

REVIEW OF TASK II CATCH AND EFFORT DATA FOR TAIWANESE LONGLINE FLEET, 1976-78

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I. Introduction

Since 1975, there have been two sets of Task II catch and effort statistics (by 5x5 area and by month) for the Taiwanese longline fleet in the Atlantic. One set was traditionally collected and compiled by the Taiwan University based on daily radio reports and daily logbooks. The other set was collected at transshipment ports and compiled by the Secretariat based on logbook abstracts. The former includes all species while the latter mainly has catches of yellowfin, albacore and bigeye only.

The coverage rates are 30-60% for the Taiwan University data and about 50-60% for the ICCAT data. Unfortunately, both sets of statistics seem to be biased in the areas covered; the Taiwan University data have better coverage in the south Atlantic and ICCAT data have better coverage in the north Atlantic. These were compared and the biases were demonstrated by Laurent (SCRS/79/15 in Collective Volume IX(2):338-343).

In order to remove these biases and make more correct estimates, the Secretariat contracted the Far Seas Fishery Research Laboratory who in turn sub-contracted the Taiwan University to compile Taiwanese tuna landing statistics for major species in Atlantic transshipment ports. Using these landing values, Kume and Yang (SCRS/80/67 - Revised in Collective Volume XV(2):191-201) reported north-south separations of Taiwanese albacore catches (Task I statistics).

The ICCAT Secretariat, in cooperation with the Far Seas Fishery Research Laboratory and the Taiwan University, extended this work to Task II catch and effort statistics (by 5°x5° area and by month).

II. Method and Procedures Used

A. Since the CHI-ICAT file (Taiwanese data from the ICCAT port sampling program) has catches in weight while the CHI-TAI file (Taiwanese data by the Taiwan University) has catches in number of fish, CHI-TAI catches were converted into weight using average weight tables. The average weights (shown in Tables 1-3) were prepared by Kume based on ICCAT port sampling. The averages are calculated for ICCAT area, quarter and year. For the strata where no data are available, the average weight of Korea's catch (also by port sampling) was used. For the strata where neither Taiwanese nor Korean data are available, Japanese average sizes were substituted.

B. Data in the CHI-ICAT and CHI-TAI (converted into weight) files were combined. In other words, if data exist in both files for the same 5°x 5° area and month stratum, both efforts and catches of each species (yellowfin, bigeye and albacore only) were added to make a new record for that stratum.

C. This new file was then weighted to the total catch of albacore separately for the area north of 5°N and for the area south of 5°N of the Atlantic. Naturally, the north-south catches of albacore are those agreed upon by the SCRS (SCRS/80/67 and Statistical Bulletin 10).

The weighting factors were calculated as follows:

$$W.F. = \frac{\text{Official statistics divided into quarter-N/S area strata}}{\text{Sum of albacore catch in the combined file in the corresponding strata}}$$

These are shown in Table 4. The factors are calculated by quarter and north-south areas (using 5°N as the dividing line).

Factors for a few areas were less than 1, as expected.

D. The weighting factors were applied not only to albacore data but to bigeye and yellowfin catches and to the effort as well, on a quarter-north/south area basis. However, the file still maintained the 5°x5° and month strata. This new weighted file is called "CHI-COMB" and kept on the ICCAT data base as the final file for Taiwanese catch and effort for yellowfin, albacore and bigeye. The catches in this file are in terms of number of fish, after converting weight using average weight tables (Tables 1-3).

III. Results and Discussions

The reason for adding the catches and efforts of the CHI-ICAT and CHI-TAI files is as follows: both files are based on very similar rates, and one is biased to the north and the other is biased to the south. Combining actually means taking the weighted average of the two. For example, if file A has five times more data for a specific area-time stratum than file B, in the combined file the file A catch will be counted with five times more weight than the file B catch.

Since the weighting (raising) factors of combined statistics are based on albacore catches, the effects of combining and raising would be quite different for different species. Therefore, the results are evaluated separately by species.

A. Albacore

In Figure 1, albacore catches reported in the CHI-TAI file, in the CHI-ICAT file and in the CHI-COMB file are compared. The top number in each

square represents CHI-TAI (unraised), the middle number represents CHI-ICAT (unraised) and the bottom number is CHI-COMB (raised).

The data are shown in this figure by quarter, while in the file they are by month. It is interesting to observe that one set of data compensates the other (CHI-ICAT and CHI-TAI). In the southeast Atlantic, both series have very similar data coverage; in the southwest Atlantic, CHI-TAI has much better coverage than CHI-ICAT, and in the northwest to the north central Atlantic, CHI-ICAT has much better coverage.

Since the southwest Atlantic is the only area where CHI-ICAT has low data coverage, the catch in that area could have been underestimated in the CHI-COMB file while the southeast Atlantic could be slightly overestimated. However, as raising is done separately for the north and south, the bias between the north and south, which is more important for albacore, should be minimal.

Table 5-1 compares 1978 albacore catches (in terms of number of fish) and catch-per-effort (number of fish per 1,000 hooks) between the two series of data and combined data. Again, data from the Taiwan University (CHI-TAI) and from ICCAT port sampling (CHI-ICAT) are not raised while those in the combined file are raised. In this table data are compiled by ICCAT sampling areas and by quarter.

From this table, it is clear that CHI-ICAT has better coverage in the north (AL 31 and 32) while CHI-TAI has better coverage in the south (AL 34). As stated in the Statistical Series, ICCAT port sampling effort data are perhaps overestimated, since many boats reported days at sea instead of fishing days. This can be noted in the lower catch per effort for CHI-ICAT. In general the trend in catch per effort among areas and quarterly periods is very similar between the two data sets. The catch per effort for the combined file shows intermediate values of the two data sets, and the large variations observed in catch per effort between strata for each set of data are narrowed in the combined catch per effort. Whether or not the catch

per effort of the combined file can be used without adjustment together with the CHI-TAI files for the period prior to 1976 still requires discussion.

B. Bigeye

Table 5-2 compares 1978 bigeye catches and catch-per-effort between the two data sets and combined data. Although the total bigeye catch recorded by CHI-TAI and by CHI-ICAT was very close (33,230 fish vs. 32,510 fish), their distribution between areas and quarterly periods was quite different. In the north (LLBE 41, 42, 43, 44), ICCAT data have higher catches indicating higher data coverage. On the other hand, in Area 45, the Taiwan University data recorded high catches. Since ICCAT records show no effort in this bigeye area, small effort recorded by the Taiwan University should have produced relatively high catches. On the contrary, in Area 46 ICCAT records have higher bigeye catches while the Taiwan University data have higher coverage in the area. The reason is not known.

The total 1978 bigeye catch in the combined file is 84,340 fish for 3,971 MT while the Taiwanese Task I catch figure for bigeye is 2,628 MT for 1978. The total bigeye catch in the CHI-TAI file is about 70,000 fish when raised (using CHI-TAI coverage rate). The discrepancy, therefore, seems to be due to the average size of fish used in the conversion of number into weight.

The average weight to obtain 2,628 MT for 70,000 fish is about 37.5 kg while the overall average weight for 3,971 MT for 84,340 fish is 47 kg. This point should be studied further, particularly from the viewpoint of how the Taiwanese total catch in weight was obtained and how the average weight of 37.5 kg was obtained.

The comparison of catch per effort data shows that both series of data are very consistent whenever enough data are available for both series. As the efforts are raised according to albacore catches, catch per effort for combined data could be highly biased. However, this table showed that such bias never occurred. For an area-time stratum where the two series of

data are available, catch per effort of combined data is closer to the catch and effort value with more effort. Since catch per effort of either series (Taiwan University or ICCAT) is free from the bias which may be introduced by the raising procedure, this similarity of the catch per effort for the combined data indicates that there should be very little bias of this type.

C. Yellowfin

Every year since the ICCAT port sampling began, we noted that the total yellowfin catch reported by the port sampling is much higher than the catch reported by the Taiwan University. For some years, the port sampling, which has a coverage rate of only 50%, recorded a higher yellowfin catch than shown by official Taiwanese Task I yellowfin catch. In Table 5.3, this is quite evident. Unraised yellowfin catch from ICCAT sampling and Taiwan University data are 16,620 fish vs. 3,430 fish respectively. The ICCAT figure of 16,620 fish is equivalent to 653 MT while Taiwanese Task I yellowfin catch for 1978 is only 340 MT.

The combined series (raised) estimates 28,122 yellowfin or 1103.4 MT which is more than three times the amount reported officially. The discrepancies are too large to be explained either by a possible bias through adopted weighting (raising) procedures or different average size of fish used (such as in the case of bigeye). It is definitely due to higher catches reported by the ICCAT port sampling. The difference should be further pursued in the future.

Catch per effort data are quite consistent between the CHI-TAI series and the CHI-ICAT series. The combined catch per effort again showed values close to the higher of the catch per effort of both series in the same stratum. Contrary to albacore and bigeye, ICCAT catch per effort is higher than those for CHI-TAI. This is the reflection of higher catches reported by ICCAT port sampling.

IV. Conclusion

It seems that the catch and effort file generated by combining CHI-ICCAT and CHI-TAI files has relatively little bias in terms of catch and effort and presents more correct overall patterns of catch and effort for all species. Albacore catches are also well estimated in terms of area and time. However, totals of bigeye and particularly yellowfin catches included in the combined file are much higher than those reported in Task I statistics. The discrepancies for bigeye may be due to using different average weight of fish in conversion of number of fish into weight. However, the discrepancy for yellowfin is much more serious, as it goes back to the difference in yellowfin catch recorded in the logbook abstracts between two surveys.

These should be further studied, even though yellowfin is not an important species in Taiwanese catch data. Possible overestimates of effort (underestimates of catch per effort) by ICCAT port sampling data can also be studied in the future.

Table 1. Quarterly average size (kg) of albacore caught by Taiwanese longline fleet, by ICCAT albacore areas for the years 1976-78 (w table).

Year	Qtr.	ICCAT albacore areas			
		31	32	33	34
1976	I	17.5	18.9*	22.1	15.4
	II	20.2	21.9	17.8	12.9
	III	17.0	24.2	18.6	15.1
	IV	17.9	18.1	25.0	17.8
1977	I	18.5	18.9*	22.1*	14.4
	II	20.2**	21.6	13.6	13.9
	III	18.7	25.4	14.4	14.4
	IV	17.0	20.5	20.1	15.5
1978	I	18.3	18.6	22.8	13.8
	II	20.3	23.4	17.8**	11.7
	III	18.7**	22.6	18.5	14.1
	IV	18.8	20.5**	21.4	13.7

*Original figure unreasonable, and recalculation or substitution was made.

**No data available, and substitution was done from the same area and quarter.

Data source: Statistical Series 3, 4, and 7.

Table 2. Quarterly average size (kg) of bigeye caught by Taiwanese longline fleet, by ICCAT bigeye areas for the years 1976-1978 (average) (w table).

ICCAT areas	Quarter			
	I	II	III	IV
41	50.8	(47.8)	47.8	54.8
42	47.8	58.4	57.1	59.1
43	57.6	55.0	55.1	44.0
44	58.9	61.2	48.0	54.6
45	60.0	61.2	44.9	50.0
46	56.8	43.8	58.9	42.2
47	37.7	53.9	36.3	45.0
48	(66.7)	66.7	46.0	(46.0)
49	52.0	51.5	44.2	(44.2)
50	34.8	(43.7)	43.7	44.6

() - substituted

Notes:

1. Based on ICCAT port sampling data, 1977 - 1979, and when Taiwan and KOR-PAN data are not available, Japanese size data are referred to.

Table 3. Quarterly average size (kg) of yellowfin caught by Taiwanese longline fleet, by ICCAT yellowfin areas (average for 1976-78).

ICCAT areas	Quarter			
	I	II	III	IV
11	33.5	39.1	24.0	33.0
12	40.7	42.3	37.0	37.8
14	52.0	31.1	50.1	45.4
15	46.4	45.5	47.2	47.4
16	29.4	45.1	33.5	38.0
17	50.5	31.9	45.1	33.7
18	53.8	42.6	28.7	35.3

Notes:

1. Based on ICCAT port sampling data, 1977 - 1979, and when Taiwan and KOR-PAN data are not available, Japanese size data are referred to.

Table 4. Comparisons of Task I albacore catch and albacore catch in combined file and weighting factors used

Year	Quarter	NORTH*			SOUTH*		
		Task I Catch	Total of Comb. C.	Weight. Factor	Task I Catch	Total of Comb. C.	Weight. Factor
1976	I	5,787	4,777	1.2114	1,745	2,857	0.6108
	II	1,409	1,149	1.2263	4,695	4,647	1.0103
	III	2,226	1,436	1.5501	5,245	4,161	1.2605
	IV	5,415	3,577	1.5138	2,915	2,012	1.4488
	Total (N+S Total)	14,837	10,939		14,600	13,677	
1977	I	4,659	3,353	1.3895	2,629	2,327	1.1298
	II	2,240	1,598	1.4018	6,791	6,394	1.0621
	III	2,189	1,685	1.2991	3,857	3,599	1.0717
	IV	4,635	3,349	1.3840	2,815	3,015	0.9337
	Total (N+S Total)	13,723	9,985		16,092	15,335	
1978	I	4,197	2,903	1.4457	3,968	3,478	1.1409
	II	2,040	1,352	1.5089	7,250	5,091	1.4241
	III	1,347	1,016	1.3258	5,735	4,192	1.3681
	IV	1,740	963	1.8069	3,514	3,776	0.9306
	Total (N+S Total)	9,324	6,234		20,467	16,537	

Task I catch = basic albacore catch of Task I divided into quarter and north-south by landing data (see SCRS/80/67)

Total of Comb. C. = Total albacore catches in the quarter/north-south strata of the combined file (see text II.C.)

Weight. Factor = Task I Catch/Total of Comb. C. (weighting factors)

*North-south division at 5°N.

Table 5. Comparison of 1978 catch (No. of fish) and catch per effort (hooks) by ICCAR area and quarter of data reported by Taiwan University, ICCAR port sampling and data combined.

5.1 ALBACORE

Species	Area	Qtr	Catch (100 fish)			C (no./E (1000 hooks))		
			Taiwan Univ.	ICCAT	Comb.	Taiwan Univ.	ICCAT	Comb.
ALB	AL 31	1	322	999	1,910	41.0	28.5	30.8
		2	30	78	154	24.1	14.6	15.5
		3	1	0	2	46.2	0	46.1
		4	123	511	899	34.4	32.6	25.9
		T	475	1,588	2,965	37.5	28.3	27.8
	AL 32	1	99	149	378	19.8	23.3	23.0
		2	58	431	738	20.0	18.6	18.8
		3	25	537	595	25.7	20.6	16.6
		4	10	7	24	32.1	9.7	13.1
		T	192	1,123	1,735	20.9	19.9	18.6
	AL 33	1	252	133	412	18.3	23.6	18.6
		2	25	0	36	13.1	0	13.1
		3	102	145	337	20.1	36.0	27.0
		4	562	1,416	1,416	21.4	41.1	24.7
		T	941	1,735	2,201	20.0	38.4	23.2
	AL 34	1	1,094	610	2,195	35.7	24.4	34.6
		2	2,837	843	6,143	45.1	24.1	44.1
		3	1,738	600	3,625	41.0	24.5	39.6
		4	90	291	354	40.1	24.9	27.3
		T	5,759	2,344	12,317	41.7	24.4	40.1
TOTAL		1	1,800	1,890	4,894	48.7	25.5	29.8
		2	2,951	1,353	7,070	51.1	21.3	36.9
		3	1,866	1,282	4,559	0	22.4	32.6
		4	791	2,265	2,693	19.2	35.2	25.2
		T	7,408	6,789	19,216	39.5	26.2	31.9

Table 5. (Cont.)

5.2 BIGEYE

Species	Area	Qtr	Catch (100 fish)			C (no.)/E (1000 hooks)		
			Taiwan Univ.	ICCAT	Comb.	Taiwan Univ.	ICCAT	Comb.
			Unraised	Unraised	Raised			
BET	LLBE 40	1	0	.6		0	1.2	
		2	0	0		0	0	
		3	0	0		0	0	
		4	0	0		0	0	
		T	0	.6		0	1.2	
	LLBE 41	1	4.6	29.1	48.9	.6	.9	.8
		2	.8	.6	2.2	.6	.1	.2
		3	.1	0	.1	1.9	0	2.0
		4	.8	20.8	39.5	.2	1.3	1.1
		T	6.2	50.6	90.7	.5	1.0	.9
	LLBE 42	1	8.7	14.2	33.5	1.9	1.8	1.9
		2	.1	.9	1.9	2.6	.4	.4
		3	0	1.6	2.1	0	.6	.6
		4	.4		.6	.9	0	.9
		T	9.1	16.7	37.8	1.7	1.3	1.4
	LLBE 43	1	.4	.2	.9	.9	.2	.3
		2	.1	4.4	7.0	.1	.3	.2
		3	+	5.1	6.4	.1	.3	.2
		4	0	0	0	0	0	0
		T	.6	9.6	14.3	.2	.3	.2
	LLBE 44	1	0	8.1	9.0	0	6.9	6.7
		2	0	.3	.4	0	.1	.1
		3	0	.4	.6	0	.1	.2
		4	0	0	0	0	0	0
		T	0	8.9	10.1	0	1.4	1.2
	LLBE 45	1	50.5	0	57.7	11.5	0	11.5
		2	18.8	0	26.5	15.1	0	15.1
		3	0	0	0	0	0	0
		4	0	0	0	0	0	0
		T	69.2	0	84.2	12.3	0	12.4

Table 5. (Cont.)

5.2 BIGEYE (cont.)

Species	Area	Qtr	Catch (100 fish)			C (no.)/E (1000 hooks)		
			Taiwan Univ.	ICCAT	Comb.	Taiwan Univ.	ICCAT	Comb.
BET	LLBE 46	1	1.6	1.2	3.2	.2	.3	.2
		2	.1	0	.2	.4	0	.4
		3	.1	1.2	1.7	.8	2.9	2.3
		4	7.1	45.7	49.4	.3	1.4	.9
		T	8.9	48.2	54.4	.3	1.3	.8
	LLBE 47	1	31.1	34.5	75.2	1.3	1.5	1.4
		2	36.7	30.1	96.4	1.0	1.0	1.0
		3	94.4	82.6	242.4	3.1	3.4	3.2
		4	13.0	33.1	42.7	3.4	2.7	2.8
		T	175.2	180.3	456.7	1.9	2.0	1.9
	LLBE 48	1	5.9	1.5	8.3	.8	.6	.7
		2	30.4	3.2	46.9	1.1	.9	1.0
		3	20.5	4.6	34.4	1.2	1.3	1.3
		4	3.9	-	3.6	2.8	0	1.4
		T	60.6	9.2	93.2	1.1	.8	1.1
	LLBE 50	1	0	0	0	0	0	0
		2	0	0	+	0	0	+
		3	+	.5	.6	.1	.4	.4
		4	0	.7	1.4	0	1.0	1.0
		T	+	1.1	2.0	+	.4	.5
TOTAL		1	103.5	89.5	236.7	1.8	1.2	1.4
		2	86.8	39.4	181.2	1.2	.6	.9
		3	115.1	95.9	288.4	2.4	1.7	2.1
		4	26.8	100.3	137.2	.8	1.6	1.3
		T	332.3	325.1	843.4	1.6	1.3	1.4

Table 5. (Cont.)

5.3 YELLOWFIN

Species	Area	Qtr	Catch (100 fish)			C (no.)/E (1000 hooks)		
			Taiwan Univ.	ICCAT	Comb.	Taiwan Univ.	ICCAT	Comb.
			Unraised	Unraised	Raised			
YFT	LLYF 11	1	1.4	17.3	28.4	.1	.5	.4
		2	.4	8.7	13.8	.3	.5	.5
		3	.2	26.2	34.9	.3	1.5	1.4
		4	.9	22.7	42.6	.3	1.8	1.5
		T	2.8	74.9	119.7	.2	.8	.8
	LLYF 12	1	5.4	7.6	18.6	1.7	1.9	1.8
		2	2.2	3.6	8.2	.8	.5	.6
		3	.1	.5	1.0	.3	.3	.3
		4	.4	3.7	7.2	.6	1.4	1.2
		T	8.2	15.4	35.0	1.2	1.0	1.0
	LLYF 14	1	6.6	9.4	18.6	1.4	5.3	2.5
		2	.4	1.0	1.6	.3	.4	.3
3		0	1.2	1.7	0	.4	.4	
4		0	0	0	0	0	0	
T		7.0	11.6	21.9	.9	1.5	1.2	
LLYF 15	1	0	.2	.3	0	.1	.1	
	2	0	0	0	0	0	0	
	3	0	12.9	17.1	0	9.5	9.5	
	4	0	.2	.2	0	.3	.4	
	T	0	13.3	17.6	0	3.3	3.8	
LLYF 16	1	0	0	0	0	0	0	
	2	.2	0	.5	3.1	0	.4	
	3	.3	11.6	15.4	1.6	9.9	8.8	
	4	0	11.1	19.9	0	15.4	15.2	
	T	.5	22.7	35.8	2.1	8.8	8.4	

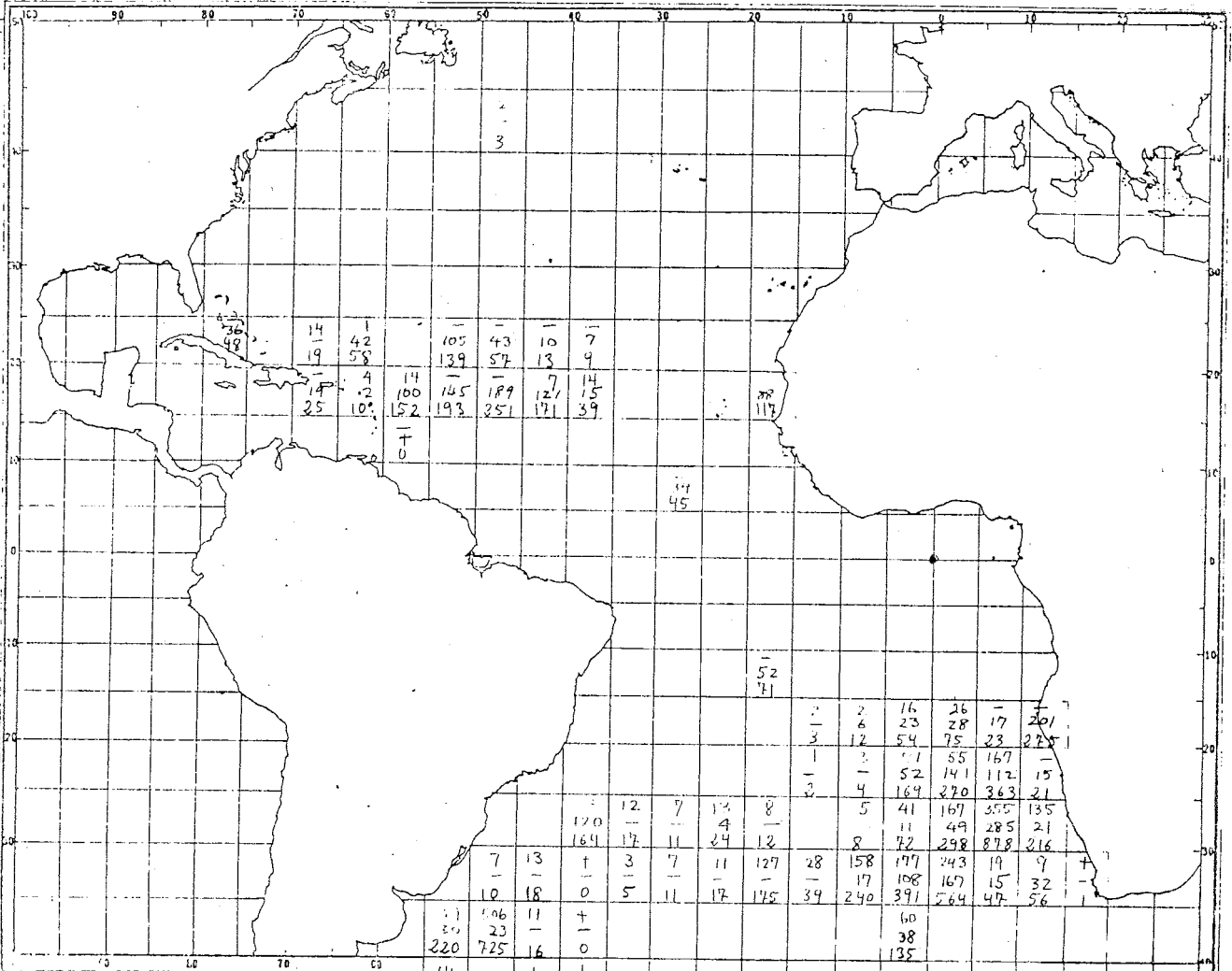
Table 5. (Cont.)

5.3 YELLOWFIN (cont.)

Species	Area	Qtr	Catch (100 fish)			C (no.)/E (1000 hooks)		
			Taiwan Univ.	ICCAT	Comb.	Taiwan Univ.	ICCAT	Comb.
YFT	LLYF 17	1	8.5	19.4	32.3	.3	.9	.5
		2	2.7	3.8	9.0	.1	.1	.1
		3	1.7	.7	3.3	+	+	+
		4	1.1	3.0	4.2	+	.1	.1
		T	14.0	26.8	48.8	.1	.2	.2
LLYF 18	1	.9	.6	1.6	.1	.1	.1	
	2	+	.2	.4	0	.2	+	
	3	.1	.7	1.3	+	.2	.1	
	4	.4	0	.3	.1	0	.1	
	T	1.4	1.5	3.6	+	.2	.1	
LLYF 19	1			0			0	
	2		.3	.5			.1	
	3			0			0	
	4			0			0	
	T		.3	.5			.1	
TOTAL	1	23.1	54.5	99.8	.4	.7	.6	
	2	5.9	17.2	33.9	.1	.3	.2	
	3	2.3	53.8	74.7	.1	.9	.5	
	4	2.9	40.7	74.4	.1	.6	.7	
	T	34.3	166.2	282.9	.2	.6	.5	

+ = minor quantity.

Per III



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Per IV

