# OUTCOMES OF THE INFORMAL WORKSHOP ON CPUE STANDARDISATION

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## PURPOSE

To inform the Scientific Committee (SC) of the outcomes of a workshop on CPUE trends and techniques used by IOTC which was held in AZTI Tecnalia in San Sebastian (Spain), from 21 to 22 October 2013.

## BACKGROUND

The organization of this workshop was recommended by many WP reports since 2003, and was finally a key recommendation identified by the SC in 2012. It is the first workshop of this kind being held dealing only with CPUE issues in the Indian Ocean.

## DISCUSSION

A total of 24 people attended from 15 countries and 23 presentations were made at the workshop. The workshop covered a large amount of information on the current status of standardizations across the different species in the IOTC area of compliance. Issues relating to fishery improvements over time or spatial complexity of the fishery and stocks were discussed, as well as details of the appropriate statistical methods that should be applied in standardizations. Finally, comparisons with other tuna RFMO's were made, and it was agreed having some objective criteria for usage of a CPUE series in an assessment would be a useful endeavour by the IOTC. Based on discussions at the workshop, a set of recommendations were developed (Appendix I) for the consideration of the Scientific Committee. The complete report is provided for reference in paper IOTC–2013–SC16–INF03.

## RECOMMENDATION/S

That the Scientific Committee **NOTE** paper IOTC–2013–SC16–12 which outlined the main outcomes and recommendations from the informal workshop on CPUE standardisation

## APPENDICES

**Appendix I:** Executive Summary and recommendations from the Informal workshop on CPUE standardisation

# APPENDIX I

## EXECUTIVE SUMMARY AND RECOMMENDATIONS FROM THE INFORMAL WORKSHOP ON CPUE STANDARDISATION

A Workshop assessing CPUE trends and techniques used by IOTC RFMO was held in AZTI Tecnalia in San Sebastian (Spain), from 21 to 22 October 2013. The following were the key issues and recommendations identified at the meeting:

1. Use of newer standardization techniques (GLMM, GEOSTATISTICAL APPROACHES and CORE AREA APPROACHES) using operational data to assess divergence in CPUE's across fleets.

    1.1. While standard approaches worked well in most cases, the CPUE WG recommended that newer approaches should be tested. The results of the workshop conducted over the two day period, indicated that the GLMM models tend to capture the trends better. In addition incorporating more vessel specifics and using geostatistical techniques is another approach to pursue over time. Finally, the use of core-area approaches may be informative for by-catch species. Moreover, the majority feeling of the group was that during CPUE standardization the use of operational data when they are available is recommended as it will allow to capture the covariates that are important during the standardization process.

    ***1.2. The strongest recommendation that came out of the workshop was that in areas where CPUE's diverged the CPC's were encouraged to meet inter-sessionally to resolve the differences. In addition, the major CPC's were encouraged to develop a combined CPUE from multiple fleets so it may capture the true abundance better. Approaches to possibly pursue are the following: i) Assess filtering approaches on data and whether they have an effect, ii) examine spatial resolution on fleets operating and whether this is the primary reason for differences, and iii) examine fleet efficiencies by area, iv) use operational data for the standardization, and v) have a meeting amongst all operational level data across all fleets to assess an approach where we may look at catch rates across the broad areas.***

    1.3. Simulation studies could also be developed to assess which models work best (delta log-Normal, zero inflated versus standard GLM+constant, Tweedie).

    1.4. Operational level data is useful if we want to quantify fishing fleet efficiency using fleet dynamic covariates. More applications could be developed using the methods developed by Hoyle and Okamoto (2010), or Hoyle (2009), and preliminarily presented by Dr. Okamoto at the CPUE workshop.

    1.5. Assess how core area Standardization works along with out of core or boundary area effects.

    1.6. Environmental data would be useful to consider in relation to standardization approaches. However, the way it is usually performed in GLMs, where an environmental covariate is associated to each observation (in regular 1°, 5° or even 10° grids) , may not be the most pertinent as it does not allow to identify the ecological processes which may affect CPUE. Alternatively, GLMs could be performed in sub-areas where the variability pattern of the environmental signature is well identified (using spatial EOFs to delineate those sub-areas). In such sub-areas, GLMs could be designed with and without environmental covariates to understand the potential effect of the environment. Environmental covariates should be in limited numbers (the lesser the better) and selected in order to test hypothesis on the ecological processes at stake.

2. Develop robust CPUE series for other species and Working Parties.

    2.1. The Working Group recommended to also focus the efforts in other species such as Temperate Tuna. In addition the WG recommended, developing better CPUE data for Neritic Tuna, and also improving the data and standardization on marlins and sharks.

    2.2. Develop a reference manual for use in performing a CPUE standardization for any fleet in any working party (e.g. neritic tuna WP or temperate tuna WP). Criteria for inclusion of the data in a stock assessment should also be developed (possibly using ICCAT techniques as a baseline).

3. With regard to Purse Seine data the following were recommended:

    3.1. Approaches being pursued by EU scientist have some promise, and more work should be put in the development of an index of abundance for the PS fleet on Skipjack Tuna, Yellowfin Tuna and Bigeye Tuna.

3.2. The availability of Vessel Monitoring System (VMS) data is a major requirement for the purse seine fishing fleet as it enables to spatialize the nominal effort (i.e. fishing or searching time), which is key to appreciate the temporal changes in the spatial extent of the prospected areas. VMS data may also be used to analyze PS trajectories with the aim to discriminate sets on FADs equipped with buoys from free school sets, log sets and foreign FADs sets (see after)

3.3. Purse seiners currently fish during the same trip on a combination of free-swimming and drifting FAD-associated schools. In addition, fishing on FADs results from both the detection of vessel-owned FADs through GPS geolocation systems as well as from the finding of 'foreign' FADs through bird detection for instance. Future analyses should focus on the separation of fishing time between searching and running towards FADs. Classification methods based on indicators describing spatial behaviour of vessels could enable to define typical fishing strategies and categorize trip components into such categories.

3.4. Data available on FAD activities collection have improved recently. Future analyses should focus on the definition of a fishing effort for purse seiners using FADs by (i) looking at the influence of the number of FADs owned by a vessel on individual CPUEs, (ii) by investigating the CPUEs in areas characterized by strong contrasts in FAD density. The influence of supply vessels on catch rates (e.g. the number of sets per day) and on the overall fishing capacity of the PS fleet should also be investigated at the vessel level through the information available from supply logbooks.

3.5. Analyses of temporal changes in individual and overall fleet catchability from CPUEs should be conducted to estimate fishing power creep and investigate how such changes are related with some major technological changes known for the PS fleet (e.g. bird radar). Including vessel effects into GLMs can reveal useful insights on vessel efficiency for such analyses. Attention should be paid also for change over time of fishery indicators which are part of the CPUE (e.g., number of set by day, % of successful set, catch size of the set).

4. The CPUE Workshop participants recommended that a thorough analysis of the history of the fishery would be useful for references for each species. In addition, the Group agreed that a central body (the Secretariat) should undertake additional activities in key areas (Neritic tunas where they can develop/collate the existing data on catch and effort and analyse this for some key species (eg. longtail and kawakawa)).

5. The CPUE Standardization Working Group agreed that a reference document that IOTC could use in what criteria should be used in utilizing a dataset for CPUE Standardization for all WP. This document would incorporate the specifics of the temporal and spatial coverage of the data, and useful covariates that could quantify the fishing activity and the environment in which the fish lived.

**Recommendations:**

***Use of newer standardization techniques***

- Develop models that account for overdispersion/underdispersion
- Encourage using Regression Tree, Random forests for high-order and stratification purposes
- Encourage using Spatial GAMs, and GLMM based techniques
- Provide more detailed vessel specific covariates for model fitting.
- Examine alternative hypothesis of spatial and temporal variation by fleets (Campbell Fish. Res. Draft Paper)
- Major CPC's to meet inter-sessionally to resolve differences and possibly combine multiple sources of data in a grand CPUE standardization across fleets and areas. This could be coordinated by the IOTC if needed.
- Develop operational data models to assess fleet effects and catchability changes over time.
- Develop spatial GLM models on operational level data to assess accuracy of the current indices with and without spatial auto-correlation processes.
- Assess Environmental data along with area (lat-long 1 by 1 degree grid) analysis.
- Assess core area approaches along with boundary effects accounting for species densities.

***Develop a workplan for improving CPUE in IOTC area***

In order of priority the following should be conducted:

- Improving the Temperate Tuna CPUE process by doing the following:
    a) Spatial structure could be revised for analysis.
    b) Try and have a sensitivity analysis using core areas so as to avoid fluctuations in CPUE by encompassing broader areas.
    c) The CPUE Index should account for targeting issues over time.
    d) Incorporate finer scale data, operational data at 1*1 degree spatial grid. Identify areas with homogenous effort distribution.
    e) Incorporate analysis by sub-region as maybe different components of the population.
    f) Explicitly model the zero catches-delta lognormal or Tweedie approaches.
    g) Alternative fleets gave a different signal and it may be useful to combine fleets and look at a core area CPUE across JPN, TWN,CHN and KOR. Use of TWN,CHN is probably recommended given it has the largest catch on Temperate Tuna.
- If survey data exists to develop and assess the series for certain areas in the Arabian Sea, Bay of Bengal and Andaman Sea.
- Missions to Indonesia, Iran and India need to be undertaken to assist those CPCs in developing catch and effort series from their historical data' and where missing, determine if estimation procedures could be developed that would produce a reliable historical series for Neritic Tuna
- Develop indices for Marlins and Sharks with improved techniques and adding better covariates (if possible)
- Develop objective criteria for utilizing one CPUE if contradictory signal are derived from different fleets.
- Develop some indices for Skipjack using the PS Series.
- For Tropical Tuna
    a) Account for targeting effects for BET and YFT Tuna
    b) If auxiliary information exists (e.g. economic data), to use that data in the standardization process
    c) Account for divergence in the trends between TWN,CHN and Japan for both BET and YFT.
    d) For YFT use some spatially explicit GAMS to derive indices that maybe more robust
    e) Account for low effort in 2009, 2010 and 2011 in areas affected by piracy.

***Develop a reference document for CPUE standardization and inclusion of an index in an assessment***

- Fine tune ICCAT, WCPFC and IATTC protocols for using an index for IOTC.
- Develop objective criteria and a reference manual for use in IOTC.

***Develop a robust index of abundance for the Purse Seine fleets operating in the Indian Ocean***

- Develop an index of abundance for the PS fleet
- Account for fishery changes of the fleet in this index, and quantify vessel effects over time
- Account for FAD effects and hyper-stability of the FAD index and compare these with free school and LL fisheries in areas where all fleets operate.

***Develop Capacity in Developing Coastal CPC's to Collect Data on Catch and Effort.***

- CPC's to initiate capacity building, but with responsibilities and capacity development carried out at a decentralized level (from IOTC secretariat on data programs and analytical approaches to use)
- Focus capacity building initiatives for data collection programs for catch and effort data that may vary by time and space, especially for neritic tuna, sailfish and black marlin in the coastal CPCs.
- Develop Gillnet CPUE's over time and assess if these are useful for Neritic tuna, billfish and sharks
- Focus capacity building initiatives for data analyzing programs for catch and effort data that may vary by time and space, especially for neritic tuna, sailfish and black marlin in the coastal CPCs.