Overlap in the distributions between indigenous and non-indigenous decapods in a brackish micro-tidal system

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Supplement 1.

Table S1. *Cancer irroratus*, *Carcinus maenas* and *Dyspanopeus sayi*. Results of 2-way ANOVA examining the effect of depth and season (spring: June; summer: August; fall: October) on the abundances of 3 species of crabs at each of 4 sites in the Bras d'Or Lakes (in 2005 only). Both factors are fixed (see 'Materials and methods'). NA: no records of *D. sayi* at Jamesville at 0.5 m depth during sampling; **bold** print: significant at $p < 0.025$

Species	Site	Factor	MS	df	*F*	p
C. irroratus	Jamesville	Depth	4.51	1	0.73	0.39
		Season	38.50	2	6.26	**0.002**
		Depth × Season	26.62	2	4.33	**0.015**
		Error	6.15	172		
	Benacadie	Depth	0.29	3	3.25	**0.022**
		Season	0.31	2	3.43	0.034
		Depth × Season	0.285	6	3.20	**0.005**
		Error	0.089	323		
	Ross Ferry	Depth	2.31	3	1.54	0.21
		Season	2.42	2	1.61	0.20
		Depth × Season	3.35	6	2.23	0.041
		Error	1.51	288		
	Kempt Head	Depth	6.44	1	4.82	0.029
		Season	2.13	2	1.60	0.21
		Depth × Season	4.00	2	3.00	0.053
		Error	1.34	170		
C. maenas	Jamesville	Depth	0.002	1	0.001	0.97
		Season	1.79	2	0.97	0.38
		Depth × Season	1.80	2	0.98	0.38
		Error	1.84	172		
	Benacadie	Depth	19.64	3	3.20	**0.024**
		Season	2.60	2	0.42	0.66
		Depth × Season	38.20	6	6.23	**<0.001**
		Error	6.13	323		
	Ross Ferry	Depth	15.00	3	8.76	**<0.001**
		Season	1.22	2	0.71	0.49
		Depth × Season	1.48	6	0.86	0.52
		Error	1.71	288		
	Kempt Head	Depth	131.20	1	24.69	**<0.001**
		Season	7.07	2	1.33	0.27
		Depth × Season	11.76	2	2.21	0.11
		Error	0.31	170		

Supplement 1 (continued)

Table S1 (continued)

Species	Site	Factor	MS	df	*F*	p
D. sayi	Jamesville	NA	NA	NA	NA	NA
	Benacadie	Depth	22.84	3	3.37	**0.019**
		Season	22.97	2	3.38	0.035
		Depth × Season	49.16	6	7.24	**<0.001**
		Error	6.79	323		
	Ross Ferry	Depth	39.04	3	9.47	**<0.001**
		Season	4.34	2	1.05	0.35
		Depth × Season	13.17	6	3.20	**0.005**
		Error	0.12	288		
	Kempt Head	Depth	20.82	1	10.80	**0.001**
		Season	11.33	2	5.88	**0.003**
		Depth × Season	11.33	2	5.88	**0.003**
		Error	1.93	170		

Table S2. *Cancer irroratus*, *Carcinus maenas* and *Dyspanopeus sayi*. Results of 2-way ANOVA examining the effect of depth and year (cold: 2005; warm: 2006) on the abundances of 3 species of crabs at each of 4 sites in the Bras d'Or Lakes (in August only). Both factors are fixed (see 'Materials and methods'). **Bold** print: significant at $p < 0.025$

Species	Site	Factor	MS	df	*F*	p
C. irroratus	Jamesville	Depth	12.05	2	5.86	**0.004**
		Year	4.27	1	1.72	0.16
		Depth × Year	4.27	2	1.72	0.16
		Error	2.13	135		
	Benacadie	Depth	0.11	3	1.70	0.17
		Year	0.12	1	1.83	0.18
		Depth × Year	0.11	3	1.70	0.17
		Error	0.07	232		
	Ross Ferry	Depth	0.64	3	0.64	0.59
		Year	4.11	1	4.01	0.05
		Depth × Year	0.69	3	0.69	0.56
		Error	1.01	192		
	Kempt Head	Depth	1.07	1	2.06	0.15
		Year	0.27	1	0.52	0.47
		Depth × Year	0.27	1	0.52	0.47
		Error	60.0	116		
C. maenas	Jamesville	Depth	25.63	2	6.89	**0.001**
		Year	24.07	1	6.47	**0.012**
		Depth × Year	24.07	1	6.47	**0.012**
		Error	3.719	135		
	Benacadie	Depth	487.38	3	19.48	**<0.001**
		Year	30.72	1	1.23	0.27
		Depth × Year	69.78	3	2.78	0.04
		Error	25.03	232		
	Ross Ferry	Depth	23.20	3	9.00	**<0.001**
		Year	11.43	1	4.43	0.04
		Depth × Year	4.91	3	1.90	0.13
		Error	2.58	192		
	Kempt Head	Depth	147.27	1	23.77	**<0.001**
		Year	8.07	1	1.30	0.26
		Depth × Year	3.27	1	0.53	0.47
		Error	718.80	116		

Table S2 (continued)

Species	Site	Factor	MS	df	*F*	p
D. sayi	Jamesville	Depth	0.034	2	0.29	0.75
		Year	0.067	1	0.58	0.45
		Depth × Year	0.067	1	0.58	0.45
		Error	0.12	135		
	Benacadie	Depth	278.76	3	10.66	**<0.001**
		Year	1.33	1	0.05	0.82
		Depth × Year	2.22	3	0.09	0.97
		Error	26.11	232		
	Ross Ferry	Depth	9.00	3	5.63	**0.001**
		Year	2.31	1	1.45	0.23
		Depth × Year	3.24	3	2.03	0.11
		Error	1.60	192		
	Kempt Head	Depth	3.27	1	3.72	0.056
		Year	0.067	1	0.076	0.78
		Depth × Year	0.067	1	0.076	0.78
		Error	0.88	116		

Table S3. *Cancer irroratus*, *Carcinus maenas* and *Dyspanopeus sayi*. Results of 2-way ANOVA examining the effect of site (Jamesville, Benacadie, Ross Ferry, Kempt Head) and year (warm, cold) on the abundances (at 0.5 m depth) of 3 species of crabs in the Bras d'Or Lakes. Both factors are fixed (see Materials and methods). **Bold** print: significant at $p < 0.01$

Species	Factor	MS	df	*F*	p
C. irroratus	Site	32.29	3	17.21	**<0.001**
	Year	0.000	1	0.000	0.99
	Site × Year	4.29	3	2.24	0.08
	Error	1.685	1702		
C. maenas	Site	649.91	3	18.01	**<0.001**
	Year	2931.92	1	81.25	**<0.001**
	Site × Year	261.89	3	7.26	**<0.001**
	Error	36.09	963		
D. sayi	Site	116.33	3	11.34	**<0.001**
	Year	0.001	1	0.000	0.99
	Site × Year	10.42	3	1.02	0.39
	Error	10.26	963		

Table S4. *Cancer irroratus*, *Carcinus maenas* and *Dyspanopeus sayi*. Results of 2-way ANOVA examining the effect of season (spring: June; summer: August; autumn: October) and year (cold: 2005; warm: 2006) on the abundances (at 0.5 m depth) of 3 species of crabs at each of 4 sites in the Bras d'Or Lakes. Both factors are fixed (see 'Materials and methods'). NA: no records of *C. irroratus* at Benacadie during sampling at 0.5 m depth; **bold** print: significant at $p < 0.025$

Species	Site	Factor	MS	df	*F*	p
C. irroratus	Jamesville	Season	0.31	2	0.077	0.93
		Year	2.28	1	0.57	0.45
		Season × Year	16.48	2	4.12	**0.02**
		Error	4.00	213		
	Benacadie	NA	NA	NA	NA	NA
	Ross Ferry	Season	2.93	2	2.42	0.09
		Year	0.007	1	0.006	0.94
		Season × Year	0.53	2	0.44	0.65
		Error	1.21	224		
	Kempt Head	Season	44.21	2	16.92	**<0.001**
		Year	5.60	1	2.14	0.14
		Season × Year	7.58	2	2.90	0.06
		Error	2.61	221		
C. maenas	Jamesville	Season	17.50	2	3.55	0.03
		Year	104.90	1	21.25	**<0.001**
		Season × Year	12.29	2	2.49	0.09
		Error	4.94	213		
	Benacadie	Season	106.19	2	1.50	0.22
		Year	2747.59	1	38.89	**<0.001**
		Season × Year	202.57	2	2.87	0.058
		Error	70.66	289		
	Ross Ferry	Season	406.99	2	36.04	**<0.001**
		Year	511.58	1	45.30	**<0.001**
		Season × Year	277.43	2	24.57	**<0.001**
		Error	11.29	224		
	Kempt Head	Season	926.28	2	34.81	**<0.001**
		Year	1264.74	1	47.53	**<0.001**
		Season × Year	613.02	2	23.04	**<0.001**
		Error	26.61	221		
D. sayi	Jamesville	Season	0.06	2	0.851	0.43
		Year	0.057	1	0.78	0.38
		Season × Year	0.062	2	0.85	0.43
		Error	0.073	213		
	Benacadie	Season	443.03	2	20.57	**<0.001**
		Year	4.183	1	0.19	0.66
		Season × Year	5.41	2	0.25	0.78
		Error	21.53	289		
	Ross Ferry	Season	117.85	2	17.83	**<0.001**
		Year	9.61	1	1.45	0.23
		Season × Year	4.33	2	0.66	0.52
		Error	6.61	224		
	Kempt Head	Season	90.94	2	23.87	**<0.001**
		Year	2.06	1	0.54	0.46
		Season × Year	3.13	2	0.82	0.44
		Error	3.81	221		

Table S5. *Cancer irroratus*, *Carcinus maenas* and *Dyspanopeus sayi*. Results of 2-way ANOVA examining the effect of time (day, night) and depth on the abundances of 3 species of crabs at 2 sites in the Bras d'Or Lakes. Both factors are fixed (see 'Materials and methods'). **Bold** print: significant at $p < 0.01$

Species	Site	Factor	MS	df	*F*	p
C. irroratus	Benacadie	Time	0.47	1	1.28	0.26
		Depth	0.17	3	0.46	0.71
		Time × Depth	0.17	3	0.46	0.71
		Error	0.37	212		
	Ross Ferry	Time	0.67	1	0.49	0.49
		Depth	1.86	3	1.36	0.26
		Time × Depth	0.54	3	0.40	0.76
		Error	1.37	172		
C. maenas	Benacadie	Time	5.47	1	0.26	0.61
		Depth	91.70	3	4.39	**0.005**
		Time × Depth	11.95	3	0.57	0.63
		Error	20.91	212		
	Ross Ferry	Time	0.027	1	0.025	0.87
		Depth	4.77	3	4.55	**0.004**
		Time × Depth	0.17	3	0.17	0.92
		Error	1.05	172		
D. sayi	Benacadie	Time	0.73	1	0.046	0.83
		Depth	147.89	3	9.38	**<0.001**
		Time × Depth	4.84	3	0.31	0.82
		Error	15.77	212		
	Ross Ferry	Time	0.43	1	0.23	0.63
		Depth	12.31	3	6.75	**<0.001**
		Time × Depth	0.49	3	0.27	0.85
		Error	1.82	172		

Table S6. Results of SIMPER analysis show the substrate composition contributing most to dissimilarity between 0.5 and 1.5 m and between 0.5 and 2.5 m depths

Substrate composition	Cumulative contributions (%)
Between 0.5 and 1.5 m	
Sand	27.74
Cobble/pebble composite	43.91
Cobble	59.51
Cobble/sand composite	70.83
Cobble/silt composite	78.78
Pebble	86.58
Cobble/pebble/sand composite	92.10
Between 0.5 and 2.5 m	
Sand	29.94
Cobble	49.57
Cobble/pebble composite	64.03
Cobble/sand composite	75.35
Pebble	82.39
Cobble/pebble/sand composite	86.88
Silt	91.10

Table S7. Results of SIMPER analysis show the substrate composition (average percent composition) contributing most to dissimilarity between Jamesville and Ross Ferry

Substrate composition	Jamesville	Ross Ferry	Cumulative
Sand	50.00	2.50	30.58
Cobble/silt composite	0.00	27.50	47.77
Cobble/sand composite	2.92	30.28	64.72
Cobble	27.08	16.43	78.50
Cobble/pebble composite	5.42	8.58	85.49
Pebble	2.92	6.88	89.26
Cobble/boulder/pebble composite	5.83	0.00	92.89

Table S8. *Cancer irroratus*, *Carcinus maenas* and *Dyspanopeus sayi*. Spearman rank correlations between percent of cobble/cobble composite material on the substrate and the abundances of 3 crab species (ind. m^{-2}) at each site (depths, seasons and years pooled) in the Bras d'Or Lakes. N: the number of samples in each correlation analysis. **Bold** print: significant at $p < 0.05$

Species	Site	Cobble material (%)	p	N
C. irroratus	Jamesville	0.14	**0.007**	358
	Benacadie	−0.093	**0.031**	535
	Ross Ferry	0.031	0.50	470
	Kempt Head	0.19	**<0.001**	347
	All sites	0.14	**<0.001**	1710
C. maenas	Jamesville	0.23	**<0.001**	358
	Benacadie	0.32	**<0.001**	535
	Ross Ferry	0.36	**<0.001**	470
	Kempt Head	0.45	**<0.001**	347
	All sites	0.32	**<0.001**	1710
D. sayi	Jamesville	0.04	0.44	348
	Benacadie	0.21	**<0.001**	535
	Ross Ferry	0.28	**<0.001**	470
	Kempt Head	0.22	**<0.001**	347
	All sites	0.19	**<0.001**	1710

Table S9. *Cancer irroratus*, *Carcinus maenas* and *Dyspanopeus sayi.* Spearman rank correlations (r_S) between abundances of each crab species (no. m^{-2}) at each site (depths and seasons pooled) in each year (cold: 2005; warm: 2006) in the Bras d'Or Lakes. N: the number of samples in each correlation analysis; NA: no analysis was completed because one or both species were not present at the location. **Bold** print: significant at $p < 0.05$

Species	Site	2005			2006		
		r_S	p	N	r_S	p	N
C. irroratus vs. *C. maenas*	Jamesville	0.05	0.44	238	−0.006	0.95	120
	Benacadie	−0.037	0.50	335	−0.054	0.45	200
	Ross Ferry	−0.034	0.56	300	0.040	0.60	170
	Kempt Head	−0.046	0.51	216	0.082	0.35	131
C. irroratus vs. *D. sayi*	Jamesville	NA	NA	238	−0.036	0.70	120
	Benacadie	−0.028	0.60	335	−0.027	0.70	200
	Ross Ferry	−0.018	0.76	300	0.017	0.83	170
	Kempt Head	0.063	0.36	216	−0.14	0.12	131
C. maenas vs. *D. sayi*	Jamesville	NA	NA	238	−0.05	0.57	120
	Benacadie	0.27	**<0.001**	335	0.35	**<0.001**	200
	Ross Ferry	0.11	0.051	300	0.26	**0.001**	170
	Kempt Head	0.061	0.37	216	0.24	**0.006**	131