

# REPRODUCTIVE BIOLOGY OF A THREATENED REEF-BUILDING VERMETID (MOLLUSCA, GASTROPODA) OFF THE COAST OF ISRAEL

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## Abstract

The *Dendropoma* reefs off the coast of Israel have been decimated over the past 30 years. As part of a research to elucidate the causes of decline, we studied the reproductive biology of *D. petraeum*. Spermatogenesis was detected as early as December, and reproductive activity ceased in July. Females brooded 1-30 egg capsules in their mantle cavity. The pace of reproductive activity differed between the fore- and back reef populations, and between the two sites studied. The females' reproductive period is shorter and the number of egg capsules is smaller than in the *Dendropoma* populations off Spain.

*Key words:* Vermetid reef, endangered, reproduction biology

Vermetids are sessile gastropods distributed in tropical and subtropical seas. Of the nine species of vermetids known from the Mediterranean, two are reef-building, *Vermetus triqueter* Bivona-Bernardi, 1832, and *Dendropoma petraeum* (Monterosato, 1892) (1). *Dendropoma petraeum*, protected by a thick shell and a close fitting operculum, inhabits the surf-beaten raised edges of the reefs. Living *D. petraeum* reefs have been described from rocky shores in the southern Mediterranean from Gibraltar Straits and southeastern Spain to the Levantine Basin (2-4). The importance of the reefs lies in being the core intertidal rocky habitat, in their rarity, and in physically protecting the shoreline from erosion. *Dendropoma petraeum* have been recently recognized as a threatened species in need of protection (5) as the reefs' location, at the meso- and infralittoral, places them at risk from coastal development and pollution.

Off the coast of Israel vermetid reefs were studied in the 1960s (2), and 1970s (6). We have recently revisited those locations to study their current status and reproductive capacity. Digital photography was used to analyze the state of the reefs. We found that only the reefs between Dor and Shikmona have retained relatively dense living populations, while most other sites are in progressive stages of demise. The once extensive reefs off Acre were destroyed by urban development, the reefs of Akhziv- Shavei Zion – Rosh-Hanikra, even at a distance of 1000 m from the shoreline, have been overgrown by algae flourishing on sewage and organic wastes from nearshore outfalls. At Mikhmoret, where platform rims were composed of 30% living vermetids 30 years ago (7), they were found in the present study to retain barely 1% living individuals. However, we found deeper-living *Dendropoma* clusters (30-150 cm below MSL) even where the rim populations were nearly extinct, like at Mikhmoret.

To gauge the reproductive state of the surviving populations we studied the (a) reproductive cycle, (b) the number and size of egg capsules produced, and (c) the number and range of embryonic stages per capsule at two locations, Atlit (32°41N 34°55E) and Shikmona (32°49N 34°57E), 30 kms apart.

Specimens were collected monthly from December 2002 to August 2003 from several sites at each location and transported alive to the laboratory. Some specimens were preserved in Bouin for histological studies, others were studied *in vivo* and some were preserved in 10% buffered formalin. A total of 124 specimens were dissected, and 625 capsules were measured and their contents carefully examined. The number of capsules observed in the brooding females examined ranged from 1 to 30, with only 13 of the 122 females having more than 10 capsules at one time. The number of eggs/embryos per capsule ranged from an average of 1.4 to 4.7, and the size of the egg capsules varied from 0.54 to 1.32 mm in length, (mean= 0.97 ±0.14); N= 709. The populations examined exhibited a discrete reproductive cycle lasting from December to June. Active spermatogenesis was observed as early as December, whereas active oogenesis was not observed till March. Of the 284 capsules collected in March and April over half contained unsegmented eggs and trochophore larvae, whereas by mid-June over 90% of the 341 capsules examined contained prehatching embryos. A complete cessation of reproductive activity was observed in the summer months. We noted that the reproductive cycle of the population sampled at Atlit lagged slightly behind Shikmona's, and that at the latter site, capsules from females collected in April on the fore reef contained more early stages (eggs and trochophore larvae), than capsules from females collected on the back reef (52% vs. 44%).

Comparison with the reproductive biology of *D. petraeum* off south-eastern coast of Spain (3) reveals remarkable differences between the populations: the reproductive period is shorter in Israel with cessation of reproductive activity in July, whereas off Spain some brooding females were found in August and September; the number of simultaneously-brooded capsules per female was much smaller in Israel (mean 5 vs. 25; max. 30 vs. 86); but most capsules contained 2 or more eggs/embryos, and 28 of 625 capsules examined contained more than 5 eggs/embryos, whereas off Spain each capsule usually enclosed a single egg or embryo.

Since dispersal of the larvae is mostly limited to the parental reef, it is entirely possible that the differences observed in their reproductive biology may hint at differing life history characteristics of the two populations separated by the length of the Mediterranean Sea that may have implications for their conservation. Or it may be that the deterioration of the SE Levantine reefs is reflected in their the lower fecundity and shorter reproductive period. It would be most interesting to examine genetic variability in specimens from a number of reef sites across the Mediterranean Sea.

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