting local markets. In São Tomé and Príncipe, artisanal fisheries dominate coastal landings, but operate under limited monitoring and fragmented data systems. These constraints hinder the assessment of whether changes in landings reflect ecological variability, fishing pressure, or reporting practices. This study addresses this gap by providing the first integrated assessment of artisanal small-pelagic fisheries in São Tomé and Príncipe.

Materials and Methods

The study was conducted in São Tomé and Príncipe (Gulf of Guinea), covering 36 artisanal fishing communities (Fig. 1). An integrated dataset combined historical landings (1952–2019) with recent data (2019–2024) from surveys, landing records, and reports. Analyses focused on landings, fleet structure, and species composition. Long-term trends were assessed using OLS regression ($Y_t = \alpha + \beta \times \text{Year}_t + \epsilon_t$). Monthly CPUE (2019–2023; kg h^{-1}) was \log_{10} -transformed and analysed using GAMs with smooth terms for time and cyclic month, including fishing effort (number of trips) as a covariate. A candidate set of models was evaluated, model selection was based on AIC, concavity was assessed, and smooth term significance was tested (REML; $\alpha = 0.05$; 95% CI). Socioeconomic indicators, including occupation and market structure, were assessed based on survey data.

Study Area



São Tomé and Príncipe small pelagic vessels

Figure 1. Location of São Tomé and Príncipe in the Gulf of Guinea and distribution of artisanal fishing grounds and landing sites. Panels show (A) regional location, (B–C) main landing sites and fishing areas, and (D) bathymetry of the EEZ.

Results and Discussion

- Artisanal landings increased from ~2,000 to ~10,800 t (1950s–2016), with a significant long-term trend ($\beta = 5.60$; $t \cdot \text{year}^{-1}$, $R^2 = 0.06$, $p = 0.03$) (Fig. 2).
- Dominant species species (*E. alletteratus*, *C. crysos*, *C. melanurus*), contributed ~20–30%, while “other species” peaked at ~80% (~9,000 t) in 2016 (Fig. 2).
- CPUE exhibited non-linear temporal patterns from GAM analyses, with AIC-selected models explaining moderate variability for *H. balao*, *E. alletteratus*, and *A. thazard* (~38–45%). Strong seasonal effects were detected in *C. melanurus* (83.1%, adj. $R^2 = 0.779$; $p < 0.01$) and *S. aurita* (68.4%), while *C. crysos* showed intermediate performance (62.2%, adj. $R^2 = 0.55$). In contrast, *Decapterus* spp. exhibited weak temporal structure (<20% deviance explained, non-significant smooth terms $p > 0.05$) (Fig. 3).
- Species composition varied by vessel (*C. crysos* >80%, *C. melanurus* >50%, *E. alletteratus* ~50%) (Fig. 4).
- Fishing gears showed distinct species patterns, reflecting gear-specific selectivity (Fig. 5).
- Revenue is driven more by market structure than production, while fuel costs are a key constraint, especially in semi-industrial fisheries (Fig. 6; Table 1).

Future work

- Population Dynamics and Life History Aspects of four Small Pelagic Fishes in São Tomé and Príncipe
- Stock assessment of four key small pelagic species using data-limited methods.

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Objective

This study provides the first integrated assessment of artisanal small-pelagic fisheries in São Tomé and Príncipe by analysing long-term landings, fleet dynamics, species composition, CPUE trends, and socioeconomic structure to support sustainable fisheries management.

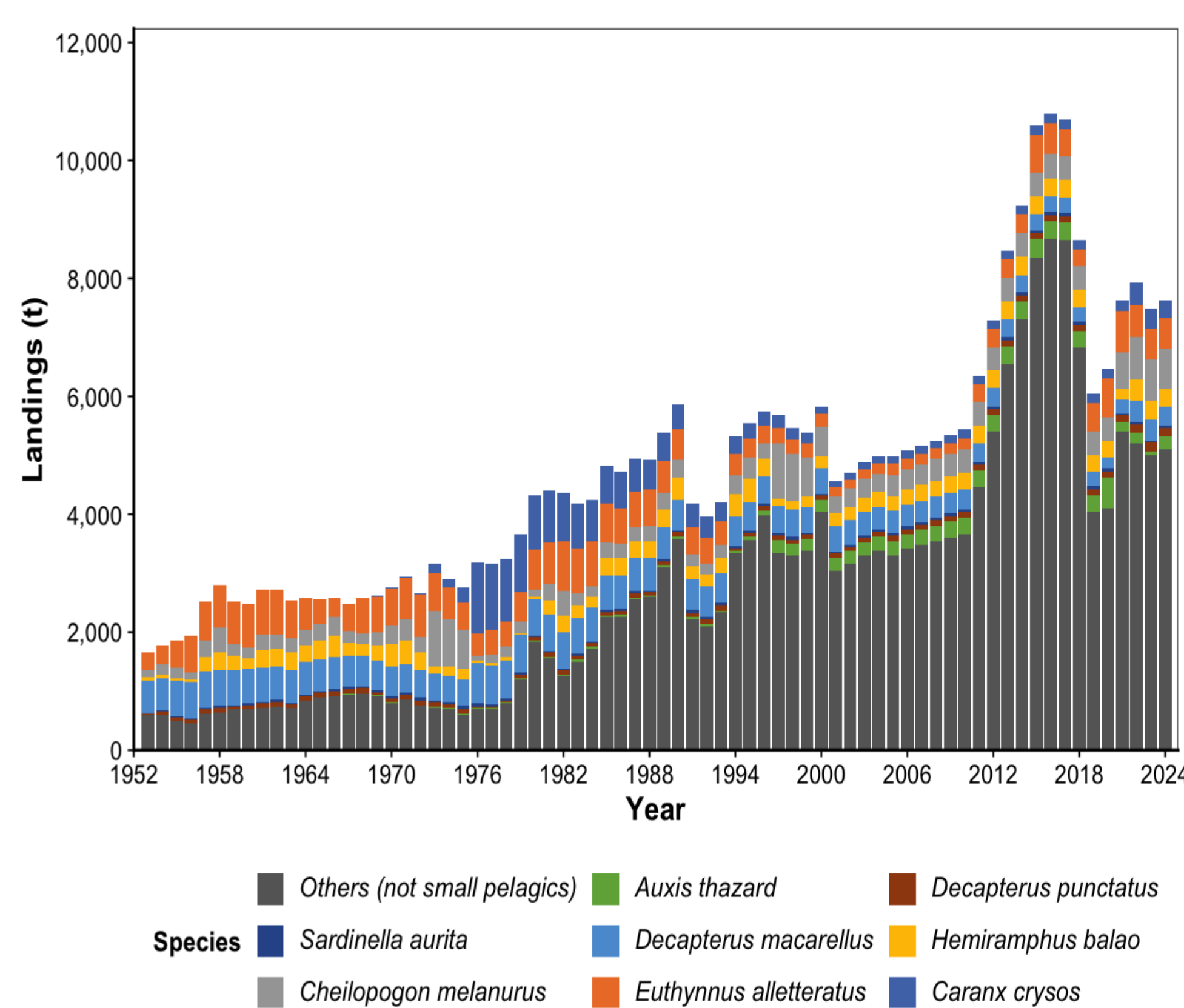


Figure 2. Annual artisanal landings (t) of small-pelagic species in São Tomé and Príncipe from 1952 to 2024, shown as stacked columns representing species-specific contributions to total landings.

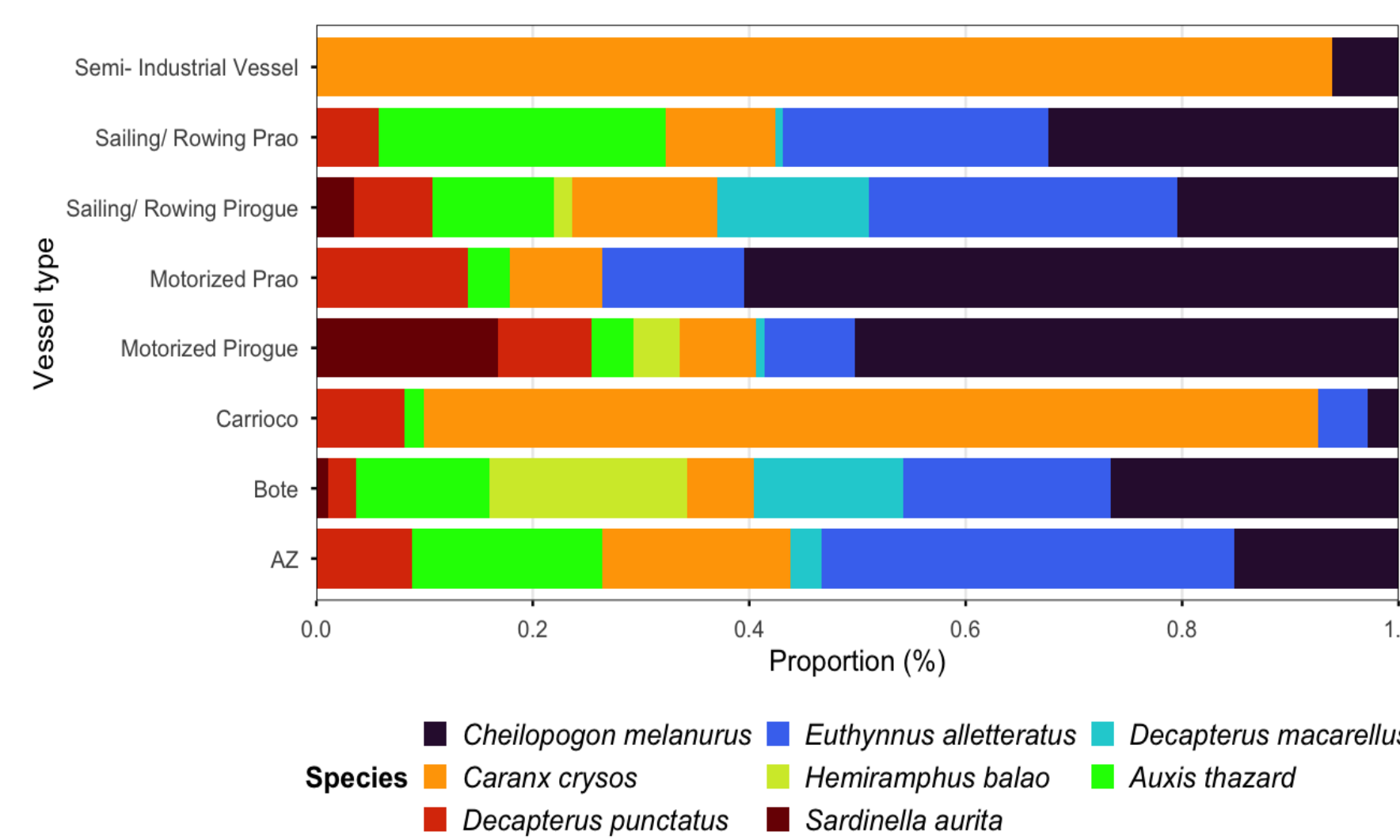


Figure 4. Proportional composition (%) of small-pelagic landings by artisanal vessel type in São Tomé and Príncipe.

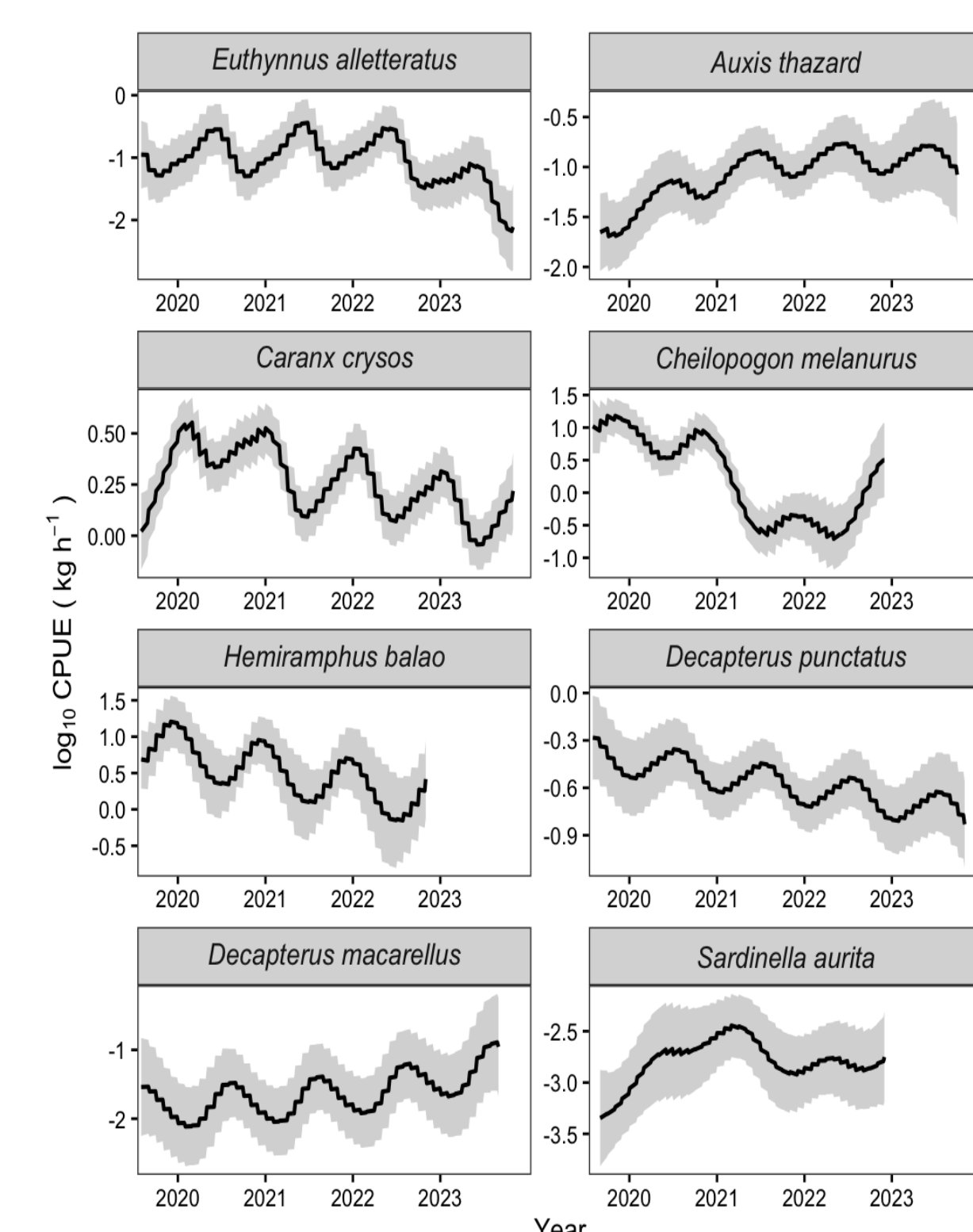


Figure 3. Species-specific monthly \log_{10} CPUE (kg h^{-1}) trends (2020–2023) fitted with GAMs including temporal and seasonal smooth terms. Solid lines show fitted trends; shaded areas indicate 95% confidence intervals.

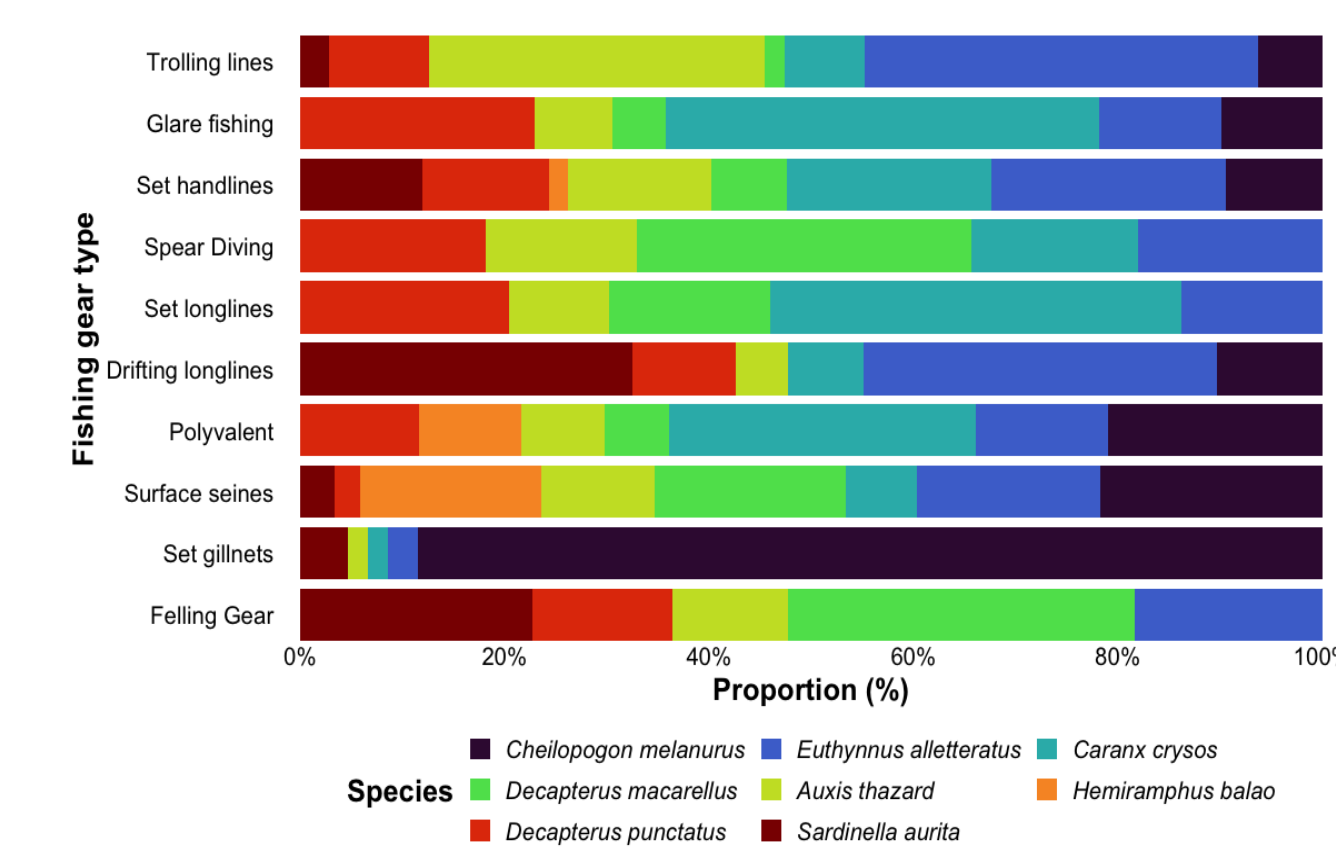


Figure 5. Species composition (%) of artisanal small-pelagic landings by fishing gear type in São Tomé and Príncipe (2021–2024).

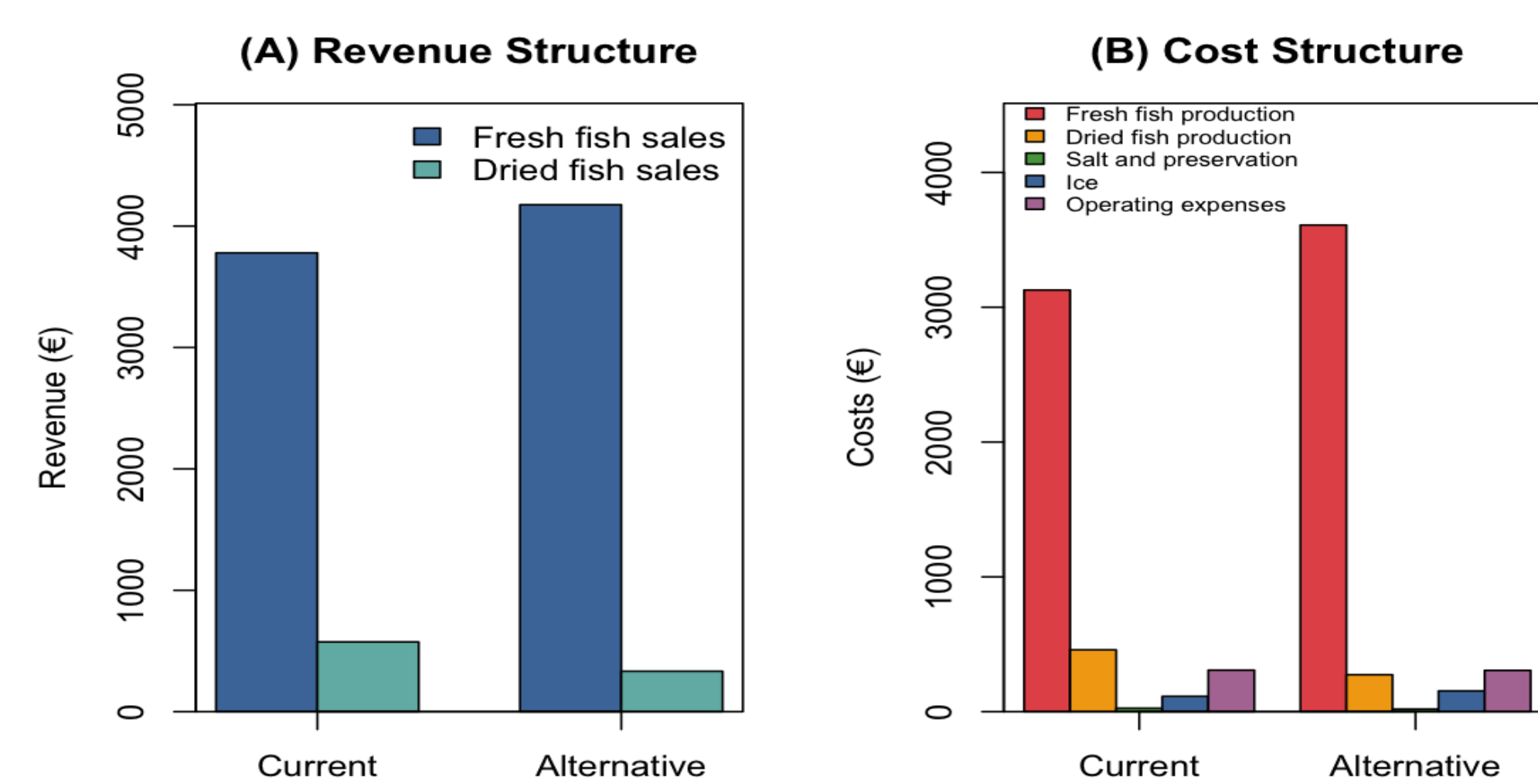


Figure 6. Revenue and cost structure of artisanal fisheries under current and alternative scenarios, highlighting the influence of fresh and dried fish production on economic performance (values in €).

Table 1. Fuel consumption and costs by fleet category (2022–2024)

Fleet category	Vessels (n)	Gasoline (L)	Diesel (L)	Total cost (STN)
Artisanal	1,863	815,288	1,929	817,217
Semi-industrial	15	426	261,270	261,696
Total	1,878	815,714	263,199	1,078,913

Conclusions

This study provides an integrated assessment of artisanal small-pelagic fisheries in São Tomé and Príncipe. Increasing fishing capacity alongside stable production suggests a decoupling between effort and yields. Species composition varied across vessels and gears, reflecting selective exploitation, while CPUE exhibited non-linear temporal variability. Economic outcomes were influenced by market structure and costs. These findings highlight the need for improved monitoring and effort standardisation.