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Updated Trial analysis for verification of reported catch by Members with CDS data and CDS tag survey data obtained from Japanese market

(CC agenda item 8.2.2)

1. Purpose of this document

In accordance with the Compliance Committee (CC) workplan, this paper presents the outcome from the trial analysis for verification of reported catch by Members with Catch Documentation Scheme (CDS) data and CDS tag survey data obtained from Japanese market.

2. Background

At CC 16 meeting in 2021, the Secretariat provided the paper "Trial analysis for verification of reported catch by Members with CDS data and CDS tag survey data obtained from Japanese market" (CCSBT-CC/2110/16), in accordance with Japan's proposal on monitoring of SBT distributions in Japan to verify catch of all Members[1,2] and following directions by the CC and the Extended Commission (EC).

CC 16 reviewed this document and agreed that the Secretariat should repeat its analysis in 2022, noting:

1) That the sample size should be increased to increase the number of matches between the market survey data and the CDS tag data.
2) Tag placement should be improved to increase the readability of tags, which would improve the coverage.
3) The formatting of some tag numbers in the market survey data sent to the Secretariat was different from the format of the CDS data held by the Secretariat and has resulted in these tags as being deemed as unreadable in the Secretariat's analysis. Resubmission of these data with CDS tag number format should improve this situation and provide a greater effective sample size.
4) Look for ways to improve representativeness across Members. For example, could there be a seasonality element to the collection of market data that is leading to the underrepresentation of certain Members?
5) Outliers above and below 20% could be removed, but there should also be a discussion around improving the data collection mechanisms.
6) Use of bar code readers for the Australian tags would improve the speed and accuracy of reading tag numbers and may also enable poorly positioned tags to be more easily read. However, it was noted that this would also require appropriate software/systems to link the tag numbers with other data collected for the fish (e.g., weights) at the market.

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[1] CCSBT-ESC/2008/23
[2] CCSBT-EC/2010/19

In this document, the Secretariat repeated the trial analysis conducted in 2021 utilising the latest Market Survey Data (including data up to mid-2022) provided by Japan and CTF data held by the Secretariat, taking account of advice by Members at CC 16.

Japan made a considerable effort since CC 16 to improve the Market Survey Data (particularly tag number information), substantially increasing the number of samples available for matching with CTF data. The Secretariat expresses its appreciation to Japan, particularly Dr Tomoyuki Itoh, for implementing the Market Survey and providing data for this analysis.

3. Data used for this trial analysis

The Secretariat used the following datasets to conduct this trial analysis.

1) *Individual SBT data from CCSBT CDS Catch Tagging Forms (2010-2022)*

These data are collected from Members and maintained by the Secretariat through the Catch Documentation Scheme (CDS) since 2010 to date.

This dataset includes CDS tag number, product type, product weight and fork length of each fish, fishing information, origin of fish (Member, wild/farming) etc[3].

The numbers of CDS tags recorded on CTFs by Member are shown in Table 1 below.

Table 1. Number of CDS tags (= number of SBT) recorded on CTFs by Member and year.

	AU	ID	JP	KR	NZ	TW	ZA	Total
2010	185,538	4,990	38,558	14,898	8,473	33,028	557	287,138
2011	213,830	11,936	63,282	13,291	8,811	15,156	687	328,047
2012	288,855	9,165	51,205	15,743	13,537	17,451	972	397,998
2013	278,440	18,187	49,459	19,540	11,922	33,553	478	412,827
2014	266,731	11,573	58,814	15,835	13,800	26,659	461	395,088
2015	301,638	5,944	85,182	22,000	14,973	33,004	645	463,386
2016	324,200	6,362	80,348	19,112	19,763	30,392	620	480,797
2017	275,531	9,617	85,019	18,352	19,255	32,845	1,210	441,829
2018	341,346	10,946	106,627	20,310	19,919	35,495	2,294	536,937
2019	360,174	12,834	112,021	21,116	16,548	34,615	2,539	559,847
2020	344,072	13,578	91,667	17,931	15,517	29,494	1,311	513,570
2021	342,756	12,463	112,343	20,456	14,070	37,767	1,268	541,123
2022	1,662	4,575	2,211		3,953		18	12,419
Total	3,524,773	132,170	936,736	218,584	180,541	359,459	13,060	5,371,006

2) *Japan's market CDS tag survey data (2010 – mid 2022)*

This dataset is provided by Japan. These data were obtained through Japan's market CDS tag survey (hereinafter "Market Survey") in the major Japanese wholesale markets[4].

This dataset includes date of survey, CDS tag number, market place, fishing vessel ID (call sign), product weight of fish, name of whole seller, and origin of fish (Member, wild or farming) etc.

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[3] Details are available at Appendix 1 of the Resolution on the Implementation of a CCSBT Catch Documentation Scheme.

[4] Japan has voluntarily conducted SBT management tag survey twice a month at Toyosu market (as well as at Tsukiji and Yaizu market since 2007).

The number of fish observed/recorded by Japan's Market Survey by Member is shown in Table 2 below.

Table 2. Number of SBT observed/recorded by the Market Survey by Member.

	AU	ID	JP	KR	NZ	TW	ZA	Total
Number of observed SBT in Market Survey (2010-2022)	1,405 (997)	893 (893)	74,281 (66345)	14,839 (14095)	1,473 (1178)	15,099 (13741)	124 (124)	**108,681** (97373)

Note: Within the table above, brackets shows figures for 2010 - 2020 (i.e. figures indicated in CCSBT-CC/2110/16).

It should be noted that the data recorded in the Market Survey described above contained many missing or incomplete data. The main reason was that there were unreadable CDS tags for some reason, such as the tag being embedded in frozen SBT meat, partially damaged, detached, or a recording error by the surveyor.

4. Trial Analysis

The Secretariat conducted trial analyses using the datasets described in Section 3 above.

1) *Data preparation for trial analysis*

To integrate the two datasets described in Section 3, the Secretariat imported the Market Survey data provided by Japan into the CDS database and matched the data by CDS tag numbers common to both the Market Survey dataset and the CTF dataset.

The number of SBT individuals with matching CDS tag numbers between the Market Survey data and the CTF data is shown in Table 3 below.

Table 3. Number of matches of CDS tag numbers between the Market Survey data and CTF data.

Member /CNM	Number of observed SBT in Market Survey (2010-2022) (A)	Number of observed tags		Rate		
		"Readable" tag numbers (B)	Number of "matched" tag numbers (C)	"Readable" rate against all records (B/A)	CTF - Matching rate against all records (C/A)	CTF - Matching rate against "readable" tag (C/B)
AU	1,405	995	975	70.82%	69.40%	97.99%
ID	893	729	642	81.63%	71.89%	88.07%
JP	74,281	63,422	62,716	85.38%	84.43%	98.89%
KR	14,839	9,746	9,558	65.68%	64.41%	98.07%
NZ	1,473	1,378	1,342	93.55%	91.11%	97.39%
PH	567	376	367	66.31%	64.73%	97.61%
TW	15,099	11,082	10,532	73.40%	69.75%	95.04%
ZA	124	89	72	71.77%	58.06%	80.90%
total	**108,681**	**87,817**	**86,204**	**80.80%**	**79.32%**	**98.16%**

In the Market Survey data used for this analysis, the number of "readable" tag numbers increased significantly compared to the 2021 analysis. Japan improved the original Market Survey data (particularly tag number information) for this analysis, increasing matchable data with the CTF significantly. In addition, Japan added new data for 2021 and mid-2022.

CDS tag numbers were readable in 80.80% of SBT observed through the Market Survey (total 108,681 individuals). The percentage of readable tag numbers ranged between Members from 65.68% to 93.55%.

As noted above, the proportion of "readable" tag numbers has improved significantly compared to 2021 analysis due to an increase in the number of tag numbers in the Market Survey data that can be matched to CTF. However, the proportion of "readable" tag numbers is relatively low amongst Members in Australia, Korea, Taiwan and South Africa, at around 70 % of the total. This may suggest a problem with the current method of attaching CDS tags by fishers and/or farm operators. The method of attaching CDS tags was discussed at the 2021 Technical Compliance Working Group (TCWG) and CC, and the guidelines for attaching CDS tags were revised. The readability of the tag number is expected to improve in the future.

The matching rate between "readable" tag numbers from the Market Survey and CTF data was very high in general, overall 98.16% and ranging 80.90% to 98.89% by Member. Indonesia (88.07%) and South Africa (80.90%) showed a relatively low matching rate amongst Members. If data record/entry error rate occurred in the Market Survey was the same, this percentage may reflect Members' "error rate" for CTF.

We created a new data set by extracting data for use in this trial analysis from the data set integrated by matching CDS tag numbers as described above. The extracted data for this trial analysis are as follows:

- CDS tag numbers of matched SBT individuals
- Survey year in which SBT individuals were observed in Japanese market
- Product weights of SBT individuals observed/recorded in Japanese market
- Product type of individuals as recorded in the CDS
- Product weights of individuals as recorded in the CDS
- CCSBT Statistical Area in which SBT individuals were caught as recorded in the CDS

We calculated the difference between the product weights obtained from the two sources and then calculated the mean and standard deviation of the proportion of the difference between them for each stratum (Member, year, product type and CCSBT Statistical Area).

2) *Coverage and representativeness of Japan's Market Survey data against all SBT individuals*

The Number of SBT individuals matched between Market Survey data and CTF data by Member and year is shown in Table 4.

Table 4: Number of individuals matched between Market Survey data and CTF data by Member and year. Figures in the cells indicate the number of individuals.

	AU	ID	JP	KR	NZ	TW	ZA	Total
2010*	-	10	967	164	-	591	-	1,748
2011*	-	90	2,386	630	89	904	-	4,156
2012*	-	211	3,029	688	40	311	9	4,427
2013*	5	147	2,443	1,210	19	401	3	4,297
2014*	8	150	3,872	1,163	54	1,292	-	6,625
2015*	89	34	5,226	924	141	1,251	-	7,665
2016*	-	-	6,472	1,237	27	1,092	-	8,828
2017*	-	-	6,833	1,231	5	768	-	8,837
2018*	-	-	7,743	1,152	-	1,195	-	10,090
2019*	227	-	8,175	372	361	1,159	20	10,314
2020*	282	-	7,126	275	316	518	40	8,557
2021*	364	-	7,561	422	282	829	-	9,458
2022*	-	-	865	82	7	219	-	1,173
Total	**975**	**642**	**62,698**	**9,550**	**1,341**	**10,530**	**72**	**86,175**

* Year code in Table 4 above is based on the date of Market Survey. Given the time lag between landing/importing and wholesale market auction, and also considering the fact that fishing season is varied between Members, the results of the calculations above should be recognised as indicative, as some matching counts may be inherently more correct to be categorised in different years. The same caution should be applied to all tables and figures below in this document.

Table 4 shows that there is a very large variation in the number of matches between Members in each year.

To check the representativeness of Market Survey data against all CTF data, the number of matched SBT individuals (Table 4 above) was compared to the total number of CDS tags registered in the CTF by Member and year (Table 1 above). The calculated coverage of the Market Survey data against all CTF data is shown in Table 5 below.

Table 5. Coverage (percentage) of Number of matches to Market Survey data against the total number of CDS tag numbers registered with the CTF, by Member and year

	AU	ID	JP	KR	NZ	TW	ZA	Total
2010	0.00%	0.20%	2.51%	1.10%	0.00%	1.79%	0.00%	0.61%
2011	0.00%	0.75%	3.77%	4.74%	1.01%	5.96%	0.00%	1.27%
2012	0.00%	2.30%	5.92%	4.37%	0.30%	1.78%	0.93%	1.11%
2013	0.00%	0.81%	4.94%	6.19%	0.16%	1.20%	0.63%	1.04%
2014	0.00%	1.30%	6.58%	7.34%	0.39%	4.85%	0.00%	1.68%
2015	0.03%	0.57%	6.14%	4.20%	0.94%	3.79%	0.00%	1.65%
2016	0.00%	0.00%	8.05%	6.47%	0.14%	3.59%	0.00%	1.84%
2017	0.00%	0.00%	8.04%	6.71%	0.03%	2.34%	0.00%	2.00%
2018	0.00%	0.00%	7.26%	5.67%	0.00%	3.37%	0.00%	1.88%
2019	0.06%	0.00%	7.30%	1.76%	2.18%	3.35%	0.79%	1.84%
2020	0.08%	0.00%	7.77%	1.53%	2.04%	1.76%	3.05%	1.67%
2021	0.11%	0.00%	6.73%	2.06%	2.00%	2.20%	0.00%	1.75%
2022	0.00%	0.00%	39.12%	-	0.18%	-	0.00%	9.45%
Total	**0.03%**	**0.49%**	**6.69%**	**4.37%**	**0.74%**	**2.93%**	**0.55%**	**1.60%**

Based on Table 5 above, the overall coverage since 2010 to date is 1.60% of coverage. On a Member-by-Member basis, there has been a wide variation between Members in recent years, ranging from 0% to around 7%. For Japan, Korea and Taiwan (far-sea longline Members), the coverage since 2010 to date is relatively high (6.69%, 4.37% and 2.93%, respectively).

For Japan's SBT, the coverage for 2021 (the most recent year the fishing season ended) was 6.73% and the arithmetic mean coverage for the period 2010 - mid 2022 was 6.69%, which is quite high considering that the Market Survey has been conducted only twice a month.

Korea (2.06%), New Zealand (2.00%) and Taiwan (2.20%) had a coverage 2% or more in 2021, while the coverage for other Members was much lower.

CC 16 made the following comments to improve the representativeness issue due to these low coverages:

1) That the sample size should be increased to increase the number of matches between the market survey data and the CDS tag data.
2) Tag placement should be improved to increase the readability of tags, which would improve the coverage.
3) The formatting of some tag numbers in the market survey data sent to the Secretariat was different from the format of the CDS data held by the Secretariat and has resulted in these tags as being deemed as unreadable in the Secretariat's analysis. Resubmission of these data with CDS the correct tag number format should improve this situation and provide a greater effective sample size.
4) Look for ways to improve representativeness across Members. For example, could there be a seasonality element to the collection of market data that is leading to the underrepresentation of certain Members?

For 1) and 4) above, considering the nature of the market (it is not known until the auction day how many SBTs will be auctioned), an increase in the frequency of market surveys (currently twice a month throughout the year) could be a solution. However, it would require coordination with the surveyor and additional funding.

For 2) above, future improvements are expected as guidelines for attaching CDS tags were revised in 2021.

The above 3) has already been resolved through Japan's effort.

Concerning the coverage improvement (and hence the representativeness of Market Survey data), we have already addressed two of the above recommendations on the readability of tag numbers. The simplest and surest way to improve survey coverage would be to increase the survey frequency. However, it is unlikely that a slight increase in survey frequency will dramatically improve the currently very low coverage rate, and survey frequency will not improve coverage for Members with increasing off-market transactions, making it difficult to increase representativeness equally for all Members.

Given the coverage indicated above, the Compliance Committee should consider carefully whether the data obtained from Market Survey is representative enough to be used in assessing the accuracy and identifying compliance trends in the CDS of all Members' stakeholders (mainly fishers and farming operators).

3) *Verification of reported catch by Members with CDS data and CDS tag survey data obtained from Japanese market*

The weight of SBT recorded in the Market Survey and in the CTF are both net weights, and these weight data are directly comparable as there are unlikely to be any changes in product type between landing or export/import and auction.

As described in Section 4-1) above, the difference between the product weights of each individual SBT between the two data sets (Market Survey product weight minus CTF product weight) was calculated for each SBT individual and then the mean and standard deviation of the proportion of difference were calculated by Member. If this proportion is "zero", it means the weight from Market Survey and the weight from CTF is the same and consequently Member's reported weights were accurate. If this proportion is a negative figure, it indicates that the weight of the fish measured on the vessel or at the farm was higher than the weight measured in the market during the auction. For some Members, this may suggest that fishers on board may have weighed SBT "conservatively", potentially to ensure that they do not exceed their quotas (e.g. if the measurement is 49.5kg, record as 50kg to CTF considering unstable weighing on board).

However, in the datasets used, very large discrepancies between the two weights data were observed for a considerable number of individuals.

To provide a visual representation of the variation in the data, a bubble plot showing the relationship between Market Survey weight and CTF weight by Member is provided at **Attachment A**. For all plots in **Attachment A**, the vertical axis is the CTF weight of each SBT individual and the horizontal axis is the Market Survey weight. Each bubble represents the counts of records within 5kg bin (i.e. the higher the count, the larger the bubble). In general, the Market Survey weight data and CTF weight data matched well (most bubbles are on/close to 1:1 line) for all Members, however Members with larger sample sizes tend to have more outliers.

In addition, to indicate the scale of extreme records, the maximum weight discrepancies (in both positive and negative directions) between the two data sets by Member is shown in Table 6 below.

Table 6. Maximum discrepancy between Market Survey weight data and CTF weight data (positive and negative directions) by Member.

	AU		ID		JP		KR		NZ		TW		ZA		All	
	Plus	Minus	Plus	Minus	Plus	Minus	Plus	Minus	Plus	Minus	Plus	Minus	Plus	Minus	Plus	Minus
2010	-	-	4.00%	-63.19%	86.40%	-334.78%	55.79%	-175.00%	-	-	68.18%	-163.16%	-	-	**86.40%**	**-334.78%**
2011	-	-	71.88%	-93.99%	77.96%	-298.34%	61.45%	-181.55%	74.14%	-160.87%	70.49%	-148.12%	-	-	**77.96%**	**-298.34%**
2012	-	-	81.09%	-76.10%	78.21%	-614.29%	81.65%	-180.30%	29.69%	-93.01%	74.81%	-172.73%	4.37%	-0.88%	**81.65%**	**-614.29%**
2013	-0.79%	-1.38%	62.72%	-1189.47%	72.55%	-900.00%	84.00%	-1229.41%	4.41%	-0.72%	69.51%	-128.57%	2.52%	1.35%	**84.00%**	**-1229.41%**
2014	-1.22%	-6.44%	69.61%	-46.55%	71.18%	-892.54%	71.43%	-900.00%	68.86%	-164.57%	76.50%	-148.68%	-	-	**76.50%**	**-900.00%**
2015	58.51%	-181.69%	5.11%	-8.59%	67.14%	-207.45%	58.50%	-891.60%	65.78%	-120.59%	76.74%	-197.62%	-	-	**76.74%**	**-891.60%**
2016	-	-	-	-	74.22%	-234.53%	63.16%	-117.39%	53.24%	-22.45%	85.04%	-537.50%	-	-	**85.04%**	**-537.50%**
2017	-	-	-	-	80.85%	-900.00%	65.65%	-220.69%	5.03%	-3.86%	75.66%	-169.46%	-	-	**80.85%**	**-900.00%**
2018	-	-	-	-	73.68%	-909.35%	65.96%	-909.71%	0.00%	0.00%	72.22%	-116.31%	-	-	**73.68%**	**-909.71%**
2019	48.81%	-115.28%	-	-	78.93%	-762.07%	66.41%	-754.37%	74.95%	-56.25%	72.48%	-174.51%	32.69%	-23.46%	**78.93%**	**-762.07%**
2020	60.21%	-116.05%	-	-	81.41%	-380.39%	61.18%	-95.18%	70.17%	-54.49%	53.72%	-46.63%	25.45%	-28.81%	**81.41%**	**-380.39%**
2021	56.52%	-25.55%	-	-	83.31%	-288.24%	75.29%	-310.57%	55.78%	-77.30%	68.52%	-594.44%	-	-	**83.31%**	**-594.44%**
2022	-	-	-	-	40.90%	-187.97%	74.61%	-120.86%	3.75%	-2.73%	60.35%	-348.28%	-	-	**74.61%**	**-348.28%**
All	60.21%	-181.69%	81.09%	-1189.47%	86.40%	-909.35%	84.00%	-1229.41%	74.95%	-164.57%	85.04%	-594.44%	32.69%	-28.81%	**86.40%**	**-1229.41%**

As shown in Table 6 above, with positive deviations of up to 86.4% and negative deviations of up to minus 1,229.41%, it is clear that this data set contains extreme outliers.

7

Besides, in order to indicate the distribution of the proportion of differences between the two weights data across all Members and year, a histogram is provided in Figure 1 below. In this histogram, the horizontal axis shows the proportion of difference between the weight data (interval 0.025 (2.5%)) and the vertical axis shows the number of SBT individuals.
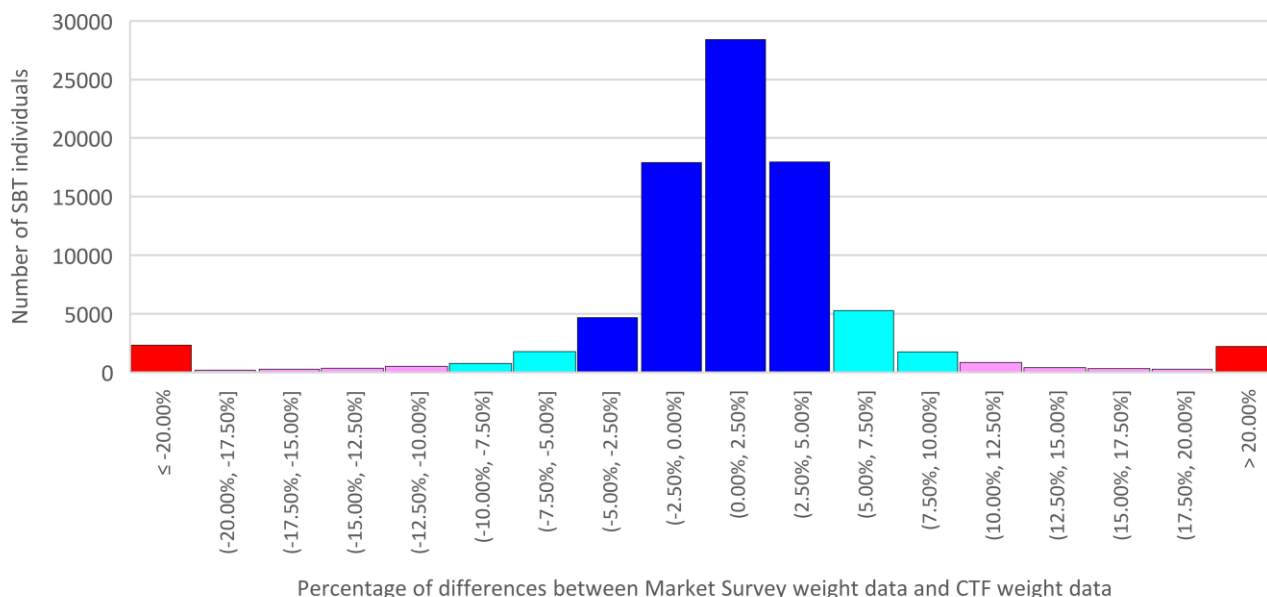

Figure 1: Histogram of the percentage of difference between the Market Survey weight data and CTF weight data. The horizontal axis shows the difference between the weight data (2.5% of interval) and the vertical axis shows the number of SBT individuals. The proportion of differences between the two weights data within ±5% are shown in blue, between ±5-10% in light blue, between ±10-20% in pink and above ±20% in red.

With regard to the difference between the weight weighed on board and the weight at landing in the CDS, taking into account the fact that Japan, Korea and Taiwan allow a range of ±5% between the weight weighed on board (the weight recorded in the CTF data) and landing weight as "error due to weighing on board", the SBT individuals with ±5% shown in blue in Figure 1 above can be considered as both the Market Survey data and the CTF data are properly recorded (within acceptable level under current CDS operation), and many of individuals (80.06%) are included in this category.

On the other hand, the number of SBTs with a difference of more than "±20%" between the two weights data is more than 2,300 in the negative direction and about 2,200 in the positive direction, and such SBT individuals showed extreme figures, as shown in Table 6.

Such "extreme" records are appeared in both positive direction and negative direction (i.e. both "under-reported" and "over-reported" by fishers and/or farm operators). If fishers and/or farm operators were deliberately under-reporting to CTF not to exceed quotas, these extreme records should be unevenly distributed on the positive direction. Considering relatively "even" distribution of records to both positive and negative directions, it would be appropriate to consider that large part of such extreme records were un-intentional errors due to administrative problems (e.g. mis-writing or mis-entering data by surveyor while Japan's Market Survey, or data error in CTF database etc.) and may be appropriate to deem these extreme records as "outliers".

In this regard, CC 16 commented that "Outliers above and below 20% could be removed, but there should also be a discussion around improving the data collection mechanisms". Based on this recommendation, the Secretariat created a new dataset by excluding outliers above ±20 % (red area in the Figure 1 histogram). The number of matches between the market survey data and the CTF data by member, excluding outliers, is shown in Table 7 below. The improving the data collection mechanisms need to be considered separately.

Table 7. Number of matchings between Market Survey data and CTF data – all matchings and matchings after excluding outliers by Member.

	AU	ID	JP	KR	NZ	TW	ZA	Total
Number of Matching	975	642	62,698	9,550	1,341	10,530	72	**86,175**
Matching exclude outliers	950	581	59,656	9,014	1,264	9,764	66	81,658
	(97.44%)	(90.50%)	(95.15%)	(94.39%)	(94.26%)	(92.73%)	(91.67%)	(94.76%)

As indicated in Table 7 above, <u>approximately 95% of matched SBTs fall within ±20% weight difference range when outliers exceeding ±20% are excluded. Of these, approximately 84% of matched SBTs fall ±5% weight difference range (Figure 1).</u> Based on these figures, <u>it can be qualitatively stated that the catches reported by Members are reasonably accurate (i.e. within the margin of error allowed by the current CDS operation).</u>

5. Additional Trial Analysis using the same dataset (excluded outliers)

The data set used for Section 4 above contains several components that allow for analysis focusing on different elements, such as by Member, by product type and by CCSBT Statistical Area.

The Secretariat repeated the additional trial analysis conducted in 2021, using the new data set (up to mid-2022, excluding outliers following CC 16 recommendations).

1) *Comparison of product weights between Japan's Market Survey data and CTF data – by Member*

The number of matched SBT individuals between Market Survey data and CTF data by Member and year shown in Table 4 above.

The percentage and standard deviations of the differences between Market Survey weight data and CTF weight data (hereinafter "Weight Difference") by Member and year are shown in Table 8. As mentioned in section 4-3), negative values may indicate a positive sign in terms of compliance, indicating that fishers and/or farm operators are weighing conservatively on site, i.e. they tend to be more careful not to exceed their quota.

Table 8: Percentage and standard deviation of Weight Difference by Member and year. Figures in brackets indicate standard deviations. Cells with negative figure are highlighted in light blue.

	AU		ID		JP		KR		NZ		TW		ZA		All	
2010	NA	(NA)	0.49%	(2.51%)	2.85%	(4.11%)	1.76%	(6.25%)	NA	(NA)	-0.06%	(5.46%)	NA	(NA)	**1.74%**	(5.00%)
2011	NA	(NA)	-1.61%	(5.84%)	2.44%	(3.90%)	-1.88%	(6.62%)	1.91%	(3.70%)	-0.25%	(5.95%)	NA	(NA)	**1.02%**	(5.25%)
2012	NA	(NA)	-2.38%	(6.92%)	2.08%	(4.41%)	-1.29%	(3.59%)	2.03%	(4.32%)	0.28%	(4.46%)	1.30%	(1.64%)	**1.12%**	(4.68%)
2013	-0.98%	(0.25%)	-1.66%	(3.54%)	2.18%	(3.74%)	-1.32%	(4.01%)	1.06%	(1.16%)	0.71%	(5.46%)	1.89%	(0.59%)	**0.94%**	(4.31%)
2014	-3.17%	(1.78%)	-3.80%	(4.91%)	2.07%	(3.35%)	-0.72%	(3.80%)	0.82%	(3.45%)	0.98%	(5.27%)	NA	(NA)	**1.27%**	(4.12%)
2015	-2.30%	(2.73%)	-3.48%	(2.46%)	1.99%	(3.35%)	-0.46%	(3.44%)	1.35%	(3.49%)	-0.35%	(5.86%)	NA	(NA)	**1.23%**	(4.04%)
2016	NA	(NA)	NA	(NA)	1.75%	(3.58%)	-2.00%	(3.51%)	1.76%	(1.98%)	0.14%	(6.01%)	NA	(NA)	**1.02%**	(4.16%)
2017	NA	(NA)	NA	(NA)	1.65%	(3.02%)	-1.98%	(3.35%)	0.01%	(3.27%)	0.36%	(5.36%)	NA	(NA)	**1.03%**	(3.57%)
2018	NA	(NA)	NA	(NA)	1.81%	(3.15%)	-1.69%	(4.12%)	NA	(NA)	-0.23%	(5.87%)	NA	(NA)	**1.18%**	(3.88%)
2019	-0.66%	(1.40%)	NA	(NA)	1.97%	(3.47%)	-0.39%	(4.43%)	-0.17%	(2.99%)	1.02%	(5.68%)	-10.24%	(3.44%)	**1.62%**	(3.87%)
2020	-0.08%	(3.13%)	NA	(NA)	1.83%	(3.14%)	-0.55%	(4.08%)	0.38%	(2.87%)	0.51%	(4.96%)	2.34%	(4.28%)	**1.56%**	(3.36%)
2021	-0.96%	(2.06%)	NA	(NA)	2.01%	(3.17%)	-0.42%	(3.16%)	-0.35%	(2.63%)	1.57%	(5.93%)	NA	(NA)	**1.68%**	(3.54%)
2022	NA	(NA)	NA	(NA)	2.37%	(3.34%)	5.80%	(11.92%)	-0.93%	(2.17%)	-0.03%	(8.41%)	NA	(NA)	**2.14%**	(4.44%)
All	-0.77%	(2.44%)	-2.46%	(5.48%)	1.94%	(3.40%)	-1.27%	(4.12%)	0.38%	(3.11%)	0.36%	(5.71%)	-1.25%	(6.65%)	**1.30%**	(4.01%)

Australia, Indonesia, and Korea showed negative calculated values for almost the whole period 2010 - mid 2022, suggesting that these operators may roundup measurements on board to reduce the chance of exports being questioned (for under-estimation of weight) or to be conservative with respect to quota usage.

Japan, New Zealand and Taiwan showed positive values for the most years from 2010 – mid 2022. However, based on the fact that most of the average values by Members/years are within the "±5%" range described above, it may be interpreted that fishers and/or farm operators in all Members are making accurate reporting of SBT weights through CTFs.

There are some cells with exceptionally high values in Table 8 (e.g. South Africa in 2019 and South Korea in 2022). In these cells, the number of matches between Market Survey data and CTF data is itself low, and the representativeness of the results for the overall assessment is questionable. Furthermore, the number of samples in each cell varies greatly, hence the reliability of the results is biased by Member/Year. Consequently, any conclusion based on the above results should be considered with caution.

2) ***Comparison of product weights between Japan's Market Survey data and CTF data – by Product type***

The number of SBT individuals matched between the Market survey data and CTF data by product type and year is shown in Table 9 below. The product types defined by the CDS Resolution that appear in this dataset are as follows:

- GG: Gilled and gutted
- GGO: Gilled and gutted – Tail on
- GGT: Gilled and gutted – Tail off
- DRT: Dressed and Tail off

Table 9: Product types in CTF data for SBT individuals matched to Market Survey data (2010 – mid 2022). Figures in the cells indicate the number of individuals.

	DRT	GG	GGO	GGT	Total
2010	-	1,598	-	-	1,598
2011	-	3,833	-	-	3,833
2012	-	4,013	-	19	4,032
2013	-	2,161	65	1,824	4,050
2014	-	294	89	5,889	6,272
2015	-	90	31	7,193	7,314
2016	-	6	-	8,436	8,442
2017	-	98	-	8,454	8,552
2018	-	-	-	9,736	9,736
2019	-	-	327	9,308	9,635
2020	-	-	326	7,855	8,181
2021	1	-	415	8,629	9,045
2022	-	-	-	968	968
Total	1	12,093	1,253	68,311	81,658

As one of the product types defined in the original 2010 CDS Resolution was "GG", almost all SBTs for the period 2010-2012 were recorded as "GG". In October 2012, the CCSBT revised its CDS resolution and the definition of "GG" was subdivided into "GGO" and "GGT". As a result of this revision to the CDS Resolution, SBT individuals from 2013 onwards were recorded as either GGO or GGT. As Table 8 shows, in recent years the product type of most Members has been GGT, although some Members have continued to process and export SBT as GGO in recent years (likely to be the case with Members exporting fresh SBT, specifically Australia and New Zealand). One case was recorded as "DRT" in 2021; it is a rare event that DRT tuna product is auctioned in the Japanese wholesale market.

The percentage and standard deviations of the differences between Market Survey weight data and CTF weight data by product type and year are shown in Table 10.

Table 10: Percentage and standard deviation of Weight Difference by product type and year. Figures in brackets indicate standard deviations. Cells with negative figure are highlighted in light blue.

	DRT		GG		GGO		GGT		All	
2010	NA	(NA)	1.74%	(5.00%)	NA	(NA)	NA	(NA)	**1.74%**	**(5.00%)**
2011	NA	(NA)	1.02%	(5.25%)	NA	(NA)	NA	(NA)	**1.02%**	**(5.25%)**
2012	NA	(NA)	1.12%	(4.68%)	NA	(NA)	3.05%	(3.07%)	**1.12%**	**(4.68%)**
2013	NA	(NA)	0.66%	(4.24%)	0.20%	(3.49%)	1.30%	(4.40%)	**0.94%**	**(4.31%)**
2014	NA	(NA)	1.02%	(4.00%)	-2.82%	(4.70%)	1.34%	(4.09%)	**1.27%**	**(4.12%)**
2015	NA	(NA)	-2.09%	(2.76%)	-3.65%	(2.43%)	1.29%	(4.03%)	**1.23%**	**(4.04%)**
2016	NA	(NA)	2.12%	(8.82%)	NA	(NA)	1.02%	(4.16%)	**1.02%**	**(4.16%)**
2017	NA	(NA)	2.31%	(2.32%)	NA	(NA)	1.01%	(3.57%)	**1.03%**	**(3.57%)**
2018	NA	(NA)	NA	(NA)	NA	(NA)	1.18%	(3.88%)	**1.18%**	**(3.88%)**
2019	NA	(NA)	NA	(NA)	-0.61%	(2.23%)	1.70%	(3.89%)	**1.62%**	**(3.87%)**
2020	NA	(NA)	NA	(NA)	0.38%	(3.31%)	1.61%	(3.36%)	**1.56%**	**(3.36%)**
2021	-15.94%	x	NA	(NA)	-0.66%	(2.33%)	1.80%	(3.54%)	**1.68%**	**(3.54%)**
2022	NA	(NA)	NA	(NA)	NA	(NA)	2.14%	(4.44%)	**2.14%**	**(4.44%)**
All	-15.94%	x	1.07%	(4.82%)	-0.56%	(3.02%)	1.38%	(3.85%)	**1.30%**	**(4.01%)**

Although there is a large difference in sample size between GGO and GGT as shown in Table 9, Table 10 shows that the calculated values are mostly negative for GGO and generally positive for GGT. This could potentially be interpreted as a tendency to weigh fish conservatively among fishers and/or farm operators who land and process SBT as GGO. If this is true, the product type could be used as an indicator to select fishers and/or farm operators when managers need to narrow targets for monitoring and guidance from the perspective of compliance with CDS requirements.

However, Given the slight Weight Difference for both GGO and GGT and the fact that Weight Differences fall within the range of ± 5 % for most SBTs (even when standard deviations are taken into account), it seems difficult to explore compliance trends in the fishing ground from "Product Type" perspective.

3) ***Comparison of product weights between Japan's Market Survey data and CTF data – by CCSBT Statistical Area***

The CCSBT Statistical Areas adopted by the CCSBT and used as the basis for the spatial aggregation of various CCSBT data (for both scientific and compliance purpose) are shown in **Attachment B**.

The CTF data contains information on the CCSBT Statistical Areas in which the SBT concerned were fished, and the information on the SBT in this dataset can be aggregated to the CCSBT Statistical Areas.

The number of matched SBT individuals between Market Survey data and CTF data by Statistical Area is shown in Table 11 below.

Table 11: Number of matched SBT individuals between Market Survey data and CTF data by CCSBT Statistical Area (2010 – mid 2020). Figures in the cells indicate the number of matched individuals.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Un-known	Total
2010	-	435	-	153	-	-	166	162	649	-	-	-	-	33	-	-	1,598
2011	-	632	-	121	2	84	764	655	1,450	-	-	-	-	121	4	-	3,833
2012	11	393	-	83	5	37	738	829	1,855	-	-	-	-	73	8	-	4,032
2013	3	369	5	168	-	19	892	693	1,803	16	-	-	-	80	2	-	4,050
2014	3	754	8	250	10	47	1,490	728	2,389	-	2	-	-	587	4	-	6,272
2015	-	601	81	320	-	134	1,906	1,051	2,859	-	-	-	-	362	-	-	7,314
2016	2	686	-	365	3	25	1,869	1,276	3,888	-	-	13	-	298	12	-	8,442
2017	-	571	-	465	3	5	2,280	634	4,373	-	-	2	-	218	1	-	8,552
2018	-	636	-	672	-	-	2,993	588	4,465	-	-	-	-	376	6	-	9,736
2019	-	867	25	1,230	190	143	2,499	712	3,774	3	1	-	-	176	15	-	9,635
2020	-	272	24	664	249	91	2,418	460	3,770	-	-	-	-	213	4	16	8,181
2021	-	389	32	898	218	158	2,939	804	3,320	-	-	-	-	283	4	-	9,045
2022	-	73	-	31	-	7	233	341	258	-	-	-	-	25	-	-	968
Total	19	6,678	175	5,420	680	750	21,187	8,933	34,853	19	3	15	-	2,845	60	16	81,658

The percentage and standard deviations of the differences between Market Survey weight data and CTF weight data by CCSBT Statistical Area are shown in Table 12.

Table 12: Percentage and standard deviation of Weight Difference between Market Survey weight data and CTF weight data by CCSBT Statistical Area and year. Figures in brackets indicate standard deviations. Cells with negative figure are highlighted in light blue.

	1		2		3		4		5		6		7		8	
2010	NA	(NA)	0.46%	(5.12%)	NA	(NA)	2.92%	(2.51%)	NA	(NA)	NA	(NA)	2.34%	(4.12%)	-0.22%	(5.50%)
2011	NA	(NA)	0.11%	(5.07%)	NA	(NA)	2.56%	(4.47%)	0.02%	(1.33%)	1.91%	(3.70%)	1.91%	(3.72%)	-0.57%	(5.12%)
2012	-0.74%	(8.02%)	0.24%	(4.68%)	NA	(NA)	1.79%	(3.09%)	4.95%	(8.06%)	1.57%	(3.28%)	1.87%	(3.65%)	-0.06%	(4.09%)
2013	3.74%	(5.14%)	1.04%	(4.62%)	-0.98%	(0.25%)	1.94%	(3.71%)	NA	(NA)	1.06%	(1.16%)	1.59%	(3.54%)	-0.31%	(3.21%)
2014	2.17%	(3.03%)	0.76%	(5.23%)	-3.17%	(1.78%)	1.04%	(4.06%)	1.89%	(0.97%)	0.82%	(3.45%)	1.59%	(3.23%)	0.57%	(3.64%)
2015	NA	(NA)	-0.82%	(5.61%)	-2.30%	(2.73%)	1.38%	(3.90%)	NA	(NA)	1.35%	(3.49%)	1.68%	(2.94%)	0.88%	(3.68%)
2016	-7.39%	(8.54%)	0.35%	(5.33%)	NA	(NA)	0.83%	(2.52%)	0.80%	(0.44%)	1.76%	(1.98%)	1.62%	(3.32%)	0.47%	(3.62%)
2017	NA	(NA)	0.11%	(5.19%)	NA	(NA)	1.39%	(3.02%)	2.98%	(1.55%)	0.01%	(3.27%)	1.49%	(2.99%)	1.56%	(2.64%)
2018	NA	(NA)	-0.10%	(5.56%)	NA	(NA)	1.29%	(2.93%)	NA	(NA)	NA	(NA)	1.53%	(2.92%)	1.84%	(3.41%)
2019	NA	(NA)	1.13%	(5.47%)	-0.79%	(0.43%)	1.38%	(4.03%)	0.01%	(2.59%)	-0.41%	(3.44%)	1.79%	(2.94%)	1.19%	(3.50%)
2020	NA	(NA)	0.76%	(4.71%)	-1.40%	(3.13%)	0.70%	(3.12%)	0.18%	(2.41%)	0.49%	(3.74%)	1.14%	(2.95%)	1.68%	(3.10%)
2021	NA	(NA)	1.31%	(5.78%)	0.14%	(2.78%)	1.41%	(3.86%)	-0.29%	(2.89%)	0.78%	(2.15%)	1.76%	(3.07%)	1.30%	(3.74%)
2022	NA	(NA)	-0.33%	(6.87%)	NA	(NA)	2.05%	(2.52%)	NA	(NA)	-0.93%	(2.17%)	2.57%	(3.77%)	1.66%	(3.03%)
All	-0.27%	(7.29%)	0.41%	(5.31%)	-1.52%	(2.69%)	1.34%	(3.56%)	0.06%	(2.72%)	0.81%	(3.27%)	1.62%	(3.13%)	0.74%	(3.77%)

Cont.	9		10		11		12		13		14		15		Unknown	
2010	2.77%	(4.94%)	NA	(NA)	NA	(NA)	NA	(NA)	NA	(NA)	-0.43%	(7.10%)	NA	(NA)	NA	(NA)
2011	1.81%	(5.72%)	NA	(NA)	NA	(NA)	NA	(NA)	NA	(NA)	-2.66%	(6.32%)	-3.88%	(3.66%)	NA	(NA)
2012	1.60%	(5.18%)	NA	(NA)	NA	(NA)	NA	(NA)	NA	(NA)	-0.94%	(4.27%)	-1.04%	(2.18%)	NA	(NA)
2013	0.95%	(4.86%)	2.82%	(1.77%)	NA	(NA)	NA	(NA)	NA	(NA)	1.41%	(5.38%)	-6.65%	(1.59%)	NA	(NA)
2014	1.47%	(3.95%)	NA	(NA)	-3.81%	(0.67%)	NA	(NA)	NA	(NA)	1.37%	(5.49%)	-2.81%	(4.61%)	NA	(NA)
2015	1.66%	(3.85%)	NA	(NA)	NA	(NA)	NA	(NA)	NA	(NA)	0.51%	(6.58%)	NA	(NA)	NA	(NA)
2016	1.10%	(4.33%)	NA	(NA)	NA	(NA)	0.16%	(1.69%)	NA	(NA)	0.49%	(6.36%)	0.22%	(2.84%)	NA	(NA)
2017	0.84%	(3.61%)	NA	(NA)	NA	(NA)	4.66%	(3.78%)	NA	(NA)	0.13%	(5.14%)	-1.33%	x	NA	(NA)
2018	1.12%	(4.02%)	NA	(NA)	NA	(NA)	NA	(NA)	NA	(NA)	-0.07%	(6.26%)	0.45%	(2.15%)	NA	(NA)
2019	2.04%	(3.76%)	-4.97%	(2.69%)	-5.82%	x	NA	(NA)	NA	(NA)	0.79%	(6.43%)	-8.97%	(3.66%)	NA	(NA)
2020	2.24%	(3.31%)	NA	(NA)	NA	(NA)	NA	(NA)	NA	(NA)	0.21%	(5.23%)	3.84%	(12.43%)	2.10%	(1.03%)
2021	2.00%	(3.27%)	NA	(NA)	NA	(NA)	NA	(NA)	NA	(NA)	1.79%	(5.27%)	0.57%	(11.86%)	NA	(NA)
2022	3.25%	(4.32%)	NA	(NA)	NA	(NA)	NA	(NA)	NA	(NA)	1.53%	(11.68%)	NA	(NA)	NA	(NA)
All	1.55%	(4.08%)	1.59%	(3.45%)	-4.48%	(1.26%)	0.76%	(2.45%)	NA	(NA)	0.55%	(6.00%)	-2.69%	(6.31%)	2.10%	(1.03%)

Note: "x" in this table means that standard deviation cannot be calculated as there is only 1 sample in the strata

As shown in Table 11 and 12 above, very little data is available for Statistical Areas 1, 3, 5, 10-13 and 15.

Overall, positive values are high in Statistical Areas for which some data are available, with Statistical Area 4, 7 and 9 tend to record positive and relatively high values (i.e. recording lower weight in CTF). However, Given the slight Weight Difference for both GGO and GGT and the fact that Weight Differences fall within the range of ± 5 % for most SBTs (even when standard deviations are taken into account), it seems difficult to explore compliance trends in the fishing ground from "Statistical Area" perspective.

6. Conclusion
(1) The results of the trial analysis carried out in this document and additional comment are summarised below.
- The Market Survey data provided by Japan and the CTF data held by the Secretariat (2010 – mid 2022) were cross-verified. Overall, there was a high (98.16%) matching of readable tag numbers in the market data against the CTF tag data. This suggests that the large weight discrepancies observed were not a result of incorrectly matched fish.
- Japan improved the original Market Survey data (particularly tag number information) and significantly increased the number of samples that can be compared with the CTF data. The coverage of the Japanese market survey data relative to the total CTF data in 2021 (the most recent year in which the fishing season ended) was high for Japan at 6.73 %, with Korea, New Zealand and Taiwan at around 2 %, but very low for the other members. As a precondition for discussion, it is still necessary

to consider that whether the data obtained from the Japan's Market Survey can be regarded as sufficiently representative of each Member's SBT, to enable it to be used as a basis of assessment by the Compliance Committee.

- To improve the coverage (and hence the representativeness of Market Survey data), the simplest and surest way would be to increase the survey frequency. However, it is not straightforward to increase representativeness equally for all Members considering very low coverage for some Members and increasing off-market transactions.
- Verification of reported catch by Members with CDS data and CDS tag survey data obtained from Japanese market was conducted. Following the recommendation by CC16, outliers (over ±20% weight difference) are excluded from the dataset for analysis. As the large part of matched records (approximately 85%) fall ±5% Weight Difference range, it could be qualitatively stated that the catches reported by Members through the CTF are reasonably accurate.
- Some additional comparison (with the latest data set excluding outliers) were conducted. Some data elements available from Market Survey and CTF data may serve as indicators for the Commission and/or Members to target monitoring and guidance in terms of compliance with CDS requirements (i.e. which Members, which product types, and which Statistical Areas fishers and/or farm operators tend to over-report or under-repot the weight of fish).
- The comparison by Member/Year suggested that fishers and/or farm operators in all Members are making accurate reporting of SBT weights through CTFs. However, the number of samples in each cell varies greatly, hence the reliability of the results is biased by Member/Year. Consequently, any conclusion based on the above results should be considered with caution. It seemed difficult to explore compliance trends in the fishing ground from "Product type" or "Statistical Area" perspective.
- It should be noted that the twice-monthly Japanese Market Survey that Japan has been conducted independently to obtain Japan's Market Survey data is proposed to be funded by CCSBT from 2023. This proposal will be discussed at 2022 annual meeting.

(2) The Compliance Committee is invited to:
- Review the result of this trial analysis for verification of reported catch by Members with CDS data and CDS tag survey data obtained from Japanese market, repeated by the Secretariat taking account of recommendations by CC16, and consider whether or not this analysis is useful for CC's assessment and discussion;
- Decide whether this analysis should be carried out again next year; and
- If so, make clear recommendations to the Secretariat on what needs to be included for the next analysis.

Prepared by the Secretariat
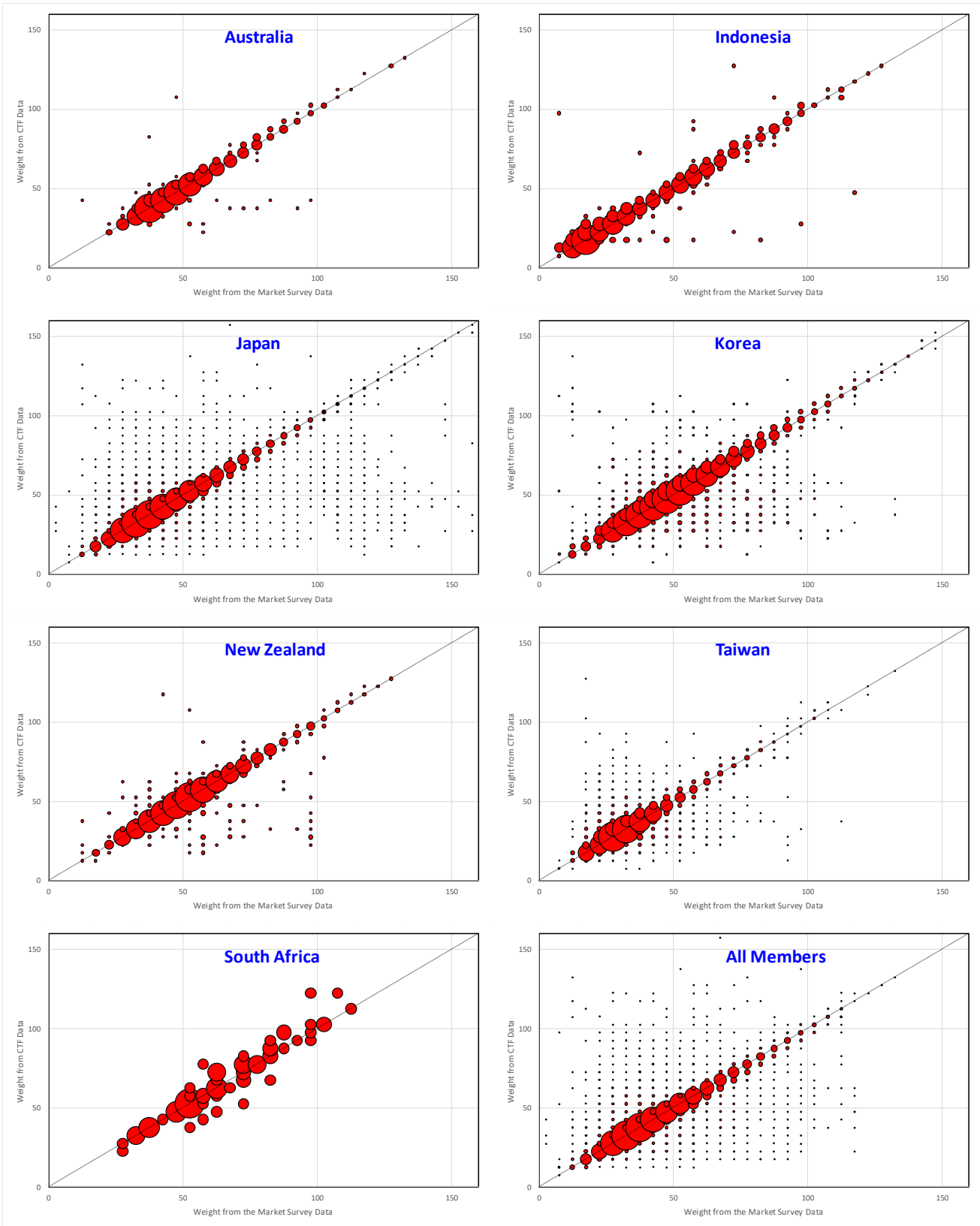
Comparison between weight data from the Market Survey (kg, horizontal axis) and from CTF data (kg, vertical axis). Each bubble in the bubble plot represents the number of records within 5kg bin (i.e. the higher the count, the larger the bubble. Black dotted line indicates 1:1. Note: the scale of bubble size is not the same between graphs as it is relative to total sample size for each Member.
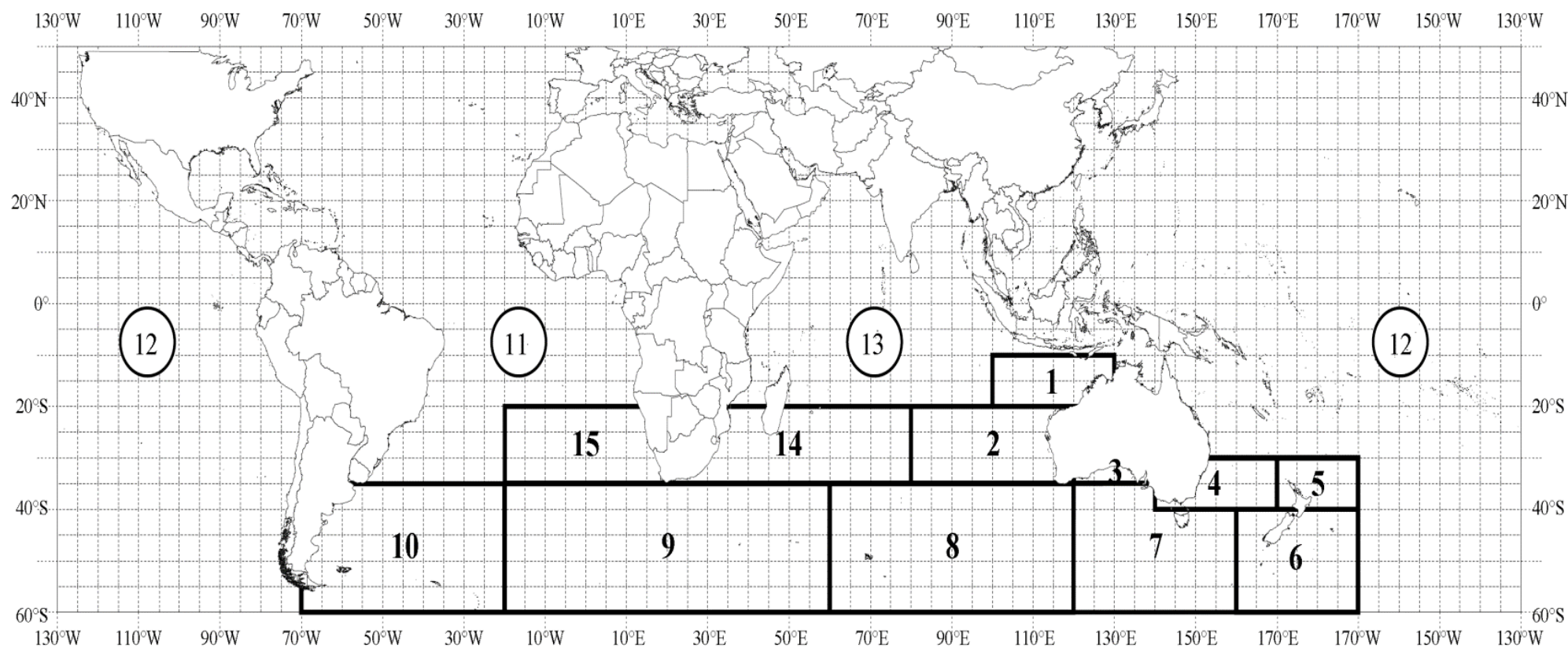
CCSBT Statistical Area (extracted from Appendix 1 of the CCSBT CDS resolution).