

to extrude sodium when incubated in saltwater in comparison to control saltwater gills. The present experiments demonstrate for the first time that ouabain may inhibit sodium efflux across the gill *in vivo*, suggesting that Na-K-ATPase may be rate limiting for gill sodium transport.

1971 #9

ECOLOGICAL SIGNIFICANCE OF SHELL AVAILABILITY TO SHELL SELECTION IN HERMIT CRABS

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Different species of hermit crabs show preferences for different types of mollusc shells (Reese, E.S. 1963 Behavior 21:78-126). In the Frenchman Bay area immature *Pagurus acadianus* and *P. pubescens* may compete for shells of *Littorina*, *Thais* and smaller *Buccinum*. The larger size of mature *P. acadianus* which occupy large *Buccinum*, *Polinices* and *Neptunea* shells (Lindsey and Grant 1970 MDIBL Bulletin) probably precludes inter-specific competition with adults of the smaller *P. pubescens* species.

The results of laboratory investigations designed to test the influence of shell availability on preference are given in Table I. The ratio of *Littorina/Thais* shells varied with each test. In only two

Table I. Shell availability studies: results of twelve hour selections by individual crabs presented with empty shells in different species ratios. All animals small intermediates.

Ratio Littorina/Thais	No. Trials	<i>P. acadianus</i>		No. Trials	<i>P. pubescens</i>	
		Littorina	Thais		Littorina	Thais
5/2	12	11	1	10	7	3
2/5	12	9	3 P<0.05	12	2	10
4/4	13	11	2 P<0.02	15	9	8

Table II. Selection of shells with colonies of Hydractinia. Each trial represents a choice made by a crab in its home shell presented with a hydractinia covered shell of appropriate size. L = *Littorina*; T = *Thais*; B = *Buccinum*. Shell types. H = Hydractinia

No. trials	Test: home shell/ hydractinia	<i>P. acadianus</i>			No. trials	Test: home shell/ hydractinia	<i>P. pubescens</i>		
		shell	Select home shell	Select H shell			shell	Select home shell	Select H shell
15	B	B	2	13	6	B	B	6	0
10	L	L	0	10	12	L	L	11	1
3	L	P	0	3	4	T	L	4	0
					4	L	T	4	0

test situations both involving *P. acadianus* was the ratio of *Littorina/Thais* occupied, significantly different from the null hypothesis that no preference occurs. Another series of tests (Table II) showed that *P. acadianus* has a strong tendency to leave home shells if presented with shells in the appropriate

size range covered with the colonial hydroid, *Hydractinia*. Individuals of *P. pubescens* showed a strong preference for their home shells in the above choice situation.

Field capture data show that *P. acadianus* of weight range 0.60-3.50 gm occupy shells in a ratio of 3.3 *Littorina*/1 *Thais*. The ratio for *P. pubescens* is 1.6/1. Table III gives the results of a prelim-

Table III Field samples: each sample was taken from a 1 sq. ft. area which contained at least one hermit crab. Samples were taken along a roughly determined swim line. L = *Littorina*; T = *Thais*; B = *Buccinum*.

Location	Sullivan Harbor	Laboratory Cove	Salisbury Cove
No. samples	11	11	15
Mean empty shells per sample	4.81	3.09	1.0
No. samples without empty shells	2	3	7

Shells by type



inary diving survey of empty shells available for occupancy which was conducted in three separate areas. Most empty shells were small size *Littorina* and *Thais*, many completely filled with silt. Laboratory observations indicated that hermit crabs have specific behaviors adapted to the evacuation of silt from shells. There is no evidence that they are capable of evicting living molluscs from their shells.

In summary the above investigations indicate that empty shells, particularly those of appropriate size are a rare commodity. *P. acadianus* showed a decided preference for *Littorina* shells independent of availability while *P. pubescens* was far less discriminating. In areas where *Littorina* shells predominate there may be intensive competition between the crab species. Where *Thais* shells are also prevalent sufficient niche diversification may preclude inter-specific competition especially where *Hydractinia* cover of *Littorina* shells reinforces preference stimulation in *P. acadianus*.