

Combining regional habitat selection models for large-scale prediction: circumpolar habitat selection of Southern Ocean humpback whales

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Supplementary materials

Table S1. Tracking data. Table summarising the tracking data collated for this study.

Dataset name	Deployment region	IWC breeding stock	Number of tracks	References
AMMC	Australia (west and east), East Antarctica	D (west Australia) E1 (east Australia) Unknown (East Antarctica)	32	Andrews-Goff et al. (2018), Bestley et al. (2019)
Constantine_Raoul_2015	Raoul Island	E2 - F (Oceania)	20	Riekkola et al. (2018, 2019, 2020)
CWR_WAVES_2014	East Antarctica	D (west Australia) E1 (east Australia)	6	Owen et al. (2018)
DallaRosa_AP	Antarctic Peninsula	G	10	Dalla Rosa et al. (2008)
Friedlaender	Antarctic Peninsula	G	58	Curtice et al. (2015), Weinstein et al. (2017), Weinstein & Friedlaender (2017)
New-Caledonia-HW	New Caledonia	E2 (Oceania)	2	Garrigue et al. (2015), Derville et al (2020)
Oceans&Coast_s_Seakamela	South Africa	B2 (west South Africa) C1 (east South Africa)	27	Seakamela et al. (2015)
OSU_2007AN T	Antarctic Peninsula	G	12	Unpublished.
Rosenbaum	Gabon	B1	2	Rosenbaum et al. (2014)
WA_Fisheries	Australia (west)	D (west Australia)	56	Bestley et al. (2019), How et al. (2020)

Zerbini	Brazil	A	153	Horton et al. (2020), Zerbini et al. (2006, 2011)
Total:			378	

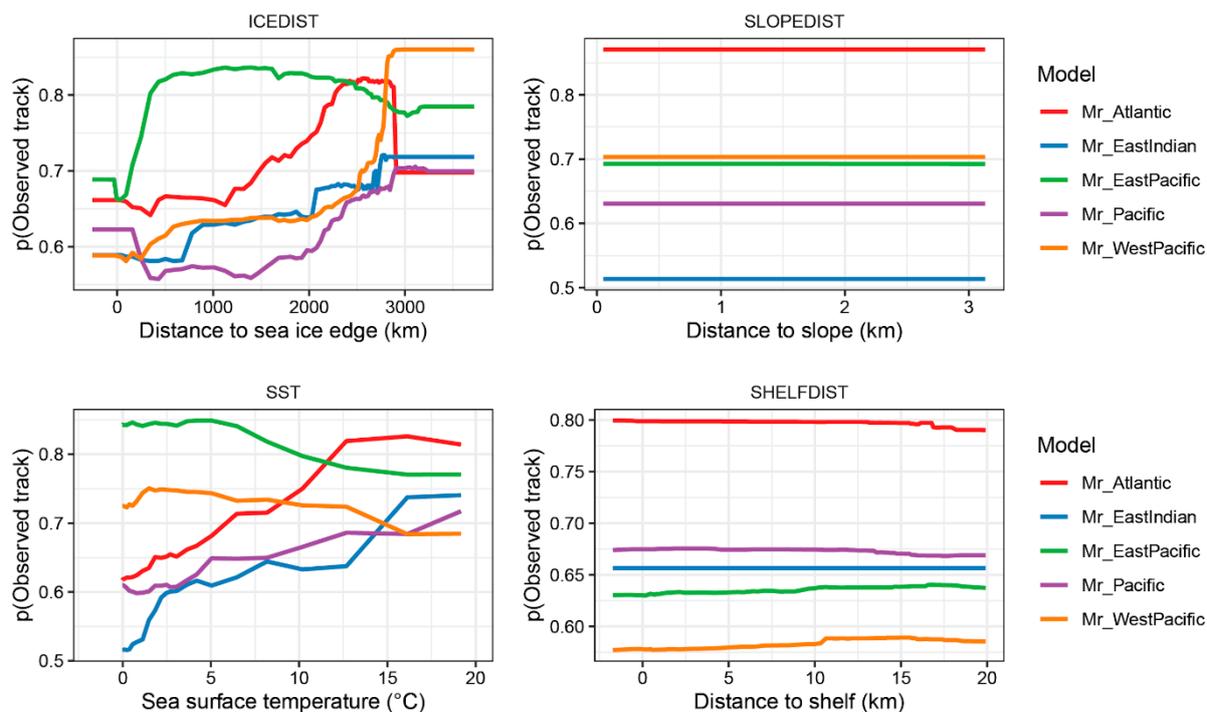


Figure S1. Partial dependence plots. Relationship between the regional model predictions and the four most important environmental covariates, in order of decreasing mean importance: ICEDIST, SLOPEDIST, SST and SHELFDIST. Partial dependence plots show the predicted response probability, here $p(\text{Observed track})$, on the vertical axis, over values of the environmental covariate in question while accounting for the average effect of the other predictors in the model (Greenwell 2017).

References

- Andrews-Goff, V. et al. 2018. Humpback whale migrations to Antarctic summer foraging grounds through the southwest Pacific Ocean. - *Sci. Rep.* 8: 1–14.
- Bestley, S. et al. 2019. New insights into prime Southern Ocean forage grounds for thriving Western Australian humpback whales. - *Sci. Rep.* 9: 1–12.
- Curtice, C. et al. 2015. Modeling the spatial and temporal dynamics of foraging movements of humpback whales (*Megaptera novaeangliae*) in the Western Antarctic Peninsula. - *Mov. Ecol.* 3: 13.
- Dalla Rosa, L. et al. 2008. Movements of satellite-monitored humpback whales on their feeding ground along the Antarctic Peninsula. - *Polar Biol.* 31: 771–781.
- Derville, S. et al. 2020. Horizontal and vertical movements of humpback whales inform the use of critical pelagic habitats in the western South Pacific. - *Sci. Rep.* 10: 4871.
- Garrigue, C. et al. 2015. Satellite tracking reveals novel migratory patterns and the importance of seamounts for endangered South Pacific humpback whales. - *R. Soc. Open Sci.* 2: 150489.
- Greenwell, B. M. 2017. pdp: An R Package for Constructing Partial Dependence Plots. - *R Journal.* 9: 421–436.
- How, J. et al. 2020. Mitigation measures to reduce entanglements of migrating whales with commercial fishing gear FRDC 2014-004. Fisheries Research Report No. 304 Department of Primary Industries and Regional Development, Western Australia. 118pp.
- Owen, K. et al. 2019. Water temperature correlates with baleen whale foraging behaviour at multiple scales in the Antarctic. - *Mar. Freshw. Res.* 70: 19–32.
- Riekkola, L. et al. 2018. Application of a multi-disciplinary approach to reveal population structure and Southern Ocean feeding grounds of humpback whales. - *Ecol. Indic.* 89: 455–465.
- Riekkola, L. et al. 2019. Environmental drivers of humpback whale foraging behavior in the remote Southern Ocean. - *J. Exp. Mar. Bio. Ecol.* 517: 1–12.

12. Riekkola, L. et al. 2020. Longer migration not necessarily the costliest strategy for migrating humpback whales. - *Aquat. Conserv. Mar. Freshw. Ecosyst.* 30: 937–948.
13. Rosenbaum, H. C. et al. 2014. Long-range movement of humpback whales and their overlap with anthropogenic activity in the South Atlantic Ocean. - *Conserv. Biol.* 28: 604–615.
14. Seakamela, S. M. et al. 2015. Report of the 2014 cetacean distribution and abundance survey off South Africa's West Coast. - Report SC/66a/SH30 presented to the Scientific Committee of the International Whaling Commission. Cambridge, UK.
15. Weinstein, B. G. et al. 2017. Identifying overlap between humpback whale foraging grounds and the Antarctic krill fishery. - *Biol. Conserv.* 210: 184–191.
16. Weinstein, B. G. and Friedlaender, A. S. 2017. Dynamic foraging of a top predator in a seasonal polar marine environment. - *Oecologia* 185: 427–435.
17. Zerbini, A. N. et al. 2006. Satellite-monitored movements of humpback whales *Megaptera novaeangliae* in the Southwest Atlantic Ocean. - *Mar. Ecol. Prog. Ser.* 313: 295–304.