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FAUNA OF THE ADRIATIC DECAPOD CRUSTACEANS (CRUSTACEA: DECAPODA) – STATUS AND OUTLOOK

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The checklist of the Adriatic decapod fauna is re-examined and supplemented. Several new species for the area are included in the list, new immigrants are noted and some species excluded. The species names are updated and their status and prospects commented on.

Key words: decapod crustaceans, Adriatic Sea, new records, revision

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Rad donosi pregled i nadopunu popisa vrsta jadranskih deseteronožnih rakova. U popis je dodano nekoliko novih vrsta za ovo područje, zabilježene su imigrantske vrste, a neke vrste su izbačene. Revidirana su imena vrsta te se raspravlja o njihovom stanju i perspektivama.

Ključne riječi: deseteronožni raci, Jadran, novi nalazi, revizija

Adriatic decapod crustaceans (Crustacea: Decapoda) have been the subject of numerous investigations, starting from the 16th century (ŠTEVČIĆ, 1993). Papers dealing with this issue are numerous and new ones appear nearly every year. Such intensive surveys of the Adriatic Sea result in a constantly increasing number of decapod species that have been noted for this region. The last complete checklist of the Adriatic decapods appeared in 1990 (ŠTEVČIĆ, 1990) and has thereafter been updated twice (ŠTEVČIĆ, 1995; 2002). In the meantime, FROGLIA (1995) published a checklist of Italian Malacostraca including the Adriatic decapods. In the last several years decapodologists from the Northern and Southern Adriatic Sea have been very active and with other researchers on the Adriatic Sea contributed to the increasing number of known Adriatic decapod species (MIZZAN, 1993, 1995; MIZZAN & ZANELLA,

1996; UNGARO, 2000; UNGARO & MARANO, 2002; VUKANIĆ, 2003; UNGARO *et al.*, 2005; KASALICA & JOKSIMOVIĆ, 2005; KASALICA, 2006; KASALICA *et al.*, 2006). New records following the latest supplements to the Adriatic decapod fauna (ŠTEVČIĆ, 2002) are presented in Tab. 1.

All species mentioned in Tab. 1 are relatively well known from the Mediterranean Sea and Eastern Atlantic Ocean. *Munida perarmata* A. Milne-Edwards & Bouvier, 1894 mentioned by UNGARO *et al.* (2005), however needs further confirmation in order to be considered an Adriatic species because its presence in the area is rather questionable (D'UDEKEM D'ACOZ, 1999: 164).

Several species have been reported for the Adriatic Sea the occurrence of which is highly questionable or even impossible: *Platymaia wyvillethomsoni* Miers, 1886, *Portunus sanguinolentus* (HERBST, 1793), *Thenus orientalis* (LUND, 1793) and *Uca coarcata* (H. MILNE EDWARDS, 1852). These species were either sampled only once, probably transported by ship ballast waters or mistakenly identified (PESTA, 1918). Two more species should also be mentioned here, *Portunus hastatus* (LINNAEUS, 1767) and *Atelecyclus undecimdentatus* (HERBST, 1783) which were noted once long time ago and whose presence has not been confirmed by subsequent explorations. *Scyllarus*

Tab. 1. New records for the Adriatic Sea

PANDALIDAE
Plesionika gigliolii (Senna, 1902) (*cf.* UNGARO *et al.*, 2005)
HIPPOLYTIDAE
Hippolyte prideauxiana Leach, 1817 (*cf.* KIRINČIĆ, 2006)
Hippolyte varians Leach 1814 (*cf.* D'UDEKEM D'ACOZ, 1996)
PALAEMONIDAE
Brachycarpus biunguiculatus (Lucas, 1846) (*cf.* KIRINČIĆ, 2003)
SCYLLARIDAE
Scyllarus caparti Holthuis, 1952 (*cf.* FROGLIA, 1995)
CALLIANASSIDAE
Callianassa truncata Giard & Bonier, 1890 (*cf.* ABED-NAVANDI & DWORSCHAK, 1997)
PAGURIDAE
Pagurus chevreuxi (Bouvier, 1896) (*cf.* ARKO *et al.*, 2001)
GALATHEIDAE
Munida perarmata A. Milne-Edwards & Bouvier, 1894 (*cf.* UNGARO *et al.*, 2005)
Munida rutllanti Zariquiey Alvarez, 1952 (*cf.* UNGARO *et al.*, 2005)
CALAPPIDAE
Calappa tuerkayana Pastore, 1995 (*cf.* UNGARO *et al.*, 2005)
PINNOTHERIDAE
Pinnotheres marioni Gourret, 1887 (*cf.* FROGLIA, 1995)
GRAPSIDAE
Hemigrapsus sanguineus (de Haan, 1835) (*cf.* SCHUBART, 2003)
Eriocheir sinensis H. Milne Edwards, 1854 (*cf.* MIZZAN, 2005)

caparti Holthuis, 1952, which was sampled just once nearly 30 years ago (FROGLIA, 1979) has to be mentioned as yet another rather problematic species. The same can be said for *Pinnotheres marioni* Gourret, 1887, which is also a doubtful species (D'UDEKEM D'ACOZ, 1999: 244).

It is worth noting that the presence of *Maja goltziana* d'Oliveira, 1888 has been confirmed just recently. ŠTEVČIĆ (1990: 255) expressed some doubt about its occurrence in the Adriatic Sea due to their rarity and the very few records so far (PALLAORO & DULČIĆ, 2004). Furthermore, *Paragalene longicrura* (Nardo, 1868) has also been found recently, a long time after its description [PESTA (1918: 431–433) reported this species for the first time], in its »locus typicus« – i.e. Middle Dalmatia (PALLAORO, 2005).

During the last fifteen years several species from Asian and North American waters have been reported from the Mediterranean (GALIL *et al*., 2002). Eight such species were reported for the Adriatic Sea (Tab. 2). The mode of introduction for these immigrant species is probably by ship ballast waters, except for *Marsupenaeus japonicus* (BATE, 1888), which most likely escaped from mariculture facilities, and *Scyllarus caparti* Holthuis, 1952, probably aquarium-released. Among exotic species two types have to be distinguished: alien species and established ones. Established species have self maintaining populations as opposed to alien species who do not have such populations and are recorded only once. All species in Tab. 2 except *Dyspanopeus sayi* (SMITH, 1869), *Rhithropanopeus harrisii* (GOULD, 1841) and *Callinectes sapidus* Rathbun, 1869 can be considered alien because they are just occasionally found in the area. Up to now, no Lessepsian migrant has been reported from the area.

The Adriatic decapod fauna shows a high diversity. The current information regarding families and their pertaining numbers of genera and species is presented in Tab. 3.

So far, 241 decapod species have been noted for the Adriatic Sea (KIRINČIĆ & ŠTEVČIĆ, in prep). If this is compared to PESTA (1918) who noted only 143 species for the same area or D'UDEKEM D'ACOZ (1999) who reported 340 species for the entire Mediterranean Sea, we can conclude that the Adriatic Sea seems to be qualitatively very well explored so far. The level of diversity in the Adriatic Sea according to the data in Tab. 3 is as follows: 4.55 species per family, 2.01 species per genus and 2.26 genera per family.

Tab. 2. Exotic species recorded at least once in the Adriatic Sea

Marsupenaeus japonicus (Bate, 1888)
Scyllarus caparti Holthuis, 1952
Dyspanopeus sayi (Smith, 1869)
Rhithropanopeus harrisii (Gould, 1841)
Callinectes danae Smith, 1869
Callinectes sapidus Rathbun, 1869
Hemigrapsus sanguineus (de Haan, 1835)
Eriocheir sinensis H. Milne Edwards, 1854

Tab. 3. Adriatic decapod fauna: number of genera and species

FAMILIES	NO. OF GENERA	NO. OF SPECIES
ARISTEIDAE	3	3
PENAEIDAE	3	3
SOLENOCERIDAE	1	1
SICYONIDAE	1	1
SERGESTIDAE	2	5
LUCIFERIDAE	1	1
PASIPHAEIDAE	1	2
OPLOPHORIDAE	1	1
PANDALIDAE	3	10
ALPHEIDAE	5	9
HIPPOLYTIDAE	5	14
PALAEMONIDAE	6	13
PROCESSIDAE	1	7
GNATHOPHYLLIDAE	1	1
CRANGONIDAE	4	11
STENOPODIDAE	1	1
POLYCHELIDAE	1	1
PALINURIDAE	1	1
SCYLLARIDAE	2	4
NEPHROPIDAE	2	2
AXIIDAE	1	1
CALOCARIDIDAE	1	1
LAOMEDIIDAE	1	1
UPOGEBIIDAE	1	4
CALLIANASSIDAE	3	7
CTENOCHELIDAE	1	1
DIOGENIDAE	5	7
PAGURIDAE	3	15
GALATHEIDAE	2	12
PORCELLANIDAE	2	4
HOMOLIDAE	2	2
LATREILLIIDAE	1	1
DROMIIDAE	1	1
CANCRIDAE	1	1
ATELECYCLIDAE	1	2
CORYSTIDAE	1	1
THIIDAE	1	1
PIRIMELIDAE	2	2
ERIPHIIDAE	1	1
XANTHIDAE	3	6

PANOPEIDAE	2	2
CALAPPIDAE	1	2
PILUMNIDAE	1	4
GERYONIDAE	2	2
GONEPLACIDAE	1	1
PARTHENOPIDAE	2	4
PORTUNIDAE	7	16
MAJIDAE	12	28
DORIPPIDAE	2	2
PALICIDAE	1	1
LEUCOSIIDAE	3	7
PINNOTHERIDAE	2	3
GRAPSIDAE	5	7
Σ 53	120	241

Because of permanent revision, species names have to be changed and adjusted to the current state of nomenclature of decapod Crustacea. According to that the names of some decapod species listed by ŠTEVČIĆ (1990, 2002) are updated and replaced by the valid names given in Tab. 4.

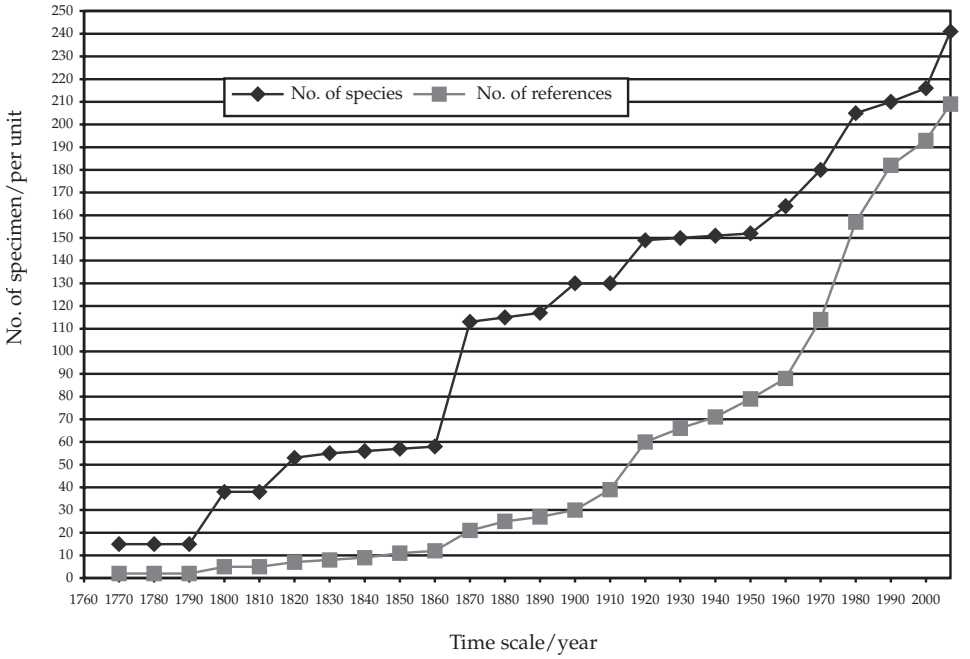

Fig. 1. Number of references and number of decapod species

It is worthy mentioning that since the mid 18th century carcinologists have been reporting nearly one decapod crustacean species per year (in the Adriatic Sea) and have published a similar number of papers dealing with Adriatic decapods (Fig. 1). In recent years the average number of species and papers has been 3.6 and 2.3, respectively per year from 2001 on. It is very indicative that the number of references and new species for this small area is not decreasing, due to the significant number of carcinologists in the area (Italy, Croatia, Slovenia, Montenegro, Albania, Austria and even Germany) and therefore we expect that prospects for this group of crustaceans are favorable.

All presented facts indicate that the Adriatic decapod fauna is qualitatively very well explored. Therefore, the increasing amount of data on decapoda fauna also provides information on the frequency and distribution of species in the area. The increase in the number of species recorded in the recent past is the result of intensified classical oceanographic research and monitoring studies based on samples utilizing grabs, dredges, and bottom trawls. In addition, it is also the result of an increased interest of carcinologists in *in situ* research and collection while SCUBA

Tab. 4. Updated names of the Adriatic decapod species

PREVIOUSLY USED NAME (Števčić, 1990; 2002)	CURRENT NAMES
Penaeus japonicus (Bate, 1888)	*Marsupenaeus japonicus* (Bate, 1888)
Penaeus kerathurus Forskål, 1775	*Melicertus kerathurus* (Forskål, 1775)
Sergestes corniculum Krøyer, 1855	*Sergestes arachnipodus* (Cocco, 1832)
Sergestes robustus (S.I. Smith, 1882)	*Sergia robusta* (S. I. Smith, 1882)
Parapandalus narval (Fabricius, 1787)	*Plesionika narval* (Fabricius, 1787)
Hippolyte longirostris (Czerniavsky, 1868)	*Hippolyte varians*, Leach 1814
Pontocaris cataphractus (Olivi, 1792)	*Aegaeon cataphractus* (Olivi, 1792)
Pontocaris lacazei (Gourett, 1887)	*Aegaeon lacazei* (Gourett, 1887)
Callianassa candida (Olivi, 1792)	*Pestarella candida* (Olivi, 1792)
Callianassa tyrrhena (Petagna, 1792)	*Pestarella tyrrhena* (Petagna, 1792)
Callianassa whitei Sakai, 1999	*Pestarella whitei* (Sakai, 1999)
Anapagurus brevicarpus A. Milne-Edwards & Bouvier, 1892	*Anapagurus chiroacanthus* (Liljeborg, 1856)
Pagurus sculptimanus Lucas, 1846	*Pagurus forbesi* Bell, 1845
Xantho incisus Leach, 1814	*Xantho hydrophilus* (Herbst, 1790)
Liocarcinus arcuatus (Leach, 1814)	*Liocarcinus navigator* (Herbst, 1794)
Portumnus pestai Forest, 1967	*Portumnus lysianassa* (Herbst, 1796)
Macropodia longipes (A. Milne-Edwards & Bouvier, 1899)	*Macropodia tenuirostris* (Leach, 1814)
Pisa corallina (Risso, 1816)	*Pisa hirticornis* (Herbst, 1804)
Anamathia rissoana (Roux, 1828)	*Rochinia rissoana* (Roux, 1828)
Pinnotheres pinnotheres (Linneaus, 1758)	*Nepinnotheres pinnotheres* (Linneaus, 1758)

diving. This allows the investigation of previously unexplored microhabitats of the infra-littoral zone such as marine caves and holes, as well as pebbly interstitia, etc. We also expect the addition of Lessepsian immigrants, which may expand their distribution due to the increase of maritime transportation and the phenomenon of global warming. A lack of quantitative, zoogeographic and ecological studies forces us to undergo new explorations and to compile already existing together with newly obtained data. The increasing amount of data on decapod fauna will also affect our knowledge on the frequency and distribution of species in the area. There have been insufficient investigations dealing with decapods carried out in the deep sea, river estuaries and underwater springs.

Therefore research into Adriatic decapods will be continue and intensify in a way that gives good prospects of future knowledge about this group.

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SAŽETAK

Fauna jadranskih deseteronožnih rakova (Crustacea: Decapoda) – stanje i perspektive

M. Kirinčić & Z. Števčić

Jadranski deseteronožni raci (Crustacea: Decapoda) predmet su istraživanja mnogih znanstvenika počevši još od 16. stoljeća. Objavljeno je mnogo radova o ovoj skupini, a i novi se stalno pojavljuju. Od izlaska zadnje nadopune jadranske liste dekapoda (ŠTEVČIĆ, 2002) zabilježeno je 13 novih vrsta. Identificirano je i 8 imigrantskih vrsta koje su u Jadran dospjele balastnim vodama iz brodova ili bijegom iz akvakulturnih uzgajališta. Jadranska dekapodna fauna sadrži 241 vrsta, koje su klasificirane u 120 rodova, te 53 porodice. Uspoređujući te podatke s PESTOM (1918) koji navodi 143 vrste za isto područje, te s D'UDEKEM D'ACOZOM (1999) koji bilježi 340 vrsta za cijeli Mediteran, Jadran možemo smatrati do sada kvalitativno vrlo dobro istraženim morem. Povećano nalaženje vrsta zadnjih godina možemo pripisati intenzivnijim oceanografskim istraživanjima temeljenima na uporabi grabila, dredža, koča, te povećanom interesu znanstvenika-karcinologa za *in situ* istraživanje i sakupljanje materijala tehnikom autonomnog ronjenja koja dozvoljava istraživanja do tada nedostupnih mikrostaništa infralitoralne zone kao što su podmorske špilje i rupe, te valutićavi intersticij. Nedostaju još sustavna istraživanja dubokih voda (otvorenog mora) i riječnih ušća. U nadolazećim godinama možemo očekivati pojavljivanja egzotičnih vrsta iz Crvenog mora (Lessepsijske vrste) i iz ostalih dijelova svijeta u Jadransko more, zbog najava povećanog brodskog prometa našim morem, kao i opće pojave globalnog zatopljenja mora. Iz svega rečenog proizlazi da je fauna jadranskih deseteronožaca dobro istražena, te spada među najistraženije uopće, a zbog stalnih revizija svojti i useljavanja novih potrebno je stalno revidirati listu pa stoga možemo očekivati da će se znanstveni rezultati na ovom polju još dugo nastaviti.