

## Some Traits of the Pelagic Amphipod *Macrohectopus branickii* (Dyb.) Distribution in Lake Baikal

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### Abstract

The study of the only pelagic fresh water amphipod *Macrohectopus branickii* distribution in the upper 250 m layer of the lake Baikal (Russia) for some sites was conducted. Statistically significant differences between obtained samples that reflect both school-type behavior of the species depending on size groups and existence of different size specimens' aggregations were discovered.

**Key words:** *Macrohectopus branickii*, Amphipods, Baikal, Plankton, Russia.

### 1. Introduction

*Macrohectopus branickii* (Dyb.) is the only known fresh water pelagic amphipod [1]. That amphipod occupies the same ecological niche as mysids in large European or North American lakes and Antarctic krill and it is the important (if not key) component of lake's food chain [2-6]. *Macrohectopus* is a principal feeder of herbivorous zooplankton (which consumes phytoplankton) as well as a major food for 2 species of pelagic sculpins living in Baikal (*Cottomephorus grewingkii* and *C. inermis*) and for both 2 species of oil fishes (*Comephorus* sp.)- the main food source for the seal (*Phoca (Pusa) sibirica*). The only Lake Baikal fish of industrial importance and omul (*Coregonus migratorius*) is also fed on this crustacean. *Macrohectopus* is characterized by distinct sexual dimorphism. For example, females can reach up to 38 mm length, while male's size varies about 6 mm [2, 7].

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Despite the significance of macrohaptopus in the lake Baikal's ecosystem, its last studies were conducted in the end of the last century [3, 4, 6, 8]. It is not enough knowledge about macrohaptopus distribution in Baikal and it is suggested that macrohaptopus' schools migrate [8]. The goal of our work is to take first glance at the pelagic amphipod *M. branickii* distribution in the upper 250 m layer.

## 2. Experimental

Samples described in the present article were collected during the expedition around Lake Baikal on the research ship "G.Titov". In total, 7 samples were collected: 3 in the northern part of the lake, 2 in the central and southern part respectively (Figure 1 & Table 1).

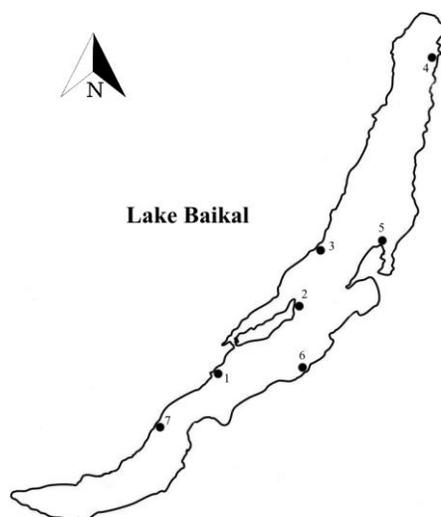
The samples were collected with specially constructed plankton net (half of Ocean zooplankton net in size, and twice larger than used for lakes: inlet's diameter is 0.55 m, with mesh size of 1 mm) in the water layer ranging from 250 to 0 m. The rise of the net was conducted by electric winch at the rate 1 meter per second. Samples were fixed with 96% ethanol after collection. Then the estimation of number of organisms, measurement of each specimen and biomass calculation was done in the laboratory according to the calculated standard specimen's weight [9]. Additionally, water temperature near the surface was measured with thermo-loggerButton and water transparency with Secchi disk.

To analyze obtained data, the Kruskal-Wallis test and Mann-Whitney U-test with Bonferoni correction were used. Based on the number of pair comparisons, the corrected critical level of significance ( $p=0,002$ ) was calculated [10].

**Table 1.** The location, coordinates and characteristics of the sampling sites.

Sample No	Location	NE	Depth (m)	Transparency (m)	t (°C)	Date
1	Opposite to cape Birkhin	52°71'403" 106°54'595"	311 m	17 m	19,1	13.07.2018
2	Opposite to Usurvillage	53°19'891" 107°47'004"	280 m	18 m	18,6	13.07.2018
3	Near cape Ryty	53°54'931" 108°12'102"	427 m	18 m	-	14.07.2018
4	In the direction of Hakusi village	55°33'800" 109°18'141"	275 m	4 m	22,1	15.07.2018
5	Near Svyatoy Nospeninsula	53°52'469" 108°56'259"	367 m	6 m	12,1	17.07.2018
6	Opposite to settlement Gremyachinsk	52°48'682" 107°51'469"	427 m	7 m	-	18.07.2018
7	Opposite to Peschanaya Bay	52°14'999" 105°43'265"	279 m	7 m	-	19.07.2018

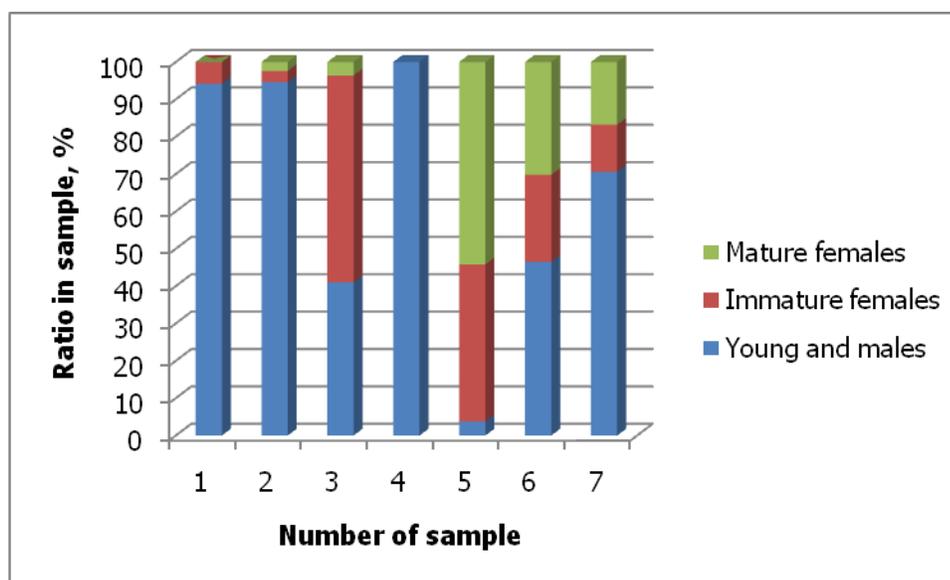
\*NE-Northern latitude/Eastern longitude.



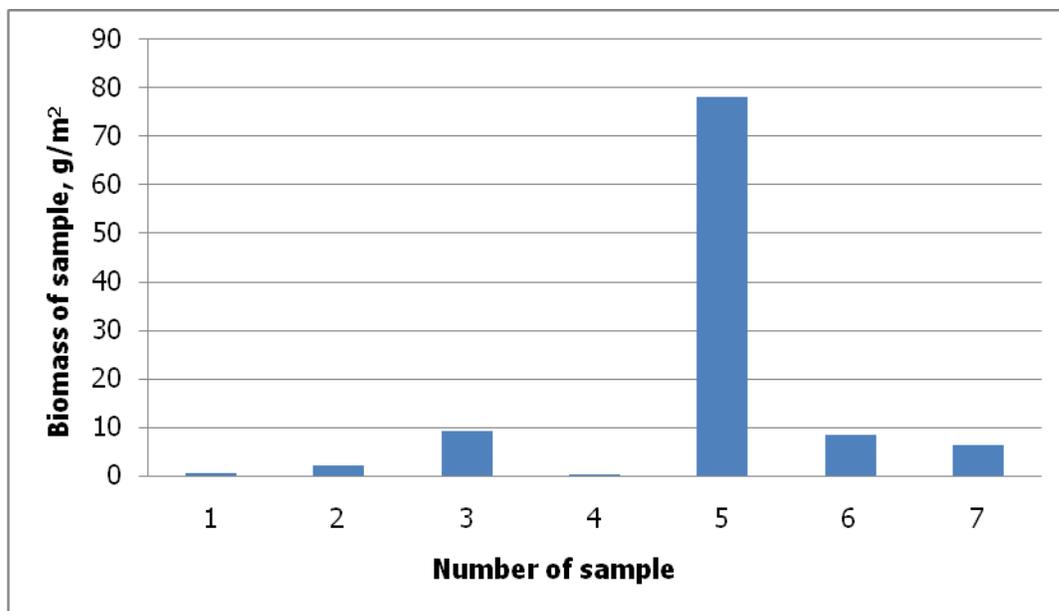
**Figure 1.** The sites of sampling: 1. Opposite to cape Birkhin, 2. Opposite to Usur village, 3. Near cape Ryty, 4. In the direction of Hakusi village, 5. Near Svyatoy Nos peninsula, 6. Opposite to settlement Gremyachinsk, 7. Opposite to Peschanaya Bay.

### 3. Results and Discussion

Sampling of the layer 250-0 m on the different sites showed the following results: first sample contained 69 specimens of macrohctopus; only 4 specimens (5.8%) were immature females while other 65 specimens were males and young (Figure 2-3).



**Figure 2.** % ratio of the size groups in the samples: 1-6 mm-young and males; 7-14 mm-immature females;  $\geq 15$  mm-mature females.



**Figure 3.** Biomass of macrohectopus of upper 250 m layer above 1 m<sup>2</sup> of lake's bottom.

Young and males prevailed in the second sample (total number of specimens is 168), while the number of immature females were 5 and mature females were 4. The dominant group in the third sample was immature females-138 out of 249 specimens; the number of mature females was 9. The least numerous fourth sample (39 specimens) consisted of young and males. In the next most numerous both in terms of number and biomass fifth sample, the dominant group was mature females (298 out of 550 specimens) while only 21 young and males were found in that sample (Figure 2). The dominant group of the sixth sample was young and males-40 out of 86 specimens, while mature females were represented by 26 specimens. Also, young and males were dominant group in the seventh sample (101 out of 143 specimens) with only 24 mature females.

We have analyzed obtained data with the Kruskal-Wallis test and with the Mann-Whitney U-test with Bonferoni correction.

The Kruskal-Wallis test ( $p = 1,129E-149$ ) showed that statistically significant differences exist between obtained samples; following use of Mann-Whitney U-test identified what samples have the most significant differences (Table 2). Sample No-1 and No-5 have statistically significant differences with all other samples and between each other. In that case the specimens of mostly similar size were collected (Sample No-1) or specimens of two size groups (Sample No-5). Since macrohectopus has sexual dimorphism that expressed by specimens' size and consequentially by the rate of movement, it defines school-like lifestyle of that species depending on size groups. Hence, in the first instance part of the school containing young and males that have approximately similar size and rate of movement were collected. In these second instances, we collected mature females and immature females that have similar rate of movement as mature females, or net collected specimens from two size groups on the different depths in the range from 0 to 250 m.

Samples No-2, 3, 4, 6 and 7 also has significant differences between each other but only partially. For example, samples 3 and 6 do not have statistically significant differences and at the same time sample 6 have doubtful statistical differences with Samples No-4 and No-7. Despite the % ration of size groups in that samples (Figure

1), statistical analysis prevents us from suggestion that there were separate size groups of macrohectopus on the sampling sites during the collection of samples.

**Table 2.** Levels of statistical significance (p) of pair wise comparisons calculated with Mann-Whitney U-test with Bonferoni correction.

Number of sample	Sample No. 1	Sample No. 2	Sample No. 3	Sample No. 4	Sample No. 5	Sample No. 6	Sample No. 7
Sample No 1	-	9,36E-14	1,44E-27	1,36E-07	1,08E-37	5,92E-11	9,00E-08
Sample No 2	9,36E-14	-	2,80E-42	1**	2,21E-71	1,24E-06	1**
Sample No 3	1,44E-27	2,80E-42	-	2,02E-16	1,92E-74	1**	5,15E-10
Sample No 4	1,36E-07	1**	2,02E-16	-	2,57E-22	0,004083*	1**
Sample No 5	1,08E-37	2,21E-71	1,92E-74	2,57E-22	-	5,05E-09	3,08E-34
Sample No 6	5,92E-11	1,24E-06	1**	0,004083*	5,05E-09	-	6,40E-03*
Sample No 7	9,00E-08	1**	5,15E-10	1**	3,08E-34	0,006401*	-

(\*Differences are not statistically significant; \*\*No differences).

#### 4. Conclusion

Obtained materials revealed that *M. branickii* might be present in the upper 250 m water layer of pelagial both as schools containing same size groups, as well as different size aggregations. Depending on that the biomass per 1 m<sup>2</sup> of the lake's surface varies significantly. For example, the biomass of macrohectopus in the sample №-4 (the least numerous) is 304 times less than the sample №-5 (the most numerous). The significant pattern between content and number on the one hand and hydrological characteristics on another hand were not revealed.

#### 5. Conflicts of Interest

The author(s) report(s) no conflict(s) of interest(s). The author along are responsible for content and writing of the paper.

#### 6. Acknowledgment

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