ESTIMATION OF SHARK CATCHES BY JAPANESE TUNA LONGLINE VESSELS IN THE ATLANTIC OCEAN

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SUMMARY

Shark catches by species (blue, shortfin mako, porbeagle and other sharks) caught by the Japanese longline fishery in the Atlantic Ocean were estimated using the species specific logbook data from 1994 to 2003 filtered using a 70% reporting rate. Yearly catches of blue shark in the entire region were estimated to be 111,000-330,000 (mean 207,000) in number and 4,200-12,700 metric ton (mean 7,600, 85.0 % of the total catch) in weight. Catches of shortfin mako shark were estimated to be 3,000-41,800 (mean 16,900) and 170-2,200 ton (mean 920, 9.4 %). A gently decreasing trend was observed in both number and weight. The estimated catches in weight of blue, shortfin mako, porbeagle and total sharks over more than 30 years from 1971 to 2003 increased from the late 70's and were stable until the middle of the 90's. After that the decreasing trend was observed.

RÉSUMÉ

Les captures de requins par espèces (requin peau bleue, requin taupe bleue, requin-taupe commun et autres requins) réalisées par la pêcherie palangrière japonaise dans l'océan Atlantique ont été estimées au moyen des données des carnets de bord spécifiques aux espèces couvrant la période 1994-2003 et filtrées au moyen d'un taux de déclaration de 70%. Les prises annuelles de requin peau bleue dans l'ensemble de la région ont été estimées à 111.000-330.000 (moyenne : 207.000) en nombre et à 4.200-12.700 t (moyenne : 7.600, soit 85% de la prise totale) en poids. Les prises de requin taupe bleue étaient estimées à 3.000-41.800 (moyenne : 16.900) et à 170-2.200 t (moyenne : 920, 9,4%). Une tendance légèrement en baisse a été observée à la fois au niveau du nombre et du poids. Sur une période de plus de 30 ans, de 1971 à 2003, les prises estimées, en poids, du requin peau bleue, requin taupe bleue, requin-taupe commun et du total des requins ont augmenté à partir de la fin des années 1970 et se sont stabilisées jusqu'au milieu des années 1990. Après cette période, une tendance à la baisse a été observée.

RESUMEN

Se han estimado las capturas de tiburones por especie (tintorera, marrajo dientuso, marrajo sardinero y otros tiburones) realizadas por la pesquería japonesa de palangre en el Atlántico utilizando datos de los cuadernos de pesca específicos de cada especie desde 1994 a 2003, filtrados utilizando una tasa de comunicación del 70%. Las capturas anuales de tintorera en toda la región se estimaron en 111.000-330.000 (media 207.000) en números y 4.200-12.700 en toneladas métricas (media 7.600, 85% de la captura total) en peso. Las capturas de marrajo dientuso se estimaron en 3.000-41.800 (media 16.900) y en 170-2.200 t (media 920, 9,4%). Se observó una tendencia ligeramente descendente tanto en números como en peso. Las capturas estimadas en peso de la tintorera, marrajo dientuso, marrajo sardinero y tiburones en total durante más de 30 años, de 1971 a 2003, aumentaron a partir de finales de los 70 y se mantuvieron estables hasta mediados de los 90. Después, se observó la tendencia descendente.

KEYWORDS

High seas fisheries, Long line, Tuna fisheries, Time series analysis, Catch/effort, Sharks

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1. Introduction

Catch data of sharks by species (blue, shortfin mako, porbeagle and other sharks) from Japanese tuna longline vessels in the Atlantic Ocean have been reported to ICCAT based on logbook data since 1993. But it is expected that fishermen will not report all shark catches. Therefore, estimates based on logbook may be lower than the actual catch values. It is thus necessary to select the appropriate logbook data to achieve a better estimation. In this report, we estimate the shark catches by species from the reliable data gained by applying the method of Nakano and Honma (1996), which filters the logbook data by shark reporting rate (the ratio of operations in which sharks were reported to the total operations in a cruise). Using this method, Nakano (1998, 1999, 2001) calculated the standardized CPUE of total pelagic sharks caught by Japanese longline fishery in the Atlantic Ocean as abundance index of blue shark. A study verifying this method was conducted by Shiode and Nakano (2001).

2. Material and methods

Filtering developed in Nakano and Honma (1996) was adopted and data where shark reporting rate was equal to and greater than 70% was used for the analysis. The time series of the data was 10 years from 1994 to 2003. Based on the distribution of sharks (**Figure 1**), research area was divided into 6 areas (**Figure 2**), and the hypothesis that there were two stocks in the Atlantic, one in the North (Areas 1-3) and another in the South (Areas 4-6), was adopted.

CPUE (the number of sharks caught per 1000 hooks) was calculated for each year, area and quarter. Catch estimates in number were obtained from the CPUE and the total effort in each stratum. Confidence intervals were generated by two stage bootstrapping. Bootstrapping was conducted for 2000 iterations. The average weight of products by stock was gleaned from the logbook. The conversion ratios from products to the whole body are shown in **Table 1** (JANUS 2002). Catch estimates in weight are obtained by multiplying those in number by the average weight of the whole body in each stock.

As the logbook data before 1993 were not divided by species, catches of total sharks in number were estimated in the same way described above by year and stock. They were apportioned to each species by the average ratio, by number, from 1994 to 2003, and then multiplied by the average weight of the whole body for each stock.

3. Results and discussion

During the 10 years from 1994 to 2003, yearly catches of blue shark in number by Japanese tuna longline vessels were ranged from 53,000 to191,000 (mean 106,000) in the North, 58,000 to 213,000 (101,000) in the South and 111,000 to 330,000 (207,000) in the entire Atlantic (**Figure 3**). After conversion to weight, these figures became 1,700-6,200 metric tons (mean 3,400 tons, 84.0 % of the total catch), 2,500-9,000 tons (4,200, 86.2 %) and 4,200-12,700 tons (7,600, 85.0 %) respectively. A gently decreasing trend was observed.

Catches of shortfin mako shark in number were estimated to range from 2,100 to 17,600 (mean 7,600) in the North, 900 to 31,700 (9,200) in the South and 3,000 to 41,800 (16,900) overall (**Figure 4**). After weight conversion, these figures became 120-1,030 tons (450, 10.8 %), 50-1,600 tons (470, 7.7 %) and 170-2,200 tons (920, 9.4 %). There were some fluctuations and no apparent trend in the North. In the South, a decreasing trend was observed.

Figure 5 shows the estimation of catch in number and weight of porbeagle. There were 70-5,400 (1,050) porbeagles caught in the North, 230-8,900 (4,180) caught in the South and 300-14,000 (5,200) caught overall, which became 2-380 tons (74, 1.3 %), 5-200 tons (92, 2.2 %) and 10-570 tons (165, 1.8 %). In the North, there was very little catch after 1999. In contrast, there was an observed increasing trend after 1997 in the South.

Yearly catches of total sharks (species combined) in number were estimated to be 62,000-217,000 (121,000) in the North, 64,000-249,000 (120,000) in the South and 127,000-385,000 (242,000) overall (**Figure 6**). These figures converted to 2,200-7,700 tons (4,300), 2,700-10,500 tons (5,100) and 4,900-15,300 tons (9,400).

Sum of effort for filtered data was about 12 % of the whole effort. The ratios of the estimated catches from the filtered data to those from all data without filtering were as follows, blue shark: 5.3, shortfin mako shark: 2.9, porbeagle: 8.2, total: 5.1.

The estimated catches in weight of blue, shortfin mako, porbeagle and total sharks by Japanese tuna longline fisheries over more than 30 years from 1971 to 2003 are shown **Figure 7**. They increased from the late 1970's and were stable until the middle of 1990's. After that the decreasing trend was observed.

Figure 8 indicates the change in effort as measured by the number of hooks fished from 1971 to 2003 by Japanese tuna longline vessels in the Atlantic. Until the middle of the 1990's, effort increased with some fluctuation, and then decreased over the entire Atlantic. The peaks of the catches and periods of downward trends in catches in recent years correspond to those of effort.

Bonfil (1994) estimated shark catch by Japanese tuna longline vessels in the Atlantic Ocean, assuming that CPUE was 7.04 (Hoff and Musick 1990) and average weight was 40.91 kg (Hazin *et al.* 1990) over the entire ocean owning to the lack of data. Applying these assumptions to current effort statistics, average catches per year from 1994 to 2003 become 680,000 in number and 28,000 ton in weight, which is three times larger than those of our results. The difference of CPUE among the areas is believed to be the main cause of the gap. This discrepancy highlights 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.

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Table 1. Conversion factors used in the analysis by stock.

		Blue	*Mako*	*Porbeagle*	*Others*
Average weight of logbook products	North	21.4	37.5	54.6	34.2
	South	28.1	32.8	17.0	23.3
Ratio of products/ whole body weight	ratio	1.50	1.56	1.29	1.45
Estimated average weight of the whole body	North	32.1	58.5	70.4	49.6
	South	42.2	51.2	22.0	33.8

70%.

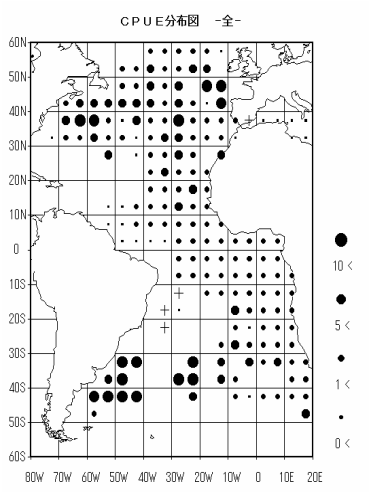


Figure 1. CPUE distribution of sharks by 5*5 degree squares. CPUE was calculated using the data whose recording rate is greater than or equal to

Error!

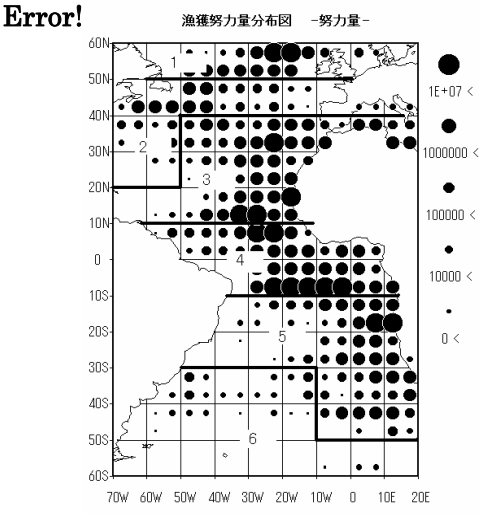
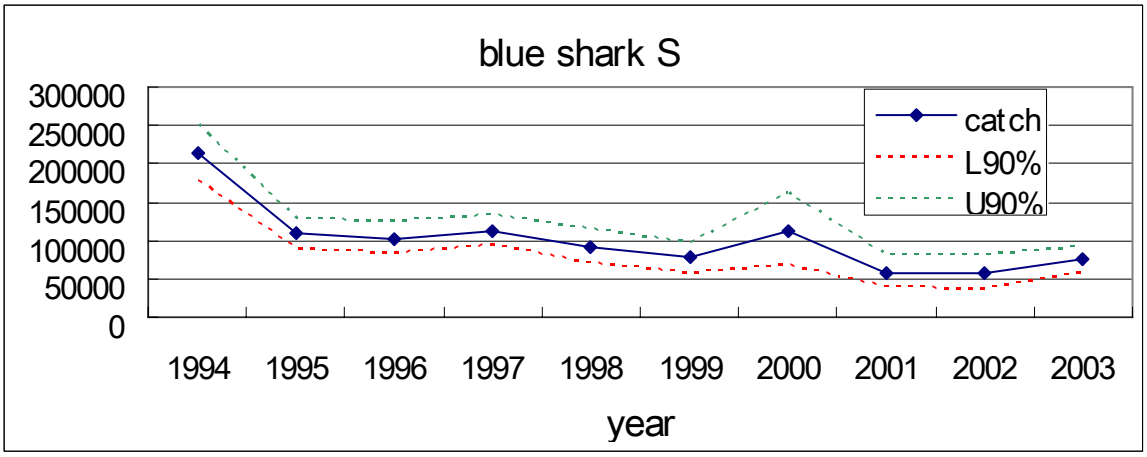
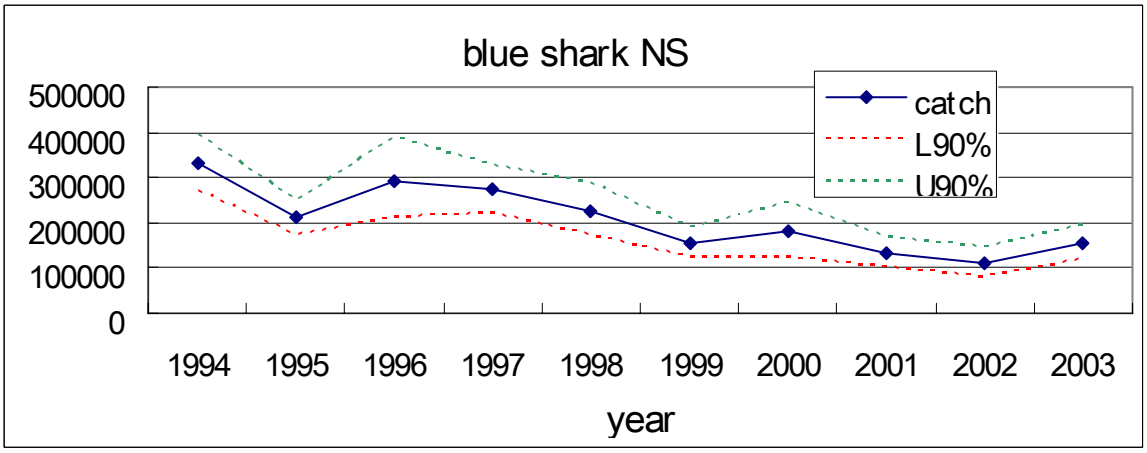


Figure 2. Distribution of fishery effort indicated by the number of hooks, and the area classification used for the analysis.





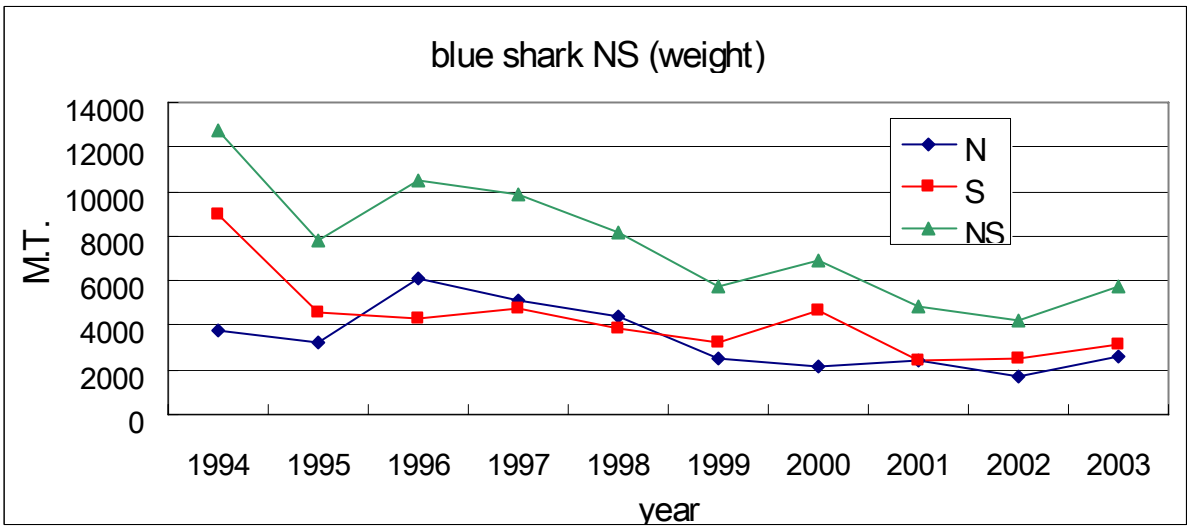


Figure 3. Estimated number with confidence intervals and weight of blue shark caught by the Japanese tuna longline fishery in the Atlantic. N: North, S: South, NS: entire Atlantic.

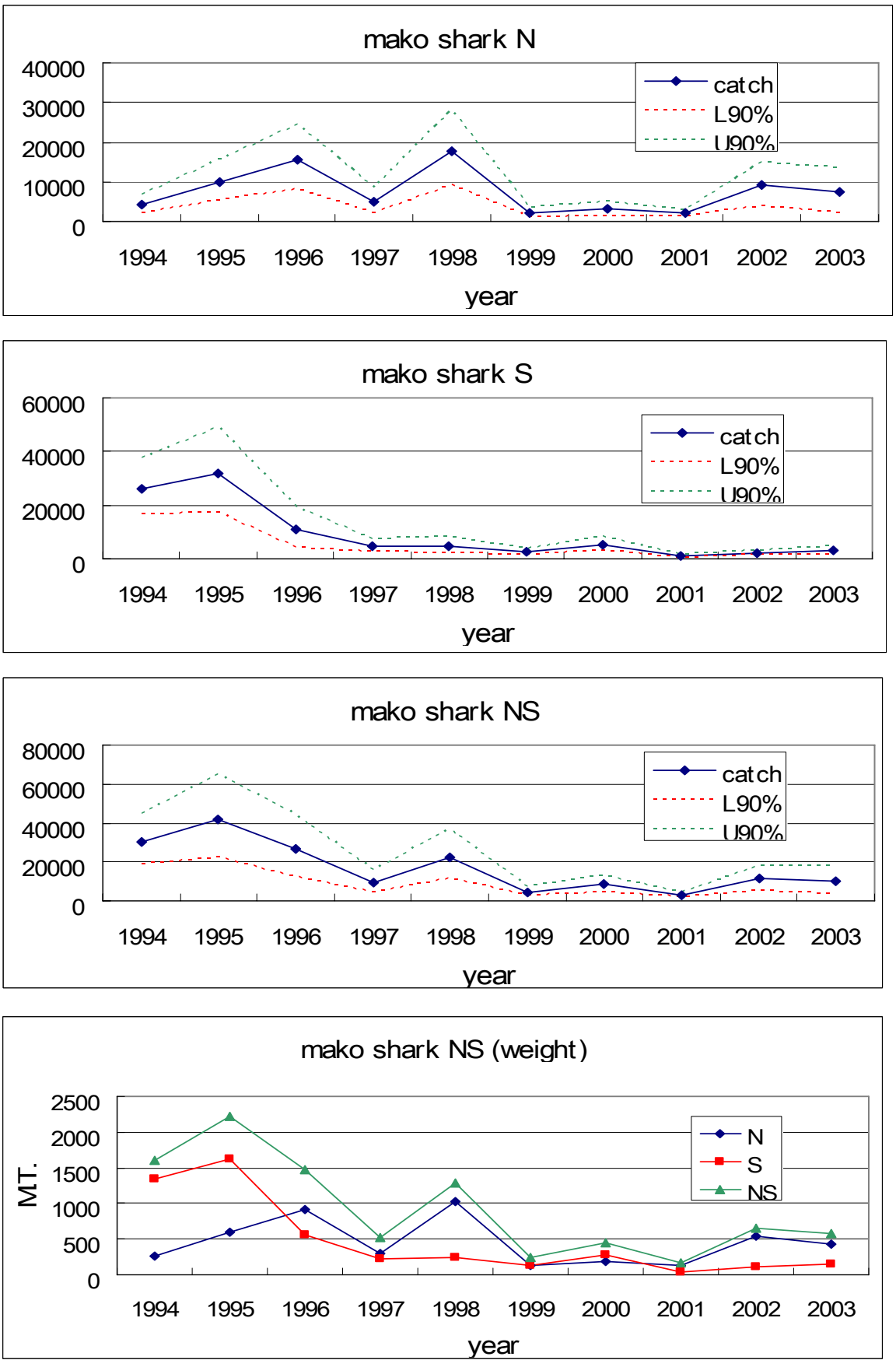


Figure 4. Estimated number with confidence intervals and weight of shortfin mako shark caught by the Japanese tuna longline fishery in the Atlantic. N: North, S: South, NS: entire Atlantic.

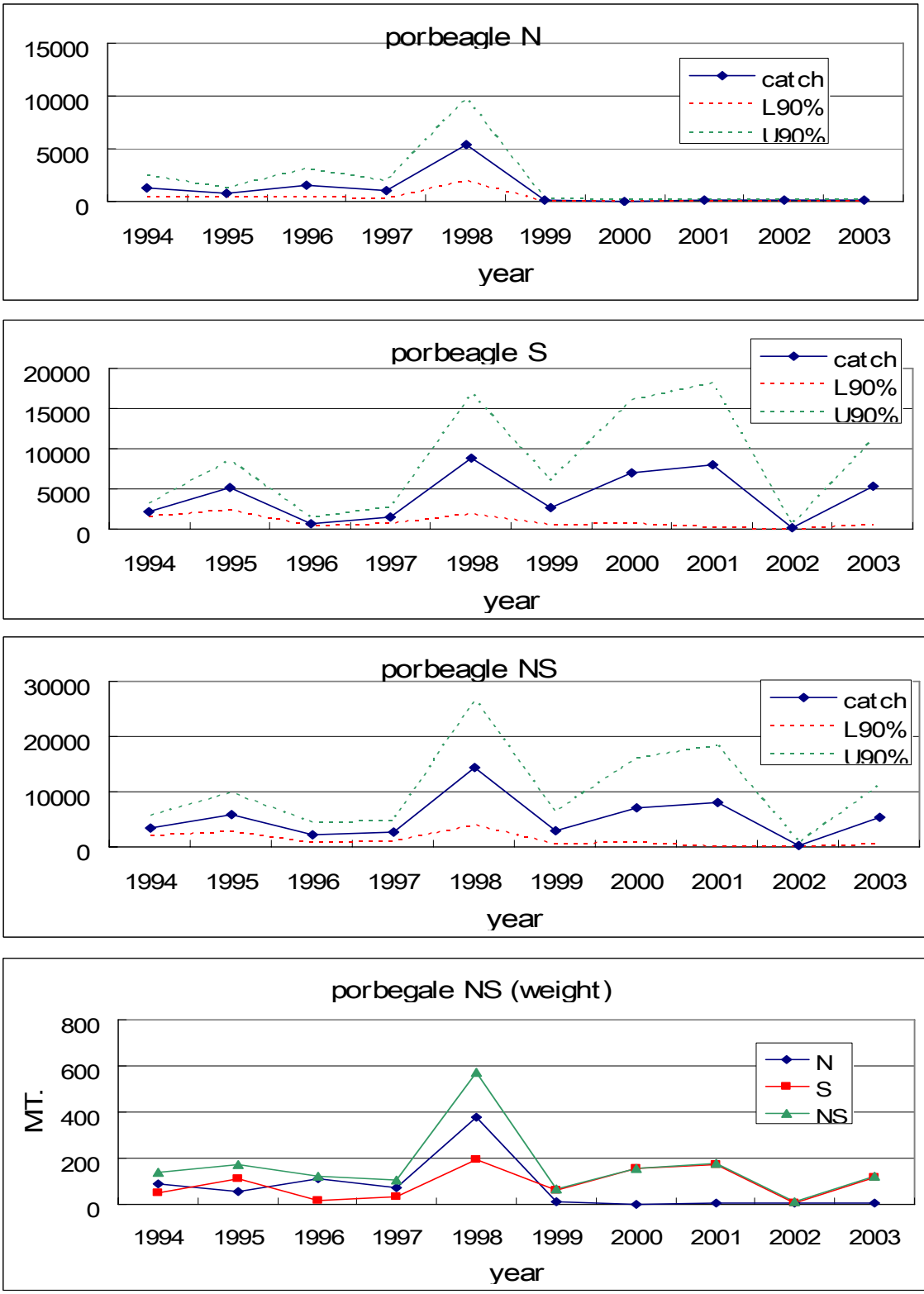


Figure 5. Estimated number with confidence intervals and weight of porbeagle caught by the Japanese tuna longline fishery in the Atlantic. N: North, S: South, NS: entire Atlantic.

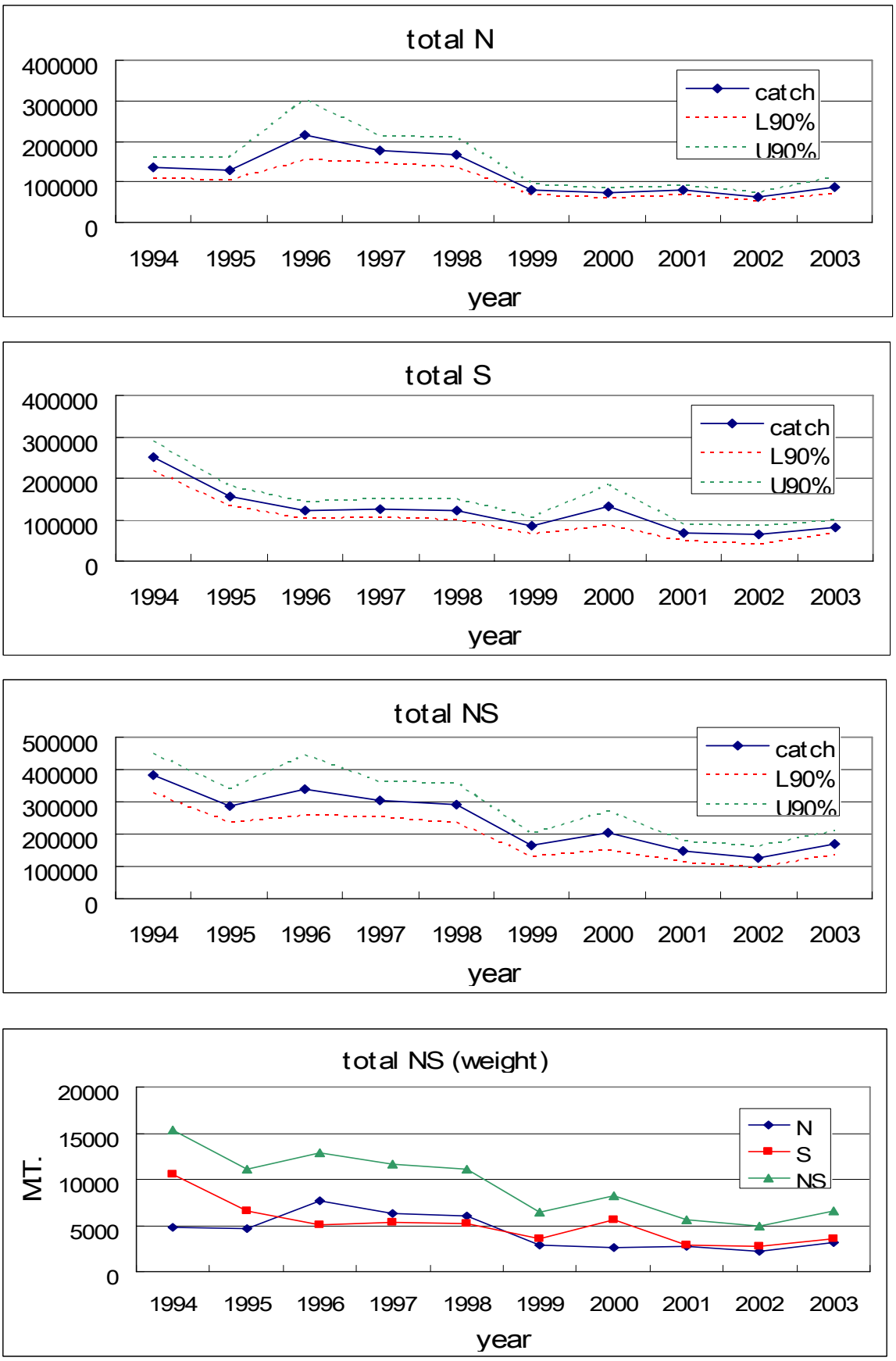


Figure 6. Estimated number with confidence intervals and weight of total sharks caught by the Japanese tuna longline fishery in the Atlantic. N: North, S: South, NS: entire Atlantic.

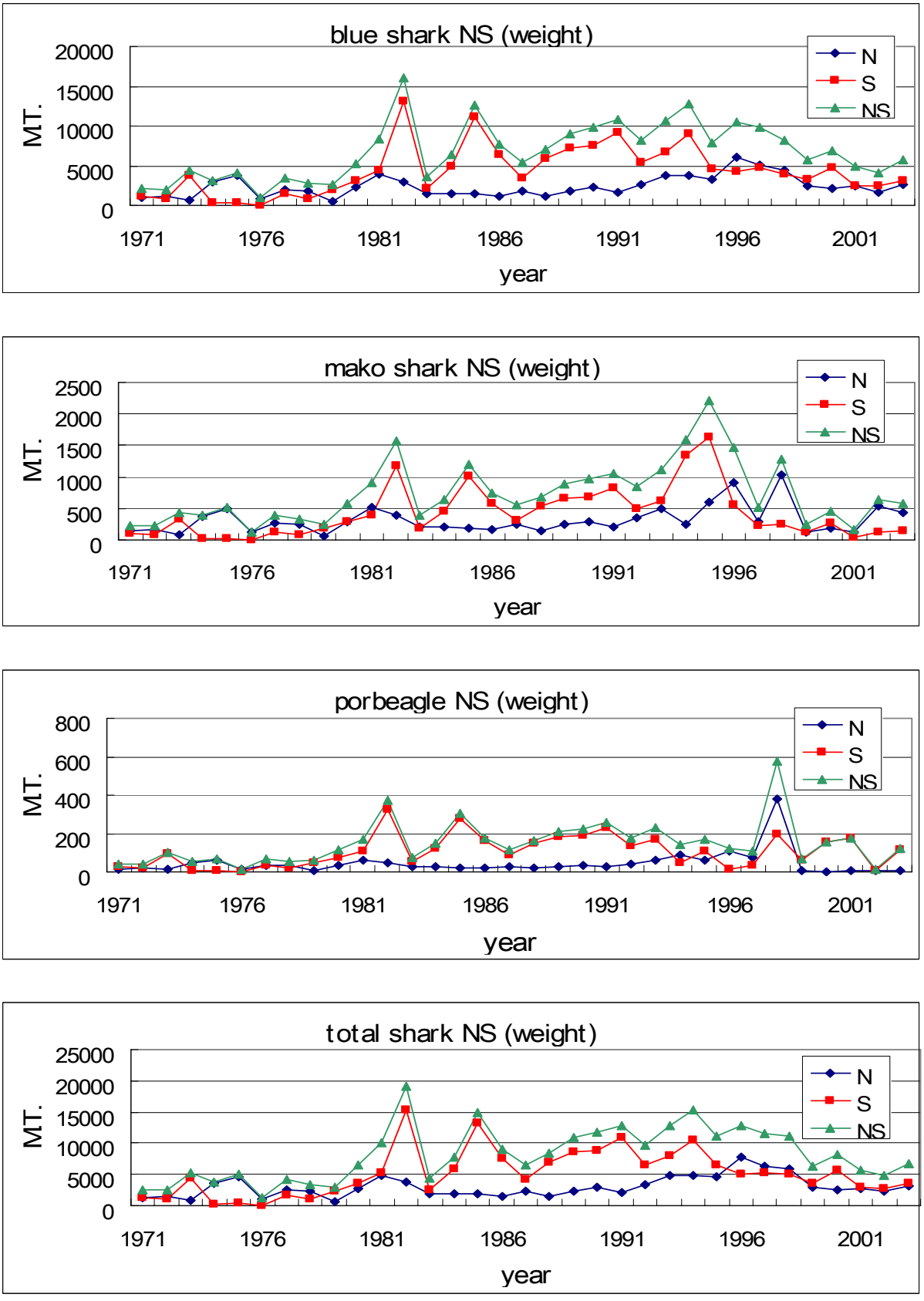


Figure 7. Estimated weight of blue, mako, porbeagle and total sharks caught by the Japanese tuna longline fisheries in the Atlantic Ocean. N: North, S: South, NS: entire Atlantic.

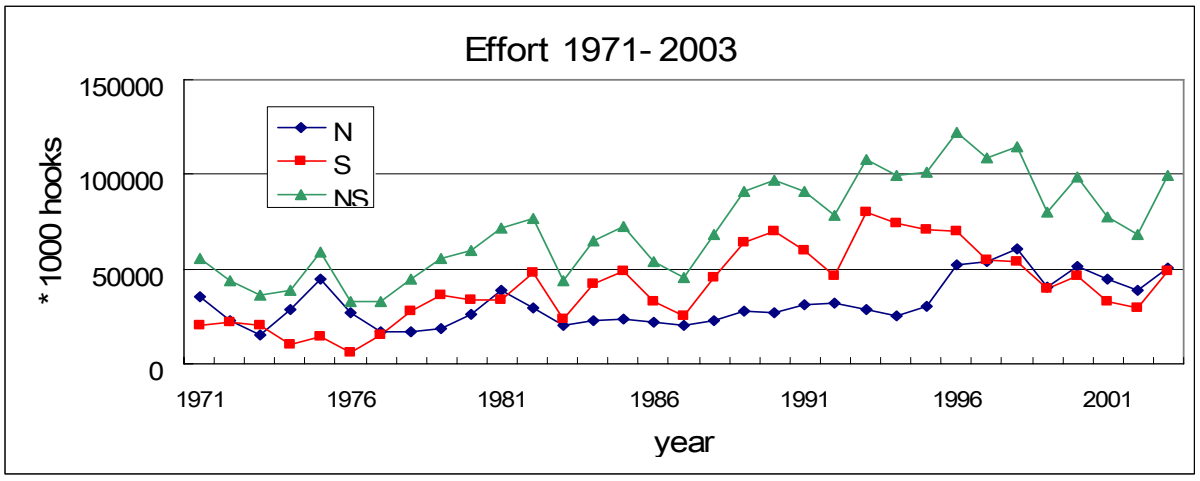


Figure 8. Yearly change in hooks fished by Japanese tuna longline vessels in the Atlantic Ocean. N: North, S: South, NS: entire Atlantic.