# FISHERY AND STOCK STATUS OF BILLFISHES EXPLOITED FROM THE EASTERN ARABIAN SEA

**S. Surya, P. Rohit, E.M Abdussamad*, K.G. Mini, K.M. Koya, S. Ghosh, J. Jayasankar, C. Anulekshmi, P.A Azeez**

**Central Marine Fisheries Research Institute**

***Indian Council of Agricultural Research (ICAR)***

Post Box No. 1603, Ernakulam North P.O. Kerala State, India, Pin: 682018

Billfishes are a group of highly predatory fishes distributed extensively along the world oceans. In India, the billfish fishery is supported by four genera and following five species: *Istiophorus platypterus, Istiompax indica, Makaira nigricans, Xiphias gladius, Tetrapturus audax* and *T. angustirostis*. Mechanised gillnetters contributed major share of their landings. *I. platypteurs* was the dominant species in the fishery and *T.angustirostis* was sporadically landed. Billfishes along the Indian coast were mainly exploited by mechanised gillnetters followed by other mechanised crafts operating pelagic longlines. The west coast of India recorded 60% of annual billfish landings. The maturity and length range of *I. platypterus, I. indica, M. nigricans and X. gladius*, the major species in the fishery, were monitored during 2019 and the length at which 50% of the population matured ($Lm_{50}$) and stock parameters of these four species of billfishes were estimated based on samples collected from major landing centres along the eastern Arabian Sea. Fishery biological observations of billfish species indicated that the stocks in general are healthy, with fairly high spawning stock biomass and are being fished at sustainable levels.

## Introduction

Billfishes are one of the major large pelagics, contributing substantially to the total large pelagic landings in India. There is no targeted fishery for billfishes along the Indian coast but it occurs as a bycatch in longlines, troll and oceanic drift gillnet fishery. In India, species of billfishes commonly reported are *Istiophorus platypterus* (Indo-Pacific sail fish), *Tetrapturus audax* (Striped marlin), *Istiompax indica* (Black marlin), *Makaira nigricans* (Blue marlin) and *Xiphias gladius* (Swordfish). Landings of *T. angustirostis* was rare. The landings of billfishes along the Indian coast registered an increasing trend since 1990s. The exploratory fishing conducted by M.F.V Yellowfin and M.F.V MatsyaVrushti (2009-18) of Fishery Survey of India revealed the presence of billfishes in significant quantities (66%) along the west coast (FAO Area 51) (Annual Report, Fishery Survey of India). It is in this context the study on billfishes was undertaken in the eastern Arabian Sea, the north western boundary of Indian

ocean from7$^0$ to 23$^0$N latitude and 60$^0$ to 74$^0$E longitude covering an approximate area of 0.86 million km$^2$. The data was collected from the south west coastal states of India and the Lakshadweep islands with special focus on landings made by small mechanized fishing vessels. The landings of billfishes were monitored by personnel specially appointed by ICAR CMFRI for collection of fishery landings data. The landings of billfishes have registered a positive trend during the last decade (Fig 1). Billfishes are generally exploited by the mechanized multiday gillnetters cum liners.

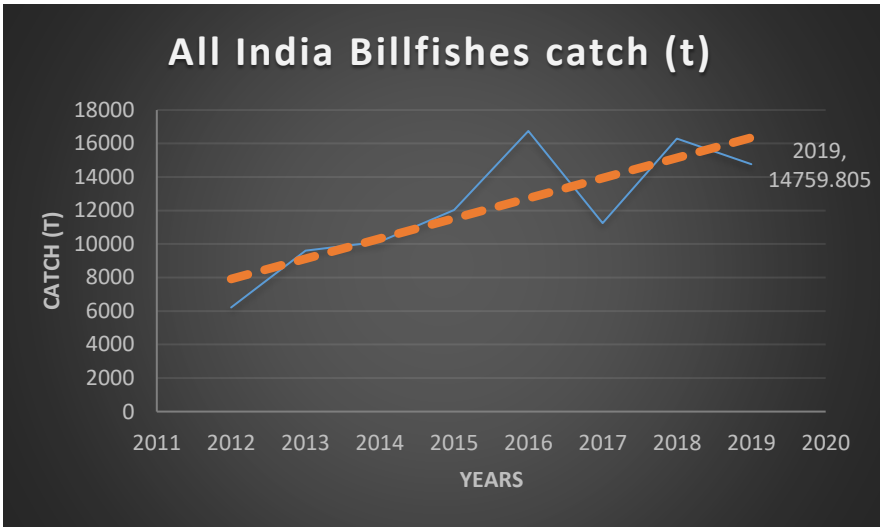


Fig 1. Graph representing the trend of billfish landings in India

The billfish fishery was supported by *Istiophorus platypterus* (51%), *Istiompax indica* (16%), *Makaira nigricans* (10%), *Xiphias gladius* (20%) and *Tetrapturus audax* (3%) and it is shown in figure 2. The percentage composition was assessed based on the landings of billfishes from 2009 to 2019 from the eastern Arabian Sea.

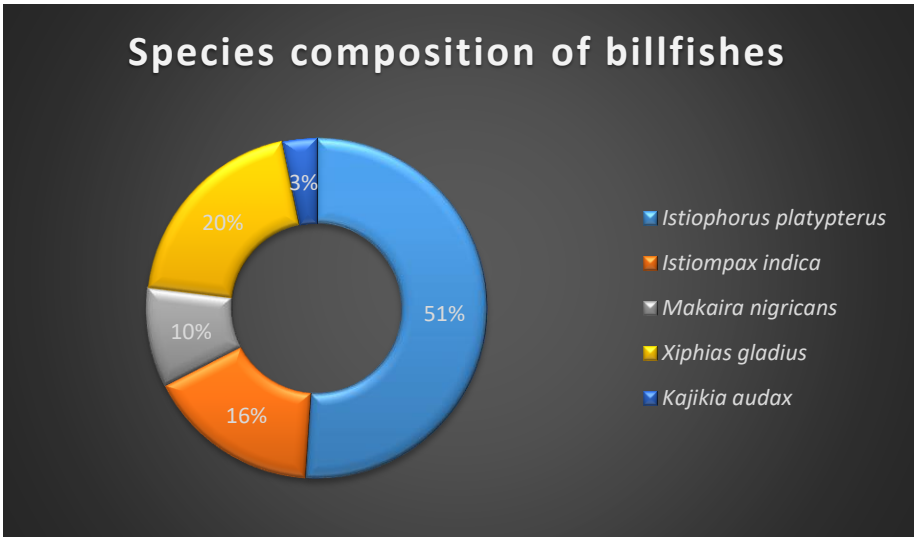


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Fig 2. Percentage contribution of different species of billfishes exploited from the Eastern Arabian Sea during 2009-2019

**Mean size**

The Lower jaw fork length (LJFL) of billfishes were monitored and the mean size of the different billfish species landed was estimated and depicted in (Figure 3). The length range of different species in detail is shown in Table 1.

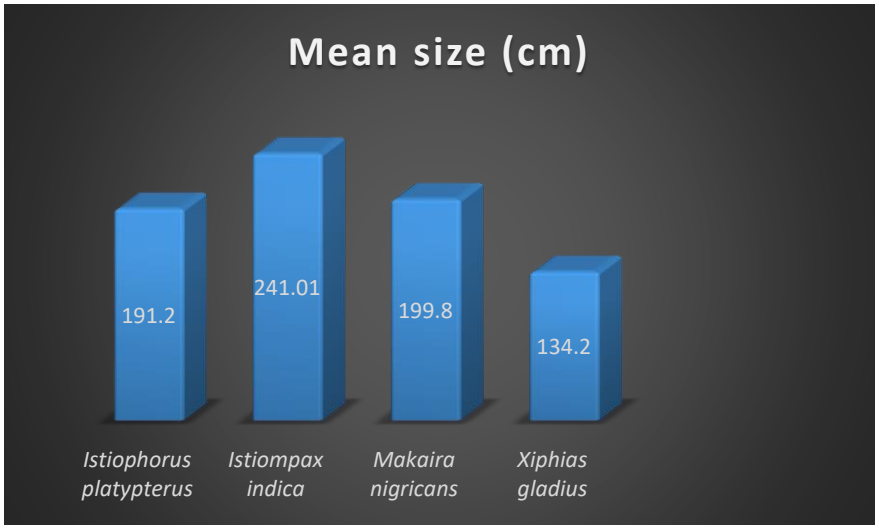


Fig 3. Mean size of 4 major billfish species

**Genetic identification of billfishes exploited from the eastern Arabian sea**

Four species of billfishes distributed in India are easily distinguishable by COI barcodes. But the striped marlin species *K. audax* available in India show highly similar sequences with *K. albida*, and cannot be distinguished by barcodes alone. Control Region (889bp) provided better phylogenetic signal, consistent with that of the whole mitochondrial genome topology. For the conserved COI region (barcoding gene) we used the FishF1 and FishR1 primer (Ward et al. 2005).For the highly variable Control Region (CR) we used CR-F/CR-R primers by Chen et al., 2012. The primer conditions were optimized for each species.

**Growth and mortality parameters of major billfish species**

Length frequency catch data of billfish species from the Eastern Arabian Sea was collected monthly from landing centres during January 2017 to December 2019. The monthly gear-wise data on landing of billfishes from the west coast states monitored by personnel specially appointed by ICAR CMFRI estimated using Stratified Multistage Random Sampling

as detailed in Srinath *et al*. (2005) for the study. The length frequency data was grouped into 5cm class interval and raised for the day and subsequently for the month using the method of Sekharan (1962). The growth and mortality parameters were derived using ELEFAN and Catch curve analysis within TropFishR (Mildenberger et al., 2017; R-Core-Team, 2017). The length range, mean size, length at first maturity and stock parameters are given in Table 1.

Table 1: Length range, mean size and population parameters of billfishes exploited from the Eastern Arabian Sea

| **Species/Growth and mortality parameters** | ***I.platypterus*** | ***M.nigricans*** | ***I.indica*** | ***X.gladius*** |
|---|---|---|---|---|
| Maximum length (LJFL) (cm) | 284.3 | 299.1 | 298.6 | 239.4 |
| Minimum length (cm) | 96.2 | 120.1 | 126.2 | 66.9 |
| Mean size (cm) | 191.2 | 199.8 | 241.01 | 134.2 |
| L∞(cm) (L Infinity) | 317 | 324.57 | 332.7 | 272 |
| K (Growth constant) | 0.19 | 0.2 | 0.21 | 0.26 |
| $t_0$ (Age at zero length) | -0.0519 | -0.0511 | -0.0497 | -0.0467 |
| M (Natural mortality) | 0.32 | 0.313 | 0.33 | 0.393 |
| F (Fishing mortality) | 0.9 | 0.71 | 0.54 | 0.80 |
| Z (Total mortality) | 1.22 | 1.02 | 0.86 | 1.19 |
| Length at first maturity (cm) | 173 | 185 | 190 | 154 |
| Most recent catch estimate (t) (2019) | 4335 | 1108 | 528 | 1483 |
| Total catch (t) (2017-2019) | 16031.8 | 2790.28 | 3093.2 | 5148.2 |
| Data period used for assessment | 2017-2019 | 2017-19 | 2017-19 | 2017-19 |

*****_Landing data for the study was collected by personnel appointed by ICAR CMFRI_

**Summary:**

The present fishing and exploitation rate were at safe for all the species of billfishes and the exploitation rate estimated is lower than the sustainable level indicated the healthy status of the stock. Regular fishery monitoring and harvest regulations will add significantly to the health of the stocks. During the last two years, the fishing activities along the Indian coast was disrupted due to natural calamities as well as lockdown effects due to Covid pandemic, considerable decline was noticed in the commercial fish landings and loss of actual fishing days. However, strict implementation and enforcement of fishery regulations improved the biological condition of the landings and stock status of the resources.

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