Review of the BET length data collection of Taiwanese large scale tuna longline fishery

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1. Executive summary

This report is to reply to the request made by SC16 concerning the lack of specimens of small size from the samples for Taiwanese longline fleet. Since this issue concerns the length sampling data of multi species, including bigeye tuna and albacore, this year we focused on reviewing the bigeye tuna length data collection as a starting point of this issue. Under the sampling protocol unchanged, the reduction of albacore targeting fishing fleet caused the length specimens to decrease sharply, and the increasing logbook recovery of bigeye tuna targeting fleet with more length measurements collected from this fleet caused the aggregated length measurements of bigeye tuna to skew toward large size on average.

We also used the length-weight relationship derived from observer data to convert the weight samplings collected from logbook to verify the length measurements of logbook data. There's no significant discrepancy between the length measurements and converted length estimated from weight measurement.

2. Introduction

It is noted that the size data for longline fisheries are dominated by samples collected by the Taiwanese fleet, and this data are used to make inference about the population dynamics of the tuna stocks in the Indian Ocean. In 2013, WPTT noted that, since the early 2000's, the number of small specimens in the samples of tropical tunas for longliners flagged in Taiwan has dropped markedly, across all areas and seasons, and agreed on the need for the IOTC Secretariat and scientists from Taiwan to explore further the issues identified in the document, IOTC–2013–WPTT15–41, in particular in-depth evaluation of data collection and processing procedures for each fleet and procedures implemented by the IOTC Secretariat to prepare datasets for the assessments that use length frequency data or estimates derived from them. The WPTT noted that in recent years fishers from the Taiwanese longline fleet have been collecting both length and weight measurements for the same specimens, and recommended that the measured lengths and lengths derived from weight measurements are compared in order to validate the reliability of this dataset. It also requested that the scientist from Taiwan explores the use of these data to validate the data collected by fishers.

To address this issue on the lack of specimens of small size from the samples for Taiwanese longline fleet, we reviewed the protocol of length sampling and conducted several data analyses in accordance with the recommendations made by WPTT. At this stage, the work has not been finished yet and we will continue our research of the length data issue.

3. Method

3.1 Protocol of length sampling

The source of size data is from the logbook records. Our fishermen are required to record the length and weight of the initial 30 fish in logbooks. Therefore, the sampled data is mainly composed of main target species (e.g. BET and ALB). The size samples of other by-catch species (e.g. marlins or sharks) would be rather less than those of main target species.

The measurement standard for tuna species and shark species is upper jaw fork length (UJFL), whereas the measurement standard for SWO is lower jaw fork length (LJFL).Before 1995, size data was recorded in a separate form out of logbook. Nevertheless, in the year 1995, size data record has been combined with logbook so that the size data can correspond with the catch and effort data. Fig.1 shows the interpretation on the length measurement of logbook, which is the same as that of previous version of logbook used before 2009. In 2009, FA of Taiwan had once again revised the logbook form, requiring fishermen to fill in both the length and weight data of the initial 30 fish, and the format of logbook section for length and weight measurement is shown in Fig.2.

There’s no change to the length sampling except for weight sampling included into the items recorded from 2009.

3.2 Shift of fishing pattern and regulations relating data collection

Taiwanese large scale tuna longline fleet operating in the Indian Ocean can be classified into conventional tuna longline fleet, targeting albacore, and super freezer tuna longline fleet, targeting tropical tuna. The albacore catch had reached the peak of its development during the 1970s, with catch accounting for 60-70% of the total production of distant water longline fishery. Since 1986 the catch of albacore has been on a declining trend, with notable decline in the Indian and Pacific Oceans. In the meantime, some operators began to build new vessels and switch to super freezer tuna longline fishing. As a consequence, proportion of albacore in the overall catch decreased, and was surpassed by the bigeye tuna and yellowfin tuna caught by super freezer tuna longline fishery. Fig. 3 shows the trends of catch of albacore, bigeye tuna

and oilfish (*Ruvettus pretiosus* and *Lepidocybium flavobrunneum*), which indicates that the albacore targeting large scale longline fishing vessels had started withdrawing from traditional fishing grounds under a strong competition from small scale longliners from 2002, with catch decreasing steadily to the lowest in 2007, and some albacore targeting fishing vessels started shifting their target to fishing oilfish in 2005. This fishing pattern shift has a major effect on length sampling of tuna species, especially for bigeye tuna as bycatch of this fishery. This effect of fishing pattern shift can be clearly observed from Fig.4. The sampling rate of bigeye tuna has dropped sharply since 2006.

For the tropical tuna targeting fleet, the catch of bigeye tuna had increased steadily with the increase in fishing vessels and reached the highest in 2003. Because of the long term economic recession in Japan, the shrink in sashimi demand caused the price of tuna to be stagnant which in turn affected the profitability of the industry. Furthermore, in response to the international trend on the management of fishing capacity on tuna longline fishery, and in order to solve the problem of incommensurability between fishing capacity and availability of fishing opportunity, in 2005, the Taiwanese government launched a mandatory vessel buyback program. With decrease in the number of tropical tuna targeting longline vessels, the catch of bigeye tuna decreased significantly after 2005. The government has implemented bigeye tuna statistical document scheme from 2002, and it also has a major effect on logbook recovery of tropical tuna targeting fleet. Although the number of this fleet has decreased, the logbook recovered and the number of bigeye length samples collected has increased significantly.

Taking into account the fishing pattern shift of albacore targeting fishing fleet and the effect of bigeye tuna statistical document scheme on raising logbook recovery of tropical tuna target fishing fleet, the portion of bigeye tuna length samples from albacore targeting fishing fleet became minor and minor in recent years (Fig.5).

3.3 Comparison of catch size by fishing fleet

Because the target species are different of these 2 fleets, albacore targeting and tropical tuna targeting, their fishing practices and gear configurations are quite different. The hooks deployed in albacore targeting fishing vessels are shallower and usually above thermocline, but most of hooks deployed in tropical tuna fishing vessels are much deeper and reach thermocline to harvest larger size tropical tuna. Fig.6 shows the BET length distributions of these 2 fishing fleet and it is noted that the size of BET catch of albacore targeting fleet is smaller than that of tropical tuna targeting fleet.

3.4 Length data verification

To comply with the recommendation made by WPTT on the length measurement verification in weight recorded coincided with length measurements, we conducted a research on the weight-length relationship with data derived from observer dara . The preliminary weight-length relationship of BET is shown in Fig.7, and we used this to convert weights (gilled & gutted weight) recorded in logbook from 2009 to 2013 to the lengths compared with the lengths sampled by fishermen. The comparison result is shown in Fig.8, it is noted that there's no significant discrepancy between the converted lengths and measured lengths.

4. Conclusions

According to the review of sampling protocol and the preliminary analysis on fishery data, the conclusions we have are as follows:

a. The length sampling protocol of Taiwanese large scale longline fishery is unchanged except for additional requirement on recording weight of individual catch sampled.

b. The preliminary result shows no significant discrepancy in the length frequency distribution between converted length and measured length, but the weight-length relationship of bigeye tuna is still uncertain and needs further research.

c. The fishing pattern shift of albacore fishing fleet has caused the sampling rate of bigeye to decrease sharply, and the implementation of bigeye tuna statistical document scheme in 2002 improved the logbook recovery of tropical tuna targeting fishing vessels with more bigeye tuna length data collected from this fleet. Both are the major reasons why the lack of specimens of small size from the samples for Taiwanese longline fleet in recent years.

填 表 說 明

一、本紀錄表專供三大洋除大西洋大目鮪組以外鮪釣漁船填寫，本表分為兩部份：第一部份為漁船基本資料，每航次填寫一張；第二部份為漁船活動資料，必須按日填寫，其中漁船位置應填報每日之下鉤經、緯度或未下鉤之正午經、緯度。若每日漁獲紀錄勾選卸魚或轉載，請填本表之轉載確認書。

二、本紀錄表之漁獲尾數與重量，請按實際捕獲及處理之情況填寫，需處理之魚種請填寫處理後重量（如大目鮪、黃鰭鮪及旗魚類等），不需處理之魚種請填寫全魚重（如長鰭鮪、小鮪等），重量以公斤（kg）為單位，體長測量（見下圖）以公分（cm）為單位，以每作業日最初捕獲之 30 尾為測量對象。（測量魚種以有魚種代號之鮪、旗、鰹魚、鯊魚類為主）

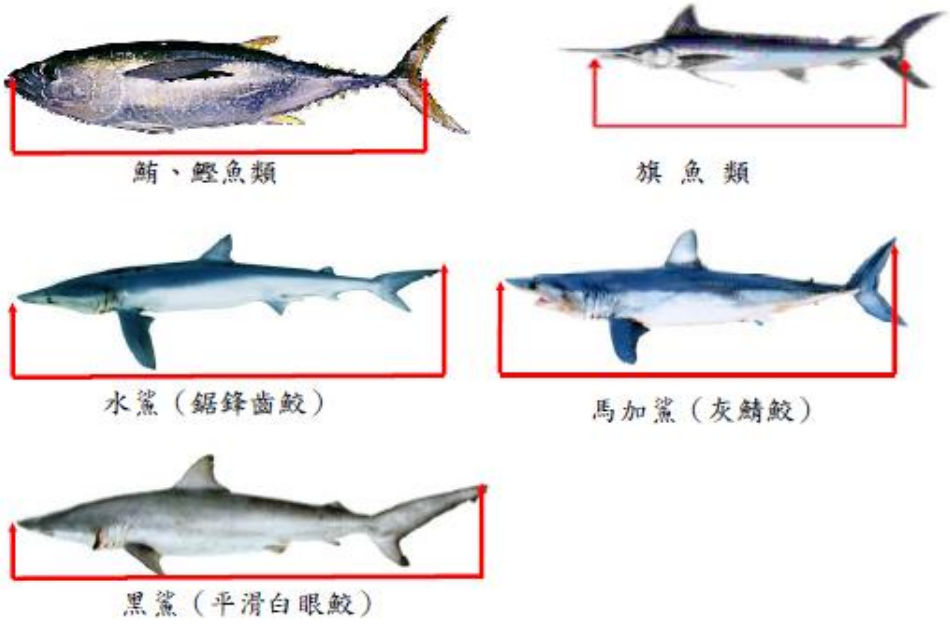

Fig. 1. The interpretation on length measurement of logbook applied to Taiwanese large scale tuna longline fishery

Record on length and weight (Unit: cm in length and kg in weight) Type of Weight Measurement: □ Estimating Onboard □Weighing Onboard □ Ocular Estimation

Species code	Length	Weight	Species code	Length	Weight	Species code	Length	Weight	Species code	Length	Weight	Species code	Length	Weight	Species code	Length	Weight

Captain signature：_____ Observer signature:_____

Species code (Species name)：

ALB. Albacore BET. Bigeye tuna YFT. Yellowfin tuna PBF. Bluefin tuna SKJ. Skipjack SWO. Swordfish MLS. Striped marlin BUM. Blue marlin BLM. Black marlin BIL. Other marlins SBT. Southern Bluefin tuna OTH. Other fish TUN. Other tuna SFA. Sailfish SSP. Shortbill spearfish SPF. Longbill spearfish WHM. White marlin OIL. Oil fish DOL. Mahi Mahi BSH. Blue shark FAL. Silky shark SMA. Shortfin mako shark SKX.Other shark LMA. Longfin mako shark OCS.Oceanic white tip shark BTH. Bigeye thresher shark PTH. Pelagic thresher shark ALV.Thresher shark RHN. Whale shark . WSHGreat white shark TIG.Tiger shark POR.Porbeagle shark PSK. Crocodile shark EUB.Winghead hammerhead shark SPL. Scalloped hammerhead shark SPK. Great hammerhead shark SPZ. Smooth hammerhead shark

Fig. 2. The format of logbook section for length and weight sampling record

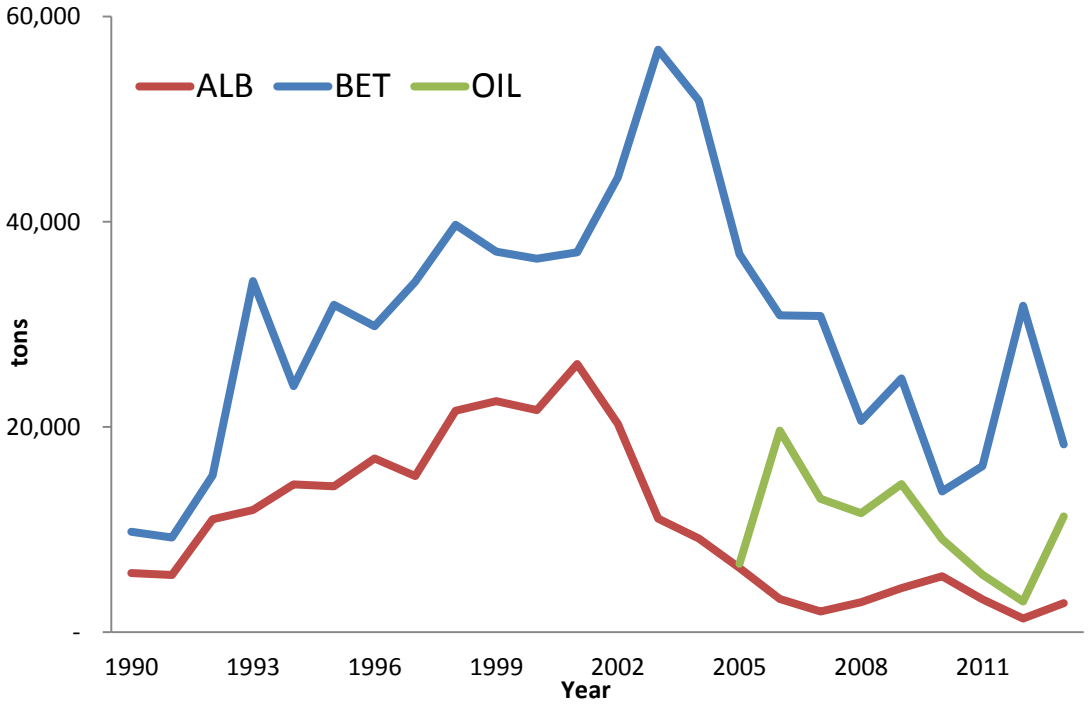

Fig. 3. The variations for BET, ALB and oil fish annual catch of Taiwanese large scale tuna longline fishery

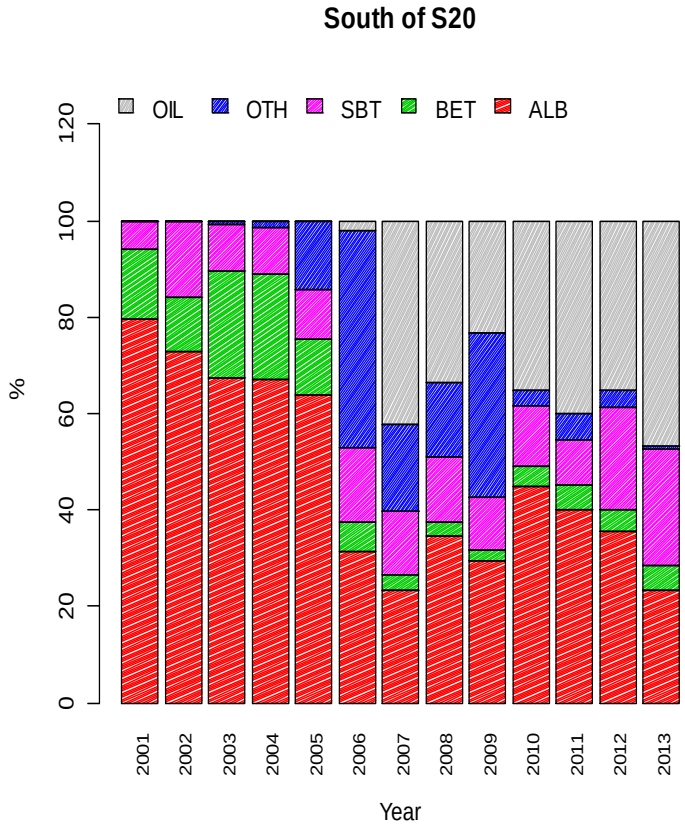

Fig. 4. The variations of bigeye tuna relative sampling rate in the areas south of 20˚S 2001-2013

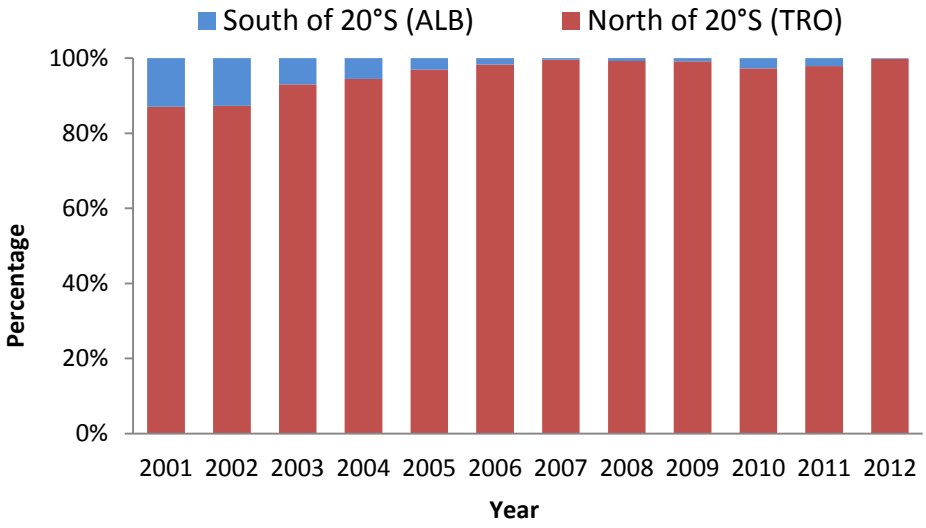

Fig. 5. The composition of bigeye tuna length samples by fishing fleet 2001-2012

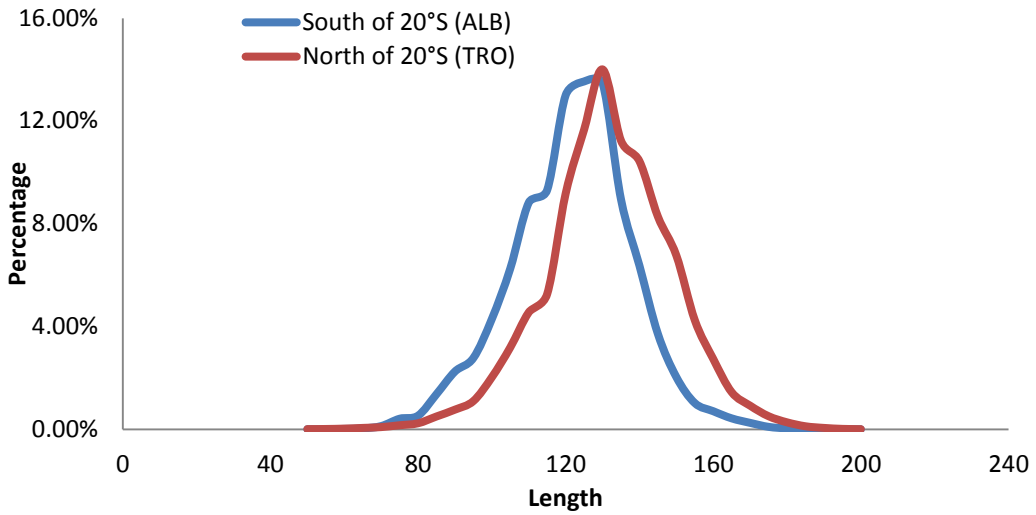

Fig. 6. The BET length frequency distribution by fishing fleet (data source: logbook length data)

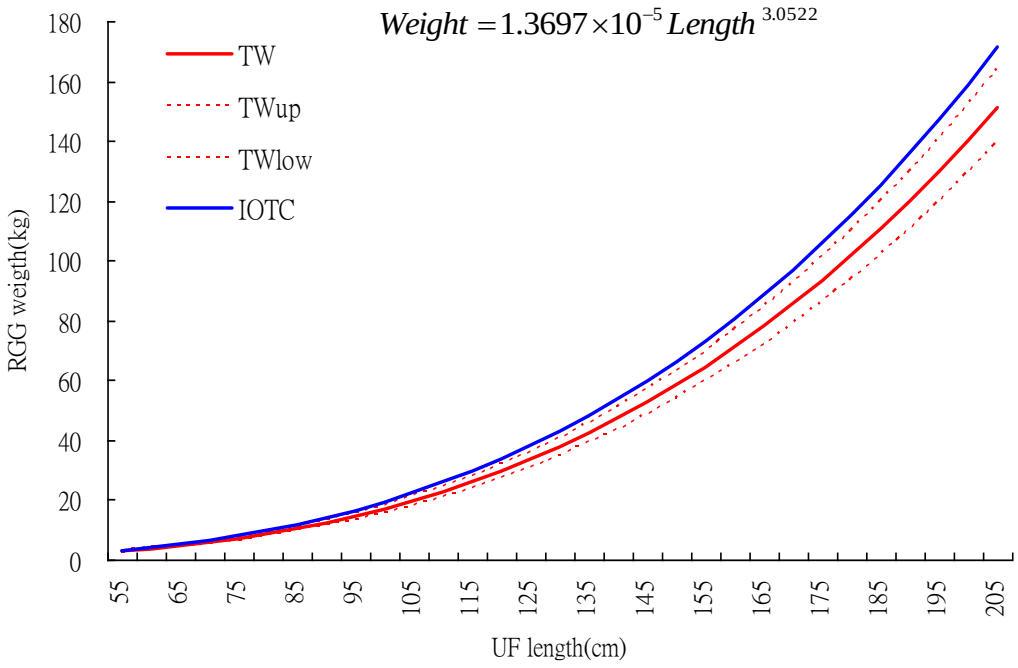

Fig. 7. The preliminary length-weight (GG) relationship of bigeye tuna derived from Taiwanese observer data 2002-2013

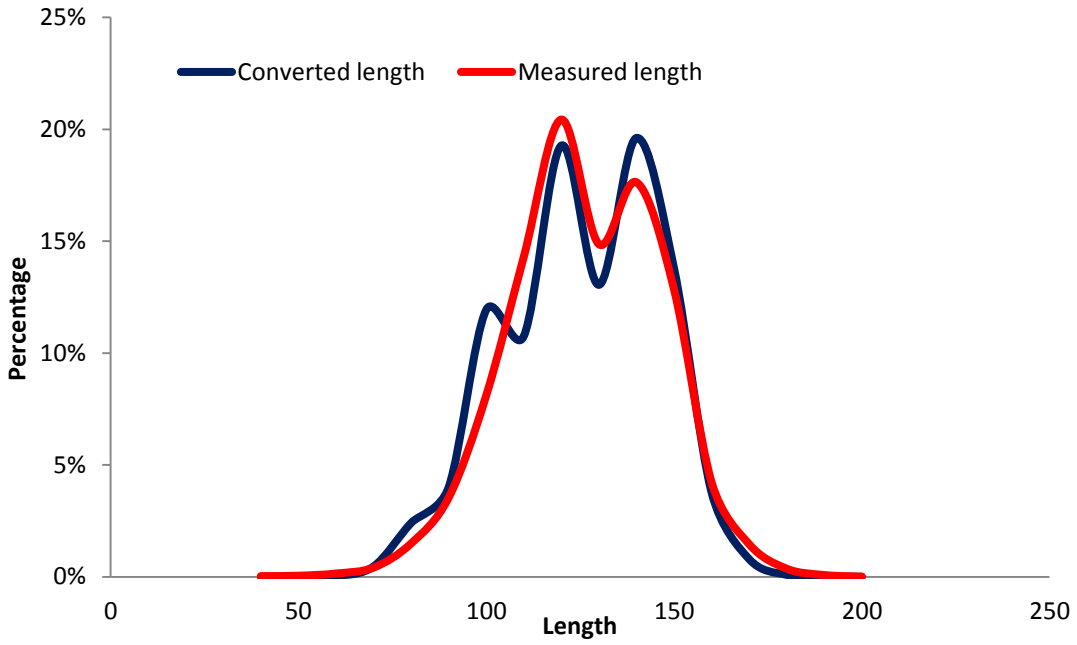

Fig. 8. The comparison of BET length frequency distributions between converted length and measured length compiled from logbook data 2009-2013

References:

Overseas Fisheries Development Council, 2013, *Data Collection and Processing System of Statistics for the Taiwanese Deep-Sea Longline Fishery,* IOTC–2013–WPTT15–40 Rev_1

Geehan, J. & Hoyle, S., 2013, *Review of the length frequency data of the Taiwanese distant water longline fleet,* IOTC IOTC-2013-WPTT15-41_Rev1