

REPORT ON THE AVAILABILITY, COMPLETENESS AND QUALITY OF CATCH DATA FOR ALL FLEETS IN THE IOTC DATABASE

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PURPOSE

To provide information to the Technical Committee on Allocation Criteria (TCAC) that would allow it to determine if the statistics available at the IOTC Secretariat are reliable enough to derive time series of catches for albacore, bigeye tuna, skipjack tuna, yellowfin tuna, and swordfish, that could be used in a future allocation process. Information is provided as:

- Time series estimates of total annual catches by country and species, including:
 - Coastal fisheries (Box 1): estimates of annual catches by country and species;
 - Surface and longline fisheries (Box 1): estimates of annual catches by country, area and species, in particular total catch within Economic Exclusive Zones (EEZ) and high seas.
- Estimates of total catches by country, species, and month, in close-to-real time.

BACKGROUND

At its first Session in 2011, the TCAC made the following statement: “Noting that historical catch data is likely to be an important component of the baseline calculation for the allocation system, the Technical Committee agreed that the Secretariat prepares, for the next meeting, a document on the availability, completeness and quality of data for all fleets in IOTC database.” (para. 34, of the TCAC01 Report).

Box 1: Definition of coastal, surface, and longline fisheries

IOTC Resolution 10/02 (Mandatory Statistical Requirements for IOTC Members and Cooperating Non-Contracting Parties) calls for IOTC CPCs to report data on IOTC species for their fisheries, including catches for surface, longline, and coastal fisheries. However, no definition exists in the IOTC context for the above fisheries. Considering that the terms coastal and artisanal are used indistinctly by the IOTC, as opposed to industrial, and taking into account that the IOTC uses the term industrial to refer to vessels in the IOTC Record of Authorized Vessels (IOTC Resolution 07/02), the following definitions are used in this paper:

- **Coastal fisheries:** Fisheries carried out by vessels having an overall length of less than 24 meters and which only operate within the EEZ of the flag country.
- **Surface and longline fisheries:** Fisheries carried out by vessels having an overall length of 24 meters or greater; or by vessels having an overall length of less than 24 meters which operate, partially or fully, beyond the EEZ of the flag country.

Compilation and review of catch estimates

IOTC Resolution 10/02 contains provisions calling for IOTC Members and Cooperating Non-Contracting Parties (collectively termed CPCs) to report statistics on IOTC species in a given format, including the following data relevant to the present study:

- **Nominal catches:** refers to estimates of total annual catches in live weight by gear type, species and IOTC basin (Eastern or Western Indian Ocean), including discards;
- **Catch-and-effort:** refers to catch and effort data reported according to the following standards:
 - **Surface fisheries:** refers to fisheries undertaken by tuna purse seiners, baitboats, and gillnetters in the IOTC record of authorized vessels. Data to be reported include catches in live weight per year, month, gear type, fishing mode, and species, as derived from fishing logbooks completed onboard fishing vessels, reported aggregated by 1 degree square areas.
 - **Longline fisheries:** refers to fisheries undertaken by longliners in the IOTC record of authorized vessels. Data to be reported include catches in live weight per year, month, gear type, and species, as derived from fishing logbooks completed onboard fishing vessels, reported aggregated by 5 degree square areas. *The two above apply to fisheries undertaken by fishing vessels in the IOTC Record of Authorized vessels (see Box 1), including tuna purse seine, baitboat, driftnet, longline, or any other fisheries with vessels in the record.*

- **Coastal fisheries:** refers to fisheries undertaken by fleets operating in coastal waters, all year round within the EEZ of their flag countries (not in the IOTC Record of Authorized Vessels). Data to be reported include catches in live weight per year, month, gear type, and species, as collected at the landing place through sampling, interviews, or by other means, reported aggregated by area, for areas that are representative of the fisheries concerned.

In addition to the above, IOTC Resolutions 10/03 *Concerning the recording of catch by fishing vessels in the IOTC Area*, and Resolution 08/04 *Concerning the recording of catch by longline fishing vessels in the IOTC Area*, and Recommendation 11/06 *Concerning the recording of catch and effort by fishing vessels in the IOTC Area of Competence*, contain provisions for IOTC coastal countries to collect and report catch-and-effort data for foreign vessels fishing within their EEZs, by flag country. All countries have to report statistics each year, no later than 1st July the following year.

In order to complete and verify the information reported to the Commission, the IOTC Secretariat also collects alternative information, including (i) catch data published by the FAO, as provided by flag states; (ii) catch data published through web pages, documents, or by other means; (iii) data collected in the field by the IOTC Secretariat (IOTC–OFCF Project, Pilot Project, etc.); (iv) reports from third parties (e.g. landings of foreign vessels, export statistics, and catches processed in canning factories).

Each year, the IOTC Secretariat contacts all parties fishing for IOTC species in the Indian Ocean, including CPCs or other countries known to have fished in the area, to remind them of the type of data that must be reported and the deadlines that apply in each case. All data received are processed and transferred to the IOTC Database. In the event of catches not reported by the flag country, the IOTC Secretariat raises estimates of catch, using alternative information. This process is summarized in the flow chart presented in Figure 1.

The preliminary estimates of catches obtained from the above process are presented to the IOTC Working Parties and Scientific Committee (SC) each year and, once adopted by the SC, are considered to represent the best scientific estimates of catch, and are used for the assessments of IOTC and associated species.

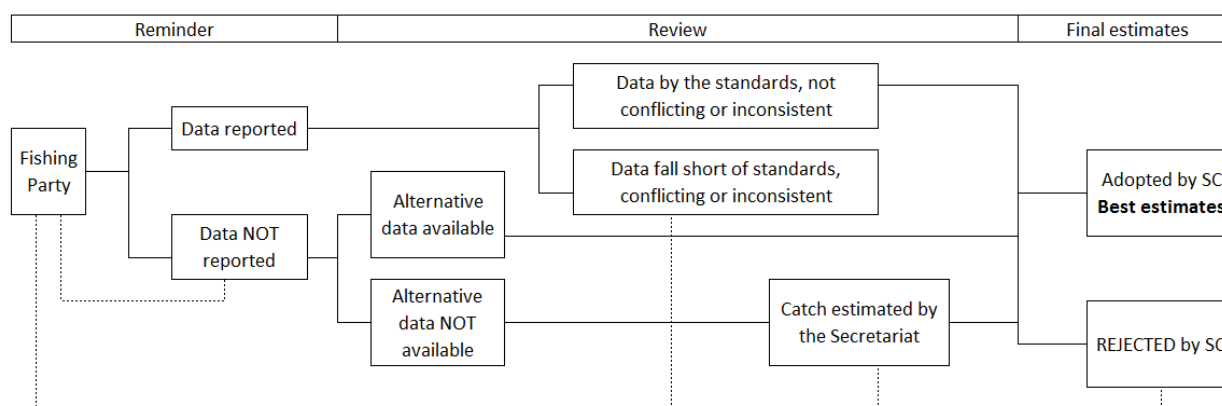


Figure 1. Flow chart showing the process leading to the production of best estimates of catch for IOTC species. Continuous lines are used to represent flow from left-to right while dotted lines refer to backward flow.

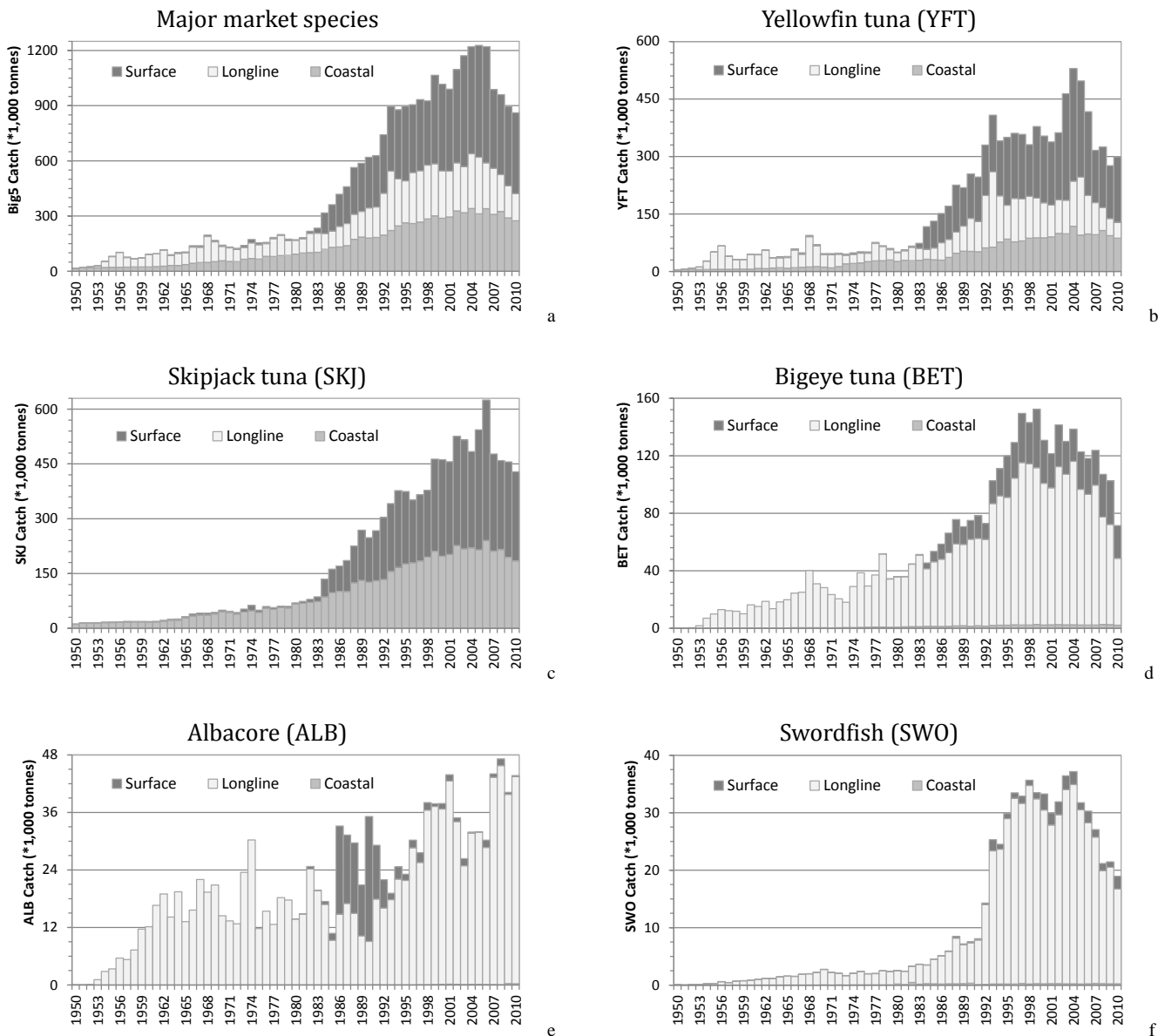
DISCUSSION

Completeness and quality of catch data (albacore, bigeye tuna, yellowfin tuna, skipjack tuna and swordfish)

Estimates of total annual catches: The total combined catches for the main market species (five species) are presented in Figure 2a by type of fleet (Box 1), as adopted at the last meeting of the IOTC Scientific Committee (SC14, December 2011). Figures 2b–f present best estimates of catch in the IOTC area for yellowfin tuna (YFT), bigeye tuna (BET), skipjack tuna (SKJ), albacore (ALB) and swordfish (SWO).

The quality of the catches estimated varies depending on the country, fishery, time-period, and species. The main issues identified for tropical tunas, albacore, and swordfish, are summarized in [Appendix A](#), including: (i) The main issues identified; (ii) periods; (iii) fleets concerned; (vi) details on whether it was possible to raise estimates of catch or not; and (v) importance of the estimates as a potential source of uncertainty in the total catch estimates, by species. The same information is summarized in Figures 3a–d, expressed as the amount of catch that had to be further revised and adjusted by the IOTC Secretariat, due to it being incomplete or inaccurate, by type of fishery, including: (i) catch officially reported or from alternative sources which conformed with the validation criteria used by the IOTC Secretariat; (ii) catch officially reported or from alternative sources which had to be adjusted for species composition, due to disaggregation or species miss-identification; and (iii) catch not available, estimated by the IOTC Secretariat

using levels of activity from the fleets and catches from other fleets or time periods (also called the Not Elsewhere Indicated (NEI) component).



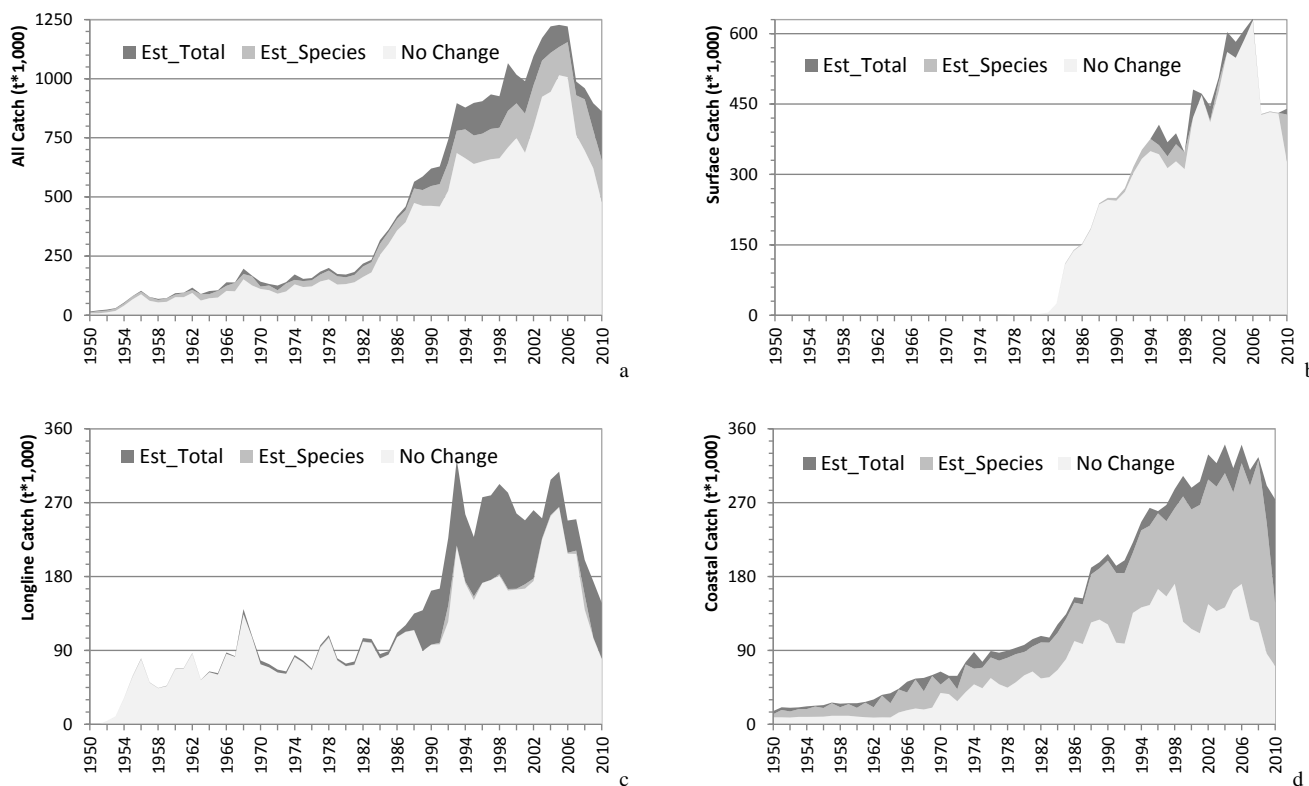
Figures 2a–f. Best estimates of catches in live weight (1000s of tonnes) for the five main market species of tunas in the Indian Ocean, and total catches for all five species, by type of fleet (Box 1). *Note: Surface fisheries include all industrial tuna purse seine fleets, and fleets using driftnets (Iran, Pakistan, Sri Lanka). Longline fisheries include all deep-freezing, fresh tuna, and swordfish longline fleets. Coastal fisheries include all baitboat, hook-and-line (other than longline), coastal gill and seine nets, and other gears operated in coastal waters (e.g. lift nets, Danish seines, beach seines, traps, etc.).*

A summary of the information presented in [Appendix A](#) and figures 3a–d is provided below:

- Overall, up to 25% of the catches of main market species in the IOTC database refer to estimates by the IOTC Secretariat (Figure 3a), the majority involving revision of original catch reports to adjust catches by species, while in other cases catches are fully estimated using information from other fleets or time periods (catch recorded under the NEI category).
- **Coastal fisheries** are, by far, the major contributor to the uncertainty in the estimates of catch for the main market species in the Indian Ocean, in particular tropical tuna species (Figure 3d); most of the uncertainty can be attributed to insufficient monitoring of the fisheries, with data systems not producing reliable estimates due to insufficient data collection or poor identification of IOTC species ([Appendix A](#)). The better quality of catch reports before the mid-1980's (Figure 3d) might be an artifact, originating from the fact that there is little information available on the fisheries or catches before that time and therefore reports cannot be validated properly. On the other hand, during the mid-1980's fisheries in IOTC coastal countries underwent substantial development, including mechanization and introduction of fiberglass vessels in many countries,

and development of new fisheries directed at tunas. The statistical systems in some of the countries concerned, however, were not updated and monitoring of tuna fisheries remains deficient in many cases.

- **Longline fisheries** undertaken by fleets using flags of convenience or under flags of coastal countries in the IOTC Area, do not report statistics to the IOTC Secretariat which are considered accurate. In addition, catch data for the fresh-tuna longline fleet of Taiwan, China is thought to be less accurate between 1989 and 1998, as the fleet was not monitored during that period ([Appendix A](#)). However, in the majority of the cases detailed above, the IOTC Secretariat has fully estimated the catch series by species (Figure 3c). The estimation procedure affects the of catch history of albacore, bigeye tuna and yellowfin tuna, especially between the mid-1980's and the late 1990's. In addition, the amounts of tuna and swordfish discarded by longline fisheries are not included in the estimates of catch, even though they are considered substantial for some of the IOTC longline fleets, especially those using surface longlines in tropical areas where depredation by marine mammals is considered high by the Scientific Committee.
- **Surface fisheries** using industrial tuna purse seines are thought to produce good catch statistics by species in most cases (Figure 3b), especially in recent years where activities are limited to a small number of fleets. The only issues relevant to these fisheries are the lack of reporting of catch data from a fleet of Russian-owned purse seiners during the 1990's, the fact that catch statistics do not contain discard levels for most of the time-series (1977–2002) and that they are derived from non-validated logbook reports for some fleets, in particular catch by species ([Appendix A](#)). On the other hand, the catches of bigeye tuna for driftnet fisheries are considered to be less reliable due to identification issues. In addition, the catches from Pakistan driftnet vessels are considered to be very unreliable as the fishery is not adequately monitored ([Appendix A](#)). The problems identified above primarily affect the catch records for bigeye tuna and swordfish. Catches of swordfish are aggregated with those of other billfish species (I.R. Iran driftnet vessels).



Figures 3a–d. Total combined catches (1000s of tonnes) of major market species in the IOTC Area for a) all species and fisheries combined; b) surface fisheries; c) longline fisheries; and d) coastal fisheries. Data classified according to the type of data processing required to derive the catches. No change = Catch data derived from official reports or alternative sources; no changes made to the original datasets. Est_Species = Catch data derived from official reports or alternative sources; catch by species re-estimated using alternative information. Est_Total = Catch data neither reported officially or available from alternative sources; total catch and species and gear breakdown estimated. *Note: Surface fisheries include all industrial tuna purse seine fleets, and fleets using driftnets. Longline fisheries include all deep-freezing, fresh tuna, and swordfish longline fleets. Coastal fisheries include all baitboat, hook-and-line (other than longline), coastal gill and seine nets, and other gears operated in coastal waters (e.g. lift nets, Danish seines, beach seines, traps, etc.).*

Estimates of catches by fishing area: The IOTC Secretariat estimates catches by species, time-period, and fishing area using the following information: (i) estimates of total catch by species, type of fishery, and year (previous

section); (ii) time-area catches available from reports of catch-and-effort data, or from alternative sources. As indicated above, the minimum standards that apply to the reporting of catch-and-effort data are different for coastal (representative areas), longline (5 degrees square areas), and surface (1 degree square areas) fleets.

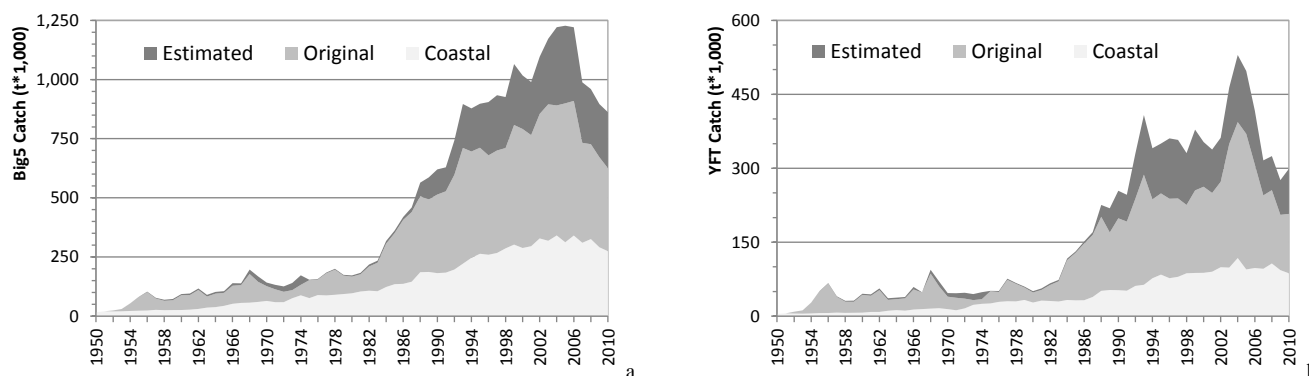
As was the case with total annual catch data, catch-and-effort data are not available from all fleets and where available, various levels of coverage and data quality apply, depending on the fleet and time period concerned. If a decision was made to estimate catches within and outside the EEZs of countries in the IOTC Area, in general it could be assumed that all coastal fisheries operate within the EEZs of their respective flag countries all year round, while most surface and longline fisheries operate both inside countries EEZs, their own or other, and on the high seas. Figures 4a–f shows the levels of coverage of time-area catches for the main market species, as per the IOTC standards, for all longline and surface fleets combined, and individually as derived from the catch-and-effort data available in the IOTC database. The following issues can be highlighted:

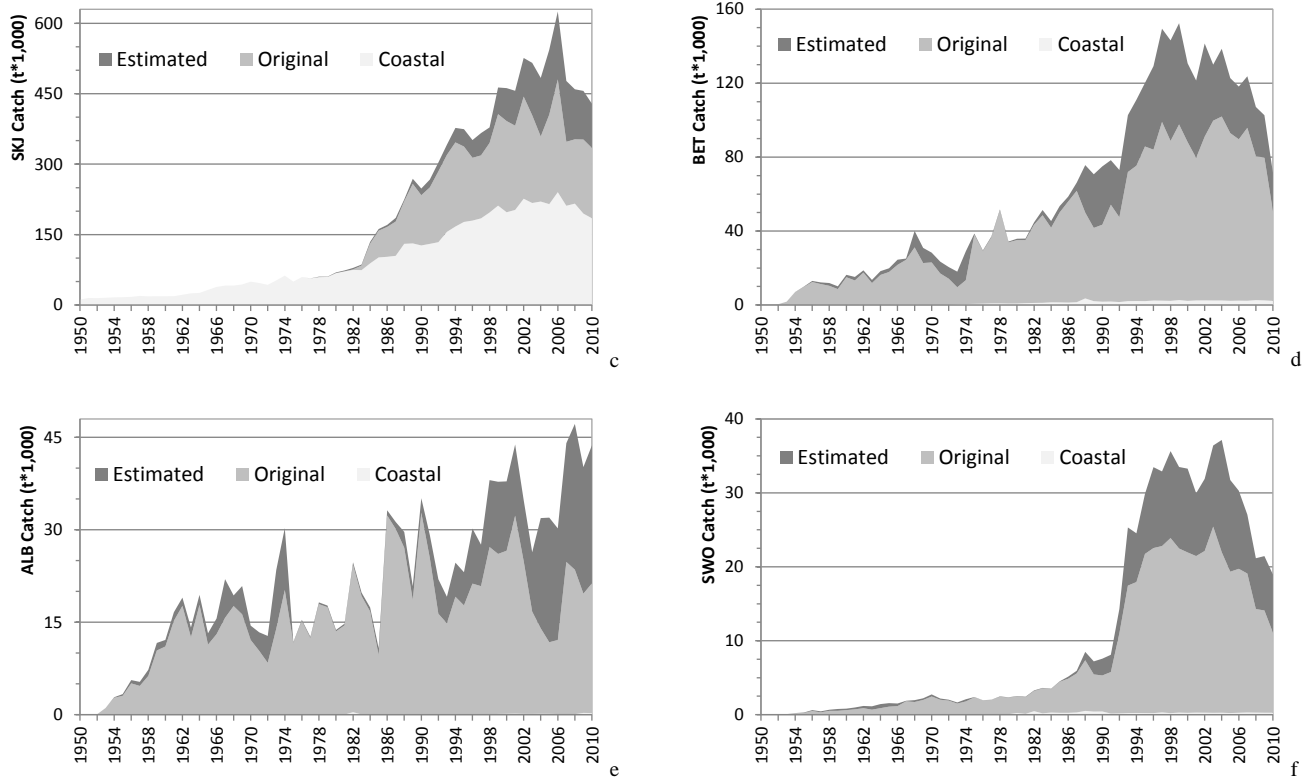
- Since the early 1990's, about 25% of the catches needed to be assigned by area using information from alternative sources, as they are not reported by the flag countries (Figure 4a). Catches by area, on the contrary, are available for most fleets before the mid-1980's. The main reason for the deterioration of data quality since the mid-1980's is the increase in the amount of fleets using purse seines, longlines, and driftnets operating in the IOTC area, for which the flag countries have consistently failed to provide, or have provided poor quality, time-area catch data series, including: (i) an increase in the activities of longline and purse seine vessels using flags of convenience; (ii) the arrival of fleets of fresh-tuna longliners from the Pacific; (iii) the construction or reflagging of longline and driftnet vessels in several coastal countries;
- As regards to time-area catches by species: (i) the catches of skipjack tuna (Figure 4c) have to be assigned by area for all fleets of driftnets; (ii) the time-area catches of yellowfin tuna (Figure 4b), and swordfish (Figure 4f) are affected by the lack of catches by area from fleets using driftnets and fleets of longliners; (iii) the catches of bigeye tuna (Figure 4d) have to be assigned by area for the same longline fleets indicated for the yellowfin tuna; (iv) time-area catches for albacore (Figure 4e) have to be estimated for Indonesian fresh-tuna longliners.

Once the available time-area catches have been raised to represent total catch, catches by EEZ and on the high seas for each fleet can be estimated using the resulting catches by year, species, and grid (1 degree or 5 degrees square). However, the catches estimated are not precise as they are derived from large areas which may overlap two or more EEZs, or EEZs and the high seas, and therefore need to be assigned to an area. In this regard, the estimates are more precise for surface than longline fleets, as the former report time-area catches by 1 degree square area. This is represented in figures 5a–b, which show the amount of catches recorded in one/five degree(s) square grids that fall entirely within the EEZ of countries versus those recorded in one/five degree square(s) grids that overlap an EEZ and the high seas.

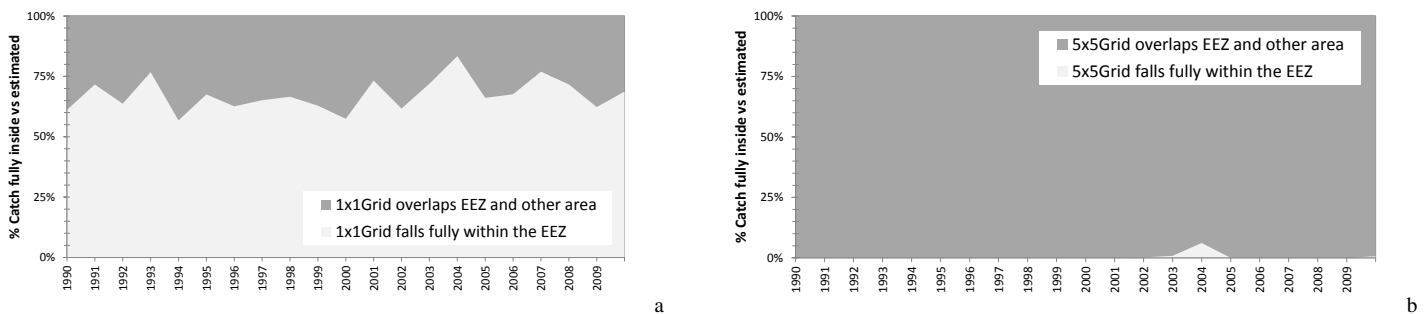
An additional problem is that, at present, the process of assigning catches ignores the licensing history of the fleets concerned and may involve the allocation of catches to EEZ areas where the fleet has never operated. This problem could be overcome if the provisions of IOTC Resolutions 10/03, 08/04 and Recommendation 11/06 are implemented as they call for IOTC CPC's to collect and report operational catch and effort data on foreign fleets operating in their EEZs and report this information to the IOTC Secretariat annually.

Estimates of catches by month in close-to-real time: The ability of coastal countries and distant-water fishing nations in the IOTC area to estimate catches of tunas by month in close-to-real time is discussed in document IOTC–2011–SC14–38, which was presented to the IOTC Scientific Committee in 2011 and is summarized in paper IOTC–2012–TCAC02–04.





Figures 4a–f. Amount of catch for surface and longline fleets for which time-area catches had to be estimated (Estimated), versus catch for which time-area catches were available (Original), as per the IOTC standards; and the amount of catches recorded for a) coastal fleets for all species combined; and by species, b) yellowfin tuna; c) skipjack tuna; d) bigeye tuna; e) albacore; and f) swordfish. *Note: Surface fisheries include all industrial tuna purse seine fleets, and fleets using driftnets (Iran, Pakistan, Sri Lanka). Longline fisheries include all deep-freezing, fresh tuna, and swordfish longline fleets. Coastal fisheries include all baitboat, hook-and-line (other than longline), coastal gill and seine nets, and other gears operated in coastal waters (e.g. lift nets, Danish seines, beach seines, traps, etc.).*



Figures 5a–b. Amount of catch recorded in grid areas which fall fully within countries EEZs or on the high seas versus catches recorded in grid areas that overlap EEZs and the high seas, when a) one degree or b) five degrees square grids are used. The time-area catches available for purse seiners under flags of EU countries was used for the comparison, for the period 1990–2009.

Conclusion

In general, all types of fishery catch statistics are obtained through sampling schemes and are therefore by definition ‘estimates’. Such catch estimates will always have some level of uncertainty associated with them however, the uncertainty is dependent on the sampling design, the type of fishery and the amount of catch and effort that are sampled by the CPC. The same applies to the catches that the IOTC Scientific Committee adopts each year as the best estimates, as they are the product of data reviews and further estimation by the IOTC Secretariat, including estimation of catches when they are not reported by the flag countries concerned.

The time-series of catches presented in this document cover all known fishing activities in the Indian Ocean and for this reason, represent the best estimates of catches for the species under consideration. Although some of the issues identified are likely to compromise the quality of the estimates to some degree, the final estimates of catch are not thought to be substantially affected by these issues.

It should be noted, however, that the accuracy of future estimates of catch can and should be improved, if CPCs address the issues identified in [Appendix A](#) as a matter of priority.

RECOMMENDATION/S

That the Technical Committee on Allocation Criteria (TCAC) **NOTE** the report by the IOTC Secretariat on the availability, completeness and quality of data for all fleets in IOTC database.

APPENDICES

Appendix A: Evaluation of the quality of the best estimates of total catch for major market species in the IOTC area, by species, type of fishery and time period.

APPENDIX A

EVALUATION OF THE QUALITY OF THE BEST ESTIMATES OF TOTAL CATCH FOR MAJOR MARKET SPECIES IN THE IOTC AREA, BY SPECIES, TYPE OF FISHERY AND TIME PERIOD

Coastal fisheries								
Time period	Issue	Fleets concerned	Estim	YFT	BET	SKJ	ALB	SWO
1950–1979	Most countries did not have statistical systems in place; catch reports cannot be validated; catch from the FAO FishStat Database, not by gear; broken by gear by the IOTC Secretariat	Most fleets	Y	M	L	H	L	L
Whole	Insufficient data collection; lack of statistical systems or, where existing, catch of tunas not recorded or highly aggregated (e.g. all marine fish species combined), or catch estimates unreliable (e.g. insufficient sampling coverage or poor data management)	Many fleets	Y	M	L	H	L	L
Whole	Underreporting of catch of juvenile tuna, especially on fishing sets around anchored Fish Aggregating Devices (pole-and-line, liftnets, gillnets, seine nets)	Fleets catching juvenile tunas	N	H	H	M	L	L
Most	Data insufficient to raise estimates of catch; data not reported; alternative data not available		N	L	L	L	L	L
Longline fisheries								
2002–2010	Significant underreporting of catch; poor monitoring of commercial longline fishery; very low logbook returns; insufficient monitoring of vessel activities		Y	H	M	L	L	M
1985–2010	Catch not reported (NEI-deep freezing longline); fleets not monitored by the flag countries; number of vessels operated reported by third parties	Flags of Convenience (FoC)	Y	M	M	L	H	M
1973–2000	Catch not reported (NEI-fresh tuna); fleets not monitored by the flag countries; landing statistics collected from third parties		Y	H	H	L	M	M
2002–2010	Likely underreporting of catches of albacore and swordfish; poor sampling of frozen component of the catch; lack of logbook system (recently implemented)		Y	L	L	L	H	M
Whole	Discards not reported; discards not recorded in the logbooks; discard levels not monitored through observers; predation rates not estimated	All fleets	N	L	L	L	L	L
Whole	Underreporting of catches in weight; processed weights reported as live weights	Some fleets (unknown)	N	L	L	L	L	L
Surface fisheries								
1989–2010	Likely miss-identification of bigeye tuna and swordfish; bigeye tuna miss-recorded as yellowfin tuna and swordfish reported as Indo-Pacific sailfish		Y	L	M	L	L	H
1977–2010	Catch by species likely to be imprecise; catch by species as reported in logbooks; not corrected using samples		N	L	L	L	L	L
1996–2003	Catch not reported (NEI purse seine); catch not monitored by flag countries; catch and effort statistics collected by third parties	FoC and other	Y	L	L	L	L	L
1996–2006	Catch not reported (NEI purse seine); catch not monitored by flag countries; catch and effort statistics collected by third parties or estimated by the Secretariat	FoC	Y	M	M	M	L	L
1977–2002	Discards not reported; discards not recorded in the logbooks; discard levels not monitored through observers	All fleets	N	M	M	M	L	L

Albacore (ALB), bigeye tuna (BET), skipjack tuna (SKJ), yellowfin tuna (YFT) and swordfish (SWO). Details on whether it was possible to raise estimates of catch (Y), or not (N; catch remains unknown); and importance of the estimates as a potential source of uncertainty in the total catch estimates, by species, including low importance (L), medium importance (M), and high importance (H).