Cross-verification of Japanese data-sets for the Southern Bluefin Tuna: 2012 fishing season

日本が収集しているミナミマグロのデータセットでの相互検証：2012 年

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Summary

This report describes the cross-verification of the scientific data-sets from Japanese longline fishery for Southern bluefin tuna (SBT) in 2012 fishing season. Total annual catch by Japanese vessels was recorded in the catch documentation scheme (CDS) which were based on the real time monitoring program (RTMP) data, and its landing weight were verified using the landing inspection. The data source of Japanese longline catch, effort, and size data were based on the Logbook data and RTMP data, and these data-set were verified using the scientific observer data. No substantial discrepancies and inconsistencies were found among these data-sets.

要約

本文書では、2012 年の日本のデータセットについて相互検証を行った結果を示す。日本の年間漁獲量は CDS に記録される。このデータは RTMP に基づく。CDS に記録された陸揚げ重量は、水揚げ検査結果により検証した。日本の漁獲量、努力量、および漁獲個体のサイズは、漁獲成績報告書と RTMP に基づく。これらのデータは科学オブザーバのデータにより検証した。各々のデータセットの間に、明瞭な相違はみつからなかった。

Introduction

Members and Cooperating Non-Members (CNMs) are encouraged to report the data verification conducted in accordance with the "High-level Code of practice for Scientific Data Verification" annually to the Extended Scientific Committee (ESC). Its purpose is to provide greatest understanding of the data, together with transparency and confidence in the data (CCSBT 2012). This paper provides the results of cross-verification according this code of practice for the Japanese data-sets in 2012.

Japanese data-sets

In this section, we listed and summarized the details of the data source of Japanese longline catch, effort, and size data for Southern Bluefin Tuna (SBT).

1) Logbook

In the logbook, shot by shot data is recorded. All Japanese tuna longline fishermen, including those who target SBT, have to report daily position, total number of fish caught and total number of hooks used in each shot by the logbook. Every longline vessel has to submit the logbook every 10 days to the Ministry of Agriculture, Forestry and Fisheries (MAFF), Japan by FAX or Email. The validity and plausibility of this data are checked and verified in the process of analyzing it. Logbook data is the main data-source of the official information of Japanese "catch and effort data" which is submitted to CCSBT secretariat during the data exchange. However, the logbook data for the most recent year was usually incomplete at the time of the data exchange, thus Real Time Monitoring Program (RTMP) data has been used as the data source of the most recent catch and effort data provisionally. When the most recent logbook data become available, the data from RTMP was replaced with the logbook data.

2) Real time monitoring program (RTMP)

In addition to the logbook, reporting by RTMP is required for Japanese longline vessels when they catch SBT. In RTMP, shot by shot data is recorded as same as logbook data. Fisherman has to report the vessel position, time of set and haul, number of hooks set, individual measurements of SBT (catch tagging information, fork length, product weight and sex), number of SBT caught, and released/discarded by the RTMP report. In some cases, zero-catch data for SBT is not reported in RTMP. Every authorized SBT longline vessel has to report the RTMP to the Fisheries Agency Japan (FAJ) by FAX on a daily basis when SBT is caught. Anomalous data are detected automatically at the time of input and corrected. RTMP data is an important data-source of the Japanese "catch and effort data", and the main data-source of the "catch at size data". Documents for the Catch Documentation Scheme (CDS) are prepared by the RTMP data.

3) Scientific Observer Program

Scientific observers can independently collect the information of fishing operation. Therefore, scientific observer data is useful to verify the fishing information reported by the logbook and/or RTMP. Japan observer program (JOP) for the SBT longline fishery complies with the CCSBT scientific observer program standards. The candidates of observers are trained in NRIFSF before the deployment to the longline vessels.

The scientific observers have to collect and report the vessel position, time of set and haul, weather condition, number of hooks set, observed number of SBT and the other species including sharks, sea turtles, and sea birds, and individual measurements of them (fork length, product weight, status, retaining and sex). All observers have to submit their observation data to FAJ and NRIFSF within one week after their trip. Anomalous data are detected automatically at the time of input and corrected.

4) Catch Documentation Scheme (CDS)

Fishermen have to prepare the Catch Documentation Scheme (CDS) documents (Catch Monitoring Form and Catch Tagging Form) when SBT is transshipped or landed. In the CDS documents, total number, total weight (processed weight), and individual weights are reported, and these information are based on the RTMP data. Anomalous data are detected automatically at the time of input and corrected. The validity and plausibility of this data are ensured by physical inspection of the SBT landing. The "Total Catch by Fleet" which Japan reported to the CCSBT is based on the Catch Monitoring Form of CDS, thus the origin of this information is RTMP. In the Catch Tagging Form of CDS, individual length and weight data are recorded with the serial number of tags. The individual information is also based on the RTMP data.

5) Landing inspection

All the Japanese domestic SBT products are inspected for validation by officials of the government of Japan when those are landed. Fishermen are required to submit the copies of CDS documents to FAJ before landing. Total landing weight which is measured during landing inspection is recorded on the Catch Monitoring Form. The landing weight is used for quota monitoring for each Japanese vessel.

Cross-verification of data-sets

1) Total annual SBT catches

Total catch weight by Japanese longline vessels in 2012 fishing season was 2,464 t (2,528 t in calendar year). Fishing trip of Japanese longline vessels usually extends for a long period of time (about 1-2 years), thus some SBT caught in 2012 have not been landed yet. This caused the difference of the total SBT weight between "Total catch by fleet" and "CDS documents" (Table 1). There is no difference between total reported catch weight and total landed weight.

Table 1. Cross verification of total annual SBT catch

Data set	"Total catch by fleet"	"CDS documents" (As of 1, July, 2013)	
Year type	Weight of Total Catch	Reported catch weight	Landed weight
2012 (Quota year)	2,464 t	2,451 t	2,417 t
Data-source	RTMP	RTMP (Some vessels have not landed their SBT yet.)	Landing inspection (Some vessels have not landed their SBT yet.)

2) Commercial catch and effort data

Logbook vs RTMP

Commercial catch and effort data is based on the logbook and RTMP data. The logbook for 2012 fishing season was incomplete at this point, thus we extracted the data for the same shot which were recorded in both data sets as the first step. In area 4-9, catch and effort data for 3043 operations from the logbook were extracted to be cross-checked against the RTMP data for the same shots (Table 2). These comparable data covered a large part of the whole data since it included 94% of SBT catch recorded in the RTMP. Total number of SBT caught in area 4-9 was 47,686 and 47,608 which were recorded in the comparable data from logbook and RTMP, respectively. The discrepancy between both data-sets was 0.16%. Total number of hooks used in area 4-9 was 9,568,184 and 9,564,069 which were recorded in the comparable data from logbook and RTMP, respectively. The discrepancy between both data-sets was 0.04%. These discrepancies were quite small and no substantial difference was observed.

Table 2. Cross verification of catch and effort between the comparable data from logbook and RTMP

Area	Logbook		RTMP		Difference		Number of operations
	Number of SBT caught …[A]	Number of hooks used …[B]	Number of SBT caught …[C]	Number of hooks used …[D]	Number of SBT ([A]-[C])/[A]	Number of hooks ([B]-[D])/[B]	
4	1321	659766	1321	658716	0.00%	0.16%	195
5	11	29720	11	29820	0.00%	-0.34%	11
7	14763	2342233	14761	2341523	0.01%	0.03%	696
8	4789	1622793	4789	1622142	0.00%	0.04%	509
9	26802	4913672	26726	4911868	0.28%	0.04%	1632
Total	47686	9568184	47608	9564069	0.16%	0.04%	3043

Scientific observer data vs RTMP

Commercial catch and effort data for observed trips can be cross-checked against the observer data for the same shots of the same trips. There were 310 operations which were comparable between the scientific observer data and the RTMP data in area 4-9. Average number of hooks used in these operations was summarized in table 3. The number of hooks reported by scientific observers was based on the hearing from the fishermen during the on-board observation, which was not actual number of hooks observed. There were small difference between the RTMP and scientific observer data.; The RTMP reports and the scientific observer data disagreed about the number of SBT caught/observed in some shots (Table 4). Since scientific observers did not observe whole of the hauling operation because of rest for meal, rough weather condition and the other reasons, the direct comparisons for the number of SBT caught /observed make little

sense. Therefore, in this document, we compared the catch per unit efforts (CPUE) between both data-sets in order to cross-check the catch and effort between both data-sets. The CPUE from the scientific observer data was based on the number of SBT and hooks which were actually observed by observers. The nominal CPUE from both data-sets for each observed trip are showed in Fig. 1.

Table 3 Cross verification of effort (number of hooks used per shot) between the comparable data from RTMP and scientific observer data.

The number of hooks reported by scientific observers was based on the hearing from the fishermen.

Trip	RTMP		Scientific observer data		Number of operations
	Average	S.D.	Average	S.D.	
Trip 1	3435.9	226.8	3438.3	227.6	29
Trip 2	3006.7	308.3	3003.6	315.7	33
Trip 3	2920.9	544.7	2920.9	544.7	15
Trip 4	2869.3	363.2	2869.3	363.2	54
Trip 5	3411.1	296.8	3435.0	296.9	18
Trip 6	3195.7	212.1	3194.7	213.8	35
Trip 7	2980.7	147.4	2952.1	121.8	7
Trip 8	2879.9	269.0	2881.1	271.0	46
Trip 9	3082.5	538.5	3195.0	189.1	8
Trip 10	3228.3	151.7	3307.9	181.5	65

Table 4 Cross verification of catch (number of SBT caught/observed per shot) between the comparable data from RTMP and scientific observer data.

The number of SBT reported by scientific observers was based on the actually observed number.

Trip	RTMP		Scientific observer data		Number of operations
	Average	S.D.	Average	S.D.	
Trip 1	18.9	22.6	11.1	6.6	29
Trip 2	19.5	18.8	18.9	17.9	33
Trip 3	9.7	5.7	9.9	5.8	15
Trip 4	12.0	6.4	12.2	6.3	54
Trip 5	25.6	34.4	23.1	23.8	18
Trip 6	18.3	11.1	15.3	8.7	35
Trip 7	2.3	1.5	1.3	1.8	7
Trip 8	12.4	9.6	9.4	6.9	46
Trip 9	27.3	30.3	13.5	16.9	8
Trip 10	10.0	6.3	6.8	4.7	65

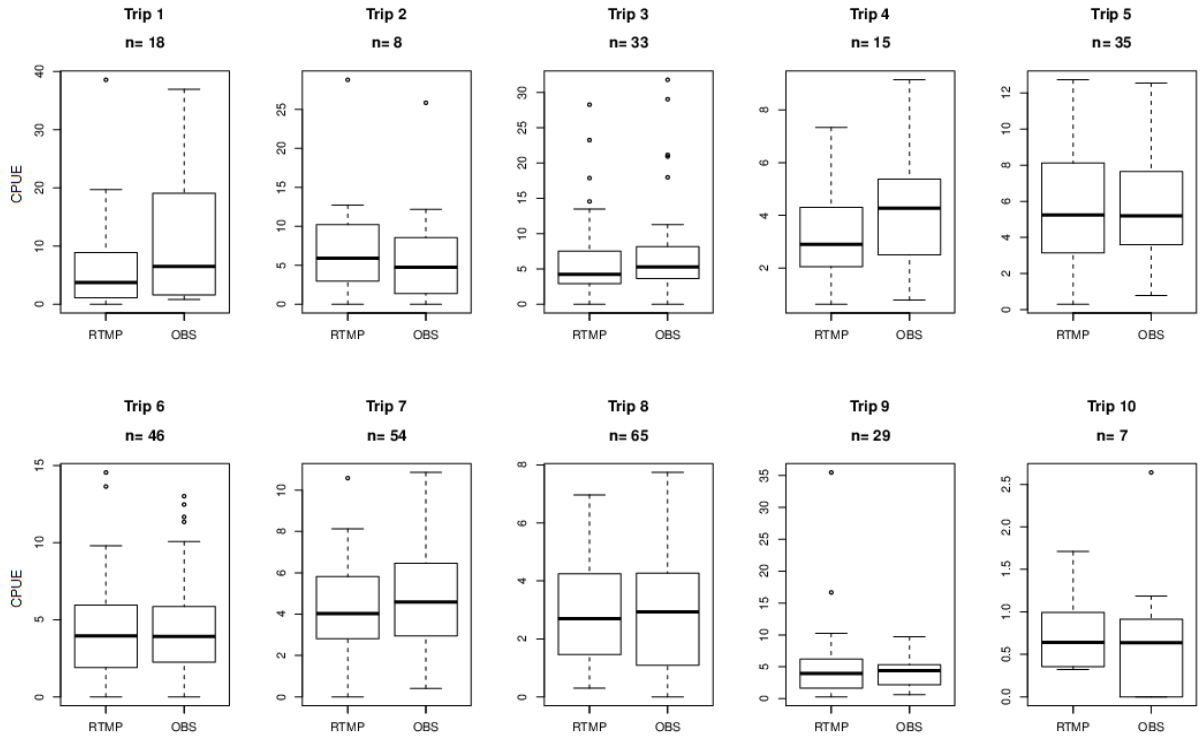

Fig. 1 CPUE comparison between RTMP data and scientific observer data for each observed trip.

In 2012, there were 10 trips observed by scientific observers.

To estimate the effect of the difference of both data-sets on CPUE, we use a generalized linear mixed model (GLMM) with log normal error structure. The model can be expressed as:

Log(CPUE + const) = Intercept + Area + Month + DataType + [r(Trip-ID) + r(Shot-ID) + Error]

where, "CPUE" is catch in number of SBT per 1000 hooks, and "const" is 10% of overall mean of CPUE. As the fixed effects, "Area", "Month", and "DataType (i.e. RTMP data or observer data)" were included into the model. "Trip-ID" and "Shot-ID" were included as the random effects. The results of the analysis of variance (ANOVA) of GLMM are shown in Table 5. This result did not support the hypothesis that there is a difference in the CPUE between the RTMP and scientific observer data.

Table 5 Result of ANOVA for the GLMM which was used for the CPUE comparison between the RTMP and scientific observer data.

Analysis of Deviance Table (Type III Wald chi-square tests)			
	Chi-square	DF	P-value
Area	53.5724	3	<0.0001
Month	85.4726	7	<0.0001
Data type	2.3614	1	0.1244

Observed shots vs Non-observed shots (by RTMP)

Commercial catch and effort data for non-observed shots by scientific observers were compared with data for observed shots. In this comparison, we cross-checked the RTMP data which have the data observed by scientific observers in same 5x5 degree and month cell. There were 2249 comparable operations; 310 of them were observed shots, and 1939 of them were non-observed shots. Average numbers of hooks used and SBT caught in these operations were summarized in table 6 and 7. There were little discrepancies in these average values between the observed shots and non-observed shots, though slight difference of the number of SBT caught was found in area 4. There is the fishing ground of Bigeye tuna and Yellowfin tuna besides SBT in area 4, thus the causes of this difference would be the each vessels fishing strategy: targeting SBT or not. The nominal CPUE from both data-sets are showed in Fig. 2.

Table 6 Cross verification of effort (number of hooks used per shot) between the observed shots and non-observed shots for the RTMP data.

Area	With observer			Without observer		
	Average	S.D.	Number of operations	Average	S.D.	Number of operations
4	3415.3	321.6	15	3397.7	393.2	130
7	3431.6	219.6	32	3357.6	261.8	596
8	3204.2	167.4	72	3212.1	181.3	492
9	2968.4	354.5	191	2964.5	338.2	721

Table 7 Cross verification of catch (number of SBT caught/observed per shot) between the observed shots and non-observed shots for the RTMP data.

Area	With observer			Without observer		
	Average	S.D.	Number of operations	Average	S.D.	Number of operations
4	3.9	2.9	15	9.0	15.2	130
7	29.7	30.1	32	21.7	17.2	596
8	9.3	6.4	72	9.8	5.5	492
9	15.0	13.0	191	16.2	11.8	721

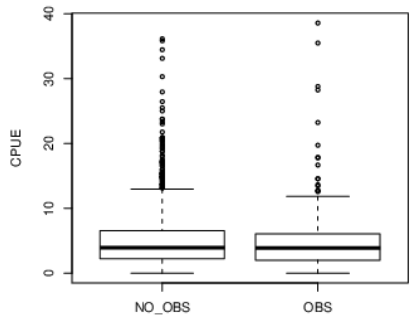

Fig. 2 CPUE comparison between observed shots and non-observed shots for the RTMP data.

To estimate the effect of the difference of both data-sets on CPUE, we use a GLMM with log normal error structure. The model can be expressed as:

Log(CPUE + const) = Intercept + Area + Month + Observation + [r(Vessel-ID) + Error]

where, "CPUE" is catch in number of SBT per 1000 hooks, and "const" is 10% of overall mean of CPUE. As the fixed effects, "Area", "Month", and "Observation (i.e. observed or non-observed)" were included into the model. "Vessel-ID" was also included as the random effects. The results of GLMM are shown in Table 8. This result did not support the hypothesis that there is a difference in CPUE between the observed shots and non-observed shots.

All the analyses in this section were conducted through "lme4" package of R (version 3.0.1).

Table 8 Result of ANOVA for the GLMM which was used for the CPUE comparison between the RTMP and scientific observer data.

Analysis of Deviance Table (Type III Wald chi-square tests)			
	Chi-square	DF	P-value
Area	355.5983	3	<0.0001
Month	213.971	7	<0.0001
Observation	0.1031	1	0.7481

3) Catch and Size data

Japanese catch and size data which are provided to the CCSBT Secretariat annually as the part of the Scientific Data Exchange are based on the RTMP data. This data-set can be cross-checked against the scientific observer data for the same area and same months: The time periods and area for the comparison correspond to the periods and area observed by scientific observers (March-May in area 7, June-October in area 8, and March-July in area 9). The length frequency distributions of the scientific observer data and

RTMP data were mostly similar to each other (Fig. 3). Seeing in detail, there was a discrepancy around 110-120 cm FL in area 8, and the cause of this difference would be the release activities for small SBT by observed/non-observed vessels (CCSBT-ESC/1309/22).

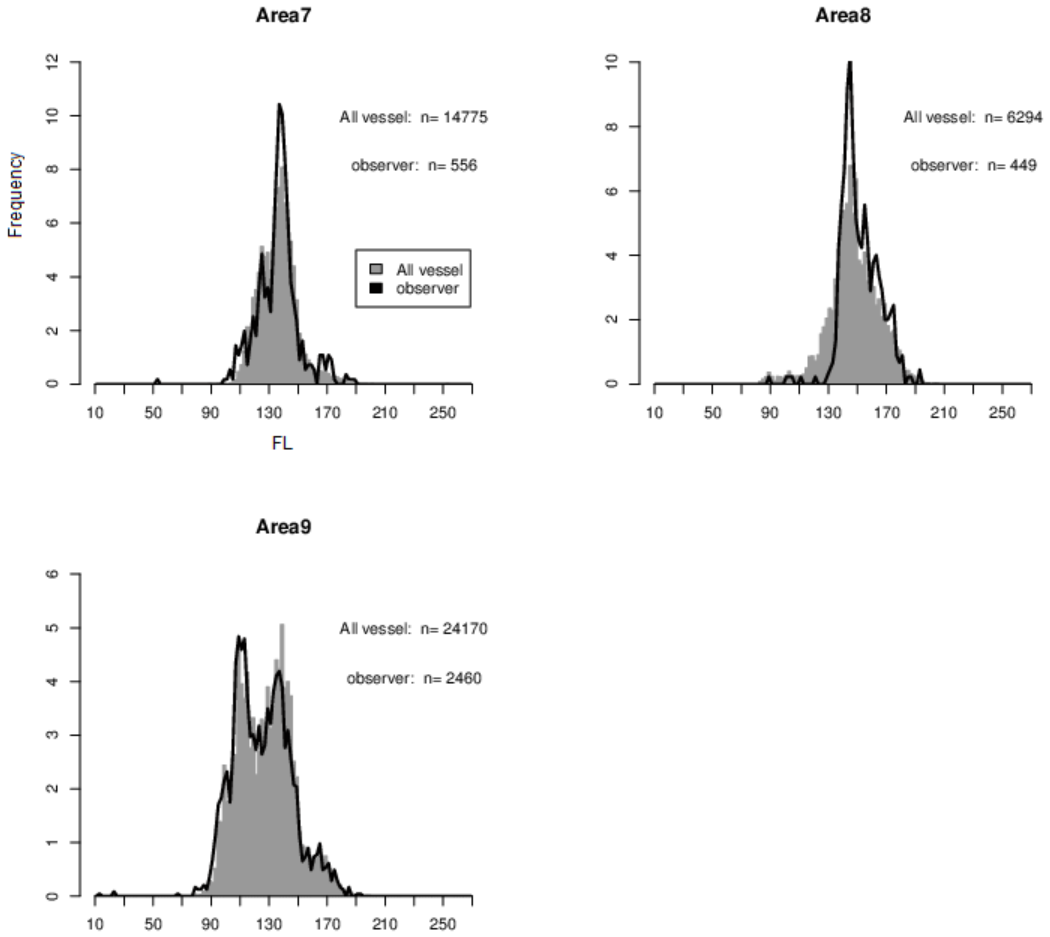

Fig. 3 Length frequency distribution of SBT by area in the 2012

Lines are from scientific observer data. Bars are from RTMP data in all vessels. Data were between March and May for area 7 (a), between June and October for area 8 (b), between March and July for area 9 (c). See CCSBT-ESC/1309/22 for more information.

References

Sakai, O., D. Tokuda, T. Itoh, H. Minami and O. Abe 2013. Report of Japanese scientific observer activities for southern bluefin tuna fishery in 2011 and 2012 CCSBT-ESC/1309/22