

## Report on Cymothoids (Crustacea, Isopoda) collected from marine fishes in Turkey

Ahmet ÖKTENER<sup>1</sup> and Jean-Paul TRILLES<sup>2</sup>

<sup>1</sup>*Cihannüma mah. Hüsnü savman sokak no: 22/5, 80690 Beşiktaş İstanbul, Turkey*

<sup>2</sup>*UMR 5171 (Génome, Populations, Interactions, Adaptation), Équipe Adaptation Écophysiologique et Ontogénèse, Université de Montpellier 2, CC. 092, Place E. Bataillon, 34095 Montpellier Cedex 05, France*

*This work describes Cymothoidae species in Turkey. Some species were collected by the authors, i.e., Anilocra frontalis Milne Edwards, 1840; Nerocila orbigny (Guérin-Méneville, 1829-1832); Ceratothoa italica Schioedte and Meinert, 1883; Ceratothoa oestroides (Risso, 1826); Ceratothoa parallela (Otto, 1828); Emetha audouini Milne Edwards, 1840; Livoneca punctata (Uljanin, 1872); Mothocya epimerica Costa, 1851, and Mothocya belonae Bruce, 1986. Four of these are reported amongst the Turkish fauna for the first time, i.e., A. frontalis, C. italica, L. punctata, and M. belonae. A list of Cymothoidae already reported from marine fishes of Turkey plus our new reports includes thirteen species (two yet undetermined) from six genera Anilocra, Nerocila, Ceratothoa, Emetha, Livoneca, and Mothocya, and 27 host species. The distributions, hosts, and reporting authors are given.*

**Key words:** Cymothoidae, Crustacea, parasitic isopods, Turkey

### INTRODUCTION

Cymothoids (Crustacea, Isopoda) are ectoparasites of marine, freshwater, or brackish water teleost fishes. Numerous families and species of fishes, including many of commercial importance, are infected by cymothoids. They settle on the skin, in the buccal cavity, in the gill chambers, and sometimes in a pouch (TRILLES, 1969; BRUSCA, 1981). Cymothoids are protandrous hermaphrodite isopods with a short phase as free-living, plankton organisms (TRILLES, 1969; COLORNI *et al.*, 1997). Upon finding a suitable

host, they initiate their parasitic life, feeding on blood and tissues (TRILLES, 1969; ROMESTAND & TRILLES, 1976, 1977; ROMESTAND, 1978, 1979; HORTON & OKAMURA, 2003). Several cymothoid isopods have been reported parasitizing marine fishes from the coasts of Turkey (MONOD, 1931; DEMIR, 1952; GELDIAI & KOCATAS, 1972; TRILLES, 1977; AKMIRZA, 1997, 1998a,b, 2000a,b, 2001; KIRKIM, 1998; YELER, 1998; TOKSEN, 1999; ÖKTENER & SEZGIN, 2000; HORTON & OKAMURA, 2001 & 2003). This study provides a comprehensive summary of Cymothoidae species found in Turkish fauna.

## MATERIALS AND METHODS

Three hundred eighty-eight samples belonging to several fish families and species (*Symphodus tinca*, *Spicara maena*, *Dicentrarchus labrax*, *Boops boops*, *Sardina pilchardus*, *Belone belone*, *Alosa fallax*, *Liza aurata*, *Mullus surmuletus*, *Atherina boyeri*) from the Black Sea, the Sea of Marmara, and the Aegean coast of Turkey were examined during 2000-2003. Fish samples were captured with a fish net. The specimens were preserved in 70% alcohol. Data on parasites and collection were recorded. The taxonomic positions of the parasites were identified mainly according to BORCEA (1933), TRILLES (1965, 1968, 1972, 1976, 1977, 1979), TRILLES *et al.* (1989), and BRUCE (1986). The overall prevalence and location of the parasites on their hosts were specified and information about their geographical distribution and host species were added. All collected specimens were deposited in the personal collection of A. ÖKTENER (Cihannüma mah. Hüsnü savman sokak no: 22/5, 80690 Beşiktaş Istanbul, Turkey).

After describing the species that we personally collected, including four species reported for the first time in Turkish fauna, we compiled a list of Cymothoidae already reported for marine fishes of all Turkish coasts. The compilation was prepared as in MOREIRA & SADOWSKY (1978) for the parasitic Isopoda of Chondrichthyes, SIRIKANÇANA (1982) for parasites of fishes in Thailand, and HOLLAND & KENNEDY (1997) for helminth and crustacean species from freshwater fish in Ireland. The following plan was followed: (1) a list of collected Cymothoids and their parasitized fish, the collection site, and author; (2) a list of parasitized fishes with the corresponding species of Cymothoidae.

## RESULTS

### Cymothoidae collected by the authors

#### *Anilocra* Leach, 1818; *Anilocra frontalis* Milne Edwards, 1840

##### Material:

*Anilocra frontalis* was collected from the nasal region of two *Symphodus tinca* among

twenty specimens examined (prevalence = 10%) at Sinop (on the Black Sea coast of Turkey). The species is recorded for the first time in the Turkish fauna.

##### Distribution:

North Sea, Channel, Atlantic Ocean, Mediterranean Sea, Adriatic Sea (TRILLES, 1994).

##### Hosts:

Especially Labridae (*Labrus maculatus*, *L. vetula*, *L. bergylta*, *L. merula*, *Crenilabrus melops*, *C. cinereus*, *C. ocellatus*); sometimes collected on other fishes (*Gadus* sp., *Merlangius pollachius*, *Blennius pholis*, *Cottus bubalis*, *Gobius flavescens*, *G. paganellus*, *G. minutus*, *Onos mustela*, *Spinachia vulgaris*, *Boops boops*, *B. salpa* and *Spondylisoma cantharus* (TRILLES, 1994).

#### *Nerocila* Leach, 1818; *Nerocila orbignyi* (Guérin-Meneville, 1829-1832)

##### Material:

*Nerocila orbignyi* was collected from the operculum on two of four *Liza aurata* (prevalence = 50%) at Sinop.

##### Distribution:

Australian coasts from central New South Wales, southeastern Tasmania, Victoria, south Australia, and western Australia to Fremantle. Apparently absent from the tropical Indo-Pacific (except for one specimen from Eilat), north Pacific, east Pacific and western north Atlantic (BRUCE, 1987). Widely distributed in the Mediterranean, northwest Africa, Red Sea, ?Egypt, ?New Zealand (TRILLES, 1994).

##### Hosts:

TRILLES (1975, 1994) summarized the known hosts of this species which chiefly parasitize Mugilidae (*Mugil auratus*, *M. cephalus*, *M. capito*, *M. chelo*, *M. labrosus*); are less common on *Flesus passer*, *Dicentrarchus labrax*, *Alosa fallax nilotica*, Siphonostomids and Serranidae, ?*Tilapia galilea* and ?*Salmo trutta*. In Australia, BRUCE (1987) recorded the parasite

on *Callorhynchus mihi*, *Acanthopagrus australis*, *Chrysophrys auratus*, *Pseudocaranx dentex*, *Mola mola*, *Sillago bassensis*, *Pomatomus saltatrix* and unidentified Mugilidae, Kyphosidae, and Platycephalidae, *Girella tricuspidata*, *Chelidonichthys kumu*, and *Dactylopera orientalis*. *N. orbignyi* is apparently widely ubiquitous but, maybe, several data concern other species.

***Ceratothoa* Dana, 1852; *Ceratothoa italica*  
Schioedte et Meinert, 1883**

**Material:**

*Ceratothoa italica* was collected from the mouth on seven of thirty-four specimens of *Dicentrarchus labrax* (prevalence = 20.6%) in a sea bass farm on the Mugla coast of the Aegean Sea, Turkey, and from the mouth on four of thirty-five *Spicara maena* (prevalence = 11.4%) in the Bosphorus (Sea of Marmara). *C. italica* was recorded for the first time in Turkish fauna.

**Distribution:**

Mediterranean Sea, Adriatic Sea, northwest Africa (TRILLES, 1994; HORTON, 2000).

**Hosts:**

*Pagellus mormyrus*, *P. erythrinus*, *Oblada melanura*, *Cantharus lineatus*, *Sargus sp.* (TRILLES, 1994; HORTON, 2000). *D. labrax* and *S. maena* are new hosts, identified for the first time for *C. italica*.

***Ceratothoa oestroides* (Risso, 1826)**

**Material:**

*Ceratothoa oestroides* was collected from the mouth of twelve of forty-five *Spicara maena* (prevalence = 26.7%) in the Erdek coast and the Bosphorus (Sea of Marmara). It was also collected on one of twenty-two *Sardina pilchardus* (prevalence = 4.5%) along the Erdek coast.

**Distribution:**

Widely distributed in the Mediterranean and Adriatic Seas. Also recorded from the northeast Atlantic including the northwest coasts of Africa (TRILLES, 1994; HORTON, 2000).

**Hosts:**

This species is found on many host species. Centracanthidae and Sparidae are the most frequently parasitized groups (*Spicara sp.*, *S. chryselis*, *S. maena*, *Smaris melanurus*, *Boops boops*, *Diplodus annularis*, *D. sargus*, *D. vulgaris*). Also, but rarely, collected on *Sardina pilchardus sardina*, *Trachurus trachurus*, *Phycis mediterranea*, *Mullus barbatus*, *Abudefduf saxatilis* (TRILLES, 1994). Recently recorded from *Dicentrarchus labrax* and *Sparus auratus* on farms of the Adriatic and Greece (PAPOUTSOGLU *et al.*, 1996; ŠARUŠIĆ, 1999; HORTON & OKAMURA, 2001; MLADINEO, 2002).

***Ceratothoa parallela* (Otto, 1828)**

**Material:**

*Ceratothoa parallela* was collected from the mouth of thirteen of twenty-eight *Boops boops* (prevalence = 46.4%) along the Erdek coast (Sea of Marmara).

**Distribution:**

Widely distributed in the Mediterranean and Adriatic Seas. Also recorded in the northeast Atlantic including the northwest coasts of Africa, the Canary and Madeira Islands (TRILLES, 1994).

**Hosts:**

*Ceratothoa parallela* has been found parasitizing particularly *Boops boops*. It was rarely collected on *Sparus*, *Dentex vulgaris*, *Boops salpa*, *Esocis belonis*, *Spicara chryselis*, *S. maurii*, *S. alcedo*, *Trigla corax*, *Mullus*, *Gadus capelanus*, *Merluccius merluccius*, *Raja asterias*, and *R. clavata* (TRILLES, 1994). However, it seems likely that several reports misidentified the species. Recently, *C. parallela* was reported on cultured *Sparus aurata* in Greece (PAPAPANAGIOTOU & TRILLES, 2001).

***Emetha* Schioedte and Meinert, 1883;  
*Emetha audouini* (Milne Edwards, 1840)**

**Material:**

*Emetha audouini* was collected from the mouth of four of twenty-two *Spicara maena*

(prevalence = 18.2%) on the Erdek coast (Sea of Marmara).

**Distribution:**

Widely distributed in the Mediterranean and Adriatic Seas (TRILLES, 1994).

**Hosts:**

*Emetha audouini* is mainly a parasite of Sparidae and Centranchidae, particularly *Boops salpa*, *B. boops*, *Spicara vulgaris*, *S. maena*, *S. aprilis*, *S. smaris*, *S. alcedo*, and *S. maurii*, (TRILLES, 1994). Recently reported in cultured *Dicentrarchus labrax* in Greece (PAPAPANAGIOTOU *et al.*, 1999).

***Livoneca* Leach, 1818; *Livoneca punctata* (Uljanin, 1872)**

**Material:**

*Livoneca punctata* was collected from the branchial cavity of ten *Alosa fallax* of fifty shads (prevalence = 20%) from the coast of Sinop (Black Sea coast of Turkey) and the Bosphorus (Sea of Marmara). *L. punctata* had previously been recorded in the Black Sea, but this is the first time it is reported amongst Turkish fauna.

**Distribution:**

TRILLES (1994) lists the known locations for this species: in the Black Sea, particularly the Crimea, the regions of Kerch in Crimea and Gelendzhik, county of Krasnodar in Russia, and region of Agigea, near Constanta, Romania; also reported from Castiglione in the Mediterranean Sea.

**Hosts:**

Several fishes, particularly Clupeidae and shads: *Clupea pilchardus*, *Alosa finta*, *Caspialosa pontica*, *C. nordmanni*, *Sardinella pilchardus*, *Sardina pilchardus*, *Engraulis encrasicolus ponticus*, *Sprattus sprattus phalericus*, *Trachurus mediterraneus ponticus*; also

*Temnodon saltator*, *Scorpaena porcus*, *Atherina hepsetus*, *Gobius sp.* (TRILLES, 1994).

***Mothocya* Costa, in Hope, 1851;**

***Mothocya epimerica* Costa, 1851**

**Material:**

*Mothocya epimerica* was collected in the branchial cavity of fifteen *Atherina boyeri* of fifty-six specimens (prevalence = 26.8%) from the coast of Sinop (Black Sea of Turkey).

**Distribution:**

*Mothocya epimerica* has been reported in the Mediterranean, Black, and Adriatic Seas (BRUCE, 1986; TRILLES, 1994). Also, recorded from Arcachon, Atlantic Ocean (TRILLES, 1968, 1977).

**Hosts:**

Exclusively on Atherinidae: *Atherina mochon*, *A. hepsetus*, *A. rissoi* and *A. boyeri* (TRILLES, 1994).

***Mothocya belonae* Bruce, 1986**

**Material:**

*Mothocya belonae* was collected in the branchial cavity of two *Belone belone* of forty-two specimens (prevalence = 4.8%) from the coast of Sinop (Black Sea coast of Turkey). This species is recorded for the first time in Turkish fauna.

**Distribution:**

Italy, Livorno. According to BRUCE (1986), "The range of this species within the Mediterranean is not even approximately known".

**Hosts:**

Recorded only on *Belone belone* (BRUCE, 1986).

## List of Cymothoidae parasites and their distribution along Turkish coasts

Cymothoid	Parasitized fish	Location	Author
<i>Anilocra physodes</i> (L. 1758)	Not identified	Mediterranean	MONOD, 1931
	<i>Spicara smaris</i>	Marmara	DEMIR, 1952
	<i>Pagellus</i> sp.	Aegean	GELDIAY & KOCATAS, 1972
	<i>Spicara smaris</i>	Aegean	GELDIAY & KOCATAS, 1972
	Not identified	Mediterranean	TRILLES, 1977
	<i>Scomber japonicus</i>	Aegean	AKMIRZA, 1997
	<i>Sparus auratus</i>	Aegean	KIRKIM, 1998
	<i>Dicentrarchus labrax</i>	Aegean	KIRKIM, 1998
	<i>Boops boops</i>	Aegean	AKMIRZA, 2000
	<i>Diplodus annularis</i>	Aegean	AKMIRZA, 2000
	<i>Diplodus vulgaris</i>	Aegean	AKMIRZA, 2000
	<i>Diplodus sargus</i>	Aegean	AKMIRZA, 2000
	<i>Pagellus erythrinus</i>	Aegean	AKMIRZA, 2000
	<i>Spondyliosoma cantharus</i>	Aegean	AKMIRZA, 2000
	<i>Oblada melamura</i>	Aegean	AKMIRZA, 2000
<i>Anilocra</i> sp.	<i>Spicara maena</i>	Aegean	AKMIRZA, 2001
	<i>Dicentrarchus labrax</i>	Aegean	YELER, 1998
<i>Anilocra frontalis</i> Milne Edwards, 1840	<i>Symphodus tinca</i>	Black	Present study
<i>Nerocila bivittata</i> (Risso, 1816)	<i>Pagellus erythrinus</i>	Mediterranean	MONOD, 1931
	<i>Pagellus</i> sp.	Marmara	DEMIR, 1952
	<i>Pagellus</i> sp.	Aegean	GELDIAY & KOCATAS, 1972
	<i>Sparus auratus</i>	Aegean	KIRKIM, 1998
	<i>Gobius niger</i>	Aegean	KIRKIM, 1998
	<i>Sciaena umbra</i>	Aegean	KIRKIM, 1998
<i>Nerocila maculata</i> (Milne Edwards, 1840)	Not identified	Mediterranean	TRILLES, 1977
<i>Nerocila orbigny</i> (Guérin-Meneville, 1828-1832)	<i>Dicentrarchus labrax</i>	Aegean	HORTON & OKAMURA, 2001
	<i>Liza aurata</i>	Black	Present study
<i>Ceratothoa oestroides</i> (Risso, 1826)	Not identified	Mediterranean	TRILLES, 1977
	<i>Scomber japonicus</i>	Aegean	AKMIRZA, 1997
	<i>Spicara maena</i>	Aegean	KIRKIM, 1998
	<i>Boops boops</i>	Aegean	KIRKIM, 1998
	<i>Diplodus annularis</i>	Aegean	KIRKIM, 1998
	<i>Sparus auratus</i>	Aegean	KIRKIM, 1998
	<i>Raja alba</i>	Aegean	KIRKIM, 1998
	<i>Trachurus mediterraneus</i>	Aegean	AKMIRZA, 1998
<i>Boops boops</i>	Aegean	AKMIRZA, 1998	

## List of Cymothoidae cont'd

Cymothoid	Parasitized fish	Location	Author
	<i>Sparus auratus</i>	Aegean	TOKSEN, 1999
	<i>Dicentrarchus labrax</i>	Aegean	TOKSEN, 1999
	<i>Mullus surmuletus</i>	Aegean	AKMIRZA, 2000
	<i>Diplodus annularis</i>	Aegean	AKMIRZA, 2000
	<i>Diplodus vulgaris</i>	Aegean	AKMIRZA, 2000
	<i>Spicara smaris</i>	Aegean	AKMIRZA, 2001
	<i>Dicentrarchus labrax</i>	Aegean	HORTON & OKAMURA, 2001, 2003
	<i>Spicara maena</i>	Marmara, Bosphorus	Present study
	<i>Sardina pilchardus</i>	Marmara	Present study
<i>Ceratothoa parallela</i> (Otto, 1828)	<i>Boops boops</i>	Aegean	GELDIAY & KOCATAS, 1972
	<i>Boops boops</i>	Aegean	AKMIRZA, 1998
	<i>Citharus macrolepidotus</i>	Aegean	KIRKIM, 1998
	<i>Diplodus annularis</i>	Aegean	KIRKIM, 1998
	<i>Spicara maena</i>	Aegean	KIRKIM, 1998
	<i>Boops boops</i>	Aegean	KIRKIM, 1998
	<i>Boops boops</i>	Marmara	Present study
<i>Ceratothoa italica</i> Schioedte & Meinert, 1883	<i>Dicentrarchus labrax</i>	Aegean	Present study
	<i>Spicara maena</i>	Bosphorus	Present study
<i>Ceratothoa capri</i> (Trilles, 1964)	<i>Diplodus annularis</i>	Aegean	KIRKIM, 1998
	<i>Boops boops</i>	Aegean	KIRKIM, 1998
	<i>Sparus auratus</i>	Aegean	KIRKIM, 1998
	<i>Puntazzo puntazzo</i>	Aegean	KIRKIM, 1998
<i>Ceratothoa</i> sp.	<i>Diplodus annularis</i>	Aegean	AKMIRZA, 2000
	<i>Oblada melanura</i>	Aegean	AKMIRZA, 2000
	<i>Boops boops</i>	Aegean	AKMIRZA, 2000
	<i>Sarpa salpa</i>	Aegean	AKMIRZA, 2000
	<i>Mullus surmuletus</i>	Aegean	AKMIRZA, 2000
	<i>Scomber japonicus</i>	Aegean	AKMIRZA, 2001
	<i>Spicara smaris</i>	Aegean	AKMIRZA, 2001
<i>Emetha audouini</i> (Milne Edwards, 1840)	<i>Boops boops</i>	Aegean	KIRKIM, 1998

## List of Cymothoidae cont'd

Cymothoid	Parasitized fish	Location	Author
	<i>Spicara smaris</i>	Aegean	KIRKIM, 1998
<i>Livoneca punctata</i> (Uljanin, 1872)	<i>Alosa fallax</i>	Black, Bosphorus	Present study
<i>Mothocya epimerica</i> Costa, 1851	<i>Atherina boyeri</i>	Black	ÖKTENER & SEZGIN, 2000
	<i>Atherina boyeri</i>	Black	Present study
<i>Mothocya belonae</i> Bruce, 1986	<i>Belone belone</i>	Black	Present study

## List of parasitized fish with corresponding species of Cymothoidae

Parasitized fish	Cymothoidae	Parasitized fish	Cymothoidae
<i>Alosa fallax</i>	<i>Livoneca punctata</i>	<i>Pagellus erythrinus</i>	<i>Anilocra physodes</i>
<i>Atherina boyeri</i>	<i>Mothocya epimerica</i>	<i>Pagellus</i> sp.	<i>Anilocra physodes</i>
<i>Belone belone</i>	<i>Mothocya belonae</i>		<i>Nerocila bivittata</i>
<i>Boops boops</i>	<i>Anilocra physodes</i>	<i>Puntazzo puntazzo</i>	<i>Ceratothoa capri</i>
	<i>Ceratothoa oestroides</i>	<i>Raja alba</i>	<i>Ceratothoa oestroides</i>
	<i>Ceratothoa parallela</i>	<i>Sardina pilchardus</i>	<i>Ceratothoa oestroides</i>
	<i>Ceratothoa capri</i>	<i>Sarpa salpa</i>	<i>Ceratothoa</i> sp.
	<i>Ceratothoa</i> sp.	<i>Sciaena umbra</i>	<i>Nerocila bivittata</i>
	<i>Emetha audouini</i>	<i>Scomber japonicus</i>	<i>Anilocra physodes</i>
<i>Citharus macrolepidotus</i>	<i>Ceratothoa parallela</i>		<i>Ceratothoa oestroides</i>
<i>Dicentrarchus labrax</i>	<i>Anilocra physodes</i>		<i>Ceratothoa</i> sp.
	<i>Anilocra</i> sp.	<i>Sparus auratus</i>	<i>Anilocra physodes</i>
	<i>Ceratothoa italica</i>		<i>Ceratothoa oestroides</i>
	<i>Ceratothoa oestroides</i>		<i>Ceratothoa capri</i>
	<i>Nerocila orbigny</i>		<i>Nerocila bivittata</i>
<i>Diplodus annularis</i>	<i>Anilocra physodes</i>	<i>Spicara maena</i>	<i>Anilocra physodes</i>
	<i>Ceratothoa oestroides</i>		<i>Ceratothoa italica</i>
	<i>Ceratothoa parallela</i>		<i>Ceratothoa oestroides</i>
	<i>Ceratothoa capri</i>		<i>Ceratothoa parallela</i>
	<i>Ceratothoa</i> sp.		<i>Emetha audouini</i>
<i>Diplodus sargus</i>	<i>Anilocra physodes</i>	<i>Spicara smaris</i>	<i>Anilocra physodes</i>
<i>Diplodus vulgaris</i>	<i>Anilocra physodes</i>		<i>Ceratothoa oestroides</i>
	<i>Ceratothoa oestroides</i>		<i>Ceratothoa</i> sp.
<i>Gobius niger</i>	<i>Nerocila bivittata</i>		<i>Emetha audouini</i>
<i>Liza aurata</i>	<i>Nerocila orbigny</i>	<i>Spondylisoma cantharus</i>	<i>Anilocra physodes</i>
<i>Mullus surmuletus</i>	<i>Ceratothoa oestroides</i>	<i>Symphodus tinca</i>	<i>Anilocra frontalis</i>
	<i>Ceratothoa</i> sp.	<i>Trachurus mediterraneus</i>	<i>Ceratothoa oestroides</i>
<i>Oblada melanura</i>	<i>Anilocra physodes</i>		
	<i>Ceratothoa</i> sp.		

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## Popis cimotoidnih rakova (Crustacea, Isopoda) na morskim ribama Turske

Ahmet ÖKTENER<sup>1</sup> i Jean-Paul TRILLES<sup>2</sup>

<sup>1</sup> Cihannüma mah. Hüsnü savman sokak no: 22/5 80690 Beşiktaş, Istanbul, Turska

<sup>2</sup>UMR 5171 (Genom, populacija, interakcija, adaptacija), Ekipa ekofiziološke adaptacije i ontogeneze, Sveučilište u Montpellier-u 2, CC. 092, Place E. Bataillon, 34095 Montpellier Cedex 05, Francuska

### SAŽETAK

U radu se daje opis cimotoidnih vrsta rakova u Turskoj. Neke vrste su sabrali autori kao što su *Anilocra frontalis* (Milne Edwards, 1840); *Nerocila orbignyi* (Guérin-Méneville, 1829-1832); *Ceratothoa italica* (Schioedte i Meinert, 1883); *Ceratothoa oestroides* (Risso, 1826); *Ceratothoa parallela* (Otto, 1828); *Emetha audouini* (Milne Edwards, 1840); *Livoneca punctata* (Uljanin, 1872); *Mothocya epimerica* (Costa, 1851), i *Mothocya belonae* (Bruce, 1986). Četiri od spomenutih vrsta po prvi su put zabilježene u fauni Turske i to: *A. frontalis*, *C. italica*, *L. punctata*, i *M. belonae*. Lista cimotoidnih rakova, nađenih na ribama Turske, zajedno s novim nalazima, obuhvaća 13 vrsta (2 još nedeterminirane) iz 6 rodova (*Anilocra*, *Nerocila*, *Ceratothoa*, *Emetha*, *Livoneca*, i *Mothocya*), i 27 ribljih domaćina. Izneseni su podaci o distribuciji i ribljim domaćinima, te odgovarajući autori.

**Ključne riječi:** Cymothoidae, Crustacea, parazitski izopodi, Turska