SCRS/1996/035

Col.Vol.Sci.Pap. ICCAT, 46 (4) : 393-398 (1997)

HISTORICAL CPUE OF PELAGIC SHARKS CAUGHT BY THE JAPANESE LONGLINE FISHERY IN THE ATLANTIC OCEAN

Nakano, H.[1], *M. Honma*[1]

SUMMARY

Historical Japanese logbook data were re-examined from the information of the revised format logbook data which include the catch by four major species recently. The data of those recording rates that were less than 21% by cruise were considered to record mainly shortfin mako catch. The data of those recording rates that were more than 70% were considered to include the catch of all shark species. The time series of CPUE were calculated for both data sets. The CPUE level for the data whose recording rates were less than 21% is similar to CPUEs of shortfin mako sharks reported from the Atlantic Ocean. The CPUE time series does not show drastic change during the period of 1971 to 1994. The CPUE level for the data which recording rates were more than 70% is in the range of total shark CPUEs reported in the Atlantic Ocean. The CPUE time series for total sharks does not show drastic change in the same periods.

RÉSUMÉ

Les données historiques japonaises issues des carnets de pêche ont été à nouveau examinées à partir des informations provenant des nouveaux carnets dans lesquels sont consignées les captures de 4 espèces principales. On a considéré que les données pour lesquelles les taux de déclaration étaient inférieurs à 21% par sortie concernaient majoritairement les captures de requin taupe-bleu et que les données pour lesquelles les taux de déclaration étaient supérieurs à 70% par sortie concernaient les captures de toutes les autres espèces de requins. Les séries temporelles de CPUE ont été calculées pour les deux jeux de données. Le niveau de CPUE pour les données dont les taux de déclaration étaient inférieurs à 21% était identique à celui des CPUE de requins taupes-bleus déclarées dans l'Atlantique. La série temporelle de CPUE n'indique aucun changement important entre 1971 et 1994. Le niveau de CPUE pour les données dont les taux de déclaration étaient supérieurs à 70% était identique à celui des CPUE de tous les autres requins déclarées dans l'Atlantique. La série temporelle de CPUE pour la totalité des requins n'indique aucun changement important entre 1971 et 1994.

RESUMEN

Recientemente se reexaminaron los datos históricos de los cuadernos de pesca de Japón a la luz de la información de los datos de los cuadernos de pesca con formato revisado que incluían la captura de cuatro especies principales. Los datos cuyas tasas de registro eran inferiores al 21% por campaña se consideraba que se referían principalmente a la captura de marrajos. También se consideraba que los datos cuyas tasas de registro eran superiores al 70% incluían las capturas de todas las especies de tiburones. Se calcularon las CPUE de las series temporales para ambos conjuntos de datos. El nivel de datos de la CPUE cuyas tasas de registro eran inferiores al 21% es similar a las CPUE de marrajo comunicadas para el Océano Atlántico. La CPUE de la serie temporal no muestra cambios drásticos durante el período de 1971 a 1994. El nivel de datos de la CPUE cuya tasa de registro era superior al 70% se encuentra en el rango de las CPUE totales de tiburones para el Océano Atlántico. La CPUE de las series temporales para el total de tiburones no muestra cambios drásticos en los mismos períodos.

Introduction

In recent years, there has been growing international concern over the conservation of some elasmobranch stocks and there is a need for a more systematic approach to the problem of assessment and management on elasmobranch stocks. It is difficult to collect fishery statistics without cooperation of fishermen for pelagic species, especially in the high sea fisheries. The historical CPUE series for pelagic shark species in the Atlantic were reviewed by Nakano (1993) using the Japanese longline fisheries statistics. However, the level of CPUE was considered to be underestimated, since logbook data do not include discard. Therefore, CPUE time series for pelagic sharks were reexamined considering the information of revised new format logbook data which include catch by the four shark species.

Materials and Methods

The Japanese longline fishery logbook data compiled by National Research Institute of Far Seas Fisheries (NRIFSF) were used for the analysis. Sharks catch was reported as "sharks" during 1971 to 1992 (Old Shark File). In 1991 the logbook format was revised and new one includes catch by

[1] National Research Institute of Far Seas Fisheries. 5-7-1 Orido, Shimizu 424, Japan.

four shark species, such as blue shark (*Prionace glauca*), porbeagle (*Lamna nasus*), shortfin mako shark (*Isurus oxyrinchus*) and other sharks (New Shark File).

In the logbook data, there are various reporting styles which depend on the strategies of the fishing vessels on shark catch treatment. For example, some vessels keep all kinds of sharks and use all of them. Other vessels keep only some kinds of sharks which have high market values. The other vessels keep no sharks and discard all of them. Therefore, the logbook data must be categorized by the reporting style for the CPUE analysis. Categorization of logbook data was done by the recording rate which is expressed as the ratio of number of the days when the sharks catch were recorded to total number of the day operated in a cruise (shark catch days / total days operated). The logbook data in a cruise which had no shark catch were excluded in the present analysis.

Occurrence rate of catch by species is expressed as the ratio of number of the days when the catch of shark was recorded to the total number of the days operated in a cruise (catch days by species / total days of operation). Distribution of CPUE (number of catch / 1,000 hooks) by 5x5 square by species were calculated using extract of New Shark File which has more than 70% of recording rate in each cruise. Strasburg (1958) reported distributions of major pelagic sharks caught by longline fishery in the tropical and north Pacific Ocean. Following his observation, species composition changed by latitudinal boundary, around 20N. Therefore, area were divided into three regions where were north of 20°N, between 20°N and 20°S, and south of 20°S for a calculation of CPUE time series. Nominal CPUEs were calculated as mean of the CPUE in each operation with 95% confidence intervals.

Results and Discussion

Figure 1 shows number of cruises by shark recording rate for New Shark File. The number of cruises was recorded at maximum in the class 1-10 %, then it decreased drastically in the next class to, but it increased again in 91-100% of recording rate. There was two modes in the recording rate composition, one is in 1-10%, and the other is in 91-100%.

Occurrence rate of catch for each species by recording rate class was shown in Figure 2. Occurrence rate of blue shark catch increased with recording rate and it became stable at recording rate more than 70%. Occurrence rate of shortfin mako shark catch is varied between 10 % and 30 %, though the occurrence rates seems to be more stable than one for blue shark. Regarding for porbeagle, occurrence rate was less than 5% in all range of recording rates. Occurrence rate of other sharks was varied between 26.9% and 1.7%. It is widely known that blue shark is the most dominant species in longline bycatch (Strasburg 1958, Taniuchi 1990). Based on those results, it could be assumed that almost of shark catch may be reported in the logbook data whose recording rate was more than 70%, though the actual discard is not known. Therefore, this data of which recording rates were more than 70% were used for CPUE of total shark. Catch of blue shark may dominate in those data. The data with recording rate less than 21% which mainly consists of shortfin mako shark was also used for CPUE calculation.

Geographical CPUE distributions by species were calculated using New Shark File with more than 70% recording rate (Fig. 3). Blue shark CPUE distribution indicated high CPUE area in higher latitude where north of 20N and south of 20S. It showed same distribution pattern reported in the north Pacific Ocean (Strasburg 1958, Nakano 1994). Shortfin mako shark CPUE distribution indicates similar trend of blue shark, although CPUE is lower than blue shark. Regarding confusion with longfin mako shark (*Isurus paucus*), Japanese longline fishermen distinguish a shortfin mako from a longfin mako, since market values are different. Because of low market value, only fishing vessels operating near Japan land longfin mako shark. CPUE distribution of porbeagle shark indicates high CPUE area in high latitudinal and also tropical regions. Considering known porbeagle distribution, high CPUE in the tropical region seems to be caused by mis-reporting, since porbeagle habit is cold high latitudinal waters. Since name of porbeagle shark in Japanese (*Nezumi zame*) is same as the Japanese local name of thresher shark, it is considered fishermen mis-reported shark species. The CPUE distribution of other sharks shows high CPUE in the high latitudinal area in the south and tropical Atlantic. It is considered that shark catch in the high latitudinal area means porbeagle, and it in for tropical includes family carcharhinidae.

Table 1 shows number of shark catch, hooks by latitudinal region and coverage of the data less than 21% recording rate for both Old and New Shark File. Coverage is expressed as the rate of number of hooks in the extracted data to the total number of hooks. It ranged between 6 and 31%. The minimum effort (467,000 hooks) was observed in 20-60S in 1975 and it corresponded to more than 150 operations. Table 2 shows coverage of the data more than 70% recording rate for both Old and New Shark File. Coverage ranged between about 2 and 20%, it was lower than 5% during 1978-1981. The minimum effort was 27,000 hooks (about 10 operations) in the south Atlantic.

Figure 4 show historical CPUE for three regions using the data less than 21% recording rate (mainly consist of shortfin mako shark) during the periods 1971 to 1994. The CPUE in all three areas fluctuated between 0.02 and 0.27, and does not show drastic change during the periods, although the CPUE for north of 20N and 20N-20S decreased gradually in the mid 1980s and recent CPUE are about half of those in the early period. The CPUE of shortfin mako shark in the Atlantic were reported by several authors (Mejuto 1985, Hazin 1990, Bonfil 1994). The range of reported shortfin mako CPUE were between 0.26 and 2.05. Those are higher than the values calculated in this study. However, the CPUE by Japanese observer in the North Atlantic (40-44N, 45-62W) was reported as 0.058 (Matsunaga per.com.), then it seems to be changed by area, season and etc.

The CPUEs for the data more than 70% recording rate (mainly consist of blue shark) show similar trends for the area 20N-20S and south of 20S (Fig. 5). It remained lower level at around 1-2 shark/1000 hooks until 1976, then up to the level of 4-8 shark/1000 hooks and decreased to around 2-4 after 1981. The CPUE for the area north of 20N fluctuated between 1 and 5 except increasing trend after 1993. The reported CPUE of total sharks in the Atlantic were 1.31-38.8 (Witzell 1985, Lopez at al. 1979, Bonfil 1994, Hazin 1990). Although, it is different among the areas reported, the CPUE in this study were in the range of reported ones. The Japanese longline fishery historically changed its fishing ground and gear configuration (Uozumi 1993). The change of CPUE for three regions seems reflecting the change of fishing grounds and gear configuration. These nominal CPUE have to be standardized near future to delete some biases.

The nominal CPUE trends for three regions of two data sets indicate no drastic change during past 23 years. In the present study, however, species specific CPUE was not analyzed. The two series of CPUE may reflect the abundance of shortfin mako and blue shark under the some assumptions. Even the CPUE of total sharks did not change, there is some possibilities that the biomass of some species might have changed. Therefore, it is necessary to conduct further research activities on board, such as observer program, to examine the population dynamics for each species.

Reference

Bonfil, R. 1994: Overview of world elasmobranch fisheries. FAO fisheries technical paper 341., pp. 119.

Hazin, F.H., A.A. Couto, K.Kihara, K. Otsuka, and M. Ishino 1990: Distribution and abundance of pelagic sharks in the south-western equatorial Atlantic. J. Tokyo Univ. Fish. 77(1):51-64.

Lopez, A.M., D.B. McClellan, A.R. Bertolino and M.D. Lange 1979: The Japanese longline fishery in the Gulf of Mexico, 1978. Mar. Fish. Rev. 41(10):23-28.

Matsunaga, H : National Research Institute of Far Seas Fisheries. (per. com.)

Mejuto, J. 1985: Associated catches of sharks, *Prionace glauca*, *Isurus oxyrinchus*, and *Lamna nasus*, with NW and N Spanish swordfish fishery, in 1984. ICES C.M. 1985/H:42: 16pp.

Nakano, H. 1993: A review of the Japanese fishery and research on sharks in the Atlantic Ocean. ICCAT CVSP 40(2):409-412.

Nakano, H. 1994: Age, reproduction and migration of blue shark in the North Pacific Ocean. Bull. Nat. Res. Inst. Far Seas Fisheries., 31: 141-256.

Strasburg, D.W. 1958: Distribution, abundance, and habits of pelagic sharks in the central Pacific Ocean. Fish. Bull. U.S. Fish. Wildlife Serv. 58:335-361.

Taniuchi, T. 1990: The role of Elasmobranchs in Japanese fisheries. NOAA Tech. Rep. NMFS 90: 415-426.

Uozumi, Y. and H. Nakano 1994: A historical review of Japanese longline fishery and billfish catches in the Atlantic Ocean. ICCAT CVSP XLI. Report of the second ICCAT billfish workshop. p.233-243.

Witzell, W.N. 1985: The incidental capture of sharks in the Atlantic United States Fishery Conservation Zone by the Japanese tuna longline fleet. NOAA Tech. Rep. NMFS 31:21-22.

Table 1. Historical shark catch in number and hooks by latitudinal area in the extracted data whose recording rate was less than 21% and coverage of hooks to the total effort of the Japanese longline fishery in the Atlantic Ocean.

	Catch in number			Hooks(x1000)				
YEAR	60N-20N	20N-20S	20S-60S	60N-20N	20N-20S	20S-60S	Total	Covarage(%)
1971	197	83	33	2095	1378	845	4318	7.73
1972	129	149	91	1228	2089	1482	4800	10.87
1973	114	65	91	1156	901	1631	3688	10.25
1974	150	55	104	2180	771	1479	4430	11.51
1975	612	128	21	4140	1677	467	6284	10.70
1976	237	55	53	3367	628	816	4812	14.65
1977	189	62	34	2629	875	1062	4565	14.05
1978	163	58	33	1008	668	1062	2738	6.12
1979	347	291	389	5416	4452	7501	17369	31.32
1980	212	358	365	4893	5189	3559	13641	22.79
1981	793	830	1558	9075	3704	5950	18729	26.02
1982	220	1051	780	3908	12679	3139	19727	25.61
1983	201	836	76	3904	6408	1728	12040	27.47
1984	167	702	71	3756	6011	2599	12366	19.09
1985	161	447	211	3434	7837	3740	15011	20.70
1986	311	370	133	4215	5114	2487	11817	21.77
1987	232	112	46	3885	1798	2483	8165	17.47
1988	146	446	80	3911	7633	2955	14499	20.61
1989	265	581	67	5058	9409	2992	17459	19.08
1990	328	742	156	6032	13128	3976	23137	23.92
1991	351	703	212	7395	13066	4051	24512	26.88
1992	330	490	138	6571	10153	1532	18256	23.17
1993	381	985	145	4523	20142	4636	29302	30.64
1994	84	514	197	2349	10306	1989	14644	14.63

Table 2. Historical shark catch in number and hooks by latitudinal area in the extracted data whose recording rate was more than 70% and coverage of hooks to the total effort of the Japanese longline fishery in the Atlantic Ocean.

	Catch in number			Hooks(x1000)				
YEAR	60N-20N	20N-20S	20S-60S	60N-20N	20N-20S	20S-60S	Total	Covarage(%)
1971	3876	6080	3077	4114	5322	1681	11116	19.89
1972	3022	3624	2132	1284	3712	1494	6489	14.70
1973	2596	3761	3298	1717	2446	571	4733	13.16
1974	12364	1673	571	3019	1083	278	4379	11.38
1975	6222	3981	273	2059	2166	218	4443	7.57
1976	2410	1026	164	2315	695	97	3108	9.46
1977	2480	9277	53	984	1131	96	2211	6.80
1978	2593	6486	245	615	1223	50	1888	4.22
1979	302	6174	308	155	740	107	1002	1.81
1980	2105	10567	667	399	1376	92	1866	3.12
1981	3450	5425	396	667	1599	156	2422	3.37
1982	1010	22360	260	579	4713	27	5320	6.91
1983	2325	6135	0	1013	1583	0	2596	5.92
1984	2498	17306	4361	1045	5128	437	6611	10.21
1985	1709	19310	7341	1172	6273	949	8395	11.58
1986	829	17558	17475	430	4273	2010	6714	12.37
1987	3680	13401	10853	1435	3019	2148	6601	14.12
1988	2043	10540	3884	1448	3362	1042	5853	8.32
1989	4967	22232	4892	1848	6825	1497	10170	11.11
1990	3220	23286	6107	923	8274	1555	10752	11.11
1991	1762	24323	7172	868	8951	1693	11511	12.62
1992	5083	15273	2596	2068	5282	840	8190	10.40
1993	11480	35311	1750	2449	11002	910	14361	15.02
1994	9282	16404	7463	1550	5860	505	7915	7.91

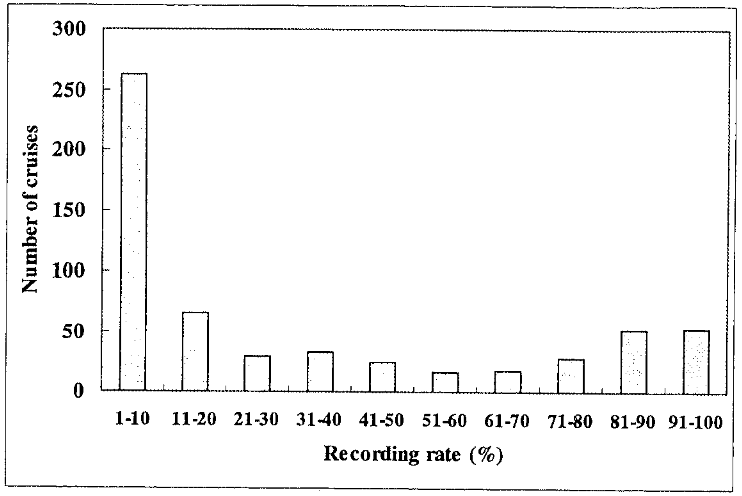

Fig. 1. Number of cruises by recording rate (number of shark catch operations / total operations by cruise). The logbook data in which no sharks catch was recorded (recording rate) were excluded in this figure.

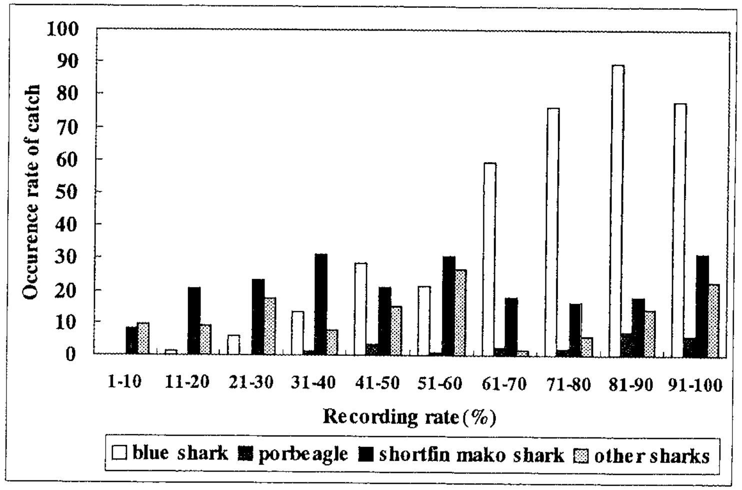

Fig. 2. Occurrence rate of catch for each species by recording rate in New Shark File. Occurrence rate of catch(%) for shark species is expressed as the ratio of number of days in which the catch of a shark species was recorded to the total number of days operated.

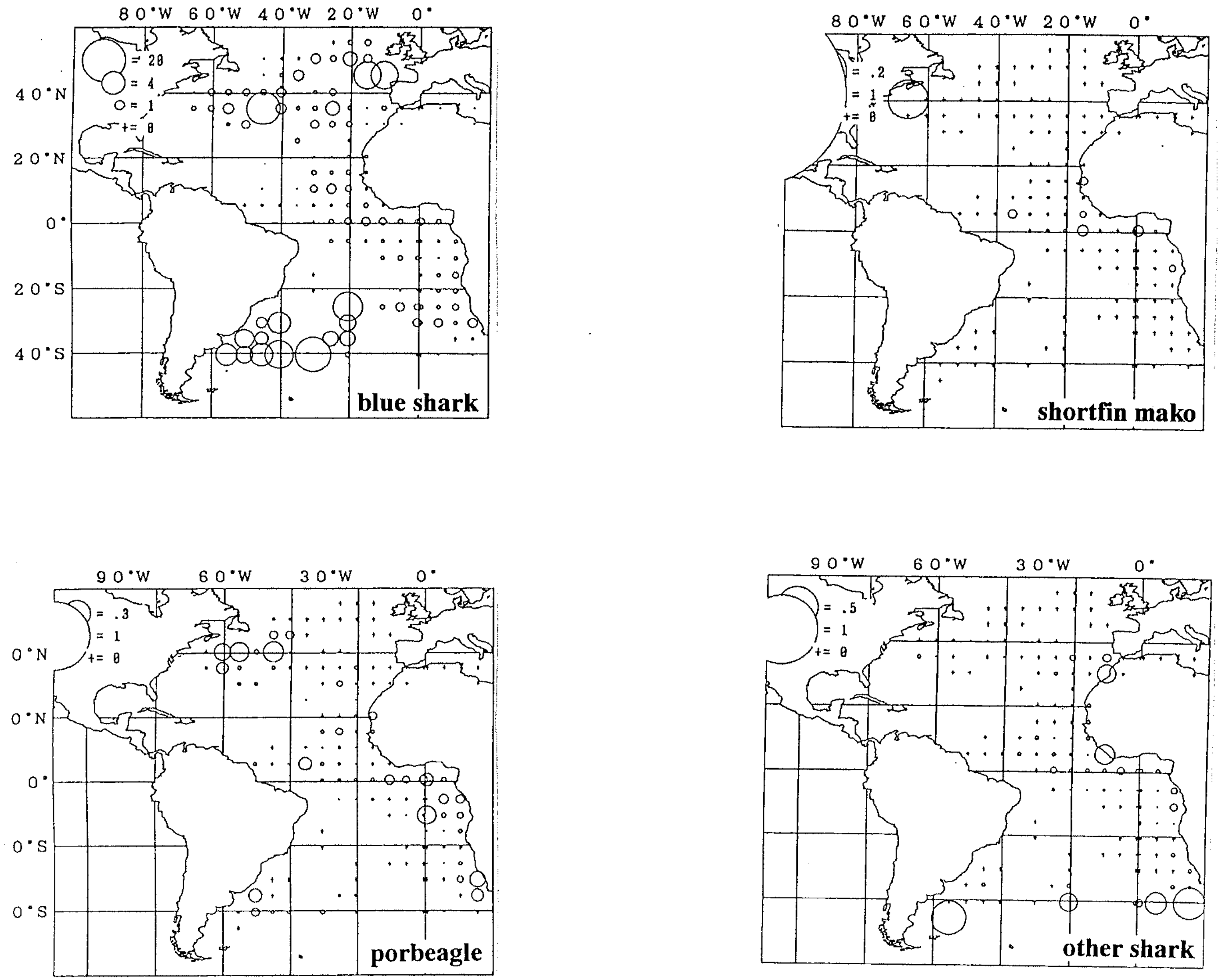

Fig. 3. CPUE distribution by 5x5 degrees squares by species. CPUE by species were calculated using the data whose recording rate is more than 70% and is extracted from New Shark File.

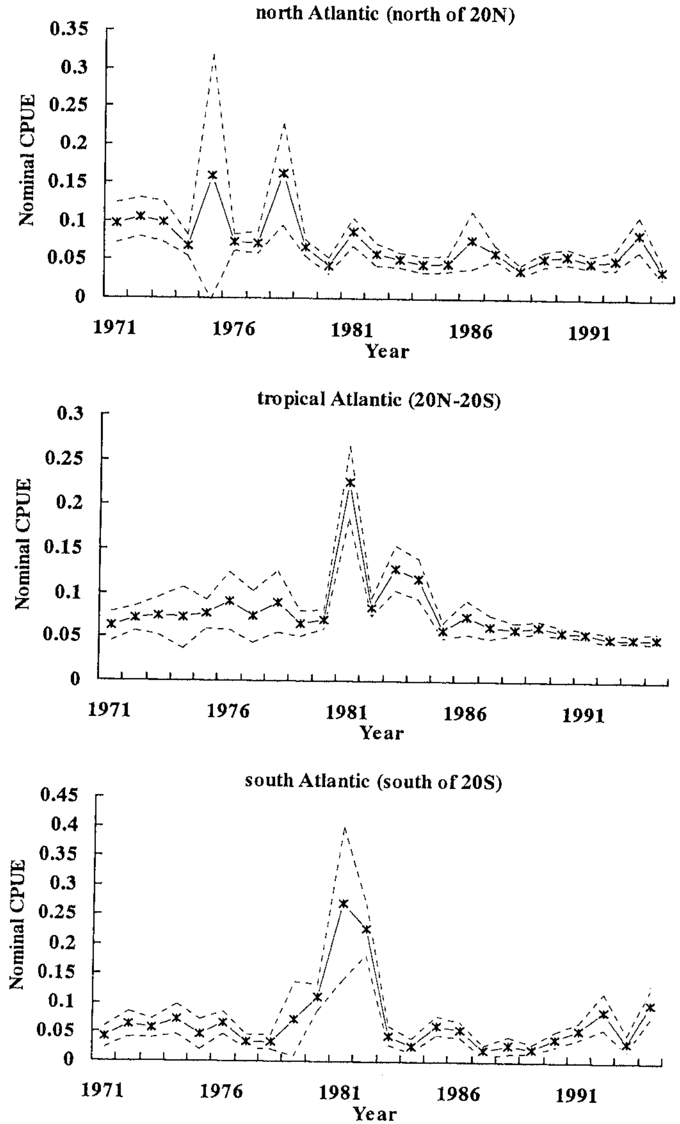

Fig. 4. Nominal CPUE and 95% confidence intervals based the data whose recording rate were less than 21%.

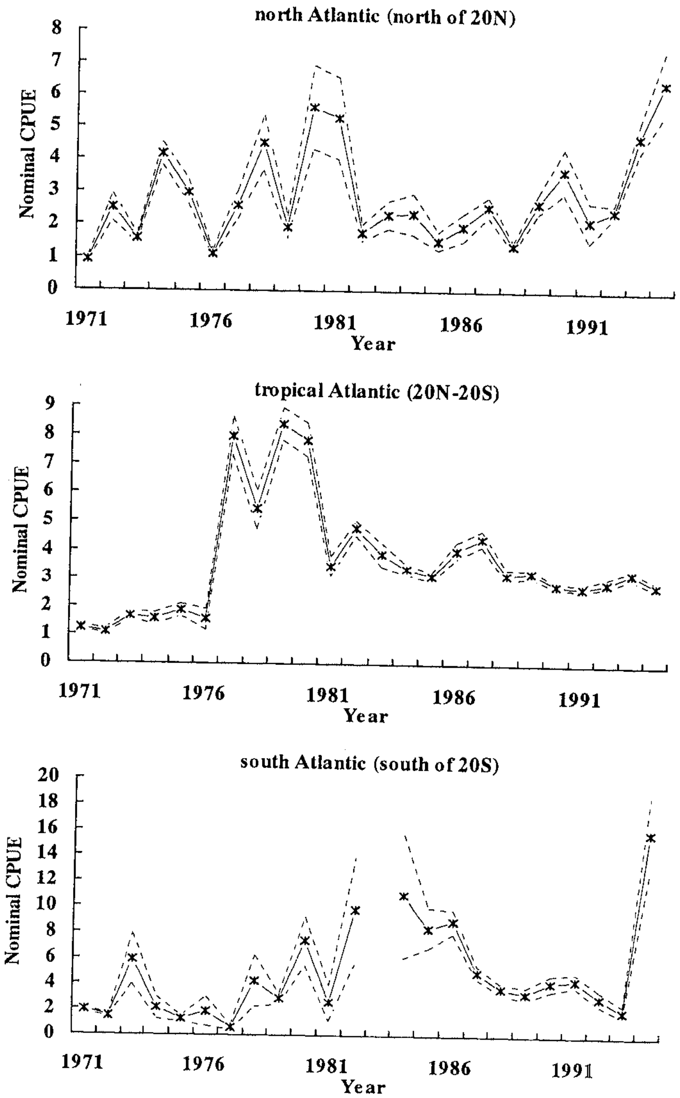

Fig. 5. Nominal CPUE and 95% confidence intervals based the data whose recording rate were more than 70%.