SUPPLEMENTARY MATERIAL 3

Dispersal and population connectivity are phenotype dependent in a marine metapopulation

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SUPPLEMENTARY MATERIAL 3: TARGETED SENSITIVITY ANALYSIS

METHODS

We completed a targeted sensitivity analysis to explore the influence of vertical distribution on model outcomes. To conduct this focused sensitivity analysis, the dispersal model was run multiple times with varying target depths (0 m, 3 m, 6 m, 10m), but with all other larval parameters held constant at the average-quality values (Table S2). This targeted analysis focused on the target depth parameter alone, as this is the most direct and empirically supported parameter in our study, whereas other biological parameters in our dispersal model (pre-competency period, vertical swim speed, development period) influence the ability of a larva to remain at this target depth.

Table S2 Biological and behavioural model parameter values for the targeted model sensitivity analysis to test the importance of target depth for *Trachinops caudimaculatus* larval dispersal outcomes.

Parameter	Model run			
	Run 1	**Run 2**	**Run 3**	**Run 4**
Mortality	0 %day^{-1}	0 %day^{-1}	0 %day^{-1}	0 %day^{-1}
Pre-competency (Prep) – the period before a fish becomes competent to settle	37.5 days (+ 25%)	37.5 days (+ 25%)	37.5 days (+ 25%)	37.5 days (+ 25%)
Initial fall velocity (iFV) – buoyance of passive hatchlings	-0.0005 ms^{-1}	-0.0005 ms^{-1}	-0.0005 ms^{-1}	-0.0005 ms^{-1}
Development period (Dev) – time spent as passive particles with iFV.	12 days	12 days	12 days	12 days
Swim speed (Sp) – used for horizontal, vertical = 5% of Sp	0.05 ms^{-1} (~10bls^{-1}, 5mm SL)	0.05 ms^{-1} (~10bls^{-1}, 5mm SL)	0.05 ms^{-1} (~10bls^{-1}, 5mm SL)	0.05 ms^{-1} (~10bls^{-1}, 5mm SL)
Target depth (TD) – vertical depth to swim towards (once development time is reached)	0m	3 m	6 m	10 m
Homing distance (HmD) – distance at which the larvae can detect a reef	6 km	6 km	6 km	6 km
Maximum PLD (days)	50	50	50	50
Reefs to release from (see Fig. 2.1)	All	All	All	All
Larval release	Daily from 1 to 30 Oct 2009, releasing 500 larvae hourly from 7pm to 1am			

RESULTS

The sensitivity analysis output supported our conclusions about the importance of vertical distribution for dispersal outcomes. The targeted sensitivity analysis showed significant differences between target depths in the same three quantified measures of dispersal as our original dispersal model. Local retention (LR) and self-recruitment (SR) varied as a function of target depth (LR: $\chi^2 = 10.88$, df = 3, p = 0.012; SR: $\chi^2 = 9.92$, df = 3, p < 0.019), with LR and SR increasing slightly with depth (Fig. S4a, b; Table S3). Target depth also had a significant influence on mean relative geographic distance travelled (GD) ($\chi^2 = 47.33$, df = 3, p < 0.001); mean GD decreased with increasing target depth (Fig S4c). The sensitivity analysis found that target depth did not have a significant influence on the proportion of larvae lost in the dispersal period ($\chi^2 = 5.66$, df = 3, p = 0.129; Fig. S4d).

Table S3 Summary statistics for a targeted sensitivity analysis. Outcomes for local retention, self-recruitment, relative geographic distance travelled, and proportion of larvae lost are based on quantified measures of dispersal from a 3-dimensional biophysical dispersal model where target depth varied between 0 m, 3 m, 6 m, and 10 m, and all other parameters were held constant.

		Mean (SE)			
Larval quality	**N**	*Local Retention*	*Self Recruitment*	*Relative Geographic Distance*	*Proportion Lost*
0 m	34	0.063 (0.021)	0.074 (0.015)	0.715 (0.066)	0.155 (0.044)
3 m	34	0.064 (0.025)	0.073 (0.015)	0.698 (0.064)	0.127 (0.037)
6 m	34	0.073 (0.017)	0.089 (0.015)	0.470 (0.044)	0.132 (0.026)
10 m	34	0.089 (0.025)	0.086 (0.016)	0.401 (0.050)	0.091 (0.022)

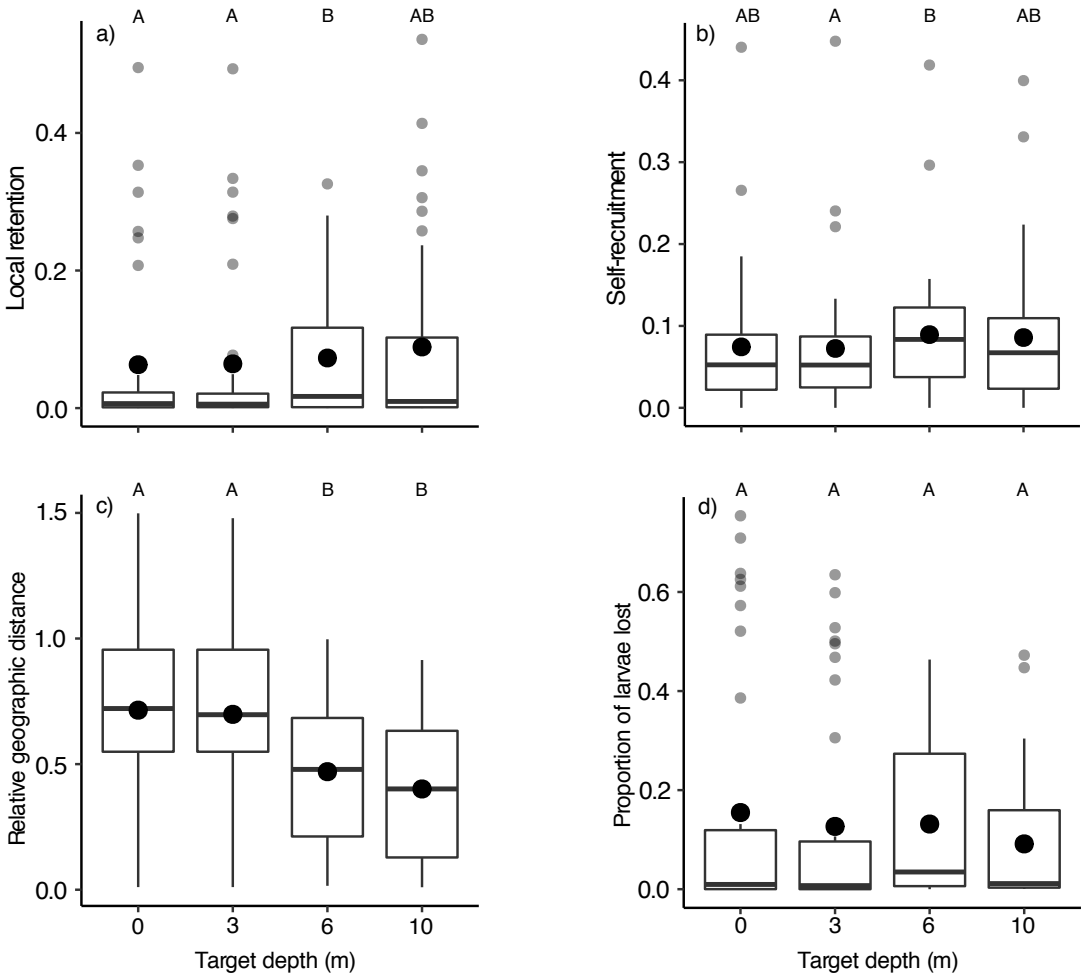

Fig. S4 Results of a targeted sensitivity analysis, where target depth varied (0, 3, 6, or 10 m) and all other parameters are held constant. Four dispersal outcomes were tested: (a) local retention, b) self-recruitment, c) relative geographic distance travelled and d) proportion of larvae lost in the dispersal period. Larger black circles represent mean values. Different letters represent significant differences determined by Tukey's HSD post-hoc test.

CONCLUSIONS

Varying target depth while holding all biological parameters in our model constant at average-quality values has shown that target depth on its own has a significant influence on larval dispersal outcomes in our model. Consistent with our original model, a greater proportion of larvae at 6 m and 10 m depths are retained compared to larvae with target depths of 0 m and 3 m, and larvae higher up in the water column travel greater distances than

larvae in the bottom depth strata. As expected, the differences in dispersal outcomes based solely on target depth are smaller than when target depth is considered alongside other biological parameters, such as pre-competency period, development time and swim speed, which would further influence the proportion of larvae retained or lost. Given that observed differences in larval growth rates and sizes are expected to result in differences in these biological parameters, the impact of larval phenotype on dispersal outcomes are likely to be greater than the conservative approach adopted here.