Appendix S4
Modelling

A warming western boundary current increases the prevalence of commercially disruptive parasites in broadbill swordfish

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Fisheries Oceanography

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Table S1

Model covariate combinations used in the analysis for the prevalence dataset (n = 42). Covariate combinations enclosed in brackets with the suffix ^2 indicate all pairwise interactions.

Model focus	**Covariates**
Temperature/EAC (using `dist_core`)	`mean_SST`
	`(mean_SST + sd_SST + mon_clim_sst_sd) ^2`
	`(mean_SST + dist_core + mo_anom) ^2`
	`(mean_SST + dist_core + DHD) ^2`
	`(mean_SST + dist_core + DHD) ^2 + mon_clim_sst_sd`
	`(mean_SST + dist_core + mon_clim_sst_sd) ^2`
	`(mean_SST + dist_core + DHD) ^2 + seas_clim_sst_sd`
	`(mean_SST + dist_core + DHD) ^2 + mo_anom`
	`(mean_SST + dist_core + DHD) ^2 + se_anom`
	`(mean_SST + dist_core + DHD) ^2 + mean_ssh_corrected`
	`(mean_SST + dist_core + mean_v) ^2 + DHD`
	`(mean_SST + dist_core + DHD + mean_eke) ^2`
	`(mean_SST + dist_core + mean_mld1) ^2 + DHD`
	`(mean_SST + dist_core + sd_SST) ^2 + DHD`
	`(mean_SST + dist_core + DHD + sd_depth) ^2`
	`mean_SST + dist_core + DHD + sd_SST + mo_anom + mean_v + mean_eke + mean_ssh_corrected + sd_depth`
Topographic	`SeamountDistKM * sd_depth`
	`(sd_depth + SeamountDistKM + mean_SST) ^2`
	`(SeamountDistKM + mean_SST + mean_eke + sd_depth) ^2`
	`(SeamountDistKM + mean_SST + sd_SST + sd_depth) ^2`
	`(SeamountDistKM + dist_core + sd_depth + mean_SST) ^2`
	`SeamountDistKM + mean_SST + mean_eke + sd_SST + dist_core + sd_depth`

	(mean_depth + sd_depth + mean_mld1 + mean_SST)^2
	(mean_depth + sd_depth + DHD + mean_SST)^2
Dynamic oceanography	mean_SST + dist_core + mean_v + mean_mld1 + mean_eke + seamountDistKM + sd_depth
	(mean_SST + mean_ssh_corrected + mean_eke + mean_mld1) ^2
	(mean_SST + mean_ssh_corrected + mean_eke + DHD) ^2
Productivity	(mean_chla + mean_mld1 + mean_ssh_corected + mean_eke) ^2
	(SeamountDistKM + mean_chla + mean_eke + sd_depth) ^2
EAC models (not using dist_core)	(mean_SST + mean_ssh_corrected + mean_v) ^2
	(mean_SST + mean_v + DHD) ^2
	(mean_SST + mean_v + DHD + mon_clim_sst_sd) ^2
	(mean_SST + mean_v + mean_eke + mon_clim_sst_sd) ^2
	(mean_SST + mean_v + mon_clim_sst_sd)^2
	(mean_SST + mean_ssh_corrected + mon_clim_sst_sd) ^2
	(mean_SST + mean_ssh_corrected) ^2 + mon_clim_sst_sd + DHD
	(mean_SST + mean_v + DHD + seas_clim_sst_sd) ^2
	(mean_SST + mean_v + mo_anom) ^2 + DHD
	(mean_SST + mean_v + se_anom)^2 + DHD
	(mean_SST + mean_v + mean_eke + mean_ssh_corrected) ^2 + DHD
	(mean_SST * mean_v) + (DHD * mean_sst) + (DHD * mo_anom) + (mo_anom * mean_SST) + mon_clim_sst_sd
Month	Month

Table S2

Model covariate combinations used in the analysis for the intensity dataset (n = 42). Covariate combinations enclosed in brackets with the suffix ^2 indicate all pairwise interactions.

Model focus	**Covariates**
Temperature/EAC (using `dist_core`)	`mean_SST`
	`(mean_SST + sd_SST + mean_mld1) ^2`
	`(mean_SST + dist_core + mo_anom) ^2`
	`(mean_SST + dist_core + DHD) ^2`
	`(mean_SST + dist_core) ^2 + DHD + mean_mld1`
	`(mean_SST + dist_core) ^2 + DHD + seas_clim_sst_sd`
	`(mean_SST + dist_core) ^2 + DHD + mo_anom`
	`(mean_SST + dist_core + DHD) ^2 + se_anom`
	`(mean_SST + DHD) ^2 + mean_ssh_corrected + dist_core`
	`(mean_SST + dist_core) ^2 + DHD + mean_v`
	`(mean_SST + DHD) ^2 + mean_eke + dist_core`
	`(mean_SST + mean_mld1 + DHD) ^2`
	`(mean_SST + DHD) ^2 + sd_SST + dist_core`
	`mean_SST + dist_core + sd_SST + mo_anom + mean_v + mean_mld1 + mean_eke + mean_ssh_corrected`
Topographic	`SeamountDistKM * sd_depth`
	`(SeamountDistKM + mean_SST) ^2 + sd_depth`
	`(SeamountDistKM + mean_SST + sd_depth + mean_eke) ^2`
	`(SeamountDistKM + mean_SST) ^2 + mean_mld1`
	`(SeamountDistKM + mean_SST + sd_SST) ^2 + sd_depth`
	`(SeamountDistKM + dist_core + mean_SST) ^2 + sd_depth`
	`SeamountDistKM + mean_SST + mean_eke + sd_SST + dist_core + sd_depth`
	`(mean_depth + sd_depth + mean_mld1) ^2 + mean_SST`

	(mean_depth + sd_depth) ^2 + DHD + mean_SST
Dynamic oceanography	mean_SST + dist_core + mean_v + mean_mld1 + mean_eke + SeamountDistKM + sd_depth
	(mean_SST + mean_ssh_corrected) ^2 + mean_mld1 + mean_eke
	(mean_SST + mean_ssh_corrected + mean_eke) ^2 + mean_v
Productivity	(mean_chla + mean_mld1 + mean_ssh_corrected + mean_eke) ^2
	(mean_chla + mean_mld1) ^2 + sd_depth + SeamountDistKM
Month	Month
	Month * mean_SST
EAC models (not using dist_core)	(mean_SST + mean_SSH_corrected + mean_v) ^2
	(mean_SST + mean_v + DHD) ^2
	(mean_SST + mean_v + DHD + mon_clim_sst_sd) ^2
	(mean_SST + mean_v + mean_eke + mon_clim_sst_sd) ^2
	(mean_SST + mean_v + mon_clim_sst_sd) ^2
	(mean_SST + mean_ssh_corrected) ^2 + mon_clim_sst_sd + mean_mld1
	(mean_SST + mean_ssh_corrected) ^2 + mon_clim_sst_sd + sd_depth
	(mean_SST + mean_v + sd_depth) ^2 + seas_clim_sst_sd
	(mean_SST + mean_v + mo_anom) ^2 + DHD
	(mean_SST + mean_v + se_anom) ^2 + DHD
	(mean_SST + mean_v + mean_eke + mean_ssh_corrected) ^2
	(mean_SST * mean_v) + (DHD * mean_SST) + (DHD * mo_anom) + mon_clim_sst_sd

Table S3

Model results from the prevalence and intensity datasets, after performing model selection and removing models with identical AIC Δ values. Significant covariates (i.e., $P < 0.05$), AIC Δ, marginal R^2 and deviance explained are presented for all remaining models, in addition to the area under the receiver-operating curve (AUC), true skill statistic (TSS), kappa and root mean square error (RMSE) statistics for the prevalence models. Covariate acronym key presented in Appendix S1: Table S2. Bolded values indicate the minimum adequate model for each dataset.

Response	Covariates	AIC Δ	R2 (%)	Deviance	AUC	TSS	Kappa	RMSE	Overdispersion
Prevalence	**(mean_SST * mean_v) + (mean_SST * mo_anom) + mon_clim_sst_sd**	**0**	**0.097**	**1503.52**	**0.654**	**0.157**	**0.109**	**0.396**	
	(mean_SST * mean_v) + (mean_SST * mo_anom)	3.05	0.089	1508.57	0.658	0.16	0.109	0.395	
	(mean_SST * mean_v) + se_anom	6.98	0.084	1512.5	0.665	0.165	0.113	0.394	
	(mean_SST * mean_V) + (mean_V + DHD)	7.08	0.075	1512.61	0.658	0.159	0.107	0.395	
	(mean_SST * dist_core) + DHD + mon_clim_sst_sd	7.77	0.079	1513.3	0.652	0.156	0.108	0.396	
	(mean_SST * dist_core) + (mean_SST * mo_anom)	10.31	0.07	1515.84	0.664	0.167	0.115	0.394	
	(mean_SST * mo_anom) + (mean_ssh_corrected * DHD) + mean_eke	10.77	0.074	1514.29	0.654	0.156	0.108	0.395	
	(sd_depth * mean_mld1) + mean_SST	11.43	0.06	1518.96	0.655	0.158	0.11	0.395	
	(mean_SST * dist_core) + sd_depth	12.71	0.067	1520.24	0.667	0.17	0.118	0.394	
	(mean_SST * mo_anom) + (mean_ssh_corrected * DHD) + mon_clim_sst_sd	13.34	0.069	1516.87	0.659	0.162	0.112	0.395	
	sd_depth * mean_SST	13.74	0.053	1523.26	0.662	0.164	0.113	0.394	

	(mean_SST * dist_core) + (mean_SST + mean_eke)	14.36	0.067	1519.88	0.666	0.171	0.118	0.394	
	(dist_core * mean_mld1) + mean_SST + DHD	14.76	0.064	1520.28	0.664	0.163	0.114	0.394	
	mean_SST * dist_core	15.13	0.059	1524.66	0.672	0.173	0.121	0.394	
	(mean_SST * mo_anom) + mean_eke	15.23	0.061	1522.75	0.666	0.17	0.119	0.395	
	mean_SST * mean_v	15.36	0.056	1524.89	0.667	0.168	0.117	0.394	
	mean_SST	17.31	0.041	1530.83	0.673	0.175	0.12	0.394	
	(mean_SST * mon_clim_sst_sd)	18.61	0.043	1530.13	0.671	0.175	0.121	0.394	
	(mean_mld1 * sd_depth) + mean_chla	18.97	0.045	1526.5	0.669	0.172	0.12	0.394	
	(mean_mld1 * mean_chla)	22.35	0.037	1531.88	0.665	0.163	0.118	0.394	
Intensity	sd_depth + mon_clim_sst_sd	0	0.064	21928.94					1.316
	sd_depth + mean_mld1	2.42	0.056	21931.37					1.309
	(mean_SST * mo_anom) + mean_mld1 + mon_clim_sst_sd	3.79	0.069	21926.74					1.316
	mean_chla * mean_mld1	3.93	0.054	21930.87					1.302
	mon_clim_sst_sd	4.29	0.043	21935.23					1.299
	(mean_SST * dist_core) + mean_mld1	4.64	0.061	21929.58					1.31
	mean_mld1	**5.33**	**0.039**	**21936.28**					**1.292**
	(mean_SST * mo_anom) + mean_mld1	6.33	0.056	21931.28					1.31
	(mean_v * sd_depth)	6.35	0.046	21933.3					1.324
	sd_depth	9.04	0.02	21939.99					1.303