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Veliger larvae of *Dreissena* (Bivalvia, Dreissenidae) in the zooplankton of Lake Pleshcheyevo (Yaroslavl Region, Russia)

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The abundance dynamics, spatial distribution and role of freshwater zebra mussel veligers in the structure of zooplankton were analyzed based on observations in 2012–2016 in Lake Pleshcheyevo (Yaroslavl Region). The mean abundance of larvae in the pelagial of the lake in the peak period (summer) ranged widely (0.05–50.7 thousand individuals/m^3). The minimal values were shown for 2015 when the mollusks were virtually not reproducing. The densest populations of veligers were observed in the sublittoral and pelagial of the lake. The veligers were mostly concentrated in the upper (0–6 m) water layer. All daily movements of the plankton larvae were restricted to the epilimnion, at a depth of 4–6 m in the daytime at, while in the night they were evenly spread across the upper 6 m of water. In summer the veligers constituted on average 1–38% of the abundance of non-predatory zooplankton.

Keywords: lakes, meroplankton, veligers, *Dreissena polymorpha*, distribution, abundance dynamics.

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Introduction

Fresh water mussels *Dreissena* play a considerable role in aquatic ecosystems, causing changes in bottom and pelagic communities, participating in the cleaning of water basins, and providing a source of food for many bottom-feeding fishes (Kurbatova and Lapteva, 2008; Lazareva and Zhdanova, 2008; Starobogatov, 1994). Having a planktonic larva facilitates the distribution of mollusks, and also allows them to use the supplementary food resources of the pelagial (Starobogatov, 1994). On one, hand veligers are capable of competing for food with detritophagous suspension feeders (Lazareva et al., 2015; Telesh and Orlova, 2004), but on the other hand they can be consumed by planktovorous organisms. An understanding of the dynamics of benthic populations requires knowledge of their abundance and of the distribution of their larvae.

In the 1980s, *Dreissena polymorpha* Pallas, 1771 appeared in Lake Pleshcheyevo (Zhgareva, 1992). *Dreissena* larvae were first recorded in the autumn of 1987 (Stolbunova, 2006) and since then have been present in the plankton of the lake.

The purpose of this study is to analyze the spatial (horizontal and vertical) distribution, seasonal and interannular dynamics of veligers of the genus *Dreissena* in the deep Lake Pleshcheyevo (Yaroslavl Region).

Material and methods

Lake Pleshcheyevo (N 56°43′–56°48′, E 38°43′–38°50′) is of glacial origin, regularly oval in shape and 51.5 km^2 in area. The littoral zone is up to 3 m deep and occupies 21.2% of the basin, with a maximum depth of 24 m. From the end of May to mid-September, a direct thermal stratification of the water of the lake is observed, while in mid-spring and mid-autumn the lake becomes homothermic. Over 15 tributaries flow into the lake, the most important of which is the Trubezh River, while the Vyoksa River flows out of the lake. The period of the water exchange is 5.65 years, and the water exchange coefficient is 0.18 yr^{-1}, total mineralization 300 mg/l (Butorin and Sklyarenko, 1989). The lake is mesotrophic with eutrophic features (Butorin and Sklyarenko, 1989).

The study was based on the zooplankton samples collected during the comprehensive investigation of the Lake Pleshcheyevo (2012–2016). Zooplankton was studied in the littoral (depth 1.5 m), sublittoral (depth 4–8 m) and pelagic (depth 14–24 m) areas in three hemi-sections: I – profile section directed away from the mouth of the Trubezh River, II – profile section directed away from the "Boat of Peter the Great" Museum, and III – profile section, directed away from the Vyoksa River, and also in the sublittoral zone near the "Vodozabor" water intake structure. The scheme of sampling is published by Pryanichnikova and Tsvetkov (2018). Zooplankton was collected using a 5 l Dyachenko-Kozhevnikov water sampler (2012–2013) and 4.2 l Van Dorn water sampler (2014–2016) from two depths (in two tows) at every 1 m (at stations 3–4 m deep) or every 2–4 m (at stations deeper than 4 m) with subsequent filtration through a planktonic sieve (mesh size 64 μm). At the shallow-water stations (depth <1.5 m), plankton was sampled using a measuring bucket, filtering 50 l of water through the plankton sieve (cell size 64 μm). A daily vertical distribution of zooplankton was studied on August 6–7, 2013 at a deep-water station at depths of 0, 1, 2, 4, 6, 8, 9, 10, 11, 12, 14, 16, 18, 20, 22 m every three hours. The samples were fixed using 4% formalin. The laboratory examination of the samples utilized standard hydrobiology methods (Vinberg and Lavrentieva, 1984). The veligers were studied in the zooplankton samples collected. The size of the veligers was evaluated by measuring their total length using an MS-1 microscope equipped with an eyepiece micrometer.

For the analysis of the trophic structure, the representatives of zooplankton were separated according to their trophic groups taking into account their feeding strategy: non-predatory cladocerans and rotifers, omnivorous copepods and rotifers, predatory cladocerans, *Dreissena* veligers (Lazareva et al., 2015).

The dependence between different values was estimated using a nonparametric Spearman's rank correlation coefficient. To compare the shell length of planktonic larva in different seasons at different depths we used a nonparametric Mann – Whitney test.

The concentration of oxygen dissolved in water, electric conductivity, and water temperature were measured using a YSI-85 portable device (YSI, Inc., USA).

Year	Zone	Depth, m	n	Abundance, thousand individuals/m^3				
				May	June	July	September	October
2014	Littoral	1	3	0	6.70±2.01 / 2.70–9.00	11.92±5.35 / 3.75–22.00	1.07±0.07 / 0.96–1.20	0
	Sublittoral	4–8	3–5	<0.01	7.48±2.45 / 11.25–15.00	35.77±7.89 / 24.00–58.13	1.80±1.09 / 0.01–5.00	0
	Pelagial	14–24	5–6	0	3.53±0.32 / 2.16–4.30	6.40±1.38 / 3.18–13.92	1.53±0.67 / 0.25–4.61	0
2015	Littoral	1	3	0	0.83±0.44 / 0.00–1.50	0	0.10±0.06 / 0.13–0.25	0
	Sublittoral	3–9	1–4	0	6.00	0	0.90	0
	Pelagial	14–24	4–6	0	0.04±0.04 / 0.00–0.16	0.05±0.05 / 0.00–0.22	0.74±0.41 / 0.04–1.48	<0.01

Table 1. Abundance of *Dreissena* veligers in Lake Pleshcheyevo in 2014–2015.
Note: numbers above the underscore are mean ± standard error of the mean, below the underscore are minimum–maximum.

Results

Seasonal and long-term dynamics of Dreissena veliger abundance

In 2014 and 2015, seasonal changes in the abundances of *Dreissena* larvae were recorded. However, the large time interval between the sample intakes (one month and no observations in August) only allows the trends in changes during the growing period to be estimated.

At the end of April–beginning of May, veligers were absent in the main basin of the lake (Fig. 1, Table 1). Only in May 2014, they were recorded in the sublittoral area, near the mouth of the Trubezh River (less than 0.1 thous. ind./m^3) at the water temperature of 6–7 °C. In other areas of the lake, veligers usually appeared at the beginning of June (0.2–15.0 thous. ind./m^3 at a water temperature of 10–21 °C (at depth 0–8 m). In 2014 in the littoral and sublittoral, the maximum abundance of veligers (up to 58.1 thous. ind./m^3) was registered in July at a water temperature of 17–23 °C. In September, the abundance of veligers decreased, and in October at a water temperature of 10 °C, larvae were absent in this area of the basin (Fig. 1, Table 1). In the pelagic zone from June to September, the concentration of veligers remained at approximately the same level (3.2–4.6 thous. ind./m^3).

In 2015, one increase in abundance of planktonic larvae was recorded in June in the littoral and sublittoral areas (up to 6 thous. ind./m^3) at 17–19 °C (Fig. 1, Table 1). In July in these areas of the lake, veligers were absent in zooplankton samples (water temperature 19 °C). In September, their abundance somewhat increased (0.1–0.9 thous. ind./m^3). In the pelagial, veligers were recorded from June to October in low quantities (up to 1.5 thous. ind./m^3) with a small increase in September (Fig. 1, Table 1).

The abundance of veligers strongly varied from year to year. High abundances were recorded in the years of the immigration of the mollusk (1988–1996) and in 2012–2013 (Table 2). Since 2014, the summer quantity of the zebra mussel larvae decreased considerably (10–1000 times), while minimal values are characteristic of 2015.

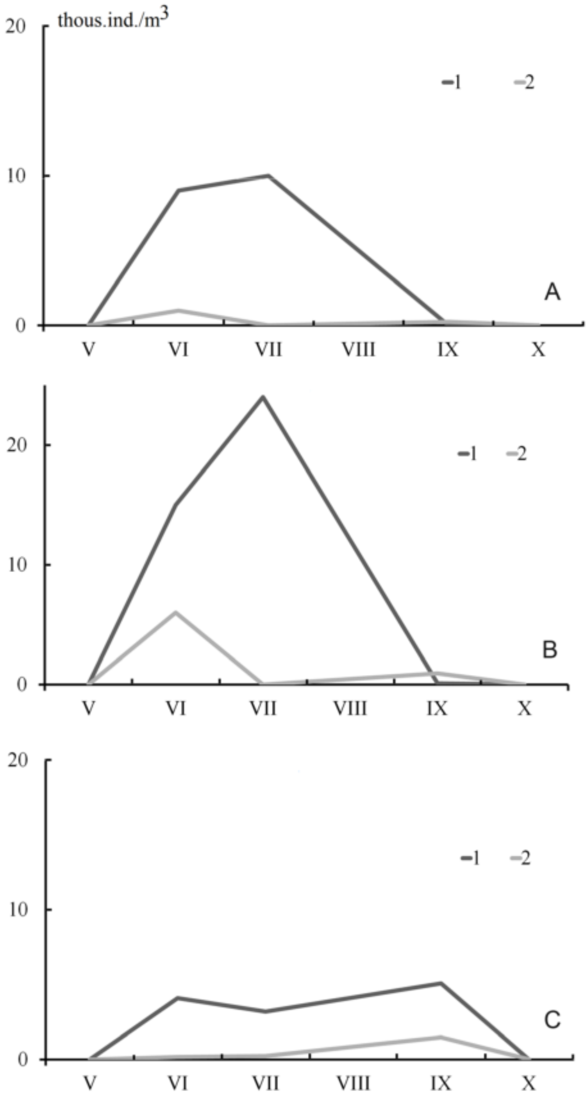

Fig. 1. Seasonal dynamics of *Dreissena* veliger abundance in different zones of Lake Pleshcheyevo in 2014–2015. **A** – littoral zone of area I, **B** – sublittoral zone (st. 1), **C** – pelagial (mean for the water column).
Note: 1 – 2014, 2 – 2015.

Horizontal distribution of Dreissena veligers

In Lake Pleshcheyevo, *Dreissena* veligers have been observed across the entire basin. The highest abundances of the larvae were most commonly recorded in sublittoral areas at depths of 4 m (Table 1, 3), in some years – in the pelagial in summer (Table 2). In June and July 2014, the southern sublittoral of the lake (areas I, II) contained more veligers compared to the northern sublittoral (area III). In September, conversely, the abundance of veligers was higher in the northern areas (Table 3).

Vertical distribution of veligers

Dreissena veligers were most abundant in the epilimnion: in June–July in various years – at depths of 0–10 m, in September – at depths of 0–12 m. In 2014–2015, in the bottom water layers, veligers were recorded in September (Fig. 2).

Veliger daily migrations were restricted to the epilimnion (Fig. 3). Data on the vertical distribution of temperature and oxygen content of the water on August 6, 2013 were published by Zhdanova (2018). In the daytime (9.00–18.00) veligers dominated at depths of 2–6 m with a maximum at 4–6 m. At sunset (21.00) *Dreissena* larvae rose to the subsurface levels (0–1 m). At night they were evenly distributed in the epilimnion at the depths of 0–6 m. A relatively high density of veligers near the surface remained until morning.

Date	Abundance, thousand individuals/m^3			
	Deep-water zone (22–23 m)	Sublittoral (st. 1)	Littoral of area I	Littoral of area III
27.07.1989*	36.2 (80)	<1	<1	<1
29.07.1996*	12.2 (115)	77.5 (176)	16	5
29.07.2004*	5.5	10.5	–	2.0
27.07.2012	50.7±0.6 (104.1)	–	–	–
07.08.2013	12.2±0.2 (84.2)	16.5±1.7 (20.0)	0.3	30.0
27.07.2014	3.2±1.3 (10)	24.0	10.0	16.4
16.07.2015	0.07±0.07 (1.7)	0.0	0.0	0.0
29.07.2016	4.0±2.1 (19.6)	0.2	1.9	1.2

Table 2. Interannual changes in abundance of veligers in Lake Pleshcheyevo in summer seasons.
Note: the values are shown as mean ±standard error of the mean; maximum values at the depth studied are given in parentheses. "–" – no data; * – data from Stolbunova (2008) and Stolbunova et al. (2013).

Size distribution of Dreissena

In 2014, plankton larva size in the lake pelagial varied from 75 to 250 µm. At the beginning of June, the mean length of the shell was 120±3 µm, and individuals 75–100 µm in size were most frequent (48%). In mid-July, veligers 75–100 µm (85%) became dominant, and the mean shell length was 98±3 µm. In mid-September, the size of the planktonic larvae increased, and constituted on average 150±3 µm, while individuals with a shell length 125–150 µm were most frequent (55%). The differences in the size of veligers in different months are statistically significant (p ≤0.05).

Vertical distribution of size of Dreissena larvae

In August 2013, the length of veligers changed from 100 to 250 µm. The largest planktonic larvae are characteristic of the depth of 8 m, and the smallest – of 6 m (Table 4). The differences in the veliger size at different depths are reliable (p ≤0.05). At the depths of 2–6 m individuals with a shell length 125–150 µm (46–67%) were dominant, and at 8 m, those 175–200 µm long were dominant (63%). Veligers inhabiting other depths were not measured, because of their lower quantity (Fig. 3).

The role of veligers in the lake zooplankton

The proportion of veligers in zooplankton was different in different years. In the summers of 2012 and 2013, they could reach 52 and 55% of the total abundance of zooplankton suspension feeders at horizons of the pelagial; whereas in subsequent years the maximum proportion of veligers was lower (Table 5, Fig. 4). As the abundance of zebra mussel larvae increased in the epilimnion, in the deep zones of the lake in summer the abundance of suspension feeding rotifers decreased (r=−0.38, p ≤0.05), while in the littoral, conversely, their abundances were directly correlated (r=0.70, p ≤0.05). No significant correlations between the abundances of other groups of suspension feeders and veligers were revealed (p >0.05).

Discussion

The time of the larva being in a planktonic state and the peaks of their abundances are related to the spawning of the adult mollusks, which is correlated with temperature fluctuations at the depth where they live (Borcherding, 1991; Guseva, 2009). Each basin might have its own unique seasonal character of abundance of *Dreissena* larvae (Sprung, 1993). In the lakes and reservoirs, there are two–three peaks (Gromova and Protasov, 2017; Lewandowski, 1999; Nichols, 1996), one peak, or no peaks (Lewandowski and Ejsmont-Karabin, 1983) of veliger abundance.

Usually, larvae appear in plankton at a water temperature of 12–17 °C (Starobogatov, 1994), and the optimal temperature for their development is 18 °C (Sprung, 1987), which coincides with our and previous observation in Lake Pleshcheyevo (Stolbunova, 2008; Stolbunova et al., 2013). In the plankton of the lake, *Dreissena* veligers were usually

Area	Depth, m	Abundance, thousand individuals/m^3		
		June	July	September
I	1	9.00	10.00	0.96
	4	14.06	58.13	1.00
	8	0.750	1.50	–
	14–15	3.12	13.93	0.27
II	1	8.40	22.00	1.20
	4	13.13	35.63	1.13
	8	1.90	11.00	–
	14–15	3.75	4.14	1.91
III	1	2.70	16.40	1.05
	4	11.25	25.31	5.00
	14–15	3.79	5.94	1.41

Table 3. Abundance of *Dreissena* veligers in different zones of Lake Pleshcheyevo in July 2014.
Note: I – profile section directed away from the mouth of the Trubezh River; II – profile section directed away from the "Boat of Peter the Great" Museum; III – profile section directed away from the source of the Vyoksa River; "–" – no data.

present from the beginning of June (occasionally in May) to October, whereas peaks of abundances were in July–August, as also in the reservoirs on the Volga River (Lazareva et al., 2014; Sokolova, 2015; Stolbunova, 2013). The presence of small (D-form) larvae (75–100 μm) in the plankton of the lake from the beginning of June to the beginning of September suggests that *Dreissena* spawns throughout summer and stops at the beginning of autumn. The same is recorded for Lake Lukomslskoe (Starobogatov, 1994). In Lake Pleshcheyevo at the beginning of June both D-shape veligers, and veliconchs (umbonal veligers) were recorded. It is known that the duration of the development from the D-shape veliger to the veliconch at a temperature above 15 °C is 6–10 days (Lvova, 1980), hence, zebra mussel could begin spawning at the end of May. In mid-July 2014, the number of *Dreissena* larva, and the proportion of small veligers both increased, suggesting a mass spawning of these mollusks.

In different basins, *Dreissena* larva show noticeable perennial variations in abundances (Guseva, 2009; Lazareva et al., 2014, 2015; Lewandowski, 2001; Sokolova, 2015). Variations in the abundances of veligers can be due to the density of maternal populations (Lazareva et al., 2014, 2015), differences in the temperature regimes of the basins and associated reproduction cycle of *Dreissena* (Borcherding, 1991; Guseva, 2009; Lewandowski, 2001; Lvova, 1980; Lucy, 2006). In Lake Pleshcheyevo in June 2015, there was one rise in the abundance of veliger in the littoral and sublittoral areas, whereas in the pelagial no prominent peaks have been recorded. Low quantities of larvae and their unusual dynamics in that year were apparently caused by a disrupted reproductive cycle because of the climate that year (Pryanichnikova and Tsvetkov, 2018).

Dreissena veligers were found in the sublittoral, pelagial and littoral areas of Lake Pleshcheyevo, which is characteristic for other basins as well (Guseva, 2009; Lewandowski, 2001; Semenova, 2008; Sokolova, 2015). The seasonal dynamics of planktonic larvae can be different in different zones of the basin (Nalepa and Schloesser, 1993), which is apparently related to the differences in the time of spawning in local populations. In Lake Pleshcheyevo in 2014–2015, in the littoral and sublittoral zones, the peaks of abundance of veligers were more pronounced

Depth, m	Shell length, μm
2	164±8 (n=122)
4	153±3 (n=421)
6	137±2 (n=217)
8	174±3 (n=40)

Table 4. Size of veligers at different depth in the deep zone of Lake Pleshcheyevo in August 2013.
Note: data are represented as as mean ± standard error of the mean; n – number of measurements.

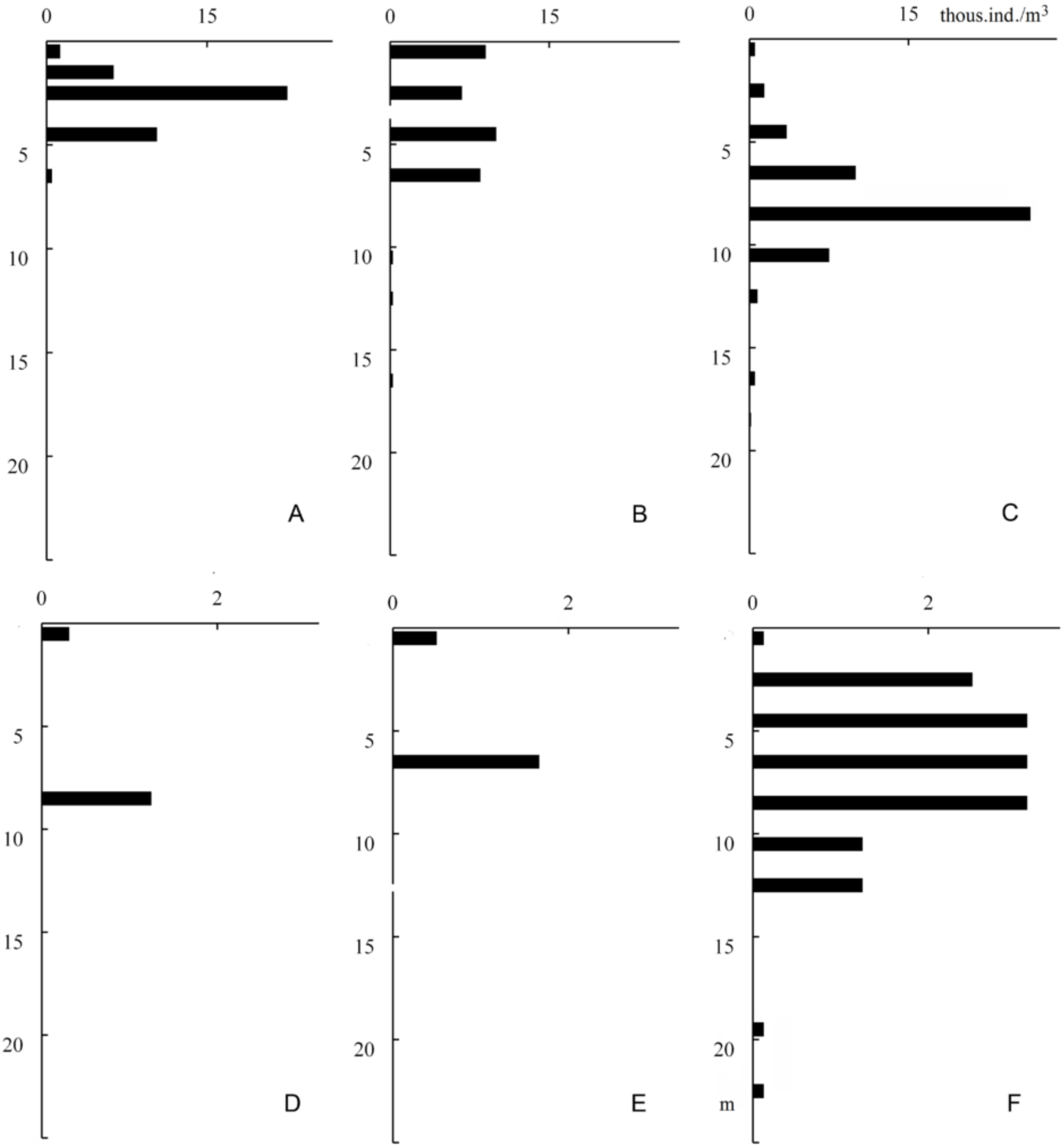

Fig 2. Vertical distribution of veligers in the deep-water zone of Lake Pleshcheyevo in different months of 2014–2015: **A** – June 2014, **B** – July 2014, **C** – September 2014, **D** – June 2015, **E** – July 2015, **F** – September 2015.

compared to the pelagial. In the lake, adult mollusks occur to a depth of 15 m, and the densest populations of *Dreissena* were characteristic of depths of 4–9 m (Pryanichnikova and Tsvetkov, 2018; Shcherbina, 2008), therefore these areas most commonly show high abundances of larvae. The southern sublittoral is richer in veligers in summer, which agrees well with the data on the density of adult mollusks (Pryanichnikova and Tsvetkov, 2018). Accumulations of *Dreissena* larvae in the epilimnion over depths of 20–23 m are related to their passive transport in the basin by wind-driven and gradient currents. Lewandowski (2001) also showed that the abundance of planktonic larvae in the littoral zone is more variable compared to the pelagial. This is related on one hand to the presence of spawning mollusks, and on the other hand to the presence of substrate available for their settling. Also, in most lakes the area of the littoral zones is less than the area of the pelagial (Lewandowski, 2001). In the water reservoirs of the upper reaches of the Volga River, high abundance of veligers is characteristic of deep water areas above the flooded riverbed of the Volga River and its large tributaries (Lazareva et al., 2014).

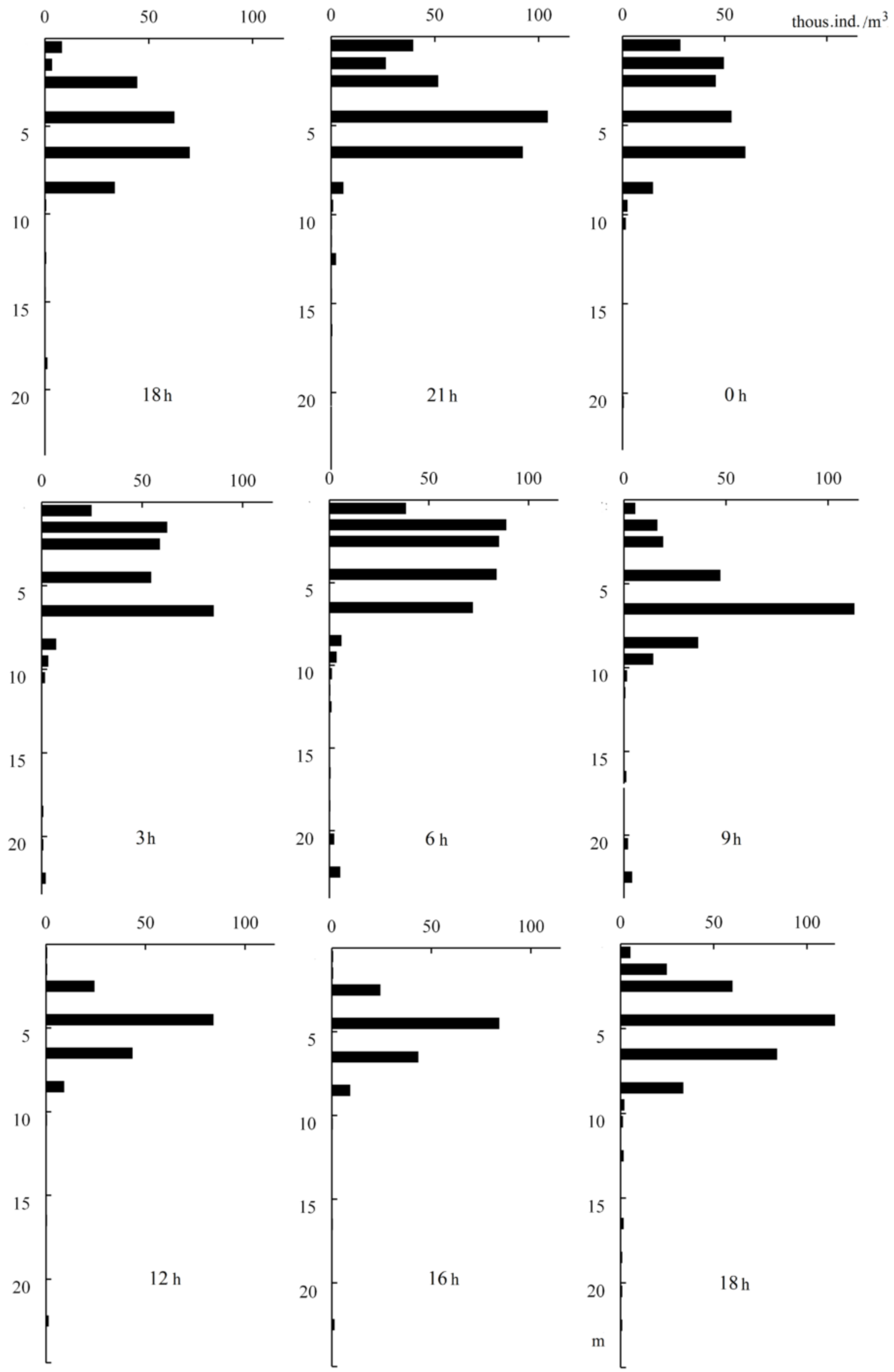

Fig. 3. Daily vertical distribution of zebra mussel veligers in Lake Pleshcheyevo on 6–7 August 2013.

The distribution of *Dreissena* larvae in plankton depends on the depth, body size, and time of day (Karataev, 1981). It is shown that in basins with thermal stratification, veligers mostly populate the epilimnion (Lewandowski, 2001). The same is observed in Lake Pleshcheyevo, where favorable conditions for *Dreissena* larvae exist in the upper water layers. The Ivankovo and Rybinsk Reservoirs showed a similar pattern of vertical distribution of *Dreissena* veligers, with most larvae concentrated in the upper 5 m of water (Lazareva et al., 2014).

Few data exist on the daily migrations of *Dreissena* veligers (Karataev, 1981; Stolbunova, 2008, 2013; Walz, 1973). It is shown for the Ivankovo Reservoir, Lukomlskoe Lake and Bodensee that in the night, the maximum density of larvae characteristically occurs in the upper 2 m of water. In Lake Pleshcheyevo the pattern of the daily vertical distribution was somewhat different from that described above. For instance, in the night the density of veligers was evenly distributed in the upper 6 m of water.

The mollusk larvae can play an important role in a plankton community in the period of their mass distribution (in July–August), whereas at other times their proportion in the community is not significant (Lazareva et al., 2014, 2015; Stolbunova, 2013). For instance, in the Rybinsk Reservoir in summer, veligers contributed significantly (12–25%) to the non-predatory zooplankton (Lazareva et al., 2014). In other reservoirs of the upper reaches of the Volga River, their proportion of the total abundance of suspension feeders did not exceed 10%. In July–August in Lukomlskoe Lake, the contribution of *Dreissena* veligers to the total zooplankton abundance reached 70% (Karataev, 1981). In Lake Pleshcheyevo in 1992 and 1996, at high density of *Dreissena* veligers, their proportion in the total zooplankton abundance reached 33% (Stolbunova et al., 2013). In the study period 2012–2016, the maximum contribution of *Dreissena* larvae to the total zooplankton and to suspension feeder abundances was recorded in 2012 and 2013 at the peaks of their concentration. In later years, the maximum proportion of veligers was considerably lower.

The appearance of *Dreissena* veligers can change the structure of zooplankton. For instance, they can cause a decrease in the abundance of planktonic suspension feeders and their products (Burlakova, 1998). According to Stolbunova et al. (2013), the appearance of the *Dreissena* in Lake Pleshcheyevo (1989–1996) was associated with a trend towards a decrease in the mean summer abundance of zooplankton and rotifers compared to the time before the immigration of this mollusk (1979–1985). In summer 2012–2016, in the epilimnion of the deep zone of the lake basin, the abundance of veligers and suspension feeding rotifers were inversely proportional, whereas in the littoral zone, conversely, it was directly proportional. In the Rybinsk Reservoir, the rotifer abundance was directly proportional to the abundance of veligers (Lazareva and Zhdanova, 2008). The comparison of rotifer and veliger diets showed that *Dreissena* larvae do not compete for food with planktonic rotifers (Lazareva et al., 2015). The feeding spectrum of veligers is similar to that of microzooplankton (infusorians, rotifers, cladocerans), because their lifestyle, body size and the size of consumed suspended particles are similar (Lazareva et al., 2014, 2015; Telesh and Orlova, 2004).

Conclusions

Planktonic larvae play an important role in the structure of zooplankton at times of their mass abundance (July–August). The mean abundance of the larvae in the pelagial of the basin in the summer season varied widely (0.05–50.7 thous. ind./m^3).

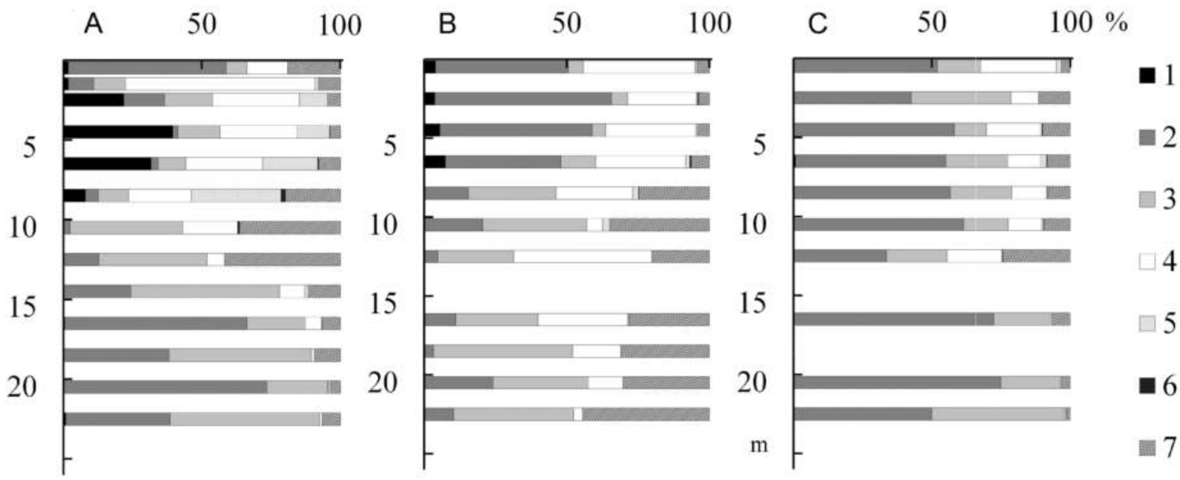

Fig. 4. Trophic structure of zooplankton in a deep zone of Lake Pleshcheyevo in a summer season of 2013–2015: **A** – August 2013, **B** – July 2014, **C** – July 2015. The numbers indicate zooplankton components: 1 – veligers, 2 – non-predatory rotifers, 3 – non-predatory cladocerans, 4 – non-predatory copepods, 5 – omnivorous rotifers, 6 – predatory cladocerans, 7 – omnivorous and predatory copepods.

Zone	Date	$\%N_{vel}$	$\%N_{vel\text{-}filtr}$	$\%N_{rot\text{-}filtr}$	$\%N_{clad\text{-}filtr}$	$\%N_{cop\text{-}filtr}$
Deep	27.07.2012	36±2 (52)	38±2(55)	7±2 (9)	25±10 (36)	19±1 (20)
	07.08.2013	10±1 (40)	13±1 (47)	23±6 (74)	36±6 (67)	24±5 (75)
	27.07.2014	2±1 (7)	2±1 (8)	27±6 (62)	36±8 (76)	30±5 (61)
	16.07.2015	<1	<1	56±4 (75)	26±3 (48)	13±3 (29)
	29.07.2016	5±2 (22)	6±3 (24)	8±2 (24)	52±7 (89)	31±6 (61)
Sublittoral	07.08.2013	15±6 (27)	18±8 (32)	5±1 (6)	21±4 (26)	55±10 (72)
	27.07.2014	12±3 (25)	15±5 (29)	30±4 (41)	18±6 (41)	31±2 (39)
	29.07.2016	<1	<1	2	37	58
Littoral	07.08.2013	7±5 (17)	10±8 (25)	3±1 (5)	21±14 (54)	66±17 (90)
	27.07.2014	14±4 (18)	16±5 (23)	20±5 (40)	12±5 (54)	50±7 (90)
	29.07.2016	13±5 (22)	15±5 (26)	28±4 (36)	10±3 (15)	42±9 (60)

Table 5. Role of veligers in the trophic structure of zooplankton in the pelagial of Lake Pleshcheyevo in summer seasons.
Note: $\%N_{vel}$ – percentage of the number of veligers from the total abundance of zooplankton; $\%N_{vel\text{-}filtr}$ – percentage of the number of veligers from the total abundance of suspension feeders; $\%N_{rot\text{-}filtr}$ – percentage of the number of rotifers-suspension feeders from the total abundance of suspension feeders; $\%N_{clad\text{-}filtr}$ – percentage of the number of cladocerans-suspension feeders from the total abundance of suspension feeders; $\%N_{cop\text{-}filtr}$ – percentage of the number of copepods-suspension feeders from the total abundance of suspension feeders. The values are shown as mean ± standard error of the mean; in the parentheses – maximum values at certain depths and areas.

Minimal values are characteristic of 2015 when adults of these mollusks hardly reproduced at all. A high density of veligers was most commonly recorded in the sublittoral area, and in some years in the pelagial of the lake. Veligers tended to occur in the upper 6 m of water. All daytime migration of planktonic larvae was in the epilimnion, with a maximum at daytime at a depth of 4–6 m, whereas in the night they were evenly distributed in the upper 6 m of water. The summer abundance of veligers in the epilimnion until 2014 was 13–38% of that of the total non-predatory zooplankton. Since 2014 a trend toward a decrease of the proportion of veligers in the structure of the zooplankton has been recorded.

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