

# GEOSPATIAL VARIATION AND FORECAST MODELLING OF THUNNUS ALBACARES ALONG INDIAN COAST: REMOTE SENSING APPROACH



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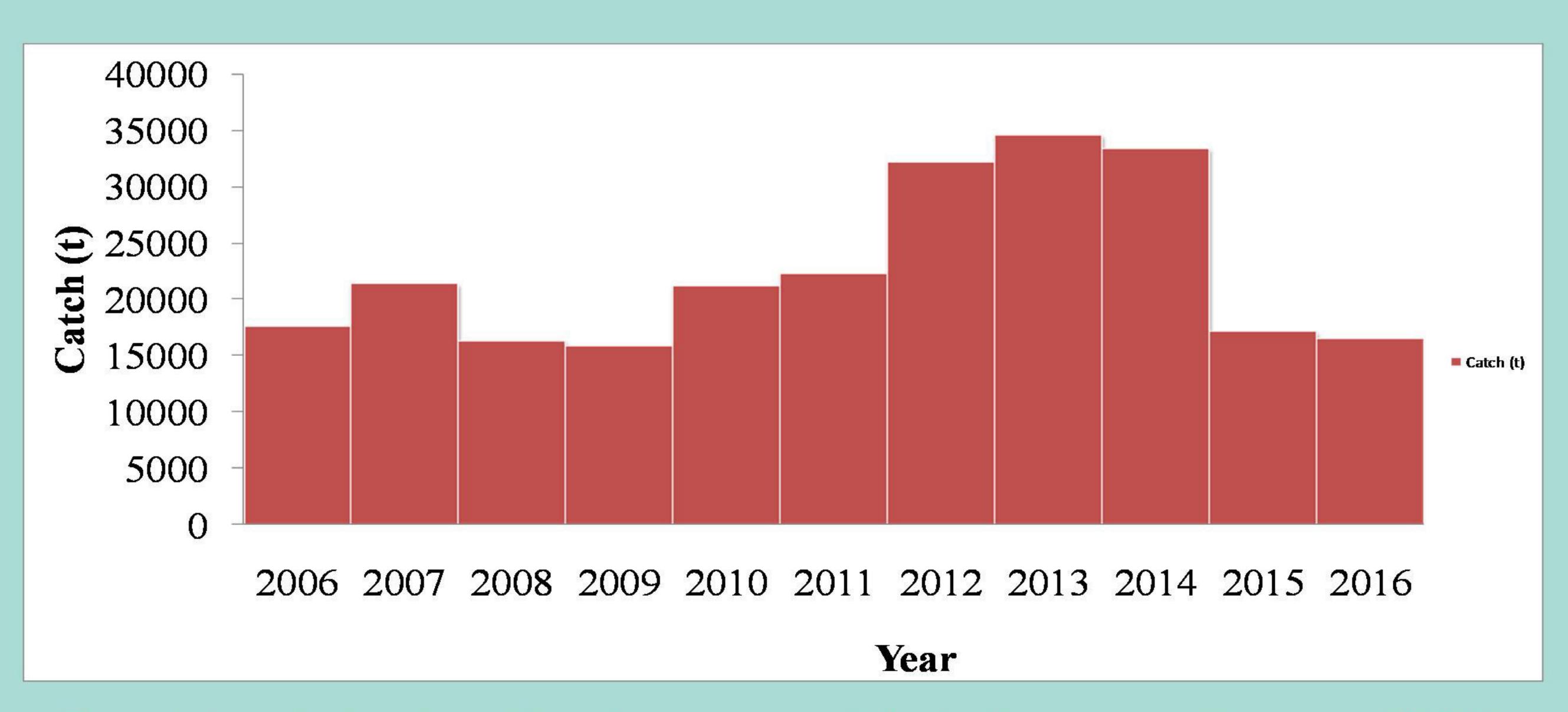
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# Introduction

Yellowfin tuna (*Thunnus albacares* (Bonnaterre, 1788)) inhabits the surface layer of all warm seas of the world and is extensively fished using seines, gillnets as well as hooks and line. Along the Indian coast, the yellowfin tuna is mainly exploited by longlines. Gillnets and the larger meshed purse seines too land this oceanic species occasionally (Rohit et al. 2012).

The wide distribution of yellowfin tuna means that search for this resource is time consuming and costly. The search can be made more efficient and less costly by predicting the areas where fish aggregate in space and time.

A forecasting model is necessary to enable rational exploitation of fish stocks, despite the competition between fleets and the laws relating to the exploitation of exclusive economic areas. It will also help to give an answer to the question asked by fishermen as to where the fish are located. Hence the present study aim to understand the geospatial variation yellowfin tuna (*Thunnus albacares*) of along Indian coast and build forecast model for the same.



Decadal variation in yellowfin tuna catch in Indian ocean (Source: IOTC)

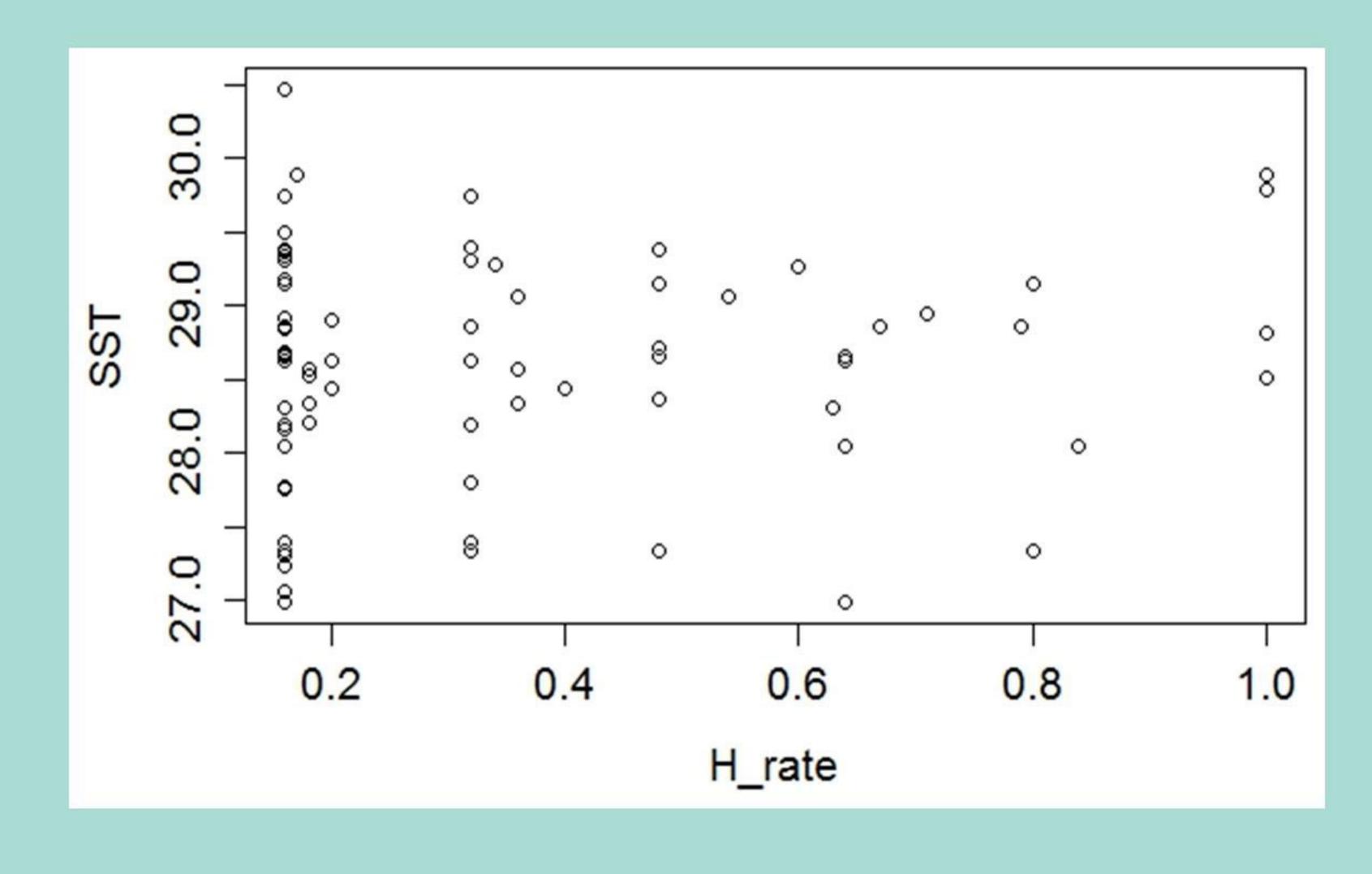
## Data and Methods

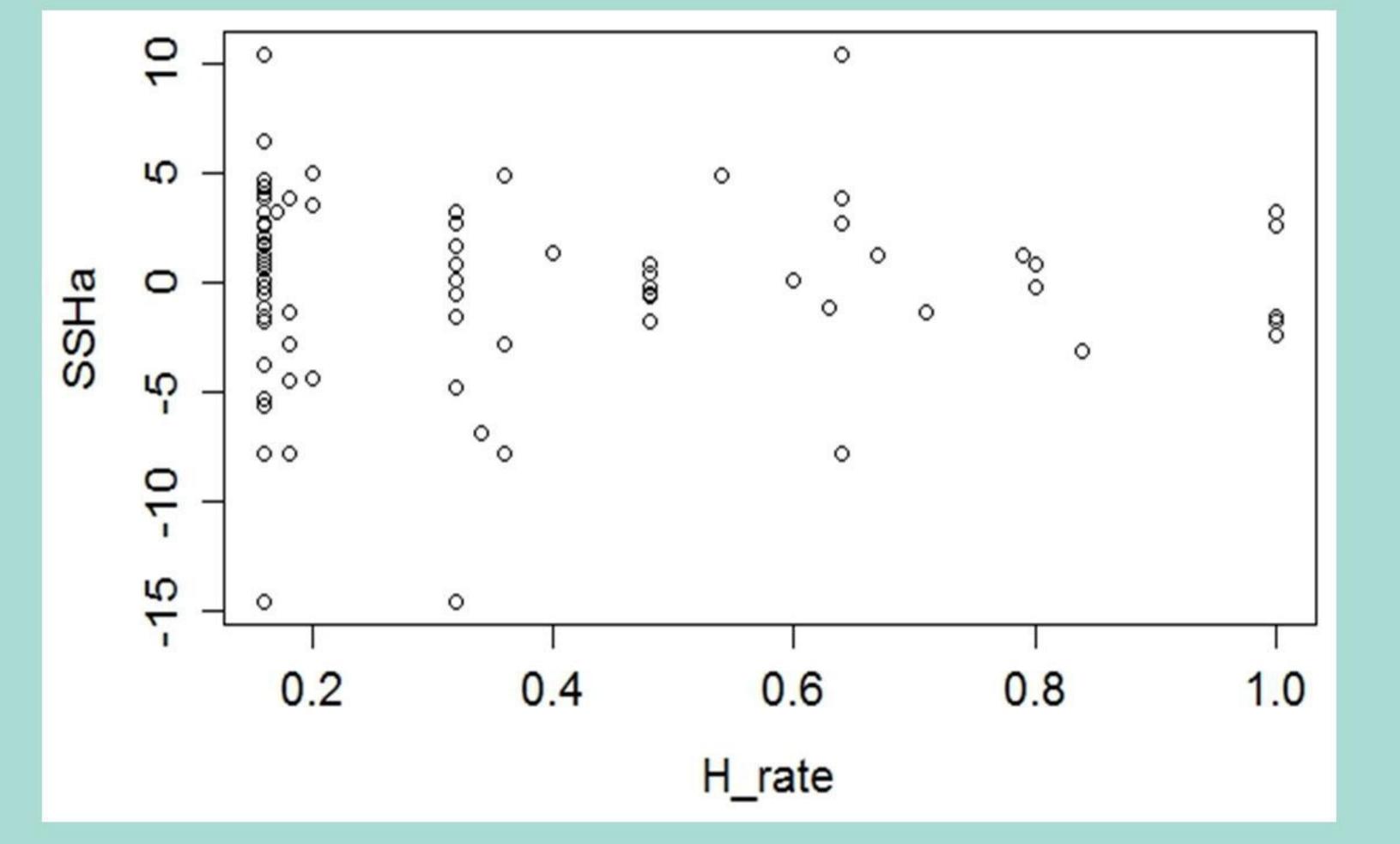
- Hook and Line Fishery Data during 2004 to 2012 from FSI, Govt. Of India.
- GHRSST (Group for High Resolution Sea Surface Temperature) L4 gridded products were generated by combining complementary satellite and in situ observations within Optimal Interpolation systems. These data are ideal for model diagnostic studies, model boundary condition specification and model initialisation.
- AVISO (Archiving, Validation and Interpretation of Satellite Oceanographic) provides Sea Surface Height anomaly (SSHa) observations from multiple satellites (Merged Jason-1-Envisat, ERS-2, GFO, T/P)
- Geospatial variations in hooking rate along Indian coast were analyzed using Geo-statistical analysis in Arc GIS 10.
- Forecast model were build using Multiple Regression Analysis in MS-Excel with Number of individual fish hooked as Criterion variable (Y) and SSHa (X<sub>1</sub>) and SST (X<sub>2</sub>) as predictor variable.

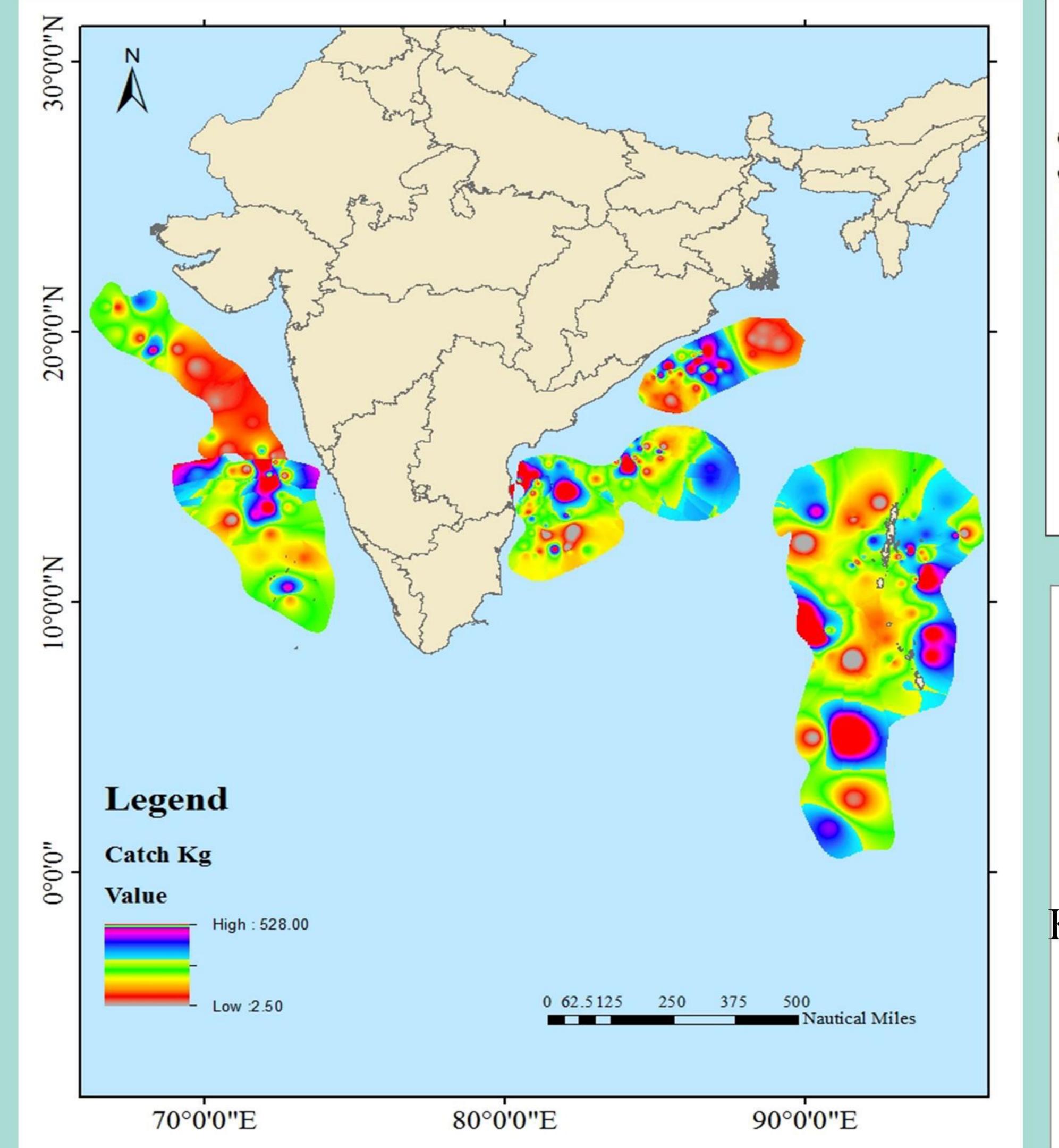
#### $Y=a+b_1X_1+b_1X_2$

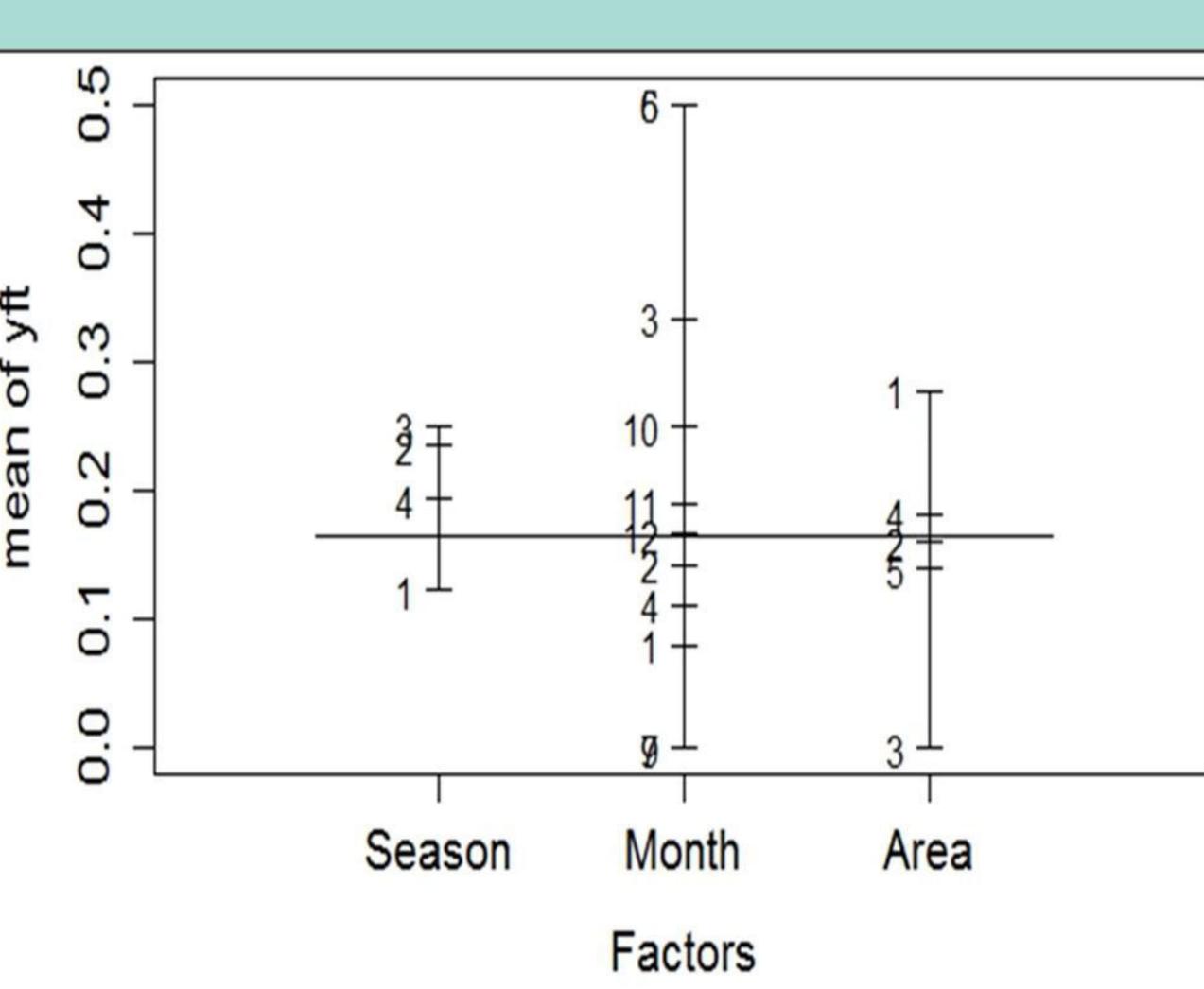
#### Result and Discussion

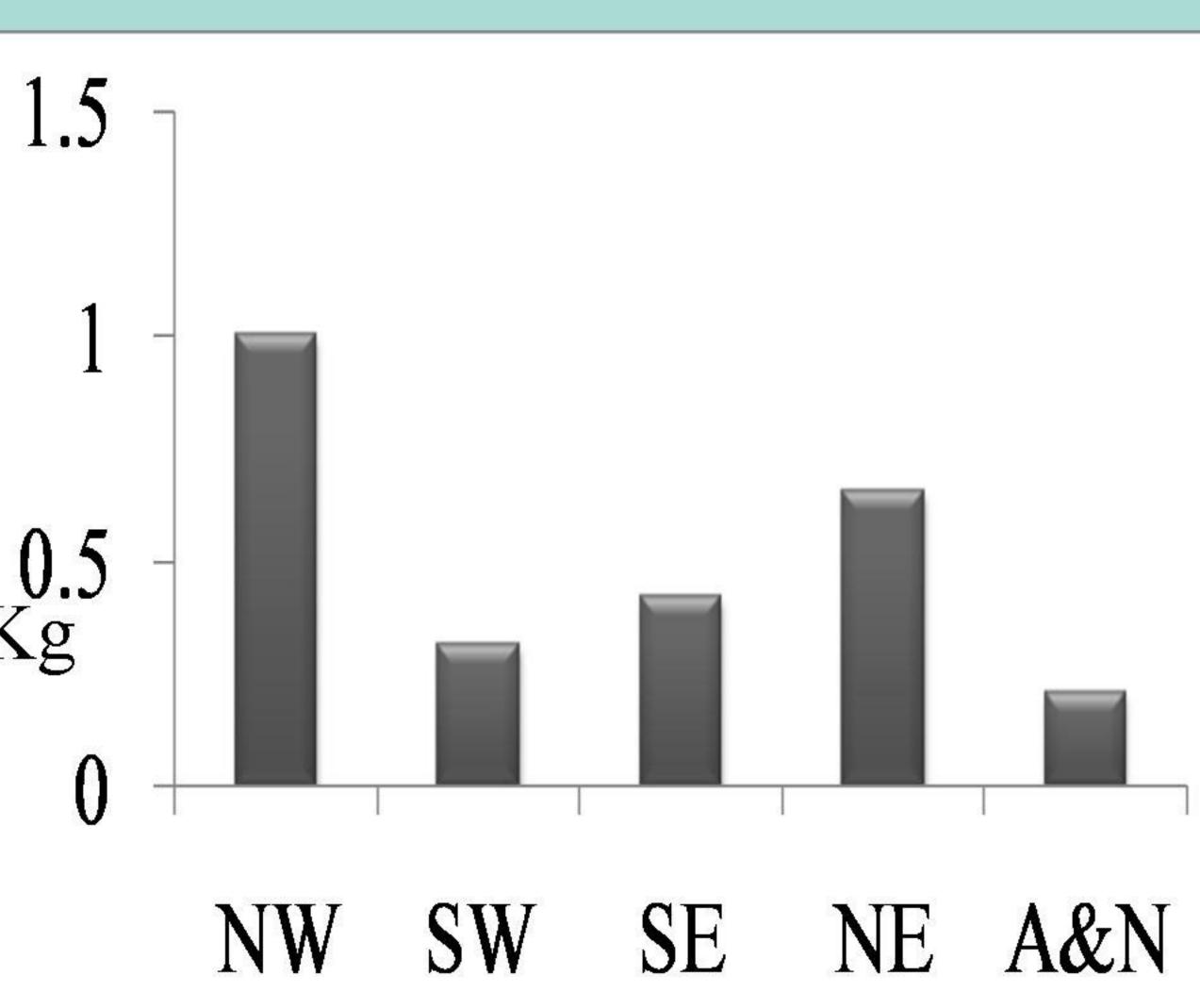
• Pairplot of hooking rate of yellowfin tuna and predictor variable (SST & SSHa) shows association of SSHa and yellowfin tuna catch location. Majority of the catch locations were within 28-29.5°C SST and off +5 to -5 cm range of SSHa.











# Geospatial variation in hooking rate of yellowfin tuna along Indian coast [Seasons - Winter (1), Pre-monsoon (2), Monsoon (3) and Post monsoon (4)] [Area - North-west Arabian sea (1), South-west coast Arabian sea (2), South-east Bay of Bengal (3), North-east Bay of Bengal (4) and Andaman Sea (5)]

• Relationship between predictor variables and a Criterion variable

Y = 2.86 + 0.174 (SSHa) - 0.000023(SST)

- P-value for SSHa (0.0025) is less than the common alpha level of 0.05, indicates that it is statistically significant.
- Nimit et al. (2015) gave association of SSHa and yellowfin tuna catch location. Majority (77%) of the catch locations were within +5 to -5 cm range.

#### Conclusion

- Oceanic environment affect spatio-temporal distribution of yellowfin tuna. Sea Surface Height anomaly (SSHa) can be a parameter equally useful for demarcation of suitable habitat and PFZ advisories for yellowfin tuna.
- The use of several techniques applied to the same dataset allowed us to evaluate the influence on the results due to the selection of a particular statistical technique.
- There might be other variables, not measured, but still highly correlated with yellowfin tuna presence that are the real driving factors.

### References

- Prathibha Rohit, G. Syda Rao and K. Rammohan . 2012. Age, growth and population structure of the yellowfin tuna *Thunnus albacares* (Bonnaterre, 1788) exploited along the east coast of India. *Indian J. Fish.*, 59(1): pp. 1-6.
- Nimit Kumar, Nagaraja Kumar M, Naga Swetha, Jyoti Nayak, Rose P Bright and Srinivasa Kumar T. 2015. Utility of Sea Surface Height anomaly (SSHa) in determination of Potential Fishing Zones. Technical Report Report No.: ESSO/INCOIS/ASG/TR(02)2015. p.16.

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