

MARINE FAUNA OF THE MLJET NATIONAL PARK (ADRIATIC SEA, CROATIA) 3. BRACHIOPODA

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Six brachiopod species (1 inarticulate and 5 articulate) are identified and briefly described from Mljet National Park. All are known from the Mediterranean Sea and eastern North Atlantic. The number of taxa is lower than that for the Adriatic Sea (11 species) as a whole, suggesting that further discoveries might be expected in Mljet. *Megerlia truncata*, usually found between 50–350 m elsewhere, occurs occasionally in shallow caves at one locality in the Park, supporting the »bathyal island« hypothesis advocated by French investigators in the Mediterranean.

Key words: marine fauna, Brachiopoda, Mljet, Adriatic Sea

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U Nacionalnome parku Mljet nađeno je i ukratko opisano šest vrsta ramenonožaca, pet inartikulatnih i jedna artikulatna vrsta. Sve su te vrste poznate iz Sredozemnog mora i istočnog sjevernog Atlantika. Broj vrsta zabilježenih na Mljetu manji je od broja (11) utvrđenog za cijeli Jadran. To znači da na tom području možemo očekivati nove nalaze. *Megerlia truncata* čiji se nalazi obično bilježe između 50–350 m dubine, na jednom je lokalitetu u Nacionalnom parku nađena u podmorskim špiljama na manjoj dubini, što ide u prilog hipotezi »batijalnih otoka« francuskih istraživača u Sredozemlju.

Ključne riječi: morska fauna, Brachiopoda, Mljet, Jadransko more

INTRODUCTION

Mljet National Park encompasses the land and near-shore waters of the western part of Mljet Island in the central part of the Adriatic Sea (Fig. 1). Details of the park's history, geology and oceanography are provided in BRALIĆ (1990), KRUŽIĆ (2002) and ZAVODNIK (2003).

The phylum Brachiopoda is presently a minor one, traditionally of little interest to biologists but important to palaeontologists because of its long and impressive geological history. Today the group survives in most seas but with a reduced diversity of about 100 genera. There are presently 14 species belonging to 10 genera in the Mediterranean Sea, all of which are sessile epibenthic forms. Some are shallow water forms, occupying the infralittoral and circalittoral zones to the shelf edge, while others are eurybathic, extending into the bathyal zone (LOGAN, 1979). The bivalved shell is attached either by a pedicle stalk or by cementation of one valve to a firm substrate, which, for the Mediterranean species, is essential to their survival.

Eleven living brachiopod species were re-described and figured from the Mediterranean Sea by LOGAN (1979) to which the reader is referred for details of distribution, ecology and shell morphology. Since then, 3 new discoveries have increased the number of species to 14 (LOGAN *et al.*, 2004). Twelve Mljet National Park localities (Fig. 1, Tab. 1) out of 90 sampled have yielded brachiopods, comprising 6 species belonging to 4 genera, compared to 11 species from 8 genera for the entire Adriatic Sea. A limited amount of information about Adriatic brachiopods is found in older literature, such as GRAEFFE (1903), BRUSINA (1907), and GAMULIN-BRIDA (1965, 1967). LOGAN (1979) identified 4 species collected by Zibrowius in 1971 from Prvić Island in the northern Adriatic, while more recent publications of GRUBELIĆ (1992), ŠIMUNOVIĆ (1997), GRUBELIĆ *et al.* (1998), SIMON & WILLEMS (1999), ZAVODNIK *et al.* (2000), LOGAN & LONG (2001) and SKET (2003) refer to records of brachiopods in the Adriatic but outside of Mljet National Park.

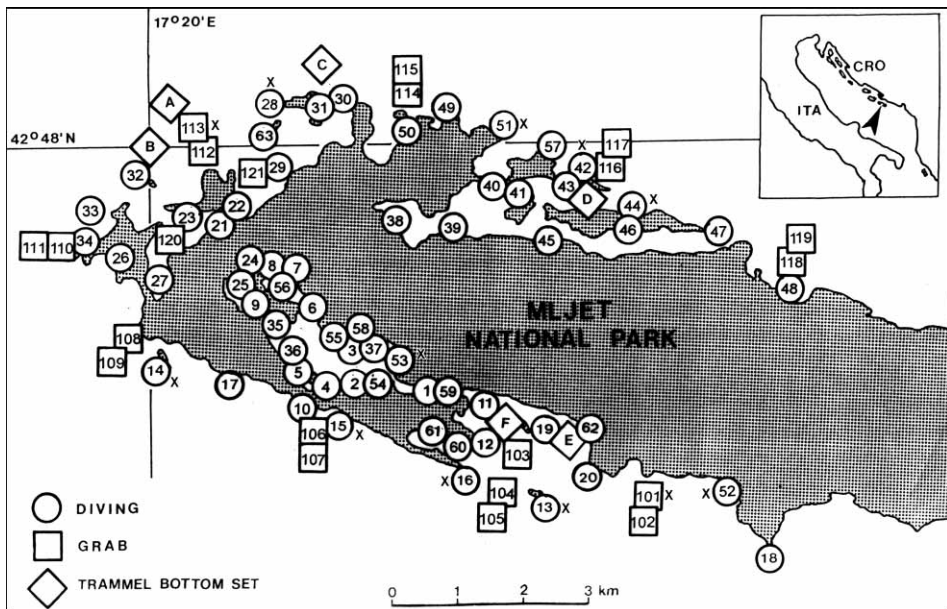


Fig. 1. Map of sampling sites in Mljet National Park, with 12 brachiopod sites indicated with an X.

MATERIALS AND METHODS

Samples were collected by SCUBA divers on rocky bottoms and in caves and sediments at depths from 5–68 m (Tab. 1). Biogenic clumps were especially examined. It should be noted that, in general, brachiopods were obtained somewhat inadvertently during the quest for specimens from other groups; thus very few were preserved and most came dry to the author.

Tab. 1. Brachiopod collection sites (MLJ.). Relief codes: c – cove; cp – cape; i – islet. Community codes: Alg – photophilous algae associations; Cor – coralligenous (coralligène) biocoenosis; Det – communities of coastal detrital sand; off Det – community of offshore detrital sand; Pos – *Posidonia oceanica* bed.

Station MLJ-	Locality name	Bottom slope	Maximum depth	Dominant communities
13	Vanji Školj i.	steep, cliff	48	Alg, Cor
14	Štit i.	steep	42	Alg, Cor, Pos
15	Velika Priveza	cliff	40	Alg, Cor
16	Lenga cp.	cliff	57	Alg, Cor
28	Glavat i.	steep	44	Alg, Cor, Pos
42	Ovrata i.	steep, cliff	45	Alg, Cor, Det
44	Kobrava i.	steep	57	Alg, Cor, Pos
51	Rastupa cp.	steep, cliff	45	Alg, Cor
52	Procjep c.	gentle	42	Alg, Pos
53	Veli Most (N)	gentle	27	Alg, Cor, Det
101	Grabova cp.	plain	60	off Det
113	N Pomeštak	plain	68	off Det

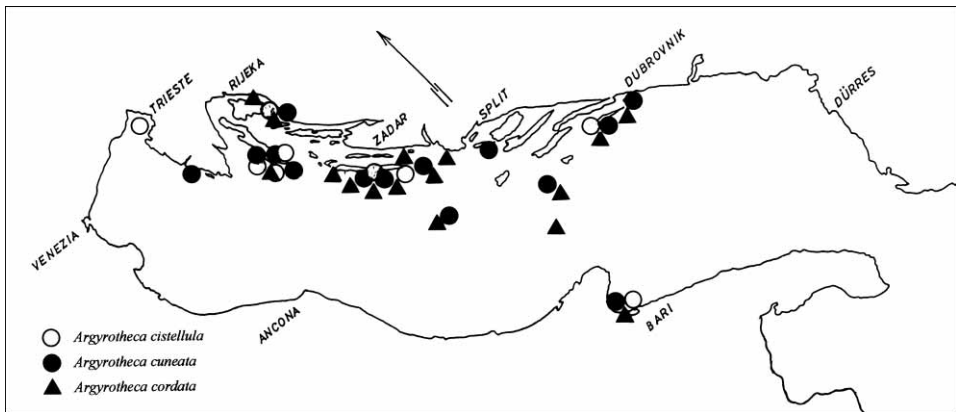


Fig. 2. Map of Adriatic Sea, showing records for three species of *ArgYROTHECA*.

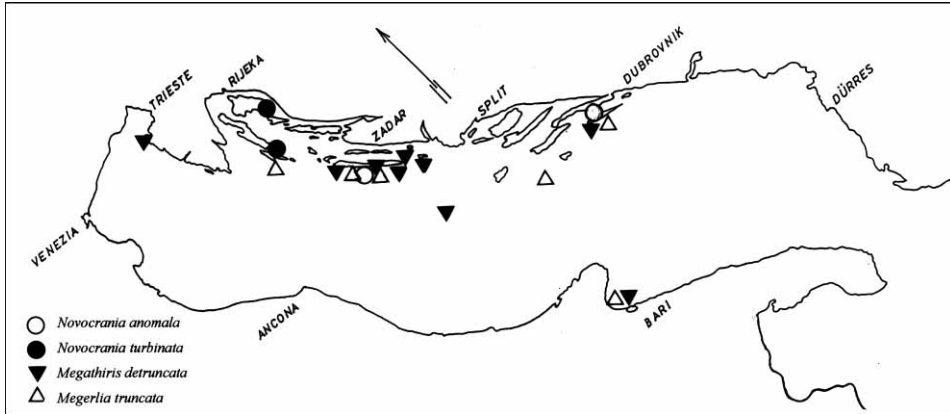


Fig. 3. Map of Adriatic Sea, showing records for species of *Novocrania*, *Megathiris* and *Megerlia*.

SYSTEMATIC DESCRIPTIONS

The suprafamilial classification below follows that established by WILLIAMS *et al.* (1996). The geographical distribution of all species in the Adriatic Sea are shown in Figs. 2 and 3.

Phylum BRACHIOPODA Duméril 1806

Subphylum CRANIIFORMEA Popov *et al.*, 1993

Class CRANIATA Williams *et al.*, 1996

Order CRANIIDA Waagen, 1885

Superfamily CRANIOIDEA Menke, 1828

Family CRANIIDAE Menke, 1828

Genus *Novocrania* Lee & Brunton, 2001 (formerly *Neocrania* until 2001)

Novocrania anomala (Müller, 1776)

Stations: MLJ-16, 28.

Depth range: 20–39 m

Brief description: Shell brown in colour, roughly oval in outline, reaching about 12 mm in width, with rugose conical upper (dorsal) valve and flat lower (ventral) valve, the latter cemented to substrate. Dorsal valve interior with subdued anterior adductor muscle scars, prominent divided brachial protractor scars and distinct crescentic brachial retractor scars separated from adductors scars. Lophophore spirolophous, unsupported by a brachial skeleton.

Habitat: Attached by cementation to firm substrates in cryptic habitats (sub-boulder, coralligène, caves); dead shells in sediments.

Remarks: This species and its sibling species *N. turbinata* (Poli, 1795) are the only inarticulate brachiopods presently living in the Mediterranean. Both are also known

from the eastern North Atlantic (LOGAN & LONG (2001)). The 2 species cannot be distinguished externally, but LOGAN & LONG (2001) showed that specimens collected by Zibrowius in 1971 from caves at 30–40 m, Prvić Island, Croatia all belong to *N. turbinata*. Furthermore, specimens collected and sent to the author by Simon (see SIMON & WILLEMS, 1999) from sediments at 35–40 m depth in a cave in Privlaka Cove, and 3 m depth in Veli Bok Bay, Lošinj Island, also belong to *N. turbinata*. They are characterised by dorsal valve interiors with prominent, elevated anterior adductor muscle scars, small obscure brachial protractor scars and brachial retractor scars not separated from the adductors. However, all of the 30 specimens examined by the author from Mljet National Park belong to *N. anomala*, suggesting that *N. turbinata* occurs mainly in the northern Adriatic and *N. anomala* further south, with little overlap. Further collecting is needed to test this hypothesis, however. There is a record in the reference collection of the CMRR (Centre for Marine Research, Rovinj, Croatia) of *N. anomala* from Borovnik islet, Kornati Islands, at 40 m depth ((Zavodnik, pers. comm.) but the internal features of the dorsal valve should be checked, for reasons mentioned above.

Subphylum RHYNCHONELLIFORMEA Williams *et al.*, 1996

Class RHYNCHONELLATA Williams *et al.*, 1996

Order TEREBRATULIDA Waagen, 1883

Suborder TEREBRATELLIDINA Muir-Wood, 1955

Superfamily MEGATHYRIDOIDEA Dall, 1870

Family MEGATHYRIDIDAE Dall, 1870

Genus *Argyrotheca* Dall, 1900

Argyrotheca cistellula (Searles-Wood, 1841)

Station: MLJ-16.

Depth range: 26–39 m.

Brief description: Shell very small, rarely exceeding 2 mm in width, yellow-brown in colour, smooth except for prominent growth lines; coarsely endopunctate. Shell transverse, wider than long, strongly biconvex, bilobed anteriorly, hinge line straight with large centrally-placed pedicle opening (foramen). Internally, schizolophous lophophore supported by two semi-circular lamellae in dorsal valve, prominent median septum.

Habitat: Attached by a short pedicle to firm substrates in cryptic habitats (sub-boulder, coralligène, caves); dead shells in sediments.

Remarks: This diminutive articulate brachiopod is the least common of the 3 species of *Argyrotheca* in the Mediterranean although its small size makes it easily overlooked (LOGAN, 1979). Only 10 complete specimens were obtained from a single locality in Mljet National Park but 73 examples were collected by Zibrowius in 1971 from a vertical cliff at 40 m, Prvić Island (LOGAN, 1979). It often occurs with other micromorphic brachiopods, such as *Tethyrhynchia mediterranea* (LOGAN & ZIBROWIUS, 1994) and *Gwynia capsula* (SIMON & WILLEMS, 1999), the latter authors collecting all three species in Privlaka Cove cave, Lošinj Island and Mišnjak Bank cave,

Unije Island. *A. cistellula* also occurs in association with *Gwynia capsula* in the eastern North Atlantic (LOGAN *et al.*, 1997). GRAEFFE (1903) recorded this species from beneath boulders in Trieste harbour in the northern Adriatic, and GRUBELIĆ (1992) from Purara, Kameni Žakan and Ravni Žakan islets in the southern part of the Kornati Islands and Mana and Pleščina islets in the northern part. LOGAN (1979) recorded 4 specimens of this species from a cave at 10 m at Bari collected by Griessinger in 1968.

Argyrotheca cuneata (Risso, 1826)

Stations: MLJ-14, 16, 44, 51, 52, 53, 113.

Depth range: 12–68 m.

Brief description: Shell small, biconvex, usually wider than long, rarely exceeding 4 mm in width, strong development of about 3–6 radial ribs (costae) in both valves, typically with pink-red wash between white ribs, red colouration deepening anteriorly; coarsely endopunctate. Hinge line straight, large pedicle foramen centrally placed. Internally, schizolophous lophophore supported by two semi-circular lamellae in dorsal valve, prominent median septum.

Habitat: Attached by a short pedicle to firm substrates in cryptic habitats (sub-boulder, coralligène, caves); dead shells in sediments.

Remarks: This articulate species is the commonest of the 3 species of *Argyrotheca* in the Mediterranean Sea (LOGAN, 1979) and the eastern North Atlantic (LOGAN, 1988), its distinctive red-striped shell easily distinguishing it from its congeners. It occurs in abundance (for example 90 specimens from MLJ-16 alone) at 7 of the 12 Mljet National Park brachiopod localities, often in association with *A. cordata* and *Megathiris detruncata*. Thirteen examples of this species were collected from caves and coralligène at 6–40 m by Zibrowius in 1971 from Prvić (LOGAN, 1979) and 6 specimens from a cave at 11 m, Banjole islet, Rovinj, also by Zibrowius. There are 6 specimens in my collection obtained by Willems from Mišnjak Bank cave, Unije Island and 4 specimens from 3 m depth in Veli Bok Bay, Lošinj Island. There is a single specimen collected by J. Štirn from the Argonaut expedition to the northern Adriatic in 1965. There are also 10 examples of this species in my collection from a cave at 10 m depth at Bari, southern Adriatic, collected by Griessinger in 1968. The CMRR collections contain specimens of this species from Dugi otok (Grpašćak cliff) at 78 m and the Balun, Mali Obručan and Mrtvac islets at 24–50 m in the Kornati Archipelago (Zavodnik, pers. comm). Records of this species elsewhere in the Adriatic were made by BRUSINA (1907, Žirje and Lokrum islands), GAMULIN-BRIDA (1965, 1967 off Sušac Island and Šolta Island), and ZAVODNIK *et al.* (2000, Jabuka islet).

Argyrotheca cordata (Risso, 1826)

Stations: MLJ-14, 16, 28, 51, 101, PA5-20

Depth range: 16–60 m

Brief description: Shell small, biconvex, smaller valve less convex than larger valve, rarely exceeding 4 mm in length or width. Shell cream-white, semi-transparent,

coarsely endopunctate; elongate heart-shaped, shallow median sulcus present in both valves, 2–4 shallow radial costae, producing distinctive scalloped anterior margin. Hinge line short, straight, large pedicle foramen centrally placed. Internally, schizolophous lophophore supported by 2 semi-circular lamellae in dorsal valve, prominent median septum with 5–6 serrations anterior to crest, distinctive row of sub-marginal ridges, noded at anterior extremities, marking outline of brachial loop.

Habitat: Attached by a short pedicle to firm substrates in cryptic habitats (sub-boulder, coralligène, caves); dead shells in sediments.

Remarks: This articulate brachiopod is common throughout the Mediterranean and eastern North Atlantic (LOGAN, 1979; 1988) where it is usually associated with the 3 other megathyridid species. It can be distinguished from them by its distinctive semi-transparent shell, heart-shaped outline, shallow ribbing, serrated median septum and sub-marginal noded ridges. It occurs abundantly at 5 of the 12 MLJ stations (63 specimens from MLJ-16 alone), at Palagruža Island and at Borovnik in the Kornati Islands, where it was collected by Vacelet from a cave at 6 m depth. Zibrowius obtained 125 examples in 1971 from coralligène at 12–25 m at Prvić Island (LOGAN, 1979). There is a single specimen collected by J. Štirn from the Argonaut expedition to the northern Adriatic in 1965. There are 2 specimens in my collection obtained by Willems from Mišnjak Bank cave, Unije Island. There is also one example of this species in my collection from a cave at 10 m at Bari, southern Adriatic, collected by Griessinger in 1968. BRUSINA (1907) records it from Cape Veli rat and Žirje Island, GRUBELIĆ *et al.* (1998) from Rogoznica Cove, near Šibenik, and there are specimens in the CMRR collections from Dugi otok (Grpašćak cliff) at 78 m and the Balun, Mali Obručan, north-west Mrtvac islets at 24–50 m in the Kornati Archipelago, and east Mrtovnjak islet at 90 m the Murtersko more area (Zavodnik, pers. comm).

Genus *Megathiris* D'Orbigny, 1847

Megathiris detruncata (Gmelin, 1790)

Stations: MLJ-13, 14, 15, 16, 28, 42, 44, 51, 115

Depth range: 16–68 m

Brief description: Shell small, biconvex, wider than long, rarely exceeding 5 mm in length and 6 mm in width. Shell cream or light brown in colour, coarsely endopunctate. Radial costae rounded, opposite, 8–14 in number, occasionally bifurcating near anterior margin, strong concentric growth lines reflecting ribbing, resulting in scalloped anterior margin. Hinge line straight, interarea broad, flat, with central foramen for short pedicle stalk; umbo usually abraded by substrate. Dorsal valve interior with 3 sharp-crested septa (a central and 2 lateral) which reach a crest at about half the shell length and then slope steeply anteriorly, by way of 2–3 rounded serrations, to a termination near the anterior margin. Looped brachial skeleton supports ptycholophous lophophore, consisting of 2 arcuate lamellae attached to valve floor for most of their length.

Habitat: Attached by a short pedicle to firm substrates in cryptic habitats (sub-boulder, coralligène, caves); dead shells in sediments.

Remarks : This species is common in the Mediterranean and eastern North Atlantic (LOGAN, 1979; 1988) and is also the most common articulate brachiopod in Mljet National Park, occurring at 9 of the 12 brachiopod stations and in abundance at most (83 specimens at MLJ-16 alone). Although closely related to the 3 species of *Argyrotheca* previously mentioned, it is distinguished by its larger maximum size, numerous rounded costae and 3 prominent septa in the interior of the smaller (dorsal) valve. Records of this species from the Adriatic are by BRUSINA (1907, Veli rat, Žirje), ZAVODNIK *et al.* (2000, Jabuka) and SKET (2003, Savudrija Cape, Croatia). There are specimens in the CMRR collection from Murtersko more, east Mrtovnjak islet at 62–90 m, and from Gominjak, Obručan, Purara and Škulj islets at 61–68 m in the Kornati Archipelago (Zavodnik, pers. comm). There are also 18 examples of this species in my collection from a cave at 10 m depth at Bari, southern Adriatic, collected by Griessinger in 1968.

Superfamily KRAUSSINOIDEA Dall, 1870

Family KRAUSSINIDAE Dall, 1870

Genus *Megerlia* King, 1850

Megerlia truncata (Linnaeus, 1767)

Station: MLJ-16

Depth range: 30–39 m

Brief description: Shell brown, biconvex, slight sulcus-fold, transversely oval, rarely exceeding 20 mm in width, slightly wider than long, ornament of fine radial ribbing and concentric growth lines, endopunctate; hinge line straight, with large centrally-placed pedicle foramen shared by both valves. Interior of dorsal valve with large, complex, looped brachial skeleton supporting plectolophous lophophore and supported dorsally by median septum.

Habitat: The normal habitat of this eurybathic form in the Mediterranean is attached to firm substrates in the circalittoral and upper part of the bathyal zone, from 60 – >300 m depth. Occasionally it occurs in shallow caves and sediments, as in Mljet.

Remarks: This species is common in the Mediterranean Sea and the eastern North Atlantic (LOGAN, 1979; 1988). As mentioned above, this articulate brachiopod normally inhabits deeper offshore waters but is occasionally found in shallow caves where environmental conditions, such as light and water temperature, approximate those in deeper water (LOGAN, 1979). Three specimens have been found on rock walls and in sediments in a dark cave at 38–39 m at one locality in Mljet National Park. One specimen has also been found by Vacelet in the dark zone in a submarine pothole, Levrnaka Island at 15–22 m and 2 specimens in Kravljacića cave at 30 m in the Kornati Islands (specimens and data sent to author by Zibrowius). In both cases water temperatures are in the range of 16–17 °C in the cooler parts of the cave where the specimens were found. These are important records, similar to that from 12 m in Figuier Cave near Marseille (LOGAN 1979) and from a dark cave at 8 m near Fornells, Menorca, collected by J.-G. Harmelin in 1998 and sent to the author by Zibrowius. They re-inforce the concept of the »bathyal island« in shallow water advanced by VACELET *et al.* (1994) and supported by LOGAN & ZIBROWIUS (1994).

GAMULIN-BRIDA (1967) records *M. truncata* from off Sušac Island at 90–100 m and there are specimens from Balun islet at 40 m, Kornati Islands in the CMRR collections. There is a single specimen from off the coast of Puglia, about 10 nm north-east of Bari, collected by the Urania expedition in 1997 at 250 m depth. Simon (pers. comm) found 2 specimens of *M. truncata* at Male Srakane Island in small cavities at 35 m depth and 7 more at Škojić at 45 m depth in the north cape area of the Lošinj island.

DISCUSSION & CONCLUSIONS

Collecting in the Mljet National Park area has turned up 6 species of brachiopods, mostly from cryptic habitats such as micro-cavities and caves. Recent discoveries of the micromorphic brachiopods *Gwynia capsula* (Jeffreys) and *Tethyrhynchia mediterranea* Logan by SIMON & WILLEMS (1999) in northern Croatian submarine limestone caves, where light, water movement and food supply are also reduced, suggest that similar cryptic habitats in Mljet National Park might yield more brachiopod finds in the future. For the Adriatic Sea as a whole, a further 5 species have been recorded. These are *Novocrania turbinata* (Prvić, LOGAN & LONG, 2001), *Gryphus vitreus* (CMRR collection, south of Mljet Island at 396 m, identified by A. Šimunović), *Platidia anomioides* (CMRR collection, Veli Rašip Islet, Kornati Islands at 47 m, identified by F. Velkoverh), and the 2 micromorphic species *G. capsula* and *T. mediterranea* mentioned above. That leaves 3 species unaccounted for in the Adriatic. These are *Lacazella mediterranea*, *Terebratulina retusa* and *Platidia davidsoni*. The first species is a cementing articulate believed to be restricted to the south-western part of the Mediterranean basin (LOGAN, 1979; LOGAN *et al.*, 2004) and therefore unlikely to occur in the Adriatic. The other 2 are deeper water forms likely to be discovered where substrate conditions suitable for brachiopod attachment prevail. Hopefully, this report will encourage renewed efforts by investigators to systematically collect specimens of this important group in the Adriatic.

SUMMARY

Six brachiopod species, comprising 1 inarticulate *Novocrania anomala*, and 5 articulates *Argyrotheca cistellula*, *A. cuneata*, *A. cordata*, *Megathiris detruncata* and *Megerlia truncata*, are identified and briefly described from Mljet National Park. Their depth range, habitat and geographical distribution in the Park and in the Adriatic Sea as a whole are also recorded. All species are known from the Mediterranean Sea and eastern North Atlantic. Although the number of brachiopod taxa in Mljet National Park is lower than that for the whole Adriatic Sea (11 species) it is expected that future investigations will yield new records, although it is unlikely that the total will reach the 14 species recorded for the Mediterranean as a whole, as *Lacazella mediterranea* appears to be restricted to the western basin. Of unusual interest is the discovery of *Megerlia truncata*, usually found between 50–350 m in the Mediterranean,

in shallow caves at less than 40 m at one locality in the Park. Shallow enclaves of this species are rare, so this discovery in Mljet further supports the »bathyal island« hypothesis advocated by French investigators in the north-western Mediterranean.

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SAŽETAK

Morska fauna Nacionalnog parka Mljet (Jadransko more). 3. Ramenonožci (Brachiopoda)

A. Logan

Navode se nalazi i kratko se opisuju šest vrsta ramenonožaca nađenih u Nacionalnom parku Mljet, i to: jedna vrsta inartikulata (*Novocrania anomala*) i pet vrsta artikulata (*Argyrotheca cistellula*, *A. cuneata*, *A. cordata*, *Megathiris detruncata* i *Megerlia truncata*). Navodi se i dubina na kojoj su te vrste nađene, njihova staništa i rasprostranjenost u istraživanom području i u cijelom Jadranskom moru. Sve su te vrste poznate iz Sredozemnog mora i istočnog Sjevernog Atlantika. Kako je utvrđeni broj svojiti ramenonožaca u Nacionalnom parku Mljet manji od broja vrsta poznatih u Jadranskom moru, mogu se u budućnosti očekivati novi nalazi. Međutim, malo je vjerojatno da će biti nađene sve vrste koje obitavaju u Sredozemlju. Čini se da *Lacazella mediterranea* nastanjuje samo zapadni dio Sredozemnog mora. Posebno su zanimljivi nalazi vrste *Megerlia truncata* u podmorskim špiljama kod rta Lenga na dubini manjoj od 40 m, budući da se ta vrsta obično nalazi u Sredozemlju na dubinama od 50–350 m. Kako su plića obitavališta te vrste rjeđa, možemo podatke s Mljeta smatrati prilogom hipotezi »batijalnih otoka« koju su postavili Francuzi istražujući sjeverozapadno područje Sredozemnog mora.