



Evaluation of Potential Fishing Zone (PFZ) Advisories for Enhanced Fishing Efficiency along the Karwar Coast, Karnataka

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Abstract

Potential Fishing Zone (PFZ) advisories based on satellite-derived Sea Surface Temperature (SST) and chlorophyll-a data provide valuable information on potential fish aggregation areas. This study compared catch performance from PFZ-guided and non-PFZ fishing operations along the Karwar coast, Karnataka. Catch data of major pelagic species, including Indian mackerel (*Rastrelliger kanagurta*) and Indian oil sardine (*Sardinella longiceps*), were analyzed from selected fishing vessels and landing centres. The results indicated that fishing trips utilizing PFZ advisories recorded higher catches compared to conventional non-PFZ operations. The use of PFZ information enabled fishermen to identify productive fishing grounds more efficiently, reducing search time and improving fishing success. The findings highlight the role of satellite-based PFZ advisories as an effective tool for enhancing fishing efficiency and supporting sustainable fisheries management.

Keywords: Potential Fishing Zone (PFZ), *Rastrelliger kanagurta*, *Sardinella longiceps*, Karwar, Marine Biology, Climate Adaptation, Remote Sensing.

1. Introduction

The marine fisheries sector plays a pivotal role in the socio-economic framework of India's coastal states, providing food security, employment, and foreign exchange earnings. Along the central-west coast of India, the Karnataka coast supports vital pelagic fisheries, with the Indian mackerel (*Rastrelliger kanagurta*) and the Indian oil sardine (*Sardinella longiceps*) serving as the twin pillars of local livelihoods and marine biodiversity. These small pelagic species are characterized by short lifespans and rapid growth rates, rendering them highly sensitive to climate-driven oceanographic anomalies. Variations in Sea Surface Temperature (SST), coastal upwelling indices, and altering monsoon patterns profoundly impact their recruitment, schooling behavior, and spatial distribution patterns.

In recent years, Karwar, a prominent fishing hub situated in the Uttara Kannada district, has experienced severe catch fluctuations. The compounding pressures of anthropogenically driven overfishing, destructive gears, and critical habitat loss have exacerbated stock stress. Concurrently, an alarming rise in juvenile landings has been documented, signaling potential recruitment overfishing and long-term instability in biomass yields. To mitigate these climate-induced vulnerabilities and buffer artisanal and small-scale fishers against unproductive voyages, data-driven management frameworks are urgently required.

The Indian National Centre for Ocean Information Services (INCOIS) addresses this gap by generating and disseminating Potential Fishing Zone (PFZ) advisories. By integrating real-time satellite remote sensing data—specifically thermal boundaries derived from SST and chlorophyll-a concentrations indicative of phytoplankton blooms—INCOIS identifies highly productive biological fronts. While the theoretical benefits of PFZ advisories are well-documented, localized empirical validations are critical to quantify their actual economic and conservation impacts.

2. Objective

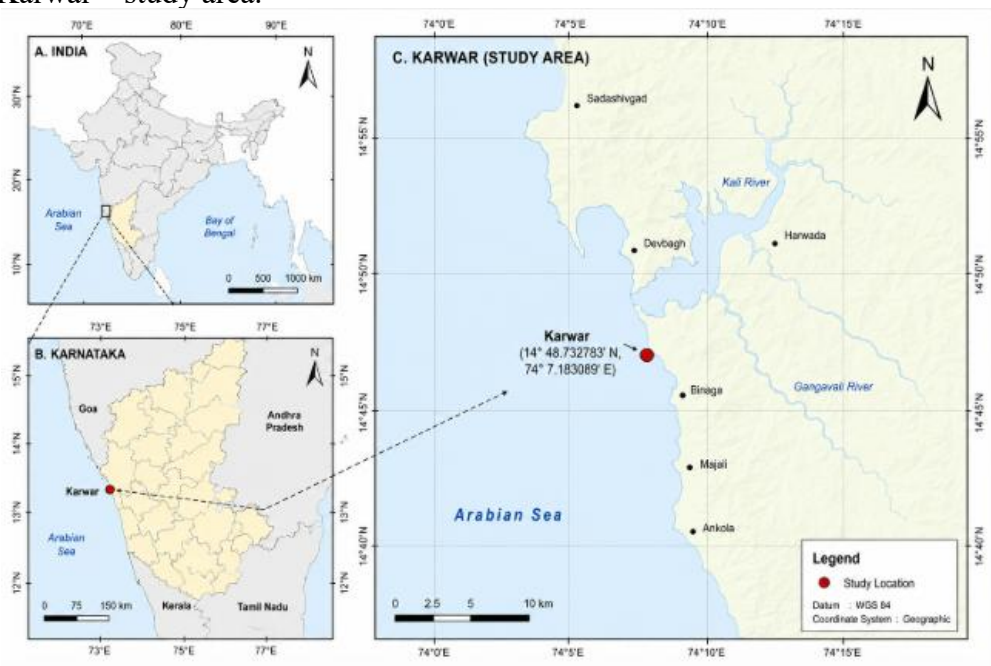
The primary objective of this investigation is to empirically evaluate the operational effectiveness and economic viability of INCOIS Potential Fishing Zone (PFZ) advisories as a reliable climate-adaptive tool for improving marine resource utilization and optimizing catch outcomes along the Karwar coast.

3. Materials and Methods

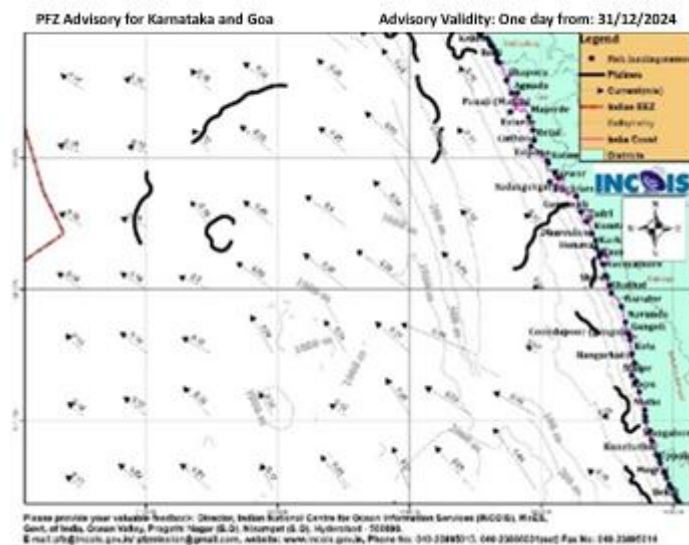
3.1 Study Area and Spatial Domain

The study was conducted along the coastal waters of Karwar, Karnataka, India. The primary tracking and fish landing assessments were centralized at the Karwar Baithkol landing center.

Map showing Karwar – study area.



The dark black lines represent the PFZ identified zones from satellite data.



3.2 Data Dissemination and Fishermen Training

Potential Fishing Zone (PFZ) advisories were generated using satellite-derived Sea Surface Temperature (SST) and chlorophyll-a datasets to identify biologically productive oceanographic features, including thermal fronts, chlorophyll gradients, eddies, and upwelling zones associated with enhanced fish aggregation. The advisories were disseminated to registered fishers operating from Karwar through a multi-platform communication network comprising mobile Short Message Service (SMS) alerts, and community-based extension and awareness programmes. To facilitate effective utilization of the advisories, structured capacity-building programmes were conducted to train fishers in interpreting PFZ maps, understanding navigational vectors, geospatial coordinates, and optimal route planning for efficient navigation to the identified fishing grounds.

3.3 Sampling and Data Collection

Systematic field monitoring programme was conducted from August 2024 to December 2024 to evaluate the operational effectiveness of Potential Fishing Zone (PFZ) advisories in enhancing pelagic fish landings. Nine commercial mechanized fishing vessels operating from Karwar Fishing Harbour were purposively selected based on the consistency of their vessel movement records, regular fishing operations, and compliance with standardized data-reporting protocols throughout the study period. For each participating vessel, daily logbooks were maintained to document fishing operations, including date of voyage, fishing duration, fishing grounds, PFZ adherence, species-wise catch composition, total catch, and operational characteristics. Catch composition was recorded separately for the dominant pelagic species, Indian mackerel (*Rastrelliger kanagurta*) and oil sardine (*Sardinella longiceps*), to facilitate species-specific assessment of PFZ advisory performance.

In addition to onboard monitoring, a comparative analysis of fish landings was carried out using landing statistics collected at the Baithkol Fish Landing Centre between August 2024 and December 2024. Monthly landing records were classified into two operational categories: (i) voyages conducted following satellite-derived PFZ advisories (PFZ-guided operations) and (ii) voyages employing conventional fishing practices without the aid of PFZ information (non-PFZ operations). Species-specific landings were quantified for each category to evaluate differences in catch performance attributable to PFZ utilization under varying seasonal and oceanographic conditions. This comparative framework enabled the assessment of the effectiveness of PFZ advisories in improving catch efficiency and optimizing fishing effort within the study area.

4. Results and Discussion

Satellite imagery analysis provides the foundational oceanographic basis for tracking target pelagic species. The boundaries of thermal gradients and elevated chlorophyll-a patches are demarcated on the advisory charts by dark black lines, which represent the precise PFZ locations identified from satellite

data. Fishers utilizing these lines bypass nomadic scouting, steering vessels directly toward stable forage zones where pelagic fishes are abundantly available.

Data Collected from Karwar:



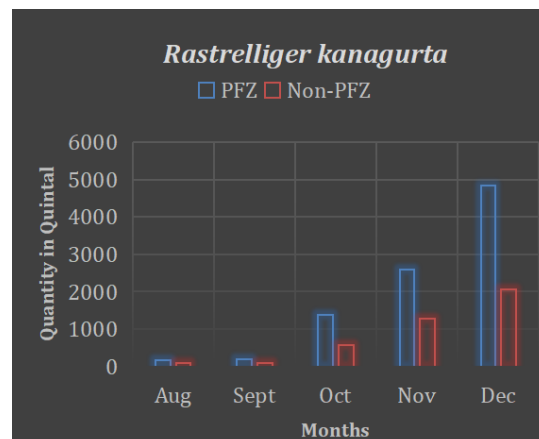
Without PFZ advisory - resulted in juvenile catch

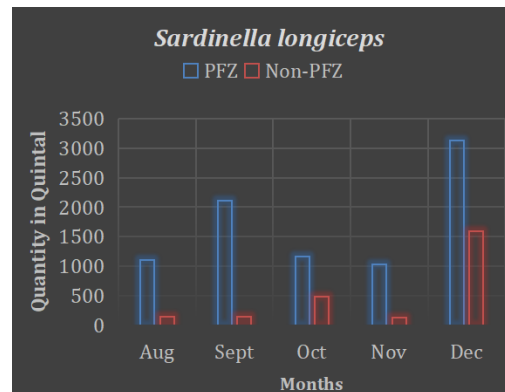
With PFZ Advisory – marketable size fishes

The variation in total catch among the individual vessels can be attributed to differences in crew size, net dimensions, and varying numbers of total operational days at sea. However, across all monitored vessels, catch rates remained consistently higher than historical baseline averages for non-advisory scouting in the region.

Table 1. Total fish availability from PFZ and Non-PFZ areas collected between Aug 2024 to Dec 2024 at Karwar Baithkol (quantity in quintal).

Month	<i>Rastrelliger kanagurta</i> (Indian mackerel)		<i>Sardinella longiceps</i> (Indian Oil sardine)	
	PFZ (In quintal)	Non-PFZ (In quintal)	PFZ (In quintal)	Non-PFZ (In quintal)
Aug	179	97	1,113	153
Sept	199	83	2,116	147
Oct	1,387	567	1,162	484
Nov	2,601	1,281	1,027	137
Dec	4,829	2,070	3,126	1,599





An evaluation of the monthly trends reveals distinct seasonal dynamics. During August, oil sardine landings achieved a major peak via PFZ alignment (1113 quintal) compared to non-PFZ voyages (153 quintal). Similarly, Indian mackerel landings also increased markedly during this period under PFZ conditions, indicating that PFZ advisories enhanced the catch efficiency for both pelagic species during their peak seasonal abundance. This indicates that early post-monsoon upwelling features were successfully captured via remote sensing (Solanki et al., 2003; Nayak et al., 2003), allowing fishers to target dense pelagic schools. A massive surge across both species occurred in December, with PFZ-guided mackerel catches reaching comparatively high landings of 4829 quintal, outperforming non-guided catch metrics by more than 2070 quintal. These substantial disparities strongly demonstrate the reliability of forecast models during seasonal transition periods.

5. Conclusion

Present observations indicated that fishermen who adhered to PFZ advisories experienced significantly higher catch rates compared to those who did not, demonstrating the advisories' efficacy in enhancing fishing efficiency and resource utilization. Leveraging Potential Fishing Zone (PFZ) data has significantly enhanced the operational efficiency and profitability of fishermen. By utilizing PFZ advisories, which pinpoint areas with optimal sea surface temperatures and chlorophyll concentrations, fishermen can directly navigate to productive fishing zones. This targeted approach not only increases catch quality and quantity but also reduces fuel consumption and time spent at sea. Consequently, these efficiencies lead to substantial cost savings and higher profits.

Conversely, fishermen who do not utilize PFZ data often spend additional time and resources searching for fish, resulting in lower catch rates and increased operational costs. This disparity underscores the value of integrating satellite-based PFZ advisories into fishing practices as a pivotal sustainable management strategy. Future policies should focus on scaling the resolution of these remote sensing models to mitigate the ongoing stock stress and juvenile overexploitation observed within the nearshore ecosystems of the Karnataka coast.

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