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Investigation of fin to body weight ratio for blue shark (Prionace glauca) caught by Japanese longline fisheries in the North Pacific

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Abstract

Blue shark (*Prionace glauca*) is one of the main species caught by Japanese distant-water longline fishery. This document reports the fin to body weight ratio for blue shark based on the trimmed and dried fin weight and dressed carcass weight, common form of processing this species in the fishery. Fin set consists of the first dorsal fin, right and left pectoral fins, and whole caudal fin (including both upper and lower lobe). Dressed carcass was obtained after head, gill, gut, lower part of belly and all fins are removed. The ratio of dried fin to dressed body weight ranged 1.73~4.70% (mean 2.65%, S.D. =0.45, n=84). The GLM analysis suggested year, location of catch, sex, gear and body size did not affect the fin ratio but the month was influential at statistically significant level. This document is prepared in response of SC11 recommendation on fin to carcass ratio.

1. Introduction

Blue shark (*Prionace glauca*) is usually caught with surface fishing gear and is one of the main species caught by Japanese distant-water longline fisheries. Semba et al. (2015) reported that 97.3% of retained blue sharks by Japanese distant-water longline fisheries were processed in the form of dress in which head, gill, gut, and fins were removed. In this fishery, removed shark fins are typically dried in the vessel before landing.

Accurate conversion factors between fin weight and body weight are necessary not only as a management tool to prevent shark finning (defined as retaining only the fins and discarding the remainder of the body) , but also as an alternate estimation method of total catch (Cortés and Neer 2006).

In this document, we report the fin to body weight ratio for blue shark of a common form used in Japanese distant-water longline fishery, based on the detailed measurement of specimen collected in the North Pacific.

2. Materials and Methods

2.1 Definition of fin and body weight

In this document, fin set consists of the first dorsal fin, right and left pectoral fins, and caudal fin (including both upper and lower lobe). Total weight of the fins mentioned above was weighed after trimmed and dried, following the procedure obtained by the survey to the fishermen.

Regarding body weight, the weight of dressed carcass, in which head, gill, gut, lower part of belly and all fins were removed (described as “Type I dress” in this document), is used as denominator of fin to body ratio. In this

procedure, head was removed by making incisions in the anterior base of pectoral fins and above the first gill slit with the vertebrae and muscle above left.

2.2 Processing of products

The specimen used in the analysis was collected in research cruises between 2014 and 2015. The gear used consists of driftnet, trawl, and longline. After hauled on the deck, shark was killed and body length was measured to the nearest cm in natural position. Precaudal length (PCL) was used as the standard length in this document.

35 specimen was dissected on the board and dressed carcass was weighed to the nearest 0.1 kg by the scale on the vessel. Other 49 specimen was retained intact in the freezer and processed in the laboratory after thawing and dressed carcass was weighed to the nearest 0.01 kg.

The set of fin was removed from the body at the base in straight line and excessive muscle and skin attached near the cut edge was removed from each fin so as not to damage the filament of fin and vertebrae. The trimmed fin was joined by the nylon through the center of the fin by individual and dried under the roof with cover so as not to be exposed to daylight and rain on the research vessel. The duration of drying ranged from 10 to 19 days depending on the climate and dried fin was stored in the freezer, which was weighed in the laboratory by fin to the nearest 0.1 g.

2.3 Analysis

Fin to body weight ratio was calculated as trimmed and dried fin weight divided by Type I dress weight.

GLM analysis was conducted to investigate the factors that influence the fin to body ratio. As small size of shark such as neonate is not usually hooked by distant-water longline fishery and not utilized as product even if hooked, GLM analysis was conducted for data from specimen over 50 cm, which is arbitrarily assigned as the minimum size observed in the longline survey. The model used is as follows;

Log(Dried fin weight (g)) ~ Intercept + *year* + *month* + *latitude* + *longitude* + *gear* + *sex* + *PCL* +offset (log(Type I dress (g))) + ε,

Where year, month, latitude and longitude, and PCL is the effect of year (2014-2015), month (4-10), latitude (24.3N-42.5N), longitude (133.5E-178E), and body size (56.2~235.0 cm) and body size, which were treated as continuous variables. Gear (longline, driftnet, and trawl) and sex (male and female) were treated as categorical variables. Errors ε was assumed to be normally distributed. Considering the purpose of analysis and the small sample size used, interaction term was not included.

3. Results and Discussion

A total of 84 specimen (48 males and 36 females) were used for the measurement (Figure 1). For males, body size ranged from 40.2 to 210.0 cm with mean of 138.9cm. For females, body size ranged from 33.4 to 235.0 cm with mean of 128.5 cm. Although the specimen covered wide range from neonate to adult in both sex, several modes were observed around 45cm, 75cm, and 175cm.

Range of fin weight to Type I dress weight ratio was summarized in Table 1. Ratio (%) ranged from 1.73 to 4.70 with mean of 2.65 and S. D. of 0.45.

The relationship between covariates (year, month, latitude, longitude, sex, gear, and PCL) and fin weight to Type I dress weight ratio was shown in Figure 2. GLM analysis suggested that the effect of covariates on fin weight were not statistically significant except for month (Table 2). Regarding month, the ratio was relatively high between April and July and then remained lower in September and October ($P<0.01$). The seasonal change of physiological condition associated with reproductive cycle (Fujinami pers. Comm.) and seasonal bias of body size (smaller specimen between April-July and larger specimen between September–October) might cause this result. Regarding gear effect, the fin weight to Type I dress weight ratio of specimen obtained from longline gear was smaller than those from other two gears, although the effect was not significant ($P>0.05$). The effect of body size was not significant, but the raw data indicates high value for neonates. Similar trend of extreme value from smaller shark is reported in past report and reason has been unclear (Francis 2014). Even if smaller shark has high ratio, they are unlikely hooked and released if hooked, therefore, the exclusion of small sharks from the analysis is suggested to be reasonable. Further investigation of fin to weight ratio from smaller sharks (≤ 50 cm) are planned to be conducted, which will contribute to reduce the uncertainty in the relation between size and fin to body weight ratio.

References

Cortés, E., and Neer, J. A. 2006. Preliminary reassessment of the validity of the 5% fin to carcass weight ratio for sharks. Col. Vol. Sci. Pap. ICCAT, 59(3):1025-1036.

Francis, M. P. 2014. Estimation of fin ratios and dressed weight conversion factors for selected shark species. New Zealand Fisheries Assessment Report 2-14/68 31pp.

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Table 1 Range of fin weight to Type I dress weight ratio for trimmed and dried fin of blue shark.

Minimum	1st Quarter	Median	Mean	3rd Quarter	Maximum	S.D.	N
1.73	2.36	2.6	2.65	2.93	4.7	0.45	84

Table 2 Summary of GLM analysis

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	132.60	134.40	0.987	0.32704	
year	-0.06	0.07	-0.963	0.33882	
mon	-0.04	0.01	-3.36	0.00128	**
lat	-0.01	0.01	-1.425	0.15887	
lon	0.00	0.00	0.83	0.40929	
as.factor(sex)2	0.05	0.03	1.614	0.1111	
as.factor(gear)ll	-0.12	0.11	-1.094	0.27772	
as.factor(gear)tr	-0.04	0.09	-0.525	0.60132	
pcl	0.00	0.00	-0.257	0.79787	

Signif. codes: 0 ‘***’ 0. 001 ‘**’ 0.01 ‘* ’ 0.05 ‘ .’ 0.1 ‘ ’ 1

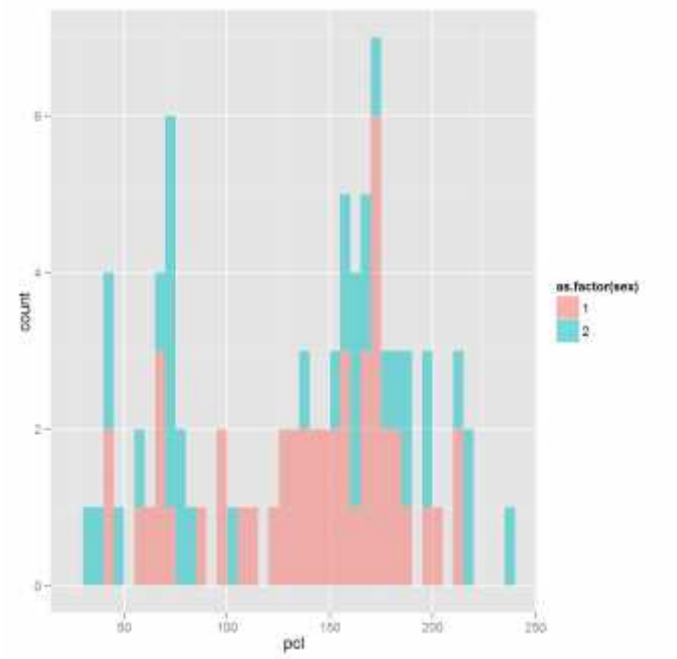

Figure 1. Size frequency of the specimen of blue shark used in the analysis. For sex, 1 and 2 denote male and female, respectively.

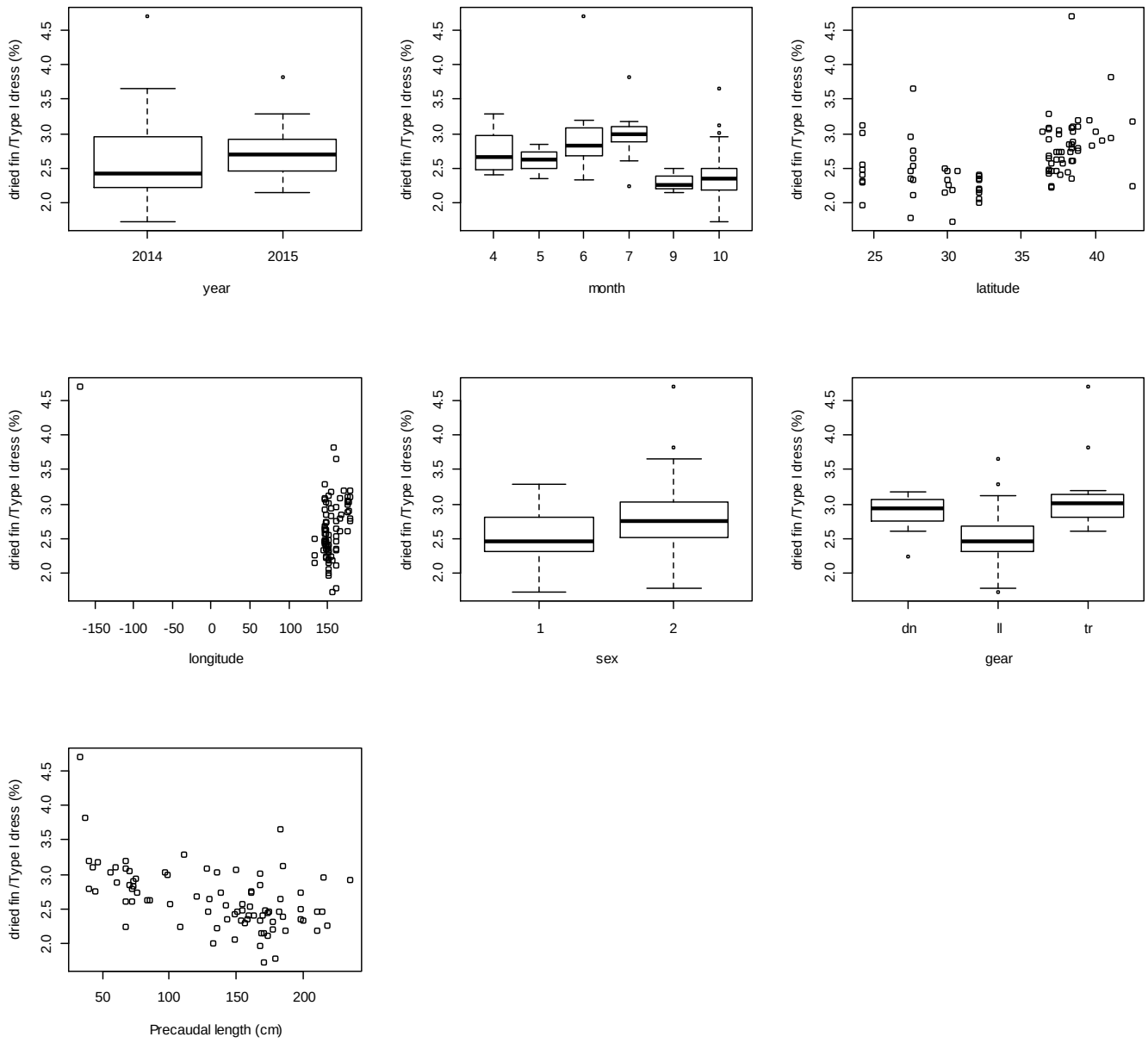

Figure 2. Relationship between each covariate and dried fin to Type I dress weight ratio. For sex, 1 and 2 denote males and females, respectively. For gear, dn, ll, and tr denote driftnet, longline, and trawl, respectively.

Appendix Diagnostic plot for GLM analysis