THE EFFECT OF ALTERNATE RAISING FACTORS ON THE ESTIMATED CATCH OF SBT BY THE INDONESIAN LONGLINE FISHERY

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ABSTRACT

Four forms of export data were compared as raising factors (as recommended by the Indonesian Catch Monitoring Review Workshop) to estimate the total catch of SBT by the Benoa-based longline fishery. Raises based on whole fresh and frozen exports generally produced higher estimated catches than raises using other export categories. However, in some months the estimates based on the non-USA and European exports exceed those based on the whole and fresh frozen categories. The next highest estimates in general were those based on non-USA and Europe tuna exports, followed by Japan tuna exports and fresh tuna exports. The greatest differences in estimates occurred when there were high catches of SBT due to the larger SBT landings that were raised.

There are at least three confounded sources of biases contributing to each of the various raising factors:

1. All tuna that are graded as export quality at the time of landing (especially grade c) are not actually exported as whole tuna. Some are not exported, and some are exported as loin etc.
2. Exporters may miss record the product type on the packing list that is sent to Dinas. The most common error is that exporters do not always distinguish frozen loins from frozen whole tuna.
3. Compilation errors when the data are aggregated by Dinas into monthly totals. Discrepancies were found both in the designation of product types and export destinations.

Each of these sources of bias can contribute differentially (both in direction and magnitude) to the overall SBT catch estimates depending upon which raising factor is used. However, it is important to note that the first source will contribute a negative contribution no matter which raising factor is used. If misclassification bias was the only source of bias in the Dinas statistics, it would appear that using the non-USA and Europe exports is likely to provide a better raising factor than whole fresh and frozen exports. The use of whole fresh tuna is likely to underestimate total catches of SBT as a portion of frozen whole tuna is likely to have been wrongly assigned by Dinas and should have been whole fresh tuna.

There is no direct information on the extent to which export graded tuna are not exported as whole tuna (i.e. source 1 above). However, estimates produced by the IOTC sampling program may provide some indication, as these estimates are generally higher than the CSIRO/RIMF estimates. In all months the IOTC estimates would be substantially higher then estimates based only on non-USA and Europe exports or on fresh tuna exports. This suggests that substantial negative biases may exist in using any of the suggested raising factors derived from the Dinas statistics and that estimates based on Dinas export whole fresh and frozen tuna are not likely to constitute reliable upper bounds for the estimated landings of SBT.

1. Introduction

The Indonesian Catch Monitoring Review Workshop held in Queeenstown on 10-11 April 2003 recommended that further work should be carried out to determine the

possible errors resulting from raising using Dinas export data. The issue being that the whole fresh and whole frozen tuna components of the Dinas export statistics used by CSIRO/RIMF might not correspond directly to the export component monitored at processors. It was shown that in the analysis of packing list data for 2001 and 2002 by CSIRO/RIMF (Davis and Andamari – CCSBT-ICM/0304/7), that there were inconsistencies in comparison with the Dinas compiled export data that would suggest that whole frozen tuna could have been miss-assigned and might be part of either the whole fresh tuna or frozen tuna fillet categories. It was also noted that a large part of frozen tuna is exported as fillets/loins to Europe and USA. As a result it was suggested that three different approaches could be used to estimate raising factors and thus provide some indication of the range of uncertainty in using the export statistics as a raising factor.

2. Methods

Three forms of the export data were suggested by the Indonesian Catch Monitoring Review Workshop. These were:

1. The whole fresh and whole frozen tuna categories as use in the past by CSIRO/RIMF. These data was available for the entire catch monitoring series (back to January 1993).
2. The whole fresh tuna category. These data were available back to January 1995.
3. Dinas tuna exports to non- USA and European countries as provided by Japan. These data were available back to January 1996.
4. A fourth category was also used because it provided a useful comparison with the whole fresh tuna category – Dinas tuna exports to Japan. These data provided by Japan were available back to January 1996.

The four types of export data were used to determine the raising factor as described by Davis and Andamari (CCSBT-ICM/0304/6) and applied to the catch monitoring data. The estimated SBT catches were determined monthly for all years that the export data were available.

3. Results

The monthly landings of SBT estimated by using the four raising methods have been compared in a scatterplot matrix (Figure 1). The currently used method (whole fresh and whole frozen tuna) consistently provided higher estimates than the other methods. Non-USA & Europe provided consistently higher estimates than Japan exports, and the whole fresh tuna category consistently resulted in the lowest estimated landings. The greatest differences occurred in the months of highest catches which were most often in January (Figure 2).

The annual estimated landings of SBT for the four raising factors are presented in Figure 3 and Table 1. The annual aggregates generally follow the trends shown for monthly estimates using the four raising factors. Whole fresh and frozen tuna provided the highest estimates followed by non-USA & Europe tuna, Japan tuna and

whole fresh tuna. The only exception to this occurred in 2000, when Japan tuna provided a lower estimated landing than whole fresh tuna.

The estimated landings of SBT by spawning season are presented in Figure 4 and Table 2. Again, the spawning season aggregates follow the trends shown for annual estimates using the four raising factors. This time the Japan tuna provided a lower estimated landing than whole fresh tuna for the 1999/00 spawning season.

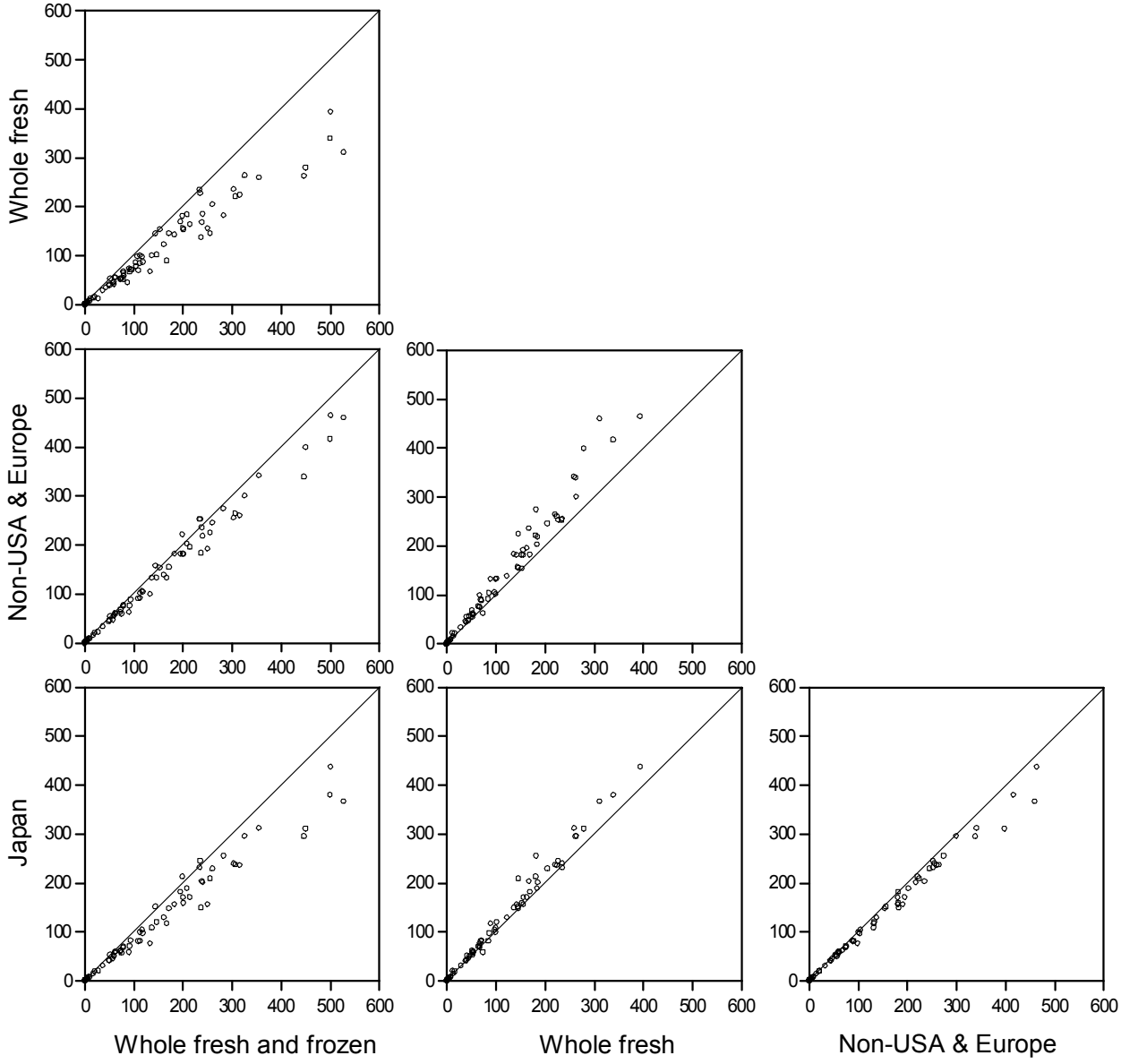

Figure 1. Comparison of the estimated monthly landings of SBT (tonnes) based on raising factors derived from the four Dinas export categories.

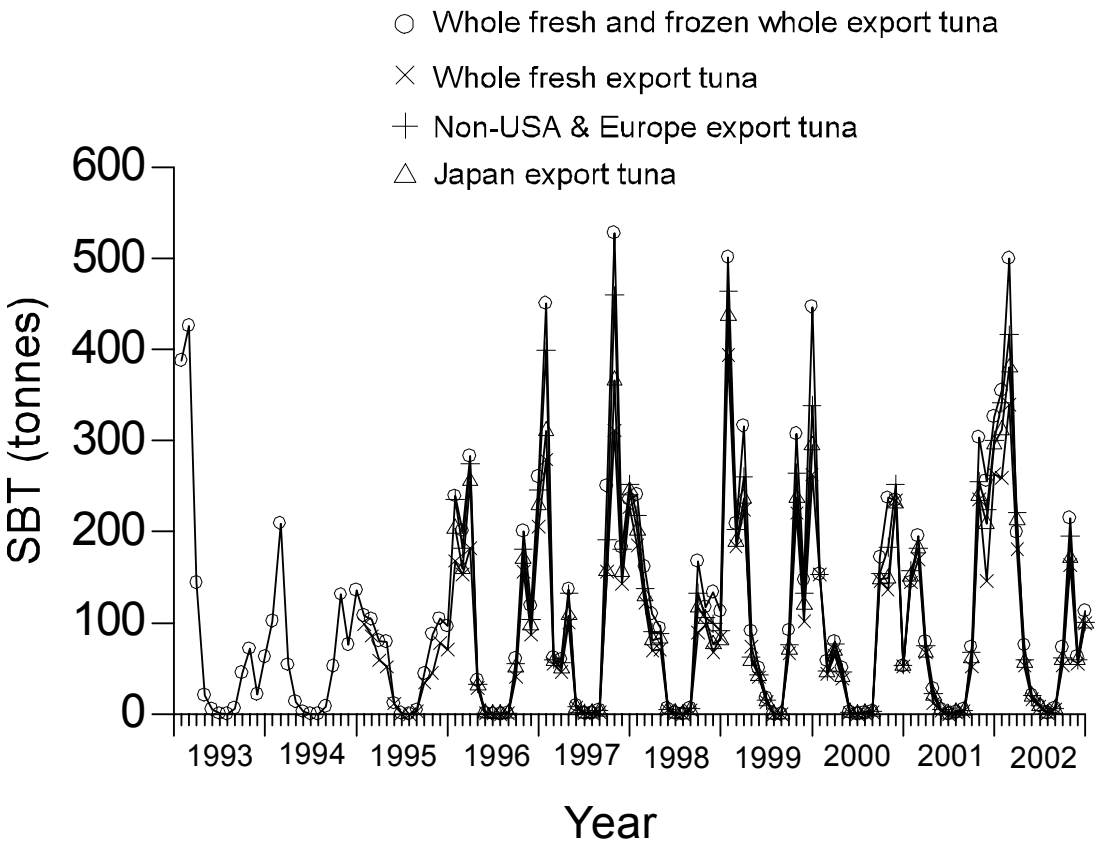

Figure 2. Estimated monthly landings of SBT using raising factors derived from the four export components.

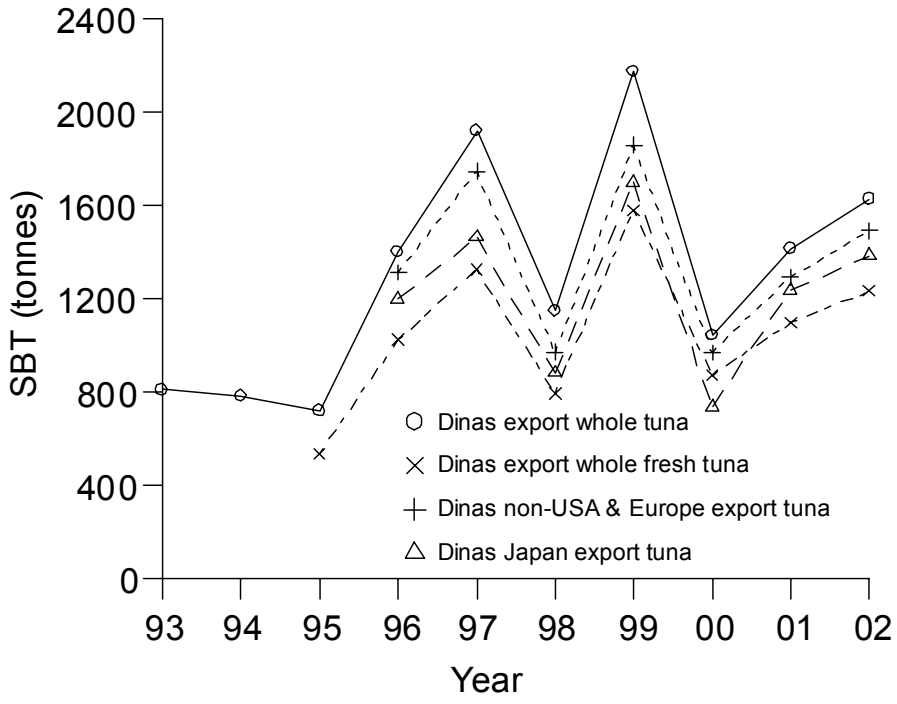

Figure 3. Estimated catch by year using alternate raising factors.

Table 1. Estimated catch of SBT by year using alternate raising factors (tonnes). 1 – Dinas export whole tuna; 2 – Dinas export whole fresh tuna; 3 – Dinas non-USA & Europe export tuna. 4 – Dinas Japan export tuna.

Year	1	2	3	4
1993	811.8			
1994	785.7			
1995	720.8	538.7		
1996	1403.6	1024.5	1313.4	1200.6
1997	1922.1	1328.8	1746.7	1464.3
1998	1151.4	797.1	974.3	884.1
1999	2177.8	1582.3	1859.3	1700.4
2000	1045.7	874.6	972.9	738.1
2001	1418.9	1099.6	1294.8	1237.6
2002	1630.9	1235.1	1493.0	1386.3

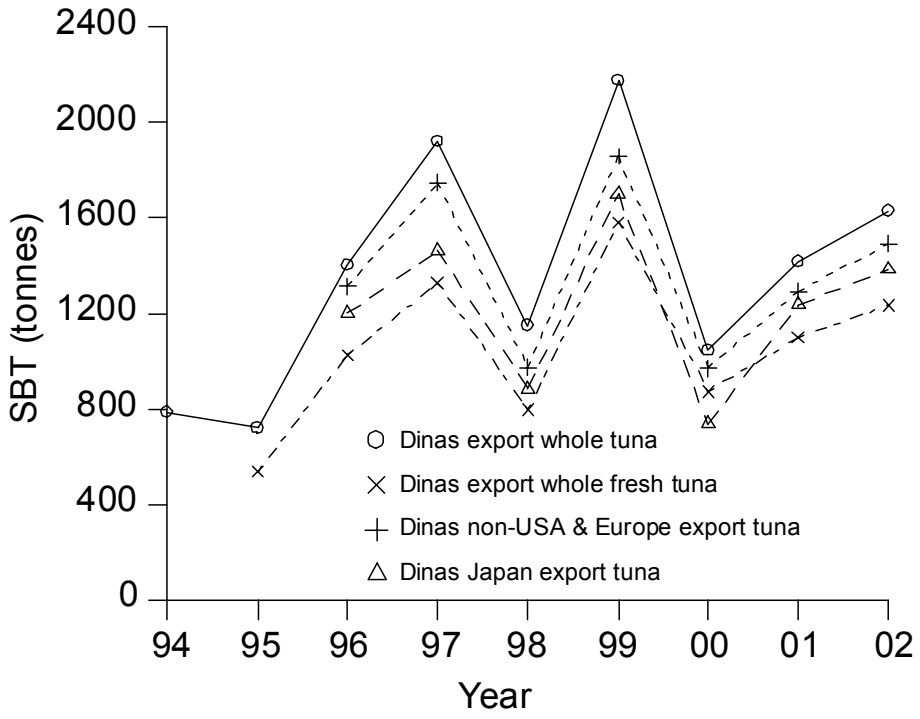

Figure 4. Estimated catch by spawning season using alternate raising factors. The 1993/94 spawning season is denoted as 94.

Table 2. Estimated catch of SBT (tonnes) by spawning season using alternate raising factors. 1 – Dinas export whole tuna; 2 – Dinas export whole fresh tuna; 3 – Dinas non-USA & Europe export tuna. 4 – Dinas Japan export tuna.

Spawning season	1	2	3	4
1993/94	589.1			
1994/95	787.9			
1995/96	1098.9	764.6		
1996/97	1361.9	979.6	1243.9	1085.5
1997/98	1815.1	1294.0	1629.4	1428.3
1998/99	1722.9	1273.8	1482.1	1361.9
1999/2000	1337.4	953.5	1136.8	876.0
2000/2001	1154.1	970.3	1088.8	1010.8
2001/2002	2125.9	1559.6	1921.8	1802.0

In relation to the results plotted in Figure 1 we noted that the largest deviations in estimates occurred in the months of largest catches. Here we examine whether this was simply a result of the catch size or whether there were trends caused by differences in Dinas export categories in those months. The difference between raising factors based on whole fresh and frozen export tuna and that derived from non-USA & Europe export tuna and that derived from whole fresh export tuna have also been plotted against month in Figure 5. There does not seem to be any increase in the difference between raising factors in months of high SBT catches, in fact the difference is less in those months. Overall, non-USA & Europe export tuna provided a raising factor about 10% less than that for whole fresh and frozen tuna exports, and whole fresh export tuna a raising factor about 25% less.

The difference between raising factors based on whole fresh and frozen export tuna and that derived from non-USA & Europe export tuna and that derived from whole fresh export tuna have also been plotted against year in Figure 6. There does not seem to be any year trend in the difference between raising factors with non-USA and Europe export tuna providing a raising factor about 10% less than whole fresh and frozen tuna exports, and whole fresh export tuna a raising factor about 25% less.

Table 3. Comparison of the export tuna product categories (fraction) as compiled by Dinas and CSIRO/RIMF for 2001 and 2002.

2001	Dinas		CSIRO/RIMF	
	Fresh	Frozen	Fresh	Frozen
Whole	0.58	0.21	0.51	0.04
Loin	0.03	0.19	0.03	0.43

2002	Dinas		CSIRO/RIMF	
	Fresh	Frozen	Fresh	Frozen
Whole	0.58	0.17	0.63	0.04
Loin	0.03	0.21	0.03	0.30

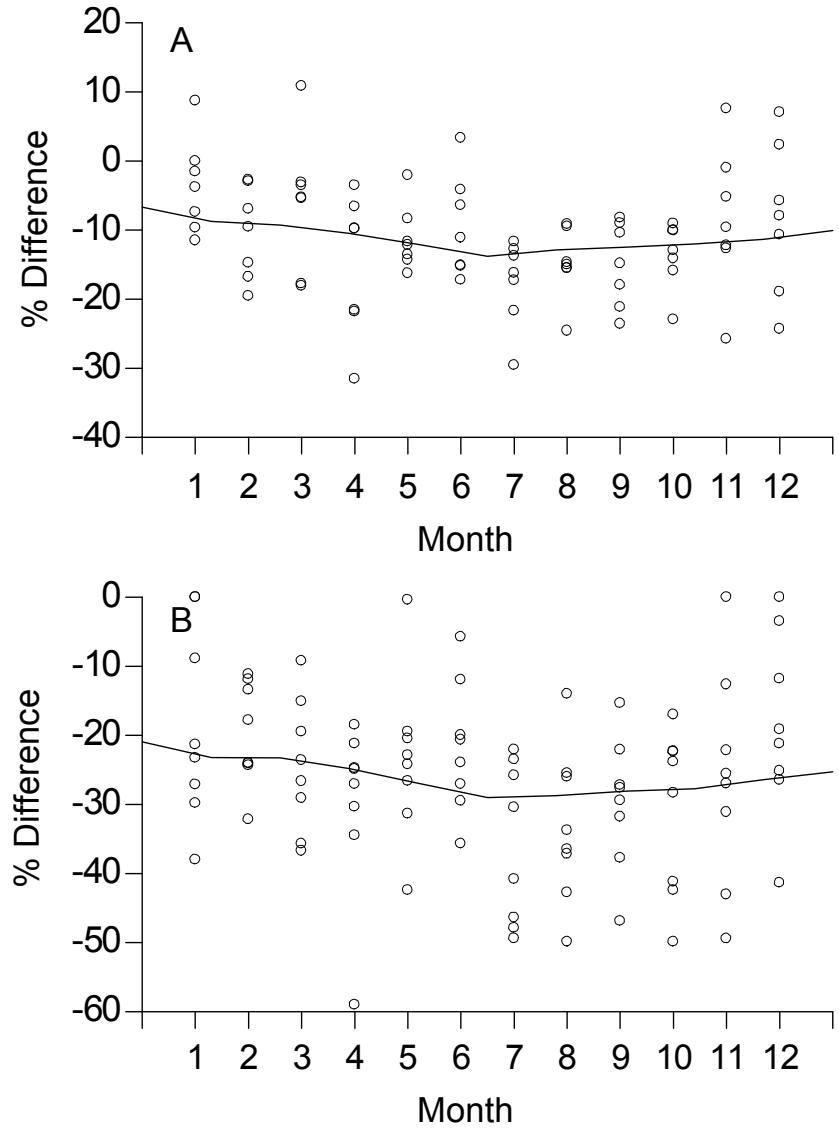

Figure 5. Difference (percent) between raising factor based on whole fresh and frozen export tuna and that derived from non-USA & Europe export tuna (A) and that derived from whole fresh export tuna (B) plotted against month.

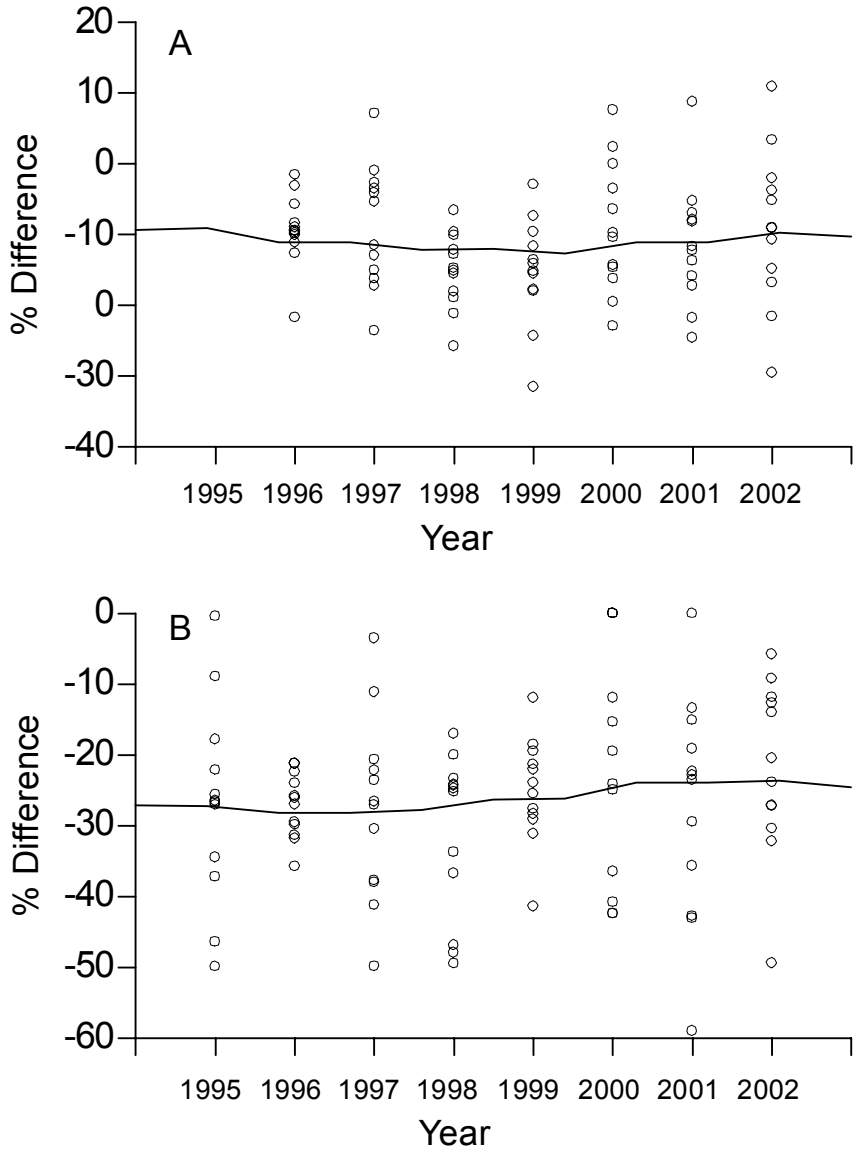

Figure 6. Difference (percent) between raising factor based on whole fresh and frozen export tuna and that derived from non-USA & Europe export tuna (A) and that derived from whole fresh export tuna (B) plotted against year.

Table 4. Comparison of estimated coverage of IOTC/CSIRO monitoring during July–December 2002 using estimates based on vessel activity (IOTC/CSIRO) and Dinas export whole tuna (CSIRO/RIMF) and corresponding estimated landings of SBT. Note that the largest difference between estimates (-31.2%) occurs in December.

	IOTC/CSIRO		CSIRO/RIMF		Difference %
Month	Coverage %	SBT kg	Coverage %	SBT kg	
7	17.5	910	17.2	938	3.1
8	20.4	7,012	22.3	6,600	-5.9
9	21.4	87,943	23.3	73,021	-17.0
10	21.0	241,982	23.6	214,671	-11.3
11	20.0	67,664	23.2	62,929	-7.0
12	15.4	164,619	25.1	113,199	-31.2
Total		570,130		471,358	

4. Discussion

Catch estimated raised using the whole fresh and frozen exports generally produced higher estimated catches than those raised using other export categories. However, in some months the estimates based on the non-USA and European exports exceed those based on the whole fresh and frozen categories. The next highest estimates in general were those based on those raised using non-USA and Europe export categories, followed by those based on Japan tuna exports and fresh tuna exports. The greatest differences in estimates occurred when there were high catches of SBT, although there were no trends in the difference between raising factors by month or year. The difference was simply due to the larger SBT landings that were raised.

In trying to evaluate the properties of the different raising factors, it is important to consider that there are at least three confounded sources of biases contributing to each of the different raising factors:

1. All tuna that are graded as export quality at the time of landing are not actually exported as whole tuna. Some may be utilized within domestic markets. This is the strategy of PT. Sari Segara Utama because of the small profit margins after airfreight (Davis and Andamari – CCSBT-ICM/0304/7). Most companies only export C grade tuna if there are favourable market conditions in Japan, and if the prices are low they might be exported as fresh of frozen loin, or distributed locally (S. Simorangkir, pers. comm. 2003). There are no data on how frequently this occurs or the proportion of tuna graded as C quality, which might be used to bound the extent of the problem.
2. Exporters may miss record the product type on the packing list that is sent to Dinas. Dinas does not have a specific category format for companies applying for an export permit. The most common error is that exporters do not always distinguish frozen loins from frozen whole tuna. The extent to which this occurs is unknown.
3. Compilation errors when the data are aggregated into monthly totals. From the analysis of packing list data (Davis and Andamari – CCSBT-ICM/0304/7) it was shown that there were discrepancies between the CSIRO/RIMF compilation of categories and that by Dinas. These discrepancies indicate that substantial classification errors in the compilation of the monthly totals occur. Discrepancies were found both in the designation of product types and export destinations, although the errors are more likely to apply to product type (fresh or frozen whole tuna in particular).

Each of these sources of bias can contribute differentially (both in direction and magnitude) to the overall SBT catch estimates depending upon which raising factor is used. However, it is important to note that the first source will contribute a negative contribution no matter which raising factor is used.

In terms of compilation errors, the original rationale for raising using whole fresh and frozen tuna, was not because it was thought that whole frozen tuna corresponded to the export category in processing rooms. It was considered unlikely that tuna would be exported whole frozen because of the relatively poor price that it would realize. Thus, using the combine whole and frozen categories would avoid miss classification errors. The CSIRO/RIMF analysis of the 2001 packing list data

indicated that in fact only a small part of the frozen whole tuna belongs in this category. Thus, only ~4% of all exported tuna based on the packing lists should have been placed in this category compared to 21% in the Dinas statistics. However, further analyses of these data suggest that most of the frozen whole category should have been classified as loins and that there may also be some miss-classification of fresh whole tuna (Table 3). Overall, the CSIRO/RIMF analysis of 2001 packing list data indicated that ~55% of all export tuna products in the packing lists are in fact whole tuna compared to 79% in the Dinas statistics. To the extent the CSIRO/RIMF packing list analyses are representative of the "true" packing list data, they would suggest that the resulting estimates would be positively biased by ~20%. In addition, if all of the remaining frozen whole tuna in the Dinas data (~4%) was in error from exporters misclassifying loins as whole frozen tuna on their packing lists (source 2 above), this would be an additional source of positive bias. Note it is not clear whether there is any whole frozen tuna actually being exported from Bali or whether the entire classification into this category is an error from either source 2 and 3 listed above. In a subsequent analysis of 2002 packing list data (Table 3) these differences are not so marked. CSIRO/RIMF analysis indicated that ~ 67% of all export tuna was whole tuna compared to 75% by Dinas. This would result in a positive bias of 9% in estimated landings. It also indicates that miss-classified frozen can come from either the whole fresh or loin categories and that this may have varied substantially among years.

It is important to note that even if there is miss-classification of loins as frozen whole tuna and no frozen whole tuna are being exported this does not mean that the overall estimate based on all whole tuna exports would be positively biased because of source 1 listed above (i.e. some of the loins may have been taken from export graded C fish). This is discussed further below.

The rationale for using non-USA and Europe export tuna as obtained by Japan was to exclude most exports that were likely to be frozen loin/fillet or tuna that were not likely to have passed through the Benoa processing rooms (i.e were transhipped to Bali from other parts of the Archipelago for export). The remaining exports were then considered to be more likely to correspond to the tuna graded as export in the processing rooms. Using tuna exported to Japan as a raising factor was also considered as it represented a more extreme version of the non-USA and Europe export tuna raising factor. The CSIRO/RIMF analysis of packing list supports to some extent the use of the destination in the packing list as an estimate of whole fresh tuna in terms of compilation error. Thus, based on the CSIRO/RIMF analysis less then 1% of whole fresh tuna were exported to non-Asian countries and over 98% of it was exported to Japan. The use of non-USA and Europe tuna exports to raise catches could contain both positive and negative bias. Positive biases would exist because part of this category will include fillet/loins and negative biases because some of the whole tuna may have been exported to non-Asian countries. Based on the CSIRO/RIMF analysis of packing list data, approximately 13% of the exported tuna to Asian countries was in the form of loins, while 3% of the whole tuna (primarily frozen) was exported to Europe or the US. This would suggest an overall positive bias of ~10.

If misclassification bias was the only source of bias in the Dinas statistics, it would appear that using the non-USA and Europe exports is likely to provide a better raising factor than whole fresh and frozen exports. The difference between the two raises probably accounts at least in part for that portion of the whole frozen tuna category that is incorrectly assigned to whole frozen and should have been frozen fillet/loin.

The use of whole fresh tuna is likely to underestimate total catches of SBT because, as discussed previously, a portion of frozen whole tuna is likely to have been wrongly assigned by Dinas and should have been whole fresh tuna.

There is no direct information on the extent to which export graded tuna are not exported as whole tuna (i.e. source 1 above), but are either consumed domestically or exported as loins. However, estimates produced by the IOTC sampling program may provide some indication, as these estimates are considered to be unbiased and are independent of the Dinas estimates. In Table 4, data collected under the IOTC sampling are presented with raising factors based on the IOTC method (vessel activity) and that previously used by CSIRO/RIMF (Dinas export whole fresh and frozen tuna). The resulting estimated monthly landings of SBT are generally lower for the CSIRO/RIMF estimates. In only one month are they higher by 3.1%. In the other months they are 5.9, 17, 11.3, 7 and 31.2% lower. In all months the estimates would be substantially higher then estimates based only on non-USA and Europe exports or only on fresh tuna exports. This suggests that substantial negative biases may exist in using any of the suggested raising factors derived from the Dinas statistics (presumably as a result of exported graded tuna not being exported as whole tuna). This would indicate that estimates based on Dinas export whole fresh and frozen tuna are not likely to constitute reliable upper bounds for the estimated landings of SBT. This would suggest using a raising factor based on all exported tunas in the Dinas statistics might provide a reliable upper bound (but clearly not best) estimate for SBT landings in Bali. While the estimates based on the different raising factors provide an indication of the level of uncertainty induced in the estimated landings by the raising factor, they provide little basis for determining a “best” (in terms of unbiased) estimate.

5. References

Davis, T.L.O. and Andamari, R. 2003.The CSIRO/RIMF monitoring systems used to determine the catch of SBT by the Indonesian longline fishery. CCSBT Indonesian Catch Monitoring Review, 10-11 April 2003, Queenstown, New Zealand. CCSBT-ICM/0304/6.

Davis, T.L.O. and Andamari, R. 2003. Analysis of 2001 Dinas packing list data by species, product and destination. CCSBT Indonesian Catch Monitoring Review, 10-11 April 2003, Queenstown, New Zealand. CCSBT-ICM/0304/7.