

ISSN 0096-7807

TX?

394-981

Vol. 9, No. 6, November-December, 1978

July, 1979



SJECAN 9(6) 497-592 (1978)

THE SOVIET JOURNAL OF
ECOLOGY
ЭКОЛОГИЯ/ÉKOLOGIYA

TRANSLATED FROM RUSSIAN



CONSULTANTS BUREAU, NEW YORK

THE SOVIET JOURNAL OF ECOLOGY

A translation of *Ékologiya*

July, 1979

Volume 9, Number 6

November-December, 1978

CONTENTS

Engl./Russ.

Cyclicality of Mass Reproduction of Animals - a Basis for Long-Term Forecasting - A. A. Maksimov	497	5
Seasonal Photosynthetic Changes in Herbaceous Plants of Forest-Steppe Oakwood Associations in Relation to the Dynamics of Leaf Plastid Apparatus - T. K. Goryshina	503	14
Protective Role of Nut Forests of Southern Kirghizia - E. I. Girshevich	508	20
Some Features of the Root Anatomy of Grasses, Tribe Poeae R. Br., Differing in Ecology - A. F. Osipchuk and V. G. Nikolaevskii	511	24
Features of Vegetation Distribution in the Area of the Solfatara Field of the Mendeleev Volcano - V. P. Voroshilov and A. N. Sidel'nikov	515	30
Effect of Floods on the Drift of Benthos in the Bomnak River (Basin of Zeya River) - V. V. Bogatov	520	36
Geochemical Ecology of Microorganisms in a Habitat with Different Zinc and Copper Content - S. V. Letunova and E. A. Belova	524	42
Morphological Indicators as a Means of Differentiating Pinniped Populations - A. P. Shustov	530	50
Population Structure Dynamics of Small Myomorph Rodents Using the Example of a Controlled Group of the Bank Vole - N. S. Gashev	534	55
Means of Adaptation of Bark Beetles (Coleoptera, Scolytinae) to a Habitat on Slightly Weakened Trees - G. V. Lindeman	538	61
Effect of Some Ecological Factors on the Malate Dehydrogenase to Lactate Dehydrogenase Activity Ratio - A. Z. Shapiro and A. N. Bobkova	544	68
BRIEF COMMUNICATIONS		
Effect of Meteorological Factors on Annual Height Growth of Spruce and Pine in the Leningrad Province - A. N. Martynov	549	74
Photosynthesis and New Growth of Leaf Apparatus in Arctic Plants - S. K. Nazarov	551	76 33-6240
Critical Respiration Temperature of Clover Leaves - T. K. Golovko	553	79
Formation of Adventitious Roots in the White and European Birch - S. A. Denisov	555	81
Dynamics of Water and Formation of Biocenoses in the Littoral Zone (Using Lake Kubenskoye as an Example) - I. M. Raspopov, T. D. Slepukhina, F. F. Vorontsov, and M. A. Rychkova	557	83
Chronographic Dynamics of Morphophysiological Indices of the Willow Ptarmigan - R. N. Voronin	561	86
Occurrence and Activity of Heterotrophic Microorganisms in Ponds of the Volga River - A. F. Sokol'skii	563	89
Correlative Increase in Body and Brain Weight in Juvenile Carp - L. A. Dobrinskaya ...	566	92
BOOK REVIEWS		
R. M. Aleksakhin and M. A. Naryshkin. Migration of Radionuclides in Forest Biogeocenoses - Reviewed by F. A. Tikhomirov	570	97

CONTENTS

(continued)
Engl./Russ.

INFORMATION

Some Achievements in Biocenological Research in the USSR in 1977 - L. M. Nosova	572	99
All-Union Educational Seminar on Current Problems in Ecology Dedicated to the Hundredth Anniversary of the Birth of D. N. Kashkarov - L. A. Bogacheva and Yu. L. Vigorov	577	104

INDEX

Author Index, Volume 9, Numbers 1-6, 1978	583
Tables of Contents, Volume 9, Numbers 1-6, 1978	585

The Russian press date (podpisano k pechati) of this issue was 12/4/1978.
Publication therefore did not occur prior to this date, but must be assumed
to have taken place reasonably soon thereafter.

EFFECT OF FLOODS ON THE DRIFT OF BENTHOS IN
THE BOMNAK RIVER (BASIN OF ZEYA RIVER)

V. V. Bogatov

UDC 577.472(28)

During the flood period, there is a very sharp depletion of benthos in river beds, especially on sandbars, mainly as the result of active drifts. The number of organisms passively drifting in two days of floods is equal to their number living along a 2-kilometer line of the river prior to the flood. Comparatively smaller forms are washed away from rocks and larger specimens from the sand. The number of animals at reaches and on sandbars was not restored one month after the floods.

The migrations of bottom-dwelling invertebrates in water thickness as a reaction to deteriorating living conditions most frequently caused by floods are of theoretical and practical significance. Migrating benthic organisms play a special role as a source of food for fishes, since plankton is virtually non-existent in rivers with rapid currents.

The investigations were carried out in the summer of 1975 on the Bomnak River (right tributary of Zeya River) near the village of Bomnak (925 km above the estuary of the Zeya). The river is 78 km long, average slope 5.8‰, bogs 10%, afforestation 88%, catchment area 491 km², average height of catchment 544 m with largest water discharge of 114 m³/sec, and smallest, 0.7 m³/sec (Muranov, 1966). Current velocity at reaches was 0.5-1.2 m/sec and at sandbars 1.5-2.0 m/sec. The bottom was essentially rocky (large and small pebbles), the intervals between the stones filled with coarse-grained sand, the water temperature in the summer 7-13°C. The river had not suffered anthropogenic pollution.

The animals were removed from the water thickness by traps of transparent silk (No. 39) with an opening of 12 × 12 cm² and 25 × 30 cm². The traps were set from 30 sec to 2 min. The organisms captured were counted and weighed on torsion scales. The current velocity was determined by the trolling reel GR-11. Fluctuations of the water level were observed with the help of gauges placed in the river bays.

Quantitative collections of benthos were carried out by generally accepted methods. At each section with a definite current velocity, 4 to 12 stones were removed from the water by a lift net and washed in a small basin. The area of the stone projection was determined by the weight method, following which the organisms were calculated per 1 m² of bottom area. It should be noted that this method does not take into account the considerable part of oligochaetes and larvae of midges living in the sand filling the intervals between the stones. We established that 70-80% of these animals in the Bomnak River inhabit the surface layer of sand at a depth of 2 cm. During his investigation of the larvae of midges in the dry zone of the Amur River, A. S. Konstantinov (1950) observed that even during severe desiccation of the ground the maximum larva population never dropped lower than 1-2 cm. Similar results were obtained at the Upper Volga reservoir (Pankratova, 1940). The thickness of the layer of sand under stones in the Bomnak River usually did not exceed 1-3 cm. This sand was collected by a tubular bottom sampler at 4-5 points. The number of organisms was calculated per 1 m² of bottom area and summed up with the results obtained for organisms washed off the stones. Thus the density of animals per 1 m² of bottom area was calculated. The species affiliation of the bottom organisms was determined by colleagues at the Zoological Institute, Academy of Sciences of the USSR: larvae of stoneflies by L. A. Zhil'tsova, caddis flies by T. V. Menshutkina, midges by V. Ya. Pankratova, black flies by I. A. Rubtsov, and mollusks by Ya. I. Starobogatov, to all of whom the author expresses his appreciation.

The largest mass species whose habitats in the Bomnak River are confined to reaches, sandbars and small bays are the larvae of midges Cricotopus gr. biformis Edw., Cr. gr. algarum Kieff, caddis flies Oligoplectorodes potanini Mart., stoneflies Suwallia teleekoensis Samal., Skwala brevis (Koponen), and mayflies.

Pacific Institute of Geography, Far East Science Center, Academy of Sciences of the USSR. Translated from *Ékologiya*, No. 6, pp. 36-41, November-December, 1978. Original article submitted December 24, 1976.

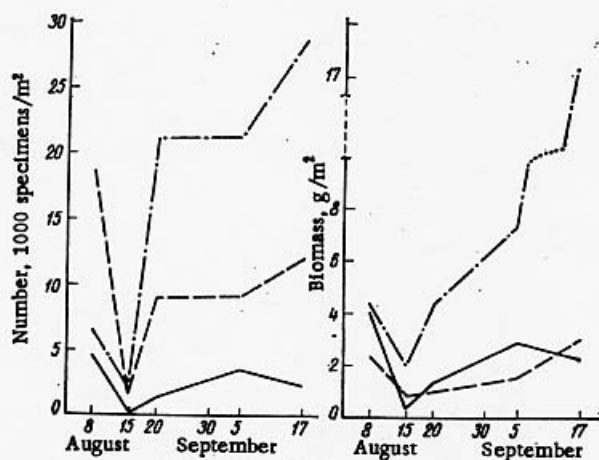


Fig. 1

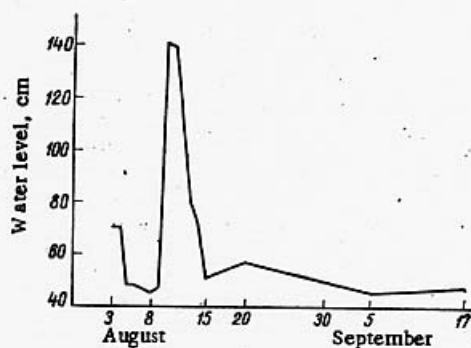


Fig. 2

Fig. 1. Population dynamics and biomass of animals of the stony ground of Bomnak River (excluding inhabitants of the sandy filler). Solid line) sandbar; dashed line) reaches; dashed and dotted line) bay.

Fig. 2. Fluctuation of water level in Bomnak River

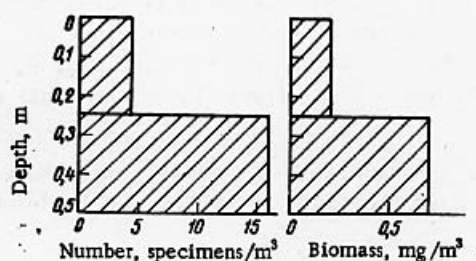


Fig. 3

Fig. 3. Vertical distribution of benthic organisms in the water thickness of Bomnak River (August 15 at 3 p.m.).

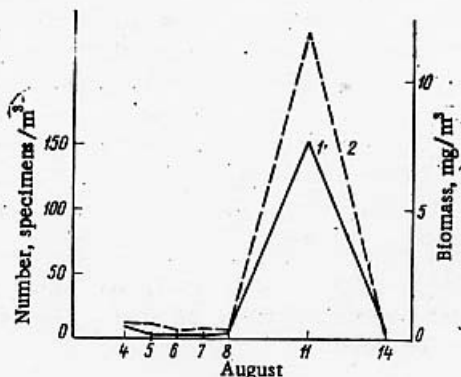


Fig. 4

Fig. 4. Drift dynamics of benthic organisms (1 is the number, 2 is the biomass) in the surface layer of water of Bomnak River.

In August-September the number of organisms on sandbars was much lower and the biomass higher than on reaches (Fig. 1). Such a difference in the biomass was the result primarily of the development on sandbars of large larvae of the midges *Gnus subvariegatum* Rubz. et Dr., *Gn. cholodkovskii* Rubz., *Simulium* (?) *vulgare* Rubz., and the larvae of the caddis flies *Mystarophora altaica* Mart. After the passage of the flood waters and flight of the midges in the middle of September, the biomass on sandbars became lower than on reaches. Fig. 2 shows the changes in the water level.

The maximum population and biomass of the bottom-dwelling animals were noted in a small bay where the current was practically nonexistent. The difference in comparison with the river bed was created at the expense of *Procladius* sp., *Chironomus* sp., *Hydatophylax nigrovittatus* Mel., *Capnia* sp., *Anisus baicalicus* (B. Dyb.), and the large number of *Cr. gr. biformis* inhabiting the bay.

It is well known that with the passage of flood waters the migrations of hydrobionts in the water thickness intensify; in Far Eastern rivers these migrations occur only at night (Levanidova and Levanidov, 1962, 1965; Levanidova, 1968; Klyuchareva, 1963; Zhuikova, 1974). The size of the drift of active migrants depends primarily on the number of their population (Levanidova and Levanidov, 1965; Pearson and Franklin, 1968); however it remains unclear to what extent the changes in bottom-dwelling communities occur during floods and at what rate these communities are eventually restored.

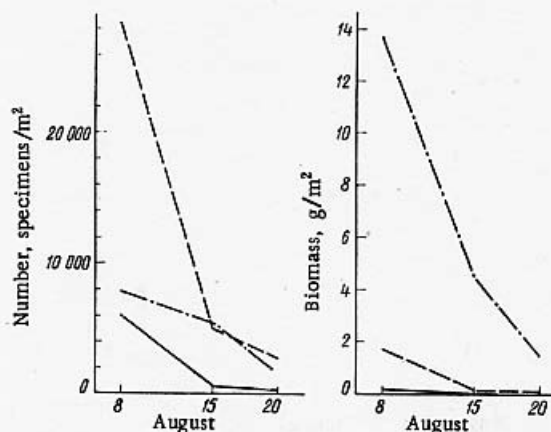


Fig. 5. Population dynamics and biomass of inhabitants of the sandy filler of stony ground of Bomnak River. Solid line) sandbar; dashed line) reaches; dashed and dotted line) bay.

Many active diurnal migrants among benthic organisms in European and American rivers are known at present (Muller, 1966; Besch, 1967; Anderson, 1967; Waters, 1968, 1972, and others). In Kamchatka rivers an increase in number of midge larvae has been observed during the day (Levanidova and Nikolaeva, 1968); the drift of water mites in the Pritornaya River (Sakhalin Island) is also confined to daytime (Zhul'kov and Shershnev, 1975). It cannot be stated with reliability that the increase in number of midge and water mite larvae in these cases is the result of active drift, since the authors do not present data on the vertical distribution of the animals in the water thickness. Among the organisms in Bomnak River washed away during the day, the larvae of *Cr. gr. algarum*, *Cr. gr. biformis* and of water mites predominated. In our case we probably observed the passive drift of organisms, since the number of animals in the benthic layers was high (Fig. 3), while a large part of the organisms always ascended to the surface during active migrations (Levanidova and Levanidov, 1965; Waters, 1965, and others).

During the flood of August 10-11, the passive drift of benthic organisms considerably increased. The number of organisms per 1 m³ of the surface layer of water increased by 50 times and their biomass by 25 times (Fig. 4) during the flood.

For one of the streams in the state of Minnesota, Waters (1962) reported the maximum figure of nocturnal bottom-dwelling animals carried downstream in August as 161,000 specimens/h per 1 m² of the river section. Bottom-dwelling animals carried downstream in the Sokoch River (Kamchatka) proved to be 20 times lower (Levanidova and Nikolaeva, 1968) and in the Belaya River (Sakhalin Island) 18 times lower (Zhuikova, 1974). Our data reveal that during the passage of flood waters in the reach of the Bomnak River, the passive drift alone in the evening hours (7 p.m.) was 891,000 specimens/h per 1 m² of the river section, about 5.5 times higher than shown in Waters' data. Consequently, if up to the time of the flood the number of organisms at the reach came to 47,170 specimens/m², then during the flood in the surface layer of water alone, there was transported within one hour through 1 m² of river section that number of benthic animals corresponding to their number per 20 m² of the bottom area of the reach. If the area of the river section at the reach was approximately equal to 20 m² and if the average width of the river was taken as 10 m, then in two days of floods the number of organisms transported only by passive drift would correspond to their number per 19,000 m² of bottom area of the reach, or approximately to 2 km of the river length.

Two kilometers is 2.6% of the overall river length; hence only a very insignificant part of the benthos drifts passively at the time of flooding. However, after the passage of flood waters, the number of organisms inhabiting stones decreases by 22 times on sandbars and the biomass by 10 times, at the reach by 11 and 3 times, respectively, and in the bay by 3 and 2 times, respectively (Fig. 1). The number of animals living in the sand filling in the intervals between stones decreases on sandbars by 12 times, the biomass by 50 times, at the reach by 6 and 16 times, respectively, and in the bay by 1.5 and 3 times, respectively (Fig. 5). Thus a large part of the organisms must be transported at night during the time of active drift. As will be seen from the foregoing data, flooding results in the number of animals inhabiting stones decreasing greater than their biomass, while the biomass of the inhabitants of sand decreases greater than their number. From this it follows that much smaller forms are washed away from the stones and comparatively larger ones from the sand. The greatest changes in number and biomass during the passage of flood waters occur on sandbars.

After flooding the diurnal drift of organisms fell sharply and the number and biomass of the bottom-dwelling invertebrates started to increase at the reach, on sandbars, and in the bay. The biomass of benthos in the bay was restored five days after the flood and the number of organisms exceeded the number prior to the flood by three times. However, the size of the population on the sandbar and reach during August and the first half of September did not attain the initial values. The biomass at the reach was restored in the middle of September, in general, due to the growth of the animals (Fig. 1).

LITERATURE CITED

- Anderson, N. H., "Biology and downstream drift of some Oregon Trichoptera," *Can. Entomol.*, 99 (1967).
- Besch, W., "Driftnetzmethode und biologische Fließwasseruntersuchung," *Verh. Internat. Verein. Limnol.*, 16 (1967).
- Klyuchareva, O. A., "The descent and diurnal migrations of bottom-dwelling invertebrates of the Amur," *Zool. Zh.*, 42, No. 11 (1963).
- Konstantinov, A. S., "Midges of the Amur River basin and their role in feeding of Amur fishes," *Trudy Amurskoi Ikhtologicheskoi Ekspeditsii*, 1945-1949, Vol. 1 (1950).
- Levanidova, I. M., "Benthos of tributaries of the Amur (an ecological-faunistic account)," *Izv. TINRO*, 64 (1968).
- Levanidova, I. M. and Levanidov, V. Ya., "Migrations of bottom-dwelling invertebrates in the water thickness of Far Eastern rivers," *Izv. TINRO*, 48 (1962).
- Levanidova, I. M. and Levanidov, V. Ya., "Diurnal migrations of bottom-dwelling larvae of insects in river flow. I. Migration of mayfly larvae in Khor River," *Zool. Zh.*, 44, No. 3 (1965).
- Levanidova, I. M. and Nikolaeva, E. T., "Bottom-dwelling animals carried downstream in the rivers of Kamchatka," *Izv. TINRO*, 64 (1968).
- Müller, K., "Die Tagesperiodik von Fließwasserorganismen," *Z. Morphol. Oekol. Tiere*, 56 (1966).
- Muranov, A. P. (ed.), *Resources of Surface Waters of the USSR. The Far East [in Russian]*, Gidrometeoizdat, Moscow, 18, No. 1 (1966).
- Pankratova, V. Ya., "Distribution of bottom fauna in the Upper Volga reservoir in connection with artificial fluctuation of the level," *Zool. Zh.*, 19, No. 5 (1940).
- Pearson, W. D. and Franklin, D. R., "Some factors affecting drift rates of *Baetis* and Simuliidae in a large river," *Ecology*, 49, No. 1 (1968).
- Waters, T. F., "Diurnal periodicity in the drift of stream invertebrates," *Ecology*, 43, No. 2 (1962).
- Waters, T. F., "Interpretation of invertebrate drift in stream," *Ecology*, 46, No. 3 (1965).
- Waters, T. F., "Diurnal periodicity in the drift of a day-active stream invertebrate," *Ecology*, 49, No. 1 (1968).
- Waters, T. F., "The drift of stream insects," *Ann. Rev. Entomol.*, 17 (1972).
- Zhuikova, L. I., "Drift of benthos in the Belaya River (southeastern Sakhalin)," *Izv. TINRO*, 93 (1974).
- Zhul'kov, A. I. and Shershnev, A. P., "Material on the diurnal drift of aquatic invertebrates in Pritornaya River (eastern coast of Sakhalin Island)," *Izv. TINRO*, 95 (1975).