Who will kill them first, Climate or Man?

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1. Background

It is evident that the variability of fish abundance in the sea has been increasing over time. This variability might be due to climate factors or anthropogenic factors such as fishing. Challenge of the modern fishery management is to distinguish between the two and take account of these sources of variability. As all of the marine fisheries resources of India are currently under exploitation, there is no control group available to distinguish climate effects from fishing effects. Here ,we are utilizing methods involving statistical controls for this purpose.

2. Aim

The goal of this work is to **distinguish impact due to fishing on fish abundance from those due to climate** , with the hope that former can be controlled where as the latter can be observed and (possibly) predicted.

3. Data and Method

Data

Abundance – 30 years Catch (Kg) and Effort (fishing days) has been taken from the ICAR-CMFRI database and Catch per unit effort (CPUE) is utilized as a proxy to fish abundance for thirty six (36) commercially important species.

Climate variable – The Sea Surface Temperature (SST) data for 2x 2 ^{o} grid (69-71^{o} N, 19- 21^{o} E) have been gathered from International Comprehensive Ocean-Atmosphere Data Set (ICOADS) for a period of 30 years (1985 to 2014).

Method

Data analysis has been performed using the R 3.3.2 software. Stepwise linear regression was performed to fit model for the abundance of all the 36 species with SST and fishing effort. 'Yhat' package was used for analyzing variable importance using the beta weights (β) and complete dominance (CD0).

4. Results

Regression has yielded linear models of all species with significant coefficient of determination. Out of 36 species studied, twenty six (26) species (mostly demersals) showed significant negative β for effort and five (5) species have showed negative β for SST (Fig. 1). Another six (6) species have showed positive β with SST. However, for all the 26 species, the negative influence of fishing effort was much higher as compared to that of SST.

4. Results continued..

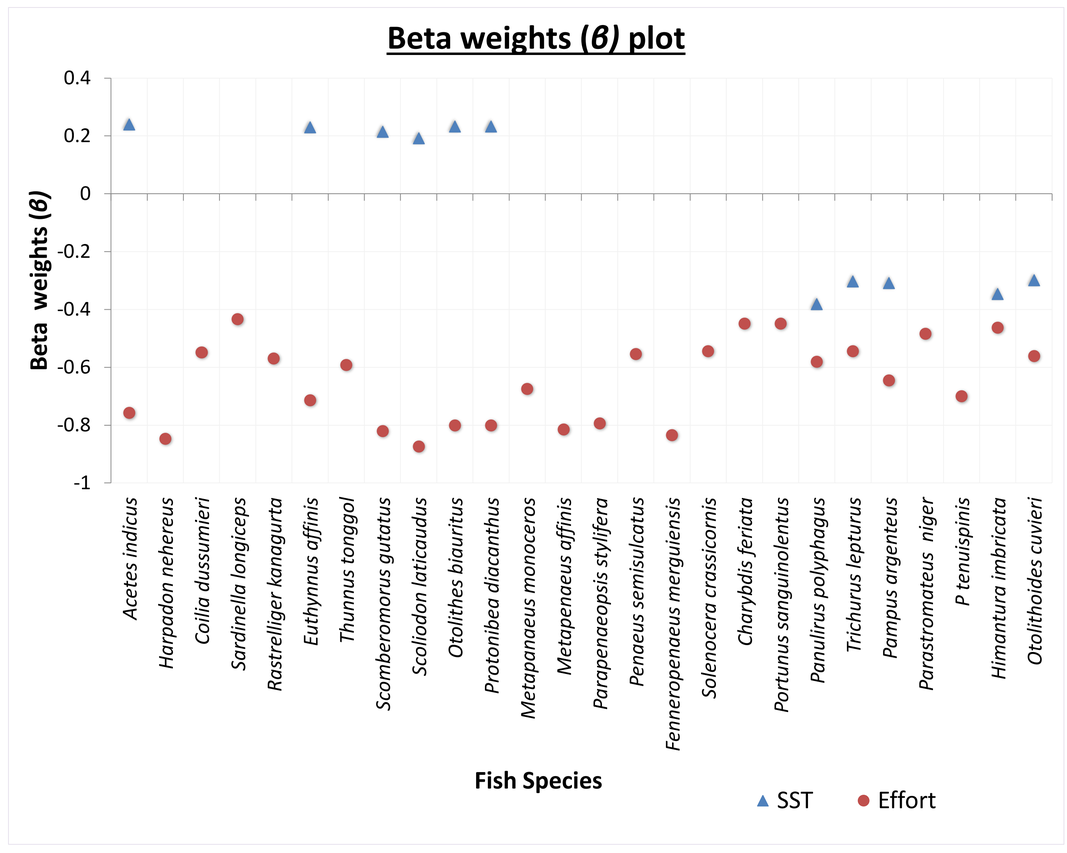

Fig.1. Significant Beta weights (β) of model fitted for each fish species' abundance with SST and fishing effort.

Complete dominance weights showed that fishing effort contributes more variance than SST (Fig. 2) .

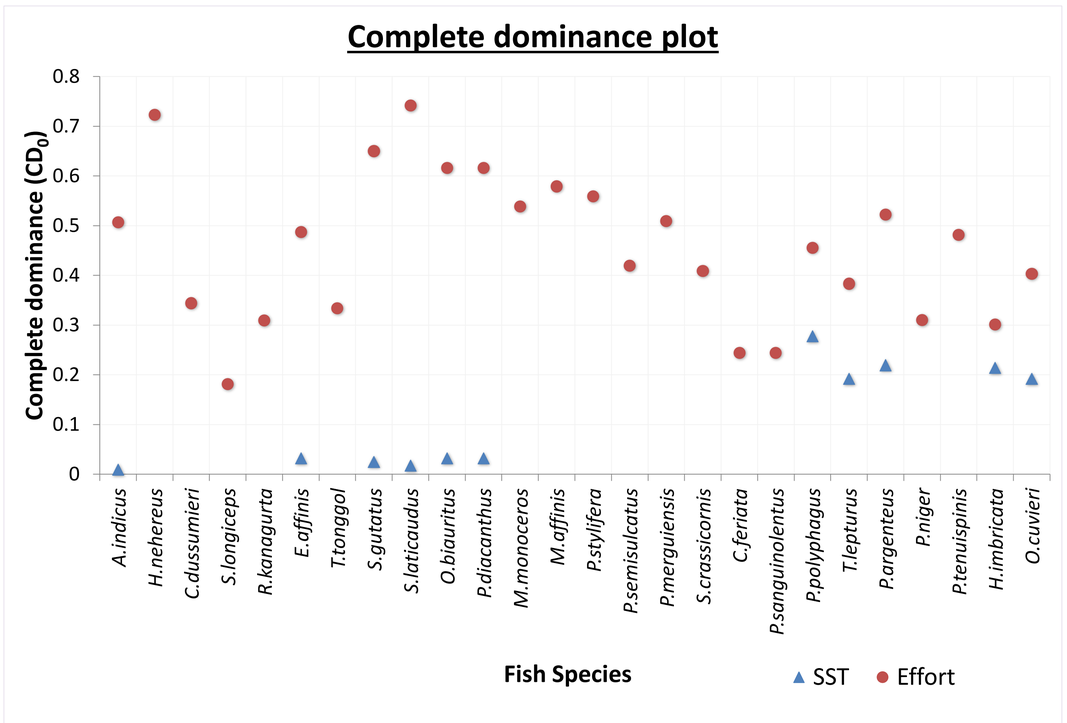

Fig.2. Complete dominance weights (CD_0) of model fitted for each fish species' abundance with SST and fishing effort.

5. Conclusion

Results of the study confirms that the **impact of fishing pressure is very high and more wide spread as compared to that of sea surface temperature** on the fish abundance. However, as14% of species have shown SST also as one of the reasons for their population variability, measures to control fishing needs to be increased simultaneous with conservative management measures which can increase resilience of vulnerable species to climate variability.

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