
**International Journal of Control Theory and Applications**

ISSN : 0974–5572



**Volume 9 • Number 40 • 2016**

# A Survey of Various Methods of Potential Fishing Zone Identification

**N.V.S. Natteshan[a] and N. Suresh Kumar[b]**

[a]*Research Scholar, School of CSE, VIT University, Vellore*
*E-mail: natteshan@gmail.com*
[b]*Associate Professor, School of CSE, VIT University, Vellore*
*E-mail: sureshkumar.n@vit.ac.in*

***Abstract :*** Potential Fishing Zone is a forecast of various fish Aggregation zones in any sea for a duration which is short. The forecast is done mainly by considering certain parameters like Sea Surface Temperature and Sea surface Chlorophyll. In the process of identification there are certain methodology which is used in some works and are validated with some systems or even some statistical models were used and in some works just the potential fishing advisory details are obtained and the results are validated. Then these details are to be propagated to the fish landing grounds and fishermen through various communication means. This paper reviews all these methods present which are used in the process of identification of a Potential Fishing Zone and also presents a model which can be adopted to identify potential fishing zones in certain coastal areas of Tamilnadu.

***Keywords:*** *Potential Fishing Zones, Sea surface Temperature, Sea surface Chlorophyll, Statistical model.*

## 1. INTRODUCTION

Fishing is one of the industries in India which deploys for around 13-14 million people, India has a stretch of 7517 kilometres in coastline of marine, 3,827 villages for fishing, and 1,914 landing centres for fishes. Annual production averaged for fish farmers in India is only 2 tonnes per person, whereas it is 172 tonnes in Norway [19]. Productivity which is high, knowledge transfer for sustainable fishing, and increase in exports of fish has the potential for increasing the standards of living of Indian fishermen. This work focuses on review of various previous technologies and in solving this problem and helping the fisher men in finding the Potential fishing zones and fishing spots. The process of Potential fishing zone identification can be broadly categorized as the following [13],

Thus here a description of various methods and a description of these methods and a direction of further research are proposed.

**Table 1**
**General Methods for PFZ identification**

| *Process* | *Input Data* | *Algorithm/method* | *Result* |
|---|---|---|---|
| GIS based application | Fishery data, SST, SSC | Overlay method | Potential fishing ground |
| Knowledge based expert system | SST, SSC, Turbidity | Heuristic rule based on Expert Knowledge | Potential fishing ground |
| Simple prediction map | SST, SSC, SSHA | Generalized Additive model | Potential fishing ground |
| Approach using Rough clustering | Bearing, direction, distance from, distance to | K-Means | Fishing Spot identification |

## 2. REVIEW OF VARIOUS METHODS FOR IDENTIFICATION OF POTENTIAL FISHING ZONES

### 2.1. Parameters considered

Sea Surface Temperature and Sea Surface Chlorophyll are the two important parameters used in most of the works which is used in the identification of Potential fishing zones. [1-4, 13,14] Along with these two important parameters there is also a consideration of other factor like Turbidity [14]. Chlorophyll and Sea Surface Temperature got from satellite were basic inputs for arriving at this information. Sea surface Temperature is the water temperature closer to ocean surface and it is between 1mm and 20 meters below the surface of sea.

### 2.2. Methodologies Adopted

The various methodologies for identification of a Potential fishing zone falls under the following categories of overlay method, heuristic rule based expert system, statistical models, rough clustering methods. Various surveys about these methodologies in literature can be presented.

### 2.3. Data mining based approach

A Potential Fishing Zone is found by using a approach of mining. The algorithm which they proposed in their work is AGRID and a clustering algorithm based on density of grid for data of high dimension. spatial temporal data is a data used about daily fish catch. Each dimension is divided into many intervals and data is subdivided into rectangular cells. By using the fish catch data obtained from clustering results in Potential fishing zone by computing the mean of each area fish catch. There is threshold for which mean values are compared and if its greater than threshold the area can be categorized as Potential area. [2]

### 2.4. Spatial temporal data mining approach

This approach consists of different works. The first work consists of catch data of fish based on distance and time. The second work consists of ocean characteristic data from web repository and they are pre-processed using sea-das. In the third work fishery and oceanographic data are integrated to obtain Sea Surface Chlorophyll and Sea Surface Temperature based on largest number of fish catch data for a particular space and time. In the last work the potential fishing ground is found based on prediction models. [2,13]

### 2.5. Statistical Approach

The work deals with visible satellite images to locate the presence and absence of group of fishing vessels. A statistical generalized additive model, generalized linear model and machine learning models were developed using a certain years of presence/absence information, chlorophyll-a concentration, bathymetry. Fishing surveys based on experiments were conducted to validate and improve the model predictions against the fishing surveys which trusts on experience. [14]

## 2.6. Rough cluster based Potential fishing spot identification

Data is collected from the INCOIS, Hyderabad for the period of 2000-2011 and is merged as a unique database to get three broad classifications on the dataset done based on distance measure of Potential Fishing Zone. Potential Fishing Zone arrived from satellite based Sea surface temperature (SST) and sea surface chlorophyll (SSC) were found to be a sign of high availability of fishes and they are useful to artisanal, motorized anchories.[12]

## 2.7. Validation

The process of ensuring that the results obtained are true with certain reference values and there are various ways by which the validation is done but they broadly come across the following categories namely direct validation and indirect validation. In [8] the methodology of obtaining Potential Fishing Zone is performed by using satellite based SSC and SST and a analysis is done with catch of a density per unit effort in the areas where satellite image observes and they are broadcasted to fisherman in display boards at the centres for landing and a direct and indirect validation is performed. Direct methods of validation means utilizing and observe the catch got in a fishing vessel in the region that is notified with catch from a region which is not notified, in indirect method by comparing data of catch from landing centres on days which is notified with days that are not notified.

Fish catch in potential fishing centre is roughly about 3-4 times greater when compared to non potential fishing zone area. PFZ validation and feedback were performed through group of active and selective fisherman found at major selected fish landing centres. Six fishing landing centres were selected in three coastal districts. PFZ information in the form of maps is generated by composing daily SST images of three or four days to obtain thermal gradient info that is maximum. These images are used to prepare relative thermal gradient info, name of landing centres, land marks are also found and the location of PFZ area with respect to a particular fish landing centre is obtained by identifying the nearest point of thermal feature to that fishing centre PFZ map also processes the direction, diffusion, bathymetry, period of validation, longitude, latitude which is helpful. PFZ advisories were disseminated by Fax, telephone and they are valid for 3 or 4 days. Finding the PFZ and non PFZ areas from remote sensing data provided by INCOIS has proved to be useful value for fish catch, reduces searching, cost of fuel [9]

The marine fisheries of goa which can be harvested is estimated to be around 2 lakh of which 50% is utilized. PFZ forecast from remote sensed chlorophyll concentration and Sea Surface Temperature are utilized for the process of harvesting marine fisheries resources. A validation study is done to study the effectiveness of PFZ advisories for goa coast by 290 purse seine fishery experiment in PFZ and non PFZ regions. A total of 290 feedbacks were obtained from 290 fishing experiences within and outside PFZ regions with similar capacity of vessels. The Catch per unit estimate was improved by 2.3 times by using PFZ.

Indian National Centre for Ocean information Studies provides short term fish forecast using remote sensing and geographic information system. The information on chlorophyll, SST, magnitude of wind is the important entities for generating PFZ forecast. The multilingual forecast are produced daily and disseminated to about 600 fish landing centres.

PFZ forecast are propagated and feedback data were obtained in a form which is standard from the fish landing centres. The PFZ maps the distance in Km, depth measured in metres from the reference points and latitude, longitude. From the fishing grounds that guide the fishermen to PFZ. The PFZ forecasts were propagated by use of Electronic display boards, PFZ advisories based on SST, SSC. Pure seines were used for experimental validations. The vessels of 20-25m and mesh size of 30-40 mm in depths between 8-25 m were used for a comparative study and a total of 290 feedbacks were collected from 290 fishing experiences within PFZ and outside the PFZ region.

Mean CPUE and mean profit obtained in PFZ in validation experiments were compared with non PFZ regions.

There were plenty of differences between the profit in PFZ and in non PFZ region. Profit obtained by mean was maximum. The species diversity were also more in non PFZ region.[10]

## 3. PERFORMANCE EVALUATION

The performances of the various methods used by different works are presented in this section which gives the direction of further research.

First the satellite images obtained are pre-processed using an approach of Euclidean filter and the comparative measure values of applying various filters are as follows

**Table 2**
**Performance of various Filters**

| *S. No.* | *Filter names* | *Root Mean Square Error* |
|---|---|---|
| 1. | Lee filter | 0.799 |
| 2. | Kuan filter | 0.67 |
| 3. | Euclidean Filter (NLMF) | 0.789 |
| 4. | Euclidean Filter (DANLMF) | 0.043 |
| 5. | Tanimoto filter | 0.04958 |
| 6. | Cosine filter | 0.494 |
| 7. | Chebyshev filter | 0.049 |
| 8. | Manhattan filter | 0.038 |

These are the various results obtained by [11] in their work, so there is a scope of adding some more additional filters like Gamma, Weiner as proposed by [16]. The results obtained from those additional methods may also be combined at arriving at the final decision of using a better filter.

[13] In their work had obtained a comparison of results between Data-mining based approach and Heuristic rule based approach which can be tabulated as follows

**Table 3**
**Performance of Data mining approach**

| *S. No.* | *Approach* | *Data used* | *Accuracy Averaged* | *Kappa Coefficient Average* |
|---|---|---|---|---|
| 1. | Data mining approach | Fishery, SSC, SST data from 2000-2004 | 87.11 | 0.93 |
| 2. | Heuristic Rule approach | SSC, SST and turbidity | 84.71 | 0.91 |

The Adjusted Heuristic Rules were tabulated as follows

**Table 4**
**Adjusted Heuristic rules for Defining Fishing Grounds**

| *Attribute Values* | *Rule Values* | *Condition Range* | *Result* |
|---|---|---|---|
| 1 | 1 | SST Range in 24- 27 C | Potential Fishing ground |
| 1 | 2 | SST Range of < 24 and >27 C | Non Potential Fishing ground |
| 2 | 3 | If SSC range of 0.3-2.5 | Potential Fishing ground |
| 2 | 4 | If SSC range of <0.3 and > 2.5 | Non Potential fishing ground |

Below is the plot of average kappa coefficient for different models

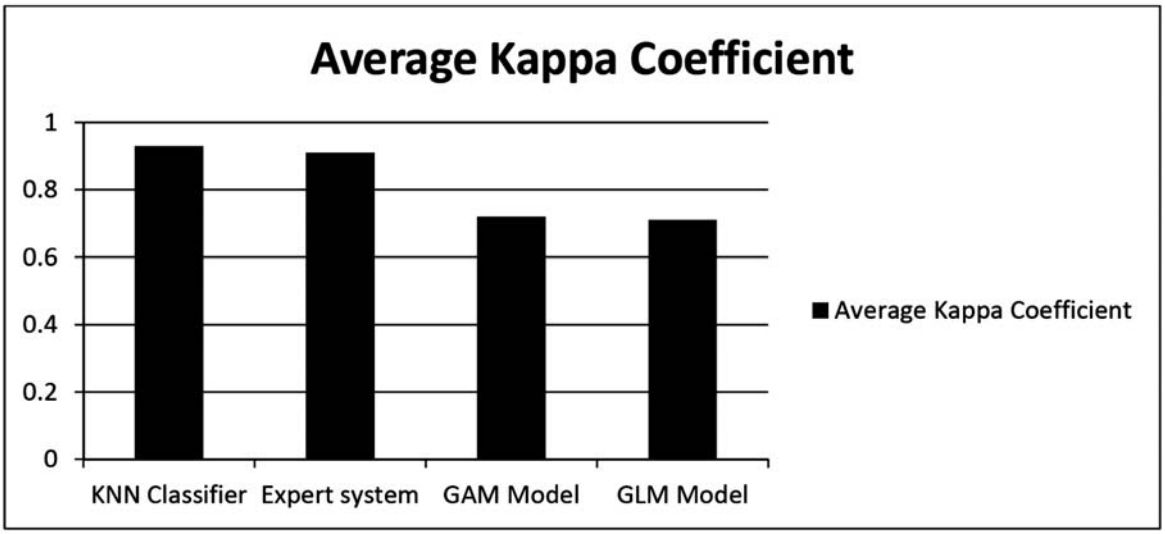


**Figure 1: Graphical plot of different Kappa Coefficients**

## 4. REPRESENTATION OF RESEARCH DIRECTION

The Research direction for further application of the various methods and obtaining a better estimate of Potential Fishing Zone for certain coastal areas of tamilnadu can be represented as as follows

In the proposed research work the entire process of identification of Potential fishing zone is to carried out for a coastal areas in tamilnadu. First the input satellite captured details are pre-processed using Nonlocal means filter and gamma filter. The main problem in a satellite aperture radar image is the speckle noise which happens because of combination of echo which scatters back from surface of earth that is rough [11]. Then a spatial temporal model is used to identify the maximum fish catch with respect to space and time. The process can be described as follows. First there is a usage of clustering the distance data for largest number of spatial daily fish catch. The clustering is based on density. A spatial clustering is used that classifies large data based on spatial dimensions. There should be two parameter defined namely minimum points and Eps. The final output of this algorithm is a spatial cluster of data of fish catch which is voluminous numerically. A Fuzzy clustering algorithm can be used to obtain final clusters. By using the spatial and temporal clustering methods a spatial-temporal potential fishing zone is obtained which can be used as a ground truth for further classification. In the process of classification three classifiers are to be used namely KNN, Neural network and Boosted regression tree and a decision level fusion is to be done to best utilize a classifier for the process of classification of a region into PFZ or not. Then there is also a usage of statistical models of Generalized Additive model and generalized linear model and then it is compared with a SVM classifier and the results obtained arte to be tabulated. Then

based on the obtained PFZ a potential fishing spot is identified using the rough clustering method and this work highly helps the fishermen to identify the PFZ easily as there is no proper way of propagation to fishermen during the winter season this work updates them frequently with the data which increases the Catch Per Unit Estimate and also reduces the effort and fuel consumption.

## 5. CONCLUSION

A survey is presented in this paper which gives an outline for further proceeding in research. The main theme of this survey paper is to identify the current trends in the process of identification of Potential fishing zones. There were various areas like Pre-processing, various data mining based methodology and some statistical methods were discussed along with the different type of validations for those data and a methodology is provided for further enhancing the research in this area with a model is provided and this model can be very well applied to identify the potential fishing zones in tamilnadu as there is no proper methodology for obtaining the details by using image processing techniques is present for this region, so this analysis work will be a source of inspiration for further performing investigations in processing those satellite images and how accurately the results obtained with a fair utilization of computing resources is the complexity in the work

## REFERENCES


[1] Mohammad Tanveer , C.K. Mukherjee and Vinu Chandran R, "Application of ANN to predict chlorophyll-a and SST in demarcation of fishing zone", in International Water Technology Journal, IWTJ, Vol. 5 –No.4, December 2015.

[2] Devi Fitrianah, Hisyam Fahmi, Achmad Nizar Hidayanto, and Aniati Murni Arymurthy, "A Data Mining Based Approach for Determining the Potential Fishing Zones", in International Journal of Information and Education Technology, Vol. 6, No. 3, March 2016

[3] Sourav Maity, Srinivasa kumar, Sachinandan dutta, anirbhan akhand, "Satellite based integrated PFZ advisories: A feasibility analysis in the coastal waters of West bengal ", Proceedings of zoological society, volume 68, issue1, pp 14-19, June 2015

[4] K.Tijani, M.T Chiaradia, A.morea, "Fishing forecasting system in Adriatic sea- a model approach based on a normalized scalar product of the SST gradient and CHL gradient vector", in Geoscience and Remote sensing symposium, July 2015

[5] K.Tijani, M.T Chiaradia, A.morea, "Prototype of a multi platform Remote sensing service for fishing forecasting ", in IEEE conference on Environmental, energy and structural monitoring system, June 2016

[6] Lei Wang, K. Scott, David Clausi, "Automatic feature learning of SAR images for sea ICE concentration estimation using feed forward neural network", Geoscience and Remote sensing symposium, july 2014

[7] P.Prabhu, N.Anbazhagan, "Improving the performance of K means algorithm for high dimensional dataset", International Journal on Computer Science and Engineering (IJCSE), Vol. 3 No. 6 June 2011

[8] Sanjeev P. Deshpande, K.V.Radhakrishnan, U.Gopalakrishna Bhat, "Direct and indirect validation of PFZ off the coast of uttara kannada, Karnataka", Volume 39, Issue 4, pp 547–554, Journal of Indian society of Remote sensing, December 2011.

[9] Nammalwar, S.satheesh, R.Ramesh, "Applications of remote sensing in the validations of PFZ along the coast of North TN", Vol 42, pp 283-292, June 2013

[10] Sreekanth, G.B.; Subramaniam, S.; Manju Lekshmi, N.; Madhu, V.R.; Passta, M.F; Singh, N.P., "Validation on satellite based PFZ advisories along GOA, South west coast of india", Indian journal on fisheries, 2016.

[11] Devi davapal, S.S.Kumar, christy jojy, "A novel approach of despeckling SAR images using Non local means filtering", pp 1-8, Journal of indian society of Remote Sensing, july 2016

[12] Sharath jagannathan, Andrews samraj, Maheshwari rajavel, "PFZ by rough cluster predictions ",international conference on Computational intelligence, Modelling and simulation, September 2012

[13] Devi Fitrianah, Achmad Nizar Hidayanto, Jonson Lumban Gaol,Hishyam Fahmi, Aniati Murni Arymurthy, "A spatio temporal data mining approach for identification of potential fishing zones based on oceanographic characteristics in the eastern indian ocean" in IEEE Journal of selected topics in applied earth observations and remote sensing, Vol 9, No.8, pp 3720-3728, August 2016

[14] Xun zhang, sei ishi saitoh, toru hirawake, "Predicting potential fishing zones of japanese common squid using remotely sensed images in coastal waters of south-western hokkaido, japan", pp1-18, international journal of remote sensing, December 2016

[15] Yu zheng, jixian Zhang, Van ganderan, "Comparison and analysis of remote sensing data fusion techniques at feature and decision levels", ISPS, 2014

[16] T. Alipour Fard a, M. Hasanlou a , H. Arefi a, "Classifier fusion of high resolution optical and SAR satellite imagery for classification in urban area", the International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, Volume XL-2/W3, 2014 The 1st ISPRS International Conference on Geospatial Information Research, 15–17 November 2014

[17] Ming qian, mario aguilar, karen zachery et al., Decision level fusion of EEG and pupil features for single trial visual detection analysis", IEEE transactions on biomedical engineering, pp 1929-1937, july 2009.

[18] Aili wang, Jinna jiang, haoye zhang, "Multisensor image decision level fusion detection algorithm based on d-s evidence theory, international conference on instrumentation and measurement, computer communication and control, september 2014.

[19] https://en.wikipedia.org/wiki/Fishing