

## Larval mantis shrimp *Rissoides desmaresti* (RISSE, 1816) (Stomatopoda) in the Belgian part of the North Sea

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The mantis shrimp *Rissoides desmaresti* (RISSE, 1816) is a stomatopod crustacean (Stomatopoda: Squillidae), native to the Mediterranean Sea and the North East Atlantic from the Southern North Sea to the coasts of Madeira (Portugal) (1, 2, 3).

Adult *R. desmaresti* are benthic and burrow in the sediment (4). They occupy sub-littoral habitats to a depth of 75-80 m (5) and can reach lengths up to 97 mm (6). Adults are fast and efficient ambush predators that use their two-toothed, raptorial forelimbs (2<sup>nd</sup> thoracopods) as a spear to capture small fish and shrimps (7). They are preyed upon by demersal fish, such as tope *Galeorhinus galeus* (LINNAEUS, 1758) and bull-rout *Myoxocephalus scorpius* (LINNAEUS, 1758) (6, 8).

The larvae of *R. desmaresti* (Fig. 1) are planktonic, have a total body length of 3.6 to 22.5 mm, and also possess strong raptorial appendices, which are mainly used to prey upon larvae and eggs of echinoderms and molluscs (9, 10).

Both adult and larval specimens of *R. desmaresti* have been reported infrequently in the Southern North Sea and English Channel region (8, 11).

In Belgian waters, adults have so far never been recorded (12). However, Stomatopoda larvae were collected by G. Gilson during the European ICES (International Council of the Exploration of the Sea) campaigns between 1902 and 1913 (Gilson collection, largely preserved at the Royal Belgian Institute for Natural Sciences (RBINS)



Fig. 1. – Picture of the 6<sup>th</sup> stage megalopa larva of *Rissoides desmaresti* (specimen 1).

in Brussels, Belgium). Several specimens that were identified as *Erichthus* larvae were re-identified in the 1960s as larvae of *Squilla desmaresti* (11), nowadays renamed to *Rissoides desmaresti* (13). An overview of these findings is shown in Figure 2. Some other specimens could not be re-identified as they were absent from the Gilson collection, but are likely to be larvae of *R. desmaresti*. The latter are presented as ‘*Erichthus*’ observations in Figure 2. Larvae of *R. desmaresti* have been found all over the Belgian part of the North Sea (BPNS) area. However, since the early 1900s, no more recordings of *R. desmaresti* larvae were made or could be uncovered for the BPNS, not even in more recent hyperbenthic and zooplanktonic studies performed in this area (14, 15).

Almost a century later, in August and September 2011, five larval *R. desmaresti* specimens were caught during zooplankton sampling campaigns in the BPNS on board RV Zeeleeuw. Four larvae were found at monitoring station W09 (N 51°45' E 2°42') situated north of ‘Hinderbanken’ and one at ‘Thornton bank’ monitoring station W07tris (N 51° 31.72' E 2° 52.44') (Fig. 2). A WP3 net (mesh size 1000 µm, Ø 1 m) was employed to collect the zooplankton samples. The net was trawled at a speed of approximately three knots, filtering the water column four times from surface to bottom in an undulating haul. Zooplankton samples were preserved in 4% buffered formaldehyde and analysed in the laboratory, using a stereomicroscope.

The larval morphology of *R. desmaresti* can easily be distinguished from another Stomatopoda species *Platysquilla eusebia* (Risso, 1816) that is also found in the North Sea, by comparing the shapes of the carapax and telson (9, 11).

During larval development nine megalopa stages can be morphologically distinguished (9). The three specimens collected in August could be allocated to the 6<sup>th</sup> and 7<sup>th</sup> stage, the two specimens caught in September to the 8<sup>th</sup> stage. Examined identification characteristics are listed in Table 1.

The larvae that were re-identified from the Gilson collection were also caught in August and September, but belonged to different developmental stages, ranging from 2<sup>nd</sup> megalopa to postlarval stage (Table 2). The duration of larval development in *R. desmaresti* has not thoroughly been investigated yet. However, there are similarities with other Squillidae, in particular *Squilla mantis* (LINNAEUS, 1758). In late autumn and winter, female mantis shrimp prepare for reproduction, but spawning only happens in spring (mid-March – mid-April) (6, 9). After a ten-week incubation period (as in *S. mantis*), stage 1 megalopa larvae of *R. desmaresti* should be present in the water in June or July. Stage 8 and 9 larvae should show up in the plankton between August and October (8-12 weeks later, just as in *S. mantis*), which is consistent with our findings for *R. desmaresti* (Table 2). Hereafter,

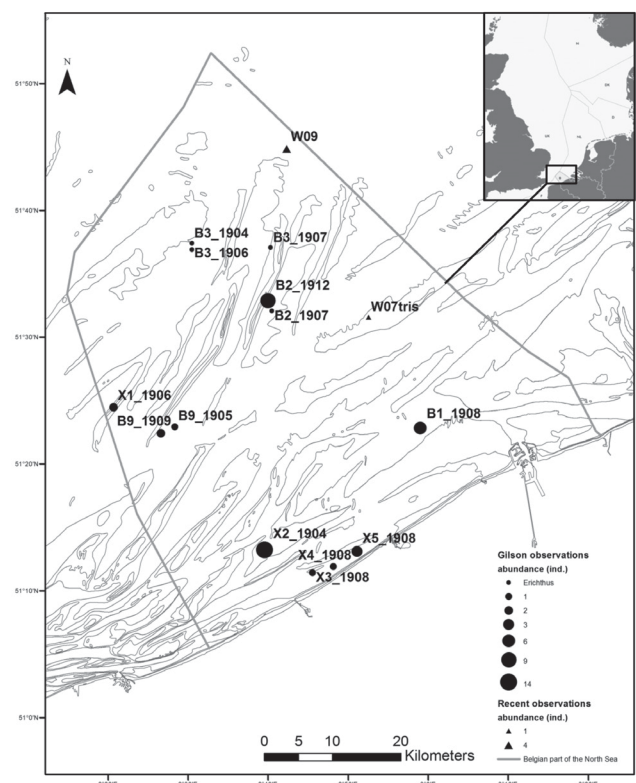


Fig. 2. – Spatial distribution of larval *Rissoides desmaresti* in the Belgian part of the North Sea. Triangles (▲) indicate recent observations; circles (●) indicate observations by Gilson from the early 1900s. Note: Coordinates of stations labeled ‘X’ are estimations based on descriptions in VAN DER BAAN & HOLTHUIS (11).

TABLE 1

Examined identification characteristics for the five collected specimens (verified with GIESBRECHT (9)), A= antenulla, B= basis, I= ischium, T1= 1<sup>st</sup> thoracopod or 'cleaning leg', T2= 2<sup>nd</sup> thoracopod or raptorial leg, T3 – T5= 3<sup>rd</sup> – 5<sup>th</sup> thoracopod, na= not applicable, + = present, - = absent.

| Characteristics                    | Spec 1     | Spec 2          | Spec 3     | Spec 4          | Spec 5     |
|------------------------------------|------------|-----------------|------------|-----------------|------------|
| Location                           | W07tris    | W09             | W09        | W09             | W09        |
| Date of collection                 | 3 Aug 2011 | 3 Aug 2011      | 3 Aug 2011 | 2 Sep 2011      | 2 Sep 2011 |
| Filtered volume (m <sup>3</sup> )  | 85         | 242             | 242        | 483             | 483        |
| Density (ind/m <sup>3</sup> )      | 0.012      | -----0.008----- |            | -----0.004----- |            |
| Length (rostrum-telson) (mm)       | 10.7       | 11.4            | 10.8       | 17.0            | 17.0       |
| # articles dorsal flagellum of A   | 2          | 2               | 3          | 8               | 8          |
| # articles ventral flagellum of A  | 1          | 1               | 2          | 4               | 4          |
| Ratio width and length telson      | na         | na              | 4:5        | na              | na         |
| Ratio B + I of T3 and B of T2      | 2:7        | 2:7             | 1:2        | >3:4            | >3:4       |
| Gills of T3                        | na         | na              | +          | na              | na         |
| Gills of T4                        | na         | na              | +          | na              | na         |
| Gills of T5                        | na         | na              | -          | na              | na         |
| Gills T1 equal in size as gills T2 | na         | na              | na         | yes             | yes        |
| Larval development stage           | 6          | 6               | 7          | 8               | 8          |

the larva undergoes metamorphosis (four postlarval stages were described by GIESBRECHT (9)), which results in a pubescent adult living in and on the sediment (duration approximately 2-3 months) (6).

It is unclear how the larvae of *R. desmaresti* arrived in the BPNS. Adult Stomatopoda have never been observed in the BPNS despite regular benthic monitoring campaigns with Van Veen grabs and an 8 m shrimp trawl (mesh size 20 mm in the cod end) since the late 1970s (12). Benthic specialists were addressed, but none of them could confirm an observation in the BPNS. However, adults were recently observed at the east, south (including English Channel area) and west coast of the UK by divers and in beam trawl and grab samples (4, 8, 16). There are a few observations in the Dutch part of the

North Sea from the early 1900s (11) and a few recent unpublished observations. The Southern North Sea is known as the northern boundary of the distribution range for *R. desmaresti*. The northernmost sighting of an adult was offshore from the Dutch Wadden islands (N 53°42' E 3°52') on 31 January 1963 (11).

Since dominant surface currents run in a north easterly direction, larvae might be transported to the BPNS and beyond from populations in the English Channel and the south coast of the UK (17). Increase in sea water temperature due to global warming might favour this larval transport and survival.

The absence of adult Stomatopoda in the BPNS is probably also related to the lack of suitable habitat. Adults require a particular sediment

TABLE 2

Overview of larval stages of *Rissoides desmaresti* found in the Belgian part of the North Sea (M = megalopa, PL = postlarva), recent observations are marked in bold.

| Station         | Date             | Larval stages |    |    |    |    |    |          |          |          | PL |
|-----------------|------------------|---------------|----|----|----|----|----|----------|----------|----------|----|
|                 |                  | M1            | M2 | M3 | M4 | M5 | M6 | M7       | M8       | M9       |    |
| X2_1904         | 29/08/1904       |               |    |    |    |    |    |          | 14       |          |    |
| B9_1905         | 25/08/1905       |               |    |    |    |    |    | 1        |          |          |    |
| X1_1906         | 23/08/1906       |               | 1  |    |    | 1  |    |          |          |          |    |
| B1_1908         | 25/08/1908       |               |    |    |    | 6  |    |          |          |          |    |
| X5_1908         | 1/09/1908        |               |    |    |    |    |    |          |          | 2        | 1  |
| X3_1908         | 16/09/1908       |               |    |    |    |    |    |          | 1        |          |    |
| X4_1908         | 23/09/1908       |               |    |    |    |    |    |          |          | 1        |    |
| B9_1909         | 22/08/1909       |               |    |    | 1  |    |    | 1        |          |          |    |
| B2_1912         | 25/08/1912       |               |    |    |    | 9  |    |          |          |          |    |
| <b>W07tris</b>  | <b>6/08/2011</b> |               |    |    |    |    |    | <b>1</b> |          |          |    |
| <b>W09_Aug</b>  | <b>7/08/2011</b> |               |    |    |    |    |    | <b>1</b> | <b>1</b> |          |    |
| <b>W09_Sept</b> | <b>8/09/2011</b> |               |    |    |    |    |    |          |          | <b>2</b> |    |

composition (a mixture of mud, sand and gravel) to construct a U-shaped burrow, while they avoid sites with either high mud concentration (> 70%) or sandy sediments with very low mud concentrations ( $\leq 2\%$ ) (4). The BPNS is characterised by mixed sediments, but only the nearshore area (overlapping with the *Abra alba* benthic community (18, 19)) contains enough mud to construct cohesive burrows (20). Together with disturbance by ubiquitous demersal fishing activities, the current lack of a proper gravel concentration in the sediment mixture probably prevents the settlement of stable *R. desmaresti* populations.

In conclusion, this manuscript describes five new recordings of larvae of the mantis shrimp *Rissoides desmaresti* in the Belgian part of the North Sea, which are the first recordings since the early 1900s. The species *R. desmaresti* and the order Stomatopoda can now be added to the Belgian marine species list (12). The larvae were most probably transported with the currents through the English Channel, possibly favoured by global sea water temperature increase.

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