

## MARINE FAUNA OF THE MLJET NATIONAL PARK (ADRIATIC SEA, CROATIA). 4. MOLLUSCA: POLYPLACOPHORA

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During the summers from 1995–2000 the benthos was studied at 63 sites by scuba- and skin-divers. Polyplacophora molluscs were recorded at 36 sites. Ten species were identified, *i.e.* 63 % of the Adriatic Sea chitons, and 34 % of taxa recorded in the Mediterranean. Synonyms, habitat, depth range and general distribution are noted for each species. With the aim of updating the distributional pattern of chitons in the Adriatic Sea, the authors' unpublished records of a number of species have been appended.

**Key words:** Mollusca Polyplacophora, National Park, Mljet Island, Adriatic Sea, zoogeography

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U Nacionalnom parku »Mljet«, na 36 ronilački istraženih obalnih postaja u razdoblju 1995–2000, nađeno je deset vrsta poliplakofornih mekušaca – babuški. To je čak 63 % vrsta poznatih za Jadran odnosno 34 % vrsta koje žive u Sredozemnom moru. Za svaku se vrstu navode sinonimi, staništa, te dubinska i opća rasprostranjenost. S ciljem boljeg poznavanja rasprostranjenosti babuški u Jadranu, dodani su i do sada neobjavljeni nalazi oba autora.

**Ključne riječi:** Mollusca Polyplacophora, Nacionalni park, Mljet, Jadransko more, zoogeografija

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## INTRODUCTION

In the zoological literature relating to the Adriatic Sea, chitons have been observed over a period of longer than two centuries (OLIVI, 1792; RENIER, 1804; MARTENS, 1838; NARDO, 1847; GRUBE, 1861, 1864; HELLER, 1863; LORENZ, 1863; STOSSICH, 1865; BRUSINA, 1866, 1870; STALIO, 1874; WIMMER, 1883; GRAEFFE, 1903; ZIMMERMANN, 1907; ODHNER, 1914; VATOVA, 1928; COEN & VATOVA, 1932). Previous reports were compiled by WEINKAUFF (1868), STOSSICH (1880), CARUS (1895), VATOVA (1928), and LELOUP & VOLZ (1938). But not since the paper by LELOUP & VOLZ appeared have Adriatic Sea chitons been the subject of a dedicated, comprehensive taxonomic paper, even in such restricted areas as that of the present study. All notes and records of chitons in the literature on the Adriatic benthos amount to simple listings of fauna, which were in part consulted in the preparation of regional check lists (FREDJ, 1974; ZAVODNIK & KOVAČIĆ, 2000). Occasionally, some chitonid genera and species were noted, and placed in figures (drawn or photographed) in manuals on Adriatic Sea flora and fauna (STEUER, 1910; ISSEL, 1918; CORI, 1928; ZEI & ZHANEL, 1947; RIEDL, 1963; MATTHES, 1976; COSSIGNANI *et al.*, 1992; CESARI, 1994; TURK, 1996; ANDRIĆ, 1999; VELKOVVRH, 2003). However, in numerous ecological papers (on benthic communities, and similar) only rarely has information appeared on chitonid habitats, and population densities (STARMÜHLNER, 1968, 1969; ŠIMUNOVIĆ, 1970; ZAVODNIK *et al.*, 1981; MIZZAN, 1992).

The first records on Mljet Island chitons were provided by DRAGANOVIĆ (1980) and OREPIĆ *et al.* (1997). In the Veliko and Malo jezero saltwater lakes these authors

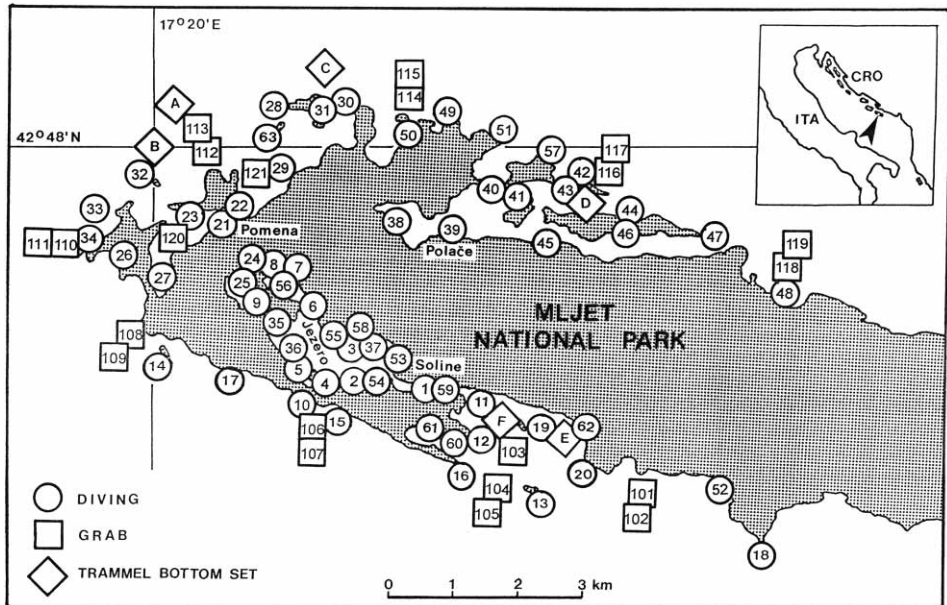


Fig. 1. Study area and stations surveyed.

recorded *Lepidopleurus cajetanus*, *Chiton olivaceus*, and *Acanthochitona communis* (= *A. fascicularis*). In the same area, KRUŽIĆ (2001) noticed *Chiton olivaceus* inhabiting the coral *Cladocora caespitosa* bioherms. ANDRIĆ (1999) provided a photo of *Chiton olivaceus* taken at Pomeštak islet, in the Polače village area.

In the past, the sea around Mljet Island, and in the National Park in particular, has not been a subject of extensive scientific research (ZAVODNIK, 1995, 2003). Much attention was paid, however, to the pelagic ecosystem in the Veliko and Malo jezero seawater lakes (ERCEGOVIĆ, 1935; BULJAN & ŠPAN, 1976; BENOVIĆ *et al.*, 2000). On the other hand, only scarce information on the benthos has been available until recently (VIDOVIĆ, 1955; DRAGANOVIĆ, 1980). The present research in the Mljet National Park was targeted at general biodiversity and benthic bionomy with special regard to rocky bottom environments (BELAMARIĆ *et al.*, 1995; OREPIĆ *et al.*, 1997; KRUŽIĆ, 2001). For this reason, chitonid specimens were noticed, and collected more or less at random. We suppose, however, that the data available are sufficiently significant to warrant their presentation to the scientific community in a paper version. Until now, similar papers on the Mljet National park fauna were provided for Anthozoa (KRUŽIĆ, 2002), Echinodermata (ZAVODNIK, 2003), and Brachiopoda (LOGAN, 2003).

## AREA INVESTIGATED

The Mljet National Park was established in 1960 at the westernmost part of the Mljet Island, south Adriatic Sea (Fig. 1). It is famous for its dense Aleppo pine (*Pinus halepensis*) forests, and a variety of land and submarine geomorphologic features (BRALIĆ, 1990). In marine environments, the most impressive features are the vertical cliffs reaching the depth of about 40–80 m, and two seawater lakes formed in karstic depressions in the post-glacial period named Veliko and Malo jezero (Large and Small Lake). The maximum depth of the lakes is 47 and 21 m, respectively. Sandy deposits, here and there rich in detrital fractions, are characteristic in the area. Seaward island coasts are much exposed to waves generated by the bora, sirocco, and maestral winds.

The present borders of the Mljet National Park extend seawards 500 m from the coast-line. There are five small villages and hamlets, with a total of about 400 inhabitants, in the National Park. The tourist impact is limited to the summer season. In general, the sea in the area is crystal clear, except for a slight organic pollution at a few sites under the direct impact of untreated household waste.

More detailed information on the area investigated is available in the papers by BRALIĆ (1990), BOGNAR & CURIĆ (1995), RIĐANOVIĆ & ŠIMUNOVIĆ (1995), BENOVIĆ *et al.* (2000), and ZAVODNIK (2003).

## MATERIALS AND METHODS

Research was carried out by skin and scuba diving, usually along 100 m long transects, perpendicular to the shore, at 63 stations located in the area of the Mljet National park (Fig. 1, Tab. 1). The sediment from grab collections was not pro-

**Tab. 1.** Polyplacophora collection sites (MLJ-). Relief codes: c – cove; i – islet. Bottom type codes: D – organogenic detritus, shell litter; G – gravel, pebbles; M – mud, silt; R – rock; S – sand. Community codes: Alg – algal associations; Cor – coralligenous community; Cym – *Cymodocea nodosa* meadow; Det – community of detrital sand; Pos – *Posidonia oceanica* bed.

Station MLJ-.	Locality	Bottom slope	Bottom type	No. surveys	Depth (m)	Dominant communities
1	Solinski kanal	gentle	GRS	4	0–3	Alg, Cym
4	Pračarica	gentle	GMRS	3	0–4	Alg, Cym
5	i. Sv. Marija	gentle	RS	4	0–8	Alg, Cym
6	Babine kuće	gentle	RS	1	0–28	Alg, Det
11	Vratosolina	gentle	GRS	4	0–23	Alg, Pos
14	i. Štit	steep	RS	6	0–42	Alg, Cor, Pos
15	Velika Priveza	cliff	R	2	0–40	Alg, Cor
16	Lenga cape	cliff	RS	10	0–57	Alg, Cor
18	Tojsti cape	steep	GR	1	0–40	Alg, Pos
19	i. Utrnji Školj	gentle	GR	2	0–15	Alg, Pos
22	Sikjerica cape	gentle	GR	8	0–7	Alg, Cym, Pos
23	i. Galijica	gentle	GRS	2	0–8	Alg, Pos
24	c. Pod MalaPoma	gentle	GRS	1	0–6	Alg, Cym
26	c. Lastovska	gentle	GRS	1	0–3	Alg, Pos
27	c. Lokva	gentle	MRS	2	0–16	Alg, Pos
29	Debeli rat (cape)	steep	GRS	1	0–47	Alg, Cor, Pos
32	i. Crna seka donja	gentle	RS	1	0–43	Alg, Pos
34	Goli rat (cape)	gentle	GRS	1	0–24	Alg, Cor, Pos
35	c. Priježba	gentle	RS	2	0–8	Alg, Cym
38	c. Polače (Gundulišta)	gentle	GRS	1	0–13	Alg, Cym, Pos
39	c. Polače (Debela Ponta)	gentle	RS	2	0–30	Alg, Cym, Pos
43	i. Ovrata (W)	gentle	GRS	3	0–23	Alg, Pos
44	i. Kobrava (N)	steep	RS	1	0–57	Alg, Cor, Pos
46	i. Kobrava (S)	gentle	RS	1	0–40	Alg, Det, Pos
47	i. Kula	gentle, cliff	GRS	1	0–40	Alg, Cor, Pos
48	c. Vela Tatinica	gentle	RS	1	0–45	Alg, Cor, Det, Pos
49	Zazupci cape	steep, cliff	R	2	0–58	Alg, Cor
51	Rastupa cape	steep, cliff	R	3	0–45	Alg, Cor
52	c. Pročjep	gentle	GRS	3	0–42	Alg, Pos
53	Veli Most (N)	gentle	RS	4	0–27	Alg, Cor, Det
57	i. Moračnik (N)	steep, cliff	GRS	2	0–45	Alg, Cor
58	c. Vrbovačka	gentle	MS	1	5–20	Cym
59	Solinski kanal	gentle	GRS	2	0–2	Alg, Cym
60	c. Velike Blace	gentle	GR	2	0–17	Alg, Pos
61	c. Male Blace	gentle	GRS	1	0–6	Alg, Cym
62	Vranje garme	gentle	GR	1	0–5	Alg, Pos
63	Crna seka i.	Gentle	DRS	1	35	Det

cessed for chitonid valves, but information is available from deposit samples collected by Dr. Helmut Zibrowius (pers. comm.). Divers counted and collected chitons by hand; alternatively, specimens were extracted from biogenic aggregations. Specimens were preserved in 70% alcohol, or dried. Voucher specimens were deposited in the study collection of the Center for Marine Research at Rovinj (CMRR).

In this study, the scientific nomenclature of chitons according to the monograph by DELL'ANGELO & SMRIGLIO (1999) is used. Nomenclature of other taxa is based on ERMS (COSTELLO *et al.*, 2001). Benthic communities were identified according to PÉRÈS & PICARD (1964), PÉRÈS (1967), and BELLAN-SANTINI *et al.* (1994).

Because of the lack of any graphic presentation of the chitonid distributional pattern in the Adriatic Sea, since the paper by LELOUP & VOLZ six decades ago, updated maps were prepared for all species recorded in the area studied.

## SYSTEMATIC ACCOUNTS

### Class POLYPLACOPHORA Gray, 1821

#### Order NEOLORICATA Bergenhayn, 1955

#### Suborder LEPIDOPLEURINA Thiele, 1910

#### Superfamily LEPIDOPLEUROIDEA Pilsbry, 1892

#### Family LEPIDOPLEURIDAE Pilsbry, 1892

#### Genus *Lepidopleurus* Risso, 1826

#### *Lepidopleurus (Lepidopleurus) cajetanus* (Poli, 1791)

*Stations*: MLJ-4, 5, 11, 16, 23, 26, 27, 29, 32, 52, 53.

*Depth range*: 0,1–4 m (12–39 m for valves)

*Habitat*: Bedrock, biogenic consolidated stones, vertical limestone wall at 5–10 m depth, and crude anthropogenic waste (glass bottle, china-ware litter).

*Description*: A full description of the species is reported in LELOUP & VOLZ (1938: 8, Figs 4–7) and DELL'ANGELO & SMRIGLIO (1999: 38, pls. 6–7, Figs 10–15).

*Remarks*: *L. cajetanus* is a common species that lives at a relatively modest depth, between 0.5 and 40 meters, under stones or rock fragments. It is generally more common between 1 and 5 meters, often hidden in microcavities of organogenic concretions. It can endure short periods out of water. WIMMER (1883) collected it from sponges and molluscan shells.

*Distribution*: In spite of being a locally very common species, the known distribution pattern of *L. cajetanus* is rather discontinuous. It has been found along all the European coasts of the Mediterranean Sea, while recordings on the African side are scarce. Its distribution in the Atlantic goes from Bretagne as far south as Morocco and the Canary Islands. In the Adriatic Sea, in addition to published records and the current data from Mljet National Park, the authors have collected specimens and/or valves at the following new localities: Limski kanal, Lošinj Island (Privlaka,

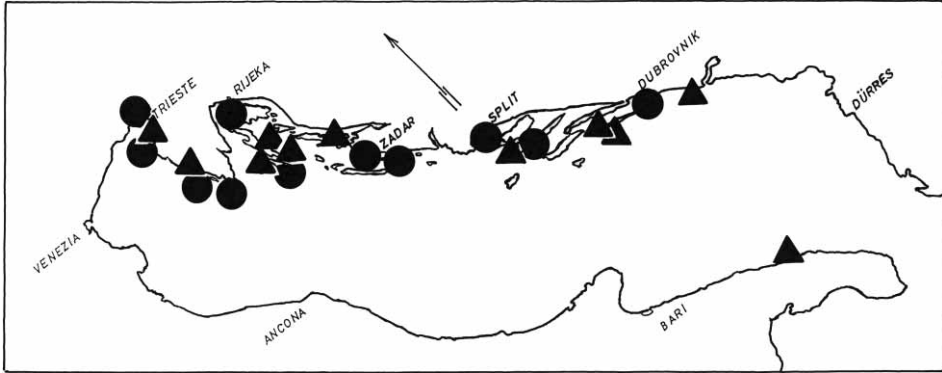


Fig. 2. Records of *Lepidopleurus cajetanus* in the Adriatic Sea. ● from the literature, ▲ this study.

Jamna cove), Cres Island (Osor, Ćutin Veli islet), Pag (Mimica, Košljun), Hvar and Korčula (Proizd Cape) Islands, at Muggia, Molunat, and S. Foca in the Province of Lecce (Fig. 2).

### Subgenus *Leptochiton* Gray, 1847

#### *Lepidopleurus (Leptochiton) bedullii* (Dell'Angelo & Palazzi, 1986)

*Station*: MLJ-53.

*Depth range*: 12 m (valves)

*Habitat*: Only valves extracted from sandy deposit (H. Zibrowius, pers. comm.).

*Description*: A full description of the species is reported in DELL'ANGELO & SMRIGLIO (1999: 71, pls. 19–20, Figs 28–29).

*Remarks*: *L. bedullii* has already been reported for the Adriatic Sea (BEDULLI *et al.*, 1995) as *Lepidopleurus (Leptochiton) boettgeri* (Sulc, 1934) on the basis of a single intermediate valve from Istria, Umag, in the DELL'ANGELO collection (unpublished data). The valves from Mljet Island confirm the presence of this species in the Adriatic Sea (Fig. 3), in spite of the fact that findings of valves known so far must be considered occasional, and the true species habitat has not yet been established. Specimens found alive, including those of the type series, were collected during research by E.N.E.A. at Laghi Alimini (Lecce) and Punta Prosciutto (Taranto) in a *Posidonia oceanica* environment at about 10 meters, associated with malacofauna typical of the SGCF biocoenoses. Other specimens and loose valves instead come from dredging by fishermen, in typical coralligenous environments and still deeper, at 50–60 meters (DELL'ANGELO & PALAZZI, 1986).

*Distribution*: In addition to the above localities, random findings occurred at Italian localities along the coast of Apulia (Fig. 3), Tuscany, and Sicily. Recorded also from Malta, Tunisia, Turkey, Greece and Cyprus.

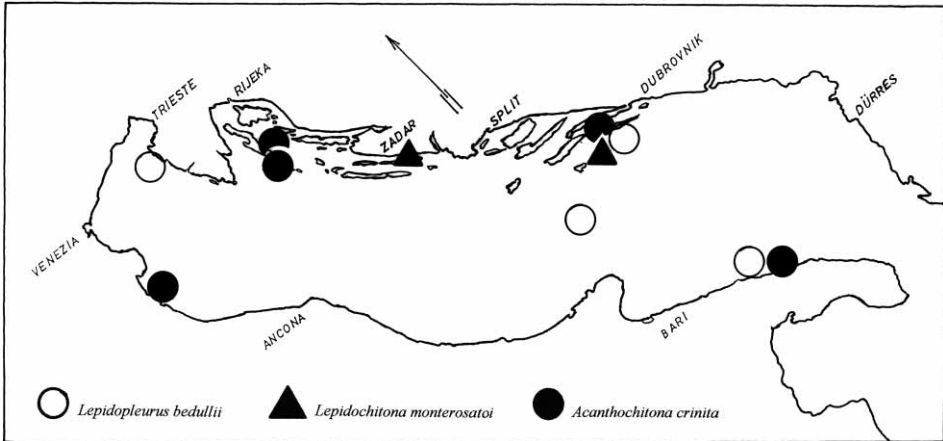


Fig. 3. Records in the Adriatic Sea of *Lepidopleurus bedullii*, *Lepidochitona monterosatoi*, and *Acanthochitona crinita*

**Suborder ISCHNOCHITONINA** Bergenhayn, 1930

**Family ISCHNOCHITONIDAE** Dall, 1889

**Subfamily ISCHNOCHITONINAE** Dall, 1889

**Genus *Ischnochiton*** Gray, 1847

**Subgenus *Ischnochiton* s.str.**

***Ischnochiton (Ischnochiton) rissoi* (Payraudeau, 1826)**

*Synonymy:* *Chiton mediterraneus* Gray MS, Reeve, 1847: Pl. 23, Fig. 157.

*Chiton meneghinii* Capellini, 1859: 325, Pl. 12, Figs. 1a–c.

*Stations:* MLJ-1, 4, 53.

*Depth range:* 1–5 m (12 m for valves).

*Habitat:* Crude anthropogenic waste. Valves extracted from sand deposited between the corallian *Cladocora caespitosa* colonies but no live chiton was recorded while adhering to corallites.

*Description:* A full description of the species is reported in LELOUP & VOLZ (1938: 18, Figs 22–25) and DELL'ANGELO & SMRIGLIO (1999: 100, pls. 29–31, Figs 40–48).

*Remarks:* The species is rather common, and very variable in size, sculpture, and colour. It is found in rather shallow water, mainly between 1 and 5 meters, rarely down to a maximum of 100 meters, always adhering to stones, fragments of rocks, and dead shells.

*Distribution:* The species is typically Mediterranean. Not recorded from the Atlantic, except in the surroundings of Gibraltar and at the Canary, Selvagens and Azores Islands, but these last records have to be confirmed. Numerous new records

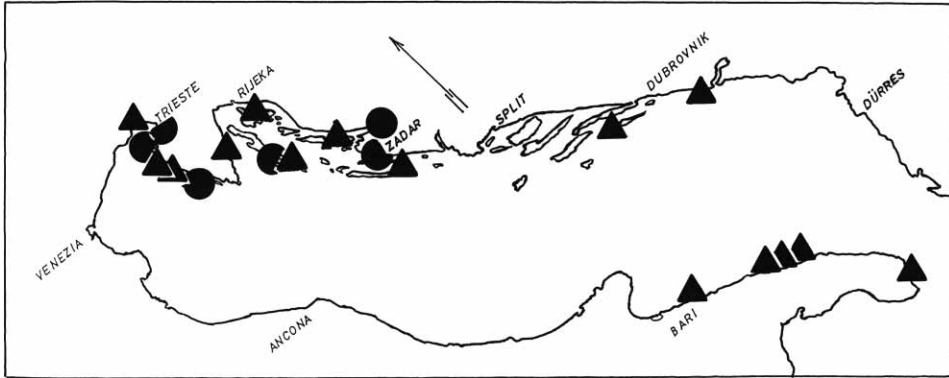


Fig. 4. Records of *Ischnochiton rissoi* in the Adriatic Sea. ● from the literature, ▲ this study.

along the eastern Adriatic coast and islands (Trieste-Aurisina, Umag, Poreč, Raša, Klimno, Pag-Mlinica, Biograd n.m., and Molunat), and in the Apulian region (Bari, Torre Chianca, San Foca, Boca Vecchia, Otranto-Torre Serpe) (Fig. 4) contributed essentially to the distribution pattern of this species in the Adriatic Sea.

### Subfamily CALLOCHITONINAE Plate, 1901

#### Genus *Callochiton* Gray, 1847

#### *Callochiton septemvalvis* (Montagu, 1803)

*Synonymy:* *Chiton achatinus* Brown, 1823: 402.

*Chiton euplaeae* O.G.Costa, 1829: I, IV, Pl. 1, Fig. 3.

*Chiton doriae* Capellini, 1859: 325, Pl. 12, Fig. 2.

*Stations:* MLJ-11, 16, 23, 51, 53.

*Depth range:* 1–16 m (12–39 m for valves)

*Habitat:* Under loose stones and on vertical walls overgrown by *Flabellia petiolata*, *Peyssonnelia* sp. and *Palmophyllum crassum*, and accompanied by the scleractinian *Madracis pharensis*, endolithic shellfish *Lithophaga lithophaga*, etc.

*Description:* A full description of the species is reported in LELOUP & VOLZ (1938: 12, Figs 12–16, as *Callochiton laevis*) and DELL'ANGELO & SMRIGLIO (1999: 125, pls. 40–41, Figs 55–63).

*Remarks:* This Mediterranean *Callochiton* has been confused until recent times with *C. laevis* (Montagu, 1803, not Pennant, 1777). It lives in a range from shallow water (20–30 cm) to a maximum of 500 meters depth, preferably on coralline algae.

*Distribution:* Present in the whole Mediterranean but in a rather discontinuous abundance, from locally very common to quite rare. It is widely distributed in the Atlantic Ocean, from Norway and the Shetland to the Canary Islands. Numerous



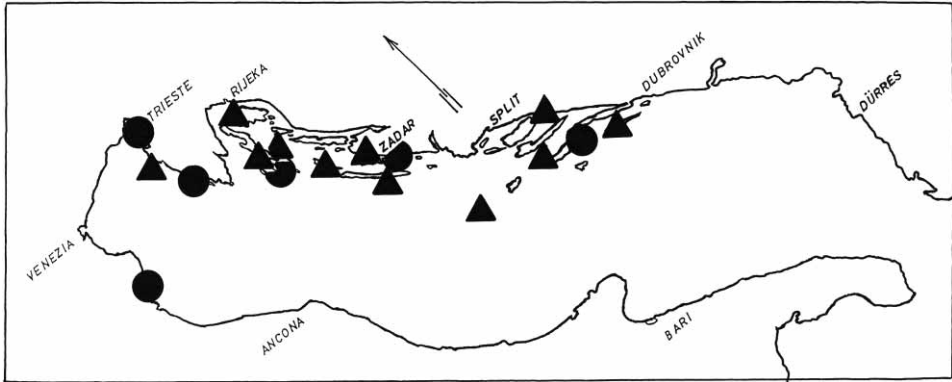


Fig. 5. Records of *Callochiton septemvalvis* in the Adriatic Sea. ● from the literature, ▲ this study.

new records are available from the eastern Adriatic Sea: Umag, Krk, Cres (Oz Cape, Ćutin Veli islet), Lošinj (Privlaka) and Korčula (Proizd Cape) Islands, Južni Greben islet, Zadar (Puntamika), Makarska, Kornat Island (Lupeščina cove), Jabuka islet, and the present Mljet Island stations (Fig. 5).

### Subfamily LEPIDochITONINAE Iredale, 1914

#### Genus *Lepidochitona* Gray, 1821

#### Subgenus *Lepidochitona* s.str.

#### *Lepidochitona* (L.) *caprearum* (Scacchi, 1836)

*Synonymy*: *Chiton polii* Philippi, 1836: 106 (non Deshayes, 1833 = *Chiton olivaceus* Spengler).

*Chiton corrugatus* Reeve, 1848: Pl. 28, Fig. 185.

*Chiton decipiens* Tiberi, 1877: 141.

*Stations*: MLJ-14, 15, 16, 18, 19, 22, 29, 34, 43, 44, 47, 51, 60, 62.

*Depth range*: 0–0,5 m.

*Habitat*: In mediolittoral rock-pools, single specimens, never aggregated, but according to phytocoenological approximations the population density in a well populated rock-pool could be recorded as 1.1. Also collected in the shaded end of a crack in the tidal zone.

*Description*: A full description of the species is reported in LELOUP & VOLZ (1938: 15, Figs 17–21, as *Middendorffia caprearum*) and DELL'ANGELO & SMRIGLIO (1999: 143, pls. 46–48, Figs 73–76).

*Remarks*: Species very common, typical in mediolittoral rocky habitats. At localities of high tides as, for instance, in the Gulf of Gabes, it was recorded in the upper belt characterised by a *Chthamalus stellatus* population, and in the lower one with

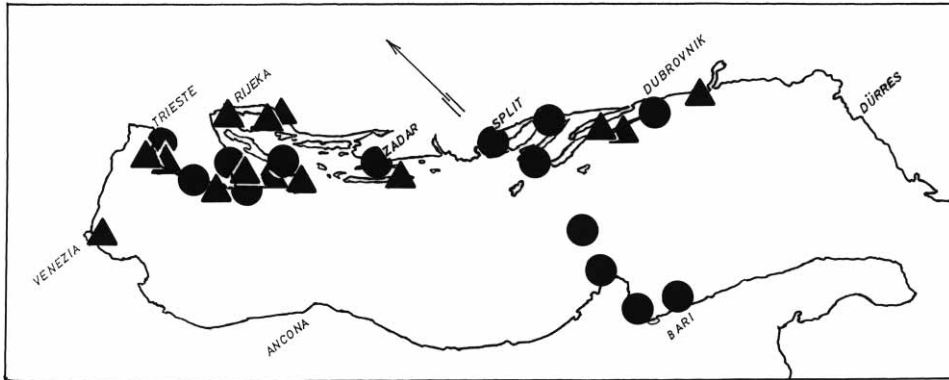


Fig. 6. Records of *Lepidochitona caprearum* in the Adriatic Sea. ● from the literature, ▲ this study.

*Osilinus turbinatus* and the *Lithophyllum* zone (FISCHER, 1978). In the north Adriatic Sea, in the biocoenosis of mediolittoral rocks, *L. caprearum* occurred somewhere between the thalli of *Fucus virsoides* (ZAVODNIK, 1967b). ŠIMUNOVIĆ (1970) recorded a maximum density of 70 specimens in a quarter of a square meter. It can survive out of water and therefore is found also at the supralittoral level besides *Melaraphe neritoides*, in the interstices of rocks where the waves break. This explains why specimens' valves are often very eroded and encrusted.

**Distribution:** A species typically Mediterranean, distributed along all Mediterranean rocky shores, including the Black and Marmara Seas. Records from the North African coast are rare. Found in the Atlantic only along the southern coast of Spain and Portugal and at the Selvagens Islands. Most common along the eastern Adriatic Sea mainland and island coasts (Fig. 6). Authors' unpublished collection sites besides those noted above, are the following: Venice (Sottomarina), Savudrija, Poreč (Črvar, Lanterna), Brioni Archipelago, Susak, Unije, Cres (Golubinec Cape) and Krk (Punat) Islands, Goli and Grgur islets, Kornati Archipelago, and Molunat (Fig. 6).

### *Lepidochitona (L.) monterosatoi* Kaas & Van Belle, 1981

**Stations:** MLJ-16, 53.

**Depth range:** 12–39 m (valves)

**Habitat:** No data (valves collected by H. Zibrowius).

**Description:** A full description of the species is reported in DELL'ANGELO & SMRIGLIO (1999: 158, pls. 52–53, Figs 79–83).

**Remarks:** *L. monterosatoi* is a small-sized species (up to 12 mm) not very frequent, but easily distinguishable from the other Mediterranean *Lepidochitona* for its dorsal elevation, beaked apex of intermediate valves, peculiar disposition of granules over the pleural areas, and presence of isolated and long curved spines on the girdle. *L. monterosatoi* lives in microcavities of calcareous algae associations. It is rather diffi-

cult to detect, as it is well camouflaged in the surrounding environments. It was often observed while feeding on Cyanophyta (BIONDI *et al.*, 1983). All the findings have taken place at depths between 0.5 and 40 meters. Specimens also have been dredged by fishermen on fragments of rocks from a depth of about 30–40 meters.

*Distribution:* Random records from various Mediterranean localities: Tyrrhenian Sea, Sicily, Sardinia, France, Turkey, Cyprus, Greece, Tunisia, and Spain. It was also recorded from the Red Sea, Dahlak Islands (STRACK, 1993). The species has already been reported for the Adriatic Sea (STRACK, 1982: 1 specimen from Murter Island, Dalmatia, on rock fragments dredged at a depth of 10–20 m) (Fig. 3).

**Family CHITONIDAE Rafinesque, 1815**  
**Subfamily CHITONINAE Rafinesque, 1815**

**Genus *Chiton* Linné, 1758**  
**Subgenus *Rhyssoplax* Thiele, 1893**

***Chiton (Rhyssoplax) olivaceus* Spengler, 1797**

*Synonymy:* *Lepidopleurus sulcatus* Risso, 1826: 268.

*Chiton siculus* Gray, 1828: 5.

*Chiton polii* Deshayes, 1832: 132.

*Stations:* MLJ-1, 4, 5, 6, 11, 16, 21, 22, 23, 24, 26, 27, 35, 38, 46, 49, 53, 57, 58, 59, 61.

*Depth range:* 0,2–30 m (26–39 m for valves)

*Habitat:* Bedrock and biogenic consolidated stones; under stones; in a clump of *Mesophyllum expansum*; on rock overgrown by photophilic algae; in *Cladocora caespitosa* bioherms – microhabitats were not specified; common on anthropogenic crude waste.

*Description:* A full description of the species is reported in LELOUP & VOLZ (1938: 22, Figs 31–35) and DELL'ANGELO & SMRIGLIO (1999: 169, pls. 56–57, Figs 86–96).

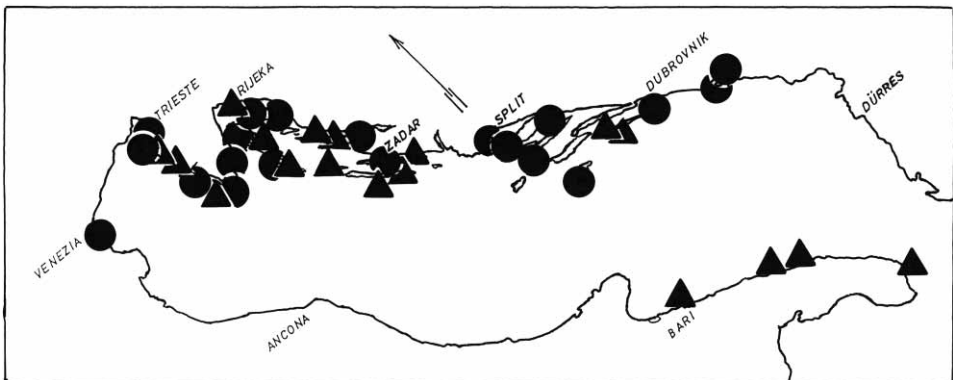


Fig. 7. Records of *Chiton olivaceus* in the Adriatic Sea. ● from the literature, ▲ this study.

*Remarks:* Species with a wide ecological distribution. It was commonly found down to 5–6 meters, more rarely deeper down to about 35–40 m in depth, always under stones or rocky fragments. It was also recorded from the lower mediolittoral belt, on rocks covered with algae, and in the crevices of the pavement built by vermetids (DELL'ANGELO & SMRIGLIO, 1999). Reported from sandy detritic bottom (VATOVA, 1928). FISCHER (1978) suggested that *Ch. olivaceus* cannot be considered a true littoral species but rather a species whose upper limit corresponds to the lower limit of the tide.

*Distribution:* A species diffused in the whole Mediterranean and recorded from the Marmara Sea. It was also collected in the Atlantic, both on the southern coast of Portugal and at Tangiers. Very common in the eastern Adriatic (Fig. 7). Newly collected along Italian Apulian coast (Bari, Lecce province: S. Foca and Roca li Posti, and Otranto environs: Torre d. Serpe) and Croatian mainland and islands: Umag, Poreč, Brioni Archipelago (Madona islet), Bakar Bay, Omišalj cove, Islands of Lošinj (Privlaka) and Cres (Ćutin Veli, Oz and Abis Capes), Srednji greben islet, Pag Island (Mlinica), Dugi Island (Telaščica cove), Kornati Archipelago (Piškera), Biograd n.m., and in the Mljet National Park.

### *Chiton (Rhyssoplax) corallinus* (Risso, 1826)

*Synonymy:* *Chiton rubicundus* O.G.Costa, 1829: i, iii, Pl. 1, Fig. 2.

*Chiton pulchellus* Philippi, 1844 (non Gray, 1828): 83, Pl. 19, Fig. 14.

*Chiton philippii* Issel, 1870: 5 (*nom. nov.* pro *Chiton pulchellus* Philippi, 1844).

*Stations:* MLJ-15, 16, 51.

*Depth range:* 35–40 m (26 m for valves)

*Habitat:* In a cluster of *Mesophyllum expansum*, and on a thallus of *Peyssonnelia polymorpha*.

*Description:* A full description of the species is reported in LELOUP & VOLZ (1938: 24, Figs 36–38) and DELL'ANGELO & SMRIGLIO (1999: 174, pls. 58–59, Figs 97–107).

*Remarks:* A not very frequent species of relatively deep water. *Chiton corallinus* has often been recorded from bottoms of the coralligenous type, between 15 and more than 100 m in depth (SABELLI, 1974; BARASH & DANIN, 1977: 2 specimens found at Cape Andreas, Cyprus, at a depth of 119 m). RIEDL (1966) quoted it as a submarine cave dweller. Other records on stones stuck in muddy bottom always deeper than 15 m depth (GHISOTTI, 1972). ZAVODNIK (1971) noticed the preference of this species with the biocoenosis of coastal detritic bottom. FISCHER (1978) added *C. corallinus* to the list of Polyplacophora living in the littoral environment, and by some recent records it occurred at a depth between the sea surface to a few meters depth (BARASH & DANIN, 1977; BIONDI *et al.*, 1983). Consequently, the species can be considered eurybathyal, between 0 and over 100 m depth. Found also in the gastric cavity of *Astropecten aranciacus*.

*Distribution:* *Chiton corallinus* has been recorded, but never frequently, in almost the whole Mediterranean, and could be considered a species endemic to this area.

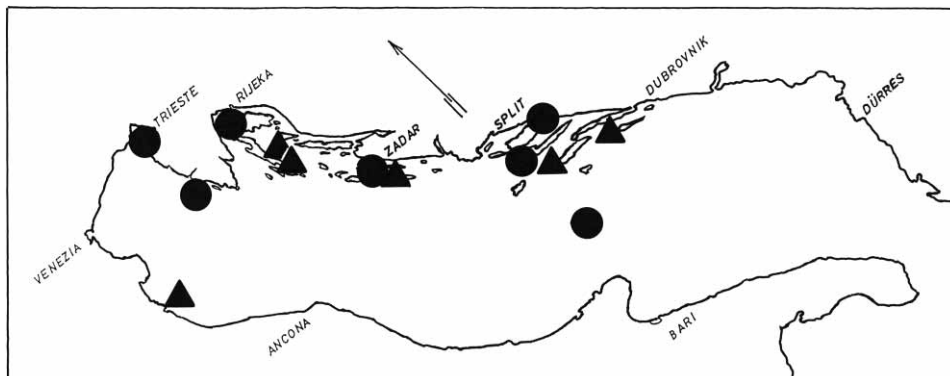


Fig. 8. Records of *Chiton corallinus* in the Adriatic Sea. ● from the literature, ▲ this study.

In the Adriatic Sea it has been collected rather rarely. The new authors' records refer to Porto Garibaldi, a few stations in the Mljet National Park, Lošinj, Ćutin Veli islet, and to the Korčula Island Proizd Cape (Fig. 8).

#### Suborder ACANTHOCHITONINA Bergenhayn, 1930

#### Family ACANTHOCHITONIDAE Simroth, 1894

#### Subfamily ACANTHOCHITONINAE Simroth, 1894

#### Genus *Acanthochitona* Gray, 1821

#### *Acanthochitona fascicularis* (Linnaeus, 1767)

*Synonymy:* *Acanthochites communis* Risso, 1826: 268.

*Chiton fascicularis* var. *major* Philippi, 1836: 108, Pl. 7, Figs. 2a–b.

*Acanthochiton communis* forma *barashi* Leloup, 1969: 1, Figs. 1, 2d, 3df, 4b.

*Stations:* MLJ-11, 16, 23, 24, 51, 53, 57, 59.

*Depth range:* 0,3–40 m (12–39 m for valves)

*Habitat:* Under loose stones, and in biogenic clusters.

*Description:* A full description of the species is reported in LELOUP & VOLZ (1938: 26, Figs 39–42, as *Acanthochiton communis*) and DELL'ANGELO & SMRIGLIO (1999: 192, pls. 64–65, Figs 113–123).

*Remarks:* *A. fascicularis* is an exceedingly variable species. Accordingly, its synonymy is quite complicated. It is a typical cryptic species inhabiting spaces under loose stones and rock fragments often covered with algae. It has been also found in the gastric cavity of *Astropecten aranciacus*. Recorded by FISCHER (1978) along the French coast of the English Channel, from the mediolittoral zone. Found in dredging operations up to 73 m depth.

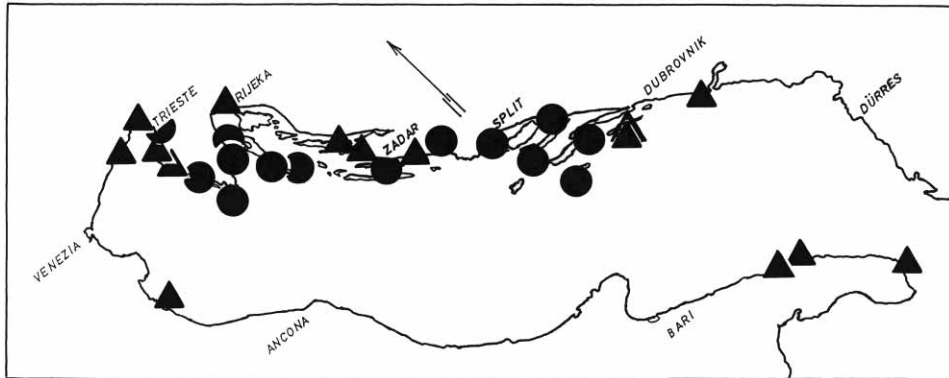


Fig. 9. Records of *Acanthochitona fascicularis* in the Adriatic Sea. ● from the literature, ▲ this study.

*Distribution:* The species is found in the whole Mediterranean and in the Atlantic Ocean, from the English Channel and Bretagne to the Azores and Canary Islands. In the light of recent unpublished records of the authors, this species, in the eastern Adriatic Sea, must be one of the most common littoral chitons. New localities in the area are the following: Grado, Trieste (Aurisina), Muggia, Savudrija, Poreč (Lanterna), Bakarac, Pag Island (Mlinica, Košljun), Zadar (Puntamika), Biograd n.m., Mljet Island, and Molunat. Along the western i.e. Italian coast, *A. fascicularis* was recorded recently at Porto Garibaldi, in the Lecce Province (S. Foca, Roca li Posti), and in the environs of Otranto (Torre Serpe) (Fig. 9).

### *Acanthochitona crinita* (Pennant, 1777)

*Synonymy:* *Chiton onyx* Spengler, 1797: 95.

*Chiton fascicularis* var. *minor* Philippi, 1836: 108.

*Acanthochiton oblongus* Leloup, 1981: 1, Figs. 1a–d, Pl. 1.

*Station:* MLJ-39.

*Depth:* 15 m

*Habitat:* On a large stone deposited in a *Posidonia oceanica* meadow, and covered by a dense carpet of *Rytiphloea tinctoria*.

*Description:* A full description of the species is reported in LELOUP & VOLZ (1938: 30, Figs 43–46, as *Acanthochiton fascicularis*) and DELL'ANGELO & SMRIGLIO (1999: 198, pls. 66–68, Figs 124–130).

*Remarks:* This species is far less common than *A. fascicularis*, from which it can be easily distinguished by differences in the length of the girdle spicules, ellipsoidal outline of intermediate valves, and shape of the tegmentum granules. *A. crinita* has been collected both in shallow water (intertidal zone) and at greater depths (down to about 50 m) in precoralligenous and coralligenous environments. Also, a much deeper finding (175 m) has been recorded. It has also occurred under stones stuck

**Tab. 2.** Data sources on the Mljet National Park chitons.

Species	Divers' records	No. Specimens studied	Subfossil valvae
<i>Lepidopleurus cajetanus</i>	11	8	+
<i>Lepidopleurus bedullii</i>	.	.	+
<i>Ischnochiton rissoi</i>	2	3	+
<i>Callochiton septemvalvis</i>	6	1	+
<i>Lepidochitona caprearum</i>	14	25	.
<i>Lepidochitona monterosatoi</i>	.	.	+
<i>Chiton olivaceus</i>	21	20	+
<i>Chiton corallinus</i>	1	4	+
<i>Acanthochitona fascicularis</i>	8	6	+
<i>Acanthochitona crinita</i>	1	5	.

in of sand and pebble bottoms. It has been reported by FISCHER (1978) from the mediolittoral level in association with acorn barnacles. Reported also in association with various kinds of algae.

*Distribution:* Found in nearly the whole of the Mediterranean, with sparse records from the African coast, and along the Atlantic coast of Europe (as far north as Norway) and North America, plus Madeira, the Azores, Canary Islands, and Cape Verde Archipelago. In the Adriatic Sea it was collected at Roca li Posti, Porto Garibaldi, Cres (Ćutin Veli) and Lošinj (Privlaka) Islands, and in the Mljet National Park (see above) (Fig. 3).

## DISCUSSION & CONCLUSIONS

OLIVI (1792) published the first report on Adriatic chitons: *Chiton fascicularis* (it is impossible to say if *A. fascicularis*, or *A. crinita*), *Chiton squamosus* (unidentifiable) and *Chiton ruber* (unidentifiable). CHIEREGHINI, in his 1802 MS, noticed some species reported subsequently by NARDO (1847) and BRUSINA (1870): *Chiton globulosus* (nomen nudum), *Chiton striatus* and *Chiton striatus* var. (= *Chiton olivaceus*, fide MONTEROSATO, 1879), and *Chiton Estuarii* (a 7-valved specimen = *Chiton olivaceus*, fide MONTEROSATO, 1879). RENIER (1804) described *Chiton punctatus* (unidentifiable) and *Chiton subdivisus* (= *Chiton olivaceus*?). NARDO (1847) described *Chiton rubellus* (probably a red form of *Chiton olivaceus*, fide MONTEROSATO, 1879). Von MARTENS (1838, fide CARUS, 1895) reported on Polyplacophorans from Venice Bay. It is very difficult to identify these old records, published without descriptions, and sometimes illustrated only in MS. Notes on the identification problem were provided by BRUSINA (1870), STALIO (1874), MONTEROSATO (1872, 1879), and DELL'ANGELO & SMRIGLIO (1999). Important basic information on Adriatic Sea chitons was provided by LELOUP & VOLZ (1938), CESARI (1987), COSSIGNANI *et al.* (1992), and BEDULLI *et al.* (1995). Regrettably, no data were available to the authors on chitons from the Albanian coast.

Altogether 16 polyplacophoran valid species have been recorded to date in the Adriatic Sea, i.e. 55 % of all species reported in the Mediterranean area (DELL'ANGELO & SMRIGLIO, 1999) (Tab. 3). In the Mljet National Park 10 species were recorded, i.e. 63 % of the Adriatic Sea polyplacophorans. With regard to their geographical distribution, six species are Mediterranean endemics: *Lepidopleurus bedullii*, *Ischnochiton rissoi*, *Lepidochitona caprearum*, *Lepidochitona monterosatoi*, *Chiton olivaceus*, and *Chiton corallinus*. The following four species are widely distributed in the Atlantic-Mediterranean province: *Lepidopleurus cajetanus*, *Callochiton septemvalvis*, *Acanthochitona fascicularis*, and *Acanthochitona crinita* (LELOUP & VOLZ, 1938; FREDJ, 1974; DELL'ANGELO & SMRIGLIO, 1999).

A great majority of polyplacophoran molluscs are shade-seeking animals inhabiting cryptic habitats such as niches below stones, cracks, crude household waste, and microniches in biogenic clumps. For example, the anthropogenic litter accumulated in the Mljet National Park was often populated by *Chiton olivaceus*, once associated also with an *Ischnochiton rissoi* specimen. In a list of Mediterranean submarine cave dwellers, the following five polyplacophoran species were quoted by RIEDL (1966) and STARMÜHLNER (1968): *Lepidopleurus cinereus* (= ? *Lepidochitona cinerea*), *Callochiton laevis* (= *C. septemvalvis*), *Chiton corallinus*, *Acanthochitona fascicularis*, and *Ischnochiton rissoi*.

The interspecific relations of the Adriatic Sea chitons are little known. Rarely has the epizoic mode of their life been reported. As far back as 1883, WIMMER recorded *Lepidopleurus cajetanus* specimens settled on sponges and molluscan shells. In the environs of Rovinj, on large *Geodia cydonium* sponges SANTUCCI (1922) collected *Chiton laevis* (= *C. septemvalvis*) and *Acanthochites fascicularis* (= *Acanthochitona fascicularis* or *A. crinita*?) specimens. On the common fan shell (*Pinna nobilis*) ZAVODNIK (1967 a) recorded specimens of *Acanthochitona fascicularis*, *Chiton olivaceus*, and *Ischnochiton rissoi*. In some places, *Lepidochitona caprearum* and *Acanthochitona fascicularis* were associated with mussel (*Mytilus galloprovincialis*) shore aggregations (EMRIĆ, 1996). Also, *Chiton olivaceus* was collected from the shells of reared mussel (IGIĆ, 1982). It is interesting, however, that on 81 *Pinna nobilis* specimens studied in the Malo and Veliko jezero (ŠILETIĆ & PEHARDA, 2003) no epizoic chiton was recorded on shellfish shells. In the area of interest, however, indigenous mussel populations were not inspected for chitons. On the other hand, valves of live chitons, obviously, are not a favourite substrate for tiny sessile organisms. In the present material collected and studied, only one *Chiton olivaceus* specimen was settled by a few, spirorbid, worms.

The ecological significance of chitons, and their affinities to peculiar benthic communities rarely have been the subject of special interest. The first notes in the world on polyplacophoran synecology were provided by LORENZ (1863) while studying benthic communities in the Quarner / Kvarner area, north Adriatic Sea. In the actual biocoenosis of low mediolittoral rocks (PÉRÈS & PICARD, 1964) named by LORENZ »Facies *Patellae et Balaneta*«, the author recorded the species *Chiton Polii* (i.e. *Lepidochitona caprearum*). In the upper infralittoral zone, between the sea surface and about 3.5 m depth, in the community recognized by LORENZ as »Facies *Echinus lividus et Actinia viridis*« (actually a degraded biocoenosis of photophilic algae),



**Tab. 3.** List of chitons recorded in the Adriatic Sea. General distribution codes: AM – Atlantic Mediterranean; BO – Boreal; MM – Mediterranean (endemic).

Species	General distribution	Adriatic Sea first record	Identified as species
		Author	
<i>Lepidopleurus cajetanus</i> (Poli, 1791)	AM	Danilo, 1856	<i>Chiton cajetanus</i>
<i>Lepidopleurus cancellatus</i> (Sowerby, 1840)	AM	Zavodnik, 1971	valid sp. (*)
<i>Lepidopleurus cinnicoides</i> (Monterosato, 1879)	AM	Monterosato, 1879	valid sp.
<i>Lepidopleurus scabridus</i> (Jeffreys, 1880)	AM	Dell'Angelo & Palazzi, 1986	valid sp.
<i>Lepidopleurus bedullii</i> (Dell'Angelo & Palazzi, 1986)	MM	Dell'Angelo & Palazzi, 1986	valid sp.
<i>Lepidopleurus (Parachiton) africanus</i> Nierstrasz, 1906	MM	Mizzan, 1992	valid sp.
<i>Hanleya hanleyi</i> (Bean in Thorpe, 1844)	BO	Klečak, 1873	valid sp.
<i>Ischnochiton rissoi</i> (Payraudeau, 1826)	MM	( <i>vide</i> Leloup & Volz, 1938)	<i>Chiton Rissoi</i>
<i>Callochiton septemvalvis</i> (Montagu, 1803)	AM	Lorenz, 1863	<i>Chiton doriae</i>
		v. Martens, 1838	
		( <i>vide</i> Carus, 1895)	
<i>Lepidochitona cinerea</i> (Linnaeus, 1767)	AM	Grube, 1864	<i>Chiton variegatus</i>
<i>Lepidochitona caprearum</i> (Scacchi, 1836)	MM	Danilo, 1856	<i>Chiton Poli</i>
<i>Lepidochitona monterosatoi</i> Kaas & van Belle, 1981	MM	Strack, 1982	valid sp.
<i>Chiton corallinus</i> (Risso, 1826)	MM	Grube, 1864	<i>Chiton pulchellus</i>
<i>Chiton olivaceus</i> Spengler, 1797	MM	v. Martens, 1838	valid sp.
		( <i>vide</i> Carus, 1895)	
<i>Acanthochitona fascicularis</i> (Linnaeus, 1767)	AM	Leloup & Volz, 1938	<i>A. communis</i> (**)
<i>Acanthochitona crinita</i> (Pennant, 1777)	AM	Leloup & Volz, 1938	<i>A. fascicularis</i> (**)

(\*) Other references prior to LELOUP & VOLZ (1938) are impossible to compare as specimens could be *Lepidopleurus cinnicoides*, or *L. scabridus*, or *L. bedullii*.

(\*\*) One cannot compare references for *Acanthochitones fascicularis* prior to LELOUP & VOLZ (1938) as they probably refer to *Acanthochitona fascicularis* and/or *A. crinita*.

*Chiton siculus* (i.e. *Chiton olivaceus*) and *Chiton fascicularis* were noted. In the same biocoenosis, in the algal facies named »Ceramieta und Laurencieta« var. 1 »Litoral-Nulliporetum«, the author quoted *Chiton cajetanus*, *Ch. fascicularis*, and *Ch. siculus*.

In modern synecological papers, polyplacophoran molluscs, because of the scarce records, were rather rarely treated as a species important for their ecological preference. In his famous paper on the benthos in the environs of Marseille PICARD (1965) did not detail the ecological preference of *Acanthochiton communis* or *Callochiton laevis*. ZAVODNIK (1971) suggested that *Lepidopleurus cancellatus* and *Chiton corallinus* are species preferring the biocoenosis of the coastal detritic bottom. However, many authors suppose that *Ch. corallinus* is a characteristic species of a typical facies of coralligenous biocoenosis, inhabiting primarily microniches in the *Mesophyllum expansum* aggregations. With regard to the present data, this point of view probably is correct in spite of the suggestion by FISCHER (1978) that *C. corallinus* is a littoral species. Evidently, the clearest definition of *Lepidochitona caprearum* is as a species exclusive to the biocoenosis of lower mediolittoral rocks (BELLAN-SANTINI, 1969). The present research corroborates the species' importance in the Adriatic mediolittoral pools.

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## SAŽETAK

### Morska fauna Nacionalnog parka Mljet (Jadransko more).

#### 4. Babuške (Mollusca: Polyplacophora)

B. Dell'Angelo & D. Zavodnik

U akvatoriju Nacionalnog parka Mljet, za vrijeme ljetnih praznika u godinama 1995.–2000., ronionci studentske udruge »Thais« prilikom istraživanja bentosa uz obalu i uzduž ronilačkih transekata na 36 mjesta sakupili su ukupno 10 vrsta babuški. Prema tome, u odnosu na cijeli Jadran, u kojem je do sada utvrđeno 16 vrsta, maleno područje mljetskog Nacionalnog parka ističe se raznolikošću faune poliplakofora. Uz svaku se nađenu vrstu navode sinonimi korišteni u jadranskoj malakološkoj literaturi, staništa i dubina mljetskih nalaza, te opća rasprostranjenost vrsta. Dodani su kartografski prikazi jadranskih nalaza od kojih neki do sada još nisu bili objavljeni. Ukazuje se i na probleme vrednovanja nalaza starih autora, gdje zbog nedostatka ili manjkavih opisa primjeraka često nije bilo moguće utvrditi o kojoj se danas validnoj vrsti stvarno radi.