JAPANESE TUNA FISHERIES IN THE INDIAN OCEAN

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RÉSUMÉ

Les pêcheries japonaises qui opèrent actuellement dans l'océan Indien pêchent à la senne tournante et à la palangre. La pêche à la palangre a débuté après 1952 lorsque fut levée la limitation des zones de pêche. La pêche industrielle à la senne, elle, a démarré en 1991 après plusieurs années d'activités expérimentales.

Les pêches palangrières Japonaises peuvent se classifier en 3 catégories – (côtière, plus au large et à très grande distance) selon le type de licence et la taille des bateaux. (Près de côtes les moins de 20TJB – au large de 20 à 120TJB et très loin les 120 à 500TJB. Ce sont les navires de 300 à 500TJB qui pêchent dans l'Océan Indien.

On compte environ 200 à 400 de ces navires qui opèrent chaque année. Bien que leur nombre ait diminué, (de 403 bateaux en 1987 pour passer à 189 en 1993), ils ont aussitôt après, remonté à 195 en 1997 (Tableau I). On explique cette nouvelle croissance de la flotte dans l'océan Indien par le fait que les captures en thon et en patudo en particulier n'étaient plus suffisantes dans l'océan Pacifique.

La pêche à la senne dans l'océan Indien a débuté en 1980 sur une base expérimentale ; elle est passée au stade commercial en 1991 en prenant 10 licences de pêche pour opérer 13 navires dont un expérimental. Les senneurs opérant dans l'océan Indien se situent en classe TJB 350 à 500. C'est à dire de capacité 700 à 800t. Le Tableau 1 montre de quelle manière le nombre de ces bateaux a changé.

Des dix senneurs en activité de 1991 à 1993, il n'en restait que 3 en 1997. Le déclin du nombre de ces bateaux semble s'expliquer d'avantage par des raisons économiques plutôt que par manque de poisson, ainsi que le montre la section effort de pêche des senneurs.

Ce document fait l'historique des ces pêcheries thonières et décrit la situation actuelle des taux de captures, des zones de pêche, de la taille du poisson capturé ainsi que les récentes activités de recherches entreprises.

Introduction

Longline and purse seine fisheries are two types of Japanese fisheries currently operating in the Indian Ocean. The longline fishery started its operation in this ocean after 1952, when limitations were removed on areas of operation. The commercial purse seine fleet commenced fishing in the Indian Ocean in 1991 after several years of experimental fishing.

The Japanese longline fishery is classified into three categories (coastal, offshore and distant water) according to the license and boat size (coastal: less than 20 GRT, offshore: 20-120GRT, and distant 120-500GRT). Large-sized distant water vessels between 300 and 500 GRT are operating in the Indian Ocean. The number of vessels operated in this ocean was around 200-400 vessels per year. Though they decreased in number from 403 vessels in 1987 to 189 vessels in 1993, they increased thereafter to 195 vessels in 1997 (Table 1). This recent increase of vessels in the Indian Ocean seems to be attributable to the lower catch of tunas, bigeye tuna in particular, in the Pacific Ocean.

The Japanese purse seine fishery was initiated in the Indian Ocean in mid 1980s on an experimental basis, and shifted to a commercial basis with 10 commercial licenses (a total of 13 vessels including one experimental research vessel) in 1991. Japanese purse seine vessels in the Indian Ocean are 350-500 GRT class (700-800t carrying capacity). Historical change in the number of vessel is shown in Table 1. Though more than 10 Japanese purse seiners operated in 1991-1993, they decreased year by year to only 3 vessels in 1997. As described in the purse seine effort section, this decrease in vessel number seems to be due to economic reasons rather than decline in catch.

This paper reviews the history of these two tuna fisheries and describes the current situation on the amount of catch, area of fishing, size of fish, and recent research activities.

Japanese fishing activity in the Indian Ocean

The longline fishery

Fishing effort

The geographical distribution of fishing effort is shown in Figure 1 for each decade. In the 1950s, the fishing area of the Japanese longliners in the Indian Ocean was limited to areas North of 30°S. During the next decade, the fleet extended its fishing to waters between 30°S and 50°S where they found a good fishing ground for southern bluefin tuna. This period corresponds to the time when almost all the Indian Ocean was covered by this fishery and fishing effort was exerted more or less evenly. After that, the operational areas were divided into two main parts whose boundary falls at around 20°S. This shift seems to reflect the change in demand from fish for canning (yellowfin and albacore) to sashimi (bigeye and southern bluefin tunas). The introduction of super cold freezers also accompanied this change. In tropical to subtropical waters, the main target species has shifted to bigeye, whilst in temperate waters, targeting on southern bluefin tuna has further strengthened. This pattern of effort distribution has been maintained thereafter.

There is seasonal change in the distribution of longline effort in the Indian Ocean (Figure 2). In the second and the

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third quarters, concentrations of fishing effort in the waters off South Africa and southwest Australia become apparent while fishing effort is relatively sparse in the West and South, off Indonesia North of 20°S. In other quarters, the contrary is the case, with less fishing effort in the former areas and significant effort in the latter areas.

Since the initiation of the fishery, the amount of fishing effort had increased year by year and reached a first peak in 1967 (126 million hooks, Table 2). It went down a bit until 1970 and fluctuated at that level (80 million) thereafter. Then it rose once again from 1982 to 1985. After the second peak in 1985 (112 million), it dropped significantly to below the previous minimum level, reaching at about 50-60 million hooks in the early 90s. After 1995, it increased steeply and attained 116 million hooks in 1997. About 23 % of the total effort of the Japanese longline fishery was exerted in the Indian Ocean in the most recent five years.

Catch

Total catch in weight caught by Japanese longliners in the Indian Ocean (FAO 51 and FAO 57 area) from 1971 to 1997 is shown in Table 2 (1997 data are preliminary). The total catch was high from 1983 to 1988, with the highest figure at about 46,000t in 1985. It has declined continuously since then to about 14,000t in 1992 (Table 2). The total catch increased thereafter in function of the increase in effort, and reached around 35,000-40,000t in the two most recent years. The catch for each species in 1996 was 3,591t and 4,597t in 1997 for southern bluefin, with 2161t and 2762t, for albacore, 14,741t and 16,464t for bigeye and 10,443t and 13,971t for yellowfin, respectively. Recently, the four major tuna species (southern bluefin, albacore, bigeye and yellowfin) accounted for about 85-87 % of the total catch (Figure3). The proportion of southern bluefin tuna catch in total catch weight was 50 % or more (77 % in 1976) in 1970s and about 30 % in 1980s and came to be about 10 % in the most recent five years. In contrast, the proportions of bigeye and yellowfin became higher, 40-50 % and 20-30 %, respectively, in recent years.

The purse seine fishery

Fishing effort

Two distinct areas of fishing were observed in the western Indian Ocean, one located in the tropical area (North of Seychelles, 10°N-10°S and 45°E-70°E) and the other northeast of Madagascar. Most of the fishing effort in the western Indian Ocean was exerted in the tropical area. The fishing area in the eastern Indian Ocean is roughly between 3°N-10°S and 80°E-100°E. Before 1991, the fishing area was limited to the western Indian Ocean (Figure 4). After 1991, fishing took place in the eastern Indian Ocean as well, and the fleet withdrew almost completely from the western Indian Ocean as from late 1993. The explanation given by one purse seiner, was that this dramatic change was not due to decline of catch but to economic problems originating from the rise of the Japanese Yen during that time. Because of the low price of tuna, the choice was to save transhipment costs or to shift fishing to the Pacific Ocean. In the eastern Indian Ocean, transhipment is not needed as catches are unloaded at ports near the canneries. Total fishing effort (operation and searching days) increased from 349 days in 1989 to 2,393 in 1992, and decreased drastically to 572 days in 1997 (Table 3, Figure 5).

Japanese purse seiners have traditionally targeted fish associated with floating objects, especially on log-associated schools. In the Indian Ocean, however, logs are few, so purse seiners utilize fish aggregating devices (FADs) extensively. As seen in Figure 6, sets on FAD-associated schools accounted for more than 75 % of the total sets and, if natural log sets are added, total sets on associated school reach nearly 100 %.

Catch

The total catch in weight follows the effort trend and increased from about 5,000t in 1989 to 45,500t in 1992, and decreased steeply to 9,300t in 1997 (Table 3, Figure5). Catch weight of each species in 1996 and 1997 respectively was 7,024t and 5,726t for skipjack, 3,912t and 2463 for yellowfin and 1,335t and 1,111t for bigeye,. Percentages of catch by species were 26 % for yellowfin tuna, 61 % for skipjack and 12 % for bigeye tuna in 1997. In the last four years, proportions of bigeye were higher: 11-15 %, compared to 4-8 % from 1990 through 1993, though the catch weight of bigeye in 1997 (1,111t) was the lowest of the 1990s. This increased percentage of bigeye is probably caused by the shift of fishing grounds.

Data processing and compilation

The owners of fishing vessels have obligation to submit the log sheet on their operations and catch information to the Japanese Government. In the longline log sheets, set by set data on catch number and weight for each species and operational data such as fishing date and location, fishing effort (the number of baskets and hooks) and water temperature are included. The number of hooks per basket is important as it indicates the depth of the gear and target species. Six tunas (bluefin, southern bluefin, albacore, bigeye, yellowfin and skipjack), swordfish and six billfishes (striped marlin, blue marlin, black marlin, sailfish and shortbill spearfish) are recorded separately in the catch data. Additionally, information is requested on the on the top part of the sheet for each cruise (date and port of starting and finishing of the cruise), vessel (name, size, license number and call sign), the number of crew and the configuration of the fishing gear (material of main line and branch line).

Although the data sheet format for purse seines is similar to that of longlines, there are several differences between them. In the case of purse seine log sheets, catch data is only weight for each species. All sets are recorded and if there are no sets made, search is also recorded. School types are recorded by codes in set by set data. School types are categorized to six schools associated to floating objects (log, artificial floating object, vessel, shark and whale) and four free swimming schools (dolphin associated, free, boiling, jumping). Start and finish times of each operation are also provided in set by set data. Species included in the purse seine log sheets are skipjack, frigate tunas, yellowfin, bigeye, bluefin, albacore and others. Moreover, yellowfin and bluefin are divided into two categories, fish larger and smaller than 10kg. For fishing gear configuration, length and depth of the fishing net are provided. Gear configurations are very important information to estimate changes of fishing efficiency in these fisheries. In both fisheries, the log sheets are submitted for each cruise.

Using the log sheets submitted by Japanese longliners and purse seiners, the NRIFSF(National Research Institute of Far Seas Fisheries) compiles statistics of these fisheries. This Institute also prepares and sends these statistics in required form to each of the international organizations for fisheries resource management (SPC, ICCAT, IATTC, IPTP, etc).

Size data and other biological data of tunas and billfishes caught by Japanese tuna fisheries are obtained from port sampling, on-board measurement by fishing, training and research vessels, and observer programs. However, it has not been possible to conduct port sampling for nearly all catches by purse seiners in the Indian Ocean which were unloaded at the ports in the southeast Asian countries. These data are compiled and used for providing timely fisheries information and for studies on stock status.

Research activity

Purse seine operation research by the NIPPON MARU

JAMARC (Japanese Marine Fishery Resources Research Center) has conducted purse seine operation research in the Indian Ocean using Nippon-Maru (760GRT). The main purpose of the research was to seek possible new fishing zones and resources for the commercial purse seine fishery through biological study of tuna and oceanographic research. This vessel also performed research on 1) oceanographic environment, 2) visual and several kinds of sonar observations of fish school structure, 3)biological observation of fish caught, 4) tagging of young skipjack, yellowfin and bigeye. In 1996 research cruises (April 1996 – May 1997), the Nippon-Maru made 186 sets and caught 3,635t in total.

Real Time Monitoring Program (RTMP: SBT)

The RTMP was established in 1991 to monitor the commercial catch rates of southern bluefin tuna on a real-time basis. When the Programme was established, there was about two years' delay before completing the compilation of catch and effort information for Japanese longline, which became an obstacle to provide reliable assessment of recent stock status. In addition, the reduction of Japanese quota to 6,065t shortened the fishing season drastically. This also induced uncertainty in assessments by increasing the time-area strata where fishery data were not obtainable.

Two objectives were set: 1) to collect catch and effort information on a real-time basis, and 2) to collect catch and effort information after the fishing season closed. Vessels operating under the Programme were required to report regular catch and effort information as well as size measurement on a real time basis through radio communication for all SBT caught.

The Programme started with 12 boats with two cruises covered by observers using 300t of Australian quota and 400t of Japanese quota in 1991. The Programme was expanded in the 1992 season to 17 boats with 14 cruises covered by observers and maintained at about the same level with 18 boats with 11 observer cruises in 1993, and 20 boats with 14 observer cruises in 1994. During this period, the quota, as well as observers for the Programme, were provided from both Australia and Japan.

The Japanese Government declared the extension of RTMP to the whole high sea fleet in 1995 and the Programme shifted to a unilateral activity. Since 1992, all vessels operating within 200 miles of Australian and New Zealand waters were also required to provide the same information as RTMP vessels, i.e. daily reports of catch and effort and of the size of all SBT caught. Therefore, the system was established to obtain catch and effort information including the size of fish caught on real-time basis for all SBT caught by Japanese-type longline operations.

The details of the RTMP as well as the observer program are described in Itoh and Tsuji (1995).

Experimental Fishing Program (EFP: SBT)

The annual TAC of southern bluefin tuna (SBT) was reduced in 1989 to about half of its previous level. This caused both temporal and spatial shrinkage of Japanese longline fishing operation, especially after the increase of CPUE observed after 1993, which resulted in lowered coverage by the fishery of the potential SBT distribution area. There arose a wide range of interpretations on fish density in areas where no fishing had occurred in recent years but were fished regularly historically, ranging from the assumption that there were no fish in these areas, to the assumption that there was the same density of fish as in the fished area.

Since the current stock assessment of SBT relies heavily on CPUE information obtained from the Japanese longline fishery, the dispersion in interpretation of longline CPUEs resulted in a wide spread of interpretations on stock status. In an initiative to resolve this issue, Japan conducted an Experimental Fishing Programme (EFP) in July and August, 1998, with fishing operations in time and areas that have not been covered by the commercial fishery in recent years. The survey was designed to estimate fish density in areas which would not be covered when no constraint was put on the selection of fishing area. The details of the EFP are described in Anon (1998).

Analysis of survey results is now in progress. The preliminary result show that the area not selected for fishing when without constraint still contained 30–120 % of the fish density of commercially selected fishing areas. However, this ratio changed widely with month of operations and size group of fish, and further surveys are needed.

Recruitment Monitoring Survey (SBT)

The tuned VPA method currently used to assess the stock status of southern bluefin tuna cannot provide reliable estimates for recent recruits, especially for cohorts which had not reached the minimum age for tuning in the year of assessment. Nonetheless, the estimate of recent recruitments is extremely important for stock management, especially when the stock is over-exploited. In order to overcome this problem, Australia and Japan has developed a collaborative project since 1993to seek methods to estimate recruitment strength at the earliest possible timing.

The main components of the project are i) estimation of age 3–5 fish abundance in South Australia by aerial survey, and ii) estimation of age 1 fish abundance in Western Australia by acoustic survey. Archival tagging, conventional tagging, and development of a GIS database have been also conducted to collect information necessary to evaluate and support the development of these indices. At this time, the recruitment indices are available for 1993–1998 by aerial survey and for 1996–1998 by acoustic survey.

Shoyo-Maru survey

Japan plans to conduct a research survey with the R/V Shoyo-Maru on the southern bluefin tuna spawning ground as well as the nursery area from December 1998 to March 1999. The objectives of the cruise are i) investigation of reproductive biology and behavior of spawners, ii) investigation of larval distribution and survival, iii) investigation on the effect of oceanographic features on behaviour and distribution of larvae, juvenile and adult tunas, and iv) collection of basic information required for quantitative monitoring of age 1 tuna by acoustic survey.

References

Ihot, T., and S. Tsuji (1995), Review of the RTMP activity and 1995 situation., SBFWS/95/7, 57pp.

NRIFSF, and Fishery Agency of Japan (1998), Pilot plan for experimental fishing programme for southern bluefin tuna., CCSBT-SC/9807/30, 26pp.

Table 1. Number of Japanese boats operated in the Indian Ocean. 1997 is preliminary.

Fleet/Year	1989	1990	1991	1992	1993	1994	1995	1996	1997
Longliner	228	207	179	180	189	202	225	240	195
Purse seiner	4	5	13	12	11	8	6	5	3

Table 2. Fishing effort and catch in weight (t) by the Japanese longline fishery in the Indian Ocean (FAO area 51 and 57), 1971-1997. 1997 is preliminary. Sets and hooks are in thousand and million, respectively.

Year	Sets	Hooks	Total	SBT	ALB	BET	YFT	SWO	BILL
1971	41	103	64446	22585	3659	13969	18271	1126	4836
1972	29	78	46219	19657	1047	11401	9373	970	3771
1973	36	70	32622	18645	1647	5740	4070	679	1841
1974	35	75	40144	22310	2513	7192	4402	701	3026
1975	40	81	30935	17470	1127	5304	4301	658	2075
1976	29	67	26781	20548	778	1851	2180	291	1133
1977	23	54	23092	17229	244	2879	1640	190	910
1978	21	52	28499	10241	264	10426	3720	765	3083
1979	20	49	16183	9214	185	3254	1517	353	1660
1980	28	70	24331	13604	402	4856	3035	407	2027
1981	27	68	24660	11037	876	6355	3879	524	1989
1982	27	67	28971	9090	759	10413	5936	739	2034
1983	39	100	43883	15392	1152	17184	6567	950	2638
1984	36	95	38226	12842	1412	12830	7056	947	3139
1985	42	112	45925	13758	1968	16539	9036	1638	2986
1986	39	106	40318	9134	1828	15075	10544	1100	2637
1987	34	94	35374	8396	1642	14747	7551	1116	1922
1988	29	79	31653	8242	1024	11679	8382	1066	1260
1989	24	67	20538	8330	634	6796	3536	654	588
1990	15	42	20131	5324	740	7638	5122	785	522
1991	17	48	15597	2707	830	7139	3847	630	444
1992	15	42	14326	2949	1040	4786	3844	1151	556
1993	14	39	15599	1385	937	7353	3826	944	459
1994	24	68	29140	2520	1485	14524	6956	1355	881
1995	28	82	29287	2619	1770	14794	6044	1239	774
1996	34	99	35896	3591	2161	14741	10443	1678	941
1997	39	116	44720	4597	2762	16464	13971	2327	2048

Table 3. Catch and effort statistics for the Japanese purse seine fishery in the Indian Ocean. 1997 data are preliminary. The unit of catch and effort are metric ton and days (search days and operation days), respectively.

Year	Days F.	Total	SKJ	YFT	BET
1985	45	558	315	75	168
1986	84	864	562	160	142
1987	170	1319	937	260	122
1988	175	2917	2250	389	277
1989	349	4913	3449	883	581
1990	813	15754	11187	3222	1225
1991	1343	22242	15877	5061	1269
1992	2393	45560	31573	11882	1757
1993	2161	44277	31309	10946	1959
1994	1607	29610	20090	5338	4177
1995	1661	24434	16077	4751	3599
1996	780	12281	7024	3912	1335
1997	572	9317	5726	2463	1111

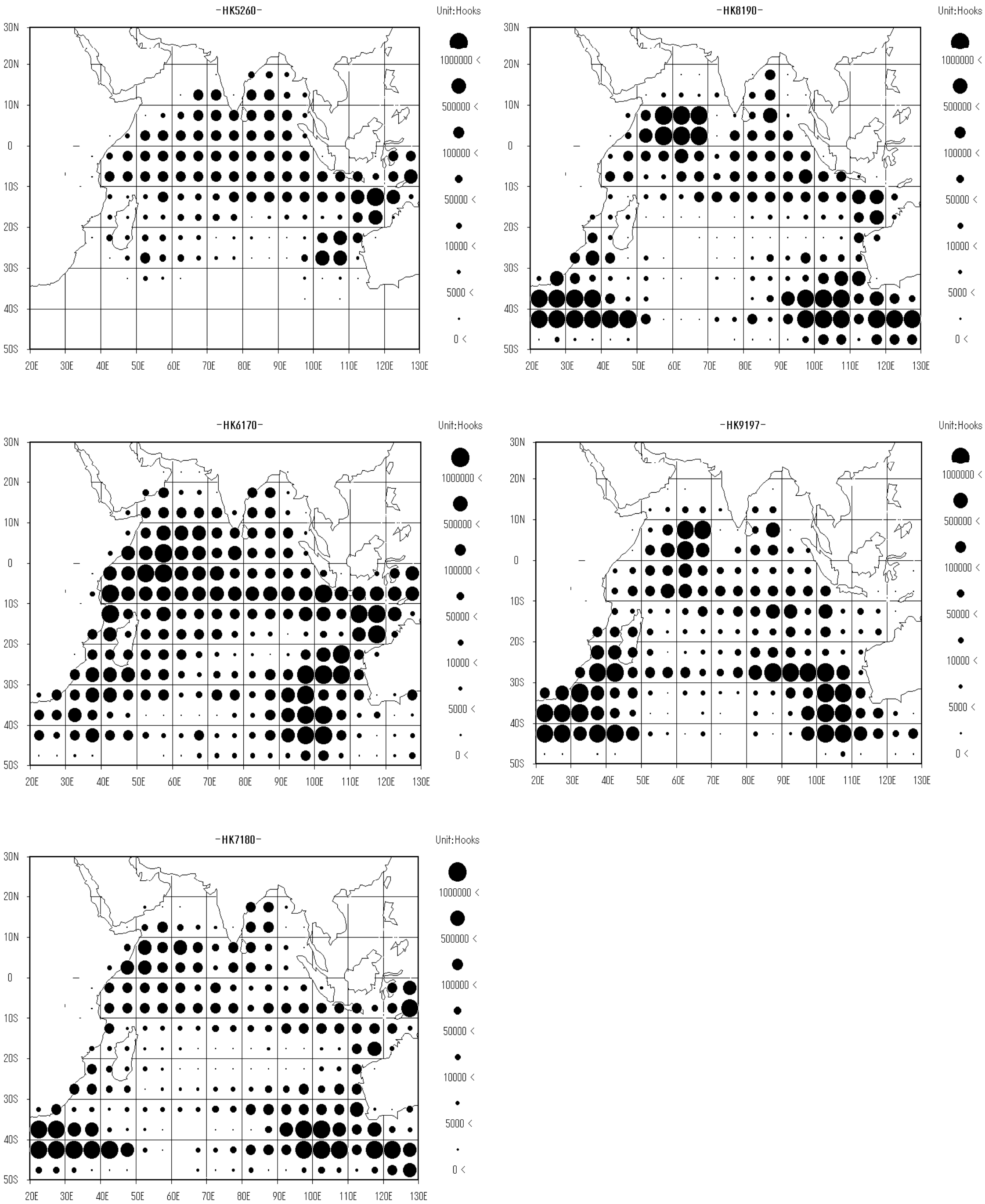

Figure 1. Geographical distribution of longline fishing effort for each decade.

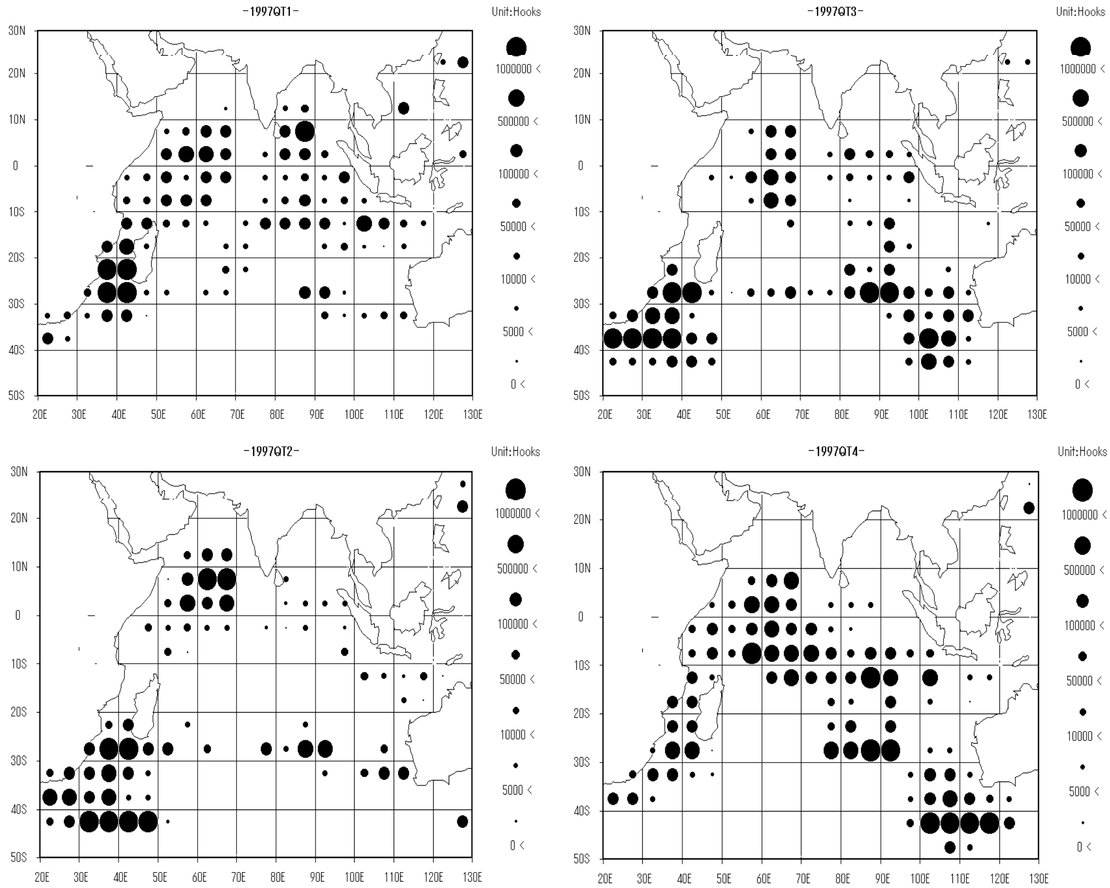

Figure 2. Seasonal change in longline effort distribution in the Indian Ocean.

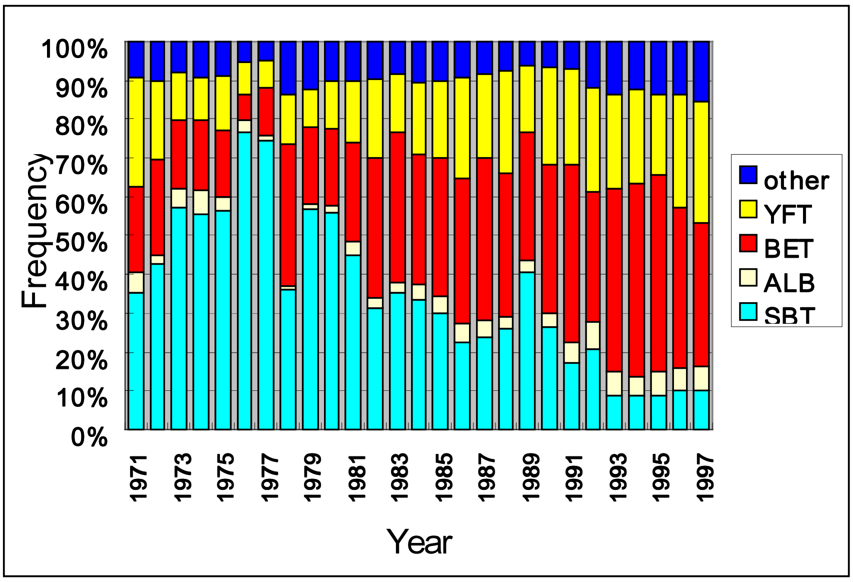

Figure 3 Proportion by weight of each tuna species (YF: yellowfin, BE: bigeye, ALB: albacore, and SBT: southern bluefin) in the total catch weight for Japanese longliners.

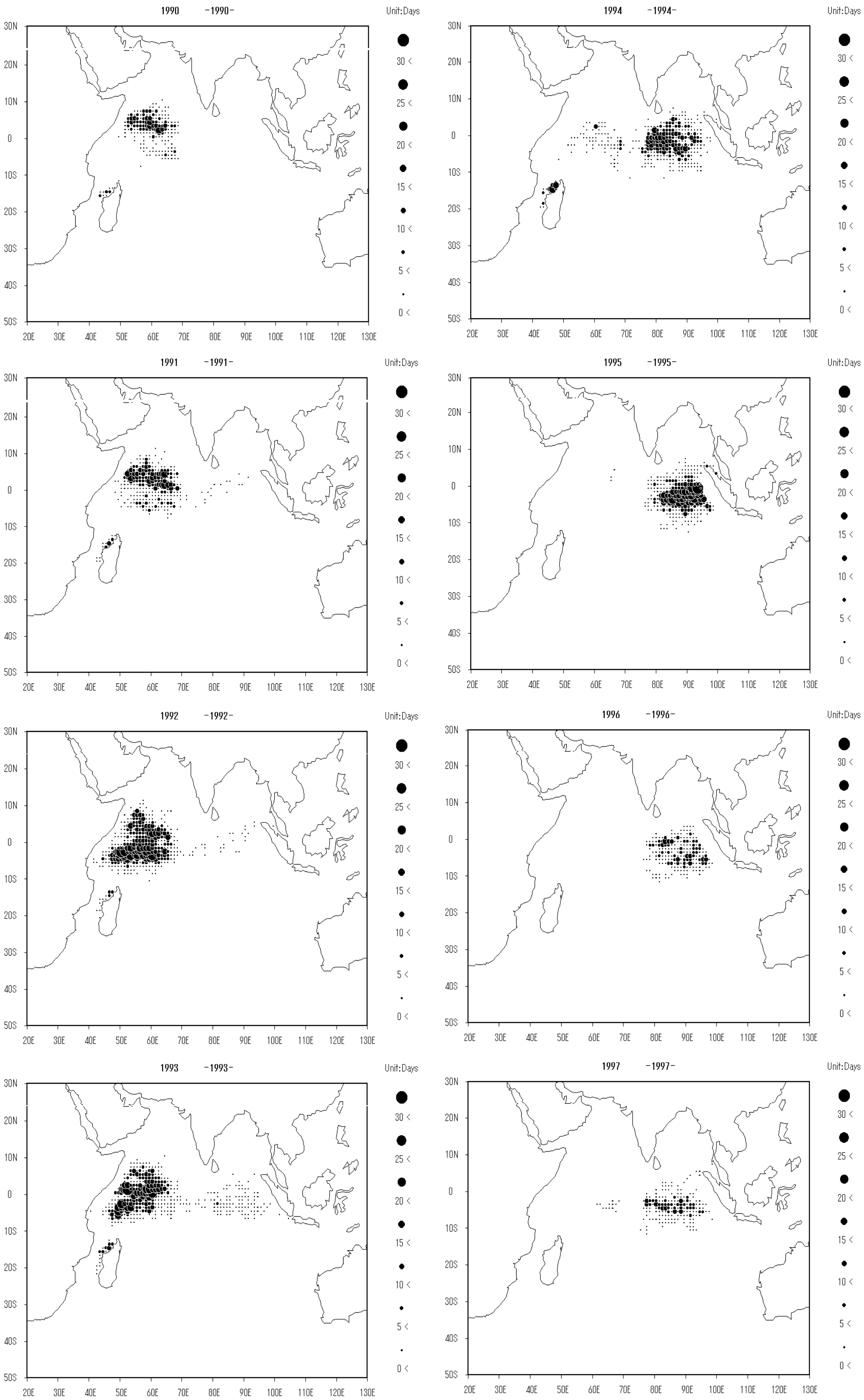

Figure 4. Distribution of effort (days) by Japanese purse seiners in the Indian Ocean from 1990 to 1997.

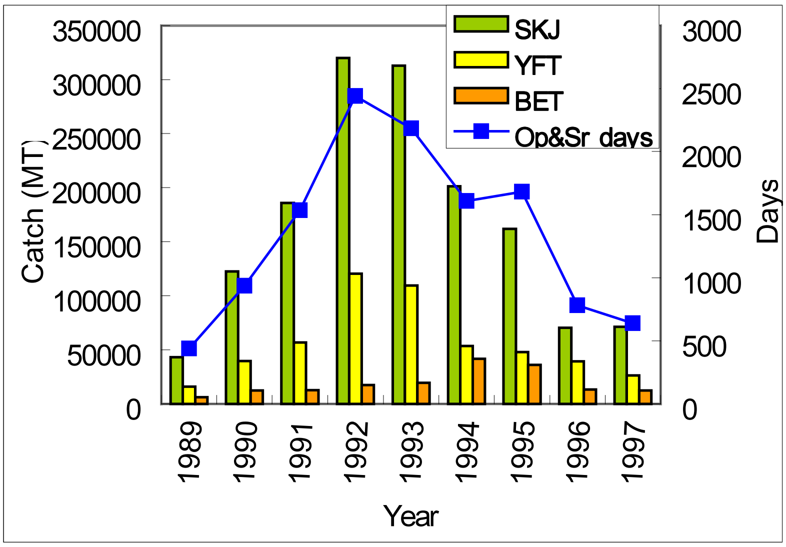

Figure 5. Change in effort and catch weight of three tuna species (YF: yellowfin, SK: skipjack, and BE: bigeye) for Japanese purse seiners in the Indian Ocean.

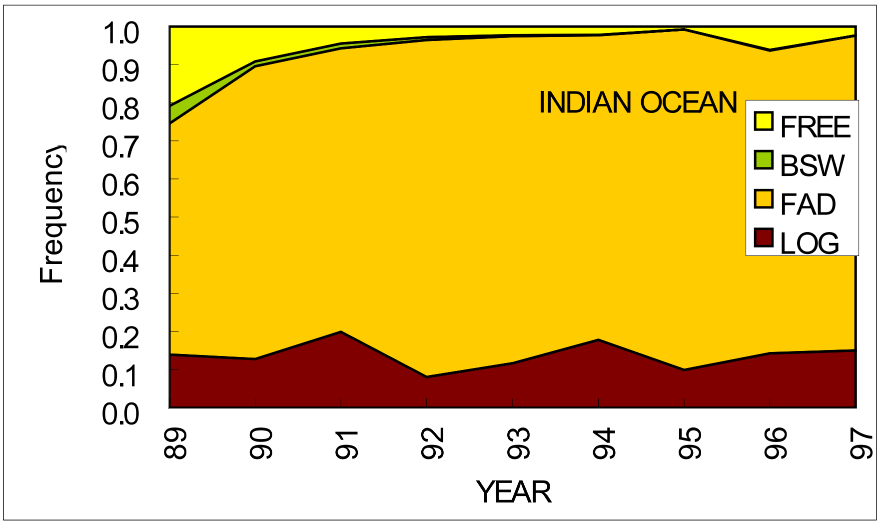

Figure 6. Change in the proportion of each set type. FREE : free school, BSW : boat, shark and whale associated school, FAD : FAD (fish aggregating device) associated school and LOG : log associated school.