Echolocation volume calculation

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10th September 2021

1 Calculating the volume of echolocation signals

Movement data from the tags are speed, pitch, roll, and heading. The inter-click interval is also available. From this, the volume of 'searchable range' can be calculated.

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Error: ArgumentError: "/Users/aran/Documents/GitHub/PosVol/D++.txt" is not
a valid file or doesn't exist
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1.1 Calculating the cone volume for echolocation

Assuming speed of sound (s_s) to be 1500 m/s and with and inter-click interval ci, the maximum distance sound can reach and return to the whale (d) can be determined by $d = s_s \times \frac{ci}{2}$ then can then be converted into a cone via the equation

$$V_c = \frac{b_a \times d}{3}$$

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ellAr (generic function with 1 method)
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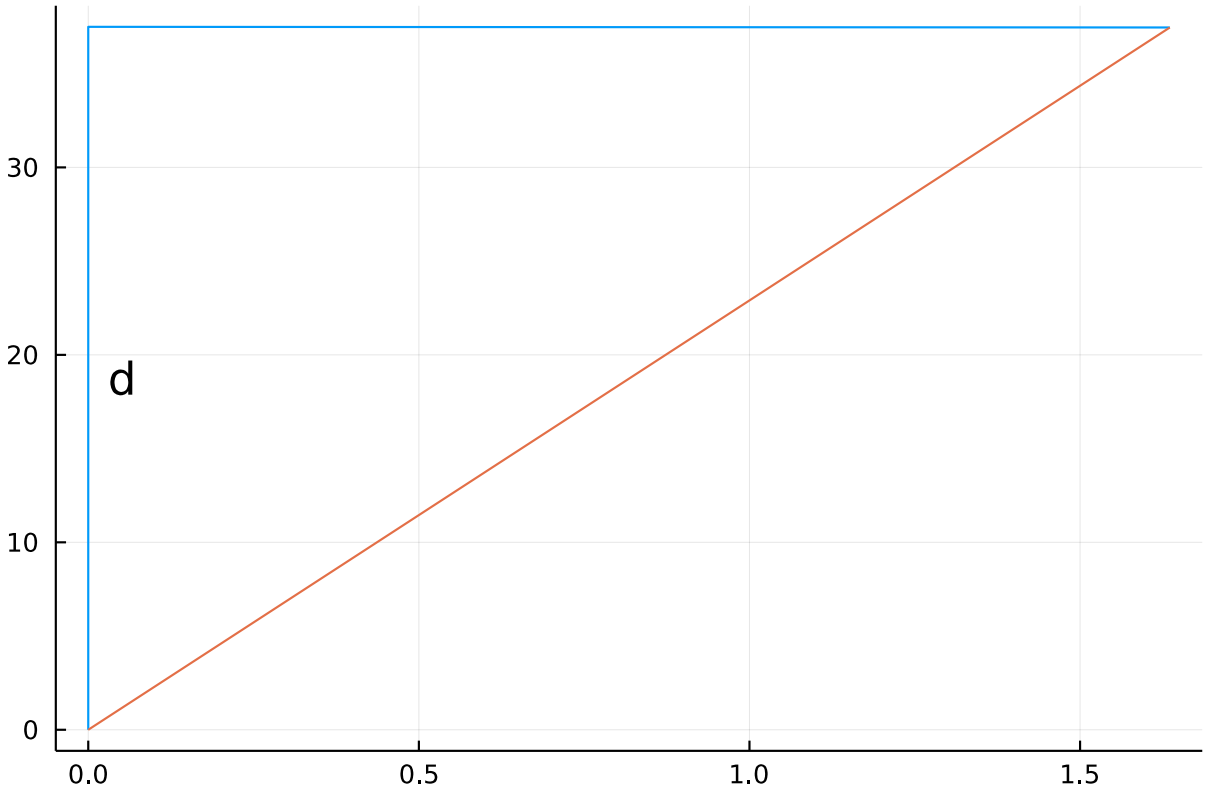
where b_a is the base area. This base area is dependent on the angle of spread of the echolocation signal. Assuming the sound originates from a single point, the sound is assumed to spread via angle θ in all directions (adjustments can be made if this specification needs changing). The radius of the resulting circle at the max distance d is equal to

$$d \times tan(\theta)$$

This base area is assumed to be a circle, but with inclusion of different angles, could form an ellipse with area πab, where a and b are the major and minor radii, respectively.



So, given a typical sperm whale *ci* of 0.05*s* and an angular spread of 5 degrees, the maximum distance would be 37.5m, giving a cone volume of meters^2. The polygon of an echolocation signal should be a segment of a sphere, or a cone with a rounded top surface. Calculation of this volume can