ISC/21/SHARKWG-1/08

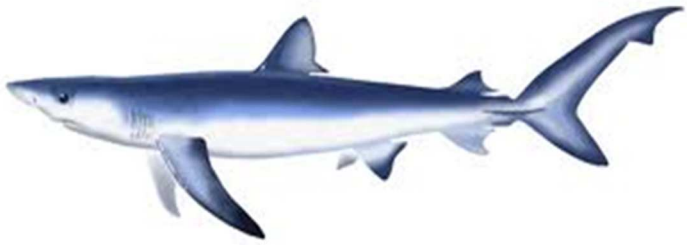
Blue shark catches in the Japanese large-mesh driftnet fishery in the North Pacific Ocean from 1973 to 1993[1]

Yuki Fujinami[2] , Minoru Kanaiwa[3], Mikihiko Kai[2]

[2] Fisheries Resources Institute, Japan Fisheries and Education Agency, 5-7-1 Orido, Shimizu, Shizuoka, 424-8633, Japan

[3] Mie University, Faculty of Bioresources, 1577 Kurimamachiya-cho, Tsu, Mie, 514-8507, Japan

Email: fuji925@affrc.go.jp



[1] Working document submitted to the ISC Shark Working Group Workshop, 9-19 November 2021, Web-meeting. **Document not to be cited without author's permission.**

Abstract

We updated annual catches of blue shark (*Prionace glauca*) caught by Japanese large-mesh driftnet fishery in the North Pacific Ocean during 1973 and 1993 because the annual catch data contains the same constant values and the calculation/estimation method is not described in the previous literatures. Since Japanese logbook data contains extremely high zero-catch for sharks caught by Japanese large-mesh driftnet fisheries, we estimated the annual catches of blue sharks using the catches in weight of all sharks reported by Japanese statistical yearbook ("Norin-toukei"). Then, Japanese scientific observer data was used to calculate the ratio of blue shark to all sharks because the species-specific shark's data is not included in the statistical yearbook. The estimated catches in weight of blue shark sharply increased from 1975 to 1977, and subsequently decreased with fluctuations until 1993. Amount of annual catch in weight had a wide range between 1,236.0 and 10,580.7 MT for 1973-1993. We recommend using the estimated catches in this paper for the upcoming stock assessment of blue sharks in the North Pacific Ocean because the values are more reasonable from the view of the annual changes in the trends compared with the unaccountable constant values.

Introduction

Japanese large-mesh driftnet fishery primarily targeted billfishes (mainly striped marlin *Tetrapturus audax*) near coastal water of Japan in the 1970's, and the main target species of this fishery changed to albacore (*Thunnus alalunga*) in 1980's, as the fishing ground expanded towards offshore and far-seas (Nakano et al. 1993; Kiyofuji et al. 2017). Due to the development of the fishery, a substantial number of sharks were caught by high seas driftnet fishery (large-mesh driftnet fishery and squid driftnet fishery) as non-target species, especially blue shark (*Prionace glauca*) in 1980's and the beginning of 1990s (McKinnell & Seki, 1998).

In the previous stock assessment of North Pacific blue shark (ISC 2017), the historical catches of blue shark caught by Japanese large-mesh driftnet fishery from 1973 to 2015 were used. However, the annual catches had a large uncertainty due to the same constant values of the annual catches for 1973-1982 (6,296.9 MT) and 1988-1992 (3,707.7 MT), respectively. In addition, the calculation/estimation method of the catches was not described in the previous literatures. It is therefore necessary to describe the calculation/estimation method and update the historical catches of blue shark caught by Japanese large-mesh driftnet fishery.

The objective of this working paper is to estimate the annual catches of blue shark caught by Japanese large-mesh driftnet fishery from 1973 to 1993 using the Japanese statistical yearbook ("Norin-toukei").

Materials and methods

Data source

1. Japanese statistical yearbook ("Norin-toukei")

Japan fishery agency complies the yearbook and opens the data to the public every year through Ministry of Agriculture, Forestry and Fisheries. The yearbook contains landing data covering wide areas in Japan and includes total amount of catches for sharks caught by different fishing gears after 1951, however, the shark species are aggregated into one category "sharks" after 1967. Since catch of billfishes (mainly striped marlin) and swordfish (*Xiphias gladius*) recorded in yearbook sharply increased after 1973, we used the data for 1973-1993. To estimate the annual catches of blue sharks caught by Japanese large-mesh driftnet fishery, we used the species composition data collected by the onboard observer.

2. Scientific observer data

This data was collected by onboard observer for 1990-1991. This data contains detailed information on each set; fishing date (year, month, day, time), fishing area (latitude and longitude), environmental condition (sea surface temperature and oceanic condition) at the time of driftnet deployment and retrieval, gear configurations (mesh size, number of deployed nets, length of one net) and catch in number of all species caught by the driftnet fishery. Using this data, we calculated shark species composition caught by Japanese large-mesh driftnet fishery for 1990-1991.

Catch estimation

Annual catches in weight of blue sharks caught by Japanese large-mesh driftnet fishery were estimated using catch of all sharks recorded by yearbook and the ratio of blue shark to all sharks calculated from Japanese scientific observer data.

Results

A total of eight shark species (including unidentified shark species) were reported by scientific observer for1990-1991 (Table 1). The ratio of blue shark to all sharks was accounted for 90.6% (n = 367) and 89.4% (n = 2,953) in 1990 and 1991, respectively. The mean value of two years was 89.5%.

Recorded catches of sharks in yearbook and estimated catches for blue shark, shortfin mako, and salmon shark were summarized in Table 2. The estimated annual catches of blue sharks had a wide range from 1,236 to 10,581 MT for 1973-1993. The catches sharply increased from 1973 and reached a peak in 1977, and subsequently decreased with fluctuations until 1993. Nakano et al. (1993) reported an estimated catches in weight (1,932 MT) of blue shark caught by large-mesh driftnet fishery during August 1990 and May 1991. The estimated catch was similar with our estimate in 1990 and 1991.

Discussion

We attempted to estimate annual catches of blue sharks caught by Japanese large-mesh driftnet fishery from a logbook data. However, we did not adopt the outputs because the estimated catches of blue shark were almost the same as those caught by driftnet fishery operated within the EEZ of Japan after 1993 that means the estimated values seem underestimation of catch. Logbook data has issues on the underreporting for the catch of sharks (i.e., high zero catch rate) and inaccurate record of the fishing effort (i.e., extremely short, and long distance for the nets). In addition, we did not use the similar method applied to the estimation of catch for Japanese high seas squid driftnet fishery (Fujinami & Kai 2018) because low data/area coverage of Japanese scientific observer program in large-mesh driftnet fishery.

Although our estimated catches in weight of blue sharks were substantially lower than those reported in the previous stock assessment (ISC 2017), the decreasing trend of annual catches in 1980's and 1990's are explainable from the expansion of the fishing area from the coastal to far seas for the targeting shift from the billfishes to albacore. In addition, the estimated catch is more reasonable compared to the unaccountable constant value in the previous stock assessment. We therefore recommend using the estimated catches in this paper for the upcoming stock assessment of blue sharks in the North Pacific Ocean.

Acknowledgements

We are deeply grateful to Dr. K. Uosaki, Fisheries Resources Institute, Japan Fisheries and Education Agency in Japan, for provided us valuable data of Japanese high seas large-mesh driftnet fishery. The driftnet observer data were produced through the combined efforts of many fishing crews, observers, and scientists at the Japan Fisheries and Education Agency in Japan, the National Marine Fisheries Service in USA and Fisheries and Oceans Canada.

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Table 1. Shark species composition (percentage in observed numbers among species) caught by Japanese large-mesh driftnet fishery of the North Pacific Ocean during 1990 and 1991.

Shark species	Species rate (%)		
	1990	1991	Total
Blue shark	90.6	89.4	89.5
Salmon shark	2.5	1.8	1.9
Shortfin mako shark	6.2	5.9	5.9
Cookie cutter shark	0.0	1.7	1.5
White shark	0.0	0.2	0.2
Unidentified hammerhead shark	0.0	0.0	0.0
Unidentified thresher shark	0.2	0.0	0.0
Unidentified shark	0.5	1.0	1.0

Table 2. Catches in weight (MT) of all sharks recorded in “Norin-toukei”, and estimated annual catches in weight of three shark species (blue shark, shortfin mako, and salmon shark) caught by the Japanese large-mesh driftnet fishery from 1973 to 1993.

year	Catches in weight of “Norin-toukei”	Estimated catches in weight			Catches in weight used in the stock assessment (2017)
	All sharks	Blue shark	Shortfin mako	Salmon shark	Blue shark
1973	3865	3459.2	73.4	228.0	6296.9
1974	3158	2826.4	60.0	186.3	6296.9
1975	3898	3488.7	74.1	230.0	6296.9
1976	7179	6425.2	136.4	423.6	6296.9
1977	11822	10580.7	224.6	697.5	6296.9
1978	7222	6463.7	137.2	426.1	6296.9
1979	5350	4788.3	101.7	315.7	6296.9
1980	3884	3476.2	73.8	229.2	6296.9
1981	3810	3410.0	72.4	224.8	6296.9
1982	3817	3416.2	72.5	225.2	6296.9
1983	2871	2569.5	54.5	169.4	5926.8
1984	3127	2798.7	59.4	184.5	4727.5
1985	3011	2694.8	57.2	177.6	3763.6
1986	3349	2997.4	63.6	197.6	4081.1
1987	2982	2668.9	56.7	175.9	3990.5
1988	2463	2204.4	46.8	145.3	3707.7
1989	2051	1835.6	39.0	121.0	3707.7
1990	1787	1599.4	34.0	105.4	3707.7
1991	2127	1903.7	40.4	125.5	3707.7
1992	2012	1800.7	38.2	118.7	3387.7
1993	1381	1236.0	26.2	81.5	660.5