

Potential Fishing Zone

M. Amudhan¹ and M. Ponmani²

¹B.Sc Nautical Science, AMET University- Chennai, Tamil Nadu

²Department of Aquatic Environment Management, TNJFU - Fisheries College and Research Institute, Thoothukudi, Tamil Nadu

SUMMARY

Potential Fishing Zones (PFZ) leverages advanced technologies to identify regions in oceans and seas where fish aggregation is likely to occur. By utilizing satellite data, sea surface temperature (SST), and chlorophyll concentration, PFZ predictions enable fishermen to locate productive fishing grounds with higher accuracy, thereby optimizing fishing efforts and reducing fuel consumption. This approach not only enhances the efficiency and sustainability of fishing activities but also contributes to the conservation of marine ecosystems by minimizing overfishing and bycatch. The integration of PFZ into fisheries management practices represents a significant step towards balancing economic benefits with ecological responsibility, ensuring the long-term viability of marine resources.

INTRODUCTION

A Potential Fishing Zone (PFZ) refers to a specific area where conditions are highly favorable for fish presence, often identified through advanced technologies such as satellite data and oceanographic research. These zones are determined by analyzing factors like sea surface temperature, chlorophyll concentration, and ocean currents, which signal where fish are likely to be abundant. The concept of PFZs plays a crucial role in enhancing fishing efficiency by guiding fishermen to areas with higher catch potential, thus saving time and resources. Additionally, PFZs contribute to sustainable fishing practices by focusing efforts on productive zones and helping to manage fish stocks effectively. By leveraging the information provided by PFZs, the fishing industry can achieve better economic returns while supporting conservation efforts.

Methodology for Generation of PFZ Advisories

It is well known that the adaptation of fish to the surrounding marine environment is controlled by various physico-chemical and biological factors. Fishes are known to react to changes in the surrounding environmental conditions and migrate to areas where favorable environmental conditions in terms of seawater temperature, salinity, dissolved oxygen levels etc., exist. Availability of food is an important factor which control their occurrence, abundance and migrations in the sea. Sea Surface Temperature (SST) is the most easily observed environmental parameter and is quite often correlated with the availability of fish, especially pelagic fish. Many pelagic species are known to concentrate at current boundaries especially in areas with sharp horizontal temperature gradients.

Usually, chlorophyll and SST 2 images are expected to reveal common gradients due to inverse correlation between these two parameters. (Solanki, et al, 2005). Monitoring the above-mentioned parameters in space and time is time-consuming and prohibitively expensive and a real time picture of any one of these parameters or a combination of the above becomes almost impossible. Indirect methods of monitoring selected parameters such as SST and phytoplankton pigments (Chlorophyll-a) at sea surface from satellites is found very ideal as it provides high repetivity and large special coverage. The methodology discussed on integration of Chlorophyll and SST images by Dwivedi & coworkers has been adopted. Integrated PFZ (IPFZ) Advisories are generated using SST and Chlorophyll Imagery derived from NOAA-AVHRR (USA) and IRS P4-OCM (India) data.

The features such as oceanic fronts, meandering patterns, eddies, rings, up-welling areas (Table 2) are identified from these satellite images in near real time and translated as advisories in terms of latitude, longitude and depth of the shelf at such locations as well as angle, direction and distance from the landing centres/light houses. These IPFZ advisories prepared in English, Hindi and other local languages (Gujarati, Marathi, Kannada, Malayalam, Tamil, Telugu, Oriya and Bengali) and local measurement units are disseminated thrice a week, i.e. every Monday, Wednesday and Friday through various dissemination modes.

S.No	Feature Type Definition/ Morphology description Relevance to fishery resource	Feature Type Definition/ Morphology description Relevance to fishery resource	Feature Type Definition/ Morphology description Relevance to fishery resource
1.	Oceanic fronts (colour and thermal)	Fronts are the boundaries between two water masses with different properties They can be easily detected as breaks in the ocean colour (chlorophyll concentration) or SST of water masses on an image.	High chlorophyll is indicator of biomass production. Hence, resource sustained for longer period. The chances of development of local eco system are greater, which enables benthos exploration. Higher SST gradient is an indicator of upwelled water from deeper layer. Hence, the water with greater nutrient concentration would be available in euphotic zone, which enables enhanced production. Restrict movement in species that prefer particulate temperature ranges
2	Mushroom shaped features	The feature appears mushroom shaped on an image	Form an enclosed pocket. Periphery is important. Sometimes rings form inside the feature, which may be productive. Form due to wind driven current.
3.	Coastal Upwelling	Easily detected in thermal imagery. Appear as different bands of thermal gradients in the images.	Indicates the nutrient rich water transported from bottom to surface. Form in different phases like initiation phase, stabilization phase and maturation phase. Initiation phase should be avoided for fishing due to low oxygen water. In the maturation phase a well-developed ecosystem form, should be exploited.
4.	Meandering pattern of features	A turn or winding of current that may be detached from the main stream. Easily detected through the curvatures in the image.	They cover a large area. So, even if feature shift the potential area may not shift totally. This also helps in delayed fishing. Large concentrations of phytoplankton are available as compared to linear features. An enclosed pocket is formed, hence confining the resources. Sometimes rings are formed, which are productive and important for resource exploration
5.	Eddies	A current of water often on the side of the main current, especially one moving in a circle. Easy to monitor in space and time.	Rotating water masses cause deep mixing hence nutrient enrichment occurs leading to high production. Persistence for relatively longer duration. The visual predictors like tunas prefer periphery of eddies and streamers.
6.	Rings	Rings of derivative of meanders and eddies. Easy to identify on an image.	Rings are productive and already localised developed eco systems. These features ensure secondary and tertiary production.
7.	Plume front	Plumes form mostly in the coast area near river mouths as well as at discharge points of effluent.	Coastward side should be avoided because of the turbidity; generally fish avoid turbid water due to visibility and blocking of gills. Seaward side may be explored for resources. Sediment images may be checked before suggesting the PFZs.
8.	Shelf Break Front	Formed due to bathymetry at shelf and slope depth	If it is a high depth gradient it will appear many times at same location. Persist for longer periods.

		gradient.	Supporting ecosystem. Not suitable for bottom trawling
9.	Diverging fronts	Water flows in a different direction from the centre due to diverging current.	The process enriches the nutrient supply, which supports the enhanced production.
10	Converging fronts	Two or more fronts converge at one point.	Causes mechanical aggregation of resources and plankton, centre may be more productive. Can be used for resource exploration.

Dissemination of PFZ Advisories:

Multi-lingual IPFZ advisories are being generated and disseminated during the non-ban and non-monsoon period to the entire fishermen community situated all over the entire coast of India and Islands under 12 sectors, viz. Gujarat, Maharashtra, Goa & Karnataka, Kerala, South Tamilnadu, North Tamilnadu, South Andhra Pradesh, North Andhra Pradesh, Orissa & West Bengal, Andaman Islands, Nicobar Islands and Lakshadweep Islands.

Mode of Dissemination	Number of Users
Telephone / Fax	200
Electronic Display Boards(23 No.)	NA
Email	124
Website (PFZ Text)	4018
Website (Web-GIS)	285
Doordarshan (DD-Saptagiri)	NA
News Paper (Eenadu)	NA
Information kiosk (Brahmavar, Karnataka)	3000

PFZ advisories along with SST and Chlorophyll images, vector coverage and text information have been also made available through INCOIS web-site to the user community. PFZ advisories in both map and text forms are e-mailed to about 124 registered users located along the coast of India.

Electronic Display Boards (EDB):

To improve the coverage, advances in Information and Communication Technology have been adapted. Installations of Electronic Display Boards (EDB) at major fishing harbours have made significant impact in the delivery chain. The forecast is being updated thrice a week directly from Indian National Centre for Ocean Information Services (INCOIS) and about 1000-3000 fishermen from each fishing harbour 5 6 use this information for their fishing activities. The new version of these boards is equipped with voice communication, siren and alert system for alerting the coastal states during disasters and Tsunami warnings. These boards use the GSM Communication technology for transfer of data remotely from INCOIS.

User Interaction Workshops:

Frequent and intense interactions at the fishing harbours between scientists and fishing community ensure improved awareness and effective use of these advisories. Parallel affirmation and feedback are integral to this mission for which necessary institutional mechanisms are in place.

Validation Experiments

With a view to validate the Potential Fishing Zone Advisories being generated and disseminated by INCOIS and to assess the potential benefits to the fishing community, INCOIS had undertaken PFZ validation projects, since 2002, at various places under the leadership of fishery experts affiliated to leading research organisations/universities.

CONCLUSION

PFZ advisories generated from satellite retrieved SST and Chlorophyll were found more beneficial to artisanal, motorised and small mechanised sector fishermen engaged in pelagic fishing activities such as ring seining, gill netting etc., thereby reducing the searching time which in turn result in the saving of valuable fuel oil and also human effort. Reduction in searching time was found to be 60-70% for oil sardine shoals in ring seining

with 30-40% reduction reported for mackerel, anchovy, tuna and carangid shoals in ring seining operations. From the quantitative results of the fishing operations done by identical vessels simultaneously within and outside PFZ area, it was concluded that the average income received by vessels operated in the PFZ areas were considerably higher than vessels operated in non PFZ areas. Fishing expenses were also comparatively less for vessels which operated within PFZ.

REFERENCES

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