ESTIMATION OF CATCHES FOR SHORTFIN MAKO (*ISURUS OXYRINCHUS*) BY THE JAPANESE TUNA LONGLINE FISHERY IN THE ATLANTIC OCEAN FROM 1994 TO 2010

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SUMMARY

The number and weight of shortfin mako caught by the Japanese tuna longline vessels in the Atlantic was estimated based on the logbook data and the standardized CPUE from 1994 to 2010. Live releases and dead discards were estimated based on the information on the life status which was collected in the observer program. The catch number was estimated at 1,916-4,395 t for the North (from the equator to South of 50 degrees North) and 665-6,720 t for the South, and the catch weight was estimated at 72-227 t for the North and 32-308 t for South.

RÉSUMÉ

Le nombre et le poids du requin-taupe bleu capturé par les palangriers thoniers japonais dans l'Atlantique ont été estimés sur la base des carnets de pêche et de la CPUE standardisée de 1994 à 2010. Les remises à l'eau des spécimens vivants ainsi que les rejets morts ont été estimés sur la base des informations concernant leur état vital qui ont été recueillies dans le cadre du programme d'observateurs. La capture en nombre été estimée à 1.916-4.395 spécimens pour le Nord (de l'équateur au Sud de 50° Nord) et à 665-6.720 spécimens pour le Sud, et le poids de la capture a été estimé à 72-227 t pour le Nord et 32-308 t pour le Sud.

RESUMEN

Se estimó el número y el peso de los marrajos dientusos capturados por los palangreros atuneros japoneses en el Atlántico basándose en los datos de los cuadernos de pesca y en la CPUE estandarizada desde 1994 hasta 2010. Se estimaron los descartes de peces muertos y las liberaciones de peces vivos basándose en la información sobre su estado vital, que fue recopilada durante el programa de observadores. La captura en número fue estimada en 1.916-4.395 ejemplares para el norte (desde el Ecuador hasta el sur de 50 grados norte) y en 665-6.720 ejemplares para el sur. El peso de la captura se estimó en 72-227 t para el norte y en 32-308 t para el sur.

KEYWORDS

Shortfin mako, Japanese longline, catch

1. Introduction

Previously, catch of shortfin mako by Japanese tuna longline fishery in the Atlantic Ocean was estimated by Matsunaga (2007, 2009) based on the data filtered by method of Nakano and Honma (1996). In these reports, catch was estimated in each stratum of year, area, and quarter by multiplying total effort of the stratum by the CPUE of each stratum, which was calculated from the data filtered with reporting rate of sharks ≧80% without applying the standardized CPUE. The average weight of products was estimated by season and area based on the filtered logbook (SFMRR>= 80%). Additionally, the gap between catch and landing was treated entirely as the dead discard. Ideally, this gap is preferable to be divided into live release and dead discard, and only dead discard should be added to the landing as catch. Considering that the mortality of sharks is known to be low when they are hauled on the deck (Matsumoto and Miyabe 1997), it is necessary to take into account for this point for catch estimation. Then the number of dead discard can be estimated roughly, but rather accurately, by multiplying the number of released individuals by the mortality.

In this document, we report the catch estimates using the standardized CPUE based on new filtering method (Semba *et al.* 2012) and the information of "mortality" in order to divide the number of "released individuals" into the dead discard and the live release.

2. Materials and Methods

Catch number

Catch is expressed as the sum of landing and dead discard. For calculation of catch number, total effort was multiplied by the standardized CPUE which was estimated in Semba *et al.* (2012) by year. For the North Atlantic, effort in the area north of 50 degrees north was excluded from the calculation because the standardized CPUE was estimated in the area without the region north of 50 degrees north. The catch data which was raised by total effort was used as landing. The dead discard was estimated by multiplying the difference between catch and landing by 0.226, which is the mortality of this species estimated from the information collected in the observer data in the Atlantic. The temporal changes of effort in both Ocean were indicated in Figue1. The sum of landing and dead discard was treated as the catch number for each year.

Catch weight

Based on the filtered dataset used for the standardization in each Ocean in Semba *et al.* (2012), the average weight of products was calculated for each year, separately for the North and South Atlantic. Average weight of whole body was calculated by multiplying average weight of product by 1.56 which is the conversion ratios from products to the whole body for shortfin mako (JANUS 2002). Catch estimates in weight were obtained by multiplying those in number by the average weight of whole body.

The estimates were compared with those by Matsunaga (2009), separately for North and South.

3. Results and Discussion

Table 1 indicates the calculated average weight of whole body of shortfin mako for the North and South Atlantic. Mean weights throughout the period is similar between the North (45kg) and the South (43kg), but the weight in the South Atlantic in recent 3 years was smaller than in the North Atlantic.

Table 2 and **Figure 2** indicate the estimated catches in number and weight (ton) for shortfin mako caught by Japanese tuna longline fishery in the Atlantic Ocean.

For the North Atlantic, catch number/weight gradually declined from 1995 to 1999 and then gradually increased after that. Regarding catch number, our estimate was higher than past estimates between 1994 and 1999 and two estimates were closer in the following 4 years. Fluctuations after 2003 in Matsunaga (2009) were removed in our estimate. In catch weight, the gap between these two estimates might be amplified by the fluctuation of annual change of average weight of whole body we used and/or the difference in the method and dataset for the calculation of average weight.

For the South Atlantic, catch number/weight decreased drastically from 1994 to1996 and was stable until 2000. After 2000, the catch number/weight showed fluctuation between 2000 and 2006. After 2006, the estimated catch gradually increased in number, but relatively stable in weight. The decline of catch in early 3 years may be partly due to the decline of effort in the same period (**Figure 1**) but another factor such as temporal change of fishing area and market is left to be investigated.

Comparing the catch number between the North and South (**Figure 3**), estimates in the North were higher than those in the South except 1994 and 1999. The gap between these estimates got smaller in recent 3 years. Generally, the trend of this gap was similar to the gap of effort between Oceans except for 1999 and 2003. For 1999, the amount of landing was small and this might cause the small catch. For 2003, neither standardized CPUE nor the landing showed large fluctuation and thus the reason for this is unknown at present. Regarding the catch weight, the trend was similar to that of catch number until 2007, but it began to diverge after that. This gap is partly explained by the difference in the average weight of whole body between oceans in these years (**Table 1**). The reason for the divergence of this is unknown at present, but the temporal change of fishing area or landing pattern of fishing vessels might be possible cause, which needs to be examined in the future work.

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Table 1. Average weight of whole body for shortfin mako in the North and the South Atlantic.

Year	North	South
1994	44	46
1995	53	45
1996	47	48
1997	36	47
1998	48	47
1999	38	31
2000	45	41
2001	50	55
2002	49	52
2003	43	48
2004	45	43
2005	49	38
2006	34	36
2007	42	41
2008	53	36
2009	50	38
2010	45	32

Table 2. Estimated catch of shortfin mako in number (left) and weight (ton) (right), caught by Japanese tuna longline fishery in the Atlantic.

Catch number

Year	North	South
1994	4,395	6,720
1995	4,322	3,569
1996	3,294	1,922
1997	3,255	1,940
1998	3,969	1,488
1999	1,916	2,048
2000	2,250	1,764
2001	2,614	729
2002	2,968	665
2003	2,560	1,528
2004	3,466	1,578
2005	3,190	848
2006	4,360	2,941
2007	2,917	2,187
2008	4,287	3,374
2009	3,540	3,007
2010	3,919	3,952

Catch weight (ton)

Year	North	South
1994	192	308
1995	227	188
1996	154	107
1997	118	92
1998	192	72
1999	72	77
2000	101	72
2001	132	40
2002	147	35
2003	110	74
2004	157	69
2005	155	32
2006	146	109
2007	123	92
2008	225	122
2009	176	115
2010	178	129

Figure 1. Temporal change of effort in the North and the South Atlantic.
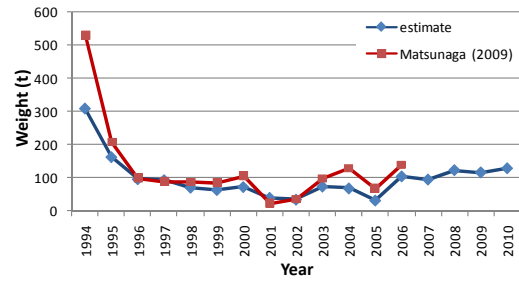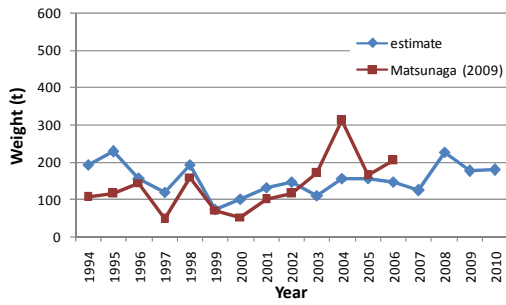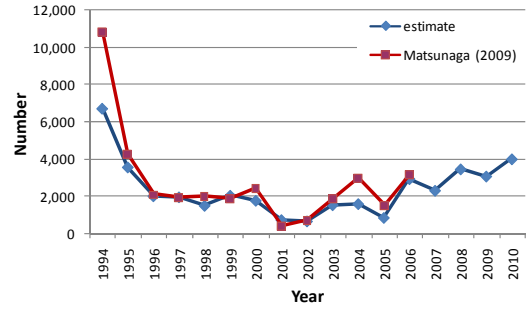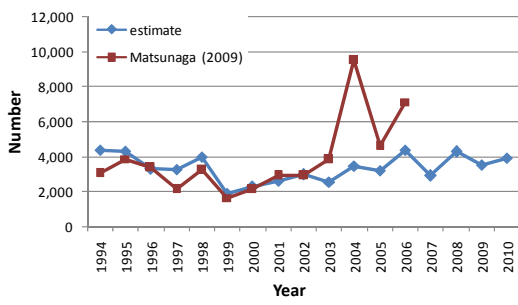
Figure 2. Estimated catch number and weight for the North (left) and the South (right) Atlantic Ocean. Upper is catch number and lower is catch weight (ton).
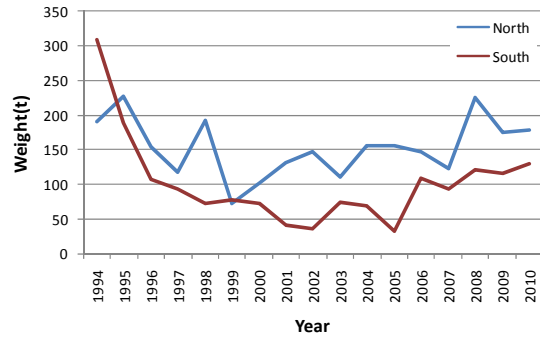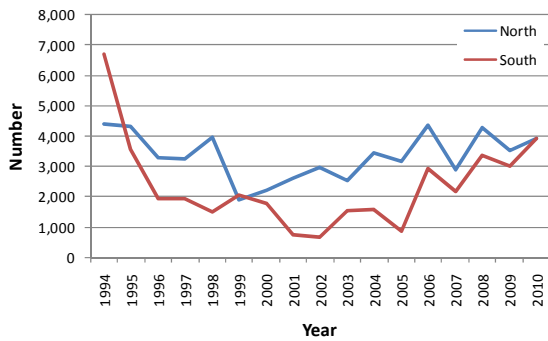

Figure 3. Comparison of estimates between the North and the South for catch number (left) and catch weight (right).