Southern Resident killer whales with anomalous growth, 2021/2022

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Rational. In 2018, a 3-4 year old Southern Resident killer whale (SRKW), J50, died after our photogrammetry research measured declining body condition and estimated her body length to be anomalously small for her age. This emphasized that patterns of growth, in addition to quantitative measures of body condition, may be useful for identifying constrained health.

Sample Data. We estimated body length for 73/74 SRKW individuals known to be alive between September 2021 and April 2022. Standard drone photogrammetry methods were used, including a precise laser-altimeter to estimate scale (Groskreutz et al. 2019) and an octocopter platform (Durban et al. 2022) to carry a digital camera with full frame sensor (7360 x 4912 pixels) and a 55mm lens long enough to ensure a flat and undistorted image. The sample included all 12 whales in the population that were under 10 years of age and therefore in a key phase of early growth (J49, J51, J53, J56, J57, J58, J59, L121, L122, L123, L124, L125).

Identifying anomalously small whales. Length estimates for these 12 young whales ranged from 2.40 m for J59 in the first weeks of her life to 5.48 m for L119 in her 10th year. These were included in a larger dataset of 214 lengths for known-age SRKWs measured from drone photogrammetry in 2017-2022, all estimated with the same precise laser altimeter for scale. This expanded dataset comprised 77 different whales, and importantly contained 61 measurements from 26 different whales under the age of 10. We fit a Bayesian formulation of the Richards growth curve (Fearnbach et al. 2011) to these length-at-age data and used a mixture formulation (Hoeting et al. 1996) to specify a heavy-tailed residual distribution of measurements around sex-specific growth curves to allow for outliers. Two whales from this current young cohort had high probability of being outliers, with p(outlier)>0.66 reflecting more than twice the probability supporting their outlier status rather than being adequately described by the expected growth curve. These were J53 (female, 0.59 m smaller than expected) and L123 (male, 0.68 m smaller than expected). These two whales were measured to be in sub-normal and above-normal body condition (body condition classes 2 and 4, as per Stewart et al. 2021), respectively, when last measured. This indicates additional concern for the health of J53 in particular, because she is both anomalously small and in sub-normal condition.

References

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