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Korean SBT otolith collection activities in 2022

Republic of Korea

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ABSTRACT

To investigate the age and growth of southern bluefin tuna (SBT) we collected 58 otolith samples in 2022, totally 1,119 otoliths since 2015. The relationship between fork length and total weight was $TW=7.6E\text{-}05 \times FL^{2.723}$ ($R^2=0.911$). The von Bertalanffy growth's parameters estimated from the non-linear method using length-at-age data were $L_\infty=175.5$ cm, $K = 0.190$/year, $t_0 = -1.209$ years.

1. Sampling activities of otolith and ovary and its process

Since 2015 a total of 1,119 otoliths of SBT have been collected by Korean scientific observer program (Fig. 1). The fork length and weight were measured onboard for each specimen by sex, and the age was determined from annuli in otolith, based on the CCSBT manual (CCSBT, 2002). We analyzed the relationship between fork length (FL) and total weight (W), and estimated the von Bertalanffy growth parameters (1938). We first calculated the growth parameters using Walford method (Walford 1946) and the mean fork length by age. With the calculated parameters as initial (or starting) values, they were re-estimated by the non-linear method using length-at-age data which consists of length and age estimated to each fish at the time the fish was captured, and their confidence intervals were constructed througth boostrappng with 1,000 iterations using R package *FSA* (Ogle et al. 2018) in the R stats package (R Core Team 2018).

2. Analysis of age and growth using otolith

The SBT otolith samples were collected from April to September during 2015-2022. The length distributions collected for analyzing age of SBT are shown in Table 1. The length ranged from 60 cm to 180 cm with a mean of 127.9 cm in fork length (FL).

The relationship between fork length and total weight is shown in Fig. 2, which was $W = 7.6E\text{-}05 \times FL^{2.723}$ ($R^2 = 0.911$).

Fig. 3 shows the von Bertalanffy growth model for SBT with the 95% confidence intervals for the mean length-at-age and the 95% prediction intervals from bootstrapping. With initial values (L_∞=174.4 cm, K=0.172/year, t_0=-1.177 years) estimated by Walford method (1946) using the back-calculated mean fork length, the von Bertalanffy's growth parameters estimated from the non-linear method using length-at-age data were L_∞=175.5 cm, K=0.190/year, t_0=-1.209 years.

REFERENCES

Bertalanffy, L. von. 1938. A quantitative theory of organic growth (Inquiries on growth laws. II). Human Biology, 10(2), 181-213.

CCSBT. 2002. A manual for age determination of southern bluefin tuna *Thunnus maccoyii* - Otolith sampling, preparation and interpretation. The Direct Age Estimation Workshop of the CCSBT. 11-14 June, 2002. Queenscliff, Australia, 39pp.

Ogle D.H., Wheeler P., Dinno A. 2018. FSA: Fisheries Stock Analysis. R package version 0.8.22.

R Core Team. 2018. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.

Walford L.A. 1946. A new graphic method of describing the growth of animals. Biol Bull 90:141-147.

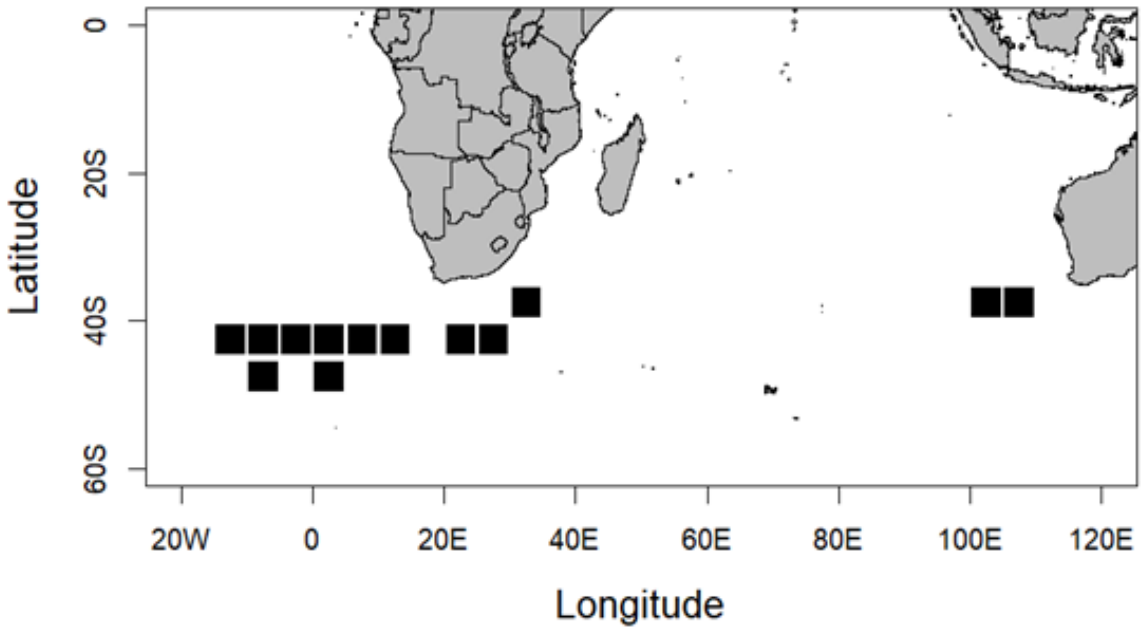

Fig. 1. Map showing the sampling area of SBT otoliths collected by Korean scientific observer program during 2015-2022.

Table 1. Length distributions of SBT collected by Korean observer programs, 2015-2022

Month	Area 8			Area 9			Total		
	No. samples	Range of FL (cm)	Mean FL (cm)	No. samples	Range of FL (cm)	Mean FL (cm)	No. samples	Range of FL (cm)	Mean FL (cm)
Apr				300	90-171	133.4	300	90-171	133.4
May				251	87-170	135.4	251	87-170	135.4
Jun				295	80-170	123.2	295	80-170	123.2
Jul				150	80-180	118.8	150	80-180	118.8
Aug	68	60-170	123.4	23	90-120	101.7	91	60-170	117.9
Sep	32	80-160	130.9				32	80-160	130.9
Total	100	60-170	125.8	1,019	80-180	128.1	1,119	60-180	127.9

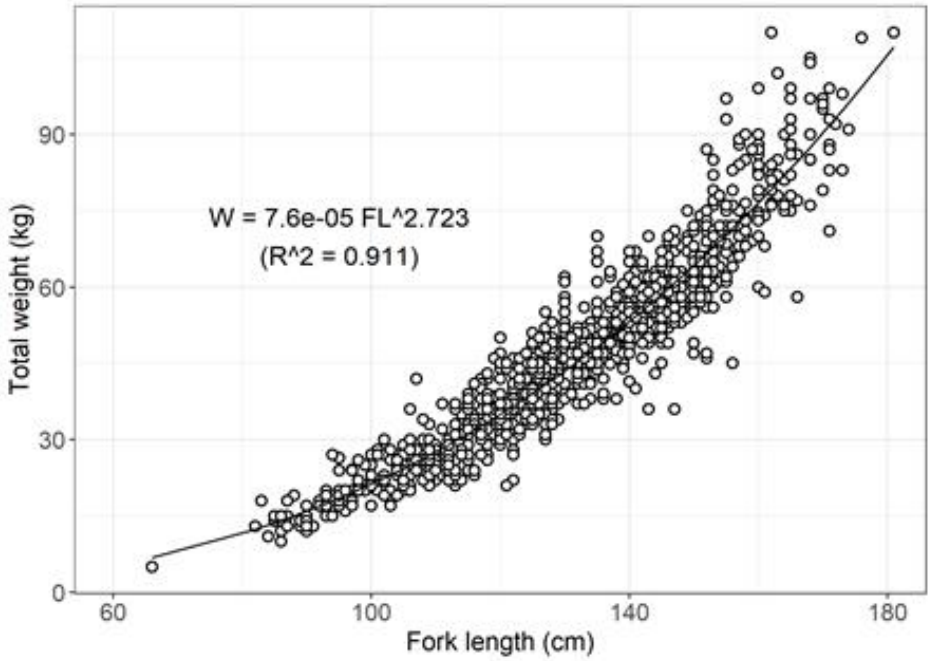

Fig. 2. Relationship between fork length and total weight of SBT collected during 2015-2022.

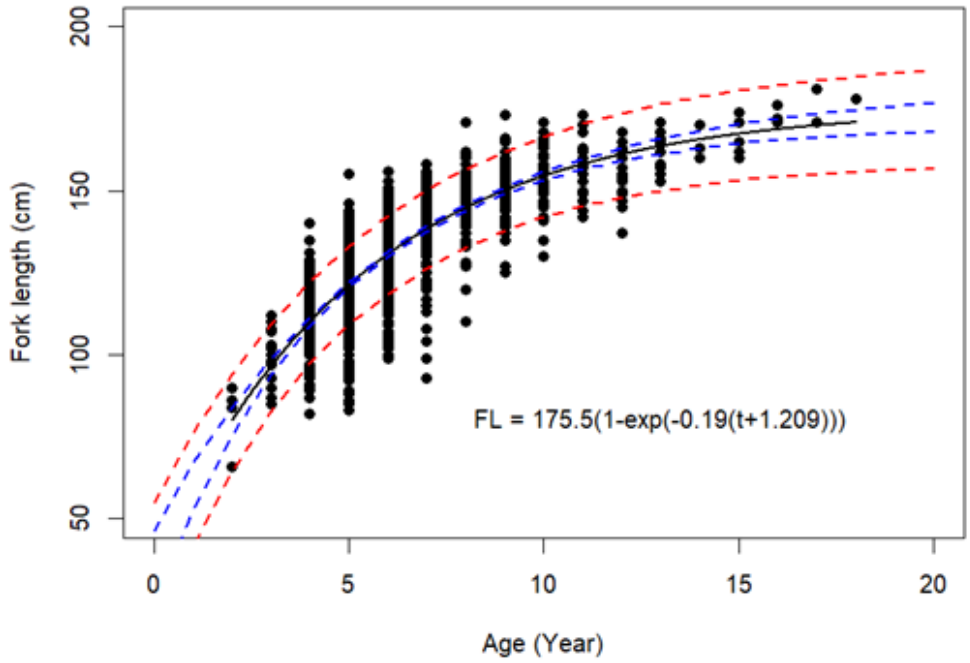

Fig. 3. The von Bertalanffy growth curve of SBT (Red: 95% CI, Blue: prediction interval).