

# Study of Copepod Species from the Western Black Sea in the Cruise r/v 'Knorr' during May-June 2001

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**Abstract:** Results of investigation of copepod fauna in the western Black Sea are obtained in May-June 2001. 49 taxa have been found including 33 taxa that are not of the Black Sea origin. The problem of intensification of process of copepod fauna Mediterraneanization in the Black Sea basin is discussed.

**Key words:** Western Black Sea, copepod species

## Introduction

The numerous investigations testify the intensive transport of holoplanktonic animals from the Mediterranean Sea to the western Black Sea (PAVLOVA 1964, PAVLOVA 1965, BOGDANOVA, SHMELEVA 1967, PAVLOVA *et al.* 1969, KOVALEV *et al.* 1976, PORUMB 1980, KOVALEV *et al.* 1988). These data were summarized in KOVALEV *et al.* (1998), where the list of 60 Mediterranean copepods species was presented. The Bosphorus region of the Black Sea accepts invaders carried from Marmara Sea by the Lower-Bosphorus flow and so these organisms are mostly abundant during the periods of increasing Mediterranean water flow, in particular in March and October (BOGDANOVA 1976). In the present contribution, we analyze copepod species and distribution in the western Black Sea during May-June 2001, in order to see further Mediterranean contribution to the Black Sea zooplankton.

## Material and methods

The examined copepods were taken from zooplankton samples obtained in the cruise r/v 'Knorr' during May-June 2001 (Table 1). The investigated area is shown in Fig. 1. Samples collected by vertical tows of Nansen net (mesh aperture 135  $\mu$ m) and preserved in 4% formaldehyde. The laboratory procedure and technique of identification are described by VIVES, SHMELEVA (2007).

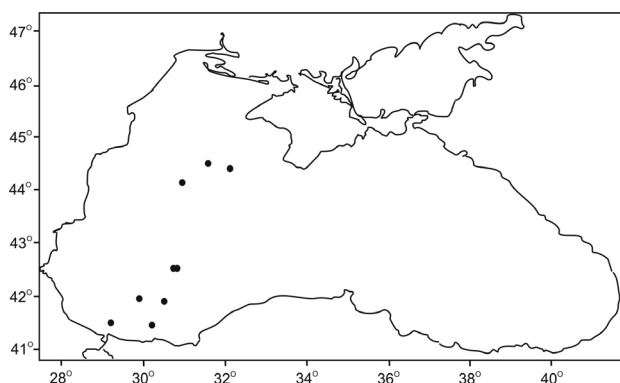
## Results and Discussion

The list of copepod species, collected in the western part of the Black Sea, is given in Table 2. The systematic status of species is submitted according to RAZOULS, DURAND (1991). There are 33 Mediterranean copepods taxa including 20 taxa that were discovered for the first time for the Black Sea during May-June 2001 by r/v 'Knorr' expedition.

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**Table 1.** Sampling data for copepod of Western Black Sea during May-June 2001.

Stn No	Date	Local time	Depth, m	Sampling depth, m
1	24.05.2001	18:30	300	250-0
2	25.05.2001	16:00	1740	140-0
3	27.05.2001	13:00	2200	140-0
4	29.05.2001	13:00	2270	150-0
5	30.05.2001	6.30	112	100-0
6	30.05.2001	11.30	400	170-0
7	04.06.2001	16:30	500	170-0
8	05.06.2001	12:45	38	30-0
9	06.06.2001	16:35	910	150-0
10	07.06.2001	12:00	1400	170-0
11	08.06.2001	12:15	2168	130-0
12	08.06.2001	12:30	2168	170-0
13	09.06.2001	12:20	2160	170-0

**Fig. 1.** Sampling locations in the western Black Sea during May-June 2001.

Species diversity of Mediterranean copepod was unusually high from the region nearest to the Bosphorus. Most probably these invaders were carried by the Lower-Bosphorus flow. However, some species were also found in the northwestern Black Sea at the significant distance from Bosphorus. The examined copepods were seemingly in good conditions indicating that these organisms were alive during preservation. Lower Bosphorus flow is not necessarily the sole factor for the transportation of these copepods to the Black Sea. The ballast water of commercial ships nowadays plays an almost leading role in anthropogenic distribution, extending the areas of marine organisms (TIMOFEEV, SELIFONOVA 2005). According to the Resolution IMO (A.868(20)) commercial ships

that enter the Black Sea exchange water ballast in open sea water (200 m deep and 200 nautical miles from shore) (IMO BULLETIN 1998). Despite this regulation, reports of new biological invasions via ballast water in the Black Sea continue. The significant number of the Mediterranean copepod species (from 11 to 36 taxa) is registered in areas of large sea ports of the northeast part and Crimea, that, most likely, is caused by the ballast waters of commercial ship's (MURINA *et al.* 2002, SELIFONOVA, SHMELEVA 2007, SHMELEVA *et al.* 2008; ZVYAGINTSEV, SELIFONOVA 2008). For example, one tanker may transport up 85 million specimens of meroplanktonic and holoplanktonic organisms (SELIFONOVA 2008). It is established, that a vector of the greatest risk of biological invasions in the Novorossiysk port – Mediterranean basin, from which enters 62% of a ship's water ballast. As a visual example of invasions in area of the ports Novorossiysk, Tuapse, Sevastopol maybe the periodic autumn outbursts of density of *Oithona brevicornis* Giesbr. ( $1.6-42 \cdot 10^3$  ind./m<sup>3</sup>) in areas of the dump of ballast waters (GUBANOVA, ALTUKHOV 2007; ZVYAGINTSEV, SELIFONOVA 2008). *O. brevicornis* – a new species for the fauna of Black Sea copepod – the inhabitant of coastal waters of tropical and moderate latitudes, in particular, Mediterranean sea (SHUVALOV 1980). Our observation demonstrated

**Table 2.** Lists of copepod species in Western Black Sea during May-June 2001.

	Species	Sex	Size, mm
1	<i>Acartia</i> (Acartiidae) <i>A. clausi</i> GIESBR., 1889 (large form)	♀♂	1.05
2	<i>Acartia clausi</i> GIESBR., 1889 (small form)	♀	0.6
3	<i>Acartia danae</i> GIESBR., 1889 *	♀	0.9
4	<i>Acartia tonsa</i> DANA, 1849	♀♂	0.95-1.1
5	<i>Acartia</i> sp.	♀	0.8-0.95
6	<i>Acrocalanus</i> (Paracalanidae) <i>A. gibber</i> GIESBR., 1888**	♀	0.85
7	<i>Acrocalanus monachus</i> GIESBR., 1888* **	♀	0.9
8	<i>Calanus</i> (Calanidae) <i>C. euxinus</i> (HULSEMAN, 1991)	♀♂	2.5-4.4
9	<i>Canthocalanus</i> (Calanidae) <i>C. pauper</i> GIESBR., 1888* **	♂	1.2
10	<i>Calocalanus gracilis</i> TANAKA, 1956* **	♀	0.6
11	<i>Calocalanus</i> (Paracalanidae) <i>C. grezei</i> SHMEL., 1973* **	♀	0.5
12	<i>Calocalanus</i> sp. (small form)*	♀	0.35
13	<i>Candacia</i> (Candaciidae) <i>C. sp.</i> *	V ♀♂	1.37 (1.25)
14	<i>Centropages</i> (Centropagidae) <i>C. bradyi</i> WHEELER, 1901* **	♂	2.0
15	<i>Centropages furcatus</i> DANA, 1849* **	♀	1.5 (1.7)
16	<i>Centropages ponticus</i> KARAV., 1894	V ♀	0.87 (0.95)
17	<i>Centropages violaceus</i> (CLAUS, 1863)*	♂	1.37
18	<i>Centropages</i> sp.*	♂	1.32
19	<i>Copilia</i> (Sapphirinidae) <i>C. sp.</i> *	♀	0.9
20	<i>Corycaeus</i> (Corycaeidae) <i>C. speciosus</i> DANA, 1849* **	♀	1.8
21	<i>Corycaeus</i> sp. (small form)*	♀	0.37
22	<i>Ctenocalanus</i> (Ctenocalanidae) <i>C. sp.</i> *	♀	1.1 (1.25)
23	<i>Cyclopoida</i>	♀♂	1.1 (0.9)
24	<i>Delius</i> (Paracalanidae) <i>D. nudus</i> (SEWELL, 1929)* **	♀	0.4
25	<i>Euchirella</i> (Aetideidae) <i>E. sp.</i> **	V ♀	2.0
26	<i>Heterorhabdus</i> (Heterorhabdidae) <i>H sp.</i> * **	♀	1.3
27	<i>Metridia</i> (Metridinidae) <i>M. sp.</i> **	V ♀	1.5
28	<i>Oithona</i> (Oithonidae) <i>O. brevicornis</i> GIESBR., 1891*	♀♂	0.45-0.6
29	<i>Oithona nana</i> GIESBR., 1892	♀♂	0.45-0.55
30	<i>Oithona similis</i> (CLAUS, 1863)	♀♂	0.6-0.75
31	<i>Oithona simplex</i> FARRAN, 1913* **	♀	0.45
32	<i>Oncaea</i> (Oncaeidae) <i>O. ivlevi</i> SHMEL., 1966* **	♀	0.3
33	<i>Oncaea venella</i> FARRAN, 1929*	♀	0.85
34	<i>Oncaea zernovi</i> SHMEL., 1966*	♀	0.32
35	<i>Oncaea</i> sp.*	♀	0.3
36	<i>Paracalanus</i> (Paracalanidae) <i>P. indicus</i> WOLFENDEN, 1905*	♀	0.85
37	<i>Paracalanus nanus</i> G.O.SARS, 1907*	♀	0.52
38	<i>Paracalanus parvus</i> (CLAUS, 1863)	♀♂	0.8-1.0

Table 2. Continued.

	Species	Sex	Size, mm
39	<i>Paracalanus</i> sp. (small form)	♀	0.45
40	<i>Parvocalanus</i> (Paracalanidae) <i>P. crassirostris</i> (DAHL, 1894)*	♀	0.5
41	<i>Paracartia</i> (Acartiidae) <i>P. grani</i> G.O. SARS, 1904*	♀	0.9
42	<i>Pleuromamma</i> (Metridinidae) <i>P. indica</i> WOLFENDEN, 1905**	♀	2.0
43	<i>Pontellina</i> (Pontellidae) <i>P. sp.</i> * **	V ♀	1.2
44	<i>Pseudocalanus</i> (Clausocalanidae) <i>P. elongatus</i> (BOECK, 1872)	♀ ♂	1.0-1.5
45	<i>Saphirella</i> (Clausidiidae) <i>S. sp.</i>	IV ♀	0.35-0.50
46	<i>Scolecithricella</i> (Scolecithricidae) <i>S. sp.</i> * **	♀	1.2
47	<i>Scolecithrix bradyi</i> GIESBR., 1888* **	♀ ♂	1.2-1.0
48	<i>Temora</i> (Temoridae) <i>T. discaudata</i> GIESBR., 1889* **	♀	1.6
49	<i>Temora turbinata</i> (DANA, 1849)**	III V ♀	1.0 (1.3)

\* – Mediterranean copepod species

\*\* – Copepod species that were discovered for the first time in the Black Sea

that alien copepod species can live in water with rather low salinity, and therefore maybe able to penetrate into Black Sea.

The marked appearance of 33 Mediterranean copepod taxa in the Western Black Sea confirms that process of Mediterraneanization of fauna (PUSANOV 1967) is continuing.

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## Изследване на копеподите от западната част на Черно море през май – юни 2001 година

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### (Резюме)

През май-юни 2001 г. бяха проведени изследвания в западната част на Черно море и бяха получени резултати за копеподната фауна. Намерени са 49 таксона, вкл. 39, които не са с произход от Черно море. Обсъжда се процеса на увеличаване броя на средиземноморските видове в черноморската копеподна фауна.