

# Southern Resident killer whales with anomalous growth, 2023/2024

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**Rational.** In 2018, a three year old Southern Resident killer whale (SRKW), J50, died after our photogrammetry research measured her 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 10 whales in the SRKW population that were under 10 years of age, and therefore in a key phase of early growth, between June 2023 and May 2024 (J51, J53, J56, J57, J58, J59, L121, L125, L126, L127). Standard drone photogrammetry methods were used, specifically an octocopter platform (Durban et al. 2022) to carry a digital camera with full frame sensor (7360 x 4912 pixels), a 55mm lens long enough to ensure a flat and undistorted image and a precise laser-altimeter to estimate scale (Groskreutz et al. 2019).

**Identifying anomalously small whales.** Length estimates for these 10 young whales ranged from 2.74 m for L126 in the first year of his life to 5.19 m for J51 in his tenth year. These were included in a larger dataset of 384 lengths for 85 known-age SRKWs measured from drone photogrammetry in 2017-2024, all estimated with the same precise laser altimeter for scale. Importantly, this expanded dataset contained 106 length-at-age measurements from 29 different whales under the age of 10. We fit a Bayesian formulation of the Richards growth curve (Fearnbach et al. 2011) to the length-at-age data and used the Bayesian approach of Chaloner and Brant (1988) to calculate the probability that a measurement was an abnormal outlier with a residual of more than two standard deviations on either side of its sex specific regression line. Although no whales had a high probability of being negative outliers, J53 and L121 (a female and male, both in their ninth year of life when measured) were in the lower tails of the distribution for residuals and were -0.38 m and -0.41 m shorter than expected for their age, respectively. Of note. J53 had measured to be a small outlier for her age in previous years, coincidental with being in the “poor” (BC1) body condition state (see Stewart et al. 2021). Although still small and still in poor body condition, her more recent measurements are closer to the expected size for her age, indicating some improvement in growth. Another young female (J56, six years old) that has also been identified in “poor” (BC1) or “sub-normal” (BC2) condition states in recent years, showed concerning slowing of growth with a residual below the growth curve that had declined to -0.23 m in May 2024 (compared to only -0.06 m in 2023 and +0.06 m in 2022). These two small whales demonstrate the effect on growth from prolonged poor body condition and we will continue to track their growth trends. In contrast, two relatively large female calves (L127 and J59, ages 0.8 and 2.2 years) had positive residuals of 0.58 m and 0.51 m larger than expected for their age, and L127 had a high probability ( $p = 0.986$ ) of being a positive outlier for length-at-age.

## References

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