



The Naticidae (Mollusca: Gastropoda) of Giglio Island (Tuscany, Italy): Shell characters, live animals, and a molecular analysis of egg masses

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Abstract

We investigated the occurrence of members of the predatory caenogastropod family Naticidae in the littoral of the island of Giglio, Tuscany, Italy. We recorded a total of 8 species, all but one represented by both empty shells and living specimens. As most studies of Mediterranean naticids are based solely on empty shells, we here provide images of living animals for 7 out of the 8 species encountered; for several of these species this is the first photographic documentation of the animal. Our survey included a systematic collection of egg masses ("sand collars") which were hatched in the laboratory. The larvae obtained as well as the sand collars themselves were used for molecular analysis of the species based on gene fragments of mitochondrial cytochrome oxidase subunit I (COI), histone 3 (H3), the mitochondrial 16S rRNA (16S), and 18S rRNA (18S). We show that such molecular analysis allows the confirmation of the identity of naticid species without having access to adult specimens or shells. This approach identified one additional naticid species for which no adult specimens or shells were found. Additionally, our molecular analysis allows consideration of naticid phylogeny.

Key words: Naticidae, Naticinae, Naticarius, Notocochlis, Tectonatica, Polinicinae, Euspira, Neverita, gastropod biodiversity, phylogenetic relationship, taxonomy, molecular identification, sand collars, egg masses, Mediterranean Sea

Introduction

The Naticidae are a cosmopolitan gastropod family that lives from the intertidal zone to several thousand meters depth. The animals are equipped with a large muscular foot and use its front part, the propodium, to bury into sand and mud bottoms. The naticids are predators that have developed a characteristic mode of feeding on their prey, commonly bivalves but also other gastropods including other naticids, in enveloping their prey with their foot and drilling a hole into the shells to reach the soft parts with their proboscis. It has been estimated that worldwide there are about 260–270 Recent species in this family (Kabat 1996), which is assumed to have originated in the late Triassic (Wenz 1941, Bouchet & Warén 1993) or in the early Jurassic (Carriker & Yochelson 1968, Marinovich 1977). The greatest species and generic diversity is found in tropical regions (Kabat 1996), but Naticidae are also abundant in moderately temperate as well as Arctic and Antarctic waters. Members of the Naticidae can easily be recognized by their shell shape, distinctive animals and their peculiar predatory behavior. The biodiversity of the Naticidae in the Mediterranean Sea has been described by several authors (e.g. Kobelt 1901, Hidalgo 1917, Settepassi 1972, Schiró 1977–1978, Sabelli & Spada 1977–1980, Nordsieck 1982, Riedel 1983, Villa 1985–1986, Doneddu & Manunza 1989, Sabelli *et al.* 1990, Poppe & Goto 1991, Barash & Danin 1992, De Smit & Bába 2001, Demir 2002) during the last two centuries. In 1993, Alf *et al.* published a species list of Mollusca for Giglio Island, Italy, that included three naticid species: *Naticarius hebraeus* (Martyn, 1786) [as *Natica cruentata* (Gmelin, 1791)], *Notocochlis dillwynii* (Payraudeau, 1826) [as *Natica dillwynii* (Payraudeau, 1826)], and either *Euspira nitida* (Donovan, 1804) or *Euspira macilenta* (Philippi, 1844) [as *Lunatia* cf. *guillemini* (Payraudeau, 1826)]. Just one specimen of *Naticarius hebraeus* was reportedly found alive (Alf *et al.* 1993), while only broken shells were found of each of the other two species. Since only one shell picture was published (*N. hebraeus*) and, unfortunately, no voucher specimens have been deposited (Alf, in litt.), it is impossible to confirm the identification of these specimens. Terreni (1980) mentioned 10 naticid species in his compilation of the molluscs of the *Archipelago Toscano* of which 2 are reported from Giglio Island: *Payraudeautia intricata* (Donovan, 1804) and *N. hebraeus*. While the biodiversity of the Mediterranean Sea is well known, only few live pictures of species of the Naticidae have been published. Mostly, shells and, if available, their operculi have been figured. Sabelli *et al.* (1990) listed 21 naticid species for the entire Mediterranean Sea of which 20 are currently believed to belong to the Naticidae [all but *Bulbus globosus* (Jeffreys, 1885); see Bouchet & Wáren 1993]. The 20 species were assigned to three subfamilies and 8 genera. Some pictures of living animals of Naticidae have also been published by Settepassi (1972) who showed images of *Naticarius stercusmuscarum* (Gmelin, 1791) [as *Naticarius punctatus* (Karsten, 1798)] and *Neverita josephinia* (Risso, 1826), by Schiró (1977–1978) who showed