The following supplement accompanies the article

Natural drivers of distribution of ghost crabs *Ocypode quadrata* and the implications of estimates from burrows

Maíra Pombo*, Andréa Lima de Oliveira, Luciana Yokoyama Xavier, Eduardo Siegle, Alexander Turra

*Corresponding author: mairapombo@gmail.com

Marine Ecology Progress Series 565: 131–147 (2017)

AIC and model comparison test results of the stepwise backwards model selection processes of each objective

1. Across-shore distribution

Crab abundance - Table 2 of the MS comprise all the information required

Burrow occupation

Table S1. Summary of results of optimal Generalized Linear Model selection (family Poisson, logit link) for burrow occupation rate of *Ocypode quadrata* (OR) as a function of across-shore position (ASP), beach, and sampling date (SD). A backward stepwise model selection was performed based on Akaike Information Criteria (AIC); when AIC differences between models were ≤1, model comparison based on log-likelihood ratio test (LRT) was used to support the decision. Test results are always relative to the model resulting from the previous step, one level above. Bold lines highlight terms that were not dropped (i.e., dropping them led to a significantly worse model); the grey line highlights the final model.

Model	d.f.	AIC	LRT	*p*
OR ~ ASP*Beach *SD		996		
drop 3-way	24	964		
drop SD*Beach	24	949		
drop Beach*ASP	8	948	9.79	0.28
drop SD*ASP	3	946		
OR ~ ASP+Beach+SD		**948**		
drop SD		**949**	**10.22**	**0.02**
drop Beach		**949**	**20.43**	**<0.01**
drop ASP		**959**		

Crab size

Table S2. Summary of results of optimal Linear Model selection for carapace width of *Ocypode quadrata* as a function of across-shore position (ASP), beach, and sampling date (SD). A backward stepwise model selection was performed based on Akaike Information Criteria (AIC); when AIC differences between models were ≤1, model comparison based on F-test was used to support the decision. Test results are always relative to the model resulting from the previous step, one level above. Bold lines highlight terms that were not dropped (i.e., dropping them led to a significantly worse model); the grey line highlights the final model.

Model	d.f.	AIC	F	p
Crab width ~ ASP*Beach*SD		-481		
drop 3-way	24	-498		
drop SD*ASP	3	-501		
drop SD*Beach	**24**	**-496**		
drop Beach*ASP	**8**	**-486**		
Crab width ~ ASP*Beach + SD*Beach		**- 501**		

Sex ratio

Table S3. Summary of results of optimal Generalized Linear Model selection (family binomial, logit link) for sex ratio of *Ocypode quadrata* (SR) as a function of across-shore position (ASP), beach, and sampling date (SD). A backward stepwise model selection was performed based on Akaike Information Criteria (AIC); when AIC differences between models were ≤1, model comparison based on log-likelihood ratio test (LRT) was used to support the decision. Test results are always relative to the model resulting from the previous step, one level above. Here, the model with 3-way interaction terms was also acceptable (light grey line), as some beaches did not have enough data during some periods to verify across-shore sex ratio distribution. Furthermore, there were only 283 observations available for this variable; therefore, the model selection was restarted from the full 2-way interaction. Bold lines highlight terms that were not dropped (i.e., dropping them led to a significantly worse model); the grey line highlights the final model.

Model	d.f.	AIC	LRT	p
SR ~ ASP * Beach*SD		394		
drop 3-way	24	413		
Restarting from full 2-way				
SR ~ ASP * Beach + ASP*SD +Beach*SD		418		
drop Beach*SD	24	404		
drop Beach*ASP	8	390		
Beach	8	382		
drop ASP*SD	**3**	**385**		
SR ~ ASP*SD		**382**		

2. Relationship with environmental factors

Crab abundance

Table S4. Summary of results of optimal Linear Model selection for density of individuals of *Ocypode quadrata* as a function of: mean slope in the range of occurrence of crabs, mean slope in the range of occurrence of crabs, mean midlittoral grain size and sorting coefficient (phi), wave height (H; m), wave period (T; s) and length of the living area (m). A backward stepwise model selection was performed based on Akaike Information Criteria (AIC); when AIC differences between models were ≤ 1, model comparison based on F-test was used to support the decision. Test results are always relative to the model resulting from the previous step, one level above. Bold lines highlight terms that were not dropped (i.e., dropping them led to a significantly worse model); the grey line highlights the final model.

Model	AIC	$F_{1,106}$	p
Density ~ slope + grain size + sorting coefficient + wave height + wave period + length of living area	-586		
drop length of living area	-587	0.17	0.68
drop wave height	-588	1,10	0.29
Drop slope	**-583**		
Drop wave period	**-576**		
Drop grain size	**-574**		
Drop sorting coefficient	**-575**	**15.74**	**<0.01**
Full 4-way: Density ~ (…) slope * grain size * sorting coefficient * wave period	-580		
drop 4-way interaction	-581	0.20	0.65
drop grain size*sorting coefficient*wave period	-583		
drop slope*grain size*wave period	-585		
drop slope*sorting coefficient*wave period	-587		
drop grain size*sorting coefficient	-588	0.78	0.38
drop sorting coefficient*wave period	-587	3.10	0.08
Density ~slope * grain size * sorting coefficient +grain size*wave period+slope*wave period+slope*grain size+slope*sorting coefficient	-584		
drop slope*wave period	-586		
drop grain size*wave period	-588		
drop slope * grain size * sorting coefficient	-589	1.22	0.27
drop slope*grain size	-590	0.24	0.62
drop slope*sorting coefficient	**-588**		
drop grain size	**-586**		
drop wave period	**-580**		
Density ~ grain size+ wave period+slope*sorting coefficient	**-611**		

Burrow occupation rate

Table S5. Summary of results of optimal Linear Model selection for burrow occupation rate (OR) of individuals of *Ocypode quadrata* (cm) as a function of: crab density (ind*m^{-2}), mean slope in the range of occurrence of crabs, mean midlittoral grain size and sorting coefficient (phi), wave height (H; m), wave period (T; s) and length of the living area (m). A backward stepwise model selection was performed based on Akaike Information Criteria (AIC); when AIC differences between models were $\leq$1, model comparison based on F-test was used to support the decision. Test results are always relative to the model resulting from the previous step, one level above. Bold lines highlight terms that were not dropped (i.e., dropping them led to a significantly worse model); the grey line highlights the final model.

Model	AIC	$F_{1,104}$	p
OR ~ crab density + slope + grain size + sorting coefficient + wave height + wave period + length of living area	-362		
drop wave period	-364		
drop wave height	-366		
drop sorting coefficient	-367	0.37	0.54
drop grain size	-369		
drop length of living area	-370	0.64	0.42
drop slope	**-364**		
drop crab density	**-348**		
OR ~ crab density*slope	**-400**		
drop crab density*slope	**-398**		

Crab size

Table S6. Summary of results of optimal Linear Model selection for carapace width of individuals of *Ocypode quadrata* (cm) as a function of: burrow size (cm), mean slope in the range of occurrence of crabs, mean midlittoral grain size and sorting coefficient (phi), wave height (H; m), wave period (T; s), and length of the living area (m). A backward stepwise model selection was performed based on Akaike Information Criteria (AIC); when AIC differences between models were ≤1, model comparison based on F-test was used to support the decision. Test results are always relative to the model resulting from the previous step, one level above. Bold lines highlight terms that were not dropped (i.e., dropping them led to a significantly worse model); the grey line highlights the final model.

Model	AIC	$F_{1,336}$	*p*
Width ~ burrow size + grain size + sorting coefficient + wave height + wave period + length of living area	-591		
drop sorting coefficient	-593		
drop length of living area	-595		
drop wave height	-597		
drop slope	-598	1.16	0.28
drop wave period	-597	2.64	0.10
drop grain size	**-595**		
drop burrow size	**-280**		
Width ~burrow size*grain size	-595		
Width ~burrow size+grain size	**-597**		