

RE-ESTIMATION OF SHORTFIN MAKO SHARK CATCHES BY JAPANESE TUNA LONGLINE VESSELS IN THE ATLANTIC OCEAN

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SUMMARY

Shortfin mako shark catches by the Japanese longline fishery in the Atlantic Ocean were re-estimated using the logbook data from 1971 to 2004 filtered using a 70% reporting rate. Yearly catches of shortfin mako shark in number were estimated to be 900-17,600 in the North and 200-31,700 in the South. They became 50-890 tons and 10-1,620 tons, respectively, after conversion by the mean body weight. The trend and absolute amount re-estimated and those previously estimated were very similar.

RÉSUMÉ

Les prises de requin taupe bleu réalisées par la pêcherie palangrière japonaise dans l'Océan Atlantique ont été réestimées à l'aide des données des carnets de pêche de 1971 à 2004 avec un filtre utilisant un taux de déclaration de 70%. Les prises annuelles de requin taupe bleu ont été estimées, en nombre, à 900-17.600 dans le Nord et à 200-31.700 dans le Sud. Après conversion par le poids corporel moyen, elles s'élevaient à 50-890 t et 10-1.620 t, respectivement. La tendance et le volume absolu réestimé et ceux estimés auparavant se sont avérés très similaires

RESUMEN

Se volvieron a estimar las capturas de marrajo dientuso de la pesquería palangrera japonesa en el océano Atlántico utilizando los datos de los cuadernos de pesca de 1971 a 2004 filtrados utilizando una tasa de comunicación del 70%. Se estimó que las capturas anuales de marrajo dientuso en número ascendían a 900-17.600 ejemplares en el Norte y a 200-31.700 especímenes en el Sur. Tras una conversión mediante el peso medio del cuerpo, se convirtieron en 50-890 t y 10-1.690 t, respectivamente. La tendencia y cantidad absoluta reestimadas fueron muy similares a las estimadas anteriormente.

KEYWORDS

High seas fisheries, Longline, Tuna fisheries, Time series analysis, Catch/effort, Shortfin Mako

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1 Introduction

Inter-Sessional Meeting of the Sub-Committee on By-Catch (Shark stock assessment) was held in Tokyo in June 2004 to make clear the stock status of blue shark and shortfin mako shark in the Atlantic Ocean. Attending countries brought the catch data and stock assessments of these species were conducted. Catches by Japanese tuna longline vessels were estimated from the logbook data gained by applying the method of Nakano and Honma (1996), which filters the logbook data by shark reporting rate (the ratio of number of operations in which sharks were reported to the total operations in a cruise) (Matsunaga & Nakano 2004). In this report, we estimated the catch of shortfin mako shark in number and weight with using the updated data based on smaller time and area strata than before.

2 Material and Methods

Filtering developed in Nakano and Honma (1996) was adopted and data where shark reporting rate were equal to or greater than 70% were used for the analysis. The time series of the data was 34 years from 1971 to 2004. Based on the distribution of sharks (**Figure 1**), area was divided into 6 (**Figure 2**), and based on the two stock hypothesis in the Atlantic, one in the North (Areas 1-3) including Mediterranean and another in the South (Areas 4-6), was adopted.

CPUE (the number of sharks caught per 1000 hooks) of shortfin mako shark was calculated for each year, area and quarter. Catch estimates in number were obtained from the CPUE and the total effort in each year, area and quarter. As the logbook data before 1994 were not divided into species, catches of shortfin mako shark in number were estimated by multiplying the catch of total shark by the ratio of shortfin mako shark in each stratum (by area and quarter) obtained from the data after 1994 (**Table 1**). Confidence intervals were generated by two stage bootstrapping. First stage is to resample n cruise with replacement. Second stage is to resample s set with replacement for each resampled cruise. Bootstrapping was conducted for 2000 iterations. The average weights of products in each stratum were gleaned from the logbook. The conversion ratio from products to the whole body used was 1.56 (JANUS 2002). Catch estimates in weight were obtained by multiplying the number by the average weight of the whole body in each stratum (**Table 1**).

3 Results and Discussion

Table 2 and **Figure 3** show the estimated yearly catches of shortfin mako shark in number in each stock. They were estimated ranging from 900 to 17,600 in the North and 200 to 31,700 in the South. There were some fluctuations. They increased from the late 1970's and were stable until the early 1990's. After that the increasing trend was observed until 1998 in the North and 1995 in the South. From 1999 to 2001, the level was very low but increasing trend was observed again after 2002 in the North. On the other hand, decreasing trend was observed in the South after 1996.

Table 3 and **Figure 4** show the estimated yearly catches of shortfin mako shark in weight (ton) in each stock. They ranged from 50 to 890 in the North, 10 to 1,620 in the South. There were not a lot of differences between the trends in number and those in weight.

In the previous report (Matsunaga & Nakano 2004), we pointed out the importance of partitioning the fishing area into sub-areas with reference to characteristics relating to shark catches, in order to avoid over simplification using ocean-wide assumptions. But we did not conduct the enough partitioning in neither the catch estimation of shortfin mako shark in number before 1993 nor that in weight in the whole period at that time. This time, the partitioning in both fishing area and quarter was done, so that more precise estimation must be made than that in the previous time. Comparison of the results from the two methods for estimating the catch of shortfin mako shark in number and weight are shown in **Figures 5** and **6**. There were not a lot of differences between the trends obtained by the two methods. But the trends by the method in this report were smoother than those in the previous one.

References

- JANUS 2002. Conversion of the shark catches by species and gear to the whole body. Report of the research on the resource of high-migratory fishes around Japan, 225-233.
- MATSUNAGA H. and H. Nakano. 2005. Estimation of shark catches by Japanese tuna longline vessels in the Atlantic Ocean. Col. Vol. Sci. Pap. ICCAT, 58(3): 1096-1105.
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Table 1. Average ratio in the shark catch and body weight of shortfin mako shark in each stratum. RS: ratio; AW: Body weight (kg).

Q uarter Area	1		2		3		4	
	RS	AW	RS	AW	RS	AW	RS	AW
1	0.076	61	0.076	61	0.064	38	0.088	83
2	0.072	53	0.265	38	0.029	72	0.042	58
3	0.038	49	0.061	40	0.083	45	0.089	52
4	0.064	63	0.037	49	0.043	40	0.072	61
5	0.118	45	0.090	42	0.156	46	0.105	57
6	0.018	43	0.007	67	0.000	55	0.008	55

Table 2. Estimated number of shortfin mako shark caught by the Japanese tuna longline fisheries in the Atlantic ocean.

Year	North			South		
	Catch	L90%	U90%	Catch	L90%	U90%
1971	2389	2050	2758	1821	1523	2156
1972	2552	1709	3509	1035	874	1200
1973	1208	980	1441	4062	2589	5824
1974	6206	4526	7910	770	479	1185
1975	7685	5664	10007	899	673	1136
1976	1794	1385	2225	169	124	224
1977	4979	3104	7039	4511	3138	5825
1978	3271	1713	5318	2899	1598	4236
1979	877	701	1065	5043	3311	6918
1980	5122	3271	7006	4543	3461	5768
1981	7590	4892	11378	3776	2861	4750
1982	5829	4042	7761	12433	10292	14710
1983	3556	3039	4088	4422	3416	5535
1984	2935	2156	3756	8652	7177	10228
1985	2988	2277	3749	9706	8323	11024
1986	2381	1567	3286	7847	6504	9288
1987	4817	3346	6614	4058	3376	4765
1988	2281	1745	2840	9147	7460	10969
1989	4275	3548	5061	11287	9855	12759
1990	4588	3047	6287	9613	8578	10694
1991	3307	2263	4510	9078	8047	10192
1992	5968	5006	7007	8449	7401	9535
1993	8182	6117	10370	13002	10315	16200
1994	4343	2294	6863	26261	15985	37420
1995	10071	5319	15839	31719	16575	49275
1996	15628	8059	23934	10795	4143	19321
1997	4970	2256	8536	4549	2533	7071
1998	17645	9015	27815	4820	2318	8306
1999	2349	1049	4031	3041	2038	4126
2000	3071	1392	5154	5486	2943	8328
2001	2120	1367	2914	1043	584	1574
2002	8894	4006	14609	2387	1391	3453
2003	4239	2021	6880	2530	1399	3929
2004	13009	8968	17802	7269	1738	13605

Table 3. Estimated weight of shortfin mako shark caught by the Japanese tuna longline fisheries in the Atlantic ocean.

Year	North			South		
	Catch	L90%	U90%	Catch	L90%	U90%
1971	112	97	128	88	73	105
1972	115	80	153	53	45	61
1973	61	49	73	202	122	287
1974	307	226	394	39	23	63
1975	344	257	449	45	33	58
1976	84	65	105	8	6	11
1977	236	152	334	229	162	298
1978	153	87	241	146	80	214
1979	45	36	54	268	170	377
1980	246	155	345	228	178	287
1981	387	241	586	206	154	265
1982	273	195	363	703	591	824
1983	159	136	182	252	187	316
1984	141	104	184	462	382	549
1985	142	109	177	540	463	616
1986	120	79	168	428	361	502
1987	218	159	294	234	193	277
1988	113	86	143	525	425	628
1989	207	168	247	618	544	694
1990	221	149	307	538	475	603
1991	157	111	209	506	444	574
1992	318	265	373	460	406	518
1993	425	324	538	701	553	880
1994	214	119	326	1369	837	1946
1995	592	269	1047	1617	905	2471
1996	790	414	1229	514	211	881
1997	258	102	456	244	122	388
1998	892	455	1378	267	117	478
1999	120	48	205	151	101	214
2000	138	64	226	264	147	402
2001	105	68	146	56	32	85
2002	438	186	746	133	72	190
2003	267	105	467	118	70	177
2004	572	377	796	398	88	775

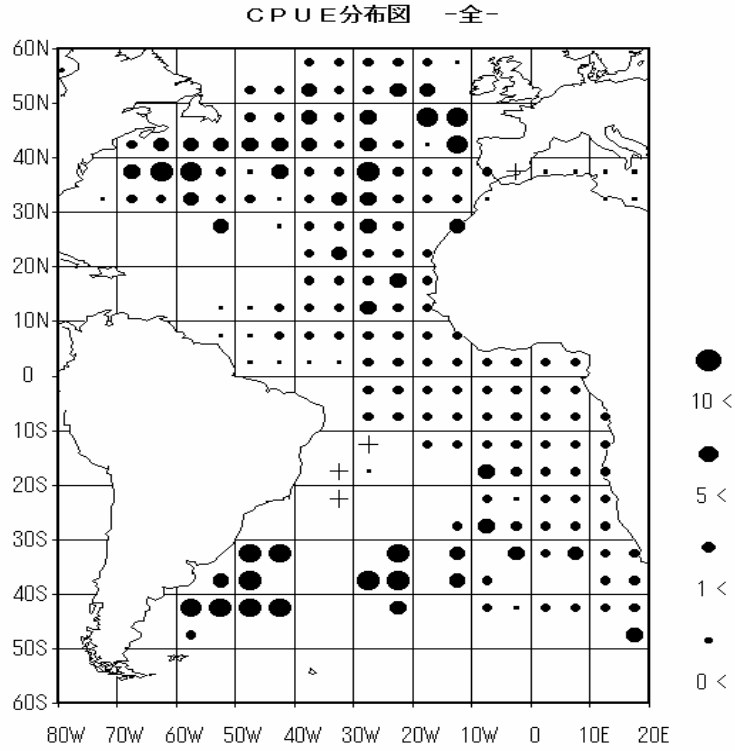


Figure 1. CPUE distribution of sharks by 5*5 degree squares. CPUE was calculated using the data whose recording rate is greater than 0 equal to 70% (see text for explanation).

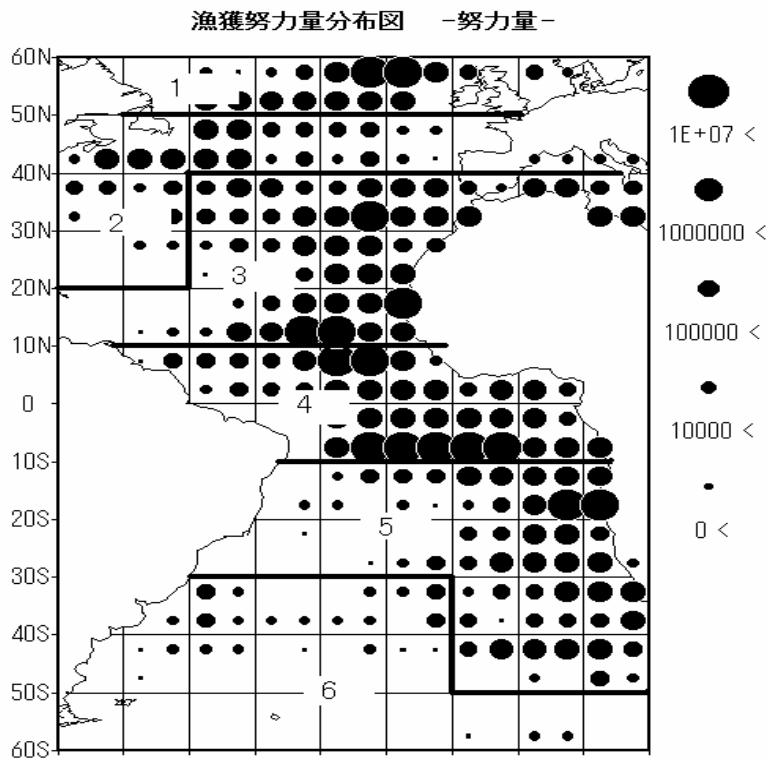


Figure 2. Distribution of fishing effort indicated by the number of hooks, and the area classification used for the analysis.

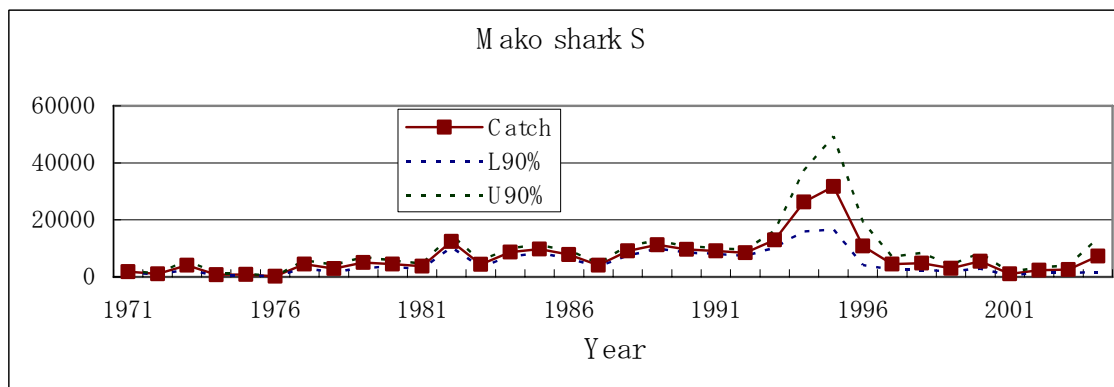
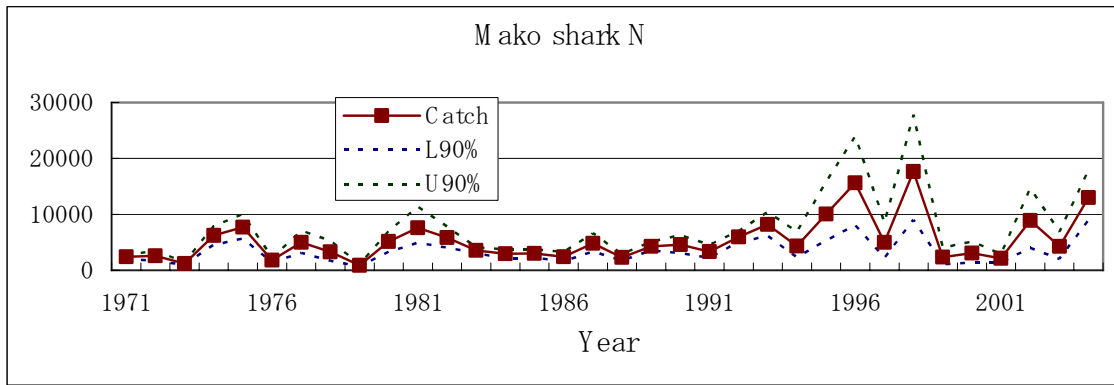


Figure 3. Estimated number of shortfin mako shark caught by the Japanese tuna longline fisheries in the Atlantic ocean.

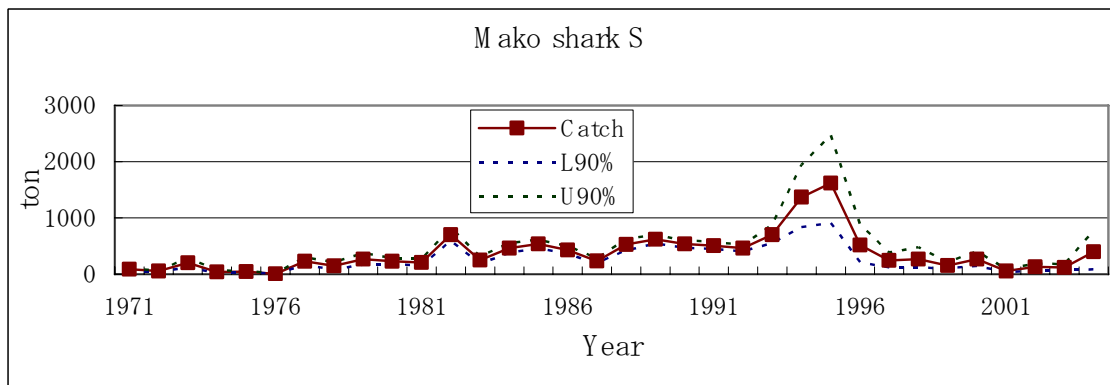
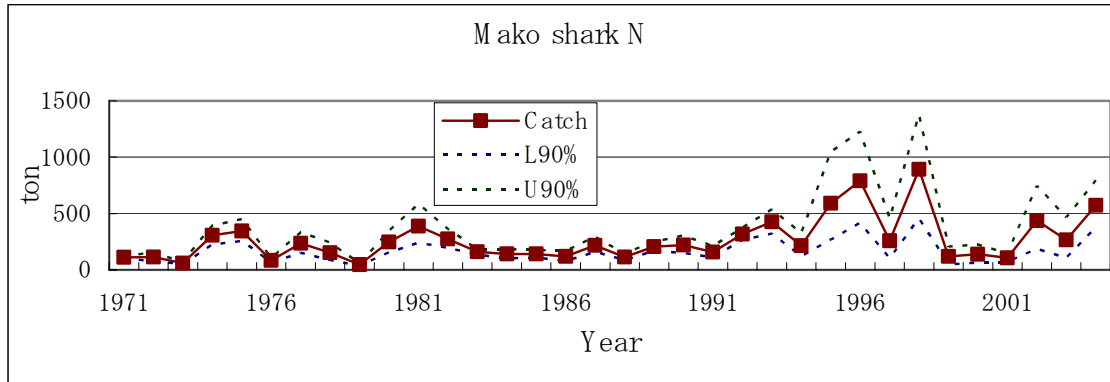


Figure 4. Estimated weight of shortfin mako shark caught by the Japanese tuna longline fisheries in the Atlantic ocean.

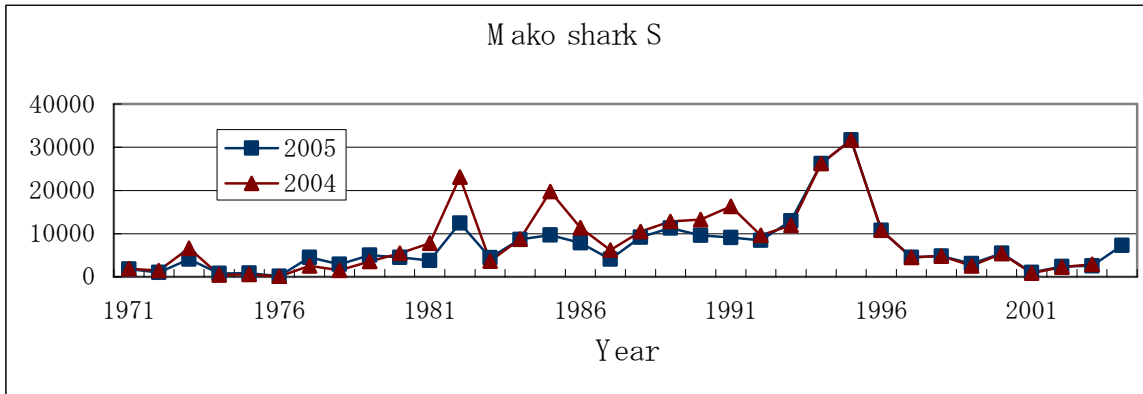
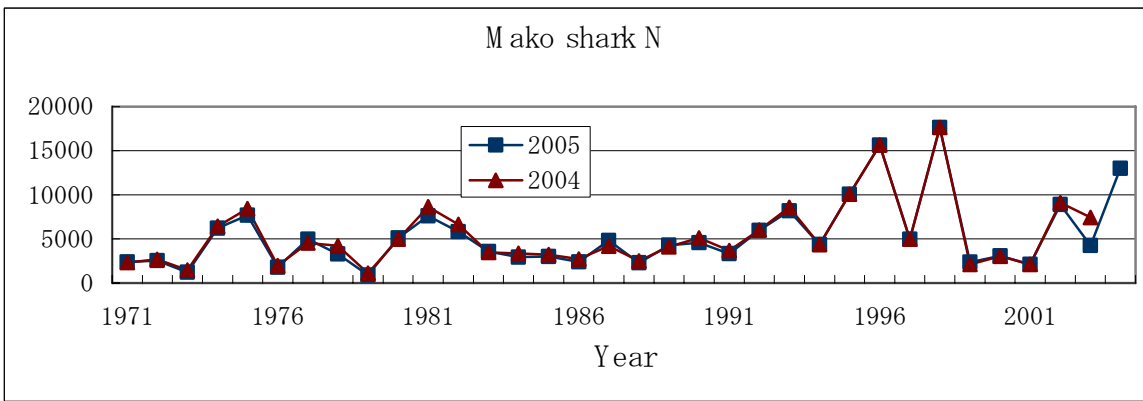


Figure 5. Comparison of two methods for estimating the number of shortfin mako shark caught by the Japanese tuna longline fisheries in the Atlantic ocean (upper: north; lower: south)

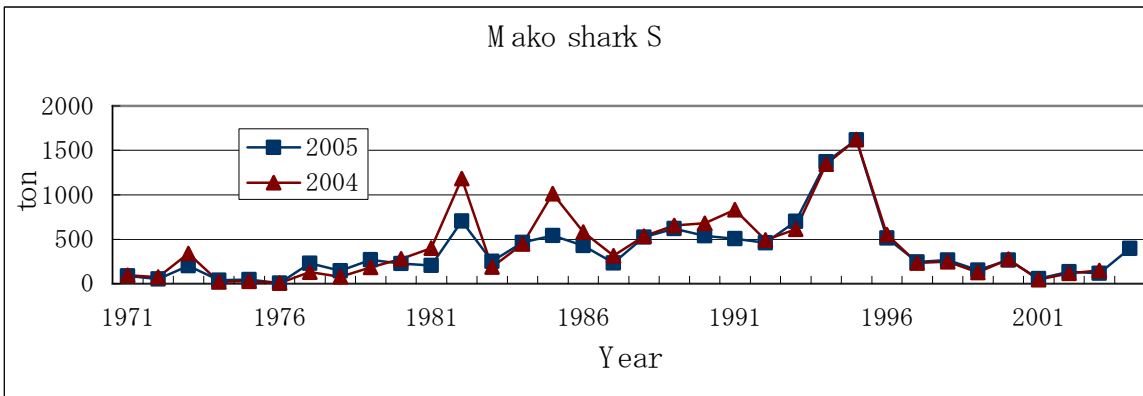
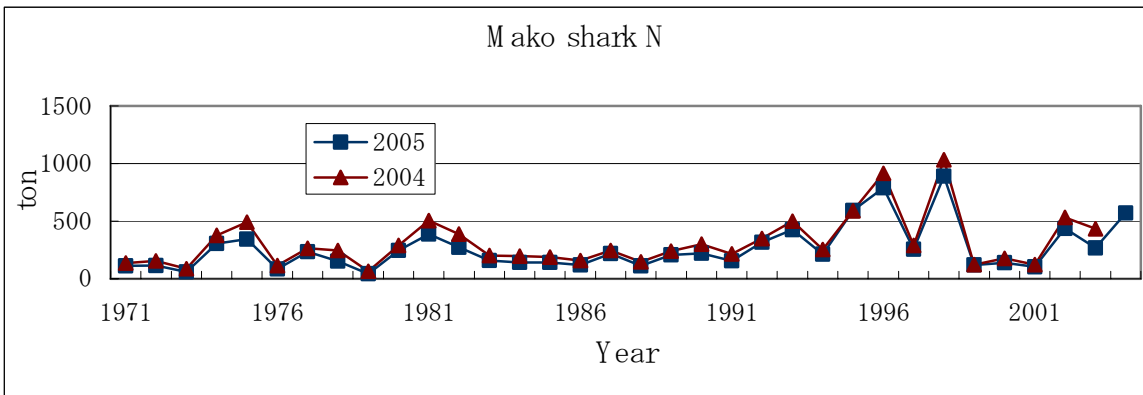


Figure 6. Comparison of two methods for estimating the weight of shortfin mako shark caught by the Japanese tuna longline fisheries in the Atlantic ocean (upper: north; lower: south)