

## Hermit crabs in evidence: unusual gastropod shell occupation.

Meireles, A. L.; Biagi, R. and Mantelatto, F. L. M.

Departamento de Biologia, Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto, Universidade de São Paulo (USP), Av. Bandeirantes 3900, 14040-901 Ribeirão Preto, São Paulo, Brasil; e-mail: flmantel@usp.br

### Abstract

Empty gastropod shells have been shown to be a limiting resource to the hermit crab population. Here we report findings based on field collections of the occupancy of shells containing soft parts of snail by the hermit crabs species *Dardanus insignis* and *Pagurus exilis* and the unique occupancy of a land gastropod shell by *D. insignis*. This is the first account of unusual shell occupation by hermit crabs in the Brazilian coast.

**Key-Words:** Paguridae, Diogenidae, hermit crabs, shells, unusual resources

### Introduction

Hermit crabs are commonly found occupying empty marine gastropod shells. The strong association between these crustaceans and their occupied shelters has greatly influenced almost all aspects of their biology (Hazlett, 1981). When gastropod shells are not available, some hermits may utilize a variety of alternative shelters such as tusk shells, serpulid tubes, cavities of stones, sponges, dead corals, pieces of bamboo, bivalve shells. In this sense, Imafuku and Ando (1999) presented a good review about shelters occupation by hermit crabs.

Hermit crabs may obtain shells of many ways, such as: by the natural mortality of gastropod shells, finding empty shells, changing shells with other specimens, mainly. Some authors have described the active predation of gastropod shells by hermit crabs (Rutherford, 1977; Imafuku and Nakamura, 1995). However, according to Scully (1983) the predation of gastropods by the hermit crabs in laboratory conditions may not be considered as a natural event.

Only few reports to date have registered hermit crabs occupying shells with some remnants of the soft parts of the snail still in the shell (see Imafuku and Nakamura, 1995). In the Brazilian coast, there is a single and recent paper by Garcia *et al.* (in press), who reported the occupancy of unusual shelters by *Dardanus venosus* (H. Milne Edwards, 1848), *D. insignis* (Saussure, 1858), and *Paguristes erythrops* Holthuis, 1959.

During the last ten years an extensive effort has been made to identify and characterize the biology of decapods crustaceans occurring in the Ubatuba region (Hebling *et al.*, 1994; Negreiros-Fransozo *et al.*, 1997; Fransozo *et al.*, 1998; Mantelatto and Garcia, 2002). In this sense, an impressive number of systematized samples were carried out during the last three consecutive years (2001 to 2003) on soft bottom substrate of shallow water areas (from 5 to 35 m deep) focusing on decapod species composition along the northern coast of São Paulo.

The occupancy of shells containing soft parts of snail by the hermit crabs *D. insignis* and *Pagurus exilis* (Benedict, 1892) and the unique occupancy of a land gastropod shell by *D. insignis* are presented here based on specimens collected in their natural habitat.

### Material and Methods

In January and February 2003, hermit crabs occupying unusual shells were collected in one of the sampled area - Caraguatatuba Bay (23° 57'S, 45° 28'W). In June 2003, hermit crabs were also collected in another northern area - Ubatuba Bay (23° 26' S, 45° 02' W) of São Paulo State coast. Specimens were collected by a shrimp boat equipped with a double rig trawl net. All collections were made over transects of about of 1 km<sup>2</sup> long.

The physical and chemical conditions of studied site have been described by Mantelatto and Fransozo (1999).

Hermit crabs obtained in the samplings were immediately frozen and transported to the laboratory where they were thawed at environment temperature and then removed from their shells. Sex of each crustacean was achieved from the gonopore position. Measurement of shield length (SL) of each hermit crab was made with a caliper (0.1 mm).

The shell species were identified according to Rios (1994) and confirmed by Dr. Wagner Avelar (from the same institution of the authors). All found shells were measured for their aperture width (SAW).

Voucher specimens collected are deposited in the Crustacean Collection of the Biology Department of FFCLRP, University of São Paulo, Brazil (DB/FFCLRP/USP 1111 to 1114).

## Results

From the 93 animals captured in January and February, two males of *Dardanus insignis* (11.2 and 11.9 mm of SL, respectively) (table I and figure 1) inhabited *Tonna galea* (Linnaeus, 1758) shells (18.0 and 18.8 mm of SAW, respectively) with remnants of the soft parts of mollusks and/or the whole mollusk. From the 52 specimens of *Pagurus exilis* captured, one male (6.0mm of SL), inhabited a *Buccinanops gradatum* Deshayes, 1844 shell (18.7mm of SAW) with soft parts of the snail too (table I and figure 1).

In June 2003, one female (14.9 mm of SL) of *Dardanus insignis* from a total of 10, was collected inhabiting a land gastropod shell *Achatina fulica* Bowdich, 1822 (SAW = 22.4 mm) (table I and figure 1).

## Discussion

This is the first account on hermit crabs occupying shells with soft parts of snails to the Brazilian coast. It is important to note that during the last years working in the studied areas on biology and ecology of hermit crabs, almost all hermit species reported for the São Paulo coast region were found occupying only gastropod shells without soft parts of the mollusks in the natural population (Negreiros-Fransozo *et al.*, 1991; Negreiros-Fransozo and Fransozo, 1992; Martinelli and Mantelatto, 1999; Bertini and Fransozo, 2000; Mantelatto and Garcia, 2000; Mantelatto and Dominciano, 2002; Mantelatto and Meireles, in press). This situation is uncommon and inspires caution since the cause of this occupation remains unknown. However, this condition may sign for an important aspect that affect directly the life cycle of hermit crabs – the resource availability.

The fact noticed here may indicate low availability of the resources for the natural populations of hermit crabs inhabiting the soft bottom region of these bays. This assertion can be considered once from our experience working on hermit's community, this is the first occurrence of occupation of shell with parts of the snail. It is known that from the 8 species found in both bays (Biagi *et al.*, unpub.), *D. insignis* is the dominant one with a large number of specimens, and with a great variety of hermit crabs in different size classes (Meireles pers. com.). We cannot discharge the hypothesis of the predation of live gastropods by *D. insignis* in function of high abundance in the area (Meireles, pers. obs.). The competition among hermit crabs in the area as well as the low number of available resources for occupation to larger specimens of *D. insignis* can also be other stressing elements.

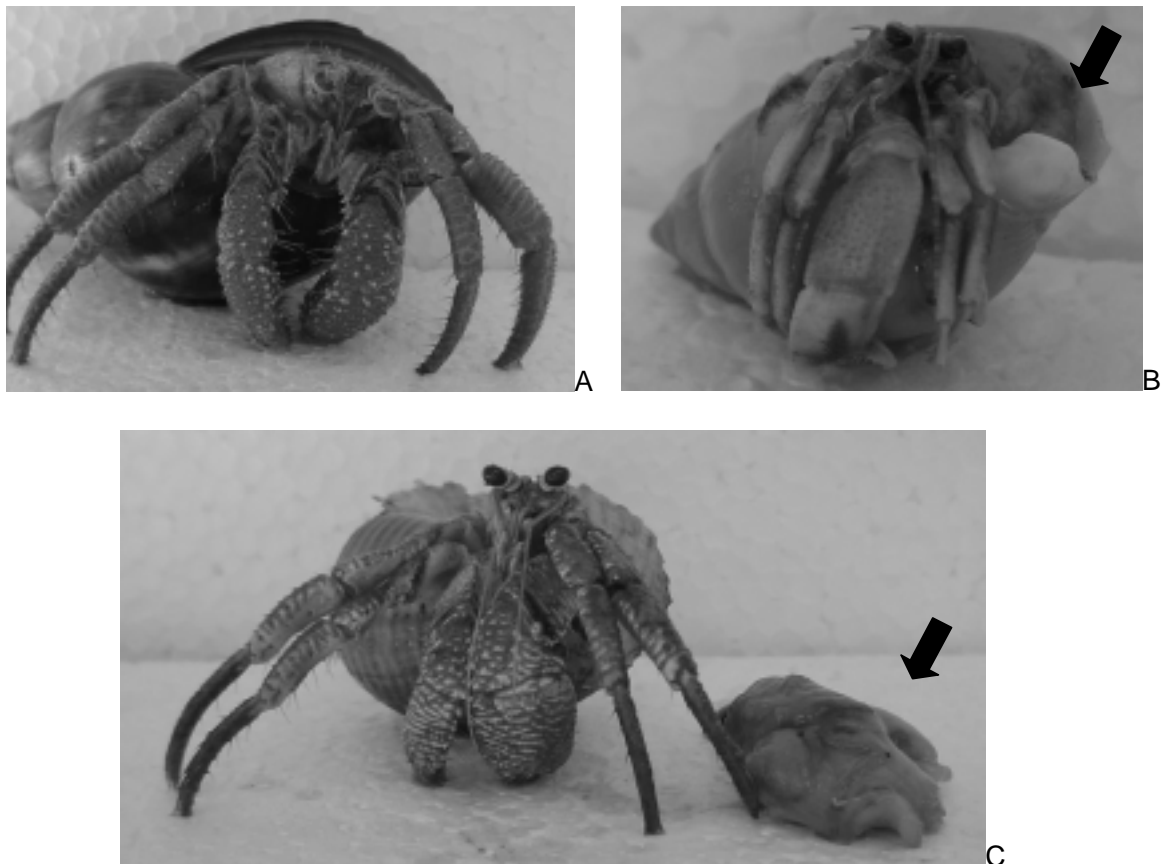
The gastropod *A. fulica* was introduced in Brazil in 1988 from Africa for human consumption as "scargot". As they have a high reproductive potential and the current market was not prepared to receive the great production, *A. fulica* has become an agricultural pest. The specimens have escaped from its artificial breeding sites dispersing to different regions and, thus colonizing them successfully (Teles *et al.*, 1997; Vasconcellos and Pile, 2001). The occupation of *A. fulica* shell in Ubatuba could be supposed a discharge by people as a sewage, taking in to account that such biological material have been reared in areas close to the Ubatuba Bay (Vasconcellos and

Pile, 2001). Our hypothesis is based on the fact the *A. fulica* is a land snail gastropod that is not reported in the marine region to date.

The present study reported isolated cases of uncommon hermit crab shell occupation in the São Paulo coast. Furthermore, intra and interspecific encounters, shell fights and low shell availability may have contributed to the occurrence of the situation described here. The most important aspect of this report is to make available this unusual information for the carcinologists' community and focus on for this condition that can affect in some way the hermit crab community.

**Table I:** Records of hermit crabs from the São Paulo coast inhabiting gastropod shells containing soft parts of snail and occupying the land snail *A. fulica*.

Species	Collection Site	Month (2003)	Total number of hermit crabs	% of soft parts occurrence	SL (mm)	Gastropod Shell species	SAW (mm)
<i>D. insignis</i>	Caraguatatuba	January	56	2%	11.2	<i>T. galea</i>	18.0
<i>D. insignis</i>	Caraguatatuba	February	37	3%	11.9	<i>T. galea</i>	18.8
<i>D. insignis</i>	Ubatuba	June	10	10%	14.9	<i>A. fulica</i>	22.4
<i>P. exilis</i>	Caraguatatuba	February	52	2%	6.0	<i>B. gradatum</i>	18.7



**Figure 1:** Hermit crabs inhabiting different shells: A) *D. insignis* occupying the land snail *Achatina fulica*; B) *P. exilis* occupying *B. gradatum* shell with remnants of the mollusk; C) *D. insignis* and the whole mollusk that were inside the *T. galea* shell. The arrows indicate parts of the mollusks.

## Acknowledgements

The authors are grateful to Dr. Adilson Fransozo (IB – UNESP - Botucatu) for assistance with collections and to Dr. Wagner E. P. Avelar (FFCLRP/USP – Ribeirão Preto) for shell

identification. Special thanks are due to Danilo Espósito and Mariana Rodrigues for helping with laboratory analysis, and to anonymous referee for providing comments on the manuscript.

## References

- Bertini, G. and Fransozo, A. 2000. Patterns of shell utilization in *Petrochirus diogenes* (Decapoda, Anomura, Diogenidae) in the Ubatuba Region, São Paulo, Brazil. *Journal of Crustacean Biology*, 20 (3): 468-473.
- Fransozo, A.; Mantelatto, F. L. M.; Bertini, G.; L. C. Fernandez-Góes and Martinelli, J. M. 1998. Distribution and assemblages of Anomuran Crustaceans in Ubatuba Bay, north coast of São Paulo State, Brazil. *Acta Biologica Venezuelica*, 18(4): 17-25.
- Garcia, R. B.; Meireles, A. L. and Mantelatto, F. L. M. in press. Unusual shelters occupied by Brazilian hermit crabs (Crustacea: Decapoda: Diogenidae). *Brazilian Journal of Biology*, 63(4).
- Hazlett, B.A. 1981. The behavioral ecology of hermit crabs. *Annual Review of Ecology and Systematics*, 12: 1-22.
- Hebling, N. J.; F. L. M. Mantelatto; M. L. Negreiros-Fransozo and Fransozo, A. 1994. Levantamento e distribuição de braquiúros e anomuros (Crustacea, Decapoda) dos sedimentos sublitorais da região da Ilha Anchieta, Ubatuba (SP). *Boletim do Instituto de Pesca*, 21: 01-09.
- Imafuku, M. and Ando, T. 1999. Behaviour and morphology of pagurid hermit crabs (Decapoda, Anomura) that live in tusk shells (Mollusca, Scaphopoda). *Crustaceana*, 72: 129-144.
- Imafuku, M. and Nakamura, Y. 1995. Hermit crabs occupying shells that contain soft parts of snails. *Crustacean Research*, 24: 19-22.
- Mantelatto F. L. M. and Garcia, R. B. 2002. Hermit crab fauna from the infralittoral zone of Anchieta Island (Ubatuba, Brazil). p. 137-143. *In: Escobar-Briones, E.E. and Alvarez, F. Modern Approaches to the Study of Crustacea*, Kluwer Academic/Plenum Publishers, New York, U.S.A.
- Mantelatto, F. L. and Meireles, A. L. *in press*. The importance of shell occupation and shell availability in the hermit crab *Pagurus brevidactylus* (Stimpson, 1859) (Paguridae) population from the southern Atlantic. *Bulletin of Marine Science*.
- Mantelatto, F. L. M. and Dominciano, L. C. C. 2002. Pattern of shell utilization by the hermit crab *Paguristes tortugae* (Diogenidae) from Anchieta Island, southern Brazil. *Scientia Marina*, 66(3): 265-272.
- Mantelatto, F. L. M. and Fransozo, A. 1999. Characterization of the physical and chemical parameters of Ubatuba Bay, northern coast of São Paulo state, Brazil. *Revista Brasileira de Biologia*, 59(1): 23-31.
- Mantelatto, F. L. M. and Garcia, R. B. 2000. Shell utilization pattern of the hermit crab *Calcinus tibicen* (Diogenidae) from southern Brazil. *Journal of Crustacean Biology*, 20(3): 460-467.
- Martinelli, J. M. and Mantelatto, F. L. M. 1999. Shell utilization by the hermit crab *Loxopagurus loxochelis* (Diogenidae) in Ubatuba Bay, Brazil. p. 719-731. *In: Schram, F. R. and Vaupel Klein, J. C. Crustaceans and the Biodiversity Crisis*, Vol. 1, Brill, Leiden.
- Negreiros-Fransozo, M. L. and Fransozo, A. 1992. Estrutura populacional e relação com a concha em *Paguristes tortugae* Schmitt, 1933 (Decapoda, Diogenidae), no litoral norte do Estado de São Paulo, Brasil. *Naturalia*, 17: 31-42.
- Negreiros-Fransozo, M. L.; A. Fransozo and Hebling, N. J. 1991. Estrutura populacional e determinação do tamanho da concha ocupada por 4 espécies de ermitões (Crustacea, Decapoda, Anomura) do litoral de São Paulo. *Biotemas*, 4(2): 135-148.
- Negreiros-Fransozo, M. L.; Fransozo, A.; Pinheiro, M. A. A.; Mantelatto, F. L. M. and Santos, S. 1997. Anomuran species (Crustacea, Decapoda) and their ecological distribution at Fortaleza Bay sublittoral, Ubatuba, São Paulo, Brazil. *Iheringia*, 83: 187-194.
- Rios, E. C. 1994. Seashells of Brazil. Rio Grande do Sul. Fundação cidade do Rio Grande, Instituto Acqua, Museu Oceanográfico de Rio Grande, Universidade de Rio Grande. 2ª Ed. 368p. + 113pl.
- Rutherford, J. C. 1977. Removal of living snails from their shells by a hermit crab. *Veliger*, 19: 438-439.
- Scully, E. P. 1983. The behavioural ecology of competition and resource utilisation among hermit crabs. p. 23-55 *In: Rebach, S. and Dunham, D.W. Studies in adaptation: the behaviour of higher Crustacea*. John Wiley & Sons, New York.
- Teles, H. M. S.; Vaz, J. F.; Fontes, L. R. and Domingos, M. F. 1997. Registro de *Achatina fulica* Bowdich, 1822 (Mollusca, Gastropoda) no Brasil: caramujo hospedeiro intermediário da angiostrongilíase. *Revista de Saúde Pública*, 31(3): 310-312.
- Vasconcelos, M. C. and Pile, E. 2001. Ocorrência de *Achatina fulica* no Vale do Paraíba, Estado do Rio de Janeiro, Brasil. *Revista de Saúde Pública*, 35(6): 582-584.