

# INTERSPECIFIC INTERACTIONS BETWEEN THE GRAPSID CRABS *PERCNON GIBBESI* AND *PACHYGRAPSUS MARMORATUS*: IMPLICATIONS OF AN INVADER

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## Abstract

One-on-one interspecific encounters between the recently introduced alien *Percnon gibbesi* and the native *Pachygrapsus marmoratus*, with which *P. gibbesi* occurs syntopically, were staged in the laboratory to assess the behaviour of these species relative to each other. Unless the encounter involved large *P. gibbesi* with small *P. marmoratus*, the native species was the 'winner'. These results suggest that the native species has competitive superiority over the invader and is unlikely to suffer from spatial resource partitioning or, worse, competitive exclusion from its natural habitat as a result of the invasion by *P. gibbesi*.

**Keywords :** *Decapoda, Behaviour, Competition, Species Introduction.*

## Introduction

Human-mediated transport of species from one biogeographical setting to another is now considered to constitute a serious threat to marine ecosystems and biodiversity [1]. Knowledge on the actual impacts of a specific introduced species on native biota is often anecdotal and detailed evidence is rare [2]. This applies also to the subtropical grapsid crab, *Percnon gibbesi*, which was first recorded from the Mediterranean Sea in 1999 and from the Maltese Islands in 2001 [3]. Field observations made in the Maltese Islands suggest that *P. gibbesi* overlaps in habitat with the native grapsid *Pachygrapsus marmoratus* [4], and therefore, the possibility of competition might occur. This study was designed to investigate the outcome of interspecific interactions between the two crabs when space is restricted.

## Methods

Individuals of both species were collected by hand from Pembroke and Marsascalea, Malta. Crabs were divided into three groups according to their carapace length (CL): large = CL > 30 mm, medium = CL 20-30 mm, and small = CL < 20 mm. After an acclimation period of 7 days in aerated seawater at 20 deg.C without feeding, one-on-one interspecific interactions between individuals of the two species in different size combinations were staged in rectangular aquaria of dimensions (29.5 x 20 x 19 cm) and were recorded using videography. These video records were then analysed by dividing the behavioural sequence into 'acts' (see legend to Fig 1). The behaviour of the crabs was recorded in an alternating sequence, i.e. act by crab 1, act by crab 2, etc. Ten replicate trials for each size combinations were made.

## Results and discussion

*P. marmoratus* was the initiator of an encounter, defined as the crab that made the first move towards or engaged in physical contact with its opponent, in 80.8% of the trials and the winner of an encounter, defined as the crab that elicited repeated retreats from or inflicted harm to or killed its opponent, in 86.9% of the trials. *P. gibbesi* won encounters only when matched with a small *P. marmoratus*, where the ratio of *P. gibbesi* chelae length to that of *P. marmoratus* was >1. This suggests that the native species has a higher resource holding potential than the invader. *P. gibbesi* was never observed to attack its opponent unless the latter advanced towards or engaged in physical contact with the *Percnon*.

In 10 out of 16 encounters between a large or medium *P. marmoratus* and a small *P. gibbesi*, the former deliberately attacked the latter and killed the *Percnon*. In general, all the initial acts performed by *P. marmoratus* significantly affected the distribution of the following acts (p-value associated with chi-square was less than 0.001) indicating that communication between the two species via visual displays is taking place. This may be important in determining the degree to which these two species overlap in their resource utilization. Irrespective of size, *P. gibbesi* exhibited the highest number of retreat or submissive (low intensity merus display, L) actions (which constituted 92.3% of the acts performed by *Percnon*) in response to acts by *P. marmoratus* such as advance, medium and high intensity merus display (M&H), attack with chelae in open position (Ac) and physical contact (T) (Fig. 1).

## Conclusion

One determinant of invasion success is the nature of competitive interactions with native ecological analogues. Our results suggest that the native species is unlikely to be excluded from its natural habitat by the alien, or even that any significant spatial resource partitioning on the part of *P. marmoratus* will occur. The successful invasion by *Percnon* on Maltese shores (and perhaps other Mediterranean shores) may be due to this species finding habitat space that does not bring it into competition with native crab species with similar resource requirements.

## References

- 1 - SCBD, 2001. *Assessment and management of alien species that threaten ecosystems, habitats and species.* (CBD Technical Paper No. 1). Secretariat of the Convention on Biological Diversity, Montreal, Canada; 123pp.
- 2 - Ruiz, G.M., Carlton, J.T., Grosholz, E.D., and Hines, A.H., 1997. Global invasions of marine and estuarine habitats by non-indigenous species: mechanisms, extent and consequences. *Amer. Zool.*, 37: 621-632.
- 3 - Borg J.J. and Attard-Montalto J., 2002. The grapsid crab *Percnon gibbesi* (Milne Edwards, 1853) (Crustacea, Decapoda, Brachyura), a new addition to the marine fauna of Malta. *Cent. Medit. Nat.*, 3: 159-160.
- 4 - Sciberras, M. J., 2005. Aspects of the biology of the alien grapsid crab *Percnon gibbesi* in the Maltese Islands. Unpublished B.Sc. (Hons) dissertation, Department of Biology, Faculty of Science, University of Malta; 96pp.

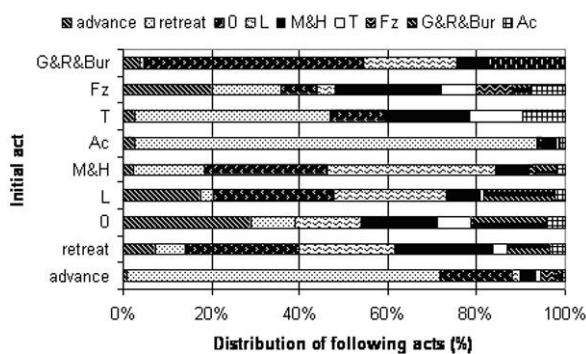


Fig. 1. Percentage distribution of acts following specific initial acts (shown on the y-axis) during the staged encounters between *P. gibbesi* and *P. marmoratus*. The acts considered were: advance of crab 1 towards crab 2; retreat by crab 2, L = low intensity merus display where the crab adopts a neutral posture by holding its body close to the substratum with chelae folded inwards; M&H = medium and high intensity merus displays where the crab lifts its body off the substratum on its dactyls and spreads its chelae open; T = physical touch; Fz = complete cessation of movement; Ac = attack with chelae in open position; G&R&Bur refer to grooming, random movement, and burrowing; 0 (does nothing) is an act used to preserve the alternation of acts whenever an intra-individual transition occurred.