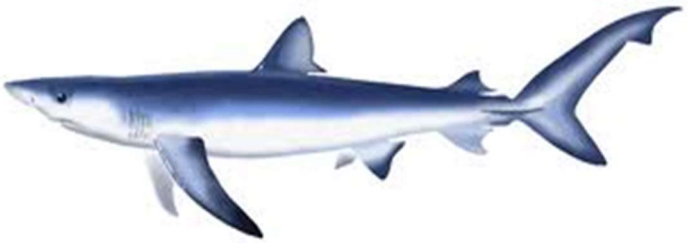
Length frequency of blue sharks sampled by Canadian observers in the Japanese flying squid driftnet fishery in 1991 [1]

Mikihiko Kai[2], Nicholas Ducharme-Barth[3], Yasuko Semba[2], Steven L. H. Teo[4],

[2] Fisheries Resources Institute, Japan Fisheries and Education Agency,
5-7-1 Orido, Shimizu, Shizuoka, 424-8633, Japan
[3] NOAA Fisheries, Pacific Islands Fisheries Science Center, Honolulu, Hawaii USA
[4] NOAA Fisheries, Southwest Fisheries Science Center, La Jolla, California USA

Email: kaim@affrc.go.jp



[1] Working document submitted to the ISC Shark Working Group Workshop, 19-22, 26-28 April 2022 (JST), Web-meeting. **Document not to be cited without author's permission.**

Summary

This working paper describes the length composition data of blue sharks sampled by Canadian observers in the Japanese flying squid driftnet fishery in the North Pacific Ocean in 1991. The length composition data in total length (cm) was digitally extracted from a figure in McKinnell and Seki (1998; Shark bycatch in the Japanese High Seas squid driftnet fishery in the North Pacific Ocean. Fish. Res. 39, 127–138). The total length was converted to precaudal length (PCL) using the allometric equation used for Japanese fisheries on this stock. Given that the data presented in this study are currently the best available scientific information on the size of blue sharks caught by this important historical fishery, it is recommended to use this length composition data to represent the size of fish caught by the Japanese squid driftnet fishery in the 2022 stock assessment of blue shark in the North Pacific Ocean. It is also recommended that the WG continue working on rediscovering data for this important historical fishery.

Introduction

Japanese high seas squid driftnet fishery commenced operations in 1978 and commonly targeted flying squid, *Ommastrephes bartrami* (Yatsu et al., 1993). A substantial number of sharks were caught by this fishery as non-target species, especially blue shark, (*Prionace glauca*) in 1980s and the beginning of 1990s (McKinnell and Seki 1998). Blue shark (*Prionace glauca*) is widely distributed from tropical to temperate waters around the globe and is the most abundant species of oceanic pelagic shark (Nakano and Steven, 2008). Blue shark in the Pacific Ocean is thought to comprise two-stocks, roughly separated north and south along the equator (ISC, 2017). The stock assessment of blue shark in the North Pacific Ocean is conducted by the ISC SHARK working group (WG). In the previous stock assessment in 2017, the WG was unable to find any size data for this fleet. Furthermore, the reported average weight of the blue sharks caught by this fleet was substantially smaller (~ 7 kg; Yatsu et al. 1993) than other fleets in the assessment, and the WG could not mirror the selectivity of the squid driftnet fleet to another fleet in the assessment. Therefore, for the 2017 assessment, the selectivity curve of the squid driftnet fleet was not estimated but instead fixed a priori, following a double normal pattern with the peak at 50 cm precaudal length (PCL). In preparation for the assessment in 2022, we rediscovered the work of McKinnell and Seki (1998), who reported the length frequency data of blue sharks sampled by Canadian observers in the Japanese flying squid driftnet fishery in 1991. Using a figure in McKinnell and Seki (1998), we developed length composition data for the squid driftnet fishery that could be used in the 2022 stock assessment.

Materials and Methods

To retrieve the length frequency of blue sharks sampled by Canadian observers in the Japanese flying squid driftnet fishery in 1991, the data from Figure 7 in McKinnell and Seki (1998) was digitally extracted using an online data extraction tool (https://plotdigitizer.com/). The reported lengths in McKinnell and Seki (1998) were in total length (TL) and was converted to precaudal lengths (PCL) used in the assessment, using the following allometric equation (Fujinami et al., 2017):

$$PCL=0.78\times TL-3.75, \quad (1)$$

where PCL is precaudal length (cm) and TL is total length (cm). In Figure 7 of McKinnell and Seki (1998), there were 9 bins in the interval between 100 and 200 cm TL, resulting in bin widths of ~11.1 cm TL. Given that the units of the y-axis were reported as counts and the extracted counts were very close to whole numbers, the extracted counts were rounded to the nearest whole number.

Results and Discussions

This working paper describes the length composition data of blue sharks sampled by Canadian observers in the Japanese flying squid driftnet fishery in 1991. The extracted length frequency data are shown in **Table 1**. The peak of

length frequency data ranged from 48.3 to 56.9 cm PCL.

The mean body weight estimated from the extracted length frequency data using the sex-specific weight-length relationships (Nakano, 1994) was approximately 2.68 kg (i.e., the mean value of male; 2.72 kg and female; 2.64 kg). This value is much smaller than that of point estimates (7.0 kg) in Yatsu et al. (1993) and the reported grand means of set-specific mean weights (6.9 kg) from hailed biomass data in McKinnell and Seki (1998), but is similar to the mean weight of samples reported by McKinnell and Seki (1998; 2.8 kg; n=166). However, this value could be more representative of the blue shark catch of this fleet because the data are from samples taken by scientific observers. In contrast, the data source for the mean body weight reported by Yatsu et al. (1993) is unclear, and the hailed biomass data reported by McKinnell and Seki (1998) may be from visual estimates of mean weights from sets. Given that the data presented in this study are currently the best available scientific information on the size of blue sharks caught by this important historical fishery, it is recommended to use this length composition data to represent the size of fish caught by the Japanese squid driftnet fishery in the 2022 stock assessment of blue shark in the North Pacific Ocean. It is also recommended that the WG continue working on rediscovering data for this important historical fishery.

References

Fujinami, Y., Semba, Y., Okamoto, H., Ohshimo, S., Tanaka, S., 2017. Reproductive biology of the blue shark (*Prionace glauca*) in the western North Pacific Ocean. Mar. Freshw. Res. 68:2018-2027

ISC. 2017. Stock assessment and future projections of blue shark in the North Pacific Ocean through 2015. ISC Plenary report and documents. Annex 13.

McKinnell, S., Seki, M.P. 1998. Shark bycatch in the Japanese High Seas squid driftnet fishery in the North Pacific Ocean. Fish. Res. 39, 127–138.

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

Nakano, H., Stevens, J. D. 2008. The biology and ecology of the blue shark, *Prionace glauca*. In: Camhi, M. D., Pikitch, E. K., Babcook, E. A., editors. Sharks of the open ocean: biology, fisheries and conservation. Oxford: Blackwell Scientific. p. 140–51.

Yatsu, A., Hiramatsu, K., Hayase, S. 1993. Outline of Japanese squid driftnet fishery with notes on the by-catch. Bulletin 53 (I)-North Pacific Commission. 5-24.

Table 1. Length frequency of blue sharks sampled by Canadian observers in the Japanese flying squid driftnet fishery in 1991. Data were extracted from Figure 7 in McKinnell and Seki (1998) and were originally in total length (TL) that were converted to precaudal length (PCL).

Startbin(TL;cm)	Endbin(TL;cm)	Startbin (PCL;cm)	Endbin (PCL; cm)	Count
33.3	44.4	22.3	30.9	1
44.4	55.6	30.9	39.6	10
55.6	66.7	39.6	48.3	66
66.7	77.8	48.3	56.9	108
77.8	88.9	56.9	65.6	78
88.9	100.0	65.6	74.3	86
100.0	111.1	74.3	82.9	65
111.1	122.2	82.9	91.6	22
122.2	133.3	91.6	100.3	22
133.3	144.4	100.3	108.9	13
144.4	155.6	108.9	117.6	13
155.6	166.7	117.6	126.3	5
166.7	177.8	126.3	134.9	2
177.8	188.9	134.9	143.6	3
188.9	200.0	143.6	152.3	5
200.0	211.1	152.3	160.9	4