Occurrence and Distribution of Crustacean Decapoda in Boka Kotorska Bay

Olivera Marković, Slavica Petović, Zdravko Ikica, and Aleksandar Joksimović

Abstract An annotated species of crustacean Decapoda list is provided for the area of Boka Kotorska Bay, based on the available literature. Review of the relevant literature showed that the number of the species known in this area is 62. Two of these species are recognized as Atlanto-tropical immigrants. All species were collected using trawl, dredge, grab bottom sampler, gillnets, as well as scuba-diving techniques. Description of each species gives the valid scientific name and vernacular, common names, literature, distribution and findings in Boka Kotorska Bay, Adriatic distribution, and some remarks as well as their potential commercial interest for fishery. Most of these species have a wide distribution range, including the whole Mediterranean Sea.

Keywords Annotated list, Boka Kotorska Bay, Crustacean Decapoda

Contents

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1 Introduction

1.1 Study Area

The Boka Kotorska Bay is situated in the southern part of the eastern Adriatic, and according to Lepetić [1] it represents the most sinuous part of the Adriatic coast. The geographical position of this bay is determined as follows: 42°31′00″N, 42°23′32″S, 18°46′32″E, and 18°30′29″W.

This bay is subdivided into four smaller bays, namely, the Kotor Bay, the Risan Bay, the Tivat Bay, and the Herceg Novi Bay (Fig. 1). The bays of Herceg Novi and Tivat are connected by the Kumbor Strait, and the Kotor and Tivat Bays are joined by the Verige Strait (width 340 m, length 2,300 m). The Bay of Tivat is the most extensive part of Boka Kotorska reaching the depth of 48 m in its southern part but considerably shallower in its eastern part. It is connected with the Herceg Novi Bay (depth 47 m) by the Kumbor Strait (depth 43 m, the minimum width 730 m) [2]. The entrance to the Boka Kotorska, also called the Strait of Oštra, is closed by Cape Oštra from the west and by Cape Mirište from the east. The innermost part of the bay, near Kotor, is at 15 nautical miles from its entrance. Given its depth, the whole Kotor Bay belongs to coastal or littoral system.

It is hypothesized that the Boka Kotorska Bay, having a coastline 105.7 km long, covering an area of 87.3 km^2, containing a volume of 2.4×10^6 km^3 of water, and having a maximum depth of 60 m, was formed by fluvial erosion [3]. In each bay

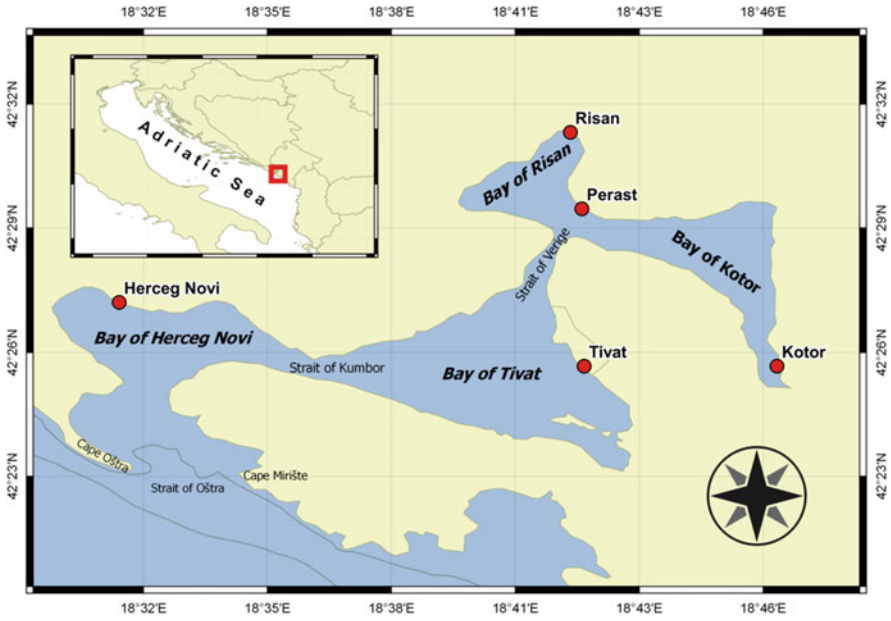


Fig. 1 Map of the Boka Kotorska Bay

the depth increases toward the central part, except in the Kotor Bay where the maximum depth is near the northern coast (Perast). According the latest data, the average depth of the Boka Kotorska Bay is 27.6 m, and its maximum is 64 m (Kotor Bay) [4].

It is well known that Boka Kotorska Bay has a specific position in the Adriatic Sea. This specificity is the result of not only its geographical position but also biotic and abiotic environmental factors. Therefore, life conditions in this bay differ considerably from those of the open sea part of the Adriatic [5]. The hydrographical measurements (temperature, salinity, transparency of the sea, and mechanical composition of the sea bottom) may have considerable and different significance in distribution of zoobenthos in the Boka Kotorska Bay.

The features of the submarine relief may be grouped in two main categories: the first is the continental shelf and the second is the deeper part of the bay [5]. Karaman and Gamulin-Brida [6] during their investigations found that the structure of Boka Kotorska Bay littoral shelf bottom is of terrigenous and mineral origin. The central parts of the Boka Kotorska Bay are covered by soft terrigenous mud with more or less detrital elements. The inshore zone of the Kotor, Risan, and Herceg Novi Bays are of sandy mud. The eastern part of the Kotor Bay bottom is rich in *Zostera*, and the northeast inshore parts of the Herceg Novi Bay and Igalo with the inlet Njivice showed significant concentration of *Cymodocea nodosa*, *Posidonia oceanica*, and *Zostera marina* [5].

Research of benthic biocoenosis in the Boka Kotorska Bay was done in 1970 by Karaman and Gamulin-Brida [6]. They found the following:

- The biocoenosis of the coastal terrigenous ooze as well as elements of other biocoenosis on the solid and mobile substrata
- Elements of the coralligenous biocoenosis
- Elements of the biocoenosis of beds of *Posidonia* (Fig. 2)
- Elements of the biocoenosis of beds of *Zostera*
- Elements of the biocoenosis of beds of *Cymodocea* (Fig. 3)
- Elements of the biocoenosis of photophilic algae (Fig. 4)

1.2 Historic Review

Adriatic decapod crustaceans (Crustacea: Decapoda) have been the subject of numerous investigations [7]. The first documented insights into the Adriatic decapod fauna were presented at the beginning of the sixteenth century by Giovio (syn.: Jovius), whose first documented observations were made in 1524 [8]. According to Merker-Poček [9], the first papers on decapod crustaceans and their records in the Adriatic date back to 1792 [10] and 1863 [11]. Later, Pesta [12] gives a monograph on decapod crustaceans of the Adriatic "Die Decapodenfauna der Adria" citing also their records. They made considerable contribution to knowledge not only with regard to the decapod Crustacea in the Adriatic Sea and the Mediterranean but also

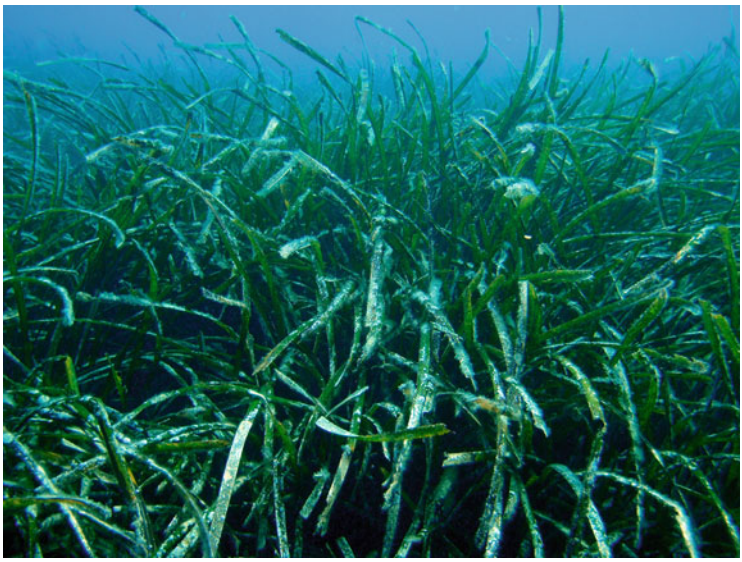


Fig. 2 *Posidonia* beds in the Boka Kotorska Bay

Fig. 3 *Cymodocea* beds with fun mussel, *Pinna nobilis* in the Boka Kotorska Bay

in general [13]. From then on, the intensive research of Adriatic decapods begins (Karlovac [14–17], Lutze [18]; Kurian [19]; Holthuis [20]; Karaman [21]; Riedl [22]; Ševčić [23]; Ševčić and Forstner [24]; Jukić [25]; Merker-Poček [26–28]; Froglia [29]).

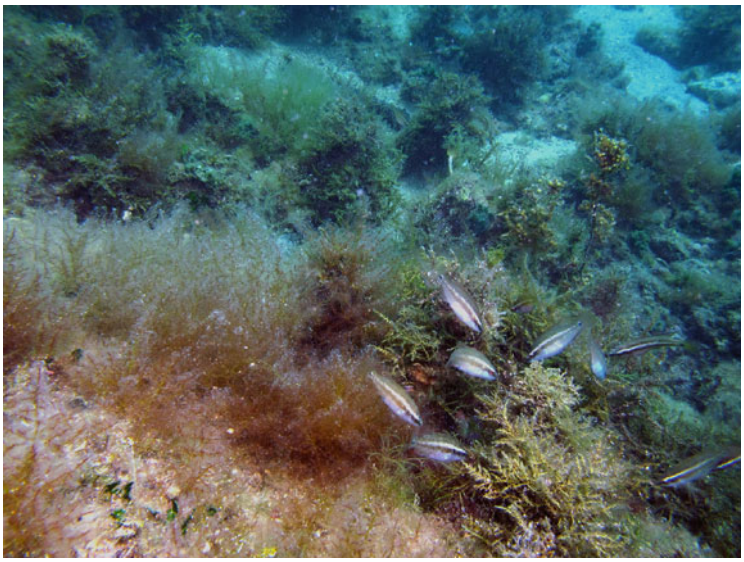


Fig. 4 Beds of photophilic algae

After the publication of the first list of the Adriatic decapod fauna by Ševčić [30], several publications increased the number of decapods species known in this area to 203, representing 62.08% of the Mediterranean fauna [31]. The last complete checklist of the Adriatic decapod species was published in 1990 [13] and has thereafter been update twice (Ševčić [32, 33]). So far, 241 decapod species have been noted for the Adriatic Sea [34].

Although there is plenty of information on the decapod crustaceans in the Adriatic Sea, there are very few reference works regarding the Boka Kotorska Bay. Only a few papers have addressed this topic.

The existing information on decapod crustaceans in the Boka Kotorska Bay is very limited. The first records of the marine decapods in the Boka Kotorska Bay were published by Karaman and Gamulin-Brida [6]. They recorded 18 species from 12 families. Merker-Poček [9, 35] gives quantitative and qualitative analysis of crustacea Decapoda in biocoenosis in the area of Boka Kotorska Bay. This author registered 39 species from 18 families. After that, Stjepčević and Parenzan [36] reported 33 species for Kotor and Risan bays, of which seven have been already reported in the Kotor Bay and the Risan Bay, while 15 have not been previously reported for the Boka Kotorska Bay.

The main objective of this chapter is to put together all previously published information in an attempt to develop an updated checklist of the decapods occurring in Boka Kotorska Bay.

2 Material and Methods

According to the available bibliographic information, the decapod material has been collected by trawl, dredge, and Petersen grab bottom sampler covering an area of 0.50 m^2 as well as scuba-diving techniques. Karaman and Gamulin-Brida [6] as well as Merker-Poček [9, 35] give the data about decapod species which were collected during the first research survey in the Boka Kotorska Bay. That survey was carried out in 1964/1965 with the research vessel "Atlant." Its trawling speed was 2.5 knots, while the dredge was towed for only 10 min at the same speed. To improve accuracy, when the grab was less than one-half full of collected material, the sampling was repeated. In stations 3K, 4K, 7K, and 8K, the hauls were 50 min long, due to the rocky bottom. Material was collected four times a year. During the research surveys, decapod samples were collected from nine stations. Sampling stations named 1K and 2K were located in the Kotor Bay, 3K in the Risan Bay, 4K in the Verige Strait, 5K and 6K in the Tivat Bay, and 7K, 8K, and 9K in the Herceg Novi Bay. The decapod sampling stations, as reported in the literature, are shown in Fig. 5. Bottom dredging haul stations were the same as for bottom trawling. Material collected from the dredge and Petersen grab bottom sampler was rinsed through the fine sieve and preserved in 5% formalin solution. Material collected by trawl was separated by groups, and decapod crustaceans were preserved in 75% ethyl alcohol.

Stjepčević and Parenzan [36] used dredge to collect decapod species only in the Kotor and Risan Bays. The dredging haul numbers carried out in each bay are presented in Fig. 6.

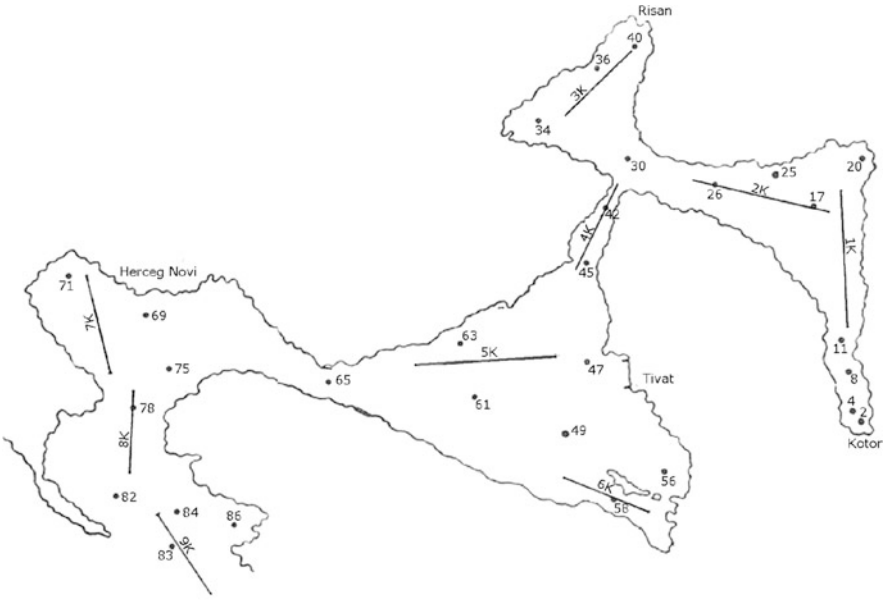
Two recent alien species were caught by different types of gillnet in the Tivat Bay (Fig. 7). The specimens were brought to the Laboratory of Ichthyology and Marine Fishery in the Institute of Marine Biology. After identification, the specimens were deposited in the Ichthyological Collection of the institute.

3 Results

The Boka Kotorska Bay decapod fauna shows a high diversity. The current information regarding families and their pertaining numbers of genera and species is presented in Table 1.

The following information is given for each species: valid name, common names, literature in which these species were mentioned, distribution in each bay, Adriatic distribution according to Ševčić [13], remarks, and for some of them interest to fishery.

In this checklist the families are classified according to WoRMS [37]. Within the families, genera and species are listed alphabetically.



Pregled istraživanih postaja u Bokokotorskom zalivu

Coupe schématique de stations de prélèvements dans la baie de Boka Kotorska

Legenda:

● Postaje P — Stations P

——— Postaje K — Stations K

Fig. 5 Decapod sampling stations (collected by bottom trawl and bottom dredge) in the Boka Kotorska Bay according to literature of Karaman and Gamulin-Brida [6]

3.1 List of Species

Order Decapoda Latreille, 1803

Suborder Dendrobranchiata Spence Bate, 1888

Superfamily PENAEOIDEA Rafinesque, 1815

Family Penaeidae Rafinesque, 1815

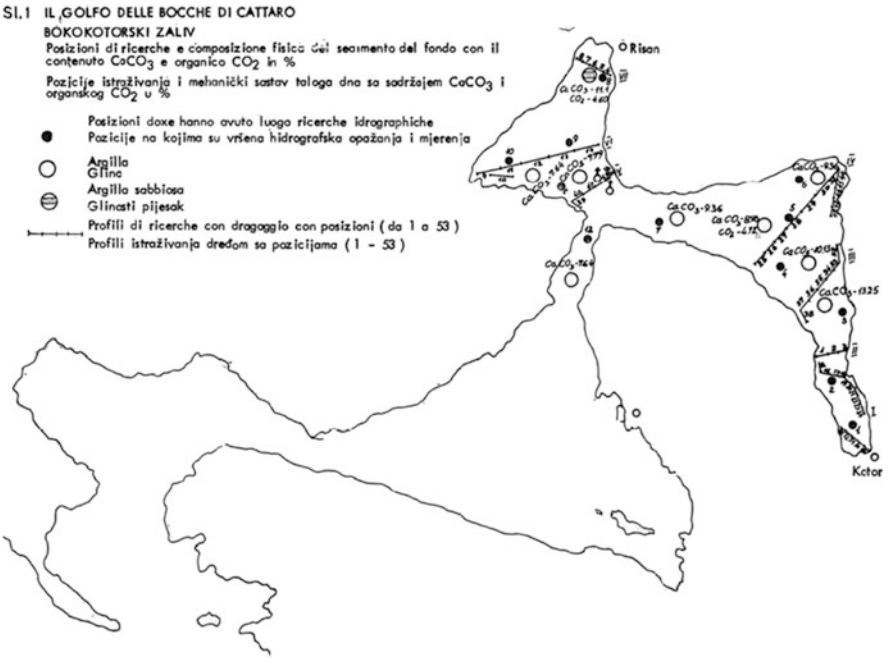


Fig. 6 Decapod sampling stations (collected by dredge) in Kotor Bay and Risan Bay according to literature of Stjepčević and Parenzan [36]

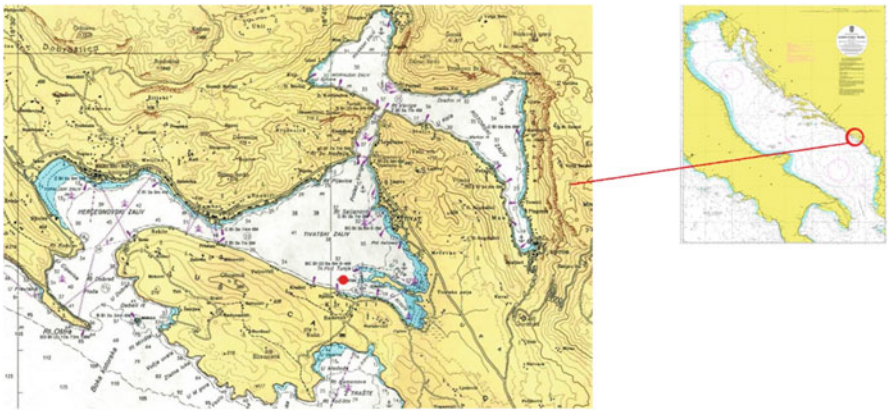


Fig. 7 Map of the Boka Kotorska Bay showing the site (*full red circle*) where the alien species (*Farfantepenaeus aztecus* and *Callinectes sapidus*) have been collected

Table 1 Decapod fauna from the Boka Kotorska Bay: number of genera and species

	Families	No. of genera	No. of species
Suborder Dendrobranchiata	Penaeidae	2	3
	Sicyoniidae	1	1
Suborder Pleocyemata			
Infraorder Achelata	Palinuridae	1	1
Infraorder Anomura	Galatheidae	1	4
	Munididae	1	1
	Porcellanidae	1	3
	Diogenidae	3	3
	Paguridae	2	5
Infraorder Axiidea	Callianassidae	1	1
Infraorder Brachyura	Calappidae	1	1
	Dorippidae	1	1
	Ethusidae	1	1
	Eriphiidae	1	1
	Goneplacidae	1	1
	Leucosiidae	2	3
	Epialtidae	2	3
	Inachidae	2	5
	Majidae	2	3
	Parthenopidae	1	1
	Pilumnidae	1	1
	Polybiidae	1	4
	Portunidae	2	2
	Xanthidae	1	1
	Pinnotheridae	1	1
	Dromiidae	1	1
	Homolidae	1	1
Infraorder Caridea	Alpheidae	1	2
	Palaemonidae	2	3
	Processidae	1	1
Infraorder Gebiidea	Upogebiidae	1	3
	Total	40	62

Parapenaeus longirostris (Lucas, 1846)

Common names: Kozica (Mne), deep-water pink shrimp (E), Gambero rosa (I), Crevette rose du large (F)
Literature: Merker-Poček [9]
Distribution: Sampled by trawl haul only in Herceg Novi Bay on 60 m of depth in very small quantities (Fig. 8)
Adriatic: This shrimp is reported from the entire area except the northern part [13] and, according to Kasalica [38], occurred in large quantities on continental shelf of South Adriatic (Montenegrin

Fig. 8 Deep-water pink shrimp, *Parapenaeus longirostris* (Lucas, 1846)

territorial waters) between 20 and 200 m on mud and sandy mud bottoms.

Remarks: This species occurs in bathyal communities "*Nephrops norvegicus–Thenea muricata*" at depths ranging from 60 to 750 m [13].

Interest to fishery: Commercially very important species in trawl fishery of Montenegro.

Penaeus aztecus Ives, 1891 = *Farfantepenaeus aztecus* Ives, 1891

Common names: Astečka kozica (Mne), northern brown shrimp (E), mazzancolla tropicale (I), crevette royale grise (F)

Literature: Marković et al [39]

Distribution: Sampled by gillnet called "bukvara," which has a 22 mm mesh size, only in Tivat Bay at a depth between 20 and 25 m (Fig. 9).

Adriatic: So far, this is the only record of this alien species in the Adriatic.

Remarks: This species occurs around east side of Mexico and the USA.

Interest to fishery: In areas where it is commercially caught, it is very important. Marketed mostly frozen and fresh; a small fraction of the catch is canned; juvenile and subadult shrimp are mainly sold as bait. This species has been farm raised on a small scale [40].

Fig. 9 Alien species, northern brown shrimp, *Penaeus aztecus* Ives, 1891 from the Tivat Bay

Penaeus kerathurus (Forskål, 1775) = *Penaeus trisulcatus* Leach

Common names:	Tigrasti gambor (Mne), Caramote prawn (E), mazzancolla (I), Caramote (F)
Literature:	Karaman and Gamulin-Brida [6], Merker-Poček [9, 41]
Distribution:	Karaman and Gamulin-Brida [6] as well as Merker-Poček [41] sampled this species by trawl in all bays, except in Kotor Bay, at depth of around 40 m on stations 3K, 6K, and 8K.
Adriatic:	According to Ševčić [13], this species is known from the entire area but more frequent in the southern part, especially near Neretva river mouth. Merker-Poček [41] found this species off the mouth of the Bojana river and in Boka Kotorska Bay.
Remarks:	Prefer brackish waters. According to the Article 18, item 3 of the Law on Marine Fisheries and Mariculture of Montenegro, the Ministry of Agriculture, Forestry, and Water Management has issued the order on prohibition of catch and trade in fish juveniles, undersized fish, and other marine organisms (OG of Montenegro No. 8/11). As the order specifies, it is forbidden to catch and place on market Caramote prawn individuals with total lengths of less than 10 cm.
Interest to fishery:	Commercially very important species (Fig. 10)

Fig. 10 Caramote prawn, *Penaeus kerathurus* (Forskål, 1775)

Family Sicyoniidae Ortmann, 1898

Sicyonia carinata (Brünnich, 1768)

Common names:	Kamena kozica (Mne), Mediterranean rock shrimp (E), Sicionia (I), Boucot méditerranéen (F)
Literature:	Stjepčević and Parenzan [36]
Distribution:	Reported at depth between 3 and 4 m on coarse sand bottoms and between many algae in Kotor Bay (from Dobrota to Prčanj).
Adriatic:	According to Ševčić [13], this species is reported from the entire area.
Remarks:	This was the first record of this species in the Boka Kotorska Bay.

Suborder Pleocyemata Burkenroad, 1963

Infraorder Achelata Scholtz & Richter, 1995

Family Palinuridae Latreille, 1802

Palinurus elephas (Fabricius, 1787)

Common names:	Jastog (Mne), common spiny lobster (E), Aragosta (I), Langouste rouge (F)
Literature:	Merker-Poček [9]
Distribution:	This species was found on rocky bottoms near coast in Herceg Novi Bay and in Kotor Bay, in Orahovac despite low and changeable salinity (Fig. 11).
Adriatic:	Reported in the middle and southern areas.
Remarks:	According to Merker-Poček [9], this species is endemic for the Mediterranean.
Interest to fishery:	It is of high commercial value. Because of high prices on the market, spiny lobster was intensively fished and became a very vulnerable species.

Fig. 11 Common spiny lobster, *Palinurus elephas* (Fabricius, 1787)

Infraorder Anomura Mac Leay, 1838

Superfamily Galatheoidea Samouelle, 1819

Family Galatheidae Samouelle, 1819

Galathea dispersa Bate, 1859

Common names:	Strigljač (Mne), squat lobster (E)
Literature:	Stjepčević and Parenzan [36]
Distribution:	Recorded in Kotor Bay, near Prčanj, at a depth of 32 m, on clay mud bottom rich with Ophiuroidea.
Adriatic:	Recorded on few localities throughout the entire area.
Remarks:	Stjepčević and Parenzan [36] were of the opinion that *Galathea nexa* which was found by Karaman and Gamulin-Brida [6] has been confused with *Galathea dispersa*.

Galathea intermedia Lilljeborg, 1851

Common names:	Hlapić (Mne), squat lobster (E)
Literature:	Karaman and Gamulin-Brida [6], Merker-Poček [9, 35], Stjepčević and Parenzan [36]
Distribution:	This species was found on Verige Strait and in Tivat Bay, at depths ranging from 4 to 30 m on oysters and on clay bottoms [6, 9]. Stjepčević and Parenzan [36] recorded this species in Risan Bay at depth from 10 to 18 m on various types of bottoms (detritic, sandy, with *Vidalia volubilis*) (bottom dredging haul number 4, 8, and 14)

Adriatic: Recorded throughout the entire area.
Remarks: Frequent.

Galathea nexa Embleton, 1834

Common names: Smeđi strigljač (Mne), squat lobster (E)
Literature: Karaman and Gamulin-Brida [6], Merker-Poček [9, 35]
Distribution: Karaman and Gamulin-Brida [6] found this species in Kotor Bay and Tivat Bay, and Merker-Poček [9] recorded this species in the muddy-sandy bottoms in all bays, except Herceg Novi Bay, at a depth of about 30 m.
Adriatic: Recorded throughout the entire area.
Remarks: This species is one of the most frequent species in Boka Kotorska Bay [35] and mainly found between sea grass meadows (*Posidonia*, *Zostera*).

Galathea squamifera Leach, 1814

Common names: Strigljač (Mne), squat lobster (E)
Literature: Karaman and Gamulin-Brida [6], Merker-Poček [9, 35], Stjepčević and Parenzan [36]
Distribution: Recorded from trawl and dredge haul samples in Kotor Bay and Tivat Bay by Karaman and Gamulin-Brida [6], while Merker-Poček [9] collected this species in all bays except Herceg Novi Bay. Stjepčević and Parenzan [36] found this species in front of Orahovac, at a depth of 10–12 m on stony bottom with algae.
Adriatic: Reported from many localities throughout the entire area.
Remarks: It inhabits the biocoenosis of the coastal terrigenous ooze with elements of coralligenous biocoenosis, mainly at depths between 5 and 20 m. Locally frequent.

Family Munididae Ahyong, Baba, Macpherson, Poore, 2010

Munida rugosa (Fabricius, 1775)

Common names: Hrapavi hlapić (Mne), rugose squat lobster (E)
Literature: Merker-Poček [9, 35]
Distribution: Recorded in Tivat Bay and Herceg Novi Bay on bottoms with elements of the coralligenous biocoenosis.
Adriatic: Recorded only from the middle and southern parts of the area.

Remarks:	Specimen was found by divers; in trawl and dredge catches were not present.
Interest to fishery:	Edible, but not used for food in the area [13].

Family Porcellanidae Haworth, 1825

Pisidia bluteli (Risso, 1816)

Common names:	Crveni porculanski račić (Mne), granchio pisello (I)
Literature:	Stjepčević and Parenzan [36], Ševčić [13]
Distribution:	Recorded in Kotor Bay, in front of Orahovac at a depth of 10–12 m on rocky bottom.
Adriatic:	Found on a few localities: Piran, Rovinj, Jadranovo, Boka Kotorska, Bari.
Remarks:	This was the first record of this species in Boka Kotorska Bay.

Pisidia longicornis (Linnaeus, 1767) = *Porcellana longicornis* Pennant, 1777

Common names:	Porculanski račić (Mne), long-clawed porcelain crab (E)
Literature:	Karaman and Gamulin-Brida [6], Merker-Poček [9]
Distribution:	One individual was found in Tivat Bay from trawl haul 5K [6]. Merker-Poček [9] found this species at the same location on sandy clay bottom.
Adriatic:	Listed from many localities throughout the entire area.
Remarks:	It occurs in littoral zone between 0 and 40 m and does not require specific type of bottom.

Pisidia longimana (Risso, 1816)

Common names:	Mrki porculanski račić (Mne)
Literature:	Stjepčević and Parenzan [36] Ševčić [13]
Distribution:	Found in Kotor Bay at a depth of 3–4 m on coarse sand rich with algae.
Adriatic:	Recorded from many localities including the Boka Kotorska Bay.
Remarks:	According to Stjepčević and Parenzan [36], this species has previously been identified as *Porcellana longicornis*.

Superfamily Paguroidea Latreille, 1802

Family Diogenidae Ortmann, 1892

Dardanus arrosor (Herbst, 1796)

Common names:	Rak samac (Mne), striated hermit crab (E)
Literature:	Merker-Poček [9, 35]
Distribution:	Recorded in Herceg Novi Bay and Kotor Bay on muddy-sandy bottoms at depths of about 30 m (Fig. 12)
Adriatic:	Known from a few localities from the middle and southern part of the area.
Remarks:	This species was found in shells of *Tonna galea* (= *Dolium galea*), *Galeodea echinophora* (= *Cassidaria echinophora*), and *Bolinus brandaris* (= *Murex brandaris*).

Diogenes pugilator (Roux, 1829)

Common names:	Diogenov samac (Mne), small hermit crab (E), Paguro Diogene (I)
Literature:	Stjepčević and Parenzan [36]
Distribution:	This species is found in Kotor Bay, along the coast of Dobrota, at depths of 2–3 m, on bottoms with Zoosteracea sea grass.
Adriatic:	Listed from many localities throughout the entire area.
Remarks:	Very common species.

Fig. 12 Striated hermit crab, *Dardanus arrosor* (Herbst, 1796)

Paguristes eremita (Linnaeus, 1767) = *Paguristes oculatus* (Fabricius, 1775)

Common names:	Okati rak samac (Mne), eye-spot hermit crab (E), Scardobola (I)
Literature:	Stjepčević and Parenzan [36]
Distribution:	This species is recorded in Kotor Bay and Risan Bay at a depth of 3–20 m, on detritic bottoms and coarse clean sand.
Adriatic:	Frequently reported over the entire area.
Remarks:	Very common species.

Family Paguridae Latreille, 1802

Anapagurus bicorniger A. Milne Edwards & Bouvier, 1892

Common names:	Dvorogi rak samac (Mne)
Literature:	Stjepčević and Parenzan [36], Ševčić [13]
Distribution:	Several specimens were collected in Risan Bay at a depth of 18–20 m and in Kotor Bay, in front of Orahovac at a depth of 12–15 m on muddy bottoms.
Adriatic:	Recorded in Piran, Kvarner, Split, Boka Kotorska.
Remarks:	Rare species.

Anapagurus breviaculeatus Fenizia, 1937

Common names:	Bodljikavi rak samac (Mne)
Literature:	Stjepčević and Parenzan [36], Ševčić [13]
Distribution:	Several specimens were collected in Risan Bay and Kotor Bay on various types of bottom (detritic mud, rock covered with algae) between 7 and 15 m.
Adriatic:	Recorded in Rovinj, Makarska, and Boka Kotorska.
Remarks:	Very rare species. This was the new record for the Adriatic as well as for the Boka Kotorska Bay.

Pagurus cuanensis Bell, 1846

Common names:	Rak samac (Mne), hairy hermit crab (E)
Literature:	Stjepčević and Parenzan [36]
Distribution:	This species was found in Kotor Bay and Risan Bay on detritic bottom as well as on coarse sand with stone at a depth of 5–10 m.
Adriatic:	Known from the northern side of the area.
Remarks:	This was the new record for the Boka Kotorska Bay.

Pagurus excavatus (Herbst, 1791) = *Pagurus alatus* Fabricius, 1775

Common names:	Rak samac (Mne), hermit crab (E)
Literature:	Stjepčević and Parenzan [36]
Distribution:	This species was found in Kotor Bay on detritic bottoms at a depth of 10 m.
Adriatic:	Known throughout the entire area.
Remarks:	This was the new record for the Boka Kotorska Bay

Pagurus prideaux Leach, 1815 = *Pagurus prideauxi* Leach, 1815

Common names:	Rak samac (Mne), Prideaux's hermit crab (E)
Literature:	Merker Poček [9, 35]
Distribution:	Recorded in all bays on shallow muddy and sandy bottoms at a depth of max 20 m.
Adriatic:	Recorded from the entire area.
Remarks:	Very common and frequent. It is usually associated with sea anemone *Adamsia palliata*.

Infraorder Axiidea de Saint Laurent, 1979

Family Callianassidae Dana, 1852

Gourretia denticulata (Lutze, 1937) = *Callianassa subterranea* minor Gourret, 1807

Common names:	Nazubčani medo (Mne)
Literature:	Stjepčević and Parenzan [36]
Distribution:	This species is found in the Kotor Bay on depths between 20 and 25 m on muddy bottoms north of the Institute of Marine Biology (bottom dredging haul number 2).
Adriatic:	It has been taken sporadically over the entire area.
Remarks:	This was the first record of this species in the Boka Kotorska Bay.

Infraorder Brachyura Linnaeus, 1758

Section Eubrachyura de Saint Laurent, 1980

Subsection Heterotremata Guinot, 1977

Superfamily Callapoidea De Haan, 1833

Fig. 13 Shamefaced crab, *Calappa granulata* (Linnaeus, 1758)

Family Calappidae De Haan, 1833

Calappa granulata (Linnaeus, 1758)

Common names:	Crvenopjegava rakovica (Mne), shamefaced crab (E), granchio melograno (I), crabe honteux (F)
Literature:	Merker-Poček [9, 35]
Distribution:	Recorded in Kotor Bay as well as in Herceg Novi Bay, on shallow muddy bottoms with parts of submarine reefs (Fig. 13).
Adriatic:	This species is very rare and has only been found in areas of the southern and middle Adriatic [13]. Recently, this species was found in northern Adriatic [42].
Interest to fishery:	Edible.

Superfamily Dorippoidea MacLeay, 1838

Family Dorippidae MacLeay, 1838

Medorippe lanata (Linnaeus, 1767) = *Dorippe lanata* (Linnaeus, 1767)

Common names:	Vuneni kratkorepac (Cro), facchino (I)
Literature:	Karaman and Gamulin-Brida [6], Merker-Poček [9, 35]
Distribution:	According to all authors, a single specimen was found in the middle part of the Tivat Bay in dredge haul (5K) in the biocoenosis of the coastal terrigenous ooze.

Adriatic: Entire area. According to Merker-Poček [9], this species was very abundant in the mouth of river Bojana (south Adriatic) at depths between 10 and 25 m.
Remarks: This species is extremely rare in the Boka Kotorska Bay [6, 35].

Family Ethusidae Guinot, 1977

Ethusa mascarone (Herbst, 1785)

Common names: Granchio facchino (I)
Literature: Karaman and Gamulin-Brida [6], Merker-Poček [9, 35]
Distribution: Sampled by trawl activity in Kotor Bay
Remarks: According to Merker-Poček [9, 35], this species is typical for the biocoenosis of the coastal terrigenous ooze as well as the biocoenosis of beds of *Zostera,* where this species occurs at depths between 10 and 30 m.

Superfamily Eriphioidea Mac Leay, 1838

Family Eriphiidae Mac Leay, 1838

Eriphia verrucosa (Forskål, 1775)

Common names: Grmelj, rak pontaš (Mne), warty crab (E), crabe verruqueux (Fr), granchio favollo (I)
Literature: Merker-Poček [9, 35]
Distribution: Recorded in all bays, mainly in rocky areas near the tide line, especially in Kotor Bay where it occurs in shallow water along rocky coastlines. It lives in the tidal zone, usually inhabiting the underwater rocks near the pier and sea cliffs and among the algae at a depth of 0–6 m (Fig. 14).
Adriatic: Recorded throughout the entire area along both sides.
Remarks: Very common and in Boka Kotorska Bay is called “rak pontaš.”
Interest to fishery: Edible and of certain economic value [13].

Fig. 14 Warty crab, *Eriphia verrucosa* (Forskål, 1775)

Superfamily Goneplacoidaea Mac Leay, 1838

Family Goneplacidae Mac Leay, 1838

Goneplax rhomboides (Linnaeus, 1758) = *Gonoplax angulata* (Pennant, 1777)

Common names:	Uglasti račić (Mne), angular crab (E)
Literature:	Karaman and Gamulin-Brida [6], Merker-Poček [9, 35]
Distribution:	This burrowing crab was recorded only in Herceg Novi Bay, station 8K, (all authors) on sandy clay bottom mainly with *Penaeus kerathurus* and *Upogebia pusilla*.
Adriatic:	Listed from many localities throughout the entire area.
Remarks:	Merker-Poček [9] reported this species also as important part of diet of *Trigla lyra*.

Superfamily Leucosioidea Samouelle, 1819

Family Leucosiidae Samouelle, 1819

Ebalia edwardsii O. G. Costa, 1838

Common names:	Edwarsijeva ebalia (Mne)
Literature:	Merker-Poček [9]
Distribution:	Sampled by trawl activity in Herceg Novi Bay
Remarks:	This species is very rare in Boka Kotorska Bay [9].

Ebalia granulosa H. Milne Edwards, 1837

Common names:	Not available.
Literature:	Karaman and Gamulin-Brida [6], Merker-Poček [9, 35], Stjepčević and Parenzan [36]
Distribution:	All authors found this species only in Kotor Bay. Stjepčević and Parenzan [36] recorded this species at a depth of 20 m in front of Orahovac.
Adriatic:	Reported mainly from the eastern side.
Remarks:	Like the previous species, it is very rare in Boka Kotorska Bay [9].

Ilia nucleus (Linnaeus, 1758)

Common names:	Mrtvačka glava (Mne), pebble crab (E), testa di morto (I)
Literature:	Stjepčević and Parenzan [36]
Distribution:	Recorded in Kotor Bay, in front of Orahovac at depths ranging between 10 and 12 m
Adriatic:	Sampled in the entire area.
Remarks:	This was the first record of this species in Boka Kotorska Bay

Superfamily Majoidea Samouelle, 1819

Family Epialtidae MacLeay, 1838

Lissa chiragra (Fabricius, 1775)

Common names:	Kvrgava rakovica (Mne)
Literature:	Merker-Poček [9, 35]
Distribution:	Recorded in Kotor Bay on detritic mud bottom at a depth of 35 m.
Adriatic:	Reported from the entire area.

Pisa armata (Latreille, 1803)

Common names:	Kosteljašica (Mne), Gibb's sea spider (E), Araignée à rostre pointu (F)
Literature:	Merker-Poček [9]
Distribution:	This species recorded in Kotor Bay on clay bottoms at a depth of 35 m.
Adriatic:	Listed from many localities in particular from northeastern and eastern coasts.

Remarks: According to Merker-Poček [9], this species is almost always camouflaged by algae, while Ševčić [13] reported that is often camouflaged with various sessile organisms, especially sponges.

Pisa tetraodon (Pennant, 1777)

Common names: Mala kosteljašica (Mne)
Literature: Merker-Poček [9, 35]
Distribution: Several individuals were sampled in trawl catches in Risan and Tivat Bays on 35 m depth but it is usually occurred at depth of 20 m.
Adriatic: Reported from many localities throughout the area.
Remarks: According to Merker-Poček [9], this species is often camouflaged with sponges and serpulids, while Ševčić [13] reported that it is usually camouflaged by algae.

Family Inachidae MacLeay, 1838

Inachus dorsettensis (Pennant, 1777)

Common names: Morski pauk (Mne)
Literature: Karaman and Gamulin-Brida [6], Merker-Poček [9, 35], Stjepčević and Parenzan [36]
Distribution: This species was recorded only in Kotor Bay, mainly on depths between 15 and 32 m.
Adriatic: Reported in the entire area.
Remarks: Mainly found between algae and often associated with sponges.

Inachus leptocheirus Leach, 1817

Common names: Morski pauk (Mne)
Literature: Karaman and Gamulin-Brida [6], Merker-Poček [9]
Distribution: Like the previous species, it is found only in the middle part of the Kotor Bay
Adriatic: Recorded from many localities along the eastern coast, in particular from southern part.
Remarks: Rare.

Inachus thoracicus Roux, 1830

Common names:	Morski pauk (Mne)
Literature:	Karaman and Gamulin-Brida [6], Merker-Poček [9, 35]
Distribution:	Few individuals were collected in Kotor Bay and Risan Bay on sandy clay bottoms.
Adriatic:	Reported throughout the entire area
Remarks:	Fairly scarce.

Macropodia longirostris (Fabricius, 1775)

Common names:	Rakovica (Mne)
Literature:	Karaman and Gamulin-Brida [6], Merker-Poček [9, 35]
Distribution:	Sampled in the middle part of the Kotor Bay on clear clay bottom and in Risan Bay on sandy clay bottom [9].
Adriatic:	Reported throughout the area.

Macropodia rostrata (Linnaeus, 1761)

Common names:	Kljunasta rakovica (Mne)
Literature:	Karaman and Gamulin-Brida [6], Merker-Poček [9, 35], Stjepčević and Parenzan [36]
Distribution:	Occurred in Tivat Bay as well as in Kotor Bay where Stjepčević and Parenzan [36] found it in front of Orahovac at depth of 20 m.
Adriatic:	Reported throughout the area.

Family Majidae Samouelle, 1819

Eurynome aspera (Pennant, 1777)

Common names:	Hrapava rakovica (Mne)
Literature:	Stjepčević and Parenzan [36]
Distribution:	Recorded in Risan Bay at a depth of 15 m and in Kotor Bay at a depths ranging between 10 and 32 m.
Adriatic:	Reported from a great number of localities throughout the entire area.
Remarks:	No earlier reported for the Boka Kotorska Bay.

Fig. 15 Lesser spider crab, *Maja crispata* Risso, 1827

Maja crispata Risso, 1827 = *Maja verrucosa* H. Milne Edwards

Common names:	Mala rakovica (Mne), lesser spider crab (E), granceola piccola (I), araignée naine (F)
Literature:	Merker-Poček [9, 35]
Distribution:	Reported in Kotor Bay on bottom between sea grass meadows.
Adriatic:	Reported throughout the entire area [13]
Remarks:	Usually found in the biocoenosis of the coastal terrigenous ooze, facies of sessile forms, at depths of about 40 m (Fig. 15).
Interest to fishery:	Edible but of no commercial importance.

Maja squinado (Herbst, 1788)

Common names:	Granceola (Mne), spinous spider crab (E), granzeola (I), araignée européene (F)
Literature:	Karaman and Gamulin-Brida [6], Merker-Poček [9, 35]
Distribution:	Several individuals reported in Kotor Bay and Risan Bay (Fig. 16).
Adriatic:	Reported throughout the entire area, in particular on the western Istrian coast.
Remarks:	In Boka Kotorska Bay, it lives on bottoms ranging between 20 and 50 m. According to the Article 18, item 3 of the Law on Marine Fisheries and Mariculture, the Ministry of Agriculture, Forestry, and Water Management has issued the order on prohibition of catch and trade in fish juveniles, undersized fish, and other marine organisms (OG of Montenegro No. 8/11). As the order specifies, it is forbidden to catch and place on market spinous spider crab individuals with total lengths of less than 10 cm. All caught specimens shorter than 10 cm and females with eggs, regardless

Fig. 16 Spinous spider crab, *Maja squinado* (Herbst, 1788)

of their length, must be returned to the sea. According to Merker-Poček [9], this species is endemic to the Mediterranean Sea.

Interest to fishery: Edible, commercially important.

Superfamily Parthenopoidea MacLeay, 1838

Family Parthenopidae, MacLeay, 1838

Parthenopoides massena (Roux, 1830) = *Parthenope massena* (Roux, 1830)

Common names: Not available.

Literature: Stjepčević and Parenzan [36]

Distribution: Found in Kotor Bay, along the coast of Dobrota, at a depth of 3–4 m, on coarse sand with many algae.

Remarks: This was the first record of this species in Boka Kotorska Bay.

Superfamily Pilumnoidea Samouelle, 1819

Family Pilumnidae Samouelle, 1819

Pilumnus hirtellus (Linnaeus, 1761)

Common names: Runjavac (Mne)

Literature: Karaman and Gamulin-Brida [6], Merker-Poček [9, 35], Stjepčević and Parenzan [36], Ševčić [13]

Distribution: Karaman and Gamulin-Brida [6] found this species in all bays, except in Herceg Novi Bay. According to Merker-Poček [9], this species is present in all bays, mainly at depths between 5 and 40 m. Stjepčević and Parenzan [36] collected this hairy crab from rocky bottoms with sea urchin *Sphaerechinus*, in Orahovac at a depth of 8–10 m.
Adriatic: Listed from many localities throughout the area.
Remarks: This is the most widespread species in percentages [9, 35] in Boka Kotorska Bay. It was even found among oysters as well as on wood remains. Števčić [13] claimed that this species is recorded with certainty in Boka Kotorska Bay.

Superfamily Portunoidea Rafinesque, 1815

Family Polybiidae Ortmann, 1893

Liocarcinus corrugatus Pennant, 1777 = *Macropipus corrugatus* Pennant, 1777

Common names: Rak veslač (Mne), wrinkled swimcrab (E), Etrille ballante (F)
Literature: Merker-Poček [9, 35]
Distribution: This species was found only in coastal parts of Herceg Novi Bay (station 7K) where the elements of coralligenous biocenosis are present.
Adriatic: Recorded throughout the entire area.

Liocarcinus depurator (Linneaus, 1758) = *Macropipus depurator* (Linnaeus, 1758)

Common names: Rakovica lopatašica (Mne), Blue-leg swimcrab (E), Etrille pattes bleues (F), Granchio di strascico (I)
Literature: Merker-Poček [9]
Distribution: Like the previous species, this species was also found only in Herceg Novi Bay, in its middle part, on sandy clay bottoms (Fig. 17).
Adriatic: Recorded from many localities throughout the entire area.
Remarks: Edible but rarely used as human food.

Liocarcinus navigator (Herbst, 1794) = *Liocarcinus arcuatus* (Leach, 1814) = *Macropipus arcuatus* Leach, 1814

Common names: Rak veslač (Mne), arched swimming crab (E), Étrille arquée (F)
Literature: Merker-Poček [9], Stjepčević and Parenzan [36]

Fig. 17 Blue-leg swimming crab, *Liocarcinus depurator* (Linneaus, 1758) (damaged specimen)

Distribution: Merker-Poček [9] recorded this species in Risan Bay in shallow waters on sandy clay at depths ranging between 5 and 20 m. Stjepčević and Parenzan [36] reported this species for Kotor Bay on various types of bottoms (coarse sand, detritic muddy, and sandy bottoms) at depths between 3 and 20 m and in Risan Bay on muddy sand in front of Morinj at depth of 2.5 m.

Adriatic: Known from the entire area.

Liocarcinus pusillus (Leach, 1816) = *Macropipus pusillus* (Leach, 1816)

Common names: Rak veslač (Mne)

Literature: Karaman and Gamulin-Brida [6], Merker-Poček [9, 35], Stjepčević and Parenzan [36]

Distribution: Recorded in Risan Bay and in Tivat Bay by Karaman and Gamulin-Brida [6]. Merker-Poček [9] found this species only in Risan Bay (station 3K). According to Stjepčević and Parenzan [13], this species was the most frequent species in Kotor and Risan bays, found at depths ranging between 15 and 20 m.

Remarks: Ševčić [13] reported that this species has been confused with *Liocarcinus maculatus*.

Family Portunidae Rafinesque, 1815

Callinectes sapidus Rathbun, 1896

Common names: Plavi rak (Mne), blue crab (E), granchio blu (I), crabe bleu (F)

Literature: Marković and Đurović [43]

Fig. 18 Alien species, blue crab, *Callinectes sapidus* Rathbun, 1896 from the Tivat Bay

Distribution:	Sampled by gillnet called "polandara," with 45 mm mesh size at a depth of 15 m in Tivat Bay (Fig. 18).
Adriatic:	The reports of the blue crab occurrence in the Adriatic are mainly limited to the southern part of the Adriatic Sea. Only few reports are dealing with the finding of this species in the northern Adriatic, reporting sites such as Grado, the Venetian Lagoon, and the waters of Ravenna [44].
Remarks:	This is the first record of the occurrence of this alien species in the Boka Kotorska Bay.
Interest to fishery:	Commercially important.

Carcinus aestuarii Nardo, 1847 = *Carcinus mediterraneus* Czerniavsky, 1884

Common names:	Mediterranean shore crab (E), granchio ripario (I), crabe vert de la Méditerranée (F)
Literature:	Stjepčević and Parenzan [36]
Distribution:	Recorded in Risan Bay at a depth of 15 m and in Kotor Bay at a depths ranging between 10 and 32 m (Fig. 19).
Adriatic:	Reported from a great number of localities throughout the entire area.
Remarks:	No earlier reported for the Boka Kotorska Bay.

Fig. 19 Mediterranean shore crab, *Carcinus aestuarii* Nardo, 1847

Superfamily Xanthoidea MacLeay, 1838

Family Xanthidae MacLeay, 1838

Xantho poressa (Olivi, 1792)

Common names:	Jaguar round crab (E), granchio di luna (I), Crabe de pierre méditerranéen (F)
Literature:	Merker-Poček [9, 35], Stjepčević and Parenzan [36]
Distribution:	Merker-Poček [9] recorded this crab in Herceg Novi Bay and Tivat Bay at a depths between 10 and 50 m, while Stjepčević and Parenzan [36] found it in Kotor Bay (bottom dredging haul 15 and 16), between Muo and the Institute of Marine Biology, on sandy detritic bottoms at a depth of 2–3 m.
Adriatic:	Listed from the entire area.
Interest to fishery:	Edible.

Section Eubrachyura de Saint Laurent, 1980

Subsection Thoracotremata Guinot, 1977

Superfamily Pinnotheroidea De Haan, 1833

Family Pinnotheridae De Haan, 1833

Pinnotheres pisum (Linnaeus, 1767)

Common names:	Čuvarkuća (Mne), pea crab (E), granchio pisello (I)
Literature:	Merker-Poček [9]
Distribution:	Reported in all bays on clay, sand, and rocky bottoms mainly where bivalves live such as *Mytilus*, *Cardium*, and *Ostrea*.

Fig. 20 Sleepy crab, *Dromia personata* (Linnaeus, 1758)

Adriatic: Known from the entire area.
Remarks: Bivalves are the most common host of this species.

Section Podotremata Guinot, 1777

Superfamily Dromioidea De Haan, 1833

Family Dromiidae De Haan, 1833

Dromia personata (Linnaeus, 1758)

Common names: Kosmač (Mne), sleepy crab (E), crabe dormeur (Fr), granchio dormiglione (I)
Literature: Merker-Poček [9]
Distribution: Recorded in Tivat Bay and Herceg Novi Bay at depths from 10 to 30 m (Fig. 20).
Adriatic: Known over the entire area.
Remarks: It is usually camouflaged by sponge species.

Superfamily Homolodromioidea Alcock, 1899

Family Homolidae De Haan, 1839

Homola barbata (Fabricius, 1793)

Common names: Kratkorepac (Mne), homole crab (E), homole (F)
Literature: Merker-Poček [9, 35]
Distribution: Recorded in Risan Bay and Tivat Bay on sandy and sandy-muddy bottoms at depth of 40 m.
Remarks: Very rare in all bays.

Infraorder Caridea Dana, 1852

Superfamily Alpheoidea Rafinesque, 1815

Family Alpheidae Rafinesque, 1815

Alpheus dentipes Guérin, 1832

Common names:	Pucketavi rak (Mne), snapping shrimp (En)
Literature:	Stjepčević and Parenzan [36]
Distribution:	This species was found in Risan Bay, at a depth of 15 m on bottom rich with *Vidalia volubilis* (bottom dredging haul number 4) and on sandy bottoms rich with detritus at depth of 10 m (bottom dredging haul number 8).
Adriatic:	It is known from many localities throughout the area.

Alpheus glaber (Olivi, 1792)

Common names:	Crveni pucketavi rak (Mne), red snapping shrimp (En), gamberetto alfeo (I), cardon rouge (F)
Literature:	Stjepčević and Parenzan [36]
Distribution:	This species was found in Risan Bay (bottom dredging haul number 14), in a depth of 18 m.
Adriatic:	Reported from many localities throughout the entire area.
Remarks:	This species had not been reported before for the Boka Kotorska Bay.

Superfamily Palaemonoidea Rafinesque, 1815

Family Palaemonidae Rafinesque, 1815

Palaemon adspersus Rathke, 1837

Common names:	Mala kozica (Mne), Baltic prawn (En), gamberetto (I), Bouquet balte (F)
Literature:	Stjepčević and Parenzan [36]
Distribution:	Stjepčević and Parenzan [36] recorded this species in the Kotor Bay on depths between 2 and 5 m on detritus bottoms and bottoms with *Ulva lactuca* (location Muo, bottom dredging haul number 15 and 16) and at depth of 20 m on bottom rich with *Gracilaria* (bottom dredging haul number 17).
Adriatic:	Known throughout the entire area.
Remarks:	This was the first record of this species in the Boka Kotorska Bay.
Interest to fishery:	Edible.

Fig. 21 Common prawn, *Palaemon serratus* (Pannant, 1777)

Palaemon serratus (Pannant, 1777)

Common names:	Mala kozica (Mne), common prawn (En), gamberetto maggiore (I), Bouquet commun (F)
Literature:	Merker-Poček [9, 35], Stjepčević and Parenzan [36]
Distribution:	Merker-Poček [9] found this species in the Kotor Bay in large quantities (haul 1K) in coastal littoral zone near the mouths of two springs (Fig. 21) where beside the elements of the biocoenosis of the coastal terrigenous ooze, photophilic algae can also be found. Stjepčević and Parenzan [36] found this species in the same bay at depth of 3 m along the coast of Dobrota on bottom covered with *Zostera* meadows.
Adriatic:	This shrimp was reported from many localities over the entire area.
Remarks:	This species is one of the most frequent species in Boka Kotorska Bay [9].
Interest to fishery:	Common prawn is valued for human consumption and may also be used as bait.

Typton spongicola O.G. Costa, 1844

Common names:	Spužvar (Mne)
Literature:	Merker Poček [9, 35]
Distribution:	Recorded in all bays, at depths between 20 and 50 m.
Adriatic:	Recorded from the entire area.
Remarks:	*Typton* lives in some sponges.

Superfamily Processoidea Ortmann, 1896

Family Processidae Ortmann, 1896

Processa canaliculata Leach, 1815

Common names:	Žljebasta kozica (Mne), *Processa* shrimp (En), Processa di fondale (I), Guernade processe (F)
Literature:	Stjepčević and Parenzan [36]
Distribution:	This species was found in Kotor Bay (along the coast of Prčanj and north of the Institute of Marine Biology) on muddy clay bottoms at depths ranging between 20 and 32 m.
Adriatic:	Recorded in the middle and southern parts.
Remarks:	This was the first record of this species in the Boka Kotorska Bay.

Infraorder Gebiidea de Saint Laurent, 1979

Family Upogebiidae Borradaile, 1903

Upogebia deltaura (Leach, 1815)

Common names:	Kanjoč (Mne)
Literature:	Stjepčević and Parenzan [36]
Distribution:	Found on coarse sand bottom with fine gravel and stone at depths between 8 and 10 m, in bottom dredging haul number 31, near the settlement Orahovac in Kotor Bay.
Adriatic:	Reported from the entire area with exception for the northern part (Gulf of Venice).

Upogebia pusilla (Petagna, 1792) = *Upogebia litoralis* (Risso, 1816)

Common names:	Kanjoč (Mne), Mediterranean mud shrimp (En), Corbola (I), Crevette fouisseuse (F)
Literature:	Karaman and Gamulin-Brida [6], Merker-Poček [9, 35], Stjepčević and Parenzan [36]
Distribution:	Reported in all sampled stations in Boka Kotorska Bay on various types of muddy and sandy bottom (clayey silt, detritic, clayey sand) (Fig. 22) where lives in burrows, except in station situated in the entrance of the bay [6, 9]. It has been found in trawl haul as well as in dredge haul. Stjepčević and Parenzan [36] collected this species in Risan Bay on coarse sand and gravelly sand at depths of 6–7 m (bottom dredging haul number 10).
Adriatic:	Reported from the entire area.
Remarks:	This is the most represented species in the Boka Kotorska Bay [9].

Fig. 22 Mediterranean mud shrimp, *Upogebia pusilla* (Petagna, 1792)

Upogebia tipica (Nardo, 1869) = *Upogebia typica* (Nardo, 1847)

Common names:	Zvjezdasti karlić (Mne)
Literature:	Stjepčević and Parenzan [36], Ševčić [13]
Distribution:	Recorded in the Kotor bay on depth of 10 m on muddy bottoms close to coast of St. Matija (bottom dredging haul number 1).
Adriatic:	According to Ševčić [13], it has been found only in Boka Kotorska Bay and in north Adriatic.
Remarks:	This was the first record of this species in the Boka Kotorska Bay.

Because of permanent revision, species names have to be changed and adjusted to the current state of nomenclature of decapod Crustacea [34]. Accordingly, the names of some decapod species listed in this checklist are updated and replaced by the valid names given in Table 2.

4 Discussion

After a review of the available literature, the decapod fauna of the Boka Kotorska Bay consists of 62 species (four Dendrobranchiata, 58 Pleocyemata of which 1 is Achelata, 16 are Anomura, 1 is Axiidea, 31 are Brachyura, 6 are Caridea, and 3 are Gebiidea), which constitute approximately 26% of the total Adriatic recorded Decapoda species. The smallest number of species, 17, was recorded in the Herceg Novi Bay, 21 in the Tivat Bay, 25 in the Risan Bay, and 45 in the Kotor Bay. Among them, four species (*Goneplax rhomboides*, *Ebalia edwardsii*, *Liocarcinus corrugatus*, *Liocarcinus depurator*) were only found in the Herceg Novi Bay. In the Tivat Bay, among four species which were collected only in that bay, two were

Table 2 Updated names of the Decapoda species from the Boka Kotorska Bay

Previously used name	References	Current name (according to WoRMS, 2015)
Farfantepenaeus aztecus Ives, 1891	Marković et al. [39]	*Penaeus aztecus* Ives, 1891
Penaeus trisulcatus Leach	Karaman and Gamulin-Brida [6], Stjepčević and Parenzan [36]	*Penaeus kerathurus* (Forskål, 1775)
Porcellana longicornis Pennant, 1777	Karaman and Gamulin-Brida [6], Merker-Poček [9]	*Pisidia longicornis* (Linnaeus, 1767)
Paguristes oculatus (Fabricius, 1775)	Stjepčević and Parenzan [36]	*Paguristes eremita* (Linnaeus, 1767)
Pagurus alatus Fabricius	Stjepčević and Parenzan [36]	*Pagurus excavatus* (Herbst, 1791)
Pagurus prideauxi Leach, 1815	Merker-Poček [9, 35]	*Pagurus prideaux* Leach, 1815
Callianassa minor Gourret	Stjepčević and Parenzan [36]	*Gourretia denticulata* (Lutze, 1937)
Dorippe lanata (Linnaeus, 1767)	Karaman and Gamulin-Brida [6], Merker-Poček [9, 35]	*Medorippe lanata* (Linnaeus, 1767)
Gonoplax angulata (Pennant, 1777)	Karaman and Gamulin-Brida [6]	*Goneplax rhomboides* (Linnaeus, 1758)
Maja verrucosa H. Milne Edwards	Merker-Poček [9, 35]	*Maja crispata* Risso, 1827
Parthenope massena (Roux, 1830)	Stjepčević and Parenzan [36]	*Parthenopoides massena* (Roux, 1830)
Macropipus corrugatus Pennant, 1777	Merker-Poček [9, 35]	*Liocarcinus corrugatus* Pennant, 1777
Macropipus depurator (Linnaeus, 1758)	Merker-Poček [9]	*Liocarcinus depurator* (Linneaus, 1758)
Macropipus arcuatus Leach, 1814	Merker-Poček [9], Stjepčević and Parenzan [36]	*Liocarcinus navigator* (Herbst, 1794)
Macropipus pusillus (Leach, 1816)	Karaman and Gamulin-Brida [6], Merker-Poček [9, 35], Stjepčević and Parenzan [36]	*Liocarcinus pusillus* (Leach, 1816)
Carcinus mediterraneus Czerniavsky, 1884	Stjepčević and Parenzan [36]	*Carcinus aestuarii* Nardo, 1847
Upogebia litoralis (Risso, 1816)	Karaman and Gamulin-Brida [6]	*Upogebia pussila* (Petagna, 1792)
Upogebia typica (Nardo, 1847)	Stjepčević and Parenzan [36]	*Upogebia tipica* (Nardo, 1869)

recognized as alien species (*Pisidia longicornis*, *Medorippe lanata*, *Penaeus aztecus*, and *Callinectes sapidus*). Two species from the Alpheidae family were found only in the Risan Bay. In the Kotor Bay, almost half of the recorded species

were found only in that bay (21 species). The most diverse, in terms of species number, were the true crabs (brachyurans) followed by anomurans (hermit crabs, squat lobsters) and caridean shrimps. Dendrobranchiate shrimps and macrurans (lobsters and relatives) contribute to a lesser extent to the decapod species diversity. Most of crustaceans were non-commercial or potentially commercial species. The most abundant species were *Upogebia pusilla* and *Pilumnus hirtellus*, while *Lissa chiraga* and *Medorippe lanata* occurred with very small number of specimen.

During the last 5 years, two species from American waters have been reported. The mode of introduction of these alien, immigrant species is probably by shipping, through ballast waters and hull fouling. This bay offers suitable environmental conditions for the establishment of such immigrants.

Finally, we conclude that the decapod fauna of this beautiful bay is fairly rich. But, the number of references for this small area has not increased from the last research survey. Continuing investigations on the fauna should add additional decapod species to the list. We believe that it would be very important to revise this checklist, as according to the experiences of many fishermen and divers, the number of the decapod crustacea species in this bay is much bigger.

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