

Development and movement of the opisthobranch, *Hydatina physis*, in the Solomon Islands

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Abstract

This study investigated several aspects of the life history of the opisthobranch, *Hydatina physis*, including the circadian foraging cycle, monthly breeding activity, development, settlement preferences and growth, using laboratory trials and field observations. We have recently published results on the nocturnal circadian rhythm mediated by photic intensity and modulated by food availability (Hamel and Mercier 2006). The present study further showed that the average absolute distance covered daily was around 471 cm. All individuals exhibited apparently random movements, changing direction after each surfacing, although a degree of homing behaviour was apparent. The courtship, copulation, egg-laying and hatching of *H. physis* was primarily influenced by the lunar cycle (Hamel and Mercier 2006). Each capsule contained between 0 and 14 eggs and/or embryos. In almost all capsule masses, abnormal development and high mortality rates were observed in the first third of the capsules released. In part of the mass that developed normally, veligers developed around 3 days after capsule-laying. They emerged from the capsules and began to feed on phytoplankton about 2 days later, settled after 7.5–9 days, and reached a size of around 4 mm after 5.5 months.

Introduction

The green-lined paperbubble, *Hydatina physis* Linnaeus, 1758, is an opisthobranch gastropod that is found circum-globally in shallow tropical waters of the Atlantic and Indo-Pacific Oceans (Rudman 1972; Kilburn and Rippey 1982; Wirtz 1999; Abbott and Dance 2000). Even though *H. physis* is widely distributed and is attractive to aquarists and shell collectors (Kilburn and Rippey 1982), data on its biology remain scarce and mostly anecdotal. According to Beeman (1977), opisthobranch populations tend to be sporadically explosive, which can partially account for the rarity of published data on their reproductive habits.

We have recently found that adult *H. physis* express a well-defined activity cycle (Hamel and Mercier 2006). The majority of individuals remain burrowed in sand for ca. 12 h each day, surfacing at dusk to forage during the night with only short periods of re-burrowing. Because individuals surface at sunset and burrow at sunrise, a photically entrained circadian rhythm is the most probable underlying factor. Apart from their nocturnal burrowing habits, adult *H. physis* display a well-marked mobility pattern with a maximum distance recorded between 20:00 and 22:00, followed by a progressive decrease in the distance travelled until the next morning (Hamel and Mercier 2006).

Our earlier study also revealed that the reproduction of *H. physis* follows a lunar periodicity and that larval settlement preferably occurs on substrata that are rich in food items sought by the adults (Hamel and Mercier 2006). For four consecutive months, hermaphroditic reciprocal copulation, preceded by pre-copulatory courtship behaviour, occurred at night, 5–7 days (d) before the full moon. Spawning occurred 3–5 d later for up to five consecutive nights, the egg mass gradually decreasing in size with each spawning. An overcast sky or rain prevented or delayed both copulation and egg release. Settlement of veligers was largely influenced by the nature of the substrate. In multiple-choice experiments, settlement occurred predominantly on sand containing cirratulid polychaetes. Juveniles reached around 3.9 mm in shell length after 5.5 months (mo) of growth (Hamel and Mercier 2006).

The present paper provides complementary data that further elucidates the movement patterns of *H. physis* and provides details on the larval development until metamorphosis into juvenile.

Methods

Numerous *H. physis* specimens (Fig. 1) were commonly found in the intertidal zone off Aruligo, Solomon Islands (9°25.59' S and 159°56.58' E). For laboratory trials, individuals were collected on the

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