

A HISTORICAL REVIEW OF JAPANESE LONGLINE FISHERY AND ALBACORE CATCH IN THE ATLANTIC OCEAN

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ABSTRACT

A history of Japanese longline fishery in the Atlantic Ocean was reviewed based on the database of the Japanese longline fishery, laying stress on the development of deep longline operations and general catch trend of albacore. The target species of the Japanese longline fishery was yellowfin and then changed to albacore in the early stage. The catch of albacore peaked at 2 million fish in 1964. Then albacore catch decreased year by year. In the early 1970's, deep longline operations were developed and the target species was changed from albacore to bigeye. In the 1980's albacore catch has been very minor in the Japanese longline catch.

RESUME

L'évolution de la pêche palangrière japonaise dans l'Atlantique a été examinée à partir de sa base de données, en mettant l'accent sur l'essor des opérations de palangre profonde et la tendance générale de la capture de germon. L'espèce visée par la pêcherie palangrière japonaise, qui était l'albacore, est bientôt devenue le germon. La prise de germon a atteint un pic de 2 millions de poissons en 1964, puis a baissé d'année en année. Au début des années soixante-dix ont surgi les opérations de palangre de profondeur, et l'espèce cible est alors devenue le thon obèse. Pendant les années quatre-vingt, la prise de germon a été très peu importante dans le cadre de la prise palangrière japonaise.

RESUMEN

Se examinó la historia de la pesquería japonesa de palangre en el Océano Atlántico a partir de la base de datos de la pesquería de palangre de Japón, destacando el desarrollo de operaciones de palangre profundo y tendencia general de la captura de atún blanco. La especie-objetivo de la pesquería de palangre de Japón era el rabil, cambiando después a atún blanco en una primera etapa. La captura de atún blanco alcanzó un máximo de dos millones de peces en 1964. A continuación, la captura de esta especie decayó de año en año. A comienzos de la década de los años 70, se desarrolló la operación de palangre profundo y la especie-objetivo pasó de atún blanco a patudo. En los años 80, el atún blanco constituyó una captura de muy escasa importancia del palangre japonés.

1. GENERAL VIEW OF JAPANESE LONGLINE FISHERY IN THE ATLANTIC OCEAN

The Japanese commercial longline fishery in the Atlantic Ocean commenced in 1956 in western equatorial waters. Then the fishing ground was expanded into the whole tropical area in the mid-1960s (Figure 1). The fishing effort, in terms of nominal hook numbers, increased rapidly to a peak of 97 million in 1965 (Table 1). In the early period the target species was yellowfin, but it was changed to albacore from the beginning of the 1960s. After 1965 some Japanese longliners had shifted to the Indian and Pacific Oceans. Then, the efforts in the Atlantic Ocean decreased rapidly to 30 million in 1969, only 30% of that in 1965. 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-1970s, as development of super cold freezers on board made possible the supply of raw meat of the Atlantic tunas for the materials of "sashimi" in the Japanese market, the fishing effort increased again and fluctuated between 32-56 million in this decade. The target species were shifted to bluefin, southern bluefin and bigeye tunas from albacore. The efforts were concentrated mainly in four areas, off Nova Scotia, off Morocco/Sahara, off Angora and

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off South Africa (Figure 1). The effort decreased drastically in the western tropical Atlantic, especially in the southwest Atlantic. The efforts were concentrated in the eastern Atlantic in this decade.

The deep longline operations were 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 1976 (Koido and Yonemori, 1987). But it was a very minor portion of the total effort in this decade.

In the 1980s the fishing effort increased gradually and reached about 90 millions in 1989 with some fluctuations. The catch of bigeye has increased gradually with development of deep longline and recently has occupied more than 70% of total Japanese catch in the Atlantic Ocean (Table 1). By contrast, the catch of albacore and yellowfin tunas gradually decreased. Most efforts were distributed throughout the tropical waters off Africa in the 1980s (Figure 1).

In 1990 the effort reached 96 million hooks and it was the second highest in the history, though the total catch decreased by about 8% on the previous year. In 1991/92 the fishing effort and catch of major species had decreased.

2. DEVELOPMENT OF DEEP LONGLINE OPERATION.

The deep longline (DLL) was developed to fish in deeper water below thermocline by the extension of main line between floats. The extension of main line resulted in an increase in the number of branch lines between floats, as the distance between branch lines was generally constant. Generally the number of branch lines ranges from 4 to 6 between floats in the regular gear and from 7 to 15 in deep one. The calculated theoretical maximum hook depths were around 170m and 300m in the typical regular longline (RLL) with 6 branch lines and DLL with 13 branch lines (Suzuki *et al.* 1977). In this paper Japanese longline gears were classified arbitrarily into four types, RLL, DLL-1, DLL-2, and DLL-3 which have 4-7, 8-11, 12-15, and 16-20 branch lines between floats, respectively.

2.1 Historical change of the gear composition.

Table 2 shows the historical change of gear composition (%) from 1975 to 1992. In 1975-79, more than 90% of the total effort (number of hooks) was composed of RLL. In 1980-84, the DLL-1 increased rapidly and occupied around 50% of the total, while the amount of RLL decreased to around 50%. In this period DLL-2 appeared but still occupied a minor portion. In 1985-89, DLL-2 increased rapidly and occupied a major portion, while DLL-1 decreased to about 20%. DLL-3 has been used since 1987 and increased rapidly. In 1992 DLL-3 occupied about 34% of the total effort and became a major gear type in the Atlantic Ocean.

2.2 Geographical distributions of the gears in the Atlantic Ocean and catch composition by the gears.

Figure 2 shows the geographical distributions of four gear types on 5° x 5° basis in 1985-92, when DLLs had been developed well. The distribution of RLL was restricted in the two latitudinal bands which were located in 35-45° N and in 35-45° S. On the contrary, DLL-3 was distributed in the eastern equatorial waters between 0° and 10° S. The distributions of DLL-1 and DLL-2 were in the areas intermediate to the former two gears.

The percentages of the catch by species in four gear types are shown in Table 3. Almost all catches of bluefin and southern bluefin tunas were obtained by RLL, and more than half of the albacore catch was also obtained by RLL. On the contrary, most bigeye and yellowfin tunas catches were obtained by DLLs.

These figures and table show clearly that RLL has targeted bluefin and southern bluefin tunas in the temperate waters after DLLs had developed, while DLLs have targeted bigeye and yellowfin tunas in the tropical waters.

3. CATCH TREND OF ALBACORE

Figure 3 shows the historical changes of albacore catch (number) and effort (hooks) by the Japanese longline fishery by north and south Atlantic. Albacore catch and fishing effort increased rapidly since 1956, peaked in 1964, and then decreased. The change in albacore catch paralleled the change of effort very well until about the beginning of the 1970's. After 1970 the fishing effort began to increase again and has continued to increase until now with some fluctuations, but the albacore catch as remained at a low level.

Figure 4 shows the nominal CPUE (catch in number /1000 hooks) of albacore by north and south Atlantic. In the 1960s, the CPUE was at a high level with large fluctuations and started to decrease sharply since 1968. The decrease in CPUE was delayed several years after the decrease in the catch. This means that the decrease in catch in the late

1960s was mainly due to the decrease in the fishing effort and the decrease in *CPUE* in and after the 1970s was mainly due to the shift of the target and fishing grounds.

Figures 5 and 6 show the distribution of catch and *CPUE* of albacore by decade. The albacore catch was mainly obtained from the north west Atlantic, off Brazil, and off Namibia/South Africa in the 1960s. Since the 1970s the albacore catch was distributed sparsely over the Atlantic Ocean. The distribution of *CPUE* in the 1960s may reflect the geographical distribution of albacore in the Atlantic, because the fishing effort was distributed widely in the Atlantic Ocean in this decade (Figure 1). Since 1970, the *CPUE* decreased sharply even in the area in which the high *CPUE* was observed in the 1960s.

4. HISTORICAL CHANGE IN MEAN LENGTH

Figure 7 shows the historical change of mean fork length by ICCAT albacore area. Historical mean length by area showed that the mean length was greater in tropical areas than temperate areas for both hemispheres. In AL-31, the mean length has been fairly stable in the years observed, though clear seasonal changes were observed (Uozumi, 1993). In AL-32, it has been also stable as in AL-31. In AL-33, the mean length was stable at around 100 cm during the 1961/69 period and then decreased, to around 90 cm, but increased again from about 1981. In AL-34, there was no clear change in the mean length, though there was no sufficient data to indicate the historical trend adequately.

Table 1. Historical catch and effort of Japanese longline fishery in the Atlantic Ocean.

Year	Hook (x1000)	Catch in number (x 1000)						
		BFT	SBF	ALB	BET	YFT	SWO	Billfishes
56	131	0	-	1	0	12	0	1
57	3,376	0	-	32	9	259	1	10
58	8,001	0	-	100	15	746	1	15
59	15,312	3	-	357	45	1,098	2	36
60	20,727	7	-	452	71	1,159	3	50
61	26,673	4	0	431	244	980	11	110
62	54,963	54	-	1,107	368	990	20	296
63	55,004	67	-	1,134	285	886	24	235
64	84,998	63	0	2,134	344	879	31	365
65	97,581	60	0	1,769	650	927	44	292
66	53,814	29	-	1,586	232	395	22	176
67	31,154	5	-	688	181	366	16	113
68	30,255	2	7	917	205	274	17	104
69	29,676	1	32	390	264	242	57	69
70	41,580	1	132	811	189	190	57	82
71	55,873	8	39	552	395	292	29	77
72	44,139	3	80	211	347	159	32	31
73	35,976	8	47	109	391	109	20	26
74	38,495	45	45	133	458	95	25	23
75	58,701	40	19	115	449	116	32	33
76	32,837	40	19	93	171	104	15	26
77	32,501	43	81	59	190	41	14	6
78	44,747	23	125	44	210	56	15	4
79	55,458	25	154	88	271	63	16	5
80	59,846	33	54	94	455	70	38	10
81	71,985	40	40	154	472	112	39	16
82	77,018	23	18	104	704	138	66	26
83	43,837	27	10	84	352	53	32	11
84	64,779	24	33	52	524	92	63	17
85	72,525	29	26	90	676	125	73	22
86	54,280	15	6	82	500	83	44	14
87	46,739	21	17	52	419	84	39	14
88	70,355	25	8	75	691	144	70	18
89	91,507	12	9	73	861	173	89	33
90	96,740	20	19	81	765	146	101	21
91	91,206	26	26	84	654	114	69	18
92	88,199	24	8	68	678	84	54	20

Table 2. Historical change of gear composition for the Japanese longline fishery in the Atlantic Ocean. Gears were classified into four groups (RLL, DLL-1, DLL-2, and DLL-3) which have 1-7, 8-11, 12-15, and 16-20 branch lines between floats, respectively.

Year	RLL	DLL-1	DLL-2	DLL-3	Total Hooks
75	100	0	0	0	59
76	97	3	0	0	33
77	100	0	0	0	33
78	97	3	0	0	45
79	96	3	1	0	55
80	72	26	2	0	60
81	65	33	2	0	72
82	36	57	7	0	77
83	48	46	6	0	44
84	43	43	14	0	65
85	34	32	34	0	73
86	46	24	30	0	55
87	47	22	28	4	47
88	34	19	42	4	70
89	26	18	44	12	91
90	32	15	28	25	97
91	36	14	16	33	91
92	29	16	18	38	88

Table 3. Catch composition (%) by four types of gears in each species in 1985-92 in the Atlantic Ocean.

Gear Type	RLL	DLL-1	DLL-2	DLL-3
Number of Hooks	30.7	15.8	27.1	26.4
Bluefin	92.6	5.3	1.4	0.8
Southern bluefin	92.7	5.6	1.3	0.5
Albacore	54.5	22.3	9.6	13.7
Bigeye	10.9	16.6	36.6	35.9
Yewllowfin	16.7	19.8	40.5	23.0
Swordfish	9.6	10.3	36.4	43.7
White marlin	5.2	15.2	41.3	38.3
Blue marlin	2.7	9.6	44.3	43.4
Black marlin	8.1	17.6	23.0	51.4
Sailfish and spearfish	4.8	9.7	24.4	61.1
Total	17.1	16.5	34.0	32.4

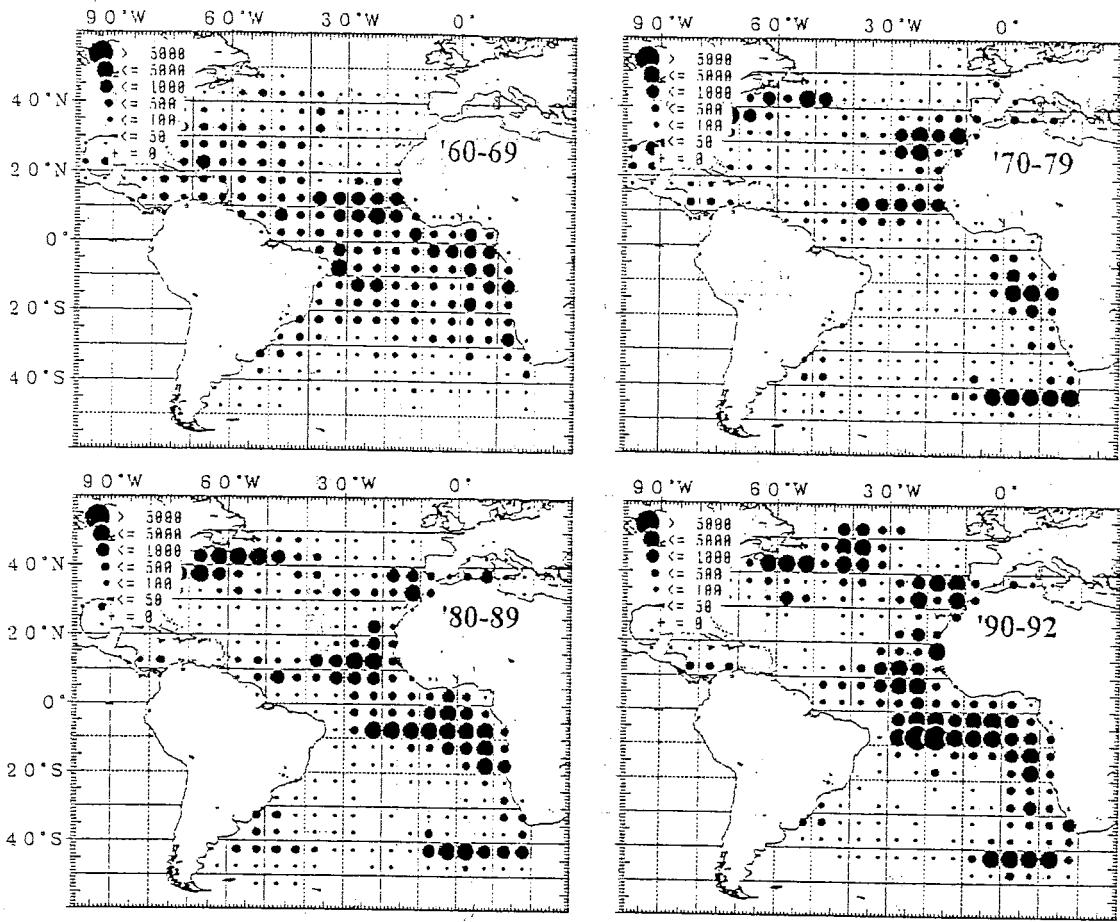


Fig. 1 Effort distribution of Japanese longline fishery in the Atlantic Ocean in each decade from 1960 to 1992. Numbers in the keys show the mean nominal hook number in thousand per year in each decade.

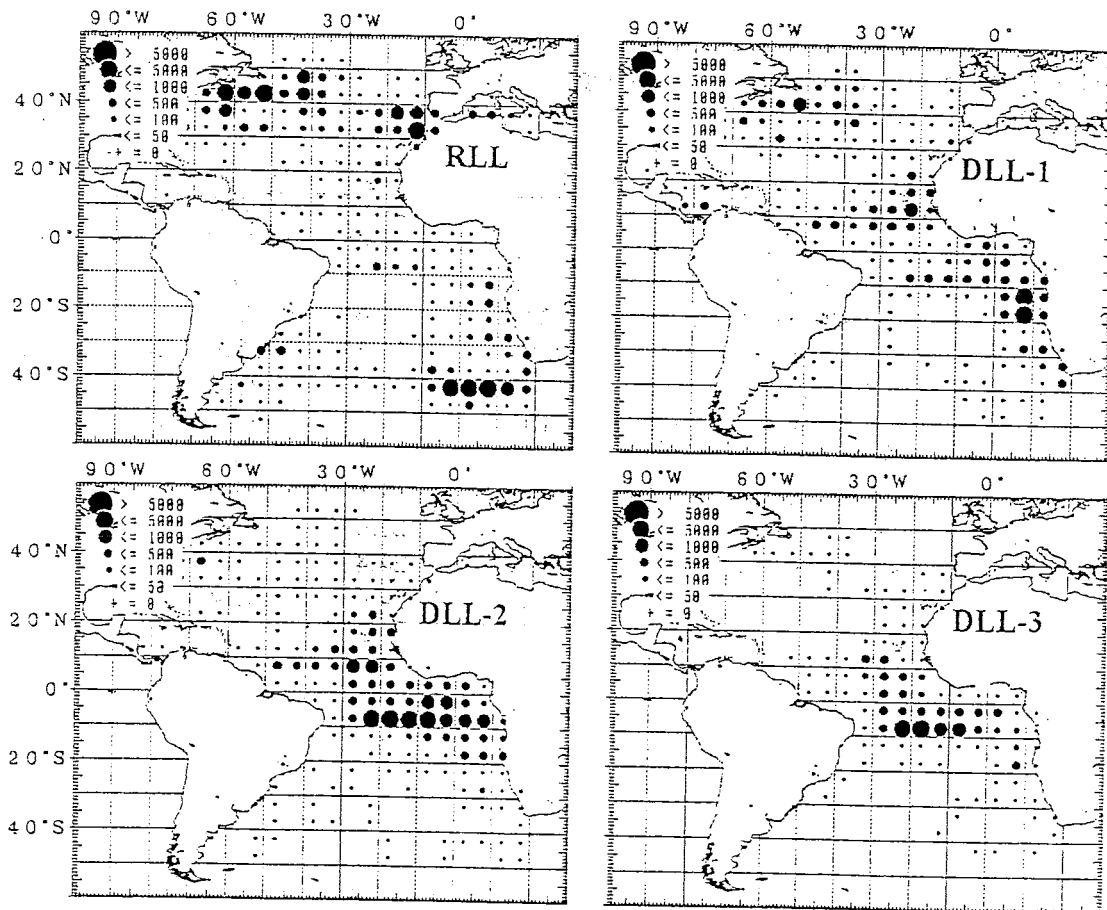


Fig. 2 Effort distributions by gears in 1985-92. RLL, DLL-1, DLL-2, and DLL-3 have 4-7, 8-11, 12-15, and 16-20 branch lines between floats, respectively.

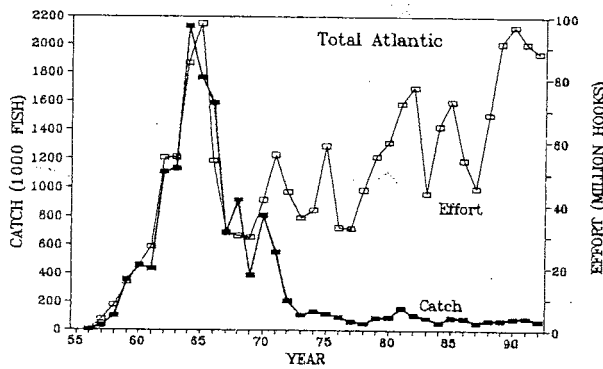
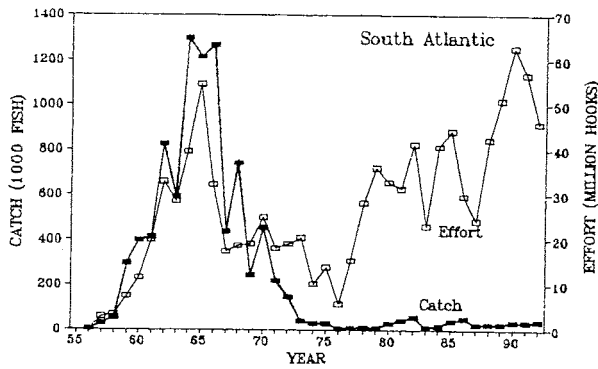
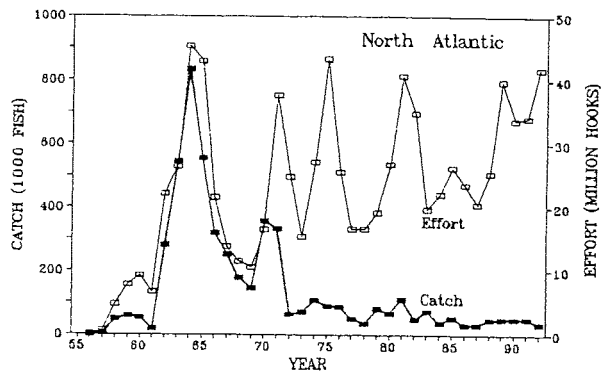


Fig. 3 Historical change of longline effort and albacore catch in the Atlantic Ocean from 1956 to 1992.

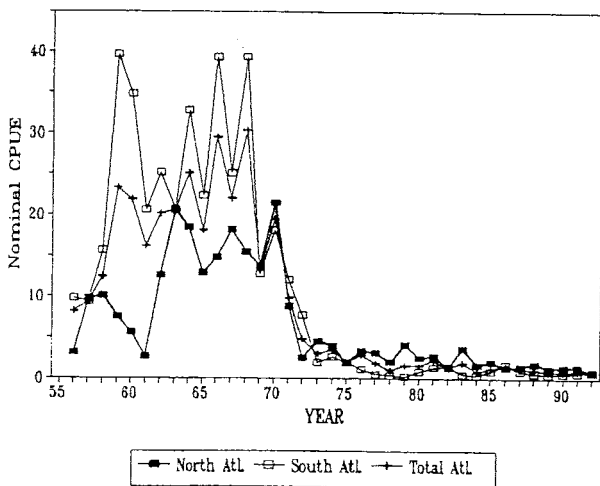


Fig. 4 Historical change of nominal albacore CPUE (number fish/1000 hooks) by Japanese longline fishery in the Atlantic Ocean.

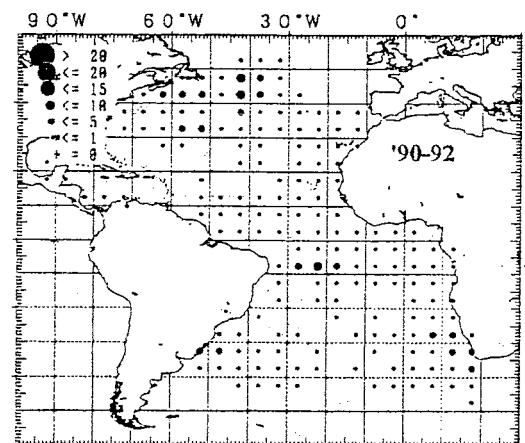
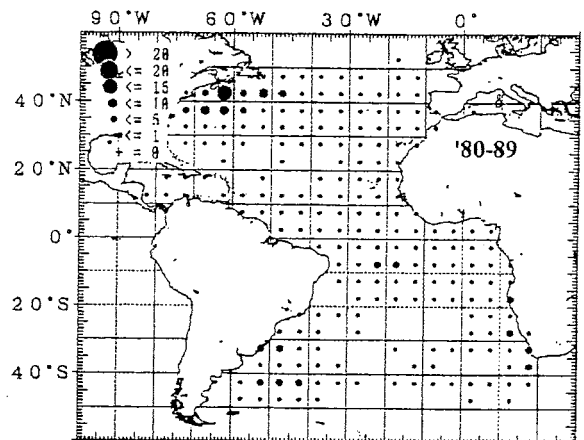
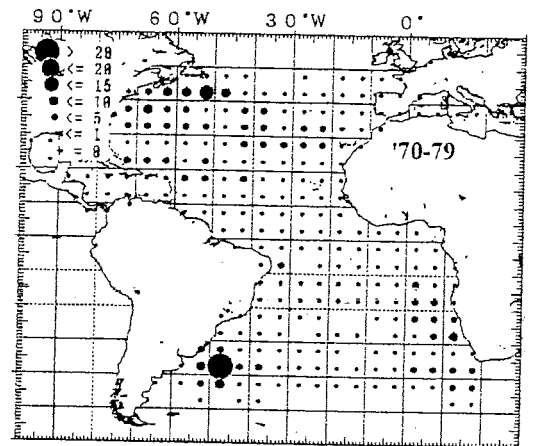
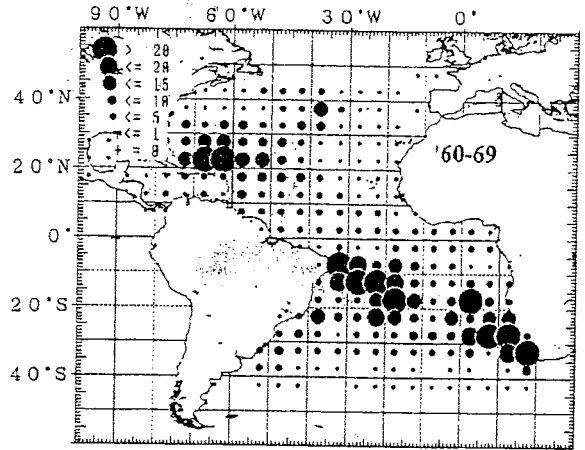


Fig. 5 Distribution of albacore catch by Japanese longline fishery in each decade. Numbers show mean catch (in thousand fish) per year in each decade.

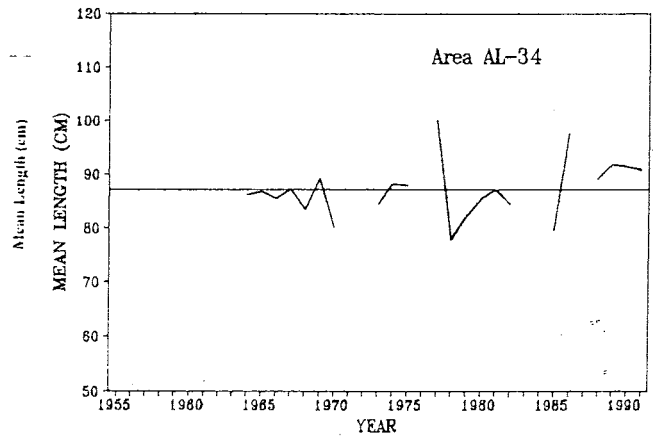
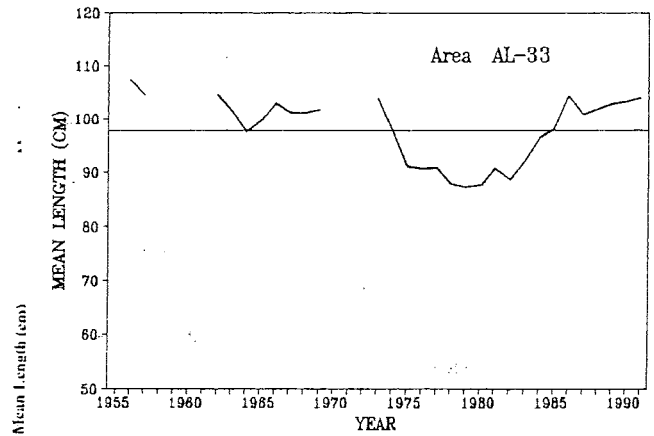
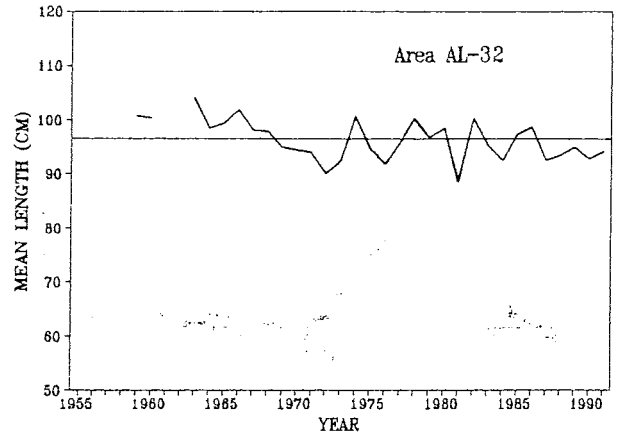
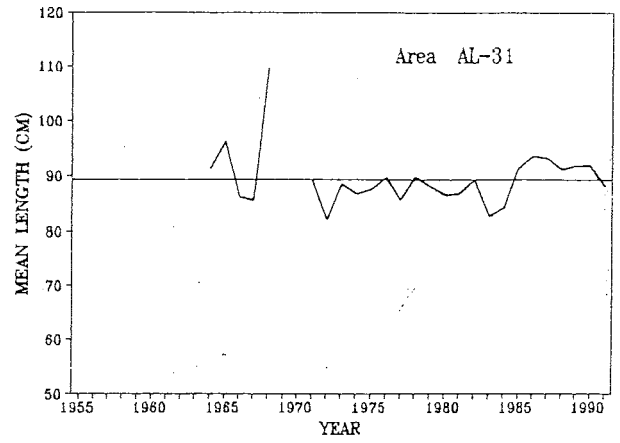
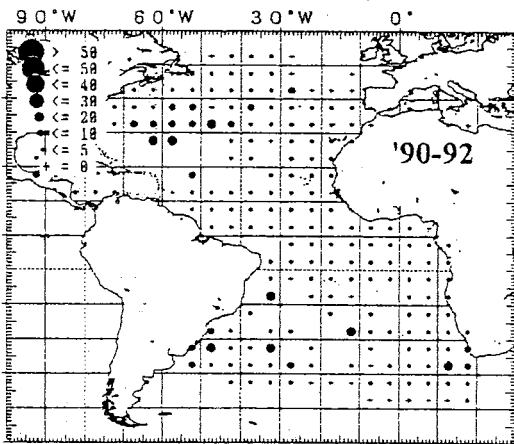
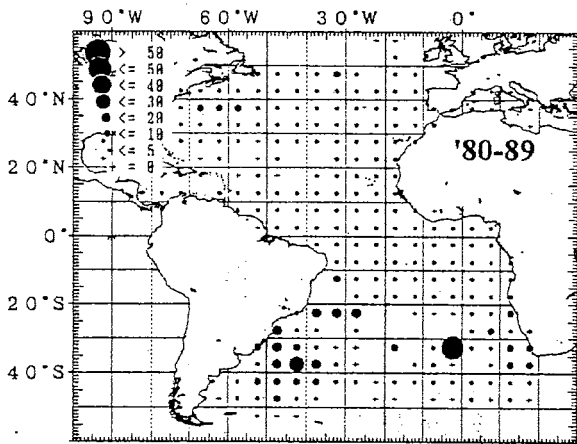
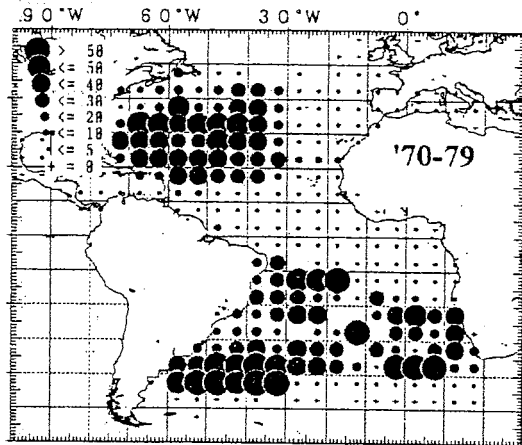
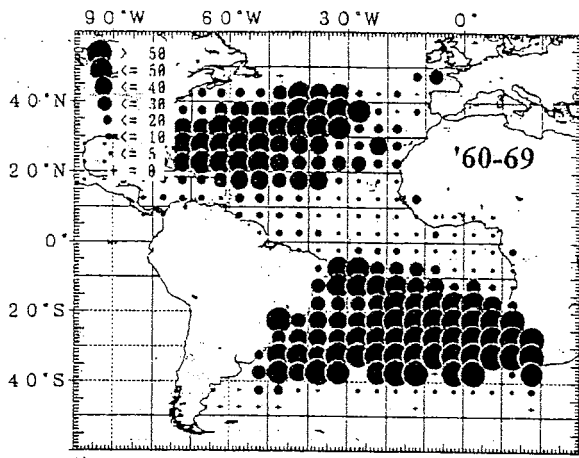


Fig. 6 Distribution of albacore CPUE by Japanese longline fishery in each decade. Numbers show mean CPUE (number fish/thousand hooks) per year in each decade.

Fig. 7 Historical changes in mean fork length of albacore caught by Japanese longline fishery.