

THE RECENT CATCH ESTIMATING PROCEDURES OF TAIWANESE LONGLINE FISHERIES

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ABSTRACT

The report describes the collection system and compilation procedure of catch and size of tunas by Taiwanese distant water tuna longline fisheries. Taiwanese distant water tuna longline fisheries were initiated in the 1960's, and grew fast after the 1980's. Around the 1990's the total catches of tunas and tuna-like species reached over 100,000 tons which is the historic high for the Taiwan tuna catches.

During the mid-80's, the fishing pattern of the Taiwanese tuna longline fishery changed significantly, an important part of Taiwanese tuna longliners, in particular the newly built boats and some driftnet boats which were banned in 1992 have become part of the main super-freezer fleet. In 1993, the ratio of longliners with super-freezers to conventional longliners was about 1:1, and the exact number of deep longliners is 289. Although the registration and facilities of fishing boats have this configuration, the exact fishing pattern may sometimes be in accordance with the oceanic conditions and captain's experience. Therefore, the actual target and fishing patterns vary each day with fishing condition. The catch data collection system includes two parts, first, the logbooks collection and second, the data compilation. The former was pursued by the Taiwanese Fishery Bureau, Department of Agriculture and Forestry, Taiwan Provincial Government before 1990 and by the Department of Fishery, Constructive Bureau, Kaohsiung Municipal Government after that, and the latter by the Institute of Oceanography, National Taiwan University. Due to some of policy changes in reporting catches of fishing boats in 1986, there was a poor recovery rate of logbooks after 1987, and very poor in 1991 and 1992.

RESUME

Le présent rapport décrit le processus de collecte et de compilation des données de capture, effort et taille des pêcheries thonières taïwanaises en eaux lointaines. Ces pêcheries ont démarré pendant les années soixante, et se sont rapidement développées à partir des années quatre-vingt. Aux alentours de l'année quatre-vingt-dix, la prise totale de thonidés et d'espèces voisines dépassait 100.000 TM, ce qui représente le maximum historique des prises thonières taïwanaises.

Au milieu des années quatre-vingt, les caractéristiques de la pêche palangrière thonière de Taïwan se sont modifiées de façon significative, une partie importante de la flottille de palangriers taïwanais, et en particulier les unités de construction récente et une partie des fileyeurs qui ont été interdits en 1992, est devenue une des principales flottilles équipées de super-congélateurs. En 1993, la proportion de palangriers avec super-congélateurs et des palangriers conventionnels était environ 1:1; les palangriers de profondeur sont exactement au nombre de 315, et les palangriers conventionnels 289. Bien que l'immatriculation et l'armement des bateaux de pêche présentent cette configuration spéciale, le schéma exact de la pêcherie peut varier en fonction des conditions océaniques et de l'expérience du capitaine. L'espèce cible et le mode de pêche varient donc tous les jours en fonctions des conditions de

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pêche. Le système de collecte des données de capture comprend deux parties, tout d'abord le relevé des carnets de pêche, puis la compilation des données. La première était effectuée avant 1990 par le Taiwanese Fisheries Bureau, Department of Agriculture and Forestry, Taiwan Province Government, et ensuite par le Department of Fishery, Constructive Bureau, Kaohsiung Municipal Government; la deuxième est à charge de l'Institute of Oceanography, National Taiwan University. Du fait de modifications des normes de déclaration des prises des bateaux de pêche en 1986, les carnets de pêche montrent un rétablissement médiocre à partir de 1987, et très médiocre en 1991 et 1992.

RESUMEN

El informe describe el procedimiento de recolección y compilación de la captura y esfuerzo así de como tallas de túnidos por las pesquerías palangreras taiwanesas de larga distancia. Las pesquerías palangreras taiwanesas de larga distancia se iniciaron a partir de los años 60, y crecieron rápidamente a partir de los años 80. Alrededor de los años 90 la casi totalidad de las capturas de túnidos y especies afines superan las 100.000 toneladas, que constituyen un máximo histórico de capturas de túnidos de Taiwan.

Durante mediados de la década de los 80, el esquema pesquero de la pesquería palangrera taiwanesa dirigida a los túnidos cambió significativamente: una importante parte de los palangreros taiwaneses dirigidos a los túnidos, en particular las nuevas embarcaciones y una parte de barcos con redes de enmalle - que fueron prohibidas en 1992 - pasaron a integrarse flotas con equipos de alta congelación en las flotas principales. En 1993, el ratio de los palangreros con equipos de alta congelación y convencionales era de aproximadamente 1:1, y el número exacto de barcos con palangres profundos suman 315, siendo 289 los palangreros convencionales. Aunque el registro y equipos de las embarcaciones poseen esta configuración específica, el esquema pesquero exacto se ajusta algunas veces a las condiciones oceánicas y a la experiencia del capitán. Por ello, la especie perseguida y el esquema de pesca real varían cada día según las condiciones de la pesca. El sistema de recolección de datos de captura incluía dos partes; la primera, recopilación de cuadernos de pesca, y la segunda, la compilación de datos. La primera estuvo a cargo de "Taiwanese Fishery Bureau, Department of Agriculture and Forestry, Taiwan Province Government" antes de 1990, y por "Department of Fishery, Constructive Bureau, Kaohsiung Manicipal Government" a partir de esa fecha, y el "Institute of Oceanography, National Taiwan University" se ocupó de la segunda. Debido a algunos cambios de normas en la comunicación de capturas de los barcos pesqueros en 1986, los cuadernos de pesca muestran escasas recuperaciones desde 1987, y muy escasas en 1991 y 1992.

1. INTRODUCTION

Recently, there have been great changes in the Taiwanese tuna longline fishing pattern. Previously, in the early 1980's, Taiwanese tuna longline fishery was very simple, from the point of view of target species and operating fishing grounds; they used foreign bases to supply anything necessary for fishing and transshipped harvests to be processed. Since the beginning of longline fishery in Taiwan in the 1960's, marvelous works of estimating production of Taiwanese fisheries have been carried out by two sorts of catch processing systems, in accordance with the requirements for policy making by the fishery authority. Since then, Taiwanese tuna longline fishery has gradually experienced a transformation of its fishing pattern. The catch statistics system has basically followed a similar principle of fundamental data collection and estimation processing. However, a significant number of boats has operated according to the captain's decision rather than to a registered fishing pattern, for instance, a registered longliner with super-freezer may possibly operate as a conventional longliner, and vice versa. This factual activity makes raising catches from available data difficult and inaccurate.

Two apparent changes in obtaining fishery information have resulted in discrepancies of catch estimates. First, the fishing pattern changes incorporated into the changes in fishery policy have resulted in the decline of recovery of logbooks and incomplete statistics of tuna trade reports since 1987. The latter were provided by tuna transshipment trade agencies to the fishery authority. Recently, the tuna trade is mostly carried out by the boat owners themselves instead of transshipment agencies, as was customary for conventional longliners, in particular for owners of longliners with super-freezers. Thus, the trade report by agency may not include all catches of all species, according to fishing boat type and species traded. Secondly, there have been changes in the daily reporting and communication between

boats and the Fishery Radio station. After these changes, boats were no longer required to submit logbooks before being granted a license for subsequent trips, and the daily position of fishing boats could be reported by SSB rather than in the usual way. Therefore, the return of logbooks significantly decreased and the exact daily position and target species were seldom known. All of these issues have made recent catch estimates difficult and problematic.

In response to the changing fishing pattern and above mentioned poor recovery of logbooks, it was necessary to collect the more fundamental data used to estimate the monthly $5^{\circ} \times 5^{\circ}$ square block catch from all possible sources. Initially, the data including logbooks, daily reports of Kaohsiung Fishery Radio Station and transshipment agencies' trade reports were used, which also included reports of Japanese commodity imports by country, the catch statistics of the Tuna Association, and the number of boats operating in each Ocean by month. Landing data by vessel have been collected by Shin Nihon Keitai Kyokai 1994.

Due to the instability of data collection and change of fishing pattern year by year, the lack of knowledge of important fishery information resulted in difficulties in estimating catch by month and by $5^{\circ} \times 5^{\circ}$ square block scale. Hence, the work of this report describes the data collection and the methods and procedures used to estimate catch in as much detail as possible for Taiwanese tuna longline fisheries. Comparisons were made between the different estimation procedures mentioned above in evaluating effects of data quality.

2. DATA AVAILABLE TO ESTIMATE CATCH

As listed in Table 1, the available data used in catch estimates for deep sea Taiwanese tuna longline fisheries can obviously be divided into two periods, i.e., calendar year before and after 1987 (or data year before and after 1986, information is presented by data year). Trade agency reports, logbooks and the daily reports of Kaohsiung Radio Station were available during the former period; and additional information including commodity reports by country, production estimates by the Association and the number of boats by month became available. The data provided by Shin Nihon Keitai Kyokai became available from January of 1994.

Usually, most trade agencies transshipped species for canning, such as albacore, small bigeye tuna, small yellowfin tuna and other canning species. On the other hand, the high priced, high quality species, such as bigeye tuna, bluefin tuna, yellowfin tuna and other species were transshipped by either the owner, or by transshipment vessels with special freezer facilities (super-freezer). This occurred in the early 1980's, and appeared in the Taiwanese data base around 1984, the deep fishing operations in the Atlantic being included from 1989 onward. Under these circumstances, the reports of trade agencies were no longer used for Task I data, because these trade agency reports do not include all catches made by Taiwanese longline fisheries, as part of the super-freezer longline catch was traded in an alternative way. However, the reports of trade agencies are accurate for some species, in particular the canning species such as albacore, but not reliable for bigeye tuna and yellowfin tuna.

Furthermore, changes in fishing patterns have also disturbed catch estimation. The exact fishing pattern changes are unknown, but the time of significant changes in fishing patterns can be estimated from the catch composition. Obviously, changes in fishing patterns influence the Task I statistics because of the targets and trade system mentioned in the above paragraph.

The return of logbooks declined from 1987 because the fishery authority withdrew fishing boat management policy. As a result, vessels landing their catches did not have to submit their logbooks before obtaining a license issued by the relative fisheries authority to load supplies and embark on the next cruise.

Since the logbooks were not required for foreign based vessels, the coverage rates of operating vessels sharply declined to an historically low level in 1992. Therefore, the conventional estimation method may no longer be helpful for catch estimation.

3. DATA PROCESSING PROCEDURES

3.1. Catch and effort

Figure 1 shows the logbooks collection system. The system estimated Taiwanese tuna longline fisheries in two ways, Task I (landing data) and Task II (catch data). The logbooks were checked against the reports of Kaohsiung Fishery Radio Station to verify the location of set lines; how far the boat had moved each day, land operations, catch discrepancies between logbooks and daily reporting to Kaohsiung Fishery Radio Station, number of hooks deployed,

etc; after that, the monthly 5° by 5° square block catch and effort was estimated by adding the catch to similar fishing time and space before 1991, and then raising Task II data.

3. 2. Size frequency

The size data collection followed two channels: on board measurement and port sampling. The port sampling was carried out when fishing boats returned to domestic ports, mainly in Kaohsiung harbour. Most boats coming from the Indian Ocean and the Pacific Ocean underwent port size sampling, but unfortunately, measurements from those coming from the Atlantic Ocean could not be taken because very little of the catch remained.

On board measurement was carried out by fishermen. We classify the reliability of data resulting from these measurements as low. Thus a very careful review and check is absolutely necessary. Items to be checked include position of fishing ground, catch numbers, systematic sequence etc. However, this catch in weight may not match the conversion of size-weight relationship, because the size data are processed some time after the catch is recorded in the logbooks. So the discrepancies which arise when converting mean size to mean weight in order to raise the total catch in weight may sometimes be due to the on-board measurement which may tend towards similar sized fish as opposed to random sampling.

4. ALBACORE FISHERY IN THE ATLANTIC

Taiwanese distant water longline fisheries began around 1960, and started to operate in the Atlantic in the mid-1960's. Of all the Taiwanese tuna longline fisheries in the three oceans, albacore is the conventional target species of Taiwanese distant water longline fishery, though recent species composition shows that albacore is no longer the highest catch, due to the changes which have taken place in the fishing pattern of longliners with super-freezer. Albacore is still the main target species in the south Atlantic. The annual number of longliners operating, the nominal effort, and the annual catch are shown in Tables 2, 3, and 4, respectively.

The total number of Taiwanese longline vessels operating in the Atlantic has stabilized at around 130-140 in recent years (Table 2), the total number operating in the Atlantic in 1993 was 44 super-freezer and 98 conventional type longliners. Since the 1970's, Taiwanese longline fleets targeted albacore in both the north and south Atlantic Oceans. Furthermore, while seeking fishing grounds, it appears that some of the fleet has targeted tropical species when fishing in regions where those species are concentrated. This trend is obvious from 1990 in the Atlantic Ocean (Table 3).

In 1987, a significant part of the Taiwanese fleet moved out from the north Atlantic, possibly to the south Atlantic for economic reasons. As far as is known, those fleets did not change their target. The total catches of tunas in the Atlantic for the Taiwanese fleet have been quite stable since the fishery was initiated. In 1993, the total catch for all species was estimated to be about 31,228 MT, which is slightly higher than those of 1991 and 1992, which were about 26,000 MT and 30,500 MT, respectively. Among the 1993 catches, albacore was the predominant species estimated at about 25,700 MT, which is slightly higher than the 1992 figure (23,200 MT). Catches of bigeye tuna and yellowfin tuna were estimated at about 1,319 MT and 895 MT, respectively, the remainder being composed of other species.

Table 1 The fishery information used in catch compilation for Taiwanese distant water longline fisheries.

Items	Current Status	Comments
Logbooks	recovery decreased from 1987 to 1992, and increased after 1993.	should be checked for unreliable information or mistakes made when filled out
Daily report of Radio Station	Most boats used SSB to report their fishing activity.	could be used to check daily position and main catch, but now is not very useful in catch estimate
Transshipped agencies trade report	Most high quality fish are not transshipped by these agencies, so their reports do not sufficiently reflect the actual catch, but the canning species are still transshipped, so their reports for canning species may be corrected.	could be used for albacore as reference to raise the total catch (Task I).
Japanese imports of commodity by country	Good reference for sashimi species such as bigeye tuna, yellowfin tuna, bluefin tuna etc.	could be used as reference of the minimum annual catch of the year.
Measuring report of Shin Nihon Kentai Kyokai	Clear unloaded fish in Japan in weight by species each month.	could be used to check the logbook, but only for high quality species; the canning species are not imported to Japan, so no measured data are available.

Table 2 The numbers of longline boats operated in the Atlantic Ocean in recent years.

Year	1988	1989	1990	1991	1992	1993
No. of Boats	111	114	149	135	136 (36/100)	142 (44/98) ¹

¹ (No. of longliners with super freezer/No. of conventional longliners)

Table 3 The nominal efforts estimated for the Taiwanese distant water longline fisheries operated in the Atlantic Ocean (million hooks)

Year		1981	1982	1983	1984	1985	1986
North	Deep	0.4	0.5	0.1	0	0.3	0.8
	Regular	13.1	16.8	25.1	30.1	34.5	56.0
South	Deep	1.8	0.6	0.3	0.9	0.3	1.4
	Regular	53.3	45.5	23.4	15.2	50.6	66.8

Year		1987	1988	1989	1990	1991	1992	1993
North	Deep	0.1	0	0.8	16.4	16.9	17.2	
	Regular	29.3	5.2	4.0	4.9	5.1	4.1	11.4*
South	Deep	4.6	2.6	2.0	14.8	21.3	4.1	
	Regular	81.4	63.3	64.6	65.9	82.7	66.4	69.9*

* fishing pattern is not seperated

Table 4 The annual catch of albacore by Taiwanese distant water longline fishery in the Atlantic Ocean (Metric Tons)

Year		1981	1982	1983	1984	1985	1986
North	Deep	0	4	3	0	14	168
	Regular	6598	10491	14294	14897	14883	19429
South	Deep	10	18	17	3	1	210
	Regular	18184	22774	9480	7896	19594	27386

Year		1987	1988	1989	1990	1991	1992	1993
North	Deep	4	0	5	203	201	140	
	Regular	6596	2100	1295	1296	1399	2304	1419
South	Deep	509	414	67	231	290	454	
	Regular	28288	20284	18332	21867	20009	20364	24281

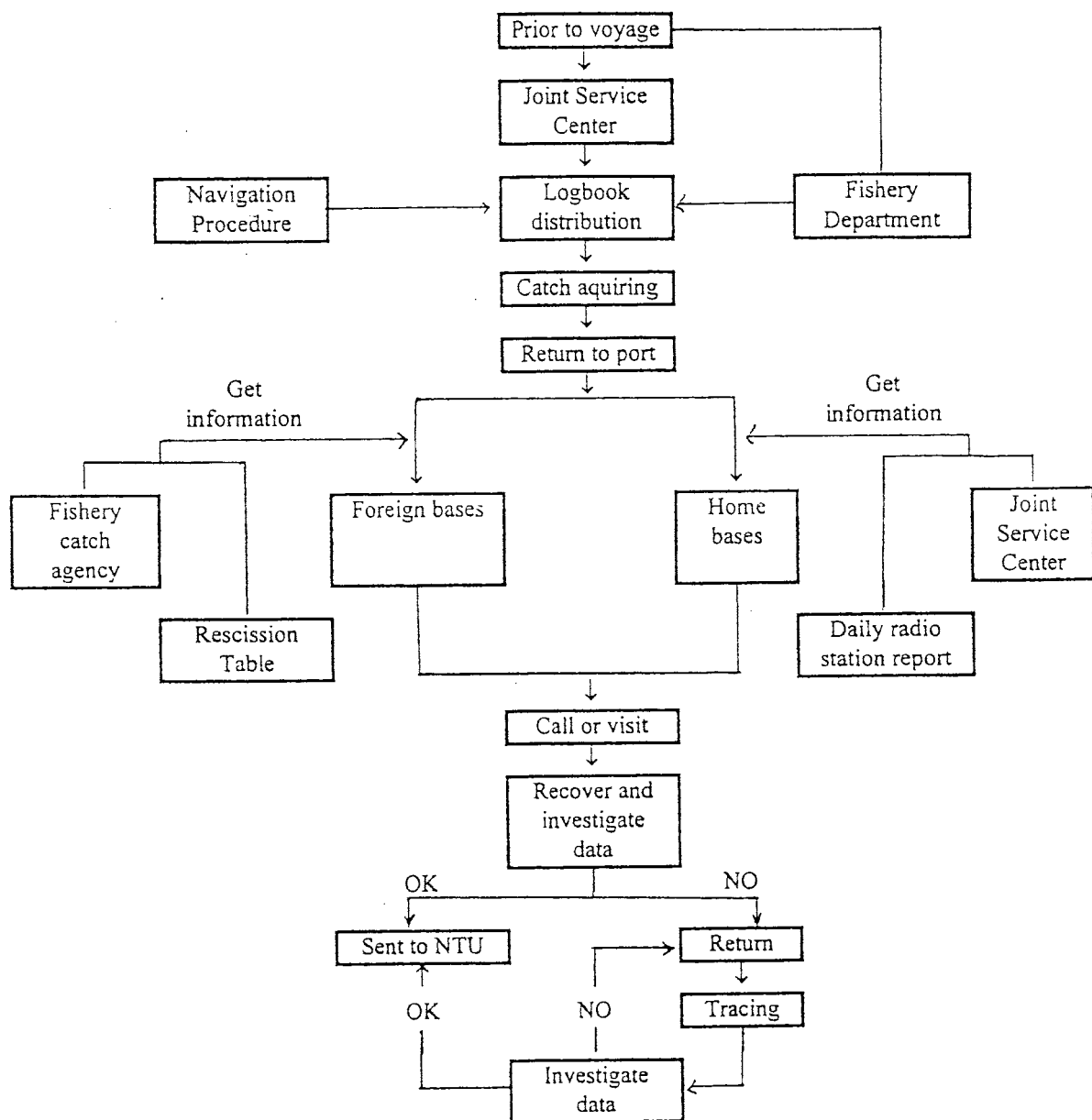


Fig. 1 Logbooks recovery system of Taiwanese distant water longline fisheries.