SUPPLEMENTARY MATERIAL 3

Dispersal and population connectivity are phenotype dependent in a marine metapopulation

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SUPPLEMENTARY MATERIAL 3: SUPPLEMENTARY RESULTS

Table S2 Results of the mixed effects model selection for zero-inflated negative binomial GLMM models assessing *Trachinops caudimaculatus* larval density as a function of depth (0, 3, 6, and 10m), tide (ebb, flood), and time of day (day, night, crepuscular) as fixed factors, and sampling date as a random factor. Presented are models with ΔAICc ≤4 and Akaike weights > 0; the best overall model is highlighted in bold.

Model	df	AICc	ΔAICc	AICc weights	Log likelihood
Depth + time + tide	**10**	**649.64**	**0**	**0.49**	**-313.64**
Depth + time	9	650.22	0.6	0.37	-315.15
Depth	7	653.28	3.6	0.08	-319.06
Depth + tide	8	653.61	4.0	0.07	-318.05

Table S3 Summary statistics for phenotypic variables (otolith size at hatch, early growth, instantaneous growth rate) extracted from otoliths of *T. caudimaculatus* larvae collected at four depth strata in Port Phillip Bay.

		Mean (SE)		
Depth (m)	**N**	*Size at hatch (μm)*	*Early growth (μm)*	*Instantaneous growth rate (μm)*
0	37	19.37 (0.41)	1.68 (0.06)	1.89 (0.08)
3	56	20.08 (0.37)	1.88 (0.06)	2.20 (0.09)
6	114	20.42 (0.22)	1.94 (0.04)	2.27 (0.06)
10	84	20.53 (0.24)	1.94 (0.05)	2.27 (0.06)

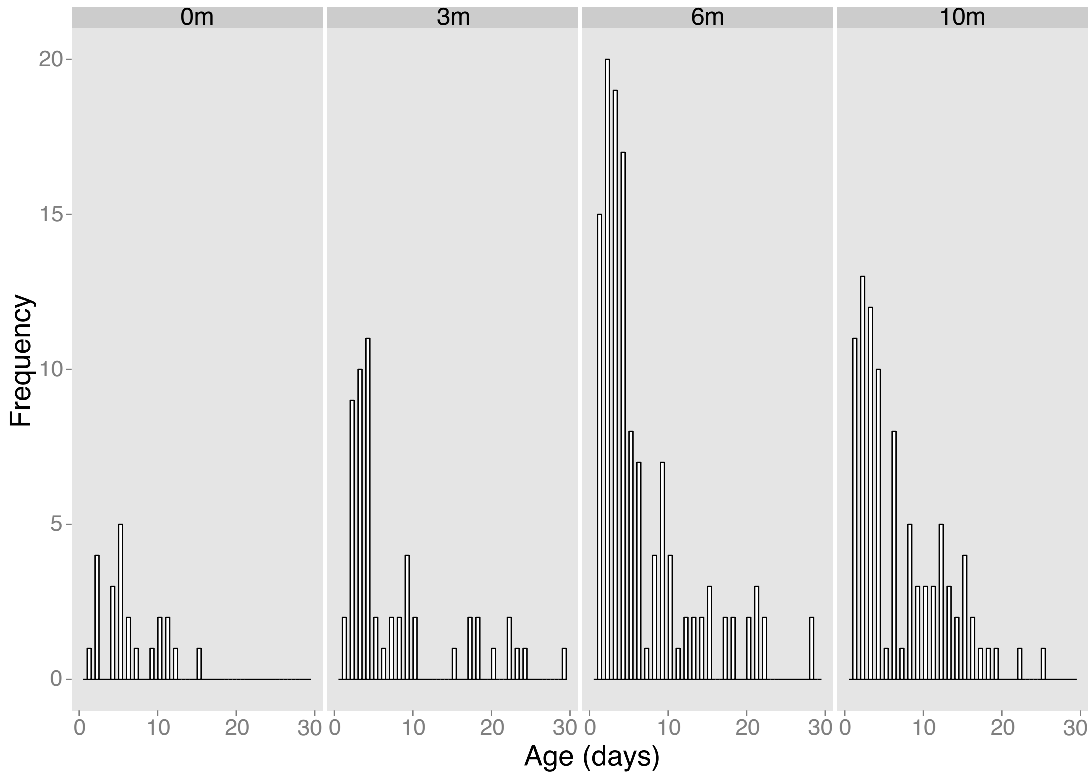

Fig. S4 Distribution of ages (days) of *Trachinops caudimaculatus* larvae collected from depth stratified ichthyoplankton sampling (n_{0m} = 23m, n_{3m} = 56, n_{6m} = 125, n_{10m} = 91). Differences in age distribution at depth are non-significant.

Table S4 Parameter estimates and test statistics for a linear mixed effects (LME) model describing the growth trajectories (otolith size at each age) of *Trachinops caudimaculatus* larvae as a function of depth (fixed factor), with collection date included in the model as a random factor. Post-hoc pairwise comparisons of the fixed term were conducted using Tukey's honestly significant difference (HSD) test. Post-hoc comparisons show mean growth trajectories of larvae found at each of the four depths were significantly different from one another, with the exception of the comparison between 3m and 6m depth.

Parameter	LS mean (SE)	df	- CI	+ CI
Model: depth + (1|date)				
Depth				
0 m (surface)	61.191 (0.547)	35.90	60.0538	62.3289
3 m	64.018 (0.474)	20.95	63.0324	65.0037
6 m	64.061 (0.442)	17.25	63.1415	64.9796
10 m (bottom)	63.004 (0.469)	20.40	62.0277	63.9804
Simultaneous tests for general linear hypotheses				
Depth comparison	Estimate (SE)	*z* stat	*P* value	
3 m - 6 m	-0.0425 (0.288)	-0.147	0.999	
3 m - 10 m	1.0140 (0.299)	3.396	0.004*	
3 m - 0 m	2.8267 (0.395)	7.162	<0.001*	
6 m - 10 m	1.0565 (0.252)	4.198	<0.001*	
6 m - 0 m	2.8692 (0.369)	7.768	<0.001*	
10 m - 0 m	1.8127 (0.374)	4.842	<0.001*	

*P values reported are adjusted P values from single-step method. ±CI represents lower and upper confidence intervals. * Indicates a significant P value*

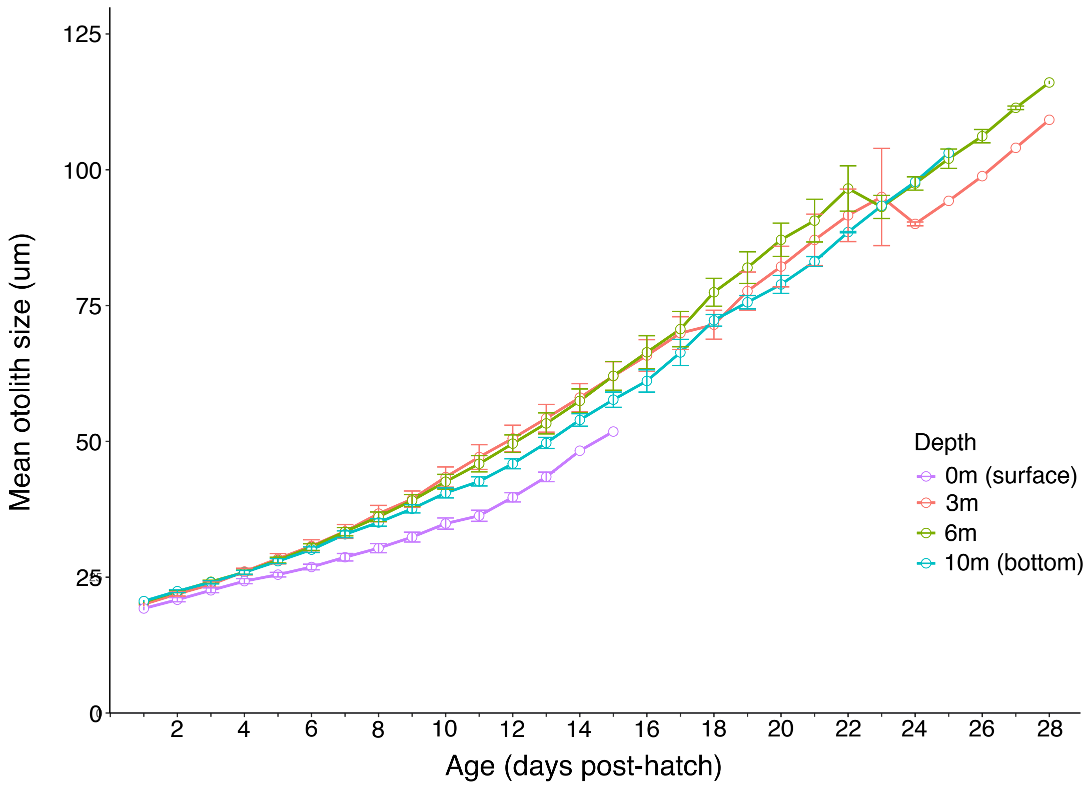

Fig. S5 Mean (± SE) otolith size at each age (days post-hatch) of *Trachinops caudimaculatus* larvae at different depths. Larvae were collected from 0 m (surface), 3 m, 6 m, and 10 m (bottom) depth stratified ichthyoplankton samples from the dispersal period (October to January) of 2012 and 2013. Otolith size data from larvae were pooled across sampling months and years.

Table S5 Summary statistics for dispersal outcomes of poor-, average-, and high-quality larval phenotypes, based on quantified measures of dispersal from a 3-dimensional biophysical dispersal model (Relative Geographic Distance, Proportion Lost) and integrated migration matrix (Local Retention, Self-Recruitment).

		Mean (SE)			
Larval quality	**N**	*Local Retention*	*Self-Recruitment*	*Relative Geographic Distance*	*Proportion Lost*
poor	34	0.010 (0.004)	0.013 (0.004)	0.914 (0.079)	0.146 (0.229)
average	34	0.041 (0.009)	0.058 (0.017)	0.470 (0.044)	0.132 (0.026)
high	34	0.024 (0.006)	0.030 (0.007)	0.323 (0.044)	0.642 (0.017)

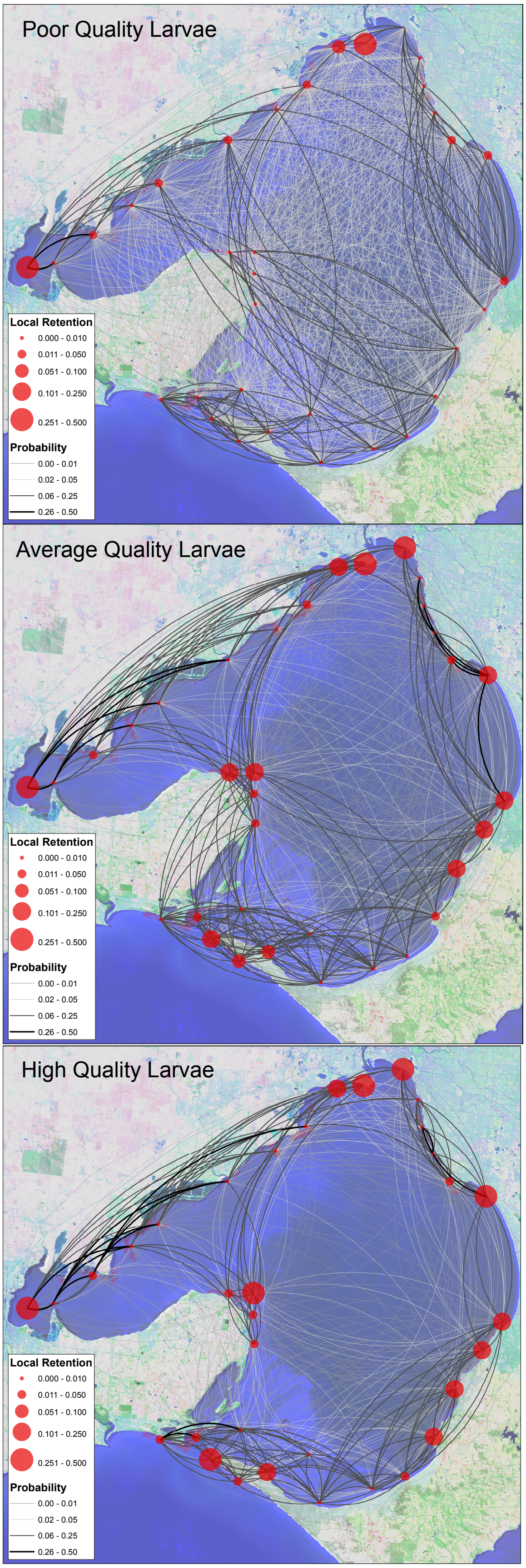

Fig. S6 Differences in downstream dispersal connections and local retention between poor-, average-, and high-quality *T. caudimaculatus* larvae, predicted by a 3-dimensional biophysical model for Port Phillip Bay, Victoria, Australia.

Biased catchability of larvae unlikely

Differences in light levels and thus visibility at different depths could lead to differences in net-avoidance abilities of larvae at the surface versus deeper in the water column and therefore could have contributed to the vertical distribution observed. However, as the maximum depth at the sample site was only 10 m, it is unlikely that light levels would differ sufficiently across this depth range to influence the catchability of larvae. Furthermore, the possibility of gear avoidance in different light conditions can be ruled out because the patterns in phenotypic distribution observed during the day were also observed during the night-time samples (i.e. larger, faster-growing larvae were not caught at the surface at night), therefore changes in visibility leading to differences in catchability is not supported by our data.

As two types of sampling gear were used for larval collections in this study, the potential for gear biases contributing to the vertical distribution of density and larval quality must be considered. The density data would suggest that if gear bias was a contributing factor, the benthic sled would be more efficient at capturing larvae – and in particular, larger larvae. This is highly unlikely, as the benthic sled, lacking the choke mechanism present on the plankton net used for mid-column samples, would, if anything, be less efficient at capturing larvae. The pelagic net could be closed and retrieved while the boat was still in motion to eliminate the possibility of larvae escaping the net during retrieval, whereas to retrieve the benthic sled, towing first had to stop. This could have provided an opportunity for larvae, especially larger, faster swimming larvae, to escape the net before retrieval. For this reason, our data is likely conservative, as a gear bias would be more likely to contribute to reducing the differences in vertical catches observed. Additionally, the absence of a significant difference between densities sampled in the two bottom depth strata, even though these strata were sampled with different gear, further supports the argument that gear bias was not responsible for driving the differences in vertical catches.