SATELLITE BASED FORECAST SYSTEM FOR YELLOWFIN TUNA FISHERY IN THE INDIAN OCEAN

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Yellowfin Tuna is the major export among Sri Lanka fishery products to Japan and European markets. Even the demand for quality fish in local and international markets are increasing, Sri Lanka has not invested sufficiently enough to increase its fishing capacity, specifically to increase the efficiency. One of the major drawbacks of the fishing industry in Sri Lanka is the long search time of fishing grounds causing high operational cost and as a consequence, low quality fish landings. These weaknesses can overcome by enhancing fishing technology, and one such improvement would be the minimizing catch uncertainty, or identifying fishing grounds that can address most of such problems.

This research was carried out to understand the relationship of catch rates with the prevailing oceanographic conditions. In the meantime, the dynamic oceanographic conditions were related with various satellite observations and, predictive models were generated to infer the oceanographic parameters with satellite observations. Finally, an operational fishing ground forecast system was developed for Yellowfin Tuna in the Indian Ocean.

Oceanographic parameters such as sea surface temperature, sea surface chlorophyll$a$ and the sea surface height from remote sensing satellite data were analyzed with Yellowfin tuna catch obtained from Sri Lankan longliners during a three year period. High frequency catch rates were observed in the regions where sea surface temperature varied primarily between 27.0-30.5°C, sea surface height between 205-215 cm and sea surface chlorophyll concentration between 0.1-0.7 mg m^{-3}. The degrees of differences between the empirical cumulative distribution function and catch-weighted cumulative distribution of the three variables were statistically significant ($p < 0.01$). The results obtained from a Generalized Additive Model have shown that the space-time factor is well above the oceanographic parameters which are also in significant levels ($p < 0.001$). The time and space factor represent the migratory pathway which is an important predictor for Yellowfin tuna. The inter-annual variability of oceanographic parameters were found consistent with high catch rates. Further, to account for the vertical migration of Yellowfin tuna, an algorithm was developed to predict accurate fishing depth based on the subsurface thermal structure. This algorithm is capable of predicting isotherm depth using sea surface height and sea surface temperature with spatial resolution of 1^o grids. Combining the depth prediction model and habitat preferences of Yellowfin tuna, a fishing grounds forecasting methodology was developed based on near real-time satellite observations. A subsurface temperature prediction algorithm was developed using sea surface observation from satellites with relatively high accuracy. Also, it was concluded that satellite derived oceanographic parameters; sea surface temperature, sea surface chlorophyll$_a$ and sea surface height can be used to predict potential fishing grounds of Yellowfin tuna in the Indian Ocean.