

EFFECT OF LIGHT POLLUTION ON THE SEVERAL AQUATIC
COMMUNITIES OF LAKE BAIKAL

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The nocturnal vertical migration activity of amphipods in the two coastal areas of Lake Baikal, exposed and not exposed to the influence of artificial lighting was investigated. In the conditions of prolonged artificial lighting, the migration activity of amphipods reduced on average by 20 times. Statistical analysis demonstrated significant differences between the two places of video surveillance indicating about the significant impact of light pollution on the nocturnal migration of the benthic animals.

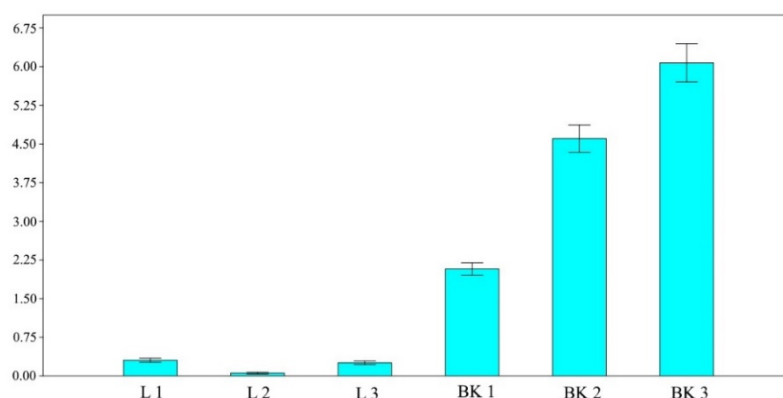
Keywords: light pollution, Lake Baikal, amphipods, nocturnal migrations.

Introduction. Light pollution of water bodies is one of the problems that is becoming increasingly apparent in the 21st century [1–3]. The ongoing research in this direction is mainly aimed at studying the effect of light pollution on the communities of marine coastal ecosystems [4, 5]. Research on freshwater ecosystems is practically not conducted [6]. However, given the growing tourist flow and the development of coastlines of large limno-ecosystems, such as Lake Baikal, more attention should be given to the study of the effects of this pollutant. It should be noted that the lighting of coastlines as well as water transport are the main sources of this pollution. Artificial light can affect several groups of organisms, for example, amphipods, which are the dominant representatives of zoobenthos in Lake Baikal [7]. In the framework of this study, we set the goal of comparing the abundance of the dominant zoobenthos group in Lake Baikal areas adjacent to the villages of Listvyanka (highly lit coastline) and Bolshiye Koty (coastline lighting is almost completely absent) on the shores of Lake Baikal.

Materials and Methods. The study of the community of amphipods was conducted in the Baikal littoral zone near the villages of Listvyanka and Bolshiye Koty in September 2019. Observations were performed opposite of the settlements twice in three replicates each time. A video recording system was used for the study. The obtained videos were investigated in the laboratory: every 5 s video was stopped and all organisms on the screen were counted and the data were collected into the tables. The technique of video surveillance and results processing was described before by the authors [8].

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Results and Discussion. The results of the study showed much higher migration activity of amphipods in the points with almost no exposure to light pollution (near Bolshiye Koty Village) (see Figure). The mean number of migrating amphipods in the points near Bolshiye Koty Village was 4.07 ind./freeze-frame and near Listvyanka Village – 0.20 ind./freeze-frame. Statistical analysis data indicated significant differences between the study areas with and without artificial lighting (see Table).



The mean number of migrating amphipods in freeze-frames (L1, L2, L3 – sites near the Listvyanka Village; BK1, BK2, BK3 – sites near the Bolshie Koty Village)

Such differences can be explained by the influence of artificial lighting and the phenomenon of daily vertical migrations of amphipods [8]. During these migrations, animals rise to the upper layers of water at night, but in artificial light conditions they became visible to predators. As a result of this, animals were constantly exposed to additional pressure from predators at unusual times for this.

Levels of statistical significance (p) of pair wise comparisons calculated with Mann-Whitney U-test with Bonferoni correction (differences are not statistically significant; ** no differences)*

| | BK 3 | BK 2 | BK 1 | L 3 | L 2 |
|------|----------|-----------|----------|----------|---------|
| L 1 | 0.000117 | 0.000116 | 6.08E-05 | 1** | 0.0015* |
| L 2 | 0.000113 | 0.000113 | 5.36E-05 | 0.000354 | |
| L 3 | 0.000105 | 0.000105 | 4.54E-05 | | |
| BK 1 | 0.000911 | 0.003394* | | | |
| BK 2 | 0.641* | | | | |

Conclusion. Light pollution can represent a threat to the ecosystem of Lake Baikal. Artificial lighting attracting amphipods at night makes them visible for potential predators, which causes a disturbance in the nocturnal migration of the benthic animals. The increasing number of tourists will inevitably intensify artificial lighting in coastlines, and therefore more detailed further studies of this pollutant are required.

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ՈՐՈՇ ԶՐԱՅԻՆ ՀԱՄԱԿԵՑՈՒԹՅՈՒՆՆԵՐԻ ՎՐԱ

Ա մ փ ո փ ո մ

Ուսումնասիրվել է Բայկալ լճի արհեստական լուսավորության ազդեցությանը ենթարկվող և չենթարկվող ափամերձ երկու հատվածների ամֆիպոդների զիշերային ուղղահայաց միգրացիայի ակտիվությունը: Երկարատև արհեստական լուսավորության պայմաններում ամֆիպոդների միգրացիոն ակտիվությունը նվազել էր միջինում 20 անգամ: Վիճակագրական վերլուծությունը ցույց է տվել նշանակալի տարբերություններ վիդեո դիտարկման 2 վայրերի միջև՝ ցուցանելով հատակային կենդանիների զիշերային միգրացիայի վրա լուսային աղտոտման նշանակալի ազդեցության մասին:

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ВЛИЯНИЕ СВЕТОВОГО ЗАГРЯЗНЕНИЯ НА НЕКОТОРЫЕ
ВОДНЫЕ СООБЩЕСТВА ОЗЕРА БАЙКАЛ

Резюме

Исследована активность ночной вертикальной миграции амфипод на двух литоральных участках оз. Байкал – подверженном и не подверженном воздействию искусственного освещения. В условиях длительного воздействия искусственного освещения миграционная активность амфипод снижается в среднем в 20 раз. Статистический анализ продемонстрировал существенные различия между двумя местами видеонаблюдения, свидетельствующие о значительном влиянии светового загрязнения на ночную миграцию донных животных.