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Processed form of blue shark (Prionace glauca) caught by Japanese longline fisheries with the estimation of conversion factor from processed weight to round weight.

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Abstract

Blue shark (*Prionace glauca*) is one of the main species caught by Japanese distant-water and offshore longline fisheries. Catch data, including that of blue shark, submitted to each RFMO is basically round weight while the catch weight recorded in logbook by tuna longliners is mainly processed weight. Therefore, obtaining appropriate information on both processed form and conversion factor from processed weight to round weight is important for estimating accurate catch amount for this species. Processed form of blue shark caught by both fisheries was investigated based on the observer data since 1992. In the distant-water longline vessel, 97.3% of retained blue sharks were processed in the form of dress in which head, gut, and fins were removed (Type I dress) and kept in a frozen state until unloaded. As for the offshore longline vessel, all blue sharks (100 %) were processed to the other type of dress in which only head and gut were removed and fins were attached (Type II dress) and kept in raw state until unloaded. These results indicate that application of conversion factor from Type I dress to round weight is appropriate for the blue shark catch of distant-water longline fishery and that from Type II dress to round weight is appropriate for the catch of offshore longline fishery. This paper also shows conversion factors of each type of dressed weight (2.04 for Type I dress and 1.68 for Type II dress) calculated from intact specimens in the laboratory or fish market. There was significant relationship between each type of dressed weight and round weight.

Although further collection of measurement from large specimens has been left to be addressed in the future work, it is expected that the conversion factor estimated in this work would facilitate to obtain more accurate catch amount for this species.

Introduction

Blue shark (*Prionace glauca*) is a wide-ranging and oceanic-epipelagic species which is distributed in the temperate and tropical waters in the world (Compagno 1984). This species is usually caught with surface fishing gear and is one of the main species caught by Japanese distant-water and offshore longline fisheries. Distant-water longline vessels are over 120 GRT and longliners in this fishery basically can fish at all oceans. Offshore longline vessels are further divided into two categories, small offshore, 10-20 GRT, and large offshore, 10-120 GRT, longlines, both of which are able to go beyond the Japan's EEZ in the Pacific Ocean with exceptional area in the eastern Pacific Ocean (Uosaki et al. 2015). Blue sharks caught by distant-water longliners are landed in frozen state and those caught by offshore longliners are landed in raw state.

Catch data, including that of blue shark, required to be submitted by each RFMO is basically round weight while the catch weight recorded in logbook by tuna longliners is mainly processed weight. Therefore, obtaining appropriate information on both processed form and conversion factor from processed weight to round weight is important for estimating accurate catch amount for this species.

Investigation on processed form of blue shark caught by both type of longline fisheries was implemented using the observer data since1992. Based on the results of investigation on the processed form, the conversion factor from processed weight most dominant in each fishery to round weight was calculated.

Materials and Methods

Processed form

The data on the processed form of blue shark was extracted from the observer data on Japanese tuna distant-water longline fishery and offshore longline fishery, collected from the Atlantic, Indian and Pacific Ocean since 1992. For each individual fish caught, the fate (released or retained) and the processed form of

product were recorded. In accordance with the processed form for tuna, billfish and sharks, processed forms recorded are classified into 6 categories for the retained fish, that is, round, dress 1 (without gill and gut), dress 2 (without gill, gut, and tail), dress 3 (without head, gut and fin) and dress 4 (without head, gut), and other. In case of blue shark, only two types of these categories (dress 3 and dress 4) were appeared in the observer data, hereafter they are called as Type I dress and Type II dress, respectively.

Conversion factor

Conversion factors from each dress type (Type I dress and Type II dress) to round weight are estimated by the following equation;

Round weight (kg) = a * Dress weight (kg) + error

, where a is coefficient, Dress weight is either Type I dress or Type II dress, and normal distribution was assumed as error distribution.

Both round weight and dressed weight were measured from intact specimens in the laboratory or fish market.

Specimens were collected from the research vessel (Taikei-Maru No.2) and commercial offshore longline vessels between 2011 and 2015 in the northwestern Pacific Ocean. The specimens collected from the research vessel were stored in the freezer after hauling on the deck and measured in the laboratory after thawing, while those collected from commercial vessels were kept in iced state until measurement in the fish market. Type I dress and/or Type II dress were weighed to the nearest 10 g by the scale after measurement of body length and round weight and sex determination. Regression analysis was conducted between Type I dress and round weight for distant-water longline fishery and between Type II dress and round weight for offshore longline fishery, assuming that the intercept is 0. In this analysis, sex was combined because the processed weight collected in the logbook sheet is sex-combined.

Results

Processed form

The ratio of products in each processed form and the total number of data analyzed was shown in Table1 by type of longline and ocean. The data from distant-water longline (n=41,981) was available from the three ocean and that from offshore water longline (n=7,383) was available only from the Pacific Ocean. Figure 1 shows the composition of processed form of retained blue shark for distant-water and offshore longline fishery. In the distant-water longline fishery, 97.3% of retained blue shark was processed as Type I dress. In the Pacific Ocean, this type occupied nearly 99 % of all product and dominated (>90%) in other ocean, too (Figure 2).

In the offshore longline fishery, 100% of the retained shark was processed as Type II dress.

Conversion factor

Weight of Type I dress and Type II dress was collected from 146 specimens (78 males and 68 females) and 347specimens (154 males and 193 females), respectively. Size frequency of specimens is shown in Figure 3. In both estimation, the specimen used for the analysis covered wide range of size from young to adult in both sex, although the number of large specimen (> 200 cm in precaudal length) was relatively small.

There was significant relationship between each type of dressed weight and round weight (Table 2,

Figure 4). The estimates of coefficient was 2.04 (standard error: 0.0129) for the regression between Type I dress and round weight and 1.68 (0.0109) for the regression between Type II dress and round weight, respectively (Table 2). ANOVA table was shown in Table 3.

Discussion

In this document, it was indicated that there was significant difference in the processed form depending on the type of longline fishery.

As for the distant-water longline fishery, Type I dress was predominant (97.3%) and most of remainder was round state (about 3%). Comparison of the composition of processed form among oceans also support the dominance of Type I dress in the catch by distant-water longliners in each ocean. These results indicate that the use of conversion factor from Type I dress to round weight (i.e., 2.04) would be appropriate for the blue shark catch of distant-water longline fishery.

In the offshore longline fishery, almost all of the product was processed into Type II dress. Therefore the use of conversion factor from Type II dress to round weight (i.e., 1.68) would be appropriate for the blue shark catch of offshore longline fishery. Offshore longliners usually land the products in the domestic market in Japan. Regarding the blue shark landed in the domestic market, more than 90% of total amount is landed in Miyagi Prefecture, Kesennuma fish market, where blue shark is landed as Type II dress in which head and gut was removed but fins are attached to the body (Shibakuki et al. 2000).

The paucity of large specimen might cause some uncertainty in the estimate of conversion factor for both type of dressed weight and has been left to be addressed in the future work, but it is expected that the conversion factor estimated in this study would facilitate to obtain more accurate catch amount for this species.

References

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Table1. The percentage of the retained blue shark in each processed form in the total number for each area. “Total” denotes the total catch number analyzed. Area corresponds to the convention area defined by ICCAT, IOTC and WCPFC.

	Area	round	other	Type I dress	Type II dress	Total
Distant-water	Atlantic	0.6	0.3	99.1	0.0	30,193
Distant-water	Indian Ocean	8.8	0.3	90.9	0.0	8,849
Distant-water	Pacific	1.2	0.3	98.5	0.0	2,939
Distant-water	All	2.4	0.3	97.3	0.0	41,981
Offshore water	Pacific	0	0	0	100	7,382

Table 2. Estimates of coefficient in the regression analysis between product weight and round weight.

	Estimate of coefficients	Std. Error	t-value	Pr(>|t|)	
Type I dress	2.04	0.0129	158.8	<2e-16	***
Type II dress	1.68	0.0109	154.2	<2e-16	***

Table 3. ANOVA table for the regression analysis between Type I dress and round (upper) and between Type II dress and round (lower).

	Df	Sum of square	Mean square	F-value	Pr(>F)	
Type I dress	1	122997	122997	25227	< 2.2e-16	***
Residuals	145	707	5			

	Df	Sum of square	Mean square	F value	Pr(>F)	
Type II dress	1	314845	314845	23785	< 2.2e-16	***
Residuals	346	4580	13			

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘

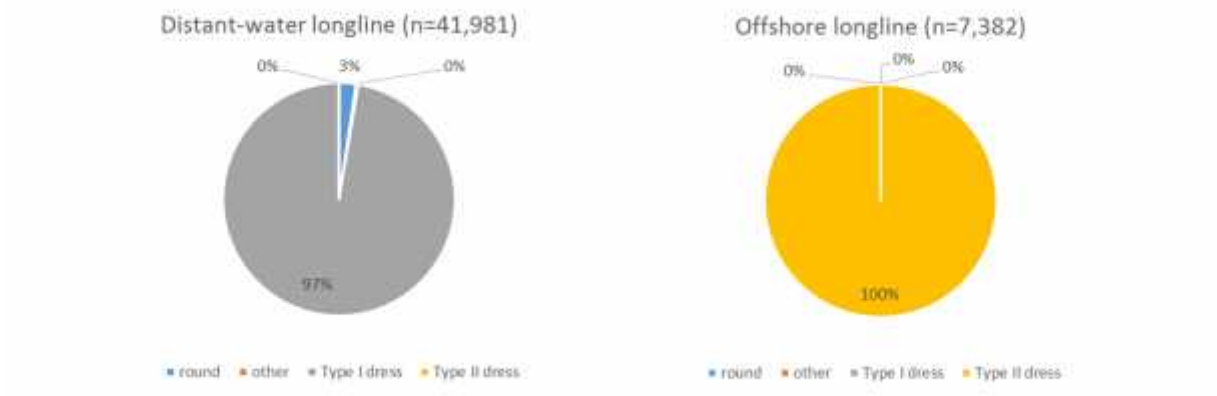

Figure 1. Composition of processed form of retained blue shark for distant-water (left) and offshore (right) longline fishery.

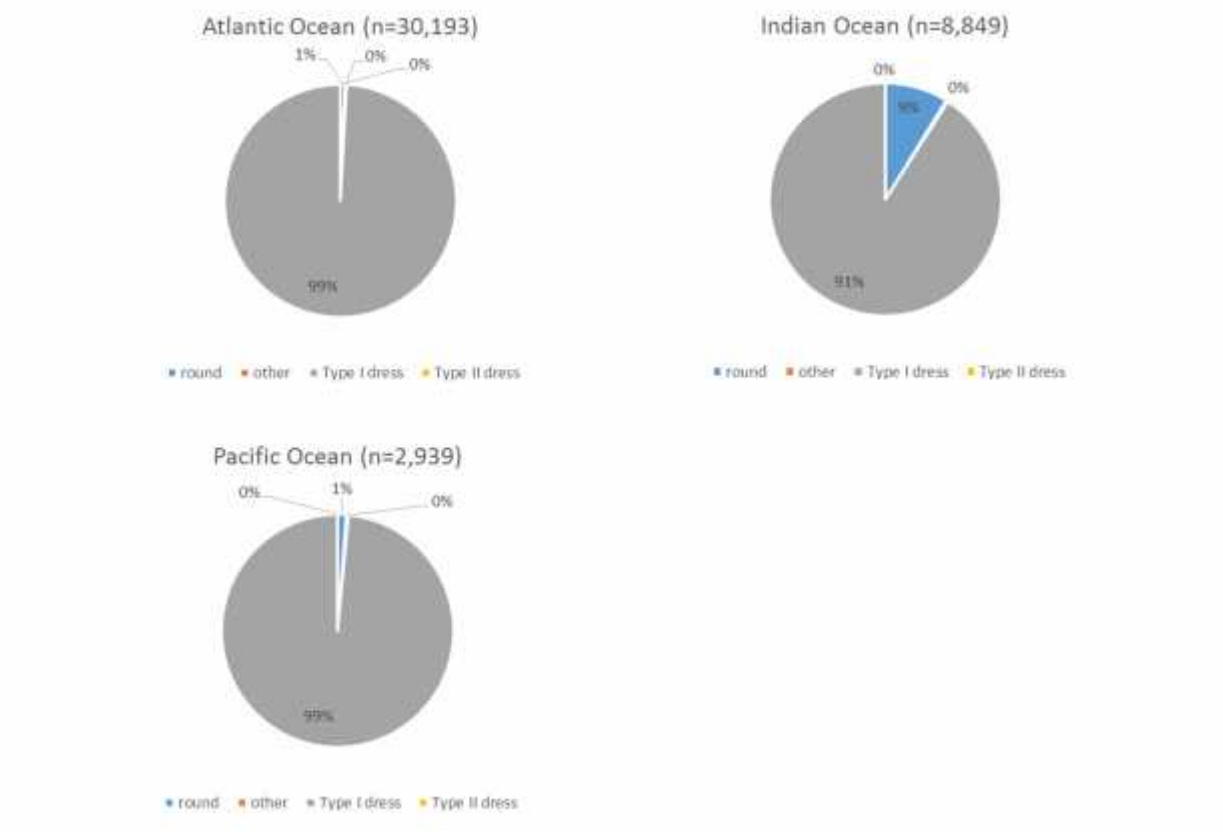

Figure 2. Composition of processed form of retained blue shark for distant-water by ocean. The ocean corresponds to the convention area defined by ICCAT, IOTC and WCPFC.

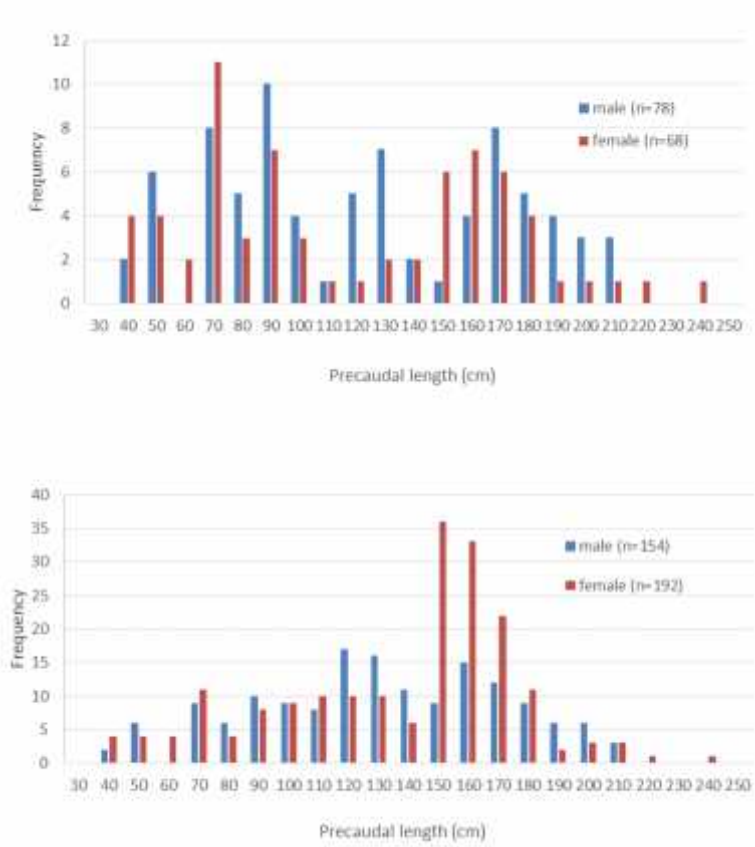

Figure 3. Size frequency of the specimen used for the estimation of conversion factor from Type I dress to round weight (upper) and from Type II dress to round weight (lower).

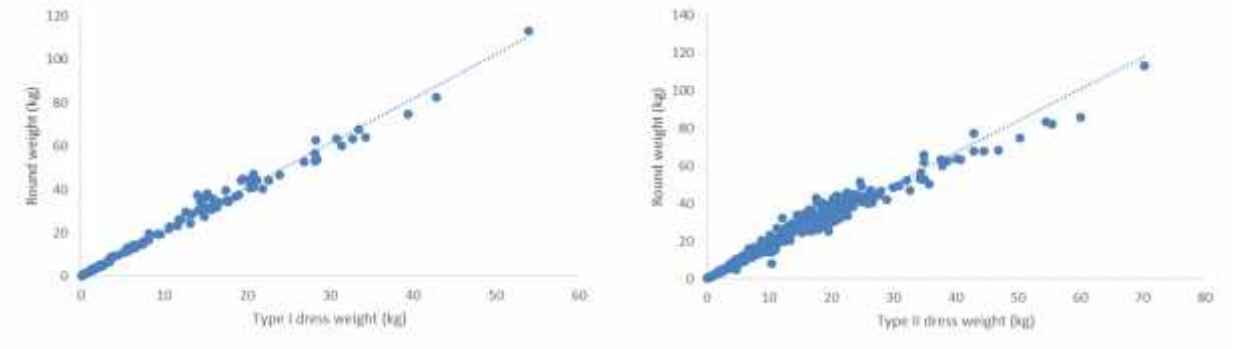

Figure 4. Relationship between Type I dress and round weight (left) and between Type II dress and round weight (right).