A C T A A D R I A T I C A
INSTITUT ZA OCEANOGRAFIJU I RIBARSTVO - SPLIT
SFR JUGOSLAVIJA

Vol. XVII, No. 15

CATALOGUE OF THE ADRIATIC ECHINODERMS

KATALOG JADRANSKIH EHINODERMATA

AMALIJA VIDOVIĆ - MATVEJEV

SPLIT 1978

CATALOGUE OF THE ADRIATIC ECHINODERMS

KATALOG JADRANSKIH EHINODERMATA

Amalija Vidović-Matvejev

Museum of Natural History, Beograd

Prirodnjački muzej, Beograd

INTRODUCTION

The echinoderm fauna of the Adriatic has been studied by many authors. However, most of these studies have been carried out in either rather limited areas or within general faunal works. Numerous and valuable data on the distribution and ecology of individual species are to be found in the biocoenological works. However, in spite of the fact that the echinoderms have been the object of many investigations, they have not been sufficiently studied in the whole Adriatic, from the taxonomic point of view.

Olivi (1792) was the first who studied the echinoderms in the northern Adriatic. But, the first taxonomic analysis of the north Adriatic echinoderms we owe to Grube (1840). Later Grube (1861, 1864) worked out the echinoderms of the bays of Trieste and Kvarner, and of Lošinj Island. Heller (1863, 1864, 1868) investigated the echinoderms occurring around Hvar, Vis and Korčula Islands, as well as those from the coastal waters near Dubrovnik. At the same time Lorenz (1860) found some new species in the Kvarner Bay. In his biocoenological studies (1868) this author also gave valuable contribution to the knowledge of the echinoderm fauna in that area. Studying samples from the »Pola« Expedition taken in the Mediterranean, Black Sea, and Adriatic, Marenzeller (1895) supplied data on the echinoderms from the deep Adriatic. In his paper »Prilog za faunu Jadranskog mora« Brusina (1908) included mainly the considerations of the echinoderms from the Zadar area. Babić (1913) contributed to the knowledge of some Adriatic asteroids.

The echinoderms collected during the »Najade« Expedition, from 1912 to 1914, were worked out by Kolosvary (1937). Owing to his later studies (1938a and b, 1940) more information on the Adriatic echinoderms became available. In his faunistic and biocoenological studies Vatova (1928, 1931, 1935, 1943, 1949a and b, 1950) dealt with the echinoderm fauna of the northern and central Adriatic, especially with that of the Venetian Lagoon and Rovinj. By heir biocoenological works Gamulin-Brida (1960, 1962, 1963, 1964, 1965, 1967a and b, 1968, 1973) supplied very valuable data on the distribution and ecology of a rather great number of the echinoderm species from the whole Adriatic. Zavodnik (1961) gave an inventory of the known Adriatic species and in his faunistic and biocoenological studies (1960, 1962, 1967a and b) worked out the north Adriatic echinoderms. In his book »Fauna und Flora der Adria« (1963, 1970) Riedl included also the considerations of the echino-

derm fauna. Some foreign authors (Ludwig, 1879, 1897; Tortonese, 1935, 1958, 1965, etc.) dealing with the Mediterranean fauna studied concurrently the Adriatic echinoderms.

The Fishery Biological Expedition »Hvar«, in 1948 and 1949, carried out the observations in almost whole of the Adriatic, from the line Rovinj — Venice to Himarë in Albania, at 167 stations, the greatest depths excluded. A smaller number of echinoderm species was preliminarily studied bu Karlovac (1959). The whole echinoderm material collected by the »Hvar« Expedition and the detailed data on it are the object of my, not yet finished, doctoral thesis. In this catalogue the data on the characteristic biotopes were taken from my thesis. The data on this subject given by other authors (Vatova, 1949; Pérès and Gamulin-Brida, 1973) were also used.

More important world data on the taxonomy and biocoenology of echinoderms, as well as almost all the data on the Adriatic were consulted. The log books and the material from the »Hvar« Expedition, and the collection of the Institute of Oceanography and Fisheries, Split were used. The inventory book of the enchinoderm collection from the National Croatian Zoological Museum in Zagreb was also available.

The taxonomic categories and the general order of taxa used were taken from the Tortonese's work »Fauna d'Italia. Echinodermata« (1965).

The synonyms from the studies of all the investigators who worked in the Adriatic are brought out in the catalogue.

The numbers of taxa for the Adriatic are as follows:

	Subclassis	Ordo	Subordo	Familia	Genus	Species
Crinoidea	—	1	—	1	2	2
Asteroidea	—	4	2	10	15	22
Echinoidea	2	4	3	9	14	17
Total	2	9	5	20	31	41

UVOD

Faunu jadranskih ehinodermata istraživali su brojni autori. Međutim, većina tih istraživanja bila je ili regionalno ograničena i obuhvatila samo pojedine delove Jadrana, ili su pojedini autori u svojim opštim faunističkim radovima, pored ostalih životinjskih grupa, obradili i grupu ehinodermata. Vrlo brojni i vredni podaci o ekologiji i rasprostranjenosti pojedinih vrsta nalaze se i u biocenološkim radovima raznih autora. No unatoč činjenici da je grupu ehinodermata proučavao veliki broj pouzdanih istraživača, ona nije u sistematskom pogledu kao celina dovoljno dobro istražena na celom području Jadrana.

Prva istraživanja izvršio je u severnom Jadranu Olivi (1792). Grube (1840) prvi put daje sistematsku obradu ehinodermata severnog Jadrana, a u kasnijim svojim radovima isti je autor posebno obradio ehinofaunu Tršćanskog zaliva, Kvarnera i Lošinja (1861, 1864); Heller (1863, 1864, 1868) svojim ispitivanjima ove grupe životinja obuhvata južni Jadran oko otoka Hvara, Visa, Korčule i obalno područje oko Dubrovnika. U isto je vreme Lorenz (1860) pronašao nekoliko novih vrsta u Kvarneru a u svojim biocenološkim istraživanjima (1868) dao je također vredne priloge o ehinofauni tog područja. Ekspedicija »Pola« istraživala je u Sredozemnom, Crnom i u Jadranskom moru, kojom prilikom je sakupljen i obrađen materijal dubokog Jadrana (Marenzeller, 1895). Brusina (1908) je u »Prilogu za faunu Jadranskog mora« obuhvatio najvećim delom zadarsko područje. Babić (1913) daje prilog poznavanju nekih vrsta morskih zvezda u Jadranu.

Ispitivanja ekspedicije »Najade« obuhvatila su najveći deo Jadrana, kojom prilikom je sakupljen obilan materijal ehinofaune koju je kasnije obradio Kolosvary (1937). Isti autor dao je veliki broj radova (1938a, 1938b, 1940), koji su mnogo doprineli poznavanju ehinodermata Jadrana. Vatova je u svojim faunističkim i biocenološkim radovima (1928, 1931, 1935, 1943, 1949a, 1949b, 1950), pored ostalog obradio i ehinofaunu severnog i srednjeg Jadrana te posebno Venecijanske lagune i Rovinja.

Svojim biocenološkim istraživanjima na Jadranu u toku poslednjih godina Gamulin—Brida (1960, 1962, 1963, 1964, 1965, 1967a, 1967b, 1968, 1973) dala je veoma značajne podatke kako o rasprostranjenju tako i ekologiji većeg broja vrsta ove životinjske grupe za ceo Jadran. Zavodnik (1961) daje spisak ehinofaune Jadrana na osnovu literaturnih podataka, a u svojim faunističkim i biocenološkim radovima obradio je ehinofaunu severnog Jadrana (1960, 1962, 1967a, 1967b). Riedl (1963) je u priručniku o flori i fauni Jadrana obuhvatio i ehinofaunu. Veći broj stranih autora, radeći na Mediteranu, svojim su radovima obuhvatili i Jadran (Ludwig 1879, 1897; Tortonese 1935, 1958, 1965 itd.).

Ekspedicija »Hvar« (1948—1949) obuhvatila je gotovo čitavo Jadransko more od spojnice Rovinj — Venecija pa do Himare u Albaniji, na ukupno 167 postaja. Manji deo materijala je preliminarno obradio Karlovac (1959). Obimni podaci zabeleženi u dnevnicima te ekspedicije i sabrani materijal ehinofaune predstavljaju predmet moje još nedovršene doktorske disertacije, iz koje su u ovom katalogu uzeti podaci o karakterističnim staništima. Takvi podaci uzimani su i iz drugih radova (Pérès i Gamulin—Brida 1973; Vatova 1949).

Prilikom sastavljanja ovog kataloga konsultirana je važnija svetska i skoro sva jadranska sistematska i biocenološka literatura, zatim dnevnici i sabrani materijal ekspedicije »Hvar«. Korišćena je zbirka Instituta za oceanografiju i ribarstvo Split; kao i inventarska knjiga zbirke ehinodermata Hrvatskog narodnog zoološkog muzeja u Zagrebu. Taksonomske kategorije i opšti redosled taksona usvojeni su prema delu Tortonesa »Fauna d'Italia — Echinodermata« (1965).

U katalogu je data taksonomska sinonimika iz dela svih istraživača Jadranskog mora.

Na tablici dat je pregled brojčane zastupljenosti pojedinih taksona ehinodermata u Jadranskom moru:

	Subclassis	Ordo	Subordo	Familia	Genus	Species
Crinoidea	—	1	—	1	2	2
Asteroidea	—	4	2	10	15	22
Echinoidea	2	4	3	9	14	17
Ukupno	2	9	5	20	31	41

PHYLUM ECHINODERMATA

CLASSIS CRINOIDEA

Ord. *ARTICULATA*

Fam. Antedonidae

Gen. Antedon.

1. *Antedon mediterranea* (Lam.)
Comatula mediterranea Lamarck, 1816
Comatula mediterranea: Grube, 1840; Heller, 1863, 1864, 1868; Lorenz, 1863; Stossich. 1884.
Comatula europea: Sars, 1857.
Alecto europea: Grube, 1861, 1864.
Antedon rosacea: Ludwig, 1879; Graeffe, 1881; Carus, 1885; Zimmermann, 1907; Vatova, 1928.
Antedon bifida: Marenzeller, 1895.
Anthedon bifidus: Brusina, 1908.
Antedon mediterranea: Tortonese, 1935, 1965; Kolosvary, 1937; Zalokar, 1942; Vatova, 1949a; Czihak, 1959; Karlovac, 1959; Gamulin-Brida, 1960, 1962, 1965, 1967a, 1967b; Zavodnik, 1960, 1961, 1967b; Karaman et Gamulin-Brida, 1970; Pérès i Gamulin-Brida, 1973; Matvejev-Vidović (in litt.).
Antedon adriatica: Clark, 1911; Kolosvary, 1937, 1938.
Antedon mediterranea adriatica: Koehler, 1927; Tortonese, 1935; Zavodnik, 1961.
Antedon petasoides: Kolosvary, 1937.
Antedon adriatica f. petasoides: Kolosvary, 1938, 1940.
Antedon adriatica adriatica: Kolosvary, 1940.

General distribution: A typical Mediterranean species.

Adriatic Sea: Predominantly on deeper stony grounds covered by algae, on the *Posidonia* beds and secondary hard bottoms. Optimal depth between 50 and 100 m, but can also be found down to depth of 200 m.

Over a considerable period of years *Antedon adriatica* (Clark, 1911) and *Antedon petasoides* (Kolosvary, 1937) were taken as different species. Later they were reported as subspecies of *Antedon mediterranea*. Finaly, a thorough analysis of Tortonese (1965), brought out in his monography on echinofauna of Italy and adjacent areas, showed that morphological differences had an ecotopis character. This is why the existence of two separate species is far from being real. It was supported by the analysis of the morphological characters of the »Hvar« Expedition samples.

Gen. Leptometra

2. *Leptometra phalangium* (J. Müll.)

Alecto phalangium J. Müller, 1841.
Antedon phalangium: Marenzeller, 1895.

Leptometra phalangium: Vatova, 1949a; Karlovac, 1959; Zavodnik, 1961; Gamulin-Brida, 1967a; Pérès i Gamulin-Brida, 1973; Matvejev-Vidović (in litt.)

General distribution: A typical Mediterranean species.

Adriatic Sea: Distributed over the central and southern part. Rather rare. Occurs between 90 and 220 m. On sandy bottoms, but can also be found on muddy sand and mud.

CLASSIS ASTEROIDEA

Ord. PHANEROZONIA

Subord. Paxillosa

Fam. Astropectinidae

Gen. Astropecten

1. *Astropecten irregularis pentacanthus* (D. Ch.)

Asterias pentacantha Delle Chiaje, 1825

Astropecten pentacanthus: Sars, 1857; Heller, 1863, 1868; Lorenz, 1863; Grube, 1864; Ludwig, 1879, 1897; Graeffe, 1881; Stossich, 1884; Carus, 1885; Marenzeller, 1895; Zimmermann, 1907; Brusina, 1908; Vatova, 1928, 1935, 1949a; Kolosvary, 1937, 1938b, 1940.

Astropecten pentacanthus var. brevior: Lorenz, 1860.

Asterias pentacantha: Grube, 1861.

Astropecten irregularis pentacanthus: Kolosvary, 1937; Vatova, 1950; Tortonese, 1956, 1965; Karlovac, 1959; Gamulin-Brida, 1960, 1962, 1965; Zavodnik, 1960, 1961; Karaman et Gamulin-Brida, 1970; Matvejev-Vidović (in litt.).

Astropecten irregularis: Riedl, 1963; Gamulin-Brida, 1967b; Gamulin-Brida et al., 1968; Šimunović, 1969; Pérès i Gamulin-Brida, 1973.

General distribution: The Mediterranean; the eastern part of the Atlantic Ocean, from Partugal to the coast of French Guinea.

Adriatic Sea: The most widespread species. Thrives from depth of few meters to 929 m. On all kinds of bottoms.

2. *Astropecten jonstoni* (D. Ch.)

Asterias jonstoni Delle Chiaje, 1825

Astropecten jonstoni: Heller, 1863, Ludwig, 1879; Stossich, 1884; Babić, 1913; Tortonese, 1935, 1956, 1965; Kolosvary, 1937; Zavodnik, 1961.

General distribution: The Mediterranean.

Adriatic Sea: A littoral form. Between 2 and 12 m. On sandy bottoms.

3. *Astropecten aranciacus* (L.)

Asterias aranciaca Linnaeus, 1758

Asterias aranciaca: Olivi, 1792

Asterina aranciaca: Gravenhorst, 1831

Astropecten aurantiacus: Sars, 1857; Lorenz, 1860, 1863; Grube, 1861, 1864; Heller, 1863, 1868; Ludwig, 1879, 1897; Graeffe, 1881; Stossich, 1884; Carus, 1885; Zimmermann, 1907; Brusina, 1908; Cori, 1912; Vatova, 1928, 1935, 1936, 1943, 1949a; Tortonese, 1935; Kolosvary, 1937, 1940; Zalokar, 1942; Riedl, 1963; Gamulin-Brida, 1967b; Karaman et Gamulin-Brida, 1967b; Karaman et Gamulin-Brida, 1970, Pérès i Gamulin-Brida, 1973.

Astropecten aranciacus: Tortonese, 1956, 1965; Zavodnik, 1960, 1961, 1969; Gamulin-Brida, 1962; Gamulin-Brida et al., 1968; Matvejev-Vidović (in litt.).

General distribution: The Mediterranean; the eastern part of the Atlantic from Portugal to Angola.

Adriatic Sea: Particularly well-distributed littoral form. Between 1 and 100 m, but more frequent from 1 to 50 m. On sandy bottoms, particulary on the meadows of sea — grasses.

4. *Astropecten bispinosus* (Otto)

Asterias bispinosa Otto, 1823

Asterias bispinosa: Gravenhorst, 1831.

Astropecten bispinosus: Sars 1857; Grube, 1861, 1864; Heller, 1863, 1868; Marenzeller, 1875; Ludwig, 1879, 1897; Graeffe, 1881; Stossich, 1884; Carus, 1885; Zimmermann, 1907; Brusina, 1908; Babić, 1913; Vatova, 1928, 1949a; Tortonese, 1935, 1956, 1965; Kolosvary, 1937, 1940; Zavodnik, 1960, 1961; Gamulin-Brida, 1962; Riedl, 1963; Gamulin-Brida et al. 1968; Matvejev-Vidović (in litt.).

General distribution: The Mediterranean, the coast of Portugal, the coast of the Azores.

Adriatic Sea: On sandy bottoms, pure or slightly covered by *Zostera.* Particularly frequent between 3 and 80 m.

5. *Astropecten platyacanthus* (Phil.)

Asterias platyacantha Philippi, 1837

Astropecten platyacanthus var. flanaticus: Lorenz, 1860.

Astropecten platyacanthus: Heller, 1863, 1868; Lorenz, 1863; Marenzeller, 1875; Ludwig, 1879; Graeffe, 1881; Stossich, 1884; Carus, 1885; Vatova, 1950; Tortonese, 1956, 1965; Zavodnik, 1960, 1961, 1967a.

Astropecten bispinosus platyacanthus: Ludwig, 1897; Tortonese, 1935; Kolosvary, 1937.

General distribution: The Mediterranean.

Adriatic Sea: On muddy bottoms and those covered by algae. Between 2 and 64 m.

6. *Astropecten spinulosus* (Phil.)

Asterias spinulosa Philippi, 1837

Astropecten spinulosus: Sars, 1857; Heller, 1868; Marenzeller, 1875; Ludwig, 1879, 1897; Graeffe 1881; Stossich, 1884; Carus, 1885; Babić, 1913; Tortonese 1935, 1965; Kolosvary, 1937; Zavodnik, 1960, 1961, 1962, 1967a, 1967b; Riedl, 1963; Gamulin-Brida et al., 1968; Specchi et Orel, 1968.

Tethyaster subinermis: Zavodnik, 1961; Matvejev-Vidović (in litt)
General distribution: A typical Mediterranean species.
Adriatic Sea: A sciaphilous species. On sandy bottoms covered by *Posidonia.* Between 3 and 35 mm.

Gen. Tethyaster

7. *Tethyaster subinermis* (Phil.)

Asterias subinermis Philippi, 1837
Astropecten subinermis: Marenzeller. 1895.
Plutonaster subinermis: Ludwig, 1897.
Tethyaster subinermis: Zavodnik, 1961; Matvejev-Vidović (in litt.)
General distribution: The Mediterranean; the eastern part of the Atlantic Ocean, from the Gulf of Gascony to the Gulf of Guinea.
Adriatic Sea: Central and southern part. Rare species, isolated. On sandy bottoms. Between 30 and 400 m.

Fam. Luidiidae

Gen. Luidia

8. *Luidia ciliaris* (Phil.)

Asterias ciliaris Philippi, 1837
Luidia savignyi: Heller, 1863.
Luidia Savignyii: Heller, 1868.
Luidia ciliaris: Ludwig, 1879, 1897; Stossich, 1884; Carus, 1885; Tortonese, 1935; Kolosvary 1937; Zavodnik, 1961; Gamulin-Brida, 1962, 1963, 1967a; Riedl, 1963; Pérès i Gamulin-Brida, 1973; Matvejev-Vidović (in litt.)
General distribution: The Mediterranean; the northeastern part of the Atlantic Ocean from the Faeroe Islands to the Cape Verde Islands. Its presence has been recently recorded even in the vicinitiy of the Norwegian coast.
Adriatic Sea: Rare. On sandy-shelly bottoms. At depths ranging from 60 to 120 m.

9. *Luidia sarsi* Düb. Kor.

Luidia sarsi Düben-Koren, 1864
Luidia sarsi: Kolosvary, 1937; Zavodnik, 1961; Tortonese, 1965; Matvejev-Vidović (in litt.).
General distribution: The Mediterranean; the northeastern part of the Atlantic Ocean, from the Norwegian coast to the Cape Verde Islands.
Adriatic Sea: Rather rare species. Inhabits the whole area. Between 38 and 400 m. Mud is the optimal bottom.

Subord. Valvata

Fam. Odontasteridae

Gen. Odontaster

10. *Odontaster mediterraneus* Mar.

Gnathaster mediterraneus Marenzeller, 1893

Odontaster mediterraneus: Marenzeller, 1895; Ludwig, 1897; Tortonese, 1956, 1958, 1965; Zavodnik, 1961; Matvejev-Vidović, 1964; Gamulin-Brida, 1967a, 1969; Pérès i Gamulin-Brida, 1973; Matvejev-Vidović (in litt.)

General distribution: Reported from the Aegean Sea, Adriatic ,along the coast of Algeria, the Gulf of Gascony, and the vicinity of the Great Britain coast.

Adriatic Sea: In the central and southern part, particularly in the central one. Predominantly on muddy bottoms. At depths ranging from 61 to 256 m, most abundant between 180 and 250 m.

Fam. Chaetasteridae

Gen. Chaetaster

11. *Chaetaster longipes* (Retz.)

Asterias longipes Retzius, 1805

Chaetaster longipes: Ludwig, 1897; Babić, 1913; Kolosvary, 1937; Gamulin-Brida, 1960, 1962, 1965, 1967a; Zavodnik, 1961; Tortonese, 1965; Pérês i Gamulin-Brida, 1973; Matvejev-Vidović, (in. litt.)

General distribution: The Mediterranean; the eastern part of the Atlantic Ocean, from Brittany to the Gold Coast, near the Azores and St. Helena and Ascension Islands.

Adriatic Sea: The central and southern part. A termophilic species. Optimal bottom muddy sand and mud. Optimal depth between 100 and 150 m, where abundant on muddy sand.

Fam. Goniasteridae

Gen. Sphaeriodiscus

12. *Sphaeriodiscus placenta* (Müll. Trosch.)

Goniodiscus placenta Müller-Troschel, 1842

Sphaeriodiscus acutus: Heller, 1863, 1868.

Goniodiscus placentaeformis: Heller, 1863, 1868.

Goniaster placenta: Marenzeller, 1875; Stossich, 1884.

Goniaster acutus: Marenzeller, 1875; Stossich, 1884.

Pentagonaster placenta: Ludwig, 1879, 1897; Carus 1885; Marenzeller, 1895; Brusina, 1908; Babić, 1913; Leidenforst, 1917; Karlovac, 1959.

Pentagonaster acutus: Carus, 1885.

Ceramaster placenta: Tortonese, 1935; Kolosvary, 1937; 1940; Gamulin-Brida, 1962, 1965, 1967a; Riedl, 1963; Pérès i Gamulin-Brida, 1973.

Sphaeriodiscus placenta: Tortonese, 1956, 1965; Zavodnik, 1961, 1969; Matvejev-Vidović (in. litt.)

General distribution: The Mediterranean; the eastern part of the Atlantic Ocean, from the Gulf of Gascony to the Senegal coast.

Adriatic Sea: The central and southern part. Optimal life conditions at depths ranging from 100 to 150 m. On muddy sand and mud.

Fam. Ophidiasteridae

Gen. Ophidiaster

13. *Ophidiaster ophidianus* (Lam.)

Asterias ophidiana Lamarck, 1816

Ophidiaster ophidianus: Babić, 1913; Kolosvary 1937; Zavodnik, 1961; Pérès i Gamulin-Brida, 1973.

General distribution: The Mediterranean, the eastern Atlantic.

Adriatic Sea: It has been found in coralligenous biocoenosis in the southern Adriatic: (Budva, Kotor, Dubrovnik).

Gen. Hacelia

14. *Hacelia attenuata* (Gray)

Ophidiaster attenuatus Gray, 1840

Ophidiaster attenuatus: Marenzeller, 1895.

Hacelia attenuata: Ludwig, 1897; Babić, 1913; Zavodnik, 1961, 1969; Gamulin-Brida, 1963, 1967a; Tortonese, 1965; Pérès i Gamulin-Brida, 1973; Matvejev-Vidović (in. litt.).

Hacelia coriacea: Brusina, 1908.

Hacella variolata: Leidenforst, 1917; Kolosvary, 1937;

General distribution: The Mediterranean, Portugal, Azores.

Adriatic Sea: In the open central Adriatic around islands and rocks, round Mljet, Dubrovnik, and southwards along the coast. Frequent on the coralline and lithothamnic bottoms. Between 1 and 150 m.

Ord. SPINULOSA

Fam. Asterinidae

Gen. Asterina

15. *Asterina gibbosa* (Penn.)

Asterias gibbosa Pennant, 1777

Asterias minuta: Olivi, 1792

Asteriscus ciliatus: 1860, 1863.

Asterias verruculata: Grube, 1861

Asteriscus verruculatus: Heller, 1863, 1864, 1868; Lorenz, 1863; Grube, 1864; Stossich, 1884.

Asterina gibbosa: Ludwig, 1879, 1897; Graeffe, 1881; Carus, 1885; Marenzeller, 1895; Zimmermann, 1907; Brusina, 1908; Babić, 1913; Tortonese, 1935, 1956, 1965; Kolosvary, 1937, 1940; Vatova 1928, 1949a, 1949b, 1960; Zei, 1955; Zavodnik, 1960, 1961, 1967a, 1967b, 1969; Riedl, 1963; Pérès i Gamulin-Brida, 1973; Matvejev-Vidović (in litt.)

General distribution: The Mediterranean; the Atlantic Ocean.

Adriatic Sea: Characteristic for the biocoenosis of the infralittoral gravel which is to be found in the vicinity of rocky shores more or less exposed to the wave action. It is particularly well developed at depths ranging from 0 to 30 m, but can also be found to depth of 100 m.

16. *Asterina pancerii* (Gasco)

Asteriscus Pancerii Gasco, 1870
Asterina gibbosa Pancerii: Brusina 1908
Asterina gibbosa var. pancerii: Babić, 1913
Asterina pancerii: Pérès i Gamulin-Brida, 1973.
General distribution: The Mediterranean.
Adriatic Sea: On the *Posidonia* beds as a vagile species. At low depths.

Gen. Anseropoda

17. *Anseropoda placenta* (Penn.)

Asterias placenta Pennant 1777.
Asterias palmipes: Olivi, 1792
Asteriscus palmipes: Lorenz, 1860, 1863; Heller, 1863, 1868; Grube, 1864.
Palmipes membranaceus: Ludwig, 1879, 1897; Graeffe, 1881; Stossich, 1884: Carus 1885; Babić, 1913; Vatova, 1928, 1949a; Karlovac, 1959.
Pamipes placenta: Marenzeller, 1895, Gamulin-Brida, 1960, 1962, 1967b.
Anseropoda placenta: Brusina, 1908; Zavodnik, 1956, 1960, 1961; Riedl, 1963; Tortonese, 1965; Gamulin-Brida et al., 1968; Karaman et Gamulin-Brida, 1970; Pérès i Gamulin-Brida, 1973; Matvejev-Vidović (in litt.)
Anseropoda membranacea: Tortonese, 1935; Kolosvary, 1937, 1940.
General distribution: The Mediterranean; the Atlantic Ocean, from the Shetland Islands to the Sierra Leone coast.
Adriatic Sea: Common and abundant littoral and sublittoral species. On muddy sand and mud. Between 20 and 110 m.

Fam. Echinasteridae

Gen. Echinaster

18. *Echinaster sepositus* (Retz.)

Asterias seposita Retzius, 1783
Asterias rubens: Olivi, 1792
Echinaster sepositus: Lorenz, 1960, 1963; Grube, 1861; 1864; Heller, 1863, 1864, 1868; Ludwig, 1879, 1897; Graeffe, 1881, Stossich, 1884; Carus, 1885; Marenzeller, 1895; Zimmermann, 1907; Cori, 1912; Vatova, 1928, Tortonese, 1935, 1956, 1965; Kolosvary, 1937, 1940; Zalokar, 1942; Karlovac, 1959, Gamulin-Brida, 1960, 1962, 1965, 1967a, 1967b, Gamulin-Brida et al., 1968; Zavodnik, 1960, 1961, Riedl, 1963; Alfirević et al., 1969; Karaman et Gamulin-Brida, 1970; Péères i Gamulin-Brida, 1973; Matvejev-Vidović (in litt.).

Echinaster sagena: Brusina, 1908.

General distribution: The Mediterranean; the eastern part of the Atltantic Ocean, from Brittany to Gold Coast.

Adriatic Sea: A sciaphilous species with particularly wide distribution. Far more frequent on sandy-muddy bottoms. At depths ranging from 1 to more than 200 m.

Ord. FORCIPULATA

Fam. Asteriidae

Gen. Coscinasterias

19. *Coscinasterias tenuispina* (Lam.)

Asterias tenuispina Lamarck, 1816

Asteracanthion tenuispinus variatio elongatus: Lorenz, 1860.

Asteracanthion tenuispinus: Heller, 1863, 1864, 1868, Lorenz, 1863, Stossich, 1884.

Asterias tenuispina: Ludwig, 1879, 1897; Graeffe, 1881; Darus 1885; Zimmermann, 1907; Vatova, 1928.

Asterias heptactis: Brusina, 1908

Coscinasterias tenuispina: Tortonese, 1935, 1965; Kolosvary, 1937, 1940; Zalokar, 1942; Zavodnik, 1960, 1961; Riedl, 1963.

General distribution: The Mediterranean; the northeastern part of the Atlantic Ocean, from the southern part of the Gulf of Gascony to the Cape Verde Islands. It has been introduced by chance to Bermudez. Its presence recorded in Brazil and near the Antilles.

Adriatic Sea: A typical inhabitant of the underwater rocks and rocky bottoms' beneath plants and stones. At depths ranging from 0 to 50 m.

Gen. Marthasterias

20. *Marthasterias glacialis* (L.)

Asterias glacialis Linnaeus, 1758

Asteracanthion glacialis: Lorenz, 1860, 1863; Grube, 1861, 1864; Heller, 1863, 1864, 1868; Lorenz, 1863; Stossich, 1884.

Asteracanthion glacialis variatio profundus: Lorenz, 1860, 1863.

Asterias glacialis: Ludwig, 1879, 1897; Graeffe, 1881; Carus, 1885; Zimermann, 1907; Brusina, 1908; Cori, 1912; Vatova, 1928.

Stolasterias glacialis: Marenzeller 1895.

Marthasterias glacialis: Tortonese, 1935, 1965, Kolosvary, 1937, 1938b, 1940; Zalokar, 1942; Zavodnik, 1960, 1961; Gamulin-Brida, 1962, 1967b; Riedl, 1963; Alfirević et al., 1969; Karaman et Gamulin-Brida, 1970; Matvejev-Vidović (in litt.)

General distribution: The Mediterranean; the northeastern part of the Atlantic Ocean, from the coast of Ireland and northern Norway to the Azores and Cape Verde Horn; the coast of South Africa. Its presence noticed in the Black Sea, not far from the Bosphorus.

Adriatic Sea: Particularly well-distributed. Inhabits mainly shallower waters, but found to depths of 150 m, too. On muddy-sandy bottoms.

Gen. Sclerasterias

21. *Sclerasterias neglecta* Perr.

Stolasterias neglecta Perrier 1891

Stolaster neglecta: Marenzeller, 1895

Asterias edmundi: Ludwig, 1897

Sclerasterias neglecta: Tortonese, 1956, 1958, 1965; Matvejev- Vidović, 1964; Zavodnik, 1961, 1969; Gamulin-Brida, 1967a; Pérès i Gamulin-Brida, 1973.

General distribution: Particularly rare species. The Bay of Biscay (Type locality); the eastern Mediteranean.

Adriatic Sea: This rare species has been found both on muddy and sandy bottoms, but is far more frequent on sandy ones. Recorded at depths ranging from 67 to 256 m.

Ord. ECULASTEROIDEA

Fam. Brisingidae

Gen. Brisingella

22. *Brisingella coronata* (O. Sars)

Brisinga coronata O. Sars, 1871

Brisinga coronata: Marenzeller, 1895; Ludwig, 1897; Leidenforst, 1917; Riedl, 1963.

Brisingella coronata: Kolosvary, 1937; Zavodnik, 1961, 1969; Tortonese, 1965; Pérès et Gamulin-Brida, 1973. Matvejev-Vidović (in litt.).

General distribution: The Mediterranean; the northeastern part of the Atlantic Ocean, from Norway to the Cape Verde Horn.

Adriatic Sea: The central and southern parts. A bathyal form, characteristic for the biocoenosis of bathyal mud. Optimal depth about 500 m.

CLASSIS ECHINOIDEA

Subcl. REGULARIA

Ord. CIDAROIDA

Fam. Cidaridae

Gen. Cidaris

1. *Cidaris cidaris* (L.)

Echinus cidaris Linnaeus, 1758
Cidaris hystrix: Grube, 1840; Heller, 1863, 1864, 1868; Stossich, 1884; Cori 1912.
Dorocidaris papillata: **Ludwig, 1879; Carus, 1885; Marenzeller, 1895.**
Dorocydaris papillata: Brusina, 1908.
Cidaris cidaris: **Tortonese, 1935, 1956,** 1965; Kolosvary, 1937, 1940; Zavodnik, 1961, 1969; Gamulin-Brida, 1962, 1963, 1965, 1967a; Riedl, 1963, Matvejev-Vidović (in litt.)
Cydaris cydaris: Karlovac, 1959.
General distribution: The Mediterranean; the eastern part of the Atlantic Ocean ,from the Norwegian coast to the Cape Verde Islands.
Adriatic Sea: Characteristic for the deeper parts. Occurs between 50 and 200 m, never in shallower waters very rarely in deeper ones. Sand is the optimal ground.

Gen. Stylocidaris

2. *Stylocidaris affinis* (Phil.)

Cidaris affinis Philipi, 1845
Cidaris affinis: Heller, 1868; Stossich, 1884.
Stylocidaris affinis: 1956, 1965.
General distribution: The Mediterranean; the eastern Atlantic, the north-western coast of Africa to the Cape Verde Horn; western Atlantic, from Bermudez to the Gulf of Mexico and the Antilles.
Adriatic Sea: Trieste, Hvar, Split. Very rare species.

Ord. DIADEMATOIDA

subord. Aulodonta

fam. Diodematidae

3. *Centrostephanus longispinus* (Phil.)

Diadema longispina Philippi, 1845
Cetrostephanus longispinus: Leidenforst, 1917; Kolosvary, 1937; Zavodnik, **1961, 1969; Gamulin-Brida, 1962, 1963, 1967a; Pérès i Gamulin-Brida,** 1973; Matvejev-Vidović (in litt.)
General distribution: The Mediterranean; the eastern part of the Atlantic Ocean, from Morocco to the Gulf of Guinea and the Azores.
Adriatic Sea: A termophilic species, with tropical affinities, not present in the northern part; in the central part present in the localities under the influence of warm Mediterranean waters (the Vis Channel); thrives in the southern part. On sandy-shelly bottoms in the circalittoral.

4. *Arbacia lixula (L.)*

Echinus lixula Linnaeus, 1758
Arbacia pustulosa: Ludwig, 1789, Carus, 1885
Arbacia aequitubercolata: Stossich, 1884.
Echinocidaris aequituberculata: Grube, 1861; Lorenz, 1863.

Echinocidaris aequituberculatus: Heller, 1863, 1868; Cori, 1912.
Arbacia lixula: Vatova 1928; Kolosvary, 1937, 1940; Tortonese, 1935, 1965; Zavodnik, 1960, 1961; Riedl, 1963; Gamulin-Brida, 1967a; Pérès i Gamulin-Brida, 1973.
Arbacia aequituberculata: Zalokar, 1942; Zei, 1955.
General distribution: The Mediterranean, with the exception of the eastern parts; the subspecies present in the Atlantic Ocean.
Adriatic Sea: Particularly frequent in the infralittoral zone. Inhabits rocky shallow waters, especially coastal rocks in clean waters covered by *Cystoseira*. Between 0 and 50 m.

Subord. Camarodonta

Fam. Toxopneustidae

Gen. Sphaerechinus

5. *Sphaerechinus granularis* (Lam.)

Echinus granularis Lamarck, 1816
***Echinus brevispinosus:* Grube, 1861, 1864; Heller, 1863, 1864;** Lorenz, 1863.
Toxopneustes brevispinosus: Heller, 1868; Stossich, 1884
***Sphaerechinus granularis:* Ludwig, 1879; Graffe, 1881; Carus, 1885;** Marenzeller, 1895; Zimmermann, 1907: Brusina, 1908; Cori, 1912; Vatova, 1928; Tortonese, 1935, 1965; Kolosvary, 1937, 1940; Zalokar, 1942; Karlovac, 1959; Zavodnik, 1960, 1961; Riedl, 1963; Gamulin-Brida, 1967a, 1967b; Gamulin-Brida et al., 1968; Pérès i Gamulin-Brida, 1973; Matvejev-Vidović (in litt.).
Toxopneustes granularis: Stossich, 1884
General distribution: The Mediterranean; the eastern part of the Atlantic Ocean, from the English Channel to the Gulf of Guinea and the Azores.
Adriatic Sea: On sandy bottoms, on the *Posidonia* beds. At depths between 1 and 60 m, optimal depth between 5 and 30 m.

Fam. Echinidae

Gen. Echinus

6. *Echinus acutus* Lam.

Echinus acutus Lamarck, 1816
Echinus Flemingii: Grube 1864.
Echinus acutus: Ludwig, 1879; Carus, 1885; Marenzeller, 1895; Kolosvary, 1937; Tortonese, 1956; Zavodnik, 1961, 1969; Gamulin-Brida, 1962, 1963, 1965; Pérès i Gamulin-Brida 1973; Matvejev-Vidović (in litt.).
Echinus acutus mediterraneus: Tortonese, 1935; Gamulin-Brida, 1960;
General distribution: The Mediterranean; the northeastern part of the Atlantic Ocean, from the Barents Sea and Iceland to the Sierra Leone Coast.
Adriatic Sea: A species of sandy-detritic bottoms in the open sea. Most abundant at depths between 50 and 100 m, but can be found to depth of 400 m, too.

7. *Echinus melo* Lam.

Echinus melo Lamarck, 1816

Echinus melo: Heller, 1863, 1868; Lorenz, 1863; Grube, 1864; Ludwig, 1879; Stossich, 1884; Carus, 1885; Zimmermann, 1907; Brusina 1908; Vatova, 1928; Tortonese, 1935, 1965; Kolosvary, 1937; Karlovac, 1959; Zavodnik, 1961, 1969; Riedl, 1963; Gamulin-Brida, 1967a; Pérès i Gamulin-Brida, 1973; Matvejev-Vidović (in litt.).

General distribution: Western part of the Mediterranean; the Atlantic Ocean, from Ireland to the Cape Verde Horn and the Azores.

Adriatic Sea: Rare in the northern part, whereas frequent in the central and southern ones. Most abundant between 50 and 150 m. On sand, although inhabits coralligenuous supstratum, too.

Gen. Psammechinus

8. *Psammechinus microtuberculatus* (Blv.)

Echinus microtuberculatus, Blainville, 1825.

Echinus microtuberculatus: Sars, 1857; Grube, 1861, 1864; Heller, 1863; Lorenz, 1863; Ludwig, 1879; Graeffe, 1881; Carus, 1885; Zimmermann, 1907; Vatova, 1943.

Psammechinus microtuberculatus: Heller, 1868; Stossich, 1884; Brusina, 1908; Vatova, 1928, 1935, 1949a; Tortonese, 1935, 1965; Kolosvary, 1937, 1938b, 1940; Czihak, 1959; Karlovac, 1959; Zavodnik, 1960, 1961, 1967b, 1969; Gamulin-Brida, 1962, 1967a, 1967b; Gamulin-Brida et al, 1968; Šimunović, 1969; Karaman et Gamulin-Brida, 1970; Pérès i Gamulin-Brida, 1973; Matvejev-Vidović (in litt.).

Psammechinus pulchellus: Stossich, 1884.

General distribution: The Mediterranean. Its presence in the Atlantic appears very doubtful, although some individuals were, on several occasions, found along the coast of Portugal, Azores and Canaries, and round Cape Verde Horn.

Adriatic Sea: On sandy and sandy-detritic bottoms in deeper settlements of algae and seaweeds, between 4 and 100 m.

Gen. Paracentrotus

9. *Paracentrotus lividus* (Lam.)

Echinus lividus Lamarck, 1816

Echinus saxatilis: Gravenhorst, 1831; Grube, 1840.

Echinus lividus: Sars, 1857; Grube, 1861, 1864; Heller, 1863, 1864; Zalokar, 1942.

Strongylocentrotus lividus: Ludwig, 1879; Graeffe, 1881; Carus, 1885; Zimmermann 1907; Brusina 1908;

Toxopneustes lividus: Heller, 1868; Stossich, 1884.

Paracentrotus lividus: Vatova, 1928, 1931, 1949a, 1950; Tortonese, 1935, 1956, 1965; Kolosvary, 1937, 1938b, 1940; Zavodnik, 1960, 1961, 1967b, 1969; Riedl, 1963; Gamulin-Brida, 1967a, 1967b, Gamulin-Brida et al., 1968; Šimunović, 1968; Pérès i Gamulin-Brida, 1973; Matvejev-Vidović (in litt.).

General distribution: The Mediterranean; the northeastern part of the Atlantic Ocean, from Ireland and Scottland to the Gold Coast, Canaries, Madeira and Azores.

Adriatic Sea: Frequent infralittoral species, occurs on rocks and rocky bot--toms covered by algae. Characteristic representative of the photophilic algae biotopes. At depths ranging from 0 to 30 m.

SUBCL. IRREGULARIA

Ord. CLYPEASTROIDA

Fam. Fibulariidae

Gen. Echinocyamus

10. *Echinocyamus pusillus* (O. F. Müll.)

Spatagus pusillus O. F. Müller, 1776.

Echinocyamus pusillus: Grube, 1861; Heller, 1863, 1864, 1868; Stossich, 1884, Carus, 1885; Zimmermann, 1907; Brusina, 1908; Vatova 1928, 1935, 1943, 1949a; Kolosvary, 1937, 1938b, 1940; Zavodnik, 1960, 1961; Gamulin-Brida et at., 1968; Riedl, 1963; Karaman et Gamulin-Brida, 1970; Matvejev--Vidović (in litt.).

Echinocymus tarentinus: Lorenz, 1863; Grube, 1864.

General distribution: The Mediterranean; the eastern Atlantic, from Norway to western Africa (Sierra Leone) and the Azores.

Adriatic Sea: Inhabits particularly the rough sand. It can be found to 100 m depth, but is most frequent between 20 and 50 m.

Ord. SPATANGOIDA

Fam. Spatangidae

Gen. Spatangus

11. *Spatangus purpureus* (O. F. Müll.)

Spatagus purpureus O. F. Müller 1776

Spatangus meridionalis: Heller, 1863, 1864, 1868; Grube, 1864; Stossich, 1884;

Spatangus purpureus: Ludwig, 1879; Carus, 1885; Marenzeller, 1895; Brusina, 1908; Tortonese, 1935, 1956, 1968, 1965; Kolosvary, 1937, 1940; Karlovac, 1959; Zavodnik, 1960, 1967a; Gamulin-Brida et al., 1968; Riedl, 1963; Karaman et Gamulin-Brida, 1970; Pérès i Gamulin-Brida, 1973; Matvejev--Vidović (in. litt.).

General distribution: The Mediterranean; the northeastern and eastern parts of the Atlantic Ocean, from Cape Nord and Iceland to Senegal and possibly to Angola, too.

Adriatic Sea: Frequent species in the whole area. On sandy and sandy-detritic bottoms. Between 30 and 200 m, in Vis Channel is frequent at depth of 80 m, rare at depths greater than 200 m.

Fam. Loveniidae

Gen. Echinocardium

12. *Echinocardium cordatum* (Penn.)

Echinus cordatus Pennant, 1777

Echinocardium cordatum: Kolovary, 1937, 1938b, 1940; Vatova, 1950; Tortonese, 1956, 1965; Zavodnik, 1960, 1961; Riedl, 1963.

General distribution: The Mediterranean; the Atlantic Ocean, from Norway to Morocco, southern Africa, from northern Carolina to Brazil; the Pacific: Japan, Corea, the Gulf of California, Australia, New Zealand.

Adriatic sea: At pure or slightly oozed sandy bottoms. Particularly frequent at depths ranging from 0 to 150 m.

13. *Echinocardium mediterraneum* (Forb.)

Amphidetus mediterraneus Forbes, 1844.

Amphidetus mediterraneus: Heller, 1863.

Echinocardium mediterraneum: Ludwig, 1879; Heller, 1868; Graeffe, 1881; Stossich, 1884; Carus, 1885; Zimmermann, 1907; Brusina, 1908, Cori, 1912; Kolosvary 1937; Vatova, 1928, 1936, 1949a; Zavodnik, 1961.

General distribution: The Mediterranean; the northeastern part of the Atlantic Ocean, from Gibraltar to the Gulf of Gascony (Gironde).

Adriatic Sea: On sandy bottoms. At depths ranging from 5 to 40 m.

Gen. Schizaster

14. *Schizaster canaliferus* (Lam.)

Spatangus canaliferus Lamarck, 1816

Schizaster canaliferus: Sars, 1857; Grube, 1861, 1864; Heller, 1868; Graeffe, 1881; Stossich, 1884; Carus, 1885; Zimmermann, 1907; Brusina, 1908; Vatova, 1928, 1934; 1935, 1936, 1943, 1949a; Tortonese, 1956, 1965; Zavodnik, 1960, 1961; Riedl, 1963; Gamulin-Brida, 1967a, 1967b; Gamulin-Brida et al., 1968; Pérès i Gamulin-Brida, 1973.

Ova canalifera: Kolosvary 1937, 1940; Vatova, 1950.

General distribution: Endemic in the Mediterranean.

Adriatic Sea: Particularly well-represented in the northern part, where together with *Amphiura chiajei* makes the constituent part of the *Schizaster chiajei* community (Vatova, 1949); on the western coast of Istra Penninsula and in the Lim Channel the constituent part of the so called *Schizaster chiajei* facies (Vatova, 1943, Gamulin-Brida *et al., 1968).* On muddy bottoms. Between 9 and 100 m.

Fam. Brissidae

Gen. Brissopsis

15. *Brissopsis lyrifera* (Forb.)

Brissus lyrifer Forbes, 1841

Brissopsis lyrifera: Marenzeller 1895; Ludwig, 1879; Tortonese, 1935; Kolosvary, 1937, 1938, 1940; Zavodnik, 1960, 1961; Gamulin-Brida, 1962, 1965, 1967a; Karaman et Gamulin-Brida, 1970; Pérès i Gamulin-Brida, 1973.
General distribution: The Mediterranean; the Atlantic Ocean, from Norway and Iceland to west Africa (Sierra Leone), south Africa.
Adriatic Sea: Frequent, pelophilous eurybathic species. In the northern part particularly abundant on the soft mud facies. In the southern part in the Bay of Kotor.

16. *Brissopsis atlantica mediterranea* Mrtns.

Brissopsis atlantica mediterranea Mortensen, 1913.
Brissopsis atlantica: Kolosvary, 1937.
General distribution: The Mediterranean; the Atlantic Ocean, west Africa, north America.
Adriatic Sea: »Najade« Expedition B. 6. N. II. B 31 Corsia Channel. At depths ranging from 90 to 100 m.

Gen. Brissus

17. *Brissus unicolor*

Spatangus Brissus unicolor Leske, 1778
Brissus brissus: Kolosvary, 1937.
Brissus unicolor: Tortonese, 1956, Zavodnik, 1961; Riedl, 1965.
General distribution: The Mediterranean; the Atlantic Ocean.
Adriatic Sea: Rare. On sand or muddy sand. Between 8 and 80 m.

REFERENCES

Alfirević, S., Crnković, D., Gamulin-Brida, H., 1969. — Problem racionalne eksploatacije škampa *(Nephrops norvegicus L.)*, Thalassia Jugosl.; 5, 5—12, Zagreb

Babić, K., 1913. — Beitrage zur Kenntnis einiger Seesterne, Zool. Anz. 41, 456—460, Leipzig

Brusina, S., 1908. — Prilog za faunu bodljikaša Dalmacije, Naravoslovne crtice, 4 (12), 73—81, Zagreb

Carus, J. V., 1885. — *Prodromus faunae mediterraneae* 1, Stuttgart.

Cori, C., 1912. — Charakteristik Fauna der nördlichen Adria, Verh. VIII Inter. Zool. — Kongress zu Graz 1910, 599—711.

Cziha k, G., 1959. — Pojava i način života Opfiuroideje *Ophiotrix quinquemaculata* u sjevernom Jadranu kod Rovinja, Thalassia Jugoslav., 1 (6—10), Zagreb.

Gamulin-Brida, H., 1960. — Primjena Sorensove metode pri istraživanju bentoskih populacija. Biol. glasnik, 13, 21—41, Zagreb.

Gamulin-Brida, H., 1962. — Biocenoze dubljeg litorala u kanalima srednjeg Jadrana, Acta adriat., 9 (7), 1—196, Split.

Gamulin-Brida, H., 1963. — Prilog istraživanju bentoskih biocenoza južnog Jadrana, Bilješke-Notes 20, Split.

Gamulin-Brida, H., 1964. — Doprinos bionomijskim istraživanjima na muljevitom dnu otvorenog srednjeg Jadrana, Acta adriat., 11 (10), 85—89, Split.

Gamulin-Brida, H., 1965. — Biocenoza muljevitog dna otvorenog srednjeg Jadrana, Acta adriat., 10 (10), 1—27, Split.

Gamulin-Brida, H., 1967a. — The Benthic Fauna of the Adriatic Sea, Oceanogr. Mar. biol. Ann. Rev., 5, 535—568, London.

Gamulin-Brida, H., 1967b. — Biocenološka istraživanja pomičnog morskog dna sjevernog Jadrana kod Rovinja, Thalassia Jugosl., 3, 23—33, Zagreb.

Gamulin-Brida, H., Požar, A., Zavodnik, D., 1968. — Contribution aux recherches sur la bionomie des fonds meubles de l'Adriatique du Nord (II), Periodicum biologorum, 21, 157—201, Zagreb.

Graeffe, E., 1881. — Übersicht der Seetierfauna des Golfes von Trieste, Arbeit, Zool. Inst. (3), 445—470, Wien.

Gravenhorst, I. L. C., 1831. — Tergestina, oder Beobacthungen und Untersuchungen über einige bei Triest im Meere lebende Arten, Breslau.

Grube, A. E., 1840. — Actinien, Echinodermen und Würmer des Adriatischen und Mittelmeers. Königsberg.

Grube, A. E., 1861. — Ein Ausflug nach Triest und dem Quarnero, Berlin.

Grube, A. E., 1864. — Die Insel Lussin und ihre Meeresfauna, Breslau.

Heller, C., 1863. — Untersuchungen über die Litoralfauna des adriatichen Meeres. Sitz. Ber. Akad. Wiss, 46 (I), 415—448, Wien.

Heller, C., 1864. — Horae Dalmatinae, Bericht über eine Reise nach der Ostküste des Adriatischen Meeres, K. K. Zool, Bot. Ges. Wein, 14, 17—46, Wien.

Heller, C., 1868. — Die Zoophyten und Eichinodermen des Adriatischen Meeres, K. K. Zool. Bol. Ges., Wien, 1—86.

Karaman, G., Gamulin-Brida, H., 1970. — Prilog istraživanju bentonskih biocenoza Bokokotorskog zaliva, Studia Marina 4, Kotor.

Karlovac, O., 1959. — Istraživanja naselja riba i jestivih bezkralježnjaka vučom u otvorenom Jadranu, »Hvar«, Rep., 5 (1), Split.

Kolosvary, G., 1936/37. — Die Echinodermen des Adriatischen Meeres, Festschr. Strand. E. 2, 433—474, Riga.

Kolosvary, G., 1938a. — Faunistische Neuigkeiten meiner Adriareisen 1937—38, Zool. Anz., 123 (1—2), 106—109.

Kolosvary, G., 1938b. — Echinodermata iz Boke Kotorske, Godišnjak Ocean. Inst., 1, 121—125, Split.

Kolosvary, G., 1940. — Über die geographische Verbreitung einiger adriatischen Echinodermen, Folia Zool. et Hidrobiol. 10 (2), 370—381, Riga.

Lorenz, I. R., 1863. — Physicalische Verhältnisse und Vertheilung der Organismen 39, 673—684, Wien.

Lorenz, I. R., 1863. — Physicalische Verhältnise und Vertheilung der Organismen im Quarnerischen Golfe, Kais. Kön. Hof. und Staatsdruck, 12, Wien.

Ludig, H., 1879. — Die Echinodermen des Mittelmeerres, Mitth. Zool. St. Neapel,, 1, 323—381, Leipzig.
Ludwig, H., 1897. — Die Seesterne des Mittelmeeres, Fauna und Flora des Golfes von Neapel, 24 Berlin.
Marenzeller, E., 1875. (1876). — Revision adriatischer Sesterne Nerh. Zool. Bot. Gesell. 25, 361—372, Wien.
Marenzeller, E., Zool. Ergebn. »Pola« V. Echinodermen, Denkschr. Akad. Wiss. 62, Wien, 123—147.
Matvejev-Vidović, A., 1964. — O dvema vrstama Asteroidea retkima u Jadranu; Acta adriat., 11 (26), 189—194.
Müller, I. — Troschel, F. H., 1842. — System der Asteriden Branschweig.
Olivi, G., 1792. — Zoologia Adriatica, ossia catalogo ragionato degli animali del Golfo Adriatico, 65—74. Bassano.
Pérès J. M. i Gamulin-Brida H., 1973. — Biološka oceanografija »Školska knjiga« 1—493, Zagreb.
Riedl, R., 1963. — Fauna und Flora der Adria — A. Streuger — Echinodermata, 446—472, Hamburg, Berlin.
Sars, M., 1857. — Bidrag til kundskaben om Middelhavets Littoral fauna. Nyt. Mag. Naturv. 9, 72—155.
Specchi, M., e Orel, G., 1968. — I popolamenti dei fondi e delle rive del vallone di Muggia preso Trieste, Boll. Soc. Adr. Sci., 56 (1), 137—161, Trieste.
Stiasny, G., 1908. — Beobachtungen über die marine Fauna des Triester Golfes im Jahre 1907, Zool. Anz. 32/25, 748—752.
Stossich, M., 1884. — Prospetto della Fauna del Mare Adriatico, Boll., Soc. Adr. Sci. Nat. Trieste, 8, 90—110, Trieste.
Šimunović, A., 1969. — Prilog poznavanju bentoske faune pirovačkog zaljeva i mogućnost uzgoja nekih školjkaša, Thalassia Jugosl., 5, 309—312, Zagreb.
Tortonese, E., 1935. — Contributo alla conoscenza degli Echinodermi Mediteranei. Ann. Mus. St. Nat. Genova 57, 219—272.
Tortonese, E., 1956. — Catalogo degli Echinodermi della collezione E. Tortonese, Ann. Mus. St. Nat. G. Doria 58, Genova, 177—233.
Tortonese, E., 1958. — Il popolamento di echinodermi nelle zone profonde del Mediterraneo. Rapp. Proc. Com. Int. Expl. Sci. Medit., 14 (Nouv. ser.), 485—491.
Tortonese, E., 1965. — Echinodermata, Fauna d'Italia 6, 1—422 Bologna.
Vatova, A., 1928. — Compendio della Flora e Fauna del Mare Adriatico presso Rovigno, Mem. Com. Tal. Ital., 143 (14), 360—388, Venezia.
Vatova, A., 1931. — Ricerche preliminari sulel biocenosi della Laguna veneta, Boll. Soc. Adr. Sci. Nat., Trieste, 30, 53—62, Trieste.
Vatova, A., 1934. — Ricerche Quantitative sul bentos del Golfo di Rovigno. Note Ist. It. Germ. Biol. Mar. Rovigno (12), Venezia.
Vatova, A., 1935. — Ricerche preliminari sulle biocenosi del Golfo di Rovigno. Thalassia, 2 (2), Venezia.
Vatova, A., 1936. — Ricerche quantitative sulla fauna bentonica dell'Alto Adriatico e loro importaza per la biologia marina, Note, Ist. It. Germ. Biol. Mar. Rovigno 19, 1—15, Venezia.
Vatova, A., 1943. — Le zoocenosi dell'Alto Adriatico presso Rovigno e loro variazioni nello spazio e nel tempo, Thalassia 5 (6), 1—61, Venezia.
Vatova, A., 1949a. — La fauna bentonica dell'Alto e Medio Adriatico, Nova Thalassia, 1 (3), 1—110, Venezia.
Vatova, A., 1949b. — Caratteri di alcune Facies bentoniche della Laguna Veneta, Nova Thalassia 1 (4), 1—15, Venezia.
Vatova, A., 1950. — Gli Echinodermi della Laguna Veneta, Nova Thalassia 1 (7), 1—13, Venezia.
Zalokar, M., 1942. — Les associations sous — marines de la côte adriatique au dessous de Velebit, Bull. Soc. bot. Genève 33, 1—24.
Zavodnik, D., 1956. — Tetramerna Anseropoda placenta Pennant v Jadranskem morju. Biološki vestnik, 5, 121—122, Ljubljana.
Zavodnik, D., 1960. — Echinodermata der Insel Krk (Ecinodermata Otoka Krka), Acta adriat., 9 (2), 1—19, Split.
Zavodnik, D., 1961. — Seznam Jadranskih Echinodermov in njihova globinska razširjenost, Bio. vest.., 8, 49—55, Ljubljana.

Zavodnik, D., 1962. — Preliminary Observations on the Phytal Populations of the Rocky Shore near Rovinj (Northern Adriatic), Publ. staz. zool., Napoli 32 (suppl), 181—184.

Zavodnik, D., 1967a. — Dinamika litoralnog fitala na zahodnoistrski obali, SAZU, Razprave 10 (1), 1—67, Ljubljana.

Zavodnik, D., 1967b. — Adriatic Echinodermus inhabiting the Phytal, Thalassia Jugosl. 3 (1—6), 11—22, Zagreb.

Zavodnik, D., 1969. — Les echinodermes(echinodermata) de la mer Adriatique sont-ils suffisamment connus? Thalassia Jugosl. 5, 457—461, Zagreb.

Zei, M., 1955. — Doprinos k ekologiji morskega litorala (s. lat.) supralitoral, litoral in zgornji infralitoral na kamniti zahodnoistrski obali. SAZU Rasprave, 3, 255—300, Ljubljana.

Received 6. January, 1976