

Aspects of sound communication in the pearl fish (*Carapidae*) under laboratory conditions.

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Introduction

Several species of *Carapidae* are well known to have commensal or parasitic relationships with invertebrates. Recently, Parmentier et al. (2003) described for the first time the sounds produced by three species of *Carapidae*. In these species, the sound-producing system seems to indicate that the action made by the sonic muscles is responsible for the sound emissions by provoking a vibration of the thinner zone in front of In Moorea (French Polynesia), *Carapus boraborensis* and *Carapus homei* are usually found in the same species of sea cucumber.



AIM In order to understand the functional significance of their sound emissions, heterosexual and heterospecific meets were realised under laboratory conditions inside the same sea cucumber (*Bohadschiaargus*).

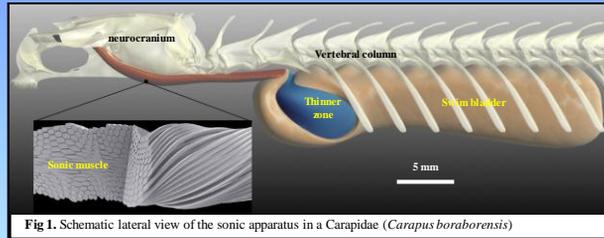


Fig 1. Schematic lateral view of the sonic apparatus in a *Carapidae* (*Carapus boraborensis*)

Results : situation A

Fish directly attempted to introduce within the host cloaca. Sounds were emitted **only** during the introduction or when the fish was just inside the sea cucumber.

- ▶ The sounds are composed of trains of 10 to 28 pulses in *C. boraborensis* males, 16 to 83 pulses in *C. boraborensis* females and more or less 10 pulses in *C. homei*.
- ▶ Sounds made by male and female *C. boraborensis*, and *C. homei* can be distinguished on the basis of the pulse (fig. 4) and interpulses (ANOVA, $p < 0,001$).

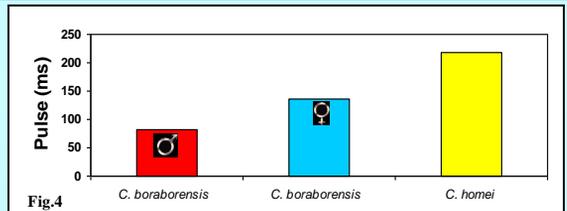


Fig.4

Results : situation B

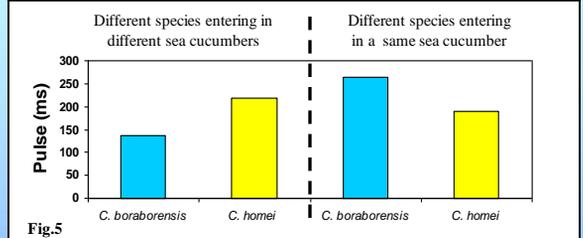


Fig.5

- ▶ Sounds of each species are reduced to one to three pulses
- ▶ The average interpulse period of *C. boraborensis* tends to lengthen when the latter fish meets *C. boraborensis* inside the sea cucumber. (ANOVA, $p < 0,001$) (fig.5)
- ▶ On the other hand the average interpulse of *C. homei* tends to shorten when the latter fish meets *C. boraborensis* inside the sea cucumber. (ANOVA, $p < 0,001$) (fig.5)

Moreover it is important to note that this adaptation of the signal in interspecific situation is made immediately, at the first sound emission

Material and Methods

- ▶ For each experiment, a specimen of *Bohadschia argus* was placed in a small tank in which *Carapidae* specimens were secondarily released.

Situation A : *C. boraborensis* male and female, and *C. homei* were presented to **different** sea cucumbers

Situation B : fish of different species (*C. boraborensis* and *C. homei*) were presented to the **same** sea cucumber

- ▶ Recordings were realised with an hydrophone (10Hz/23,8kHz, -3dB) coupled with a preamplifier (-186dB re 1V for a sound pressure of 1μPa, 2H/20kHz, -3dB) and a CAG card. Recordings were digitalised by an « analog to digital converter » and processed by a computer hardware.

- ▶ The following temporal characteristics of the sounds were measured (fig. 3) :

Pulse and sound duration (ms) : time interval between the onset of one pulse or sound and the end of these sounds.

Pulse period (ms) : time interval between the main peaks of two successive pulses.

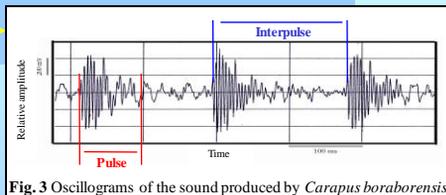


Fig. 3 Oscillograms of the sound produced by *Carapus boraborensis*

Discussion and Conclusion

- ▶ Our findings clearly support that, in *C. boraborensis*, sounds are of functional importance in sex identification, with short pulses for the male and longer ones for the female. These difference could be linked to a difference in the structure of the posterior end of the swim bladder (Parmentier and Vandewalle, in press, fig. 6). Generally speaking, vertebrate males have more vocal abilities than females. However, in this case the sex ratio (1 male : 3 females) could be at the origin of this singularity.

- ▶ This study shows also **for the first time** that these fish are able to change and to adapt their sounds in order to communicate with heterospecifics.

Sounds are used for sex identification, species recognition and territorial defense



Fig. 6 View of the posterior end of the swim bladder in *Carapus boraborensis*

Bibliography

Parmentier E, Vandewalle P & Lagardère J-P - Sound producing mechanisms and recordings in three *Carapidae* species *Journal of Comparative Physiology A*, 189: 283-292. 2003

Parmentier E & Vandewalle P - Contribution to the study of the relations between fish of the family of *Carapidae* and their holothurian hosts. *Marine Biology* (in press)