The analysis of length-weight relationship of commercial catch for Blue Shark *(Prionace glauca)*[1]

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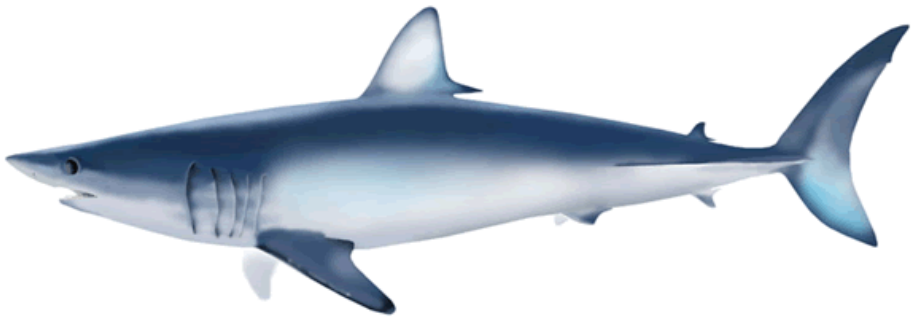

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Abstract

Blue shark (*Prionace glauca*) has one of the highest stock abundance among pelagic sharks and has enhanced life. For longline and drift net fisheries based on the Kesennuma fishing port, blue sharks has higher market value. Longliners and dirft netters unload large number of bleu sharks at once in the Kesennuma fishing port, and they are oftenly put up for the wholesale auction as a mound categorized by size and freshness. Fors such a species, the representativeness of estimated catch at size should affect on the accuracy of stock assessment. Under such condition, development of easy and effective way of size sampling of blue shark is requiered to estimate catch at size reliable enough for the input of stock assessment. To improve the representativeness of catch at size, length relationship with weight is one of most important factors. In this study, it was examined the nessasity of the developpment of fishery dependent L-W relationship using the size data collected by the sampling designed for this purpose. The results of the analysis of these data indicates the nessasity of fishery depended L - W relationship. In same time, it was suggested that the continuous monitoring program must be important and make informative data because Eastern Japan Great Earthquake Disaster will dcrease the fishing effort of blue shark fishery which has never occured historically.

Introduction

Blue shark (*Prionace glauca*) exist around all Oceans. The stock abundance is one of the highest among pelagic sharks. In Kesen-numa, Miyagi prefecture, Japan, the large targeted fisheries for this species unload their catches. There are three types of fisheries, the offshore longline (okiai), the coastal (engan) longline and the coastal drift net (nagashi-ami), landing blue shark. Blue shark was categorized by size and freshness in the wholesale market at the Kesen-numa fishing port and made some mounds by each category and each amount after landing.

In March, 2010, on the meeting of Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), there was the discussion about some species in the Atlantic shark. Restrictions of the international trade of some pelagic sharks were proposed there. In that meeting these porposals to list some pelagic sharks on the Appendicies of CITES were denied but it was agreed that more effective stock assessment and management are required.

Catch at age is the one of most important informations for stock assessment of long life species. Usually, catch at size was used to estimate catch at age. In Kesen-numa, National Research Institute of Far Seas Fisheries (NRIFSF) has conducted

the regular survey program to measure the length frequency of blue sharks caught by the offshore longline and it has mesured one mound of each category once in a week since 2009 but not for other two fisheries. The weight of the mounds of blue sharks are scaleed by the market stuff. If the number of blue sharks in mounds in each categories measured by the port samplar of NRIFSF were same as the mounds not measured, average processed weight (equal to the carcass weight) of blue sharks in all mounds can be estimated. Nakano (1994) estimated the relationship between length and whole weight of blue shark in the north Pacific using data collected by the research and training vessels, but information about the relationship between length and processed weight for landed individuals is limited. The relationship of length with whole and processed weight should show different seasonal pattern, because processed weight does not contain the weight of guts, which is including gonad, and heads. The weights of guts and carcass would change differently by season. Also, the weight of caracass should be affected by the avilability of preys which varys by area. Similarly, the relationship for the landed individuals may be different among fisheries and/or seasons because the weight would change while caught individuals pooled below deck and the pooled term and the effect will be different among fisheries and/or seasons.

In 2010, the additional size sampling was conducted in the Kesen-numa fishing port to evaluate the factors affecting on the relationship between the weight of carcass and the length of blue shark. In the present study, influence by the types of fishery unloading blue shark on Kesen-numa was analyzed.

Material & Method

The size sampling for blue shark was conducted in the period between 22th of August 2010 and 12th of September. In that period, there were three times of landing by the offshore longliners, four times landing of coastal longliners and ten times landing of gill netters, and all landing contains blue sharks. Both the length and processed weight were samples for the blue sharks caught by coastal longliners and coastal gill netters. For offshore longliners, at least one mound in each category was measured.

The relationship between length and weight was estimated by using logarithm linear model;

$$\log(\text{length}) \sim a \log(\text{weight}) + b + \varepsilon$$

Here, "length" means the distance between two back fins, "weight" means processed weigh, "a" and "b" means estimated coefficients and ε means error value depending on nominal distribution. Two scenarios are tryed to evaluate the differences of this relationsihp by fishery. One is the scenario in which combined all fishery and estimate

one relationship, i.e. no difference among fisheries is assumed. Another is the one in which the relationships are estimated in each fishery, i.e. fishery depended relationship is assumed. Akaike information criteria (AIC) was used as the criteria to select the optimal scenario.

Result & Discussion

The estimated slopes and intercepts for both scenarios are shown in Table 1 and Fig. 1. Fishery separated scenario was selected by AIC (Table 1). This indicates that fishery separated relatihonship between the length and the processed weight should be used to estimate the length of blue shark from the processed weight. In the Japanese longliners and gill netters, blue sharks are headed and gutted right after they halued aboard, and they stored in fish holds filled with ice. If the process method to remove head and guts were different by the fishery, that will affect to the relationship between length and weight. The relationship of length with processed weight should also affected by the way and terms of fish storage. Because the average cruise day of offshore longliners is more than double of those of coastal longers and drift netters and the size of fish holds is larger for offshore longliners, the meat of blue shark stored in the bottom of fish holds in the offshore longliners would lost water in it and its weight becomes lighter.

The use of the fishery specific relationship of length with processed weight are recommended for the estimation of landing weight of blue shark by the length measurment and for the estimation of length frequency from the processed weight data recorded by the wholesale market. If the relationship between length and weight will be estimated well properly, age classification of catch will be possible. Because blue shark has long life relatively longler logevity, stock assessment by using cohort model will be recommended.

Seasonality may be one of the considerable factors affect on the relationship between length and weight. The development of ovarium and testis of blue shark have seasonal change (Nakano 1994) and it will change the fatness of individuals, thus the processed weight will change by maturity level and/or pregnant or not-pregnant. In 2010, the size sampling was only conducted in Summer, so to clarify the seasonal change in the relationship, extra surveys in other seasons are required.

In 11 March 2011, Eastern Japan Great Earthquake Disaster occured and caused extensive and severe damage in Pacific Ocean side of Tohoku region. Especially in Kesen-numa, the fishing port and fish processing plant suffered serious damage. In this deplorable stiuation, productive fishery assesment and managing are

required to rebuild the shark fishery in Kesen-numa. Almost only in Kesen-numa there is the fishery targeted to blue shark and thus, the fishing effort for blue shark will reduce largely. The monitored data for length frequency of landing must be informative because this situation will become same one under adaptive management.

Reference

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

Table 1. Results of estimated intercept and slope and AIC for each scenarios

fishery	intercept	slope	sd.intercep	sd.slope	aic	
all	−7.04	2.48	0.11	0.03	−739.15	
okiai	−8.12	2.74	0.23	0.06	−247.56	sum of AIC
engan	−7.93	2.73	0.33	0.09	−44.99	−881.17
nagashi	−7.37	2.58	0.14	0.04	−588.62	

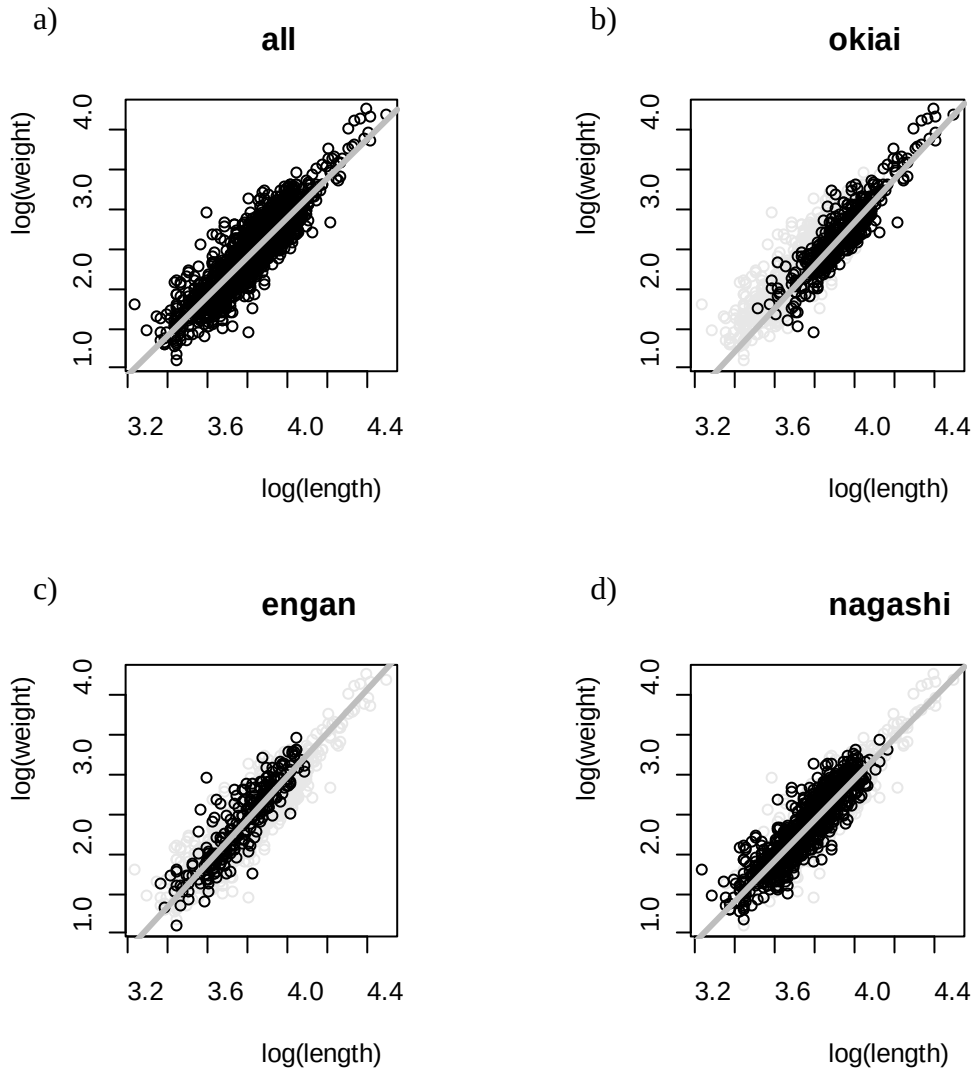

Figure 1 Observed logarithm length and weight are showed as black dot for a) all data combined, b) offshore longline, c) coastal longline and d) gill net. Gray dots means observed data for else fishery. Gray lines show estimated relationships.