

**THE DISTRIBUTIONS OF PELAGIC FISHERY RESOURCES IN  
THE STRAITS OF MALACCA AND THEIR RELATIONS TO  
CHANGES IN TEMPERATURE**

**MUSSE GABOBE HASSAN**

**DOCTOR OF PHILOSOPHY  
UNIVERSITI PUTRA MALAYSIA**

**2004**

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in Fulfilment of the requirement for the Degree of Doctor of Philosophy

**THE DISTRIBUTIONS OF PELAGIC FISHERY RESOURCES IN THE STRAITS OF MALACCA AND THEIR RELATIONS TO CHANGES IN TEMPERATURE**

By

**MUSSE GABOBE HASSAN**

July 2004

**Chairman : Professor Mohd. Ibrahim Bin Hj. Mohamed, Ph.D.**

**Faculty : Science and Environmental Studies**

The pelagic fishery of Malaysia is of major economic importance because of its significant contribution to the country's fish production. This study employed four different sets of data in order to effectively model the impact of spatio-temporal characteristics of oceanographic changes on pelagic fishery in the Straits of Malacca (SOM). The study was divided into three components: (i) investigating the variations of temperature, salinity and dissolved oxygen; (ii) determining the status of small pelagic fishery resources; and (iii) modeling the impact of oceanographic changes, mainly the impacts of sea surface temperature (SST), on the distribution and abundance of pelagic fishery resources in the SOM.

The first component of this study investigated the spatio-temporal variability of physical oceanographic features, mainly sea temperature, salinity and dissolved

oxygen. Data sets from five Malacca Straits Research and Development Centre (MASDEC) oceanographic cruise expeditions conducted in the Straits of Malacca from 1998 to 2002 were rigorously analyzed. The sea surface temperature, salinity and dissolved oxygen in the SOM were found to respectively vary from 27.4 to 30.8 °C with mean ( $\bar{x}$ ) of 29.1 °C, 27.6 to 33.5 ppt with mean ( $\bar{x}$ ) of 31.6 ppt and 4.1 to 7.7 mg/L with mean ( $\bar{x}$ ) of 6.12 mg/L.

The second component of this research investigated the status of small pelagic fishery resources in the Straits of Malacca. Fish landing reflect fluctuating patterns in the catch trends. Such patterns can be categorized into: (a) fisheries which have shown increasing trends, including indian and indo-pacific mackerel (*Rastrelliger* spp.), selar scads (*Selar* spp.), Jack-cavalla-travelly (*Carangoides* spp.), mullets (*Mugilidae*), longtail tuna and kawakawa (*Thunnus tongol* and *Euthynnus affinis*), pomfrets (*Formio niger*, *Pampus* spp.), and hairtails (*Trichiuridae*) (b) fisheries which have shown decreasing trends, including round scads (*Decapterus* spp.), anchovies (*Stolephorus* spp.), sardine (*Sardinella* spp.), hardtail scads (*Megalaspis cordyla*), spanish mackerel (*Scomberomorus* spp.), barracuda (*Sphyraena* spp.) and, wolf herring (*Chirocentrus dorab*). Moreover, despite some fluctuating trends, species like hardtail scads (*Megalaspis cordyla*), anchovies (*Stolephorus* spp.), spanish mackerel (*Scomberomorus* spp.), mullets (*Mugilidae*) and wolf herring (*Chirocentrus dorab*) have been decreasing right from the determined period whereas, species like Jack-cavalla-travelly (*Carangoides* spp.) showed declining trends only in the late 1990s.

The third component of the study determined the impacts of oceanographic changes, mainly the SST, on the distributions and abundance of pelagic fishery resource in the SOM. The annual fluctuations of the availability of pelagic fishery resources in relation to SST and Southern Oscillation Index (SOI) variations have been established. The natural environmental variations, known as El Niño Southern Oscillation (ENSO) events were identified as warmer than normal temperatures and with low negative values of the SOI. The periods 1979/80, 1982/83, 1987/88, 1991/92, 1993 and 1997/98 were identified as El Niño years whereas 1978, 1984/85, 1986, 1988/89, 1995/96 and 1999/2001 were identified as La Niña years.

Barracudas, round scads, Jack-cavalla-trevally, anchovies, hardtail scads and indian mackerel showed relatively low catch values during El Niño episodes. However, the catch of wolf herring and spanish mackerel were found to be comparatively high during El Niño episodes whereas mullets, selar scads, pomfrets, sardine, longtail tuna and hairtails did not show any significant difference during the El Niño/La Niña episodes. Annual landing of purse seine net operated in the SOM from 1980-2001 showed a significant ( $p < 0.05$ ) correlation with SOI whereas the catch from trawl net did not show any apparent relationship.

Annual variability patterns between SST and Catch Per Unit Effort (CPUE) over the years showed a significant correlation indicating the CPUE to be high when the SST is high and vice versa. The results from the general linear modeling of the impacts of different SST levels and rainfall distribution on CPUE indicated that the SST was

found to be significantly ( $p < 0.01$ ) correlated with the CPUE for both purse seine and trawl nets.

The physical oceanographic phenomenon has a significant impact on the variations of fish catches, CPUE and fish density. The concept and implications of SST variability and ENSO on distributions and abundance of pelagic fishery resources in the SOM were identified and critically discussed. Based on statistical analysis, the null hypothesis that oceanographic factors have no effect on pelagic fishery resources was subsequently rejected and the alternative hypothesis was accepted. The findings obtained from this research could be very useful for not only further development and management of pelagic fishery resources in the SOM but also all in tropical waters.