SCRS/1994/036 Col.Vol.Sci.Pap. ICCAT, 43 : 147-157 (1996)

Final Report

DATA PREPARATORY MEETING FOR ATLANTIC PELAGIC TUNA LONGLINE FISHERIES

Institute of Oceanography, National Taiwan University
May 11-15, 1994

1. Opening Ceremony

The meeting was opened by the Deputy Director, Mr. Shieh, on behalf of Dr. J.C. Lee, Director of Fisheries Department, Council of Agriculture of the Republic of China (ROC), to express his sincere welcome to those ICCAT scientists attending this Meeting and to assure them of the willingness of his Department to collaborate with ICCAT's scientific works. An opening address (Appendix 2) written by Dr. Ziro Suzuki, Chairman of ICCAT SCRS, was presented on his behalf by Dr. Uozumi.

2. Adoption of Agenda

Chaired by Dr. Uozumi, the Tentative Agenda was adopted except for the exclusion of the items relating to Korea. and Dr. H.C. Liu of the National Taiwan University was nominated and accepted as the co-chairman of this meeting.

3. Review of longline catch and effort data collection and compilation systems by country

3.1 Taiwan

Data collection (logbook collection) and data compilation was pursued by different organizations in accordance with their different functions. The Department of Fisheries, Constructive Bureau, Kaohsiung Municipal Government, taken over from the Taiwan Fishery Bureau, Department of Agriculture and Forestry, Taiwan Provincial Government in 1991, became responsible for logbook release and collection; the Institute of Oceanography, National Taiwan University is responsible for the catch data processing, which depends on the logbooks collected by the former.

Data collected include information on boats, fishing area by 5 degree squares, hooks used, sea surface temperature, bait used, daily catch in number and estimated weight by species, and the size measured from the first 30 captures regardless of species.

All of this information is reported by fishing boats or its the owner company. Aside from logbook catch data compilation, a daily report of the Kaohsiung Fishery Radio Station on the daily location of fishing boats and main target catch is collected for reference. For a preliminary check on the completeness of information provided, those items may either be mailed to the Institute of Oceanography, National Taiwan University, for processing while more complete information is awaited, or be returned to the fishing company to complete as much information as possible.

There are two groups to process catch data of tuna longline fishery in Taiwan, one is for distant water longline fishery and the other for offshore longline fishery. Distant water longline fishery is defined as Taiwanese fisheries based in foreign ports. Task I and Task II data are used for compiling logbook catches into total catches by ocean, by month and by 5-degree squares. In general, thirteen species categories are used; albacore, bigeye tuna, yellowfin tuna, bluefin tuna (or southern bluefin tuna), Atlantic small tuna, swordfish, striped marlin, white marlin, black marlin, billfishes (or sailfish), skipjack, sharks and other species. Task I data are landing data reported from transshipment agencies, and Task II data are the logbook catches, usually raised to the Task I figures.

Logbook data validation by main frame computer was carefully carried out before compilation. About 70-80% of the logbooks submitted were selected for possible use in the compilation. In the last decade, the logbook return has shown a poor recovery rate, which becomes a great dilemma when trying to estimate catch data more accurately. Fortunately, the poor recovery rate of logbooks has improved significantly in 1993 (Hsu and Lin 1996).

3.2 Japan

Longline fishing vessels of over 20 gross tons (GT) in weight have to be licensed and to submit logbook reports to the Government, mandatorily. All longline vessels operating in the Atlantic are over 20 GT, and most are over 300 GT. The submitted logbook reports are checked and summarized by the National Research Institute of Far Seas Fisheries (NRIFSF). The coverage of logbook reports is calculated by the total number of days of operations and the number of cruise logbook reports submitted. It is usually over 90 % and the catch figures are raised up to 100 % by the coverage rates.

ICCAT Task II data, monthly catch in number by species, is summarized in 5 degree by 5 degree block bases from this data. The length measurement data for tunas and billfishes are collected from the fishing ports, research, and commercial vessels and compiled by the NRIFSF. Average weight by 10 degree x 20 degree block, quarter, and species is estimated from average length using the length-weight relationship of each species.

Annual catch weight by species, ICCAT Task I data, is calculated by multiplying the catch number by species by average weight.

As the deep longline fishery has expanded, another statistic, the number of hooks between floats, has been collected by NRIFSF since 1975. In recent years, fishermen have started to use several kinds of new nylon longline gear and the technique is still developing, although not in the Atlantic. Thus, the Japanese Government has revised the format of the logbook report to a new style that includes the type of operation (swordfish, shark and other longline), type of main line (nylon and others), and type of branch line (nylon and others) since 1993 (Chang *et al.* 1993).

4. Review of longline fisheries by country

4.1 Taiwan

The Taiwanese distant water tuna longline fisheries began in the 1960s, and fishing began in the Atlantic Ocean in the middle of the 1960s. Since the 1970s, Taiwanese longline fleets have targeted albacore in both the South and North Atlantic. Furthermore, while searching for fishing grounds, it appears that some of the fleet has targeted tropical species when fishing in regions in which those species are concentrated. A change in gear from regular to deep line to target tropical species occurred in the Atlantic Ocean after 1989.

In 1987, a significant part of the Taiwanese fleet moved out of the north Atlantic, possibly to the south Atlantic, for economic reasons. It is known that those vessels did not change their target species. The total number in the Taiwanese longline fleet operating in the Atlantic in 1993 was 44 super cold freezer boats and 98 regular longliners, almost the same amount as in 1992.

The total tuna catches in the Atlantic by the Taiwanese fleet have been quite stable since the fishery was initiated. In 1993, the total catches of all species were estimated to be about 30,900 tons, which is higher in relation to those in 1992 and 1991, which were about 26,000 tons and 30,500 tons, respectively.

Among the catches, albacore was the predominate species, estimated at about 25,500 tons, which is slightly higher than in 1992 (23,200 tons), and bigeye and yellowfin tuna catches were estimated to be about 2,180 tons. The remainder of the catch was comprised of other species.

The nominal *CPUE* of albacore computed from logbooks shows that the downward trend which started in 1987 stopped in 1991, and an increase has been observed since 1992 in the south Atlantic stock. The nominal *CPUE* in the north Atlantic fluctuates, yet the level is maintained above the 1987 level, which was the historical low for the north Atlantic.

The nominal effort of Taiwanese longline in 1992 in the Atlantic Ocean shows an increase in comparison with that of 1991. For the north Atlantic, from January to April, the main fishing region was in the waters around the Equator to 15 degrees N, then moved northward between 5 degree N and 25 degree N in July, in the area between the Equator to 35 degree N in August, and finally southward to the region between 5 degree N and 15 degree N. For the south Atlantic, a very similar trend was observed in the opposite direction. The detailed data are not yet available for 1993, but it should be noted that the number of fishing vessels is almost equivalent to that of 1992, therefore the fishing effort in 1993 may be similar to that of 1992 (Hsu and Lin 1996).

4.2 Japan

The Japanese commercial longline fishery in the Atlantic Ocean commenced in 1956 and the fishing ground had expanded into the whole tropical area by the mid-1960s (Figure 1). The fishing effort, in terms of nominal hook numbers, increased rapidly to a peak of 97 million in 1965 (Figure 2), followed by a rapid decline to 30 million in the Atlantic Ocean in 1969.

This decrease was caused by the shift of the fishing ground to the Indian and Pacific Oceans to fish southern bluefin and other tunas. In the early period the target species was yellowfin, but it was changed to albacore at the beginning of the 1960s.

In the early-1970s, as the development of on-board super cold freezers made it possible to supply the raw meat of the Atlantic tunas to the Japanese "sashimi" market, the fishing effort increased again and fluctuated between 32-56 million during this decade (Figure 2). The target species shifted from albacore to bluefin, southern bluefin and bigeye tunas. Effort was mainly concentrated in four areas; off Nova Scotia, off Morocco/Sahara, off Angora and off South Africa (Figure 2). Effort decreased dramatically in the western tropical Atlantic, especially in the southwest Atlantic, and concentrated on the eastern Atlantic in this decade.

The deep longline operation was developed to target bigeye tuna in the equatorial Pacific and Indian Oceans from the late 1970s and it was introduced in the Atlantic Ocean in 1977. But it occupied a very minor portion of the total effort in this decade.

In the 1980s the fishing effort increased gradually and reached about 90 million in 1989 with some fluctuations (Figure 2). The catch of bigeye has increased gradually with the development of deep longline operations and has recently occupied more than 70% of the total Japanese catch in the Atlantic Ocean. By contrast, the catch of albacore and yellowfin tunas has gradually decreased. Most effort was concentrated in the topical waters off Africa in the 1980s (Figure 1). In 1990 the effort reached 96 million hooks which was the second highest in the history (Uozumi 1996).

5. Discussion on the standardization of longline data

5.1. Clarification on compilation procedure of Task I and Task II data

Japanese Task I data (yearly landings in weight) are the sum of all the results of the multiplications of every Task II figure (catch in number by area-time stratum) by its corresponding mean weight. Due to coverage limitations of length measurements, the unit area-time stratum for Japanese longline data has been set as the block 10 degree latitude by 20 degree longitude, and by quarter. The mean length of a species in an area-time stratum can thus be obtained from the reported length measurements of the stratum, and its corresponding mean weight estimated from the length-weight relationship.

Taiwanese Task I data, however, is compiled from the landings in weight reported by the transhipment agencies. These figures are considered the most accurate catch by weight data for the Taiwanese fleet. The Taiwanese Task II data is compiled from the recovered longline log books and amplified by a raising factor for the purpose of adjusting the sum of multiplication of Task II catch in number by its corresponding mean weight, to meet the Task I figure. The aforementioned mean weight is obtained by converting the mean length of the size distribution, which is the sum of all length measurements reported from that area-time stratum, into its corresponding weight by using its length-weight relationship.

It is thus evident that (1) how big an area-time stratum is needed for summarizing length measurement data into a size distribution from which a mean length can be obtained; and (2) that a substitution scheme adopted to replace those area-time strata of no length measurement coverage will certainly affect the calculated total catch in weight drawn from the Task II data.

5.2 Investigation on the discrepancies list provided by ICCAT Secretariat

Much effort has been devoted during this meeting to the re-calculation and comparison of the size distribution by various area-time strata. The group concluded that: by ICCAT Albacore division (Alb 31-34) and by quarter is an appropriate unit area-time stratum for the purpose of providing a size distribution for that stratum to reasonably convert Task II catch in number data into catch in weight. The group also recommends that this procedure should be standardized so that the sum of all Task II data will always be equal to the Task I landing figure, without discrepancy.

As far as the list of discrepancies in the Taiwanese data set (Table 1) is concerned, the group believes (1) the deficiency and variability in length measurement coverage and (2) the substitution scheme are some of the main causes of such discrepancies. Efforts have been made during this meeting to re-adjust the raising factor as set out in the next section. The group believes that these discrepancies in the Taiwanese longline data set can and should be corrected after such re-adjustment.

The following is one feasible re-estimation procedure. The size distribution was adopted as submitted to the ICCAT Secretariat by the Institute. First of all, four ICCAT sub-areas and four quarters were defined to construct the quarterly sub-area size distributions, and the catches in number from logbooks by month and 5-degree block were aggregated, then, using the mean size sampled within a selected quarterly sub-area (Table 2) where the data by month and 5-degree block were converted to mean weight, the length-weight equation of Santiago (1993) was applied to the north stock, and the length-weight equation of Penny (1994) to the south stock. The block lacking size data, but having catch data, was substituted as shown in Table 3.

The catches in weight obtained from this procedure were then used as the basis of Task II. Finally, those catches were raised to Task I to obtain the catch data. Taiwanese participants made these re-estimations during the meeting, and promised to construct the catch-at-size table in time for the final meeting of the albacore research program which will be held at Sukarrieta in June 1994.

5.3. Recommendations on longline data collection and compilation procedures

a. In addition to the selection of an appropriate area-time stratum for acquiring size distribution, the timing of the insertion of the raising factor to the Taiwanese data set is also very important for mathematically balancing the Task II total versus Task I figure. Therefore, the group recommends a data processing scheme for the Taiwanese data as follows:

Step 1:
Log books --> Task II primer in no. (by 5X5, monthly, gear)
Step 2:
Length measurement --> Aggregated Size-file aggregated by area,time (by ICCAT albacore block, quarter)
Step 3:
Converting mean sizes of Size-file into mean weight (by length-weight relation)
Step 4:
Task II primer in no.* mean weight --> Task II primer in wt.
Step 5:
Task I landing / Task II primer in wt. --> raising factor
Step 6:
Task II primer in no. * raising factor --> Task II final

b. As alternating between regular and deep longline fishing operations is quite easy, it is believed that a change in operation may have taken place when the prospective marginal profit from one operation prevailed over the other. A discriminatory algorithm has been developed by Chang *et al.* (1993) for designating the daily longline operation into either a regular or a deep attribute according to its daily catch composition. It is recommended by the group that the same algorithm be followed for the Taiwanese longline data set. A revised version of the Taiwanese Task II data file will then be generated, which is in fact a splitting of the previous effort and catch composition statistics into two sets: (1) effort of regular longline with its corresponding catch composition and (2) effort of deep longline with its corresponding catch composition. Not surprisingly, the sum of the two sets will always numerically equal the previous figure.

5.4 Aspects of importance in GLM analyses for standardization of longline *CPUE*

Japanese scientists have shown the historic fishing pattern and thus derived *CPUE* trends regarding the Japanese longline activities and pointed out that there is a significant decreasing *CPUE* trend of albacore in the "transitional period" (Uozumi 1996) of about 6-7 years (1969-1975), when the Japanese fishing fleet changed their target from albacore to bigeye and bluefin, although in the same period the *CPUE* of albacore revealed from the other sources of information, such as Taiwanese longline fishery, did not support such a phenomenon.

Discussion also extended to the phenomenon raised by the Japanese scientists that according to Taiwanese recovered longline logbook data, all three southern hemispheric oceans showed a similar standardized *CPUE* declining trend for albacore (Nakano 1996a), yet other sources of information did not fully support such a coincidence. Several discussions regarding this matter have taken place at this meeting but no conclusive agreement has yet been reached; therefore, further deliberations are necessary.

The group discussed the importance of including species effect and as many interaction terms as possible into GLM analyses to justify the *CPUE* trend. These comments have been noted by the group and the results of such practices will be exchanged during the coming SCRS designated meetings.

Taiwanese scientists expressed the importance of the effects of fishing practice in tuning the *CPUE* trend. As revealed in the transitional period of Japanese longline fishery, the economic stress on bigeye will help to guide the Japanese longline fishermen to make more and more selective catches of bigeye, yet the process needs time for the practice to evolve, which may, therefore, account for the declining trend in the albacore *CPUE*. The Taiwanese case is even more complicated because either albacore or bigeye can become the target species, depending on time and circumstances.

It is recommended by the group that detailed analyses on the fishing practice and its effect on the standardization of *CPUE* is needed to obtain a more convincing albacore CPUE long term trend.

Table 1. Discrepancies between Task I albacore catch and total catch estimated from 1993 albacore catch at size data for Taiwanese longline fishery (the four left hand columns, provided by ICCAT results of re-estimation (the right three columns) by using mean weight converted from size-length relations.

SOUTH ATLANTIC

Year	Task I (MT)	Est'd (MT)	Diff. (MT)	Diff. (%)	Rest.d (MT)	Diff. (MT)	Diff. (%)
1975	13384	16873	3489	26.1	*2		
1976	14600	14787	187	1.3	*2		
1977	16092	16147	55	0.3	*2		
1978	20467	20763	296	1.4	*2		
1979	20340	16201	-4139	-20.3	*2		
1980	18710	25004	6294	33.6	*2		
1981	18187	18189	2	0	18184	3	0
1982	22800	22802	2	0	22774	26	0
1983	9502	9503	1	0	9480	22	0
1984	7889	7890	1	0	7896	-7	0
1985	19643	19645	2	0	19595	48	0
1986	27592	32871	5279	19.1	27386	206	0.01
1987	28790	32959	4169	14.5	28288	502	0.02
1988	20746	26367	5621	27.1	20284	462	0.02
1989	18386	21732	3346	18.2	18332	54	0
1990	22129	21280	-849	-3.8	21867	262	0.01
1991	20345 *	21200	855	4.2	20009	*3	*3
1992	17799 *	17799	0	0	20346	*3	*3

*1 preliminary data have been revised to 20009 MT and 20346 MT for 1991 and 1992, respectively.
*2 no size data available to re-estimate the catch.
*3 not compared as the finalized landings are equivalent to re-estimated catch.

Table 2. Mean length of Atlantic albacore caught by Taiwanese tuna longline fishery, by ICCAT subarea and by quarter (Q1-Q4).

1). North Atlantic

Year	Subarea 1 Q1	Q2	Q3	Q4	Subarea 2 Q1	Q2	Q3	Q4
1981	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0
1984	89.9	83.2	91.5	90.8	102.4	99	96.5	98.4
1985	92.8	0	91.3	92.9	97.5	98.6	100.9	94.3
1986	89.8	88	88.7	84.4	95.2	100.9	100.9	89.8
1987	77.4	89.3	83.2	86.3	87.3	100.6	98.1	66.3
1988	0	0	0	0	0	0	0	0
1989	0	0	0	84.9	0	94.1	94.4	0
1990	0	0	0	85.1	0	95.1	94.4	112.5
1991	84.7	0	0	0	110.5	94.2	93.6	0
1992	0	0	0	0	110.1	105.6	105.6	108.9

2). South Atlantic

Year	Subarea 3 Q1	Q2	Q3	Q4	Subarea 4 Q1	Q2	Q3	Q4
1981	111.2	0	101.7	105	72.3	66.6	70.4	0
1982	0	0	99.7	116.1	83.7	87.8	88.7	79.6
1983	0	0	0	98.5	83.4	84.8	83.7	87.6
1984	107.6	0	99.3	101.9	83	85.8	85.8	78.2
1985	94.6	0	90.9	96.5	77.3	81.6	84.6	80.2
1986	90.6	0	89.8	103.3	76.9	82.2	86	71.5
1987	106.6	0	80.6	99.3	79.7	84.5	85.7	84.9
1988	112.2	87.5	96	106.6	84.6	85.2	88.8	0
1989	106.4	99	96.2	95.6	82.3	84.5	84.6	89.2
1990	102.4	95.2	95.5	111	94.6	84.5	85.4	90
1991	109.5	84.3	80.7	98.4	78.1	72.6	76.6	86.1
1992	99.2	95.1	88.1	94.2	89.5	86.3	86	95.2

Table 3. **Size substitution table and mean weight matrix using for reestimating Taiwanese tuna longline Task II catch.**

Missing size data				Substituted from				
Year	Catch (no.)	subarea	quarter	year	subarea	quarter	length(cm)	weight(kg)
1981	1	3	2	1988	3	2	87.5	14.20
1981	1	4	4	1982	4	4	79.6	10.59
1981	66	1	1	1984	1	1	89.9	15.72
1981	24	2	1	1984	2	1	102.4	23.55
1981	40	1	2	1984	1	2	83.2	12.35
1981	31	2	2	1984	2	2	99.0	21.20
1981	29	2	3	1984	2	3	96.5	19.58
1981	254	1	4	1984	1	4	90.8	16.21
1981	8	1	3	1984	1	3	91.5	16.60
1981	34	2	4	1984	2	4	98.4	20.81
1982	28	3	1	1981	3	1	111.2	29.83
1982	52	3	2	1988	3	2	87.5	14.20
1982	61	1	1	1984	1	1	89.9	15.72
1982	40	1	2	1984	1	2	83.2	12.35
1982	35	2	2	1984	2	2	99.0	21.20
1982	55	2	3	1984	2	3	96.5	19.58
1982	102	1	3	1984	1	3	91.5	16.60
1982	54	1	4	1984	1	4	90.8	16.21
1982	12	2	4	1984	2	4	98.4	20.81
1982	48	2	1	1984	2	1	102.4	23.55
1983	32	3	1	1981	3	1	111.2	29.83
1983	6	3	2	1988	3	2	87.5	14.20
1983	77	3	3	1982	3	3	99.7	21.27
1983	91	1	1	1984	1	1	89.9	15.72
1983	93	2	1	1984	2	1	102.4	23.55
1983	94	2	2	1984	2	2	99.0	21.20
1983	46	1	2	1984	1	2	83.2	12.35
1983	95	2	3	1984	2	3	96.5	19.58
1983	65	1	3	1984	1	3	91.5	16.60
1983	53	1	4	1984	1	4	90.8	16.21
1983	106	2	4	1984	2	4	98.4	20.81
1984	3	3	2	1988	3	2	87.5	14.20
1986	42	3	2	1988	3	2	87.5	14.20
1987	77	3	2	1988	3	2	87.5	14.20
1988	49	1	1	1987	1	1	77.4	9.87
1988	75	1	2	1987	1	2	89.3	15.39
1988	30	2	2	1987	2	2	100.6	22.29
1988	38	2	3	1987	2	3	98.1	20.61
1988	30	1	4	1987	1	4	86.3	13.84
1988	84	1	3	1987	1	3	83.2	12.35
1989	122	1	1	1987	1	1	77.4	9.87
1989	4	2	4	1987	2	4	66.3	6.10
1990	59	1	1	1987	1	1	77.4	9.87
1990	1	2	1	1987	2	1	87.3	14.35
1991	1	2	4	1990	2	4	112.5	31.54
1992	10	1	3	1987	1	3	83.2	12.35

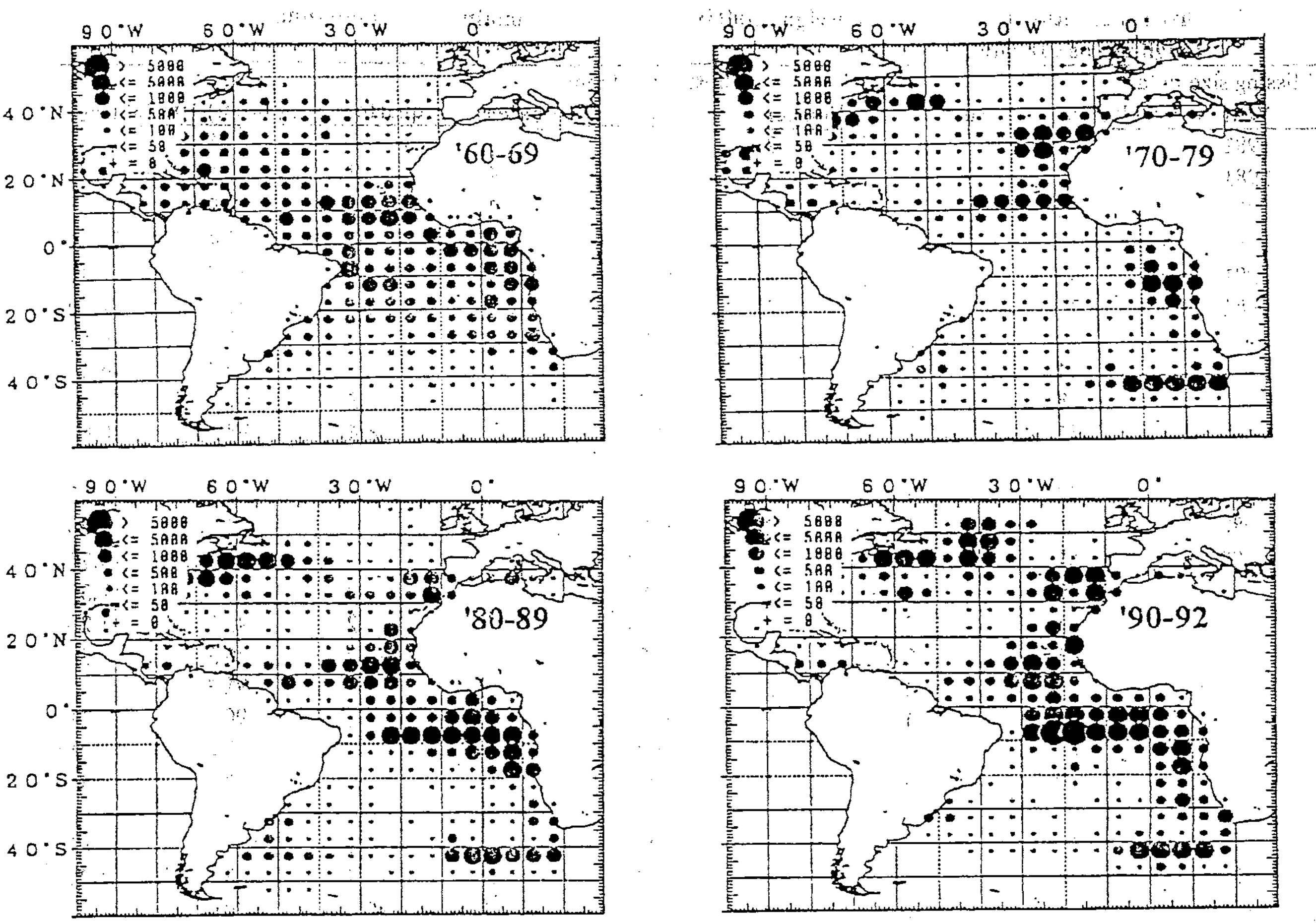

Fig. 1. Effort distribution of Japanese longline fishery in the Atlantic Ocean in each decade from 1960 to 1992. Numbers in the keys hsow the mean nominal hook number in thousand per year in each decade.

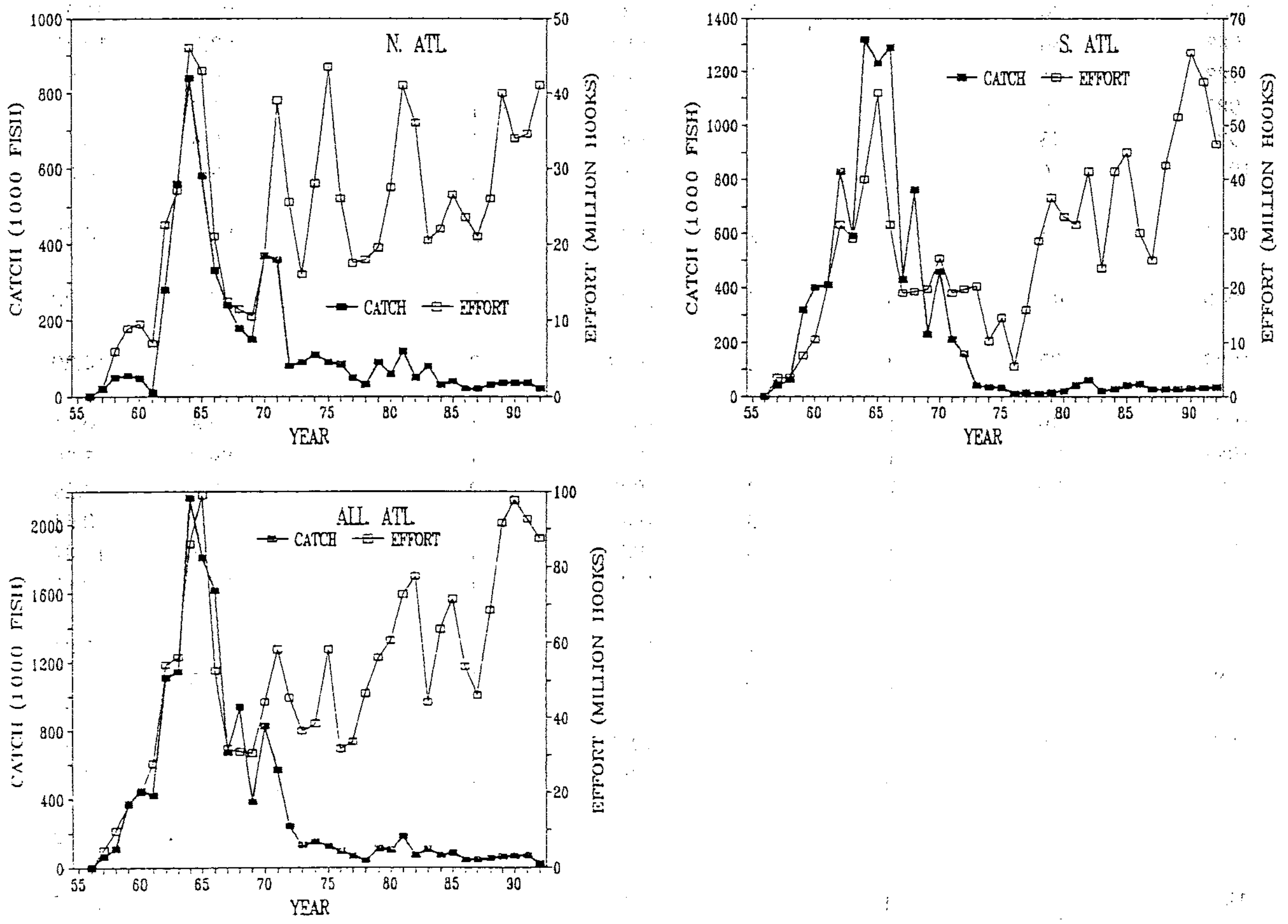

Fig. 2. Historical change of effort and albacore catch in the Atlantic Ocean, from 1956 to 1992.

Agenda

May 11
09:30-10:00 Opening ceremony
Chairman: Dr. J.C. Lee

10:00-10:05 Adoption of agenda
Chairman: Dr. Yuji Uozumi
Co-chairman: Dr. H.C. Liu

10:05-12:00 Review of longline catch and effort data collect and compilation system by country

1. Taiwan
Introduction of Atlantic longline catch and effort data collect and compilation system

2. Japan
Review of data collection system for Japanese longline fishery

14:00-17:00 Review of longline fisheries by country

1. Taiwan
Review of Taiwan longline fisheries in the Atlantic

2. Japan
Review of longline fishery and albacore catch in the Atlantic

May 12-14
09:00-17:00 Discussion on standardization of longline data

1. Clarification on compilation procedures of Task I and Task II data
2. Investigation on the discrepancies list provided by ICCAT Secretariat
3. Recommendations on longline data collection and compilation procedur
4. Aspects of importance in GLM analyses for standardization of longline CPUE

May 15
09:00-17:00 Preparation and adoption of the meeting report
Rapporteurs: Drs. C.C. Hsu & S.Y. Yeh

Appendix 2

Opening address to "Data Preparatory Meeting for Atlantic Pelagic Tuna Longline Fisheries" by Ziro Suzuki, ICCAT/SCRS Chairman

It is a pleasure to hold this important meeting to improve our knowledge of the basic questions related to the distant water tuna longline statistics with which we Asian countries share a common interest. Problems concerned with statistics are not specific to far seas longline fisheries. All fisheries have similar statistical problems to be solved. However, the accuracy of longline statistics are especially important for south Atlantic albacore because the only quantitative information available is obtained from the far seas longline fisheries. The southern stock of the Atlantic albacore shows an apparently declining trend in recent years which is of concern not only to albacore targeting countries such as Taiwan but also to other countries, such as Japan and Spain, which target bigeye and swordfish in the south Atlantic because of the multi-specific nature of the longline fisheries.

As described by the circular from the ICCAT Secretariat on background information to this workshop (April 15, 1994), this meeting will serve as one of the best occasions to clarify several issues including the credibility of catch and effort statistics, species and size compositions, standardization of the *CPUE* etc. In addition to these, however, one of the most important achievements of this meeting will be the grasp of the various key changes in the longline fisheries which cause both qualitative and quantitative effects on the interpretation of the various fisheries indicators above mentioned.

I would like to express my sincere gratitude to the Taiwanese scientists, especially to Dr. Lee, Director of Fisheries Department and Dr. Yeh, Professor of the National Taiwan University who kindly made such considerable efforts for us to hold this workshop. Although to my regret, I am unable to attend the meeting, I believe this workshop will form a basic understanding of both the nature and statistics of the pelagic tuna longline fisheries.

List of Participants

Japan

Dr. Hideki Nakano, Senior Scientist
Pelagic Fish Resources Division
National Research Institute of Far Sea Fisheries
5-7-1 Orido, Shimizu 424, Japan

Dr. Yuji Uozumi, Chief
Tuna Ecology Section
National Research Institute of Far Sea Fisheries
5-7-1 Orido, Shimizu 424, Japan

Taiwan

Dr. Jen-Chyuan Lee, Director
Fisheries Department
Council of Agriculture, Executive Yuan
Taipei, Taiwan, ROC.

Mr. Da-Wen Shieh, Deputy Director
Fisheries Department
Council of Agriculture, Executive Yuan
Taipei, Taiwan, ROC.

Mr. James Sha, Division Chief
Marine Fisheries Division, Fish. Depart.
Council of Agriculture, Executive Yuan
Taipei, Taiwan, ROC.

Mrs. Yuh-Chen Chern, Senior Specialist
Marine Fisheries Division, Fish. Depart.
Council of Agriculture, Executive Yuan
Taipei, Taiwan, ROC.

Mrs. Mei-Chu Lin, Specialist
Fisheries Department, Bureau of Construction
Kaohsiung Municipal Government
Kaohsiung, Taiwan, ROC.

Dr. Chin-Lau Kuo, Chief
Department of Fishery Biology
Taiwan Fisheries Research Institute
Keelung, Taiwan, ROC

Dr. Shui-Kai Chang, Fishery Biologist
Department of Fishery Biology
Taiwan Fisheries Research Institute
Keelung, Taiwan, ROC

Dr. Chien-Chung Hsu, Professor
Institute of Oceanography
National Taiwan University
Taipei, Taiwan, ROC.

Dr. Hsi-Chiang Liu, Professor
Institute of Oceanography
National Taiwan University
Taipei, Taiwan, ROC.

Mr. Chi-Lu Sun
Institute of Oceanography
National Taiwan University
Taipei, Taiwan, ROC.

Mr. Chi-Lun Wu
Institute of Oceanography
National Taiwan University
Taipei, Taiwan, ROC.

Dr. Shean-Ya Yeh, Professor
Institute of Oceanography
National Taiwan University
Taipei, Taiwan, ROC.