

Leopard seals in focus: comparing the accuracy and precision of pinniped body size measurements between UAS photogrammetry and traditional ground-based methods

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Measurements of body size and mass are fundamental to pinniped population management and research. Manual measurements tend to be accurate but are invasive and logistically challenging to obtain. Ground-based photogrammetric techniques are less invasive, but inherent limitations make them impractical for many field applications. The recent proliferation of unmanned aerial systems (UAS) in wildlife monitoring has provided a promising new platform for the photogrammetry of free-ranging pinnipeds. We aerially surveyed leopard seals (*Hydrurga leptonyx*) of known body size and mass to test the precision and accuracy of photogrammetry from a small UAS. Flights were conducted in January and February of 2013 and 2014 and 50 photogrammetric samples were obtained from 15 unsedated, unrestrained seals. UAS-derived measurements of standard length were accurate to within 2.01 ± 1.06 %, and paired comparisons with ground measurements were statistically indistinguishable. An allometric linear model predicted leopard seal mass within 16.04 kg (3.6% error for a 440 kg seal). Photogrammetric measurements from a single, vertical image obtained using UAS provide a noninvasive approach for estimating the mass and body condition of pinnipeds that may be widely applicable.