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DRAFT: Pilot project to improve data collection for tuna, sharks and billfish from artisanal fisheries in the Indian Ocean. Part II: Revision of catch statistics for India, Indonesia and Sri Lanka (1950-2011). Assignment of species and gears to the total catch and issues on data quality

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Introduction

The Indian Ocean Tuna Commission (IOTC), following on the study to improve artisanal fisheries reporting by the countries in the region last year, proposed a revision of the existing data in the IOTC database to assign catches by species and gears to India, Indonesia and Sri Lanka, three of the most important countries in the region in terms of capture of the species of interest.

Contracting and Cooperating Non-contracting Parties (CPCs) in the region have the obligation to fulfil the requirements set by the Commission. Until recently, no countries reported the data by species and gears as determined by the Scientific Committee of IOTC, a shortcoming that has been partially addressed in recent years. Nonetheless, there are issues with species and gear reporting as well as total catch estimates as evidenced by this revision.

The objectives of the missions were 1. to determine the catches of artisanal fisheries in India, Indonesia and Sri Lanka by species; 2. to determine the catches of said species by gears in each of the three countries in as much detail as possible; and 3. to revise the total catch if warranted.

BOX 1: Definition of artisanal fisheries on this study

Provisions in IOTC Resolution 11/04 call for IOTC CPCs to deploy observers onboard fishing vessels under their flag authorized to fish for IOTC species within the IOTC Area. This includes all vessels with length overall 24m or greater and all other vessels when they operate, fully or partially, outside the EEZ of their flag states.
In addition, IOTC CPCs are called to monitor their artisanal fisheries in port, through field samplers.

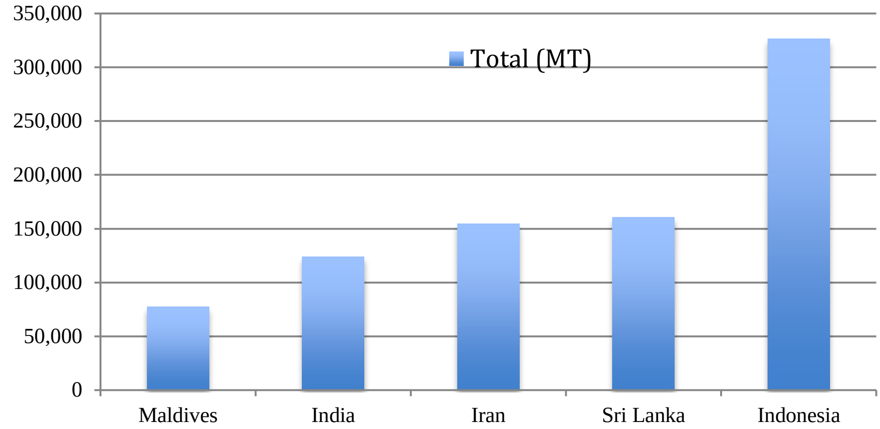
By exclusion and for the purpose of this study, **artisanal fisheries are defined as those undertaken by vessels (or any other types of fishing crafts) with LOA less than 24m and operated full time within the EEZ of their flag states**.

The need to revise the data in the database is based in the necessity to break down the species captured and gears used to better model the fisheries in these countries in the region. Substantial changes were made to the data in terms of total catch (for India) as well as species caught and gears used (for all the countries researched). The changes made will have to be assessed in light of the possible implications to the assessment and management of the species of concern.

Methods

India, Indonesia and Sri Lanka were chosen because they are three of the four top coastal producing states of tuna and tuna-like fishes in the Indian Ocean (Figure 1). Information about the fisheries in each country was extracted from the Internet, IOTC and the Indo-Pacific Tuna Development and Management Programme (IPTP, the precursor to IOTC) documents as well as visits to the countries. In India, even thought there is an extensive dataset on species, gears, length frequencies and CPUEs, no new information was gathered during the visit due to the unwillingness of the scientists at the Central Marine Fisheries Research Institute (CMFRI) to share information. Indonesia had some documents that added additional data although the information is fragmented and of questionable quality. Documents included reports from ports and provinces on species and gear utilization. Sri Lanka had few additional data to contribute to the process.

Figure 1: Catch (MT) of tuna and seerfish species in the top five coastal states in the Indian Ocean in 2011.



A common problem encountered in the catch data in these countries was the aggregation of species under a common category (*e.g.* sharks). It is necessary not only to break down the data into species but also by gears as selectivity may change substantially depending on the gear used, and this needs to be taken into account if the models are to be accurate. The main problem for catch estimation, though, appears to be the boat activity coefficient, that is the measure of the number of boats that go out fishing which is used to raise the number of boats sampled to a total catch. Informal questioning in India and Sri Lanka is not a suitable replacement for a more methodical and objective approach.

Data were extracted in as much detail as possible from the reports mentioned above and entered into Excel. Pivot tables were made to calculate year/area/species/gear contributions where possible. In most cases, due to paucity of data, it was necessary to aggregate all information as a whole or for selected time periods. These proportions were used to calculate the contribution of each species/gear combination per country.

In cases where data were missing, averages were used to estimate them. In the case of a single data point missing, the average of the previous and following number was taken. If two or more data points were missing, averages of the two immediate data points before or after were used. Specific issues regarding species proportions where species were clumped (*ie. Auxis* spp. in India) are explained in each country revision. In some occasions, data showed large unexplained increases of decreases or species/gear combinations that were implausible and these were rejected and catches re-estimated. The quality of data differs among the three countries and their processing, changes and methodologies are explained in detail in each country section.

Results

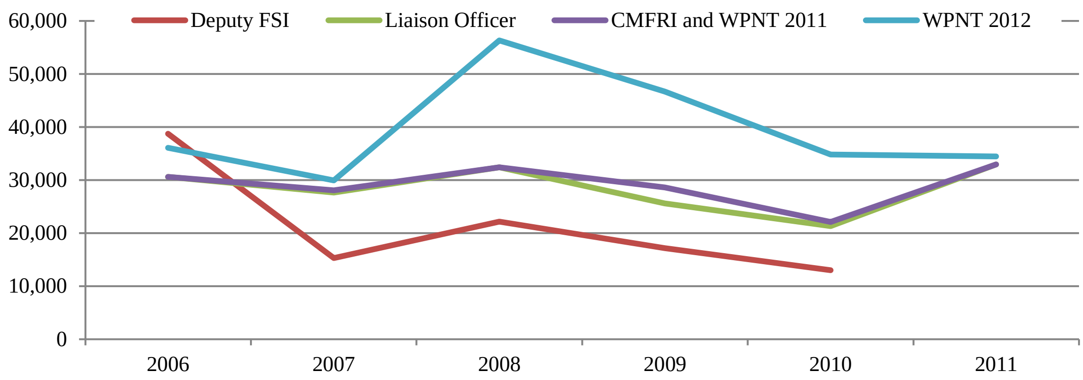
India

India possesses the most complex fishery in the region because of its size, large number of boats and species. Although India has a wealth of data on species, gears, sizes, catch per unit effort, the reluctance of scientists at CMFRI in Kochi to share this information makes any reconstruction of its fisheries a guessing game. Annual Reports from CMFRI were used as the basis for this reconstruction but changes were made in places where it was thought the quantities were unrealistically low or high. In addition, data were extracted from these reports on species and gears to reconstruct the catch composition and they are presented by decade to allow for some resolution on the changes found mainly through the introduction of new gears into the fishery.

Data currently in the IOTC database have gone through a series of revisions, the latest based on Bhathal (2005) and Country Reports (presented at Scientific Committee meetings) but little emphasis was placed on using the CMFRI Annual Reports, here used, because they were inaccessible until their recent inclusion in the e-library at this institute (http://eprints.cmfri.org.in/view/subjects/annualreport.html).

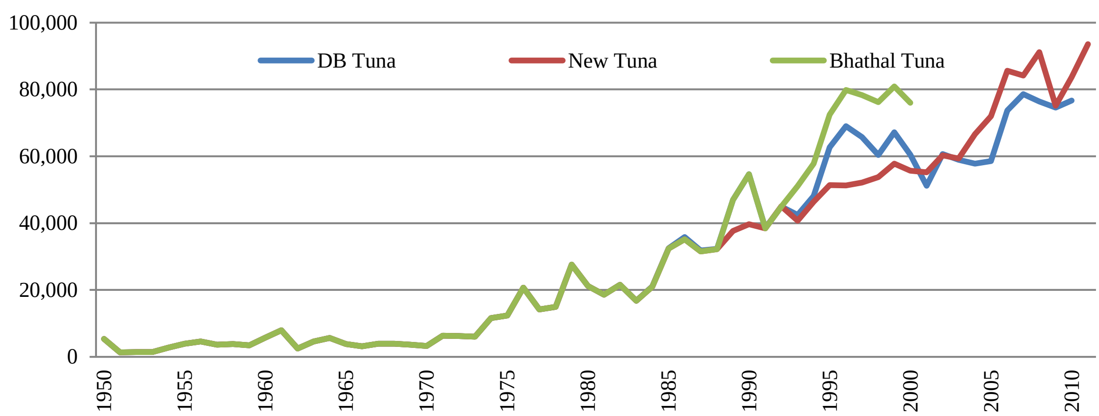
An issue encountered in India's reporting, as well as other countries in the region, is the inconsistency in catches reported from one document or institution to the next. It is common to get completely different official numbers with no explanation for the changes. Reports from the Fishery Survey of India (FSI) Deputy, Liaison Officer, CMFRI and Working Parties on Neritic Tunas (2011 and 2012), for example, show wildly dissimilar estimates (Figure 2) that emphasize the issues of misreporting already highlighted in other documents by the Commission. Furthermore, large changes in catches from year to year from the same source do not seem to elicit questions internally with an accompanying investigation on the causes. In some cases these changes may be from natural processes (*e.g.* recruitment to the fishery) but in many cases can be attributed to errors in calculations or missing information.

Figure 2: Catch per year (MT) of kawakawa (*Euthynnus affinis*) in India as reported by various national organizations and documents.



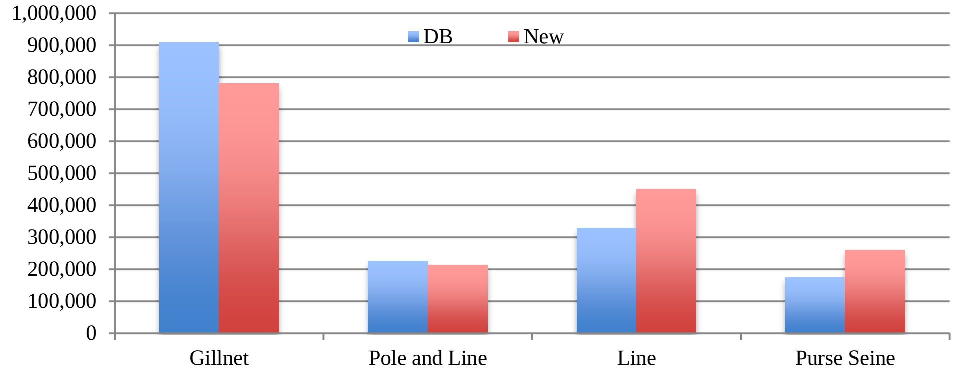
The most prominent changes observed when comparing the existing database to this revision were that the total tuna catch currently in the IOTC database is different than that calculated here since 1992 although the calculations overlap in a few years (Figure 3). Also, the total seerfish catch currently in the IOTC database is higher from 1993-2004 than that calculated here.

Figure 3: Comparison of historical tuna catches (MT) in India from Bathal, IOTC database, and current revision (1950-2011).



The overall catch of tuna species by gear type from 1950-2011 shows changes in the new revision compared to the data in the IOTC database (Figure 4) and this may have implications for stock assessment in the future as the selectivity of the gears are different. Overall, a drop in catch with gillnet, with an increase with line (handline, troll) and purse seine are observed in this revision.

Figure 4: Cumulative total catch (MT) of tuna species by gear type from 1950-2011 for India currently in the IOTC database (DB) and calculated in this study (New).



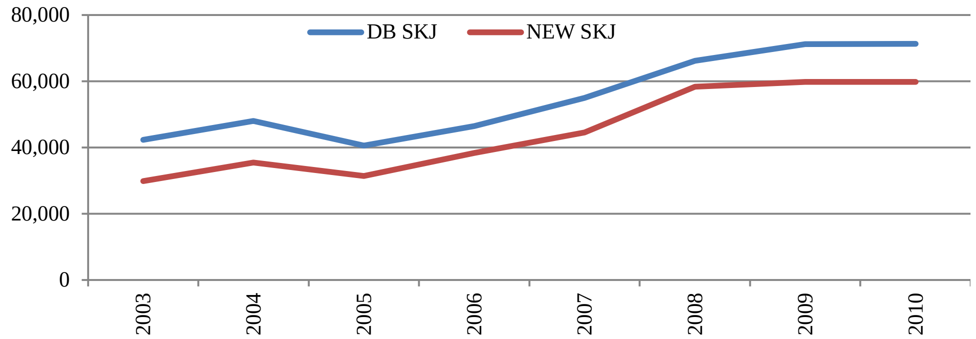
The most important tuna species by volume was kawakawa (*Euthynnus affinis*) followed by skipjack (*Katsuwonus pelamis*), yellowfin tuna (*Thunnus albacares*), frigate tuna (*Auxis thazard*) and longtail tuna (*Thunnus tonggol*). Yellowfin tuna was the most problematic species for which to derive catch estimates as it was originally grouped with the oriental bonito and other species that were not identified under the *Other Tunnies* category. Initially, 99% of the catch of *Other Tunnies* was assigned to yellowfin tuna but radical, and in many cases unrealistic, changes in the catches of that category resulted in unlikely estimates. Therefore, existing estimates in the IOTC database were kept except for 2008-2011 where values were taken from India's country reports.

Indonesia

Indonesia is one of the countries of high interest due to its geographically extensive fishery and because it is the coastal country with the highest catch of IOTC species of interest. Since 2004 Indonesia has been reporting data by species and gears although the large fluctuations encountered in this study suggest that the system has flaws that need to be addressed. Species like swordfish and mako sharks caught with beach seines, large unexplained changes in total catch in the most important port in Indonesia's India Ocean region, PPS Nizam Zachman in Jakarta, and erratic species and gear changes in all ports and districts indicate that there are issues with the reporting that need to be resolved before Indonesia has a sound statistical system in place.

The main species caught in Indonesia, as calculated from the information extracted from various reports and datasheets from DGCF, were skipjack tuna (Figure 5), frigate tuna, yellowfin tuna, kawakawa, and longtail tuna. The numbers may differ markedly from those in the IOTC database and these differences need to be considered carefully before using the numbers presented here.

Figure 5: Current and new calculated catch (MT) of skipjack tuna in Indonesia from 2003-2010.



A confounding issue in Indonesia is the large variety of longlines available that target different species in the fishery: set, drift, demersal, tuna and shark longlines. The longline usually considered at IOTC is the more commercial tuna longline that targets yellowfin tuna, bigeye tuna, albacore and has a bycatch of pelagic shark species. Other longlines in use in Indonesia, however, appear to catch species usually not associated with tuna longlines like kawakawa, frigate tuna and longtail tuna. Therefore, two sets of results were, one with tuna longline included into the calculations and one without. The latter one, uses the data calculated in Herrera (2002) for tuna longline while calculating the other species as indicated above

Changes were observed in gear usage and species composition through the historical series but these are not presented here as estimations have not been completed.

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