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INFLUENCE OF SHELL SIZE AND ISOLATION ON CON-SPECIFIC AGGRESSIVE BEHAVIOR IN HERMIT CRABS

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Hazlett (1965 An. Behavior 13:357) has reported a number of factors including isolation, shell type, and posture which influence aggression in hermit crabs. The present investigation was concerned with a comparative analysis of conspecific aggression in two crab species, *Pagurus acadianus* and *Pagurus pubescens*. Dominance was recorded in ten-minute trials when a single pair of animals had established definite dominant/subordinate relationships. In many cases threat and intimidation was followed by direct assault in which the dominant crabs positioned themselves in order to evict subordinate individuals from their shells. All crabs used were in an assigned, small intermediate category (1.05-1.34 crab wt./shell volume index).

Isolated individuals of *P. acadianus* showed a significantly higher incidence of dominance in trials with crowded animals than the latter displayed (Table I). In almost half of the cases in which isolates dominated they also assumed eviction postures. A higher percentage of such positioning was recorded for crabs isolated for 108 hours as opposed to 60 hours. Similar tests with *P. pubescens* failed to elicit any significant level of agonistic behavior.

Another series of tests was run which paired crabs occupying small and large shells (high and low crab wt./shell volume index) against each other (Table II). No significant trend in dominance for individuals occupying large or small shells was detected in *P. acadianus* although aggression occurred in every trial period. In *P. pubescens*, however, almost every trial resulted in a dominant score for the small-shelled individual and the percentage assumption of eviction posture was high. (Table III)

It is of interest to know if animals in shells of inappropriate dimensions dominate those in shells of normal size. Isolated *P. acadianus* in small shells *were* dominant to normals, but dominance was evenly distributed in tests between large and normal shelled individuals (Table IV). As isolation has no effect on increasing aggressiveness in *P. pubescens*, crowded individuals were used in tests with small and normal shells. As in previous studies small shelled crabs showed a heightened degree of dominance.

Observations made during dives which indicate *P. acadianus* is a solitary species and *P. pubescens* a more social one, substantiate laboratory studies. Aggression in *P. acadianus* is enhanced by isolation and depressed by crowding, whereas *P. pubescens* remains generally non-aggressive in either circumstance. In both species observation that dominance is greatest in animals occupying shells that are too small suggests that individuals which have outgrown their home shell may also be more aggressive in natural situations.

Table 1. Results of conspecific dominance tests between isolated and crowded individuals

	No. trials	No. isolates dominant	No. crowded dominant	P	No. isolates assuming eviction position
Pagurus acadianus					
Pooled data	44	32 (72.72$)	11 (25.00%)*	P <.001	13 (43.75%)
60 hr.	25	17 (68.00%)	8 (32.00%)	P <0.05	5 (28.82%)
108 hr.	19	15 (78.94%)	3 (15.78%)	P <0.001	8 (53.33%)
Pagurus pubescens					
60 and 108 hrs.	34	No agonistic behavior recorded between isolated and crowded individuals			

* One trial in each group resulted in a draw

Table II Dominance tests in *Pagurus acadianus* involving isolated individuals: abnormal versus normal shell size.

No. trials	Test	Crab wt./shell volume	No. dominant	P	No. of dominant assuming eviction posture
22	Small shell	3.368±1.05	16(72.72%)	P <.01	9
	Normal	1.34	6(27.22%)		None
25	Large shell	0.834±0.024	11(41.66%)	-	4
	Normal	1.34	14(58.33%)		1

Table III Dominance tests in crowded *Pagurus pubescens* : small shell versus normal size.

12	Small shell	3.68 ±0.064	8(66.7%)*	P <.001	8
	Normal	0.975±0.105	1(8.3%)*		None

Table IV Conspecific dominance tests with *P. acadianus* and *P. pubescens* occupying large and small shells (sub-optimal crab wt./ shell vol. indices

Pagurus acadianus	Total trials 33		Normal crab wt./shell vol. index 1.34	
Test animals	Crab wt./ shell volume	% dominant	P	no. and percent of dominants in eviction position
Crabs in small shells	2.337±1.16	18 (54.54)	P <.0001	6 (33.33%)
Crabs in large shells	0.687±0.302	15 (45.56%)		3 (20.00%)
Pagurus pubescens	Total trials 33		Normal crab wt./shell vol. index 1.08	
Crabs in small shells	3.73±0.64	32 (96.96%)*		17 (53.12%)
Crabs in large shells	0.834±0.126	None		None

* No activity recorded in some tests in each group.