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Review of Taiwanese Data Collection and Processing System, and Plans of Improvements for the Taiwanese Tuna Longline Fleet in the Pacific Ocean

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INTRODUCTION

Distant water longline (DWLL) fishery is the major fleet operating in the Eastern Pacific Ocean (EPO) by Chinese Taipei. The fleet refers to those vessels larger than 100 gross registered tons (GRT). They mostly operated in the high seas area or in the EEZs of coastal countries under license. Since their catch is in frozen form, the fishery is also referred as frozen tuna longline fishery. There are also some offshore longline vessels in the EPO. These vessels are generally smaller than 100 GRT (mostly 50-70 GRT), and most of them targeted sharks, rather than tunas.

Catch statistic compilation system for Taiwanese tuna fisheries underwent a re-organization in 1996. Many achievements have been made after the reorganization, including changes in the data collection and processing system and revision of historical catch statistics, with consultations from some international experts. Some of the results have been reported to the ICCAT and IOTC in 1997 and 1998, respectively.

In response to the fast change of tuna fisheries, the system is under reviewing again with the aim mainly to obtain more fishery-independent data and to correspond with the development of fishery. The following sections introduce the system by data categories and plans for the system improvement.

1. TOTAL CATCH DATA

1.1 Data collection and processing system

Since the coverage of logbooks was not satisfied for estimation of total catch, the estimation of total catch was made basically from commercial data (except some bycatch species which not enough commercial data are available).

Historically, “Traders’ sales record” provided by the tuna brokers was the major source for the estimation of the total landings before and in 1993. These records include boat names, date of port entry, date of sale of catch, and the exact weight of product unloaded (and sold) from each

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vessel. Before the mid-1980s, these traditional brokers handled mainly albacore and were accustomed to reporting their sales. Besides, up to 1987, foreign currency exchange control was applied and fishing companies could not file their tax return unless a "verification on fishing vessels' sales settlement" was provided, giving a strong motivation for submitting reports of all landings. As such, the sales records provided covered almost all landings while exchange control was applied.

The situation changed since late 1980s when there was no longer need to report shipments to the authorities because foreign currency exchange was then de-regulated. As a consequence, the system which solely depended upon sales report became inadequate. Since 1994, additional information was available and landing data was estimated based upon multiple sources including:

(1) traders' sales record,

(2) verification of fishing vessels' sales settlement,

(3) certified weight reports of New Japan Surveyors and Sworn Measures Association, NJSSMA,

(4) verification records by Taiwan Tuna Association, and,

(5) statistical documents for regulated species (such as bigeye).

Trader's sale record (Source 1) and verification of fishing vessels' sales settlement (Source 2) which was used continually are particularly important for albacore catch data. The other two new sources i.e., (Source 3) and (Source 4) were introduced for estimating landings of species other than albacore.

In 1993, an agreement was reached between Taiwanese and Japanese tuna fisheries associations, limiting the amount of frozen sashimi tuna exported from Taiwan to the Japanese market. In order to monitor Taiwanese export to Japan, data from NJSSMA (Source 3) was contracted to provide certificate weight reports. These data include records of landing (weight) by species, by vessel, and by shipment. Since 2004, these data has been replaced by the similar landing records from Organization for the Promotion of Responsible Tuna Fisheries (OPRT) when the later one becomes available.

In addition, because of the abovementioned export limit, the Taiwan Tuna Association introduced a system to monitor exports by issuing "verification of the quantity of exports" (source 4) to all the boat owners for all catches exported to the Japanese market. Such verification records thus became available.

The statistical documents were issued to fishermen for their exportation of regulated species, such as bigeye and swordfish, to markets. The documents were available since 2003 and contains year information of the catch actually been made.

The annual total catch was estimated by comparing and compiling the above data sources. Conversation factors were then applied to obtain whole weight from processed weight. Since the commercial data does not include information of fishing location, the separation of catch of EPO from WCPO, or NPO from SPO, was made based on logbook data. Until 2004, when information of major fishing location was requested in statistical documents and when the VMS information was available, the separation was done directly.

1.2 Retroactive revision of historical total catches

Albacore

Estimation of total catch of DWLL was made from commercial information, rather than from logbooks. Several sources of commercial information (Section 2.1) are available and in general, information relating to sashimi species is more complete. Comparatively, because of the role and structure of the fishery traders in the Pacific, estimates of Pacific albacore need to be closely reviewed for recent years.

Therefore, the fishery authority has made efforts with pressure putting on industry to recover detailed trading information from different sources for data comparison and to review the total catch estimation of albacore. The new recovered data has been cross-checked with the already-obtained commercial information and logbooks, and proved applicable for the adjustment. The preliminary revision on data of years 2000-2003 has been proposed in the 5th ISC meeting. Trading information back to 1995 has been recovered for the same purpose recently, but no difference was noted for the 1995 and 1996, and minor changes are proposed for 1997-1999. Table 1 shows the revised total catch estimates.

Due to low coverage of logbook information for the northern albacore fishery, the separation of northern catch from southern catch was made based on vessel information obtained from industry in the past. After recent discussions with fishery managers, traders and skippers who have operating experiences in the north region, the landing records for northern albacore have been identified accordingly. The landing dates of these records matched the seasonality of northern albacore fishery from logbook information (Figure 1), and the vessels were large and new with the capability fishing in bad conditions in the North region. This adjustment has

increased the percentage of northern albacore to be higher than previous estimations.

Sashimi species

The unloading information for sashimi species collected from Japanese market is complete and no need to revise the total catch estimation in general. However, the annual catch estimates before 2003 were made based on the year of the catch landed or unloaded. In this regard, some unloaded catch in the beginning of a year were actually caught in the end of the previous year. According to the analysis of our data, there is at least a two-month time-lag between the catching time and the unloading time. When the fishery is under-developed, the catch in the end of a year but unloaded in the beginning of next year may not be high, and the amount will be stable among years. But at the time when fishery starts to develop fast, the catch will be high and increase significantly.

For instance, the bigeye fishery started developing in 2000 and developed very fast in the second half of year 2001 (Figure 2). The significant increase of catch made in the end of 2001 was unloaded in the market in the beginning of 2002. This phenomenon is evidenced by the trend of unloaded catch in the first two months of each year (Figure 3). The unloaded catch of the two month has been sharply increased ten folds in 2002 which was impossible been made and immediately unloaded in the first two months of 2002. Therefore, according to the data analysis and the fishery operating practice, it is necessary to re-allocate the year of catch based on such algorithm.

Because that, from 2003 onwards, the annual catch was estimated based on the fishing year information recorded on the statistical documents, the catch re-allocation is not necessary for years since 2003. Based on the available detailed commercial information from 1997-2002, the catch estimates of sashimi species have been adjusted accordingly (Table 1), to correspond with the development of fishery.

2. CATCH AND EFFORT DATA

2.1 Data processing system

All catch/effort data were compiled based upon logbooks that need to be submitted mandatory to the authorities. This policy has not been changed since the beginning of the data collection system. However, the accuracy, format, and the coverage of the logbook changed from time to time, particularly when the policy for implementation of regulations changed.

The information recorded in the logbook includes daily position, number of hooks used, catches in number, and weight by species. The format of logbook was changed in 1994. Since this year, catches of southern bluefin and northern bluefin tuna were reported separately, and information on the number of hooks per basket was requested.

The format of logbook was changed again in 2003 to include information on discards, and bycatch species, such as sea bird, sea turtle and major shark species. Information on setting time was also included.

After the logbook data were reviewed and verified on rationality of fishing location, traveling course, size of fish, and so on, the data were then summed and raised by applying a single coverage rate to all species, for producing monthly 5x5 square aggregated data (the raised data).

The coverage rates were estimated by dividing (the sum of catches recorded in logbook for major target species) by (the total of landings of major target species). The major target species for Taiwanese DWLL fleet in the past was albacore. But since 2000 when the bigeye fishery developed, bigeye catch needs to be accounted for. Without consideration of bigeye catch in the calculation of coverage rate in this case, will result in over-estimation of bigeye catch in the raised data set. In this regards, the 2000 data (Figure 2) which used only albacore as the target species will need to be revised.

One single coverage rate was calculated for each year and applied for all the species and efforts. This is to keep CPUE by species and catch composition of the raised data remained the same as the original logbook data, although the summed catch by species in the raised data will be different from the total catch estimation.

There are three major differences between the raised data and logbook data. That is, the raised data (1) are monthly aggregated, without daily operation information and vessel information; (2) have been raised by applying coverage rates; (3) have been converted to whole weight by applying conversion factors.

2.2 Future revisions

Honolulu Laboratory of NMFS has collected 32 years of original logbook data (1964-1996) of Taiwanese DWLL that offloaded most of their catches to the canneries in American Samoa since 1960s. This data set was obtained from the Laboratory with appreciations, to increase the coverage and quality of historical data (Figure 4). The data has been intensively reviewed and

only records with recognizable vessel information remained. After cross-checked with the Taiwanese dataset vessel by vessel, trip by trip, the two data sets have been compiled as one and have been submitted to the IATTC.

The combined logbook data will be reviewed again for finalization. There are some pending issues need to be resolved in advance, such as the separation of southern bluefin tuna catch from northern bluefin tuna. The data is also needed to be re-compiled and raised to total catches separately for the North and the South regions, taking into account the recommendation from NPALB19 in 2004.

3. SIZE DATA

3.1 Collections of size data

Fishermen are requested to report measurements of the first 30 fish landed everyday, regardless of the species. As a result, there have been more records on the measurement of the major species (e.g., albacore) but less on the non-target species (e.g., bigeye, yellowfin and/or swordfish in earlier years).

The data format requesting fishermen to keep measurement records has been changed. Size data recorded in the file were independent of catch and effort data in the past. Since 1995 onwards, the size data have been recorded on the same data sheet as the logbook, and are entered together with the catch/effort data. It would be easier now to associate the size data with catch/effort data.

Efforts have been made to screen out or adjust the unreasonable or inappropriate samples. There were examples such as some vessels measured the swordfish using the upper jaw fork length (FL) although they were instructed to measure it with the lower jaw fork length (LJFL); some vessels reported fish measurements in a 5 cm or 10 cm class intervals, and so on. The size frequency of the EPO bigeye for 1998-2003 is shown in Figure 5.

4. STATISTICS IMPROVEMENT PROGRAM

4.1 Review of historical data

As mentioned in Sections 2.2 and 3.2, the historical total catch estimates of DWLL for the recent years have been reviewed and proposal of adjustment has been raised, so that the estimates could reflect the actual situation of the fishery. Additional logbooks information was also recovered to increase the logbook coverage and accuracy. The re-compilation of catch/effort data

is scheduled to be finished in 2005.

The following sections will mentioned some programs for collection of fishery-independent data. When these data are available, comparison and reviewing will be made on the catch/effort data and size data. If it is considered necessary from the reviewing, adjustment on those data will be proposed to increase the accuracy of scientific information.

4.2 Port sampling

Port sampling at domestic fish markets has started in 1997, collecting size data of the major tuna species (mainly bigeye and yellowfin tunas). However, because a significant amount of Taiwanese longliners unloading their catches at foreign ports and the data reported from industry are no longer satisfied, there becomes a need to launch a port sampling program at foreign ports. Owing to no experience in sampling at foreign fishing ports, this program will started from smaller scale and can only be treated as a pilot one. It is welcomed for international joint efforts to make the program successful and efficient.

4.3 Observer program

The experimental observer program was launched in 2001. There were 2 observers in the beginning, and increased to 6 each year in 2002-03 and to 9 in 2004. To improve the collection of reliable data, after four years of running, this year a task-forces has been formulated to formally take charge of the program. In addition, the number of observers will be increased to over 20 for the three Oceans. There was one observer in the Pacific Ocean with 67 observing days in 2001 and increased to two observers with 366 observing days in 2004. At least 7 observers will be dispatched in the Ocean this year, to collect fishery data and size measurements on major catch species and bycatch species. Biological samples will also be collected.

4.4 VMS monitoring

Vessel monitoring system (VMS) has been installed voluntarily on some longliners during recent years. For better management of tuna fishery resources, all the large scale vessels are required to install VMS since this year. Besides of better monitoring the vessel activities, the data will be used to verify the logbook data and to improve the data quality.

4.5 International cooperation

Since a significant amount of Taiwanese longliners unloading their catches at foreign ports and many international agencies have port sampling program on those ports for many years, such as IATTC and SPC. The data been collected will be very helpful to the improvement of the data quality of Taiwanese fleet as well as the scientific researches on the species concerned. Therefore a routine data exchange and cooperation with these agencies will be approached.

Table 1. Annual total catch estimates of the four major species for Taiwanese distant water longline fishery.

Year	Albacore	Bigeye		Yellowfin		Swordfish	
	Total	Total	EPO	Total	EPO	Total	EPO
1970	16,664	2,907	820	6,139	370	53	26
1971	19,703	3,466	933	12,722	645	56	18
1972	22,147	5,479	1,015	14,371	846	98	38
1973	26,796	5,425	1,046	7,931	284	114	30
1974	19,392	3,542	948	5,817	276	136	34
1975	14,010	4,070	401	7,290	191	100	9
1976	18,742	3,167	268	4,914	176	156	36
1977	25,171	3,777	595	6,112	298	98	31
1978	18,738	1,822	405	2,490	151	32	8
1979	12,487	1,444	234	3,334	141	246	30
1980	18,190	3,500	195	5,849	36	199	17
1981	14,595	1,478	480	2,031	156	183	35
1982	12,680	969	197	1,015	81	106	32
1983	12,083	768	244	862	60	77	9
1984	11,155	919	194	1,430	56	128	15
1985	9,601	672	188	1,210	58	79	12
1986	11,913	648	257	1,213	120	45	12
1987	15,009	766	526	1,017	107	65	29
1988	17,120	793	591	3,054	54	87	38
1989	10,867	433	311	1,207	526	169	120
1990	11,625	1,818	596	2,044	534	274	35
1991	16,529	2,677	1,291	2,974	1,319	158	43
1992	22,229	2,131	1,032	1,440	306	96	30
1993	18,474	897	297	1,637	155	180	19
1994	19,809	846	255	2,017	236	222	44
1995	19,596	664	77	1,745	28	268	10
1996	18,454	376	95	1,069	37	153	33
1997	19,275	739	256	944	131	177	37
1998	19,149	1,599	314	1,101	113	293	78
1999	18,604	1,952	890	1,076	186	282	107
2000	18,133	2,837	1,916	2,210	742	499	321
2001	18,334	10,328	9,285	5,447	3,928	2,446	2,055
2002	19,851	22,334	17,253	10,480	7,360	3,860	3,060
2003	20,559	16,726	12,016	7,517	3,477	2,484	1,873
2004*	17,368	21,035	7,384	10,031	1,824	2,984	1,083

* Data of 2004 is preliminary and the bigeye catch estimate has included catch from offshore longliners in the EPO.

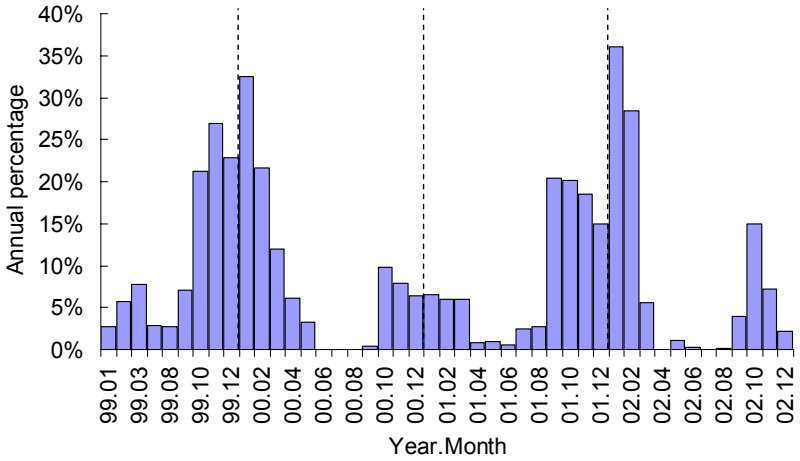

Figure 1. Monthly catch proportion of North Pacific albacore from logbook data of 1999-2002, to show the seasonality of the catch.

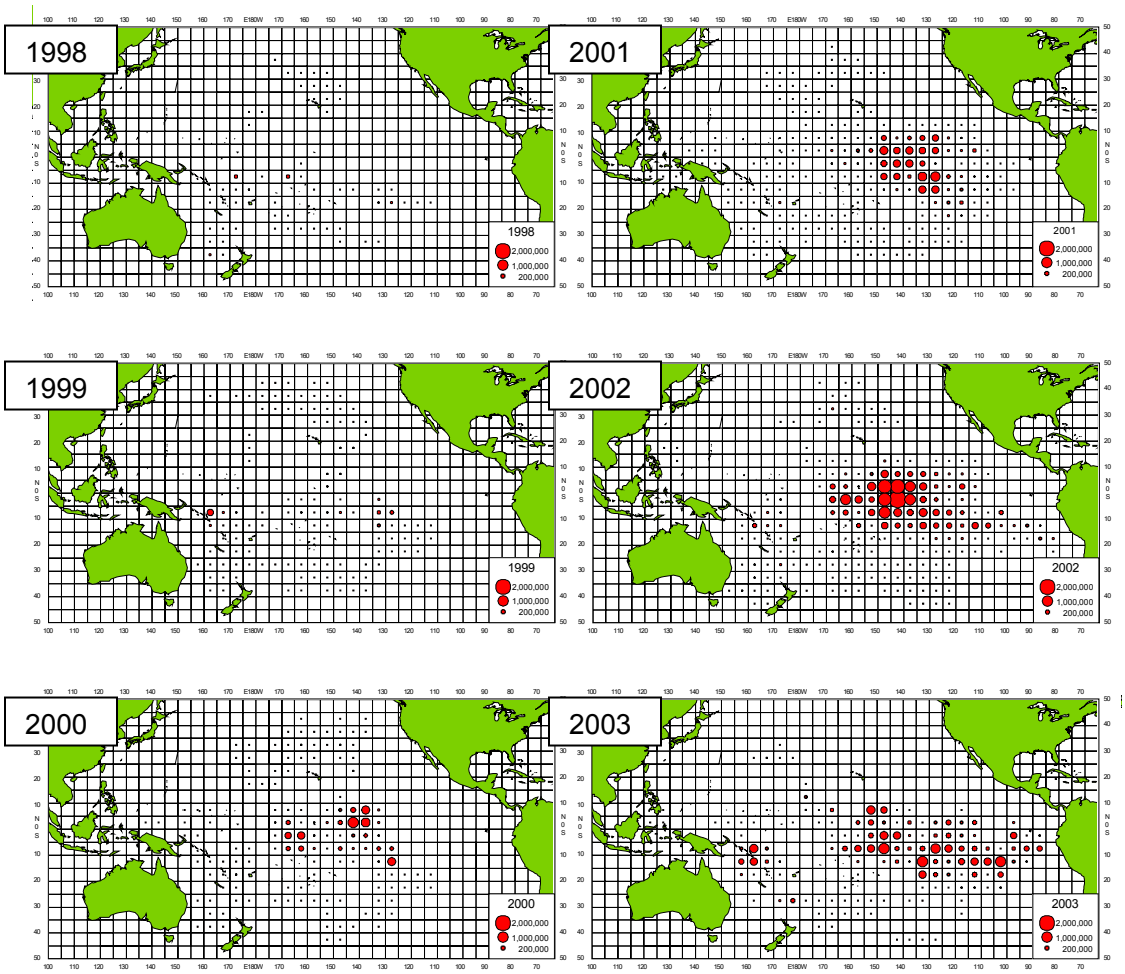

Figure 2. Bigeye catch distribution of 1998-2003 of Taiwanese longline fishery. Data of 2000 and 2003 are preliminary.

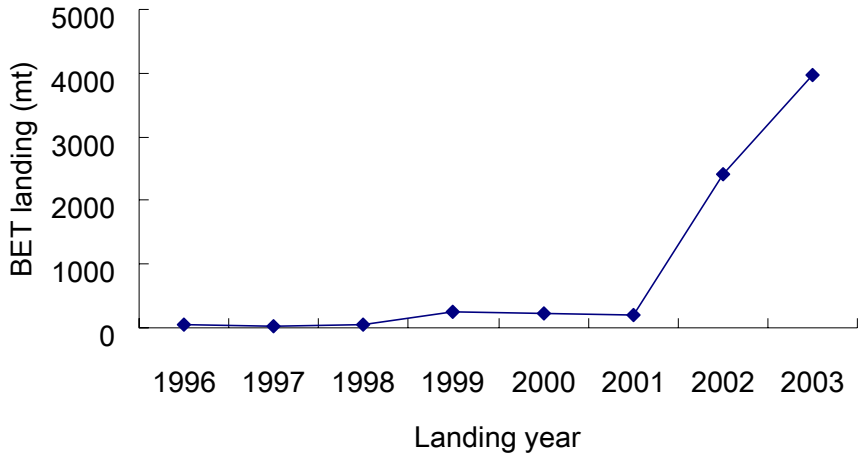

Figure 3. Accumulated Pacific bigeye landing of January and February by landing year of Taiwanese distant water longliners to the Japanese market.

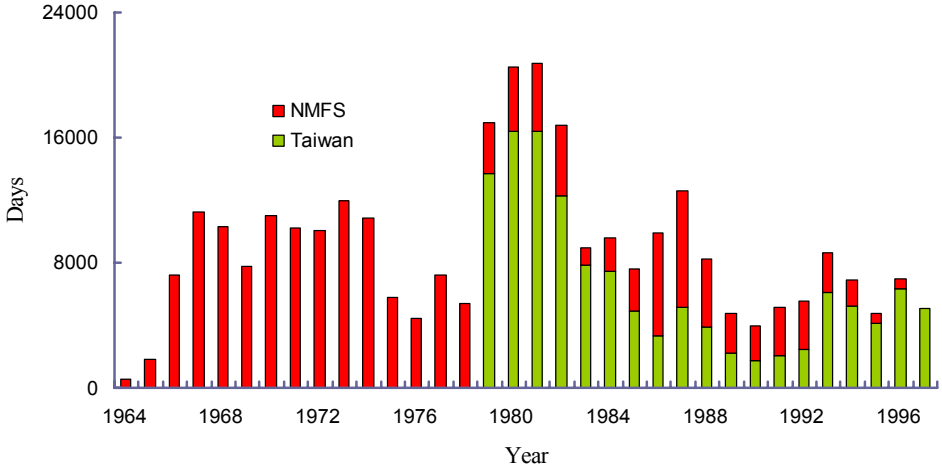

Figure 4. Days of records obtained from the logbooks collected by NMFS and by Taiwanese authority. These two data sets have been cross-checked vessel by vessel, trip by trip, and were compiled to increase logbook coverage.

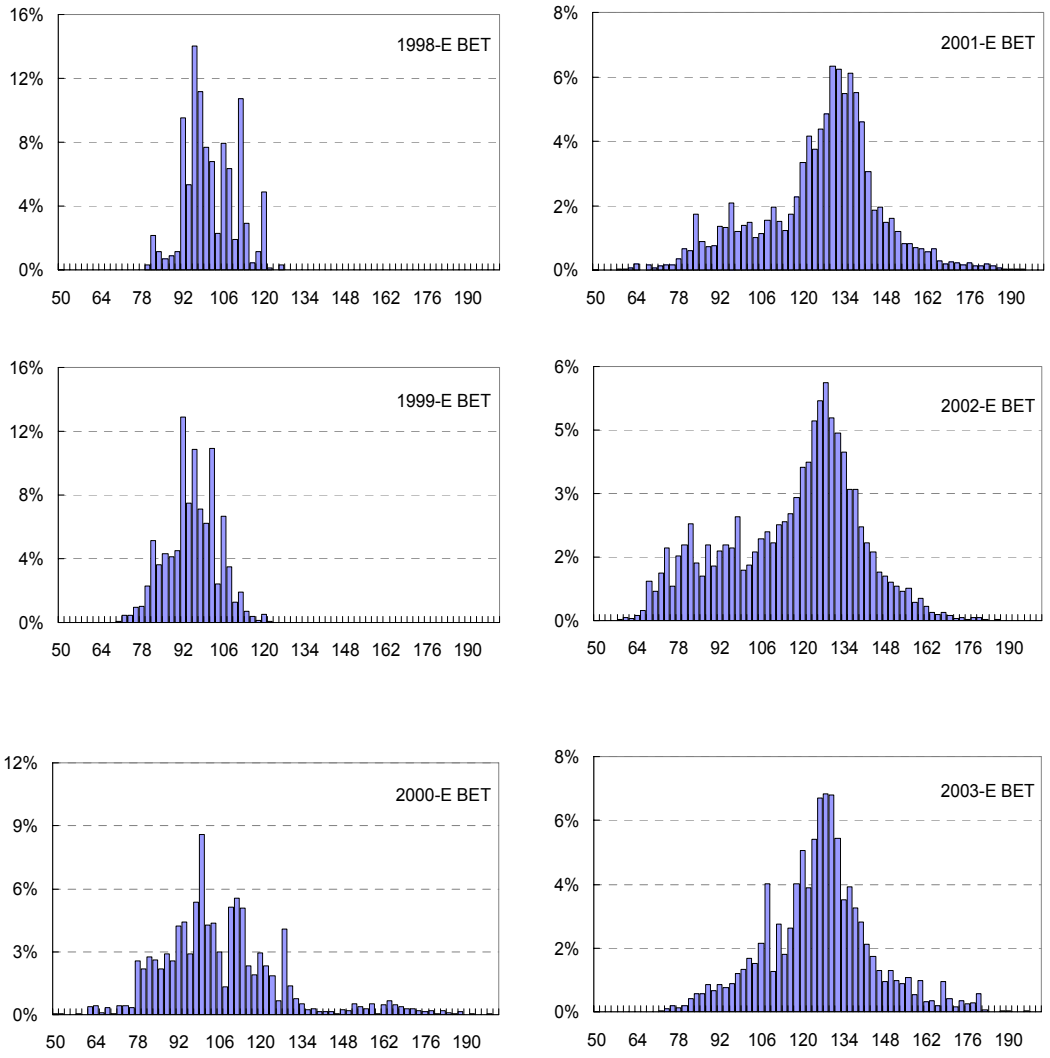

Figure 5. Length frequency of the eastern Pacific bigeye from Taiwanese distant water longline fishery, 1998-2003.