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An Evaluation of the Stock State of the Kawakawa Fisheries Using the Surplus Production Model was made in the Coastal Seas of Tamil Nadu

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Abstract

One of the tuna fisheries resources of India that is economically utilised is the Kawakawa Euthynnus affinis. There was no more information on the stock status besides arrival data. As a result, the current study examined the sustainability of the kawakawa fishery in Tamil Nadu, India. For the years 2001 through 2020, annual catch and effort data were recreated. The stock exploitation was investigated by running surplus production models with catch, catch per unit effort (CPUE), and other life history data using the Catch-based MSY (CMSY), Bayesian state-space. Maximum Sustainable Yield (MSY) or biomass giving MSY (Bmsy) and fishing mortality giving MSY (Fmsy) of all the biological reference points.

Keywords: Fisheries; Marine science; Fishing mortality; Central marine

Introduction

In temperate to tropical waters between 45° North and South of the equator, tunas are regarded as an important marine fishing resource. They are epipelagic marine fishes that inhabit the Indo-Pacific waters' near shore continental shelf regions and the top 200 metres of the ocean, where the water's surface temperature ranges from 18 to 29 °C. About 50 different species of tuna make up the Family Scombridae, which has a significant commercial value on the world market. Due to the surge in demand for canned tuna, industrial fishing has been concentrated on Asia, particularly in Japan, Taiwan of China, Indonesia, and South Korea [1].

The fisheries sector plays a pivotal role in the socio-economic fabric of coastal regions across the globe, providing sustenance, livelihoods, and economic opportunities to millions of people. In the coastal seas of Tamil Nadu, India, fisheries resources have been a vital source of nutrition and income for generations. Among the diverse array of marine species harvested in these waters, Kawakawa (Euthynnus affinis), a member of the tuna family, holds particular significance. The Kawakawa fishery is emblematic of the intricate relationship between human communities and marine ecosystems in Tamil Nadu, reflecting both the region's dependence on marine resources and the challenges posed by overexploitation and environmental variability [2].

As with many fisheries worldwide, the Kawakawa fishery in Tamil Nadu faces a complex interplay of factors, including fluctuating stock dynamics, changing environmental conditions, and evolving socio-economic pressures. In this context, the evaluation of the stock state of Kawakawa fisheries becomes a critical endeavor, serving as a foundation for informed and sustainable management decisions. Utilizing scientific models and methodologies, such as the Surplus Production Model, fisheries scientists and stakeholders aim to assess the current status of Kawakawa populations, predict future stock trajectories, and devise strategies to ensure the long-term viability of this resource [3].

This study represents a concerted effort to delve into the intricacies of Kawakawa fisheries in the coastal seas of Tamil Nadu. By employing the Surplus Production Model, a well-established tool in fisheries science, we seek to provide a comprehensive analysis of the stock state of Kawakawa populations in this region. This research is motivated by the need to understand the ecological dynamics of Kawakawa, the impacts of human fishing activities, and the broader implications for coastal communities and the marine environment.

In the following sections, we will delve into the objectives, methodology, findings, and implications of this evaluation. Through this research, we aim to contribute valuable insights into the state of Kawakawa fisheries, offering a foundation upon which sustainable management practices can be developed and fostering a harmonious coexistence between human societies and the coastal ecosystems they rely upon [4].

Materials and Methods

The southernmost marine state of India is Tamil Nadu (8°4′ N to 13°35′ N and 76°18′ E to 80°20′ E). It has a 1076 km long coastline, a 41,412 km2 continental shelf area, and 1.9 105 km2 of Exclusive Economic Zone. The Bay of Bengal to the east, the Indian Ocean to the south, and the Arabian Sea to the west border the state of Tamil Nadu. The Coromandel Coast, Palk Bay Coast, Gulf of Mannar Coast, and Arabian Sea Coast are the four major ecosystems that make up Tamil Nadu's coastline. In Tamil Nadu, 5.62 105 t of marine fish were expected to have been landed overall. The main fish species that contributed to Tamil Nadu's pelagic finfish landings were tunas, mackerels, barracudas, shads, anchovies, wolf herrings, seer fishes, and ribbonfishes [5].

There aren't any publicly accessible records of catch and effort statistics for tuna in India except from the annual species-level landing data published by the Department of Animal Husbandry, Dairy, and Fisheries (DADF, 2014, p. 38) and Central Marine Fisheries and Research Institute. Data on catch and effort is a crucial component of surplus production models (SPMs). When it comes to analysing the

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stock state of the kawakawa fisheries in Tamil Nadu, holistic model techniques like SPMs are the only choice. The current work recreated catch and effort data for the kawakawa fishery in Tamil Nadu from 2001 to 2020, fitted the data to SPMs, and assessed its sustainability. The management will benefit from knowing BRPs and stock status information [6].

Following Bhathal, the catch and effort statistics of kawakawa from 2001 to 2020 (20 years) were recreated using reports from the Government of India, such as DADF and CMFRI, as well as a number of other historical fisheries survey reports and Tamil Nadu state government report databases (GOT, 2004-2006, 2010-2020). The annual total catch was calculated as million horsepower (HP) days of fishing effort and as metric tonnes (MT) of catch. DADF, 2014, p. 38 and CMFRI, 2013-2020-2020 were used to compile catch statistics for the Tamil Nadu kawakawa fisheries.

Tamil Nadu's coastal tuna fishery uses a variety of gear types and uses many gears. To address fluctuations and inequalities in fishing efficiency, the effort was standardised in accordance with Bhathal. Because the catch ability coefficient varied between fishing techniques, effort was standardised by using engine power (HP for motorised and mechanised vessels and crew size for non-motorized vessels). In general, the length of the boat and the equipment increases the horsepower of the engine needed for propulsion and operation. Engine horsepower and fishing equipment sizes (length of net/number of hooks) were correlated. Because of this, it was thought that engine power improves catch ability coefficient [7].

In order to rebuild the fishing effort from 2001 to 2020, the first step was to gather data (number of boats, fishing days, and gear category) from historical information; we have access to a wide range of authoritative sources, including national and state reports, government documents, research institute articles, fisheries survey reports, grey literature, and various databases. The necessary components were included in the data collection and formalisation process, including the number of boats, total power (HP units), fishing days, and crew size for both vessels with and without motors [8].

Results

According to Rohit, coastal tuna are the mainstay of India's tuna fisheries and are a significant fishery on both the east and west coasts. Kawakawa, one of the main coastal species of tuna, predominated by making up 35.4% of the large pelagic. Coastal tuna make up 7.05% of the pelagic fish landings in Tamil Nadu. Juveniles were reportedly present along the Tuticorin coast (Tamil Nadu) from June to August, which also happens to be the prime fishing season for the species, according to Balasubramanian and Abdussamad's 2007 report. With the exception of the Lakshadweep pole and line fishery, tunas are primarily captured as bycatch and are fished throughout India and Tamil Nadu using a variety of vessels and equipment [9].

Discussion

Furthermore, there is no further information about kawakawa available outside annual landing statistics provided by government organisations. This necessitates the disclosure of data on catch, effort, and catch per unit effort. Therefore, the study's reconstruction of catch and effort data will be extremely helpful for all data-poor fisheries worldwide, not just the kawakawa fishery in Tamil Nadu [10].

The current study's higher catch and decreased CPUE index showed that the kawakawa fishery in Tamil Nadu's seas required a lot of fishing effort. The results given by Vivekananda and Kasim and the current findings agreed. From 2006 to 2010, they saw an increase in the kawakawa fishery's productivity, Reported that fishing activity significantly increased after a tsunami. The boat's overall length increased from 11 to 12 m to 20 to 23 m, and the one MT net was replaced with more than six MT. According to the current study, effort significantly increased in 2006 before declining in subsequent years as a result of the phase-out of outdated ships and equipment [11, 12].

Conclusion

Increasing the mesh size of fishing gear, banning fishing during certain seasons, and designating certain regions as fish sanctuaries, particularly spawning grounds, are some of the necessary actions to manage the tuna fisheries. A user interaction programme must be developed to inform fishermen about the importance of remotely sensed data and OCEANSAT must be built to find tuna fish densities in real time. Although employing BRPs for stock assessment has significant limitations, it nevertheless offers the reliable data required for management guidelines and can be one of the factors for assessing the state of the fishery at the moment.

Acknowledgement

None

Conflict of Interest

None

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