Supplementary Material

IPI to body length: equation selection

To confirm the appropriate use of the combination of the equations of Gordon (1991) and Growcott et al. (2011) to derive sperm whale body lengths from stable IPIs, a paired non-parametric test (Wilcoxon signed rank test) was used. Size-frequency distributions computed with these equations were significantly different ($p < .001$), so for greater reliability, the equation of Gordon (1991) was used to derive the length of sperm whales with IPIs ≤ 4 ms while that of Growcott et al. (2011) was used for IPIs > 4 ms, as recommended by those authors. Recently, Dickson et al. (2021) proposed a refinement of the equation of Growcott et al. (2011). Body lengths were computed using the traditional Gordon-Growcott combination, but also using the Gordon-Dickson combination, to test if the use of this recent refinement would yield significantly different body lengths. A Wilcoxon signed rank test revealed a significant difference ($p < .05$) in body lengths derived from those two combinations. Visual comparison (Figure S1) revealed a much better fit of the traditional Gordon-Growcott combination for out data, so the refinement proposed by Dickson et al. (2021) was not used here.

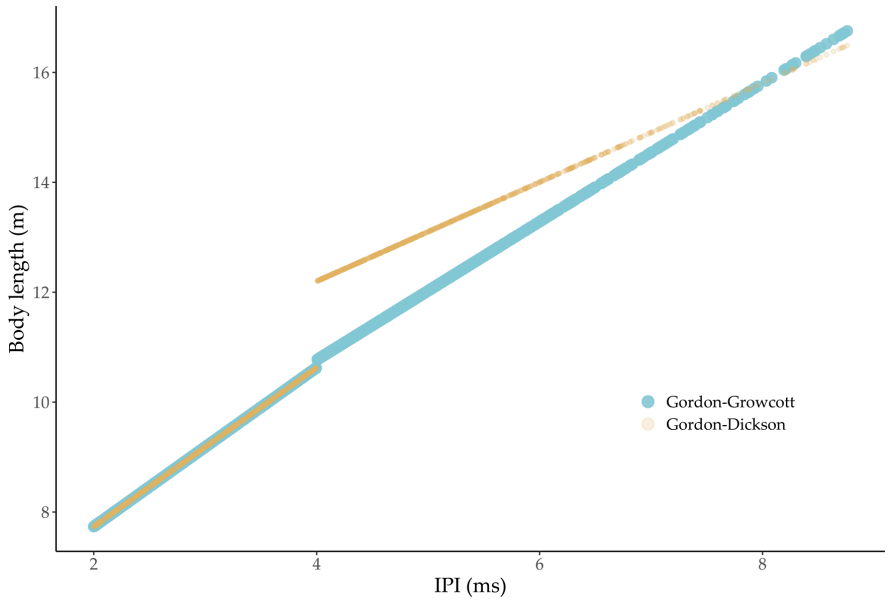

Figure S1. A comparison of the sperm whale body lengths derived from stable IPIs using different combinations of equations: Gordon-Growcott (in blue) and Gordon-Dickson (in yellow).

Body lengths across the area

Sperm whale size-frequency distributions at each recording locations and survey are reported in Figure S2.

Effect of recording type

Given that data collected using two different types of recording methodologies were used, it could introduce some bias susceptible to lead to false conclusions if left unaccounted for. A Wilcoxon signed rank test revealed a significant difference ($p < .001$) in body lengths between recording methodologies.

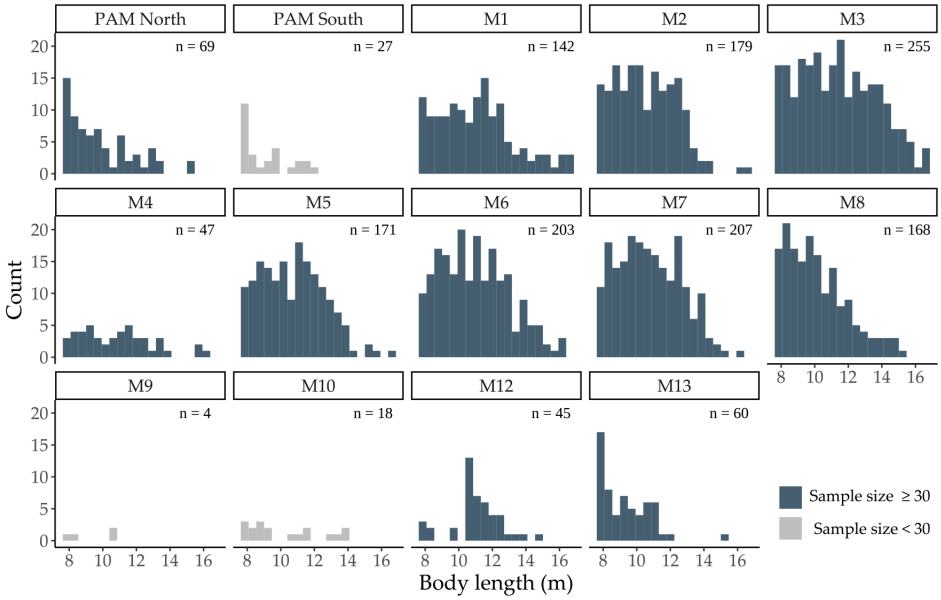

Figure S2. Sperm whale size-frequency distributions across the survey area extracted from data obtained during towed hydrophone surveys in 2015 in the north of the area (PAM North) and 2016 in the south (PAM South) and at all monitored stations (M1 to M13). Note that M11 is not represented since no stable IPI were extracted from those recordings. The number of stable IPIs (n) is given for each station/survey. Stations/surveys were excluded from subsequent comparisons if n failed to meet the inclusion threshold of 30.

Considering this finding, the body lengths derived from recordings collected using towed hydrophone arrays could not be compared to those derived from static recordings. As illustrated in Figure S3, body lengths extracted from static recordings were greater than those from towed hydrophone surveys.

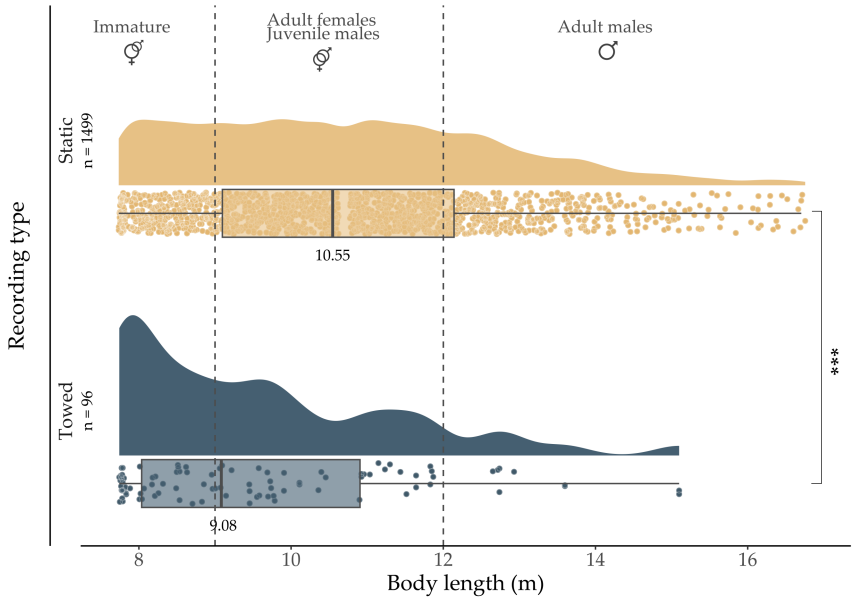

Figure S3. Sperm whale body lengths (m) per recording type. Vertical dashed lines delimit maturity stages/sex. Asterisks represent statistical significance.

Effect of year/area An additional potential confounding factor laid in the absence of spatio-temporal replicates (the north of the area was surveyed in 2015 and the south in 2016, with the exception of M3 which was monitored in both years, yet for a different period of the year), which precluded spatial effects from being detangled from temporal ones. However, we found significant evidence ($p < .05$) for differences in body lengths in 2015 and 2016, with smaller body lengths in 2016 (Figure S3).

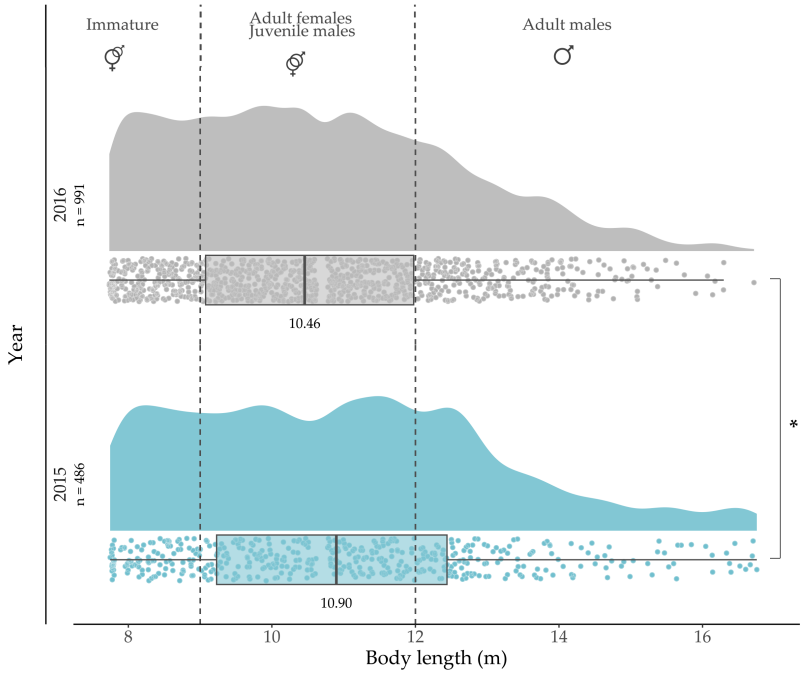

Figure S4. Sperm whale body lengths (m) per recording year. Vertical dashed lines delimit maturity stages/sex. Asterisks represent statistical significance.

Differences in body lengths across sites Detailed outputs of the post-hoc Tukey Kramer tests are given below as support of the body of the manuscript.

REFERENCES

Dickson, T., Rayment, W., and Dawson, S. (2021). Drone photogrammetry allows refinement of acoustically derived length estimation for male sperm whales. *Marine Mammal Science* , 1–9doi:10.1111/mms.12795

Gordon, J. C. D. (1991). Evaluation of a method for determining the length of sperm whales (Physeter catodon) from their vocalizations. *Journal of Zoology* 224, 301–314. doi:10.1111/j.1469-7998.1991.tb04807.x

Growcott, A., Miller, B., Sirguey, P., Slooten, E., and Dawson, S. (2011). Measuring body length of male sperm whales from their clicks: The relationship between inter-pulse intervals and photogrammetrically measured lengths. *The Journal of the Acoustical Society of America* 130, 568–573. doi:10.1121/1.3578455

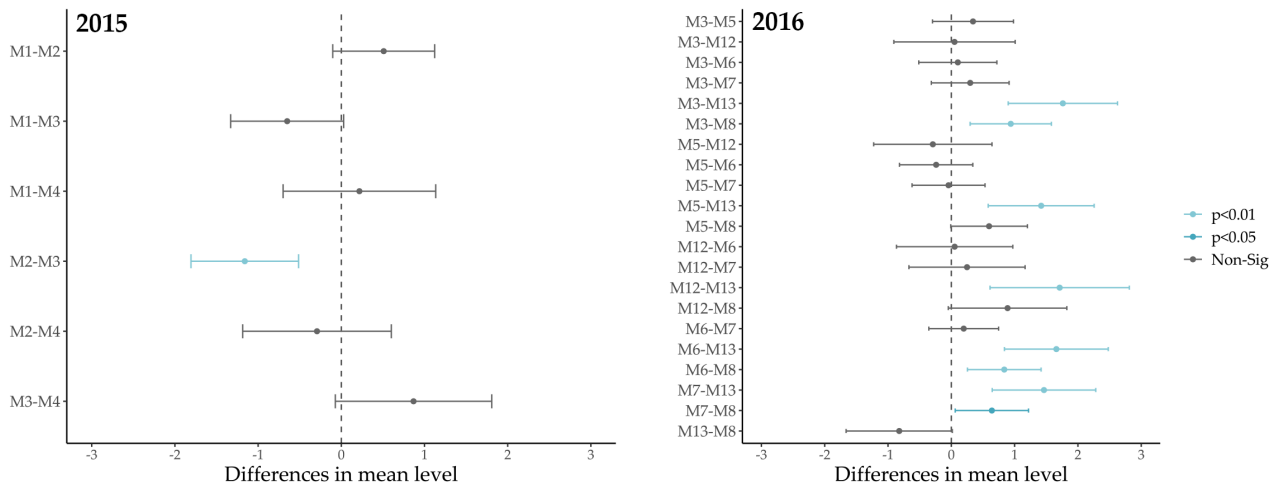

Figure S5. Results of Tukey Kramer post-hoc tests showing differences in mean sperm whale body lengths across sites in 2015 (left panel) and 2016 (right panel) with associated 95% confidence intervals. Colours indicate level of statistical significance.