Joint work on life history based approach to stock assessment

Growth curve for Splendid alfonsino (SA)

Lead by Korea

September 27, 2023

Summary of previous results

- We plotted growth curves (LVB) using the Likelihood function on the TMB.
- The female showed a higher maximum growth (L_∞) than the male.
- The growth curve exhibited varying patterns for each seamount, with the maximum size ranging from 35cm in Koko to over 1m in Milwaukee.

* The rankings of growth performance: Milwaukee, Northern Koko, Colahan, C-H, Koko, and Kinmei.

- Members suggested Korea ①analyze the effect of gear selectivity on the analyses and ②try to use mixed modelling and treat seamounts as random.

When considering the effect of gear selectivity

It seems unnecessary to consider the effect of gear selectivity on the analyses. What our group ultimately wants to do is find a growth equation using "age-length (or weight)" pair data. In other words, using data collected from multiple fishing gears (each pair of length (or weight) corresponding to age) at the same time solves this concern.

When treating the location (i.e., seamounts) as random effects

This idea is comparable to a meta-analysis where we estimate LVB parameters synthesizing location-specific data.

Posterior probability of the LVB parameters

$$\boldsymbol{\theta} = (\mathrm{Linf}, K, \mathrm{t0})$$

$$D_i = \text{data on pairs of age and length from sea mount } i$$

$$(i: \text{ Colahan, C-H, Kinmei, Koko, Milwaukee, Northern Koko})$$

$$p(\boldsymbol{\theta} \mid D_1, D_2, D_3, D_4, D_5, D_6)$$

$$\propto p(D_1, D_2, D_3, D_4, D_5, D_6 \mid \boldsymbol{\theta}) \cdot p(\boldsymbol{\theta})$$

$$= p(D_1 \mid \boldsymbol{\theta}) \cdot p(D_2 \mid \boldsymbol{\theta}) \cdot p(D_3 \mid \boldsymbol{\theta}) \cdot p(D_4 \mid \boldsymbol{\theta}) \cdot p(D_5 \mid \boldsymbol{\theta}) \cdot p(D_6 \mid \boldsymbol{\theta}) \cdot p(\boldsymbol{\theta})$$

When treating the location (i.e., seamounts) as random effects

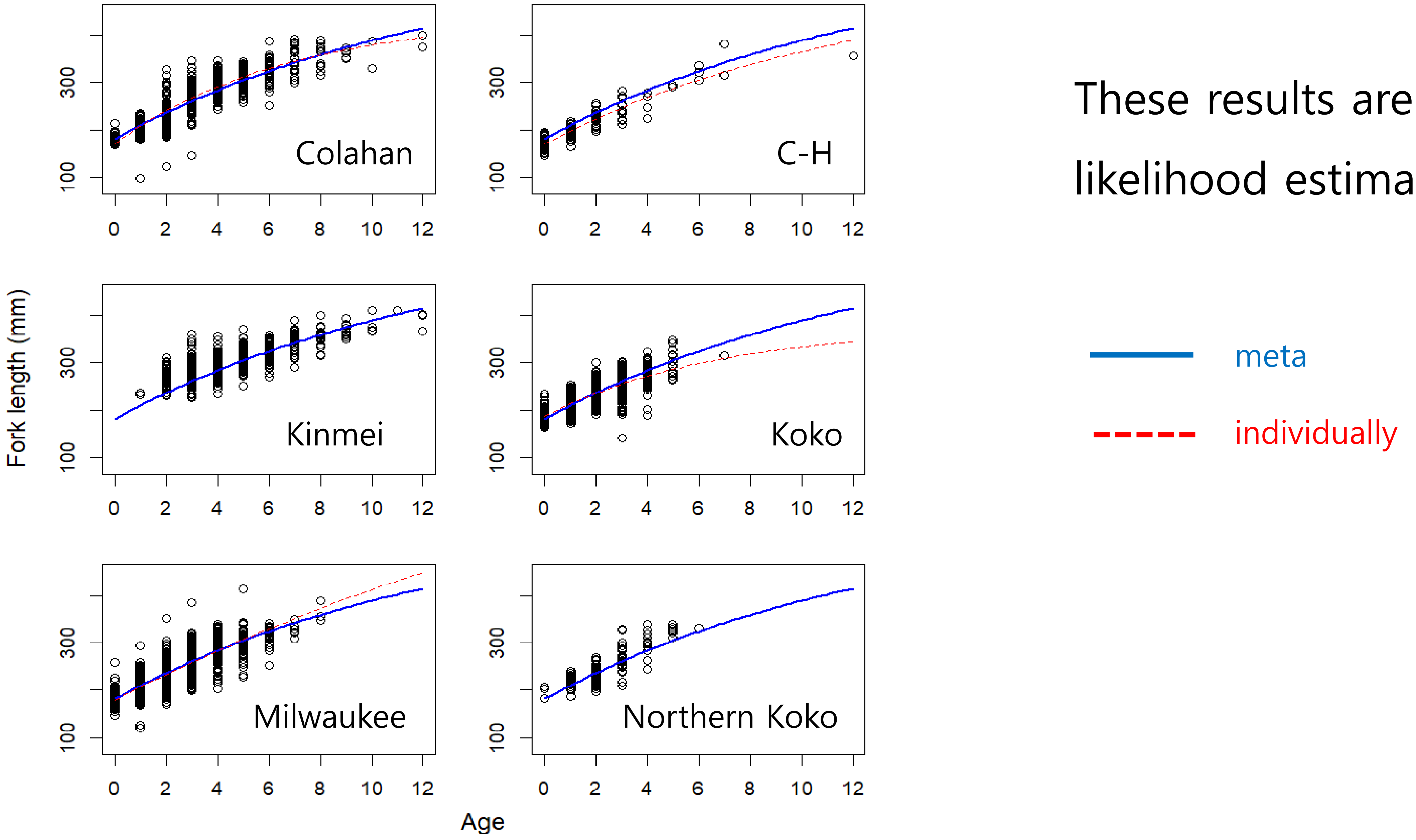
Estimation with **the additive error assumption (i.e., length ~ normal)** outperformed that with the multiplicative error assumption (i.e., length ~ lognormal) in terms of the convergence of the numerical optimization and AIC.

When treating the location (i.e., seamounts) as random effects

Likelihood estimation in case of the additive error assumption

	Estimate	Std. Error
logLinf	6.35457868	0.040787156
logK	-2.59383302	0.073356817
t0	-5.07436456	0.139914219
Linf	575.11997859	23.457508397
K	0.07473304	0.005482178
t0	-5.07436456	0.139914219

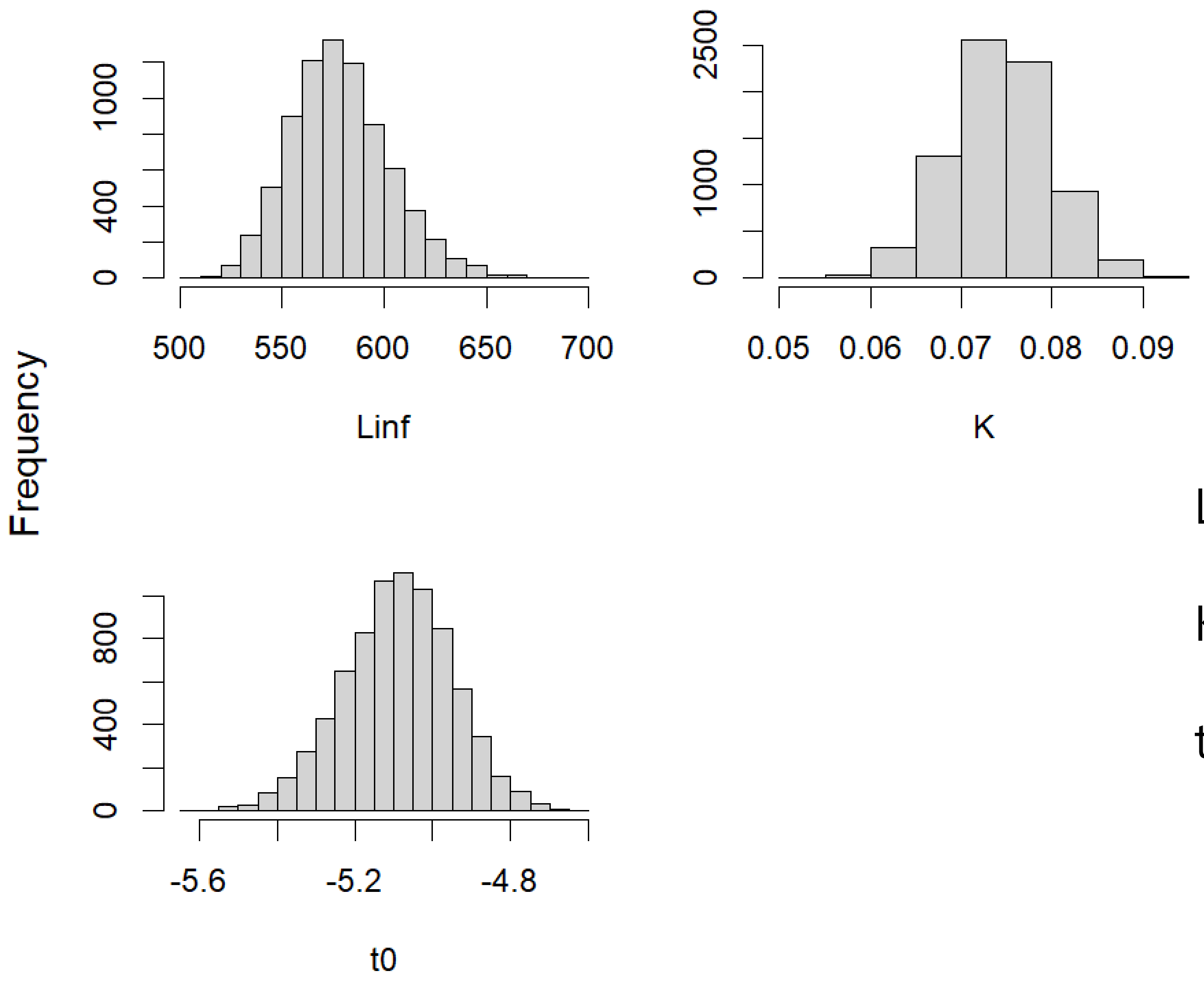
When treating the location (i.e., seamounts) as random effects



These results are from likelihood estimates

When treating the location (i.e., seamounts) as random effects

Posterior distribution in case of the additive error assumption



These results are from Bayesian posterior inference.

	Mode	**(95% credible interval)**
Linf:	571.5	(531.6 ~ 628.0)
K:	0.074	(0.063 ~ 0.085)
t0:	-5.096	(-5.375 ~ -4.814)

Summary

- The gear selectivity effects were not considered on our analyses because we can find a growth equation for SA using data collected from multiple fishing gears at the same time.
- Posterior probabilities of the LVB parameters were estimated to treat the location (i.e. seamounts) as random effects.
- The growth curves make more sense when seamounts are treated as a random effect than when they are not.