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## FIRST OBSERVATIONS ON THE SWIMMING BEHAVIOUR OF *PSEUDODIAPTOMUS MARINUS* FROM LAKE FARO

### OSSERVAZIONI PRELIMINARI SUL COMPORTEMENTO NATATORIO DI *PSEUDODIAPTOMUS MARINUS* DAL LAGO DI FARO

**Abstract** - The calanoid copepod *Pseudodiaptomus marinus* is an invasive copepod, first recorded in Lake Faro (Messina, Italy) in October 2008 and now representing the third species in terms of abundance. In this study, the swimming behaviour of the adult reproductive stages (males, females and ovigerous females) has been investigated, revealing specific adaptations to the life in a pelagic system.

**Key-words:** *Pseudodiaptomus marinus*, swimming behaviour, invasive species.

**Introduction** - The calanoid copepod *Pseudodiaptomus marinus* (Sato, 1913) is a typical estuarine-coastal copepod being found only in shallow inshore waters where the food supply is in general abundant. It is native of the Indo-Pacific region, but in the last 50 years it has successfully colonized new areas. *P. marinus* was first recorded in Lake Faro (a small coastal brackish lake situated at the North-Eastern limit of Sicily) in October 2008, and since its first introduction the copepod has become a stable component of the total zooplankton assemblage gradually becoming the third species in terms of abundance. Owing to the presence of an anoxic layer in the deepest part of the lake, the copepod, which is usually epibenthic during the morning and pelagic at night (Uye and Kasahara, 1983), has become truly planktonic, a behavioral adaptation to survive in such hostile environment. By means of video recordings, for the first time the swimming behaviour of the adult stages of *P. marinus* (females, males and ovigerous females) have been investigated in this study. The reproductive stages were filmed in presence and in absence of food to evaluate if and how the presence of prey might affect the behaviour of *P. marinus*. The motion was quantitatively analyzed evaluating the speed and the complexity of digitalized tracks, and it was further analyzed using symbolic analysis.

**Materials and methods** - A gentle sampling with a WP2 net was made in Lake Faro in January 2011. An amount of 70 copepodides were sorted and used to start up a laboratory culture. In May 2011, around 50 individuals (adults and copepodides) were transferred to Wimereux to initiate other cultures for the rearing of specimens for video recordings. Animals were put in a plexiglass aquarium (10×10×10 cm, 1 l volume) lit from the bottom using an infrared (IR) LED array (880 nm) in a dark room at a constant temperature of 19 °C. Videorecordings were performed with a SONY digital IR sensitive video camera recorder (DCR-HC96E) operating at a frequency of 25 frames/s, equipped with a Karl Zeiss lens. Two set of experiments were performed: copepods swimming in an aquarium filled with filtered water; and copepods swimming in an aquarium with food in excess, the red alga *Porphyridium cruentum*. Selected tracks were digitized with LabTrack version 2.1 (BioRAS

ApS, Copenhagen, Denmark). For each trajectory, the total swimming speed and its morphological complexity (estimated through the net-to-gross displacement ratio NGDR, see Buskey, 1984) were calculated. In addition, a symbolic analysis was performed on the instantaneous speed of each track to reveal changes in the locomotion (Schmitt *et al.*, 2006).

**Results** - In presence of food, all reproductive stages swam with speeds and NGDR similar to the case with filtered water. Females were breaking for 66% of the time in filtered water (50% in presence of food), while when *P. cruentum* was added more time was spent cruising (36% rather than 22%). Males behaved similarly to females in presence of food, while in filtered water the time breaking and cruising were respectively 54% and 38%. Ovigerous females were breaking for 62% of time and cruising for 30% in filtered water, whereas when food was added these values turned to 56% and 31%, respectively.

**Conclusions** - The analysis of the swimming behaviour showed that the benthic vocation of *P. marinus* was much more evident for females than for males, the latter having a much higher explorative behaviour likely to encounter the mates. Ovigerous females explored the surrounding environment more intensively than non ovigerous females, probably for the higher food requirements. In general, it has been observed that feeding strategy is not much different between males and females, as already observed by Uye and Kasahara (1983), but swimming motion shows marked sex-dependent features. From the video observations it is evident the typical behaviour displayed by the representatives of the genus *Pseudodiaptomus* of attaching to the substrate (Fancett and Kimmerer, 1985) for most of the time. This behaviour is used by females more than males, the latter displaying several explorative searches to explore the water volume in which are immersed likely in search of the female.

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