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Abstract

Seventeen living specimens of Haliotis mykonosensis Owen, Hanavan & Hall, 2001 are reported from the area between the wharf of Sancio Cattolico and Punta di Pioppeto (northern side of Procida Island, Naples) and thirty from further Central Mediterranean localities. The species has been known up to now from the original description only and this note contributes to a better understanding of its real distribution in the Mediterranean Sea.

Keywords: *Haliotis mykonosensis;* Marine mollusca; Mediterranean Sea; Italy; France.

Introduction

Four species belonging to the family HALIOTIDAE Rafinesque, 1815 (commonly known as Abalone) are known to occur in the Mediterranean Sea: *Haliotis tuberculata* Linnaeus, 1758, H*aliotis stomatiaeformis* Reeve, 1846, *Haliotis mykonosensis* Owen, Hanavan & Hall, 2001 and *Haliotis pustulata* Reeve, 1846. While *H. tuberculata* has been relatively well known for a long time, *H. stomatiaeformis* has only recently been rediscovered, *H mykonosensis* was described a few years ago and *H. pustulata* is an alien species, with only a few specimens known from the Mediterranean Sea. In this paper, the first records of *H. mykonosensis* for the Italian coasts are reported and we take the opportunity to present also comparative descriptions of the four Mediterranean species.

Material and Methods

Material examined and preserved in F.C. private collection (L = live taken; D = dead taken; U = unknown)

H. tuberculata tuberculata Linnaeus, 1758. Italy: Napoli: Marechiaro, Lo Scoglione, 2-10 m, 42 shells (L); La Gaiola, 3-5 m, 9 shells (L); Procida Island, Punta di Pioppeto, 2-3 m, 3 shells (L); Vivara, Secca delle Formiche, 10-15 m, 4 shells (L); Pozzuoli, 15 m, from fishermen, 1 shell (D); Seiano, beach, 1 shell (D). Potenza: Maratea, 5 m, 1 shell (L). Lecce: Porto Selvaggio, 1 m, 1 shell (L). Cro-

tone, Capo Rizzuto, 3 m, 2 shells (L). Reggio Calabria: San Gregorio, 8 m, 2 shells (L). Catania: Capo Molini, 2-10 m, 7 shells (L). Trapani: Marsala, Torre Sibiliana, 3 m, 2 shells (L). Agrigento: Lampedusa Island, 1-5 m, 6 shells (L). Trieste, 2-5 m, 43 shells (L). Livorno: Elba Island, 2-5 m, 7 shells (L). France (Corse Island): Bonifacio, 1-3 m, 10 shells (L). Calvi, Mar A Beach, 1-2 m, 13 shells (L).

*H. stomatiaeformi*s Reeve, 1846. Agrigento: Lampedusa Island, 1 m, 3 shells (L). Malta: Bahar ic-Caghaq, beach, 3 shells (D).

H. mykonosensis Owen, Hanavan & Hall, 2001. Italy: Napoli: Procida Island, La Chiaia, 3 m, 1 shell (L); Punta di Pioppeto, 2 m, 12 shells and 5 specimens in EtOH (L); Vivara Island, Secca delle Formiche, 10-15 m, 1 shell (L). Livorno: Elba Island, 2-5 m, 15 shells (L and D with *Octopus vulgaris* drills). Latina: Ponza Island, 10 m, 1 shell (U). Siracusa, 3-5 m, 2 shells (L). Agrigento: Lampedusa Island, 1-5 m, 4 shells (L). Greece: Zante, 2 shells (U). France (Corse Island): Calvi, Mar A Beach, 1-2 m, 6 shells (L).

Results

Comparative descriptions

Haliotis tuberculata Linnaeus, 1758. **Shell:** very polymorphic, oval/elongate, sometimes with strong spiral ribbing, and frequently having numerous lamellae. Variously coloured, often green and grey and mottled with other colours. Average adult size usually 45-55 mm, although Atlantic and northern Adriatic specimens can reach sizes of 100 mm (Crocetta, pers. observation). Generally with 5-6 open holes. **Epipodium:** digitiform projections on both margins, especially the dorsal. Simple short papillae (~ 1-2 mm) situated in the central area between the two margins, usually with a small stellate structure at the tips. Basic colour greyish-green, dispersed in a series of vertical bands.

Remarks: Currently divided into two subspecies: *Haliotis tuberculata tuberculata* Linnaeus, 1758, widely distributed in the whole Mediterranean Sea (UBALDI, 1987; GEIGER, 2000) where it is by far the most common Abalone species, and *H. tuberculata coccinea* Reeve, 1846, which is mainly found in the Atlantic Ocean (UBALDI, 1987; GEIGER, 2000) although three records have been reported from the Western Mediterranean Sea and one from the Italian Seas. One shell from Cartagena is illustrated in GIANNUZZI-SAVELLI *et al.,* 1994, with no further data except the locality, while two sets from the collection of the Academy of Natural Sciences of Philadelphia are listed by GEIGER (2000), constituted respectively of 2 shells from Melilla collected in 1950 by A. Guignino and coming from the Schwengel collection (ANSP 215756) and 11 beached shells of various sizes collected by D. Quammen in 1961 at Torrequebrada (Malaga) (ANSP 265699). In our opinion, only the biggest of the two specimens from Melilla belongs to *H. tuberculata coccinea;* we are doubtful about the identification of the other 12 specimens, of which the only 2 adults are almost totally encrusted and covered by barnacles and the remainder consist of 6 sub-adults and 4 juveniles, all characterized by a weak sculpture. They could also be ascribed to the highly polymorphic *H. tuberculata tuberculata.* Moreover, the record from the Italian shores, comprising one beached shell from Lecce (RUGGIERO, 1981), seems highly improbable and was never confirmed by further findings. Certain, recent and conspicuous records are therefore needed to state the real presence of this taxon in the Mediterranean Sea.

Haliotis stomatiaeformis Reeve, 1846. **Shell:** very elongate and usually strongly

arched. Generally with smooth spiral ribbing of variable width and strength. Mottled colours of olive-green and grey; sometimes rose. A small species for the genus: adults usually not over ~35 mm. Mostly with 3-5 open holes. **Epipodium:** extremely thin, with small digitiform projections on the upper and lower margins. The presence of papillae in the central area is very difficult to check because of the tiny space between the margins.

Remarks: An uncommon-to-rare species, whose correct taxonomic status was only recently resolved. Up to now known only from Malta and Sicily (GEIGER & OWEN, 2001; OWEN *et al.,* 2001; OWEN, 2003; GAETA *et al.,* 2003).

Haliotis mykonosensis Owen, Hanavan & Hall, 2001. **Shell:** thin, oblong-ovate, from flat to slightly convex; variegated with olive-green, brown and beige, sometimes with a fine radial tenting pattern of light colors against the beige background. Generally with 5-6 open holes. Average adult size about 40-48 mm. **Epipodium:** rather bizarre epipodium with large and highly ramified projections (longer than 6 mm in larger specimens), which often subdivide into complex non-symmetrical branching structures.

Remarks: Recently described from several Greek islands, so far known only from the localities reported in the original description. The main differences between *Haliotis tuberculata* and *Haliotis mykonosensis* are also presented in Table 1, following OWEN *et al.* (2001), and OWEN (2004, 2007).

Haliotis pustulata Reeve, 1846. **Shell:** elongate/ovate, frequently quite flat; spiral

Table 1
Main external and behavioural differences between *Haliotis mykonosensis* and *Haliotis tuberculata*.

	Haliotis mykonosensis	*Haliotis tuberculata*
Epipodium	Large and highly ramified projections are located between the upper and lower epipodial margins. These are further subdivided into complex non-symmetrical branching structures, which may exceed 6 mm in length in specimens larger than 25 mm. Epipodium brown to almost black.	Small digitiform projections, which are simple, blunt and seldom more than 1 mm (infrequently up to 1,5 mm). A small stellate structure is often visible at the tip when viewed under a hand magnifier. Epipodium greyish-green coloured, dispersed in a series of vertical bands.
Shell morphology	Fine narrow cording. Spire less inflated than *H. tuberculata.* Lamellae uncommon, and, when present, less pronounced, and rarely observed on shells smaller than 25 mm.	Typically with stronger and wider cording. Spire usually more inflated than *H. mykonosensis.* Often with lamellae and, when present, lamellae may begin forming on shells as small as 3 mm in length.
Behaviour	Feeding on encrusting red algae observed in aquarium. High motility during the night when disturbed by a flashlight.	Never observed in aquarium feeding on encrusting red algae. Less motility during the night when disturbed by a flashlight.

ribbing usually not strong, but often with pronounced nodes on several major cords. Generally mottled with drab green, grey and brown colours. Adults usually average 35-40 mm, and most often have 5-6 open holes. **Epipodium:** closely packed, finger-like structures on dorsal and ventral side, with thick finger-like and isolated tentacles in the middle of epipodia.

Remarks: This species originates in the Red Sea (DEKKER & ORLIN, 2000) and on the eastern coasts of Africa (GEIGER, 1998; GEIGER, 2000) with only a few specimens known from the Mediterranean Sea (TALMADGE, 1970; GEIGER, 1998; GEIGER, 2000; ZENETOS *et al.,* 2004).

Discussion

Molluscan species in the area between Punta di Pioppeto and the wharf of Sancio Cattolico (northern side of Procida Island, Naples) were surveyed during the years 1976-2005, resulting in a molluscan check-list of 419 species (SOPPELSA *et al.,* 2007). Among them the only abalone species was *Haliotis tuberculata tuberculata* (as *Haliotis tuberculata lamellosa*), of which 3 empty shells were retained in the private collection of F. Crocetta. Further studies of these specimens led to the idea that two of them could in fact belong to *Haliotis mykonosensis.* A two-hour dive was carried out on the 18th of January 2009 to look for living *Haliotis* spp., and seventeen living abalone specimens were found in the above-mentioned area under small rocks (ranging in size from 10 to 40 cm). By analyzing the soft parts fifteen were clearly identified as *Haliotis mykonosensis* while only two were *Haliotis tuberculata tuberculata* (Fig. 1). The analyzed specimens are characterized by a shell

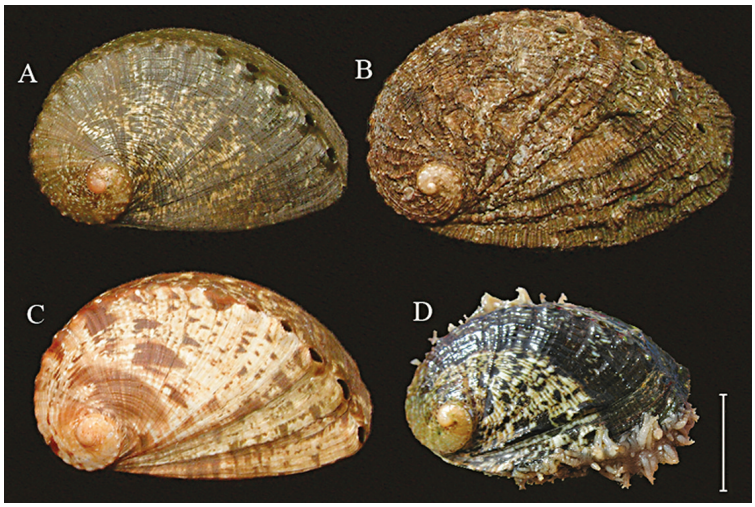

Fig. 1: **A,** *Haliotis mykonosensis* Owen, Hanavan & Hall, 2001, 39,0x23,8 mm, Procida (Punta di Pioppeto area) 18/01/2009, -5 m under rocks; **B,** *Haliotis tuberculata tuberculata* Linné, 1758, 46,5x30,2 mm, Procida (Punta di Pioppeto area) 18/01/2009, -2 m under rocks; **C,** *Haliotis mykonosensis* Owen, Hanavan & Hall, 2001, 43,2 x 25,3 mm, Procida (Punta di Pioppeto area), 13/09/2005 – 2 m under rocks; **D,** living specimen of *Haliotis mykonosensis* Owen, Hanavan & Hall, 2001, 31,7x20,4 mm, Calvi, loc. Mar A Beach (Corse Island, France), 14/08/2008, - 1 m under rocks.

that perfectly matches the specimens described and represented by OWEN *et al.* (2001) and OWEN (2004; 2007), although with less accentuated projections with respect to the figure presented in the description paper. *Haliotis mykonosensis* was found only under small, scattered rocks, covered by Corallinales and situated among patches of *Posidonia oceanica* (Linné) Delile in the vicinity of Scoglio Cannone, while *Haliotis tuberculata* was found only in areas near Punta di Pioppeto on a rocky bottom in the absence of *P. oceanica.* Morphological parameters of *Haliotis mykonosensis* from the area between Punta di Pioppeto and the wharf of Sancio Cattolico are given in Table 2. From previous observations, the species appears to be common along all the Procida shores, where it could usually be found at 1-15 m deep sites, with a preference for depths between 3 and 10 meters. In addition, further observations carried out by the two authors demonstrated that the two species could also be found living together in the same area, as was observed at Vivara, Secca delle Formiche (10-15 m depth), and at Calvi (loc. Mar A Beach, Corse Island, France,), where both species live together under the same rocks, at 1-2 m depth under large rocks (~ 60-70 cm in diameter) in the vicinity of patches of *P. oceanica.* Several empty shells of *Haliotis mykonosensis* were also retained in the collection of the first author from a number of other Central Mediterranean localities (see Material preserved in F.C. private collection).

Table 2
Morphological parameters of specimens of *Haliotis mykonosensis* from the examined area (sizes in mm); * specimens preserved in pure alcohol; # specimens found on 13/09/2005.

Width	Height
41.8	25.5
36.7	20.8
22.0	13.9
42.4	27.2
39.0	23.8
48.2	26.0
19.3	12.0
47.8	28.9
5.9	4.3
9.4	6.3
43.2	25.3#
34.7	21.5#
39.5	23.2*
37.0	22.4*
27.0	17.0*
21.9	14.0*
18.9	12.2*

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