Commentary

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Economic Aspects of Tropical Tuna Fisheries Balancing Profitability and Sustainability

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Introduction

Industrial and small-scale tuna fisheries in Mozambique may compete over the same resources, which has potential socio-ecological impacts. The two types of fisheries were investigated by characterising their catch trends, types of interactions, number of people they employ and revenues. Commercial landings, logbook data and all previously established tuna Fishing Partner Agreements in the country were analysed, as well as data collected from interviews with small-scale fishers. A declining trend in catches was observed in the industrial fisheries sector, which was also perceived by small-scale fishers, and suggests that there is some competition between these two sectors for the same tuna stocks, even when these stocks are targeted in separate grounds. While the small-scale tuna fisheries sector provides thousands of local direct and indirect jobs and high economic benefits for fishing communities, the industrial fisheries sector may only be economically advantageous to Mozambique if Fishing Partner Agreements are improved and enforced. Although maintaining non-overlapping fishing grounds between industrial and small-scale fisheries may be positive for the fishers, it could result in major pressure on the tuna stocks, as they would be exploited relentlessly.

Tropical tuna fisheries play a vital role in the global economy, providing a significant source of revenue, employment, and food security. However, the economic aspects of these fisheries are complex, influenced by various factors such as market demand, management strategies, and the sustainability of fish stocks. This article explores the economic pros and cons of tropical tuna fisheries, shedding light on the challenges and opportunities they present for sustainable economic development.

Economic Benefits of Tropical Tuna Fisheries

A time series of annual commercial pike landings from 1976–2018 from the lagoons around Rügen was obtained from the State Office for Agriculture, Food Safety and Fisheries (LALLF) of the German state Mecklenburg-Vorpommern (M-V). In addition, commercial removals from 1969–1975 and from 1955–1968 were extracted and from records generated from annual official fisheries reports published by the Institut für Hochseefischerei und Fischverarbeitung Rostock of the former GDR.

A time series of recreational removals was not available for the Rügen pike stock, as recreational removals are not actively monitored in the area. However, given the popular recreational fishery for Rügen pike, it was considered important to include recreational removals in the time series of total removals. Recreational removals were reconstructed according to the guidelines provided by Zeller et al. Data from two telephone-diary studies performed among recreational fishers in the region were used as anchor points. These studies estimated total pike removals in the Rügen area from a random sample of participating recreational fishers, found via telephone screening surveys using random digit dialling, for the years 2006/2007 and 2014/2015. From these anchor points, and using additional quantitative data such as proxies for angling effort, recreational removals were interpolated and extrapolated for the rest of the time series.

First, a suite of individual COMs were used to estimate current status of the Rügen pike stock. The results of these models were then inserted into several different “trained” statistical models, following the ensemble model approach as described by, providing an estimate of current stock status. Lastly, the outcome of the ensemble analysis was used to assign weights to COM time series estimates of biomass and fishing mortality, providing an estimate of past stock status.

Using COMs that had their performance tested seven individual COMs were fitted to the reconstructed removal data of the Rügen pike stock. This included five COMs that fit a population dynamics model, and two COMs that find statistical associations using data-rich assessed stocks. Each of the COMs returned an estimate of B/BMSY (population biomass relative to population biomass that produces maximum sustainable yield) over the course of the catch time series, including a 95% confidence interval. Furthermore, parameters and reference points returned by some, but not all, COMs include fishing mortality F (from the pooled population), fishing mortality that gives MSY FMSY, B, BMSY, MSY, intrinsic population growth rate r and population carrying capacity k.

Challenges and Trade-offs in Tropical Tuna Fisheries

An ensemble model approach was used in an attempt to resolve the potential discrepancies in the different COMs that were fitted to the data, which yielded different results due to inherent biases resulting from the different methods and assumptions used. Firstly, for each COM, the estimated values for mean and slope of B/BMSY were taken, and a mean for the last 5 years of data was calculated. Secondly, these COM means were inserted as covariates into three different statistical models (i.e. ensemble models) that were trained on stocks with known status, thereby obtaining an ensemble estimate of the mean and slope of B/BMSY for the last 5 years. The three statistical models that were used for this were a linear model, a random forest and a boosted regression tree.

The economic aspects of tropical tuna fisheries are multifaceted, with both benefits and challenges to consider. While these fisheries contribute significantly to export revenue, employment, and economic development, overcapacity and unsustainable fishing practices pose risks to the long-term viability of the industry.

To address these challenges, a holistic approach is needed. This includes implementing effective fisheries management strategies based on scientific data, establishing transparent and accountable governance frameworks, and promoting responsible fishing practices. Collaborative efforts involving governments, fishing enterprises, and stakeholders are necessary to strike a balance between profitability and sustainability.

Moreover, diversification and value addition along the tuna value chain can enhance economic returns and reduce dependence on raw tuna exports. Developing processing capabilities, promoting sustainable aquaculture practices, and investing in local infrastructure can create additional economic opportunities and support the development of resilient coastal communities.

By prioritizing sustainable fishing practices, responsible governance, and equitable distribution of economic benefits, tropical tuna fisheries can continue to play a significant role in global economic development while safeguarding the health and longevity of tuna stocks and the communities that rely on them.