Supplementary Information

Oxygen and temperature influence the distribution of deepwater Cape hake *Merluccius paradoxus* in the southern Benguela: a GAM analysis of a 10-year time-series

FL Mbatha, D Yemane, M Ostrowski, CL Moloney and MR Lipiński

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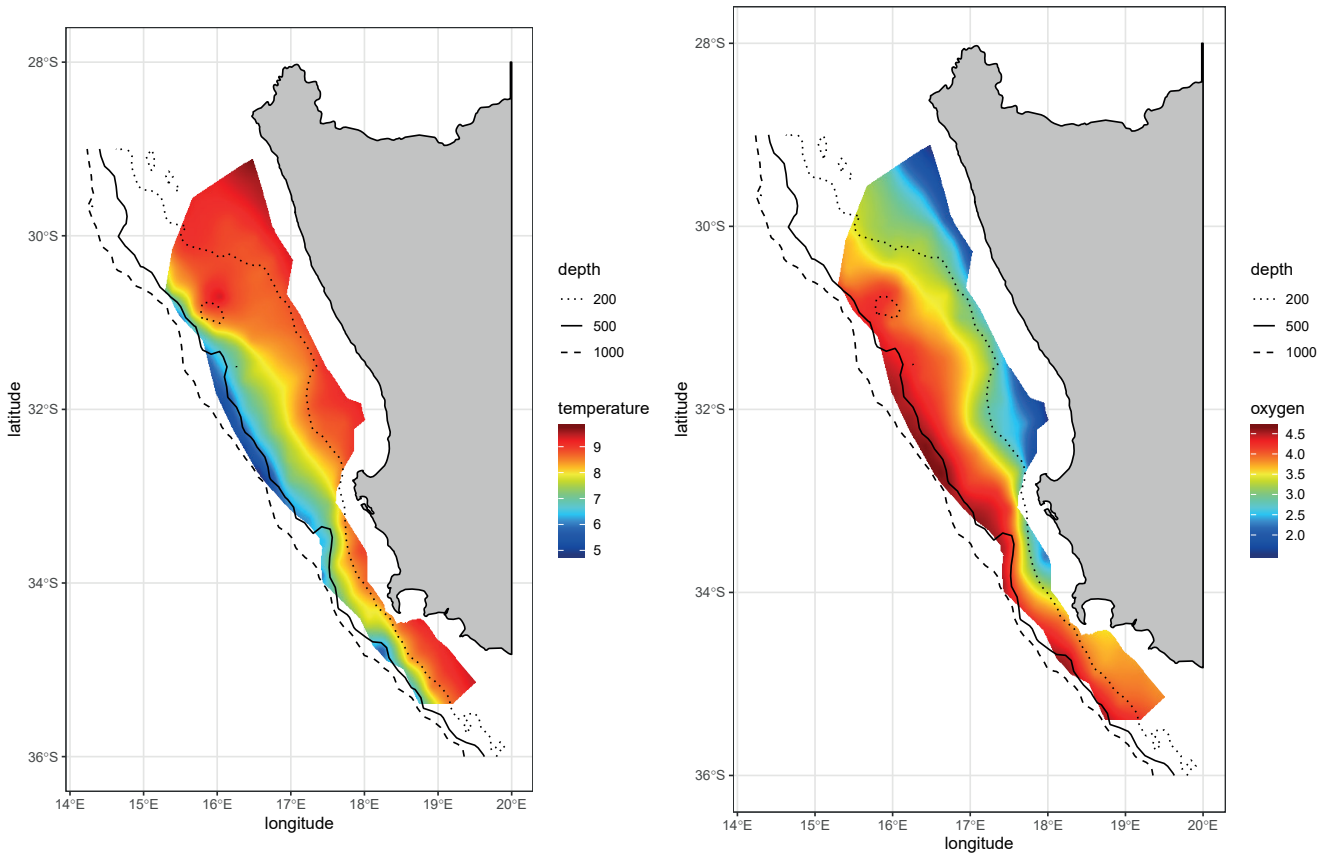

Figure S1: Composite maps showing depth contours (m) overlaid with bottom water temperatures (°C) and dissolved oxygen concentrations (ml O_2 l^{-1}) from surveys by the RV *Dr Fridtjof Nansen* during austral summers between 2003 and 2013

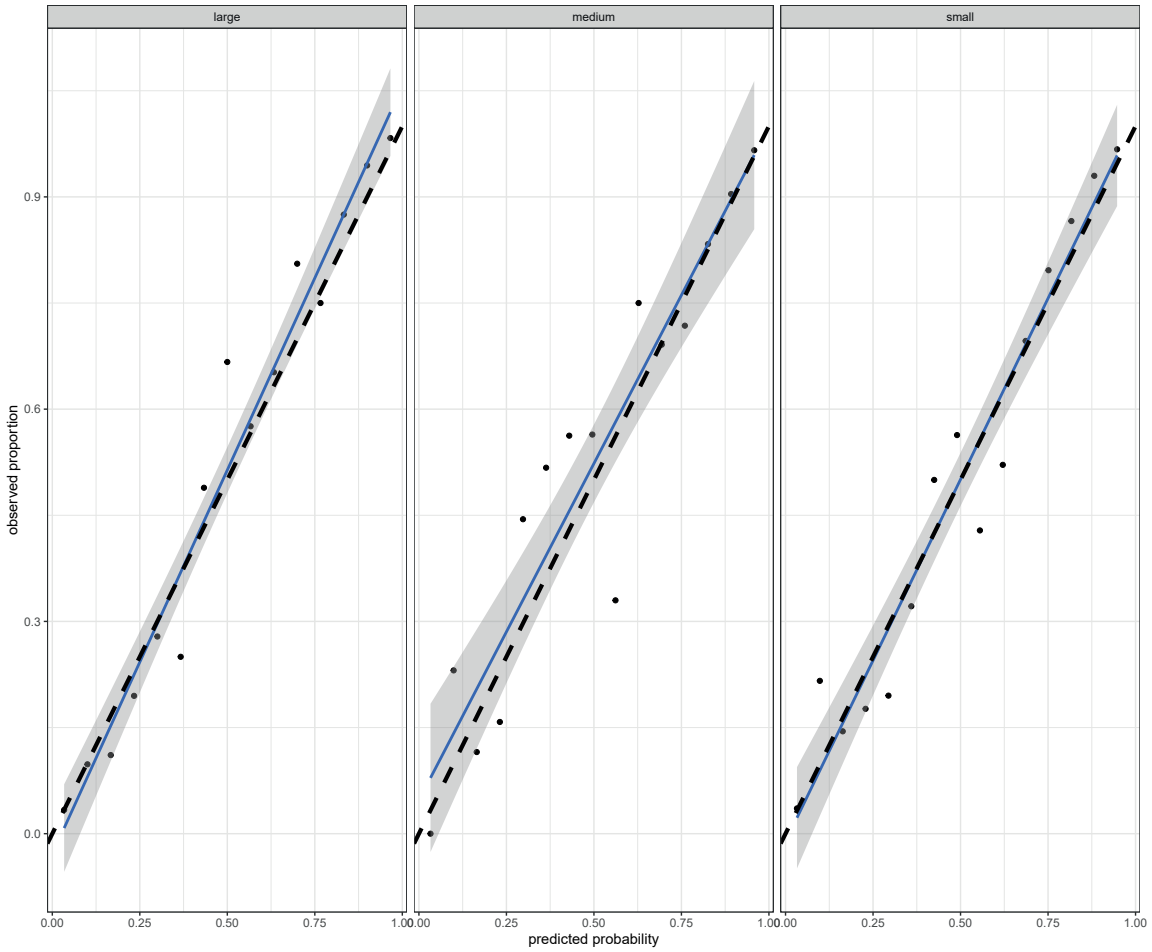

Figure S2: Calibration plot showing the observed prevalence of occurrence plotted against the predicted probability of occurrence, for the small, medium and large size classes of *Merluccius paradoxus*. Shading indicates 95% confidence intervals for the (solid) regression line, which overlaps with the 1:1 line (dashed)

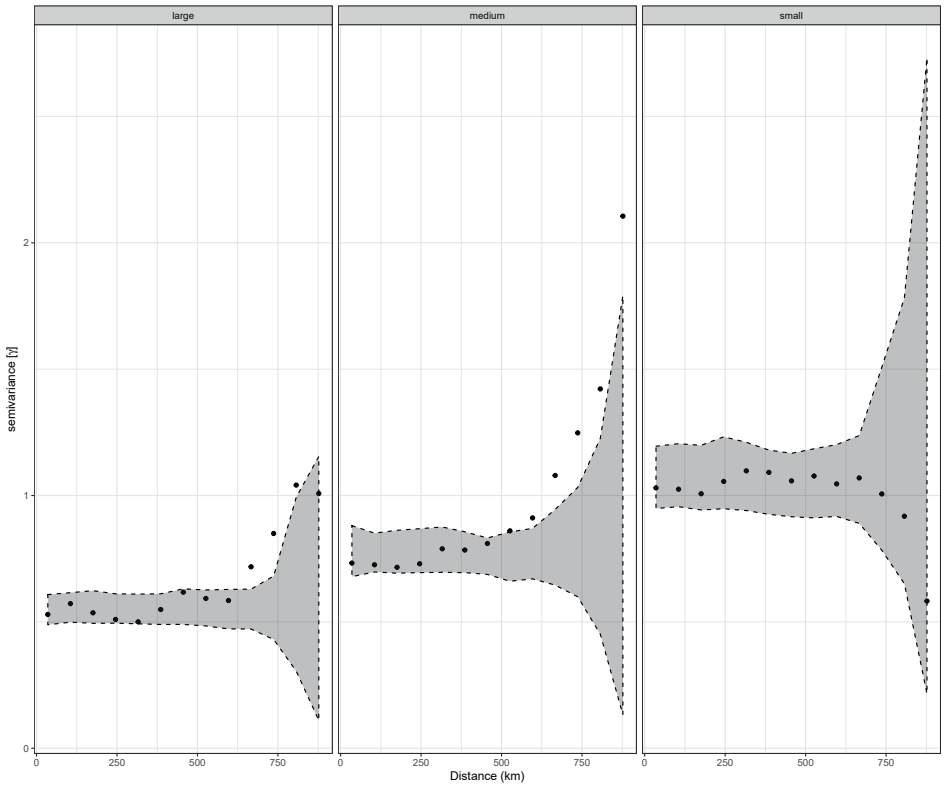

Figure S3: Sample variograms for the residuals from the best model for the three size classes of *Merluccius paradoxus*, with variogram envelopes from nugget-effect-only variogram models

Table S1: The eight generalised additive models (GAMs) applied to the data using R, linking occurrence (occ) of different size classes of *Merluccius paradoxus* on the west coast of South Africa to smoothed water temperature and dissolved oxygen concentrations, from 2003 to 2013 (omitting data for 2004 and 2007)

Model	R Formula
M1	occ ~ *s*(Oxygen, *k* = 4)
M2	occ ~ *s*(Temperature, *k* = 4)
M3	occ ~ *s*(Oxygen, by = Year, *k* = 4)
M4	occ ~ *s*(Temperature, by = Year, *k* = 4)
M5	occ ~ *s*(Oxygen, *k* = 4) + *s*(Temperature, *k* = 4)
M6	occ ~ *s*(Oxygen, *k* = 4) + *s*(Temperature, *k* = 4) + Year
M7	occ ~ *s*(Oxygen, by = Year, *k* = 4) + *s*(Temperature, *k* = 4)
M8	occ ~ *s*(Oxygen, by = Year, *k* = 4) + *s*(Temperature, by = Year, *k* = 4)

Table S2: Performance measures for each of the eight generalised additive models (GAMs, M1–M8) applied to data for each of the three size classes (small, medium, large) of *Merluccius paradoxus*. The Bayesian information criterion (BIC) is shown for each model, as well as the difference in BIC (ΔBIC) from the model with the smallest BIC. Values of the area under the curve (AUC) close to 1 indicate good model fits. Models for each size class are ordered from best to worst fit

Size class	Model	BIC	ΔBIC	AUC
Small	M6	1444.53	0.00	0.81
	M5	1447.53	3.00	0.80
	M1	1471.73	27.20	0.78
	M7	1478.68	34.15	0.82
	M3	15151.42	70.89	0.79
	M8	1559.33	114.80	0.82
	M2	1564.50	119.98	0.75
	M4	1629.67	185.14	0.77
Medium	M6	1139.00	0.00	0.83
	M5	1149.05	10.05	0.81
	M7	1159.71	20.70	0.84
	M8	1207.99	68.99	0.78
	M4	1218.46	79.45	0.82
	M8	1235.57	96.56	0.85
	M1	1352.76	213.75	0.61
	M3	1391.19	252.18	0.69
Large	M6	1819.67	0.00	0.94
	M5	1864.31	44.64	0.93
	M7	1901.10	81.43	0.94
	M2	1908.44	88.77	0.93
	M4	1952.50	132.83	0.94
	M8	1990.00	170.33	0.94
	M1	2068.68	249.01	0.88
	M3	1144.07	313.12	0.88