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PRELIMINARY INVESTIGATION OF THE SEDIMENTARY BOTTOM DECAPOD FAUNA IN THE UPPER INFRALITTORAL OF THE ISLAND OF KRK (ADRIATIC SEA)

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ABSTRACT

The UNEP Mediterranean Action Plan Draft Reference List of Habitat Types of Conservation Interest includes sedimentary bottom infralittoral biocenoses. Such habitats are very rare on the eastern Adriatic coast. Therefore an investigation of the decapod fauna collected by means of a beach seine on the upper infralittoral (at the depth of ca. 0-1 m) has been carried out on three shores of Krk Island (northern Adriatic). Each locality is characterized by a different kind of sedimentary substrate (mud, sand, gravel). The species composition, their abundance and dominance are given for each locality, upon which a comparative study was conducted. Each locality has its specific dominant species. Carcinus aestuarii is the dominant species on the muddy bottom, Philocheras trispinosus on the sandy bottom, and Palaemon elegans in the biocenosis of coarse sands and gravels. Altogether, 14 benthic decapod species have been found.

Key words: decapod fauna, littoral, sedimentary bottom, northern Adriatic

STUDIO PRELIMINARE DELLA FAUNA A DECAPODI DI FONDO SEDIMENTARIO NELL'INFRALITORALE SUPERIORE DELL'ISOLA DI VEGLIA (MARE ADRIATICO)

SINTESI

La prima stesura della Lista di riferimento degli habitat meritevoli di salvaguardia del Piano d'Azione per il Mediterraneo dell'UNEP comprende i fondi sedimentari delle biocenosi infralitorali. Tali habitat sono molto rari lungo la costa orientale dell'Adriatico. Uno studio è stato pertanto eseguito sulla fauna a decapodi raccolta con l'ausilio di una rete da spiaggia nell'infralitorale superiore (profondità compresa tra 0 e 1 m) su tre spiagge dell'isola di Veglia (Adriatico settentrionale). Ogni località è caratterizzata da un diverso tipo di substrato sedimentario (fango, sabbia, ghiaia). La composizione in specie, la loro abbondanza e dominanza vengono presentate per ogni località, come pure uno studio comparativo tra di esse. Ogni località ha una propria specifica specie dominante. Carcinus aestuarii è la specie dominante su fondo fangoso, Philocheras trispinosus su fondo sabbioso e Palaemon elegans nella biocenosi di sabbie grossolane e ghiaie. In totale sono state trovate 14 specie di decapodi bentonici.

Parole chiave: fauna a decapodi, litorale, fondo sedimentario, Adriatico settentrionale

INTRODUCTION

The research on decapods in the Adriatic began in the 19th century (Štević, 1993). In 1918, O. Pesta integrated all knowledge hitherto acquired in his monograph *Die Decapoden Fauna der Adria*. That was the actual beginning of intensive submarine research along the Adriatic coast. Within the systematic expeditions, decapods were researched as well. In the northern Adriatic, the research was mainly conducted along the Istrian coast (Manning & Štević, 1982; Štević, 1991), and the Kvarner islands (Štević, 1979; Gamulin-Brida *et al.*, 1980). The research generated new knowledge on the composition of the crustacean population in the muddy bottom biocenoses of the lower infralittoral and circalittoral (Gamulin-Brida *et al.*, 1972), and of the rocky mediolittoral and infralittoral (Pérès & Gamulin-Brida, 1973). The upper infralittoral of horizontal shores with sedimentary bottom was left open to research. Such areas have not been studied since up to that point the research was mostly conducted by means of trawl nets and bottom grabs drawn by ships. Scuba diving did not produce significant results due to fauna being burrowed in the sediment, well hidden or scared by the movements and bubbles produced by the scuba divers. The UNEP Mediterranean Action Plan Draft Reference List of Habitat Types of Conservation Interest, the title being self-explanatory, is a list drawn up by international scientists under the sponsorship of the UN Environmental Project, in order to protect rare and endangered marine habitats. The list includes sedimentary bottom infralittoral biocenoses as well. Such habitats are very rare on the eastern Adriatic coast. Therefore, an investigation has been carried out to document the decapod fauna collected by means of a beach seine from the upper infralittoral (at a depth of ca. 0-1 m) on three shores of the island of Krk (northern Adriatic). Each locality is characterized by a different kind of sedimentary substrate (mud, sand and gravel). Our intention is to carry out a qualitative analysis in order to prepare a list of species per each locality and to determine their relation to the substratum: whether they are strictly dependent to a certain type of the bottom or have adapted to different types. With a quantitative analysis we wish to determine the frequency of species and their dominance per locality, as well as relative dominance between the localities per species found at more than one station.

MATERIAL AND METHODS

Study area

The decapods recorded here have been sampled at three localities: in Meline cove, St. Marak cove, and Baška cove (Fig. 1). The coves are situated on the south-eastern coast of Krk Island.

The localities may be described as follows:

- Meline (kr1) is a relatively large cove, sheltered from northern and southern winds. The maximum depth in the middle of the cove reaches about 3 m, increasing gradually to 6 m at the cove entrance. The substrate is muddy sand. In the mediolittoral zone, the biocenosis of superficial muddy sands in sheltered waters has developed. In the sediment, the bivalve *Cerastoderma edule* prevails. In the infralittoral, too, predominates the biocenosis of superficial muddy sands in sheltered waters with communities of *Cymodocea nodosa*. The fauna is very rich in forms, composed of fishes, crustaceans, snails, bivalves, etc. The stream periodically flowing into the cove has a minor influence on the water quality. Sewage systems of the towns surrounding the cove (Klimno, Čižići, Dobrinj) may have a greater influence.

- St. Marak (kr2) is a small cove, poorly sheltered from the waves and winds. The cove ends in the beach, which is somewhat better protected by the breakwater of the nearby port. The substrate is fine sand. Up to 0.5 m in depth predominates the biocenosis of superficial sands in very shallow waters with bare bottom and endobionts' holes. Boulder stones are overgrown by algae *Acetabularia acetabulum* and *Cladophora* sp. In the eastern part of the cove, at a depth of 1.5 m, rocky bottom prevails, with pure sand between the rocks. A community of photophilic algae with low thalli has developed here. The predominant species here are: green alga *A. acetabulum*, brown algae *Dictyota linearis* and *Dictyota dichotoma*, and red alga *Laurentia obtusa*. Small thalli of the alga *Padina pavonica* and smaller settlements of the alga *Dasycladus vermicularis* were observed. Recently washed away shells of the bivalves *Acanthocardia tuberculata*, *Callista chione* and *Paphia aurea* are common on the sandy bottom. On the sandy bottom off the cove's western shore, at a depth of 2 m, biocenosis of superficial muddy sands in sheltered waters with a meadow of *C. nodosa* has developed. The nearest town (Risika) is a few kilometres away.

- Baška (kr3) is a bay, with gravel beach at its far end. The gravel substrate extends to a depth of 1 m. The bottom is bare, with a low bed of alga *Cladophora* sp. within the biocenosis of coarse sands and fine gravels mixed by the waves. Further into the bay, there are boulder stones with thick settlements of the bivalves *Mytilus galloprovincialis* and *Ostrea edulis*. The rocky bottom is covered by a mossy layer of alga *Cladophora* sp., and to a lesser degree by algae *Peyssonnelia* sp. and *Ceramium rubrum*. In the area exceeding the depth of 2 m prevails the biocenosis of superficial sands in very shallow waters. At the sampling point, the rivulet Ričina flows into the sea. As the town of Baška and its campground are situated close to the beach, the anthropogenic influence on the water quality could be considerable, especially in the summer period.

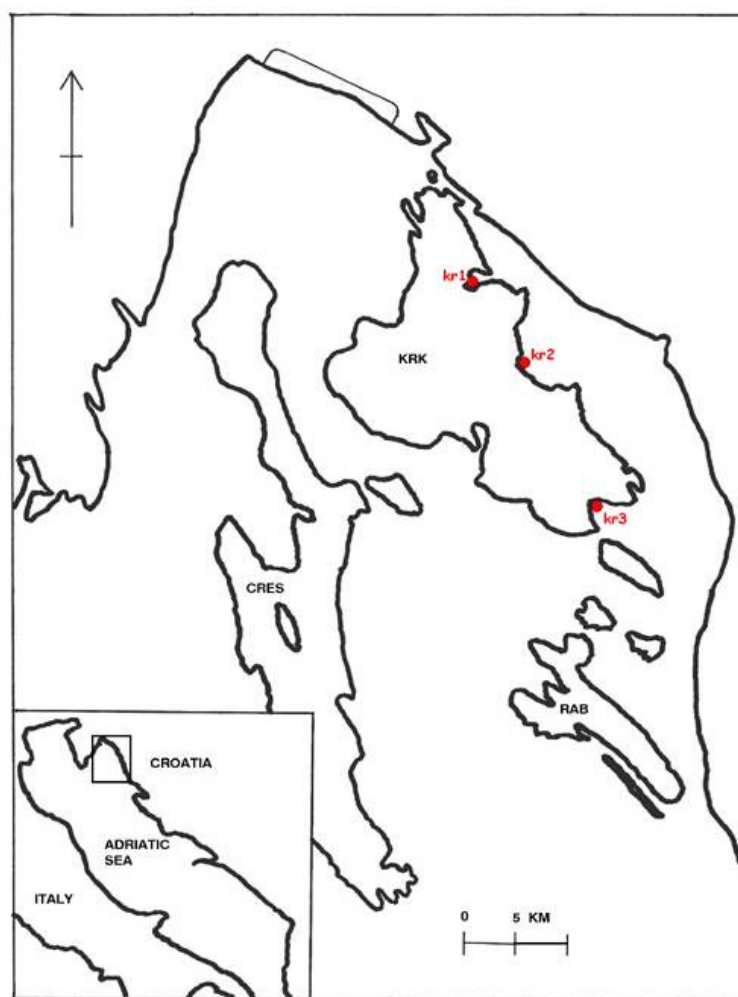


Fig. 1: Study area.

Sl. 1: Raziskovano območje.

Material and methods

The material was collected in the mornings, in March 2002, once per each station, by means of a beach seine (Gibson *et al.*, 1993). Trawl hauls lasted for approximately 1 min and covered a mean distance of about 50 meters per each station. The seine net had 6 mm meshes. Its sides were 5 m long, it was 0.8 m high, its sack 1 m deep. The seine sampled animals of all sizes: from 10 cm long *Carcinus aestuarii* specimens to only few mm long specimens of *Athanas nitescens*. Apart from the decapods, the catch included some diverse fishes (Gobiidae, Sparidae, Soleidae, Callionymidae...). At the locality kr1, the seine was drawn perpendicularly to the shore from the depth of 1 m. At the locality kr2, it was drawn perpendicularly to the shore, from the depth of 1.5 m to the shore. Due to bottom configuration at the locality kr3, the seine was drawn horizontally to the shore covering the bottom up to the

depth of 1 m. The decapods were separated in the field and preserved in 5% formal solution, to be analysed and counted in the laboratory. The species composition, their abundance and dominance were given for each locality, upon which a comparative study was conducted.

RESULTS AND DISCUSSION

The research revealed 14 decapod species at the three investigated localities. Each locality exhibits different species composition and different dominant species. The results are given in Tables 1, 2 and 3, listing the number of specimens and percentages of species per locality.

Table 1 lists six species found in the seine at kr1 locality. It is evident that *C. aestuarii* is the dominant decapod, its share in the catch being 72.50%. This species lives in the intertidal and sublittoral zone, on every kind of soft bottom, frequently nearby estuaries and lagoons

(Falciai & Minervini, 1992). *Upogebia pusilla* is also very common in this kind of environment. It lives in burrows 20 cm deep and is probably very hard to catch with seine net. *Diogenes pugilator* is a preferential characteristic hermit crab species of the well-sorted fine sands (Pérès & Picard, 1964). *Palaemon adspersus* lives on muddy sediment near sea grass meadows in brackish waters (Falciai & Minervini, 1992).

Tab. 1: Decapods collected at kr1 locality (Meline cove).

Tab. 1: Deseteronožci, ujeti na lokaliteti kr1 (draga Meline).

| Species | No. specimens | % |
|----------------------------|---------------|-------|
| <i>Palaemon adspersus</i> | 2 | 2.50 |
| <i>Crangon crangon</i> | 16 | 20.00 |
| <i>Upogebia pusilla</i> | 2 | 2.50 |
| <i>Diogenes pugilator</i> | 1 | 1.25 |
| <i>Carcinus aestuarii</i> | 58 | 72.50 |
| <i>Macropodia rostrata</i> | 1 | 1.25 |

Furthermore, *Crangon crangon* is the only species with more than two specimens in the catch. This species is also frequent at the river mouths and/or lagoons. It lives in the burrows and exits during the night (Falciai & Minervini, 1992).

Tab. 2: Decapods collected at the kr2 locality (St. Marak cove).

Tab. 2: Deseteronožci, ujeti na lokaliteti kr2 (draga Sv. Maraka).

| Species | No. specimens | % |
|--------------------------------|---------------|-------|
| <i>Athanas nitescens</i> | 2 | 3.23 |
| <i>Palaemon elegans</i> | 14 | 22.58 |
| <i>Philocheras trispinosus</i> | 33 | 53.23 |
| <i>Clibanarius erythropus</i> | 3 | 4.84 |
| <i>Pisidia longicornis</i> | 3 | 4.84 |
| <i>Porcellana platycheles</i> | 1 | 1.61 |
| <i>Xantho poressa</i> | 4 | 6.45 |
| <i>Liocarcinus depurator</i> | 1 | 1.61 |
| <i>Macropodia rostrata</i> | 1 | 1.61 |

St. Marak beach (Tab. 2) appears to be the locality with most diversified decapod population, where 9 different species of decapod crustaceans were found. *Philocheras trispinosus*, pursuant to the Adriatic decapod check-list (Štević, 1990) and a rare species in the Adriatic, appears to be fairly common at this station. It is the dominant species, its share in the catch being 53.23 %. *Palaemon elegans* is quite abundant on this beach as well, with the share of 22.58%. *P. adspersus* lives on muddy sediment near sea grass meadows in brackish waters (Falciai & Minervini, 1992). *Macropodia rostrata*

is also very common in a few meters on mixed sediments (Falciai & Minervini, 1992).

Table 3 demonstrates almost absolute dominance of the species *P. elegans*, its share in the upper infralittoral of Baška beach being 97.18%. As opposed to the "dominant" shrimps *P. trispinosus* and *P. elegans*, the crab *C. aestuarii* has been found on the muddy bottom of the Meline cove beach only. *C. aestuarii* appears to be more dependent on the substrate of its habitat than the two other species. The environment of Meline cove seems to be suitable for the species listed above (apart from *D. pugilator* and *M. rostrata*). The relative abundances are probably strictly related to the catching method utilized for the research.

Tab. 3: Decapods collected at the kr3 locality (Baška bay).

Tab. 3: Deseteronožci, ujeti na lokaliteti kr3 (zaliv Baška).

| Species | No. specimens | % |
|--------------------------------|---------------|-------|
| <i>Palaemon elegans</i> | 69 | 97.18 |
| <i>Philocheras trispinosus</i> | 2 | 2.82 |

As far as other study sites are concerned, species like *Clibanarius erythropus*, *Pisidia longicornis*, *Porcellana platycheles* and *Xantho poressa* are normally found close to the stones or pebbles on the sandy bottom. In this case, too, their relative abundances are due to the catching method.

The species *P. elegans* and *P. trispinosus* were found at the sandy locality kr2, as well as in the biocenoses of coarse sands and gravels at locality kr3. *Macropodia rostrata* was found on the muddy bottom at the Meline cove station, and in the sandy infralittoral of St. Marak beach. These are the only three species caught on more than one type of substrate. The data reveals that *P. elegans* prefers coarse sedimentary bottom to sandy bottom and does not appear on muddy substrate at all. As opposed to *P. elegans*, *P. trispinosus* prefers sandy bottom to gravel and does not appear on muddy substrate. *M. rostrata* sporadically appears in the biocenosis of superficial muddy sands in sheltered waters, yet it never inhabits coarse sedimentary substrate.

For the other listed species, not enough specimens were collected at the three localities to enable us to positively establish their exclusive connection with the type of habitat substrate.

CONCLUSIONS

The figure of 14 collected decapods is a relatively good result considering the number of times the beach seine was drawn. In comparison with the results of decapod collection nearby, at 25 stations along the southwestern coast of Krk Island at depths of 2-30 m (Gam-

lin-Brida *et al.*, 1980), where 16 species were caught, it in fact appears to be even better. The species *C. aestuarii* is dominant on the muddy bottom of the researched locality, *P. trispinosus* is dominant on the sandy bottom, and while *P. elegans* is dominant on the coarse bottom. The crab *C. aestuarii* was found exclusively on the muddy substratum. Decapods *P. elegans* and *P. trispinosus* do not depend on only one type of bottom substrata.

The acquired data on the dominance of decapod species in specific sedimentary habitats, and their dependence on those habitats should be supplemented with data per season, and data on night time beach seine drawing at the above-mentioned localities. Drawing the seine in every season would determine possible

annual vertical migrations and changes in the decapod composition. Additional night time sampling would eliminate the shortcomings of the daily sampling resulting from certain species being covered up or inactive at daytime.

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PREDHODNA RAZISKAVA FAVNE DESETERONOŽCEV NA SEDIMENTNEM DNU V ZGORNJEM INFRALITORALU OTOKA KRKA (JADRANSKO MORJE)

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POVZETEK

Osnutek referenčnega seznama habitatnih tipov varstvene pozornosti, pripravljen v okviru akcijskega načrta okoljskega programa Združenih narodov (UNEP), vključuje tudi sedimentne biocenoze spodnjega infralitorala. Zaradi dejstva, da so takšni habitatni tipi zelo redki vzdolž jadranske obale, je bila napravljena raziskava favne deseteronožcev, in sicer ob pomoči mrež s plovci v zgornjem infralitoralu (v globini od 0 do 1 m) na treh obrežnih odsekih otoka Krka. Za vsako od teh treh lokalitet je značilna specifična sedimentna podlaga (glen, pesek, prod). Na vsaki lokaliteti je bila ugotovljena sestava vrst, njihova številčnost in prevlada, in na osnovi teh ugotovitev napravljena primerjalna študija. Vsaka raziskana lokaliteta ima svojo specifično prevladujočo vrsto: *Carcinus aestuarii* prevladuje na glenastem dnu, *Philocheras trispinosus* na peščenem, *Palaemon elegans* pa v biocenozi grobega peska in prod. Skupaj je bilo zabeleženih 14 bentoških dekapodnih vrst.

Ključne besede: favna deseteronožcev, litoral, sedimentno dno, severni Jadran

REFERENCES

Falciai, L. & R. Minervini (1992): Guida dei crostacei decapodi d'Europa. Muzzio Ed., 282 pp.
Gamulin-Brida, H., D. Crnković, S. Jukić & A. Šimunović (1972): Characteristic and dominant species of Crustacea Decapoda in Adriatic biocoenosis "*Nephrops norvegicus*-*Thenea muricata*". *Thalassia Jugosl.*, 8(1), 81–97.

Gamulin-Brida, H., Z. Pavletić, D. Crnković, A. Požar-Domac, M. Legac, Ž. Žutić-Maloseja (1980): A contribution to the knowledge of the infralittoral benthos along the southwestern coast of the Krk Island. *Acta Adriat.*, 21(2), 355–367.

Gibson, R. N., A. D. Ansel & L. Robb (1993): Seasonal and annual variations in abundance and species composition of fish and macrocrustacean communities on a Scottish sandy beach. *Mar. Ecol. Prog. Ser.*, 98(1–2), 89–105.

Manning, R. B. & Z. Števčić (1982): Decapod fauna of the Piran Gulf. Quad. Lab. Tecnol. Pesca, 3(2–5), 285–304.

Pérès, J. M. & J. Picard (1964): Nouveau manuel de bionomie benthique de la Mer Méditerranée. Récents Trav. St. Mar. Endoume, 31, 5–137.

Pérès, J. M. & H. Gamulin-Brida (1973): Biološka oceanografija. Školska knjiga, Zagreb, 493 pp.

Števčić, Z. (1979): Prilozi morskoj flori i fauni lošinjske otočne skupine (Crustacea Decapoda). Otočki ljetopis Cres-Lošinj, 8, 247–255.

Števčić, Z. (1990): Check list of the Adriatic decapod Crustacea. Acta Adriat., 31, 183–274.

Števčić, Z. (1991): Decapod fauna of the seagrass beds in the Rovinj area. Acta Adriat., 32(2), 637–653.

Števčić, Z. (1993): History of investigations of the Adriatic decapod Crustacea. Bios, 1(1), 151–161.