SHELL SELECTION BY THE HERMIT CRAB, *PAGURUS HARTAE*  
(MCLAUGHLIN & JENSEN, 1996) (DECAPODA, ANOMURA)  

BY  

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INTRODUCTION  

Most species of hermit crabs rely on gastropod shells to protect their uncalcified 
abdomens, and these mobile shelters help guard against predation, desiccation, 
and physical stresses (Hazlett, 1981). Shells are so essential that their availability 
has been considered a limiting factor for populations (Vance, 1972; Spight, 1977). 
The types of gastropod shells available also determine the size of hermit crabs 
present in an area (Markham, 1968). In shell-limited environments crabs are often 
forced to occupy inadequate shells, which in turn restricts not only their growth and 
fecundity but also increases their risk of predation (Sripathi et al., 1977). There is 
considerable evidence that hermit crabs do not enter gastropod shells at random, 
but select shells according to shell species and their associated characteristics of 
shape, epibionts, dimension, and weight (Grant & Ulmer, 1974). This differential 
shell preference may lead to a form of habitat partitioning that increases the 
likelihood of coexistence between similar hermit crabs (Vance, 1972).  

*Pagurus hartae* (McLaughlin & Jensen, 1996) is a tiny species (maximum 
carapace length 6 mm) found from the Queen Charlotte Islands, Canada to 
the Mexican border. It occurs subtidally under rocks and in crevices at depths 
of 6-635 m, and large assemblages can be found in parts of Barkley Sound 
on Vancouver Island, British Columbia, Canada (Jensen, 1995). The present 
experiment was undertaken to determine what types of shells this newly described 
species occupies in natural surroundings and whether they exhibit any preference 
for shell species.
MATERIALS AND METHODS

One hundred thirteen *Pagurus hartae* were captured on 15 and 23 August 2002 by dredge in Satellite Passage near the north shore of Helby Island (51°01′N 125°11′W) in Barkley Sound, British Columbia, Canada. The crabs were brought back to the Bamfield Marine Sciences Centre where they were held in an open circuit seawater system, and the species of shell used by each was identified.

To test for shell preference, 21 adult crabs were anaesthetized and extracted from their shells. Crabs were anaesthetized using a drop of oil of cloves diluted in 25 ml of seawater; after 10-15 minutes of immersion they were gently removed from their shells. Visibly parasitized (e.g., rhizocephalan externae) and ovigerous crabs were not used, nor were any that were damaged in the process. The naked crabs were isolated in ice cube trays immersed in an ambient (10°C) open circuit seawater system and allowed to recover for at least twelve hours.

Living and dead *Homalopoma luridum* (Dall, 1885), *Calliostoma ligatum* (Gould, 1849), *Amphissa columbiana* Dall, 1916, *Nassarius mendicus* (Gould, 1850), and *Alia carinata* (Hinds, 1844) shells were collected from Barkley Sound beaches. Shells were boiled in fresh water for 20 minutes to kill any associated organisms and to aid in removing tissues. Hermits can recognize and select their own previously inhabited shell by means of chemical cues; boiling destroys the cues left behind by previous occupants (Benoit et al., 1996).

Shells were categorized into three types based on their shape: (a) *Homalopoma* (short, globose structure), (b) *Calliostoma* (conical or top-shaped), or (c) *Alia*, *Amphissa*, and *Nassarius* (elongated). *Alia*, *Amphissa*, and *Nassarius* were used interchangeably, since they are very similar morphologically. Undamaged shells with aperture measurements similar to the individual crab’s original shell were used in the trials.

Naked crabs were placed singly into large glass preparation dishes (10 cm in diameter, with a volume of 350 ml) provided with running seawater and a substratum of washed sand and gravel. Each trial consisted of four shells each of *Homalopoma*, *Calliostoma*, and a mix of *Alia*, *Amphissa*, and *Nassarius*, randomly dispersed into the dish. Each trial ran for 12 hours and shell occupancy was noted at the end of that time; each crab was used only once. Some shells were boiled and reused in later trials. Shell choice was analysed using a Chi-square test.

RESULTS

The gastropod shells occupied by *Pagurus hartae* in the field consisted of 9 genera (fig. 1). Shells of *Calliostoma ligatum* were most frequently utilized (41.6%)