

SOME OBSERVATIONS ON THE ROLE OF THERMAL PROCESSES ON DISTRIBUTION OF YELLOWFIN TUNA WITH REFERENCE TO LONGLINE FISHING

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ABSTRACT

Tunas have very distinct behaviour patterns and are known to congregate in areas where favourable ecological and environmental conditions prevail. These complex and dynamic forces of environment have a profound influence on the movement of tuna shoals, in vertical and horizontal planes, and their seasonal fluctuations and catchability. Among the several factors influencing tuna distribution, temperature and associated features are considered to be the primary determinants. This study is focussed on the influence of these thermal processes on the vertical distribution of yellowfin tuna.

The basic data were collected in survey cruises aboard the tuna longline vessel of the Fishery Survey of India. The temperature profile data, along with fishery data collected from 117 stations, were used for the statistical analysis to discover the relationship between yellowfin tuna and the environment. The thermal parameters used are the sea-surface temperature (SST), mixed-layer depth (MLD), thermocline, depth of the 18°C isotherm, and derivatives of these parameters, viz., column thickness and vertical thermal gradients (VTG). The monthly mean hooking rate for yellowfin tuna obtained in the survey was used as the index of abundance. Testing the yellowfin tuna-environment relationship was performed basically by assessing and quantifying the linear association between the thermal characters and the yellowfin tuna hooking rate.

Some of the important relationships obtained between the thermal processes and the CPUE of yellowfin tuna are:

- *The SST is inversely related to the MLD and the VTG in the thermocline, and is positively correlated to the thickness of the thermocline.*
- *The MLD has an inverse relationship with thermocline thickness and consequently a positive relationship with the thermocline gradient.*
- *The column thickness between MLD and the isotherm depth is positively correlated with SST and inversely related with MLD.*
- *The CPUE of yellowfin tuna in longline fishing is positively associated with MLD (up to the upper level of the hanging depth of the gear) and the vertical thermal gradients and negatively related to isotherm depth, column thickness, thermocline depth and thermocline thickness.*
- *The most significant correlation ($r = 0.824$) among all the CPUE-hydrologic relationships examined was between the CPUE and the thermal gradient in the hooking depth zone of the gear (80-140 m).*

The functional relationship between the thermal processes and the CPUE is that when column thickness is less, and consequently the VTG is high, the volume of the preferred temperature zone is compressed, thereby increasing the density of fish per unit volume in the zone. The higher density results in higher catch rates. The study infers that adopting an appropriate fishing strategy in harmony with the thermal features would improve the catchability of the species.
