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"Distribution And Dynamics of Pelagic Fish Along the Karnataka Coast: Insights from INCOIS Potential Fishing Zone (PFZ) Advisories"

Suraj. S. Pujar[1*] and J. L. Rathod[2]

[1*,2]*Department of Studies in Marine Biology, Karnataka University Post Graduate Centre, Karwar, Karnataka*

***Corresponding author:** Suraj. S. Pujar*
**Email: surajpujar2395@gmail.com*

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Abstract

The use of satellite technology to retrieve Potential Fishing Zone (PFZ) data has revolutionized the fishing industry by providing real-time information to fishermen. By leveraging advanced technologies such as satellite remote sensing and data analytics, PFZs are identified based on oceanographic parameters like sea surface temperature (SST) and chlorophyll-a (Chl-a) concentrations. These PFZs highlight areas where fish are most abundant, allowing fishermen to optimize their efforts and focus on regions with higher fish concentrations. This targeted approach minimizes overfishing in less productive areas, promoting sustainable fishing practices. By integrating cutting-edge technologies and data analytics, this system not only enhances the fishing process but also contributes to environmental conservation by reducing the ecological impact of fishing activities.

INTRODUCTION

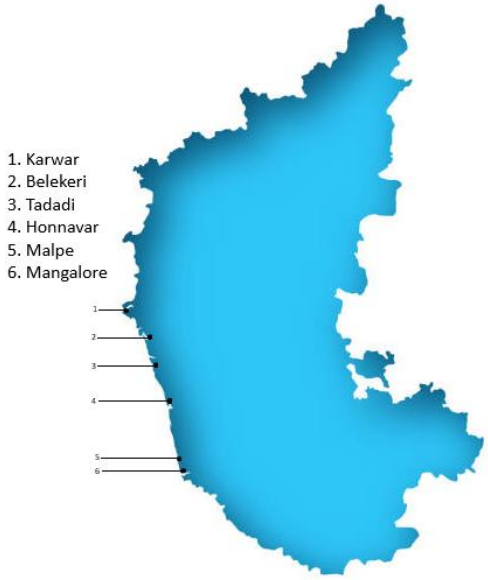
Potential Fishing Zones, which refer to specific areas in the ocean that have a high likelihood of being rich in marine life, especially fish stocks, and are therefore ideal for fishing activities.
PFZs are a crucial tool for enhancing fishing efficiency, promoting sustainability, and helping to preserve marine ecosystems. Using advanced technologies and data analytics, PFZs help pinpoint the areas where fish are most abundant, improving the overall fishing process while reducing environmental impact and data analytics to optimize fishing efforts.
Coastal fishing plays a crucial role in India's national economy, with nearly seven million people living along the country's 8,100 km coastline, relying on fishing for their livelihoods (Wasim, M., Mohanty, S., Pandey, A. C.(2024). By analyzing oceanographic conditions, it is possible to predict fish abundance in specific areas (Mursyidin et al., 2015). Key parameters for determining fish availability and the abundance of pelagic species include changes in sea surface chlorophyll-a (Chl-a) concentrations and sea surface temperature (SST) (Fitrianah et al., 2016; S. Karuppasamy et al., 2020). These factors also aid in predicting Potential Fishing Zones (PFZ) (Guidetti et al., 2010; Nammalwar et al., 2013; Fitrianah et al., 2015). The concentration of surface chlorophyll serves as an indicator of phytoplankton biomass and is used to identify fish habitats (O'Reilly et al., 1998). PFZs are areas where fish congregate due to the abundance of food, as these zones have higher food availability compared to the open sea, thanks to optimal SST and the increased concentration of surface Chl-a at specific times (Giri et al., 2016; Harahap et al., 2020).
The identification of Potential Fishing Zones (PFZs) relies on satellite data that provides critical oceanographic information.
Key oceanographic parameters used to predict PFZs include:
• Sea Surface Temperature (SST): Optimal SST ranges are used to identify warm, productive waters where pelagic fish species are likely to aggregate.

• Chlorophyll-a Concentrations (Chl-a): Higher Chl-a concentrations signify abundant phytoplankton, which is an essential food source for fish, thereby attracting pelagic species.
• Sea Surface Height (SSH) and Surface Current Data: These parameters help in understanding ocean circulation patterns that influence fish movement.
The satellite data was pre-processed using software tools like NASA's SeaDAS or ERDAS IMAGINE to convert raw satellite imagery into usable environmental data. The data was then analyzed to identify high-productivity zones based on favorable SST and Chl-a levels that are indicative of PFZs.

MATERIAL AND METHODS

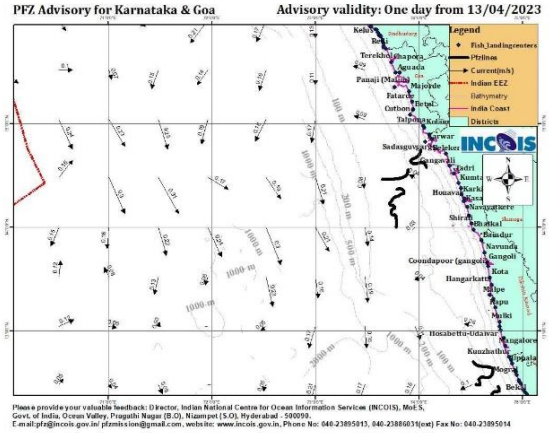
Fish landing centers are crucial hubs for both marine and inland fisheries, with Karnataka currently hosting 6 harbors. The study was focused on the waters off the west coast, which is known for its commercial fisheries targeting Rastelliger kanagurta(Indian mackerel) and Sardinella longiceps(Indian Oil sardine).

Study areas:



S.No	Study Area	Lat Long
1	**Karwar**	N 14° 48.732783' E 74° 7.183089'
2	**Belekeri**	N 14° 42.189899' E 74° 15.912191'
3	**Tadadi**	N 14° 31.545744' E 74° 21.299841'
4	**Honnavar**	N 14° 16.831218' E 74° 25.52538'
5	**Maple**	N 13° 21.048657' E 74° 41.852198'
6	**Mangalore**	N 12° 52.092278' E 74° 49.049906'

The PFZ Advisory for Karnataka provides satellite-derived information on Potential Fishing Zones (PFZs) along the coastal waters of the state. These zones identified using environmental parameters such as sea surface temperature, chlorophyll levels, and other oceanographic data, indicate areas with high fish productivity. By utilizing this advisory, local fisherman targeted areas with higher catch potential, improving their fishing outcomes compared to traditional method followed.



Picture-1: The dark black lines represent the Potential Fishing Zones (PFZs) identified from satellite data.

Potential Fishing Zone

KARNATAKA
कर्नाटक
ಕರ್ನಾಟಕ

SATELLITE DATA SHOWS LIKELY AVAILABILITY OF FISH STOCK TILL 14 APR 2023
उपग्रह से प्राप्त सूचना अनुसार 14 अप्रैल 2023 तक मत्स्य भंडार की उपलब्धता
ಉಪಗ್ರಹ ಮಾಹಿತಿ ಮೀನು ಸ್ಟಾಕ್ ಸಾಧ್ಯತೆ ಲಭ್ಯತೆ ಟಿಲ್ ತೋರಿಸುತ್ತದೆ 14 ಏಪ್ರಿಲ್ 2023

ತೀರದಿಂದ	ನಿರ್ದೇಶನ	ಬೇರಿಂಗ್ (ಡಿಗ್ರಿ)	ದೂರ (ಕಿ.ಮೀ)ನಿಂದ - ಗೆ ರಿಂದ-ಗೆ	ಆಳ (ಮೀಟರ್) ನಿಂದ - ಗೆ ರಿಂದ-ಗೆ	ಅಕ್ಷಾಂಶ (ದ್ ಮ್ ಸ್)	ರೇಖಾಂಶ (ದ್ ಮ್ ಸ್)
Bhatkal ಭಟ್ಕಲ್ ಭಟ್ಕಲ್	ವಾಯುವ್ಯ	278	79-84	59-64	14 4 18 ಉತ್ತರ	73 46 57 ಈಸ್ಟ್
Tadri ತದರಿ ತದರಿ	ವಿ	267	49-54	51-56	14 29 24 ಉತ್ತರ	73 51 54 ಈಸ್ಟ್
Belekeri ಬೆಲೆಕೇರಿ ಬೆಳಕೇರಿ	ವಿ	251	30-35	41-46	14 36 53 ಉತ್ತರ	73 58 56 ಈಸ್ಟ್
Dhareshvar ಧಾರೇಶ್ವರ ಧಾರೇಶ್ವರ್	ವಾಯುವ್ಯ	277	73-78	60-65	14 27 36 ಉತ್ತರ	73 43 9 ಈಸ್ಟ್
Kumta Pt ಕುಮತ ಪಟ ಕುಂತ ಪಿಟ್	ವಾಯುವ್ಯ	274	62-67	60-65	14 28 0 ಉತ್ತರ	73 47 39 ಈಸ್ಟ್
Honavar ಹೊನಾವರ ಹೊನ್ನಾವಾರ್	ವಾಯುವ್ಯ	273	66-71	62-67	14 18 20 ಉತ್ತರ	73 48 35 ಈಸ್ಟ್
Mavalli ಮವಾಲ್ಲಿ ಮಾವಳ್ಳಿ	ವಾಯುವ್ಯ	276	78-83	85-90	14 10 40 ಉತ್ತರ	73 45 3 ಈಸ್ಟ್
Gangavali ಗಂಗಾವಲಿ ಗಂಗಾವಳಿ	ವಾಯುವ್ಯ	277	26-31	33-38	14 37 10 ಉತ್ತರ	74 2 17 ಈಸ್ಟ್
Sadasguvgarg ಸದಸ್ಯುಗಾರ್ಗ ಸದಸ್ಯವಗರ್ಗ್	ವಿ	223	26-31	37-42	14 39 40 ಉತ್ತರ	73 56 58 ಈಸ್ಟ್
Kasarkod ಕಸರ್ಕೋಡ ಕಾಸರಗೋಡು	ವಾಯುವ್ಯ	272	73-78	57-62	14 16 21 ಉತ್ತರ	73 44 43 ಈಸ್ಟ್
Karki ಕಾರ್ಕಿ ಕರ್ಕಿ	ವಾಯುವ್ಯ	274	59-64	58-63	14 20 55 ಉತ್ತರ	73 51 12 ಈಸ್ಟ್
Shirali ಶಿರಲಿ ಶಿರಾಲಿ	ವಾಯುವ್ಯ	277	81-86	51-56	14 7 0 ಉತ್ತರ	73 44 45 ಈಸ್ಟ್
Karwar ಕಾರವಾರ ಕಾರವಾರ	ವಿ	213	24-29	49-54	14 37 22 ಉತ್ತರ	73 55 44 ಈಸ್ಟ್
Navayatkere ನವಾಟ್ಕೆರೆ ನವಯತ್ಕೆರೆ	ವಾಯುವ್ಯ	272	78-83	77-82	14 12 40 ಉತ್ತರ	73 43 35 ಈಸ್ಟ್

As per the Picture-1, The data was received from satellite sources, and it successfully processed and transformed it into a readable format. This information was then communicated to local fishermen in their local language. Based on the provided PFZ locations, fishermen conducted their fishing activities, resulting in a significantly higher catch compared to fishing without access to PFZ details.

Observation and Results

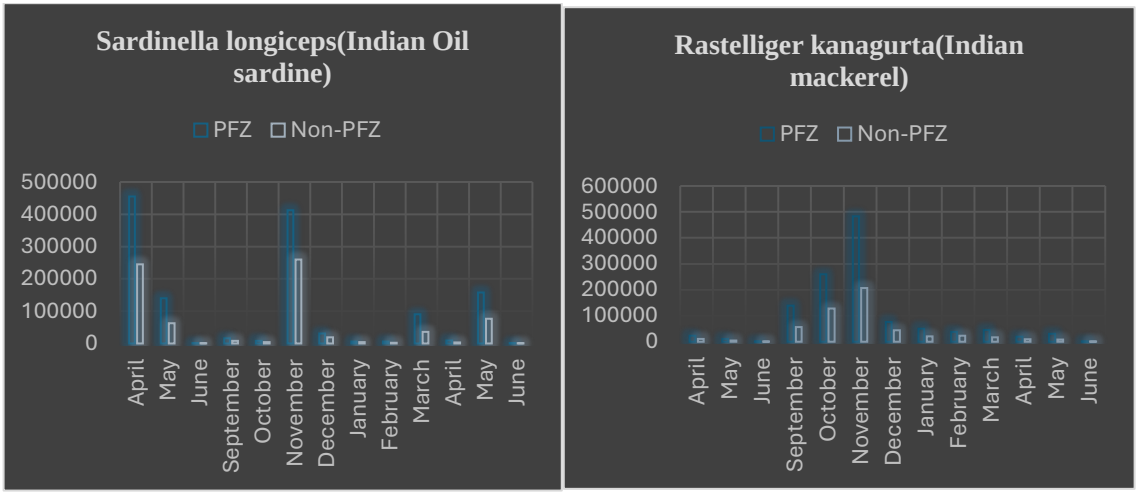
The research aims to establish links between potential fish catch availability and satellite-derived parameters such as chlorophyll concentration, sea surface temperature, sea-level anomaly, ocean surface currents, and wind vectors.

The use of Potential Fishing Zone (PFZ) data, derived from satellite information and disseminated to fishermen, has shown a range of positive outcomes in terms of fishing efficiency, sustainability, and resource management. The following observations were made from the implementation of PFZ advisories provided to fishermen along the coastal regions:

Total Fish availability from PFZ and Non-PFZ selected landing centres collected between April 2023 to June 2024:

Karwar Baithkol - Fishes in kg					
Year		Rastelliger kanagurta(Indian mackerel)		Sardinella longiceps(Indian Oil sardine)	
		PFZ	Non-PFZ	PFZ	Non-PFZ
2023	April	23662	10631	455035	245019
	May	11245	4374	139552	62697
	June	218	118	271	123
	Sept	138696	56651	16216	8354
	Oct	260110	128115	8357	3933
	November	482923	206967	412587	259871
	December	75681	44449	30521	19514
2024	January	49751	21322	6018	4182
	February	38092	23348	6090	2610
	March	45871	16895	90257	35784
	April	19365	9696	8687	2998
	May	31230	8597	157852	76985
	June	198	138	256	138

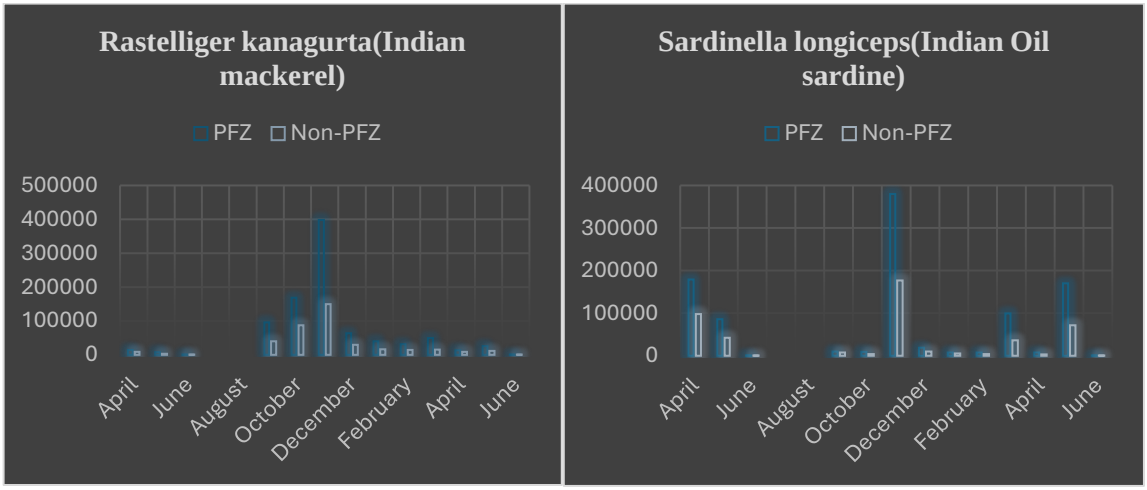
Table 1: Comparison between PFZ and Non-PFZ data from Karwar Baithkol.



Graph1: Showing the fishes from April 2023 to June 2024 in kilograms – Karwar Baithkol.

Belekeri - Fishes in kg					
Year		Rastelliger kanagurta(Indian mackerel)		Sardinella longiceps(Indian Oil sardine)	
		PFZ	Non-PFZ	PFZ	Non-PFZ
2023	April	14285	8969	178821	97882
	May	8002	3142	85799	42632
	June	169	69	215	109
	Sept	95682	39681	10255	8054
	Oct	168794	87336	8968	3696
2024	November	398557	149987	379685	176852
	December	63887	29685	19336	9685
	January	39685	15932	7784	5142
	February	31254	14221	7985	4125
	March	49857	15874	99258	36471
	April	13996	8597	7595	3012

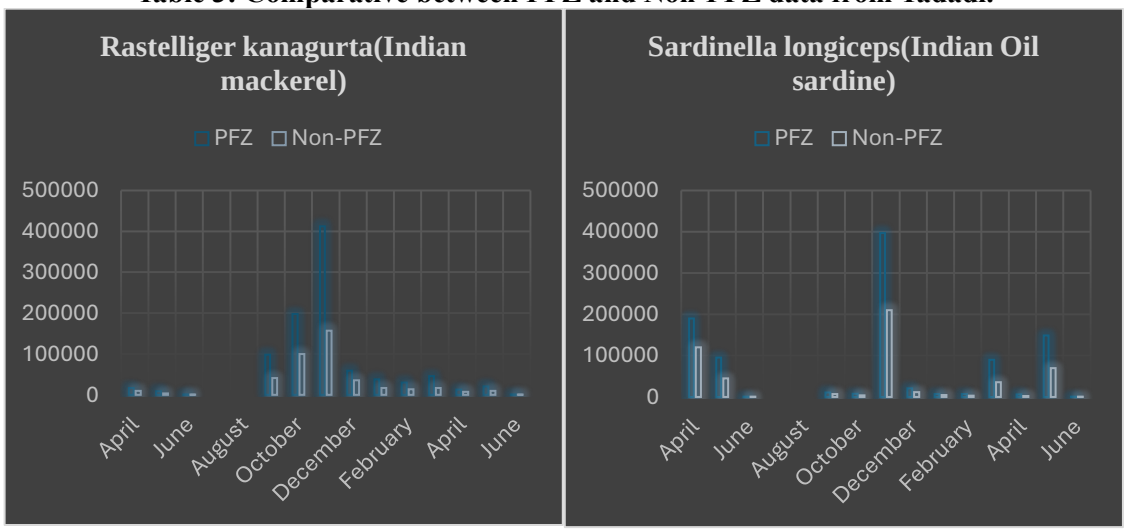
Table 2: Comparative between PFZ and Non-PFZ data from Belekeri.



Graph 2: Showing the fishes from April 2023 to June 2024 in kilograms – Belekere

Tadadi - Fishes in kg					
Year		Rastelliger kanagurta(Indian mackerel)		Sardinella longiceps(Indian Oil sardine)	
		PFZ	Non-PFZ	PFZ	Non-PFZ
2023	April	16587	9876	189652	119875
	May	8596	3284	95741	45369
	June	155	69	210	99
	Sept	98567	41395	11085	7001
	Oct	197582	99875	7985	3621
	November	412578	156997	396875	210356
	December	59285	35876	21085	11854
2024	January	37985	16487	6985	4896
	February	29857	13587	6698	3125
	March	45871	16895	90257	35784
	April	12587	7589	6120	2150
	May	21057	9875	148752	69875
	June	110	35	265	124

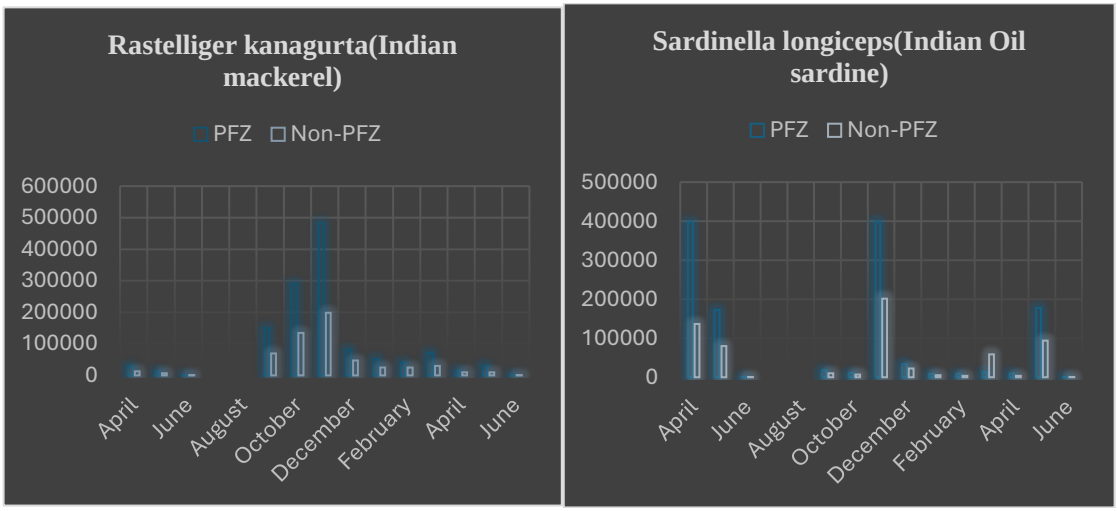
Table 3: Comparative between PFZ and Non-PFZ data from Tadadi.



Graph 3: Showing the fishes from April 2023 to June 2024 in kilograms – Tadadi:

Honnavar - Fishes in kg					
Year		Rastelliger kanagurta(Indian mackerel)		Sardinella longiceps(Indian Oil sardine)	
		PFZ	Non-PFZ	PFZ	Non-PFZ
2023	April	29574	12579	397542	136985
	May	12369	6973	172361	79685
	June	357	191	379	245
	Sept	149685	69857	18396	9985
	October	291251	134985	11025	6752
	November	482200	198756	398655	201452
	December	81212	46985	34025	22501
2024	January	51392	25301	8751	5621
	February	40852	25003	8695	4062
	March	71587	29875	12998	58968
	April	14986	9987	9687	3998
	May	31021	9685	177985	93685
	June	297	171	351	210

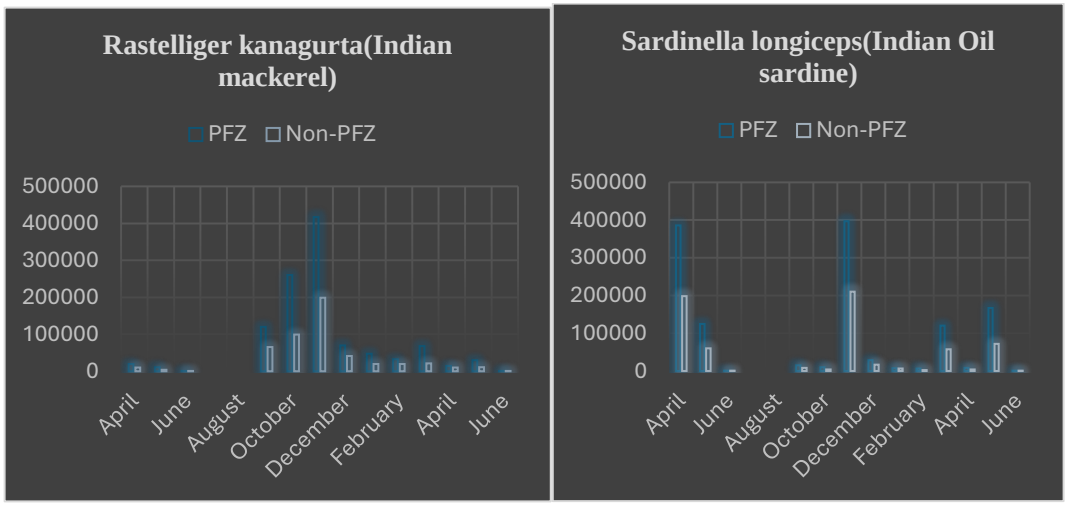
Table 4: Comparative fish availability between PFZ and Non-PFZ data from Honnavar.



Graph 4: showing the fishes from April 2023 to June 2024 in kilograms – Honnavar

Malpe - Fishes in kg					
Year		Rastelliger kanagurta(Indian mackerel)		Sardinella longiceps(Indian Oil sardine)	
		PFZ	Non-PFZ	PFZ	Non-PFZ
2023	April	19857	9865	385624	198572
	May	10857	4127	124755	59856
	June	319	176	377	198
	September	119574	65752	15274	8142
	October	259876	98963	9876	4112
	November	416987	198765	396811	210541
	December	69852	41298	28759	16987
2024	January	47369	19865	7586	6582
	February	32698	19785	6582	2668
	March	67851	21547	120241	57894
	April	14698	9875	8102	3698
	May	29683	11021	166854	72154
	June	298	114	321	147

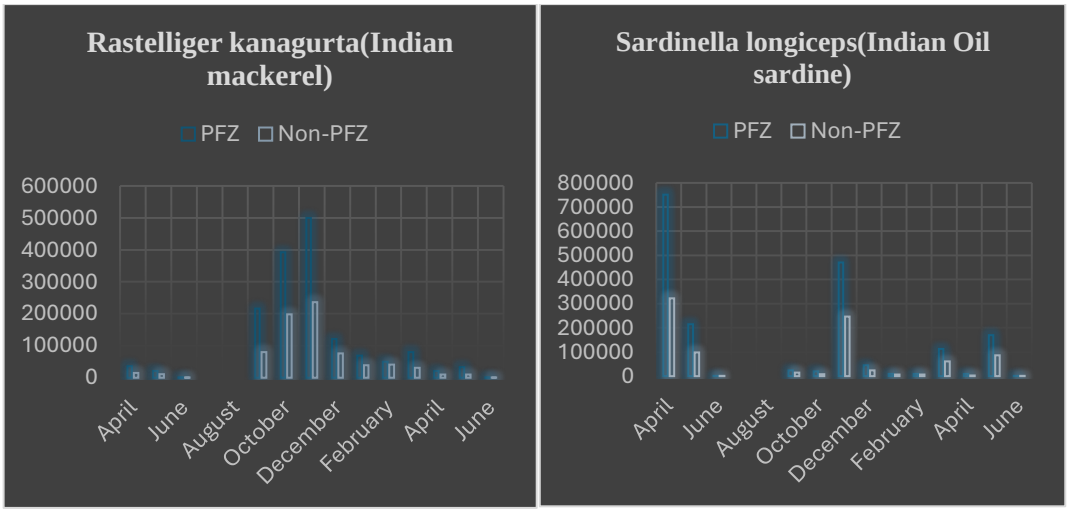
Table 4: Comparative between PFZ and Non-PFZ data from Malpe.



Graph 5: showing the fishes from April 2023 to June 2024 in kilograms – Malpe

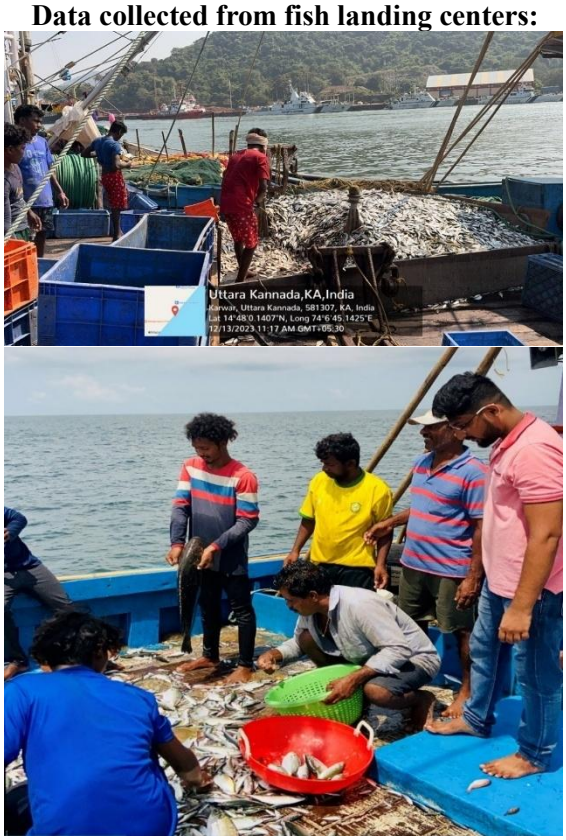
Mangalore - Fishes in kg					
	Year	Rastelliger kanagurta(Indian mackerel)		Sardinella longiceps(Indian Oil sardine)	
		PFZ	Non-PFZ	PFZ	Non-PFZ
2023	April	36541	15214	751251	321574
	May	20641	11254	214572	98765
	June	524	254	497	269
	September	215991	79685	24321	14385
	October	392541	197854	19754	7547
	November	499876	236587	469857	246978
	December	121341	76589	45214	24325
2024	January	69325	38685	9751	6975
	February	49675	41257	9875	6472
	March	79857	31024	112587	61258
	April	21369	10541	9986	3125
	May	33028	9660	169875	85741
	June	428	217	512	234

Table 5: Comparative between PFZ and Non-PFZ data from Mangalore.



Graph 5: showing the fishes from April 2023 to June 2024 in kilograms – Mangalore

Data collected from fish landing centers:



CONCLUSION

The Potential Fishing Zone (PFZ) technique, developed by INCOIS, leverages chlorophyll and sea surface temperature (SST) data to track and select pelagic fish species and accurately pinpoint their locations. This method aims to demonstrate the advantages of PFZs through targeted experiments conducted over specific timeframes and zones. The disseminated information includes PFZ maps and detailed text descriptions, which are translated into a user-friendly format for fishermen. Additionally, fishermen are trained on how to interpret the data and navigate to PFZ locations at sea.

The research aimed to demonstrate that fishing yields in PFZ areas are significantly higher compared to non-PFZ regions. PFZ advisories provide particular benefits to artisanal, motorized, and small mechanized fishermen involved in techniques such as ring seining and gill netting. By reducing search time, conserving fuel, and minimizing physical effort, this approach enhances operational efficiency. Fishermen are advised to target the PFZ locations provided by INCOIS, resulting in time and fuel savings, while improving catch rates. Utilizing PFZ data has not only saved time but also contributed to the growth and success of fishermen's operations.

Acknowledgement

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REFERENCES

1. Wasim, M., Mohanty, S., Pandey, A. C., & Pandey, A. C. (2024). Potential fishing zones estimation along the Coast of India using geospatial technology. Aquatic Ecosystems Monitoring: Conventional Assessment to Advanced Remote Sensing, 218.
2. Fitrianah, D., Fahmi, H., Hidayanto, A. N., & Arymurthy, A. M. (2016). A data mining based approach for determining the potential fishing zones. International Journal of Information and Education Technology.

3. Karuppasamy, S., Ashitha, T. P., Padmanaban, R., Shamsudeen, M., & Silva, J. M. N. (2020). A remote sensing approach to monitor potential fishing zone associated with sea surface temperature and chlorophyll concentration.
4. Nammalwar, P., Satheesh, S., & Ramesh, R. (2013). Applications of remote sensing in the validations of potential fishing zones (PFZ) along the coast of North Tamil Nadu, India. Indian Journal of Geo-Marine Sciences.
5. Harahap, S. A., Syamsuddin, M. L., & Purba, N. P. (2020). Range of sea surface temperature and chlorophyll-α values based on mackerel catches in the northern waters of West Java, Indonesia. AACL Bioflux, 13(4), 2265-2272.
6. Giri, S., Manna, S., Chanda, A., Chowdhury, A., Mukhopadhyay, A., Chakraborty, S., & Hazra, S. (2016). Implementing a spatial model to derive potential fishing zones in the Northern Bay of Bengal lying adjacent to West Bengal Coast, India. Journal of the Indian Society of Remote Sensing.