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Daily movement patterns of *Maja crispata* Risso 1827 (Brachyura, Majidae)

Sonja FÜRBÖCK and Robert A. PATZNER

Organismic Biology, University of Salzburg, Hellbrunnerstr. 34, A-5020 Salzburg, Austria

Daily movements in a population of the spider crab Maja crispata *were studied in the northern Adriatic Sea. The sex ratio of males to females was 3:2, with males reaching a maximum carapace length of 91 mm and females a maximum of 74 mm.* M. crispata *was most abundant on the bottom of the boulder field than in any other habitat. The seven studied specimens had non-directional movements in unrestricted areas and stayed mostly on the rocky bottom at depths ranging 0.8-3.5 m. The maximum distance from the starting point, reached in 9 days, was 16 m.*

Key words: Migration, habitat, *Maja crispata*, Majidae, Adriatic

INTRODUCTION

The spiny spider crab *Maja crispata*, a member of the family Majidae, lives in rocky shore habitats and sandy, shallow environments rich in algae. It is found in the Mediterranean Sea, along the Atlantic coast of Portugal, and on the west coast of Africa to the Cap Verde and Cap Blanc Islands (ZARIQUIEY-ALVAREZ, 1968; MANNING & HOLTHUIS, 1981; ŠTEVČIĆ & GALIL, 1993; UDEKEM D`ACOZ, 1999). The carapace has tufts of hook-like bristles or "setae" that enable the animal to attach algae as camouflage (FÜRBÖCK & PATZNER, 2005). When not covered with algae, the carapace appears to be covered with bumps (GRUNER *et al.,* 1993).

With the exception of *M. squinado* (Herbst, 1788), little attention has been paid to the ecology and behavior of Mediterranean spider crabs. The feeding behavior of *M. crispata* was described by ŠTEVČIĆ (1985), but little is known about its movements. The goal of this study was to discover the daily movement patterns of *M. crispata* including direction, distance, and habitat.

MATERIAL AND METHODS

The study was carried out in a bay near Camping Porton Biondi on the coast of Rovinj, Croatia, in the northern Adriatic Sea (Fig. 1). The coast consists of coarse sand and some large rocks. An artificial wall of large boulders, built in the center section of the shore of the bay, creates a relatively steep drop to -6 m. The boulders and rocks are covered by algae of different species (FÜRBÖCK & PATZNER, 2005). The northern section of the study area is flatter than the southern.

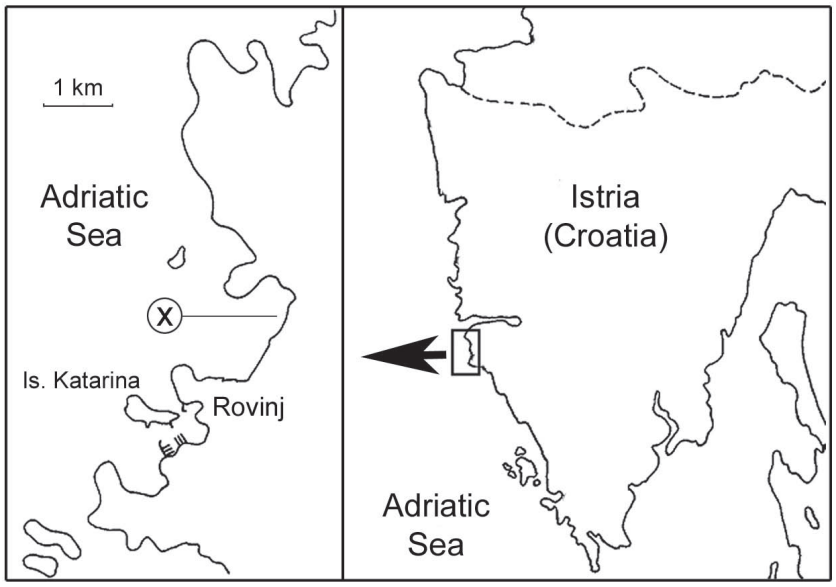

Fig. 1. Rovinj in the northern Adriatic Sea. X = the investigated area

Fifteen specimens of *M. crispata* were tagged by winding different colored thin metal wires around the carapace. The individuals were located by snorkeling four or five times a day (9:00, 12:00, 15:00, 18:00, and every second day, 21:00) during July 2002. The direction of movement and distances between consecutive locations were marked with colored stones. The crabs were sexed and the lengths of the carapace from the tip of the rostrum to the posterior margin in the midline were recorded.

RESULTS

General observations

M. crispata was most abundant on the bottom of the boulder field than in any other habitat (sand, sea grass meadows, plain rocks) in the vicinity. The crabs were often totally covered by algae so that they were difficult to see against the natural background when at rest. They were able to climb over rocks and run. If alarmed, they stopped moving and froze. Touching disturbed them, and they tried to escape by running away or pinching with their chelae.

Of the 15 examined specimens, the sex ratio of males to females was 3:2. The carapace length of the adult males ranged 57-91 mm (mean 65), slightly larger than that of the adult females, 45-74 mm (mean 60).

Movements

It was possible to observe only seven of the 15 specimens for 3-9 days; the rest were lost after a shorter time. The movements of the seven specimens are shown in Fig. 2. Starting depths were 5.5 m (specimen 1), 3.8 m (specimen 2), 3.0 m (specimen 3), 1.9 m (specimen 4), 0.9 m (specimen 5), 1.5 m (specimen 6), and 0.9 m (specimen 7). No habitat changes were observed during the study. The small-scale movements were carried out in small unrestricted areas, mostly on the rocky bottom at depths ranging 0.8-3.5 mm with no apparent orientation to the movements. The greatest distance traveled from the starting point was 16 m.

DISCUSSION

M. crispata is a climber (SCHÄFER, 1954) in the crawling II group proposed by LAUGHLIN (1981). These two characteristics (climbing and crawling), along with the morphology of their extremities, make *M. crispata* better suited to live and move on hard-bottom substrates than in other biotopes. This was shown by CARMONA-

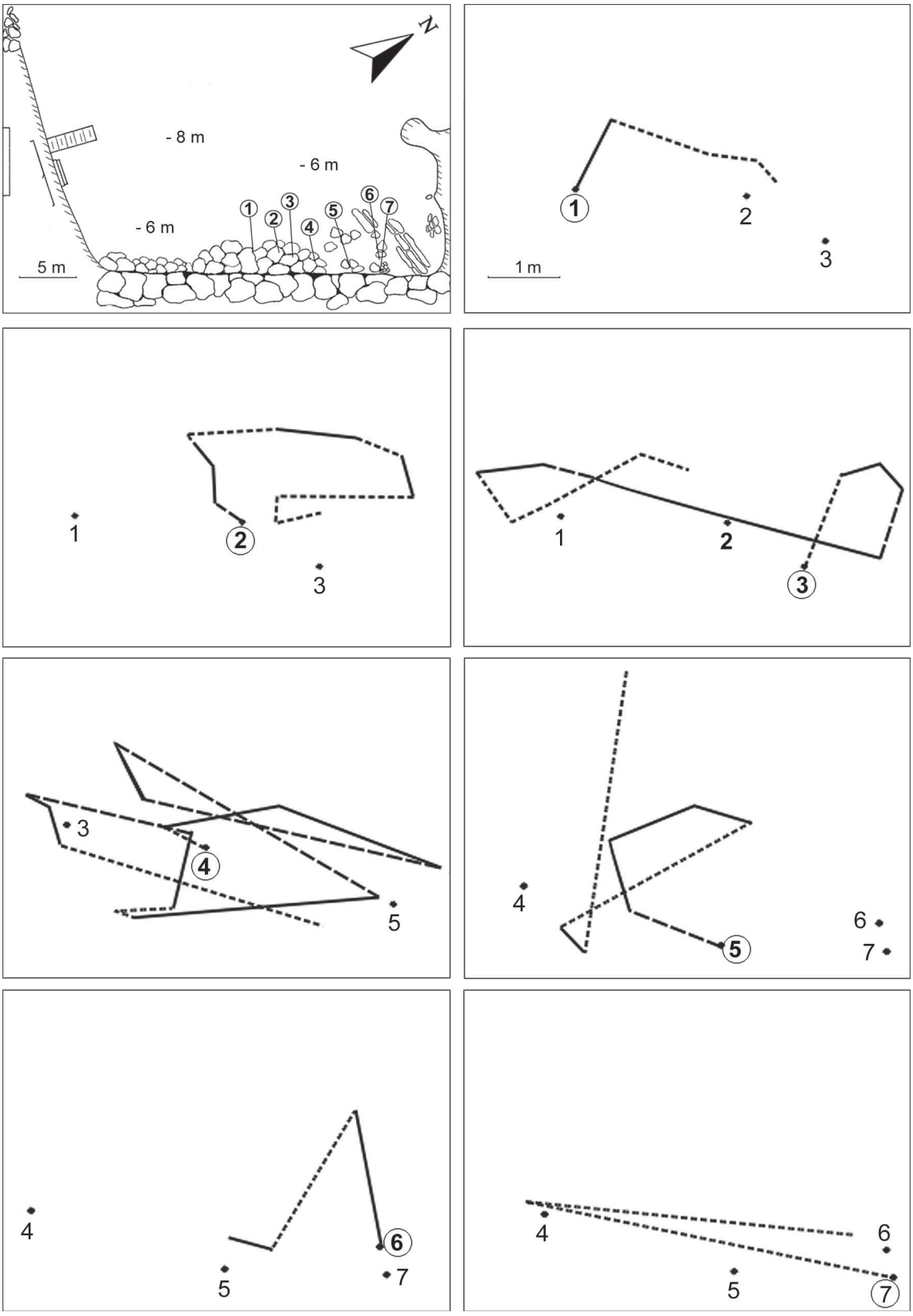

Fig. 2. Study site near Camping Porton Biondi. Numbers indicate starting points of seven specimens. Solid line = movements during the day; long dashed line = movements during the night; short dashed line = movements over a longer period of time

SUÁREZ (2002) who studied *M. crispata* in three habitats – *Posidonia* meadows, *Posidonia* matte, and rocky sublittoral. Also in the present study, *M. crispata* preferred rocky areas to soft bottoms. There are no *Posidonia* in the Rovinj area.

In studies of juveniles and adults of the spider crab *M. squinado* using telemetry and electronic tags in Galicia, NW Spain, movement was characterized by temperature, depth, and substrate (GONZÁLEZ-GURRIARÁN & FREIRE, 1994; GONZÁLEZ-GURRIARÁN *et al.,* 2002). The adult *M. squinado* had directional movements along a gradient from 10 to 100 m within a short period and over changing substrates. The juveniles, however, had slow, non-directional movements in a restricted area with no habitat changes. The movement patterns of the seven *M. crispata* in the present study were non-directional and within an unrestricted area, similar to juvenile *M. squinado*.

Knowledge of the movement patterns of *M. crispata*, as in the case of *M. squinado*, can play a role in fisheries.

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Dnevna slika migriranja kratkorepog raka, *Maja crispata*, Risso 1827 (Brachyura, Majidae)

Sonja FÜRBÖCK i Robert A. PATZNER

Biologija organizama, Sveučilište u Salzburgu, Hellbrunnerstr. 34, A-5020 Salzburg, Austrija

SAŽETAK

U sjevernom Jadranu su promatrana dnevna pomicanja populacije brahiurnog raka, *Maja crispata*. Odnos spolova, mužjaka prema ženkama, iznosio je 3:2. Mužjaci su imali maksimalnu dužinu oklopa 91 mm, a ženke 74 mm. *Maja crispata* češće se nalazila na šljunkovitom dnu nego na bilo kojem drugom habitatu. Sedmero promatranih primjeraka nije se pomicalo prema nekom određenom području, nego se zadržavalo većim dijelom na tvrdom supstratu, između 0,8 i 3,5 m dubine. Maksimalna udaljenost od početnog položaja postignuta je u 9 dana, a iznosila je 16 metara.

Ključne riječi: Migracija, habitat, *Maja crispata*, Majidae, Jadran