Freshwater Biological Association

FBA Translation (New Series) No. 152

Title: Feeding of *Gammarus lacustris* Sars under different conditions of habitation.

Author(s) Skoptsov V.G.

Reference: In *Troficheskie svyazi presnovodnykh bespozvonochnykh* (ed. G.G. Vinberg). Leningrad. Zool.Inst.AN SSSR, pp 94-98

Original language: Russian

Date of publication of original: 1980

Translator: J.E.M. Horne

Date of publication of translation: 1982

Number of pages of translation: 4pp

FBA Translations are to be considered as "provisional". As a rule they have not been prepared by expert translators, nor have they been edited by the original authors.

They are available from The Librarian,
Freshwater Biological Association,
The Ferry House,
Far Sawrey,
AMBLESIDE
Westmorland,
England,
at the current rate for xerox copying.

F.B.A. Translation (N.S.) No. 152

Translated by: J.E.M. Horne

Feeding of Gammarus lacustris Sars under different conditions of habitation.

V.G. Skoptsov (1980)

In Troficheskie svyazi presnovodnykh bespozvonochnykh (ed. G.G. Vinberg). Leningrad. Zool.Inst. AN SSSR, pp 94-98

The amphipod Gammarus lacustris, a regular representative of lacustrine communities, often plays a significant role in the transformation of matter and energy. The object of the present work was to clarify the quantitative side of the feeding of the amphipod under different conditions of habitation.

Experimental works on determination of the rate of consumption of food and its dependence on body-weight were carried out in the summer periods 1975-1978 on three water-bodies of the Krasnoyarsk region, of different conditions of habitation for the amphipods.

Lake Belyo is a lake without outflow (Area 7714 ha and max. depth 46m.) The water of the lake belongs to the sulphate class, magnesium-sodium group. The mineralization of the water is 8.0 - 10.9 g/l. The amphipods in the lake live in the pelagial. In their food are preferred the planktonic crustaceans Diaptomus salinus Daday and Daphnia magna Straus, less commonly found are detritus and diatom algae. The amphipods in L. Belyo are the final link in the food chain, since the ichthyofauna of the lake is virtually absent.

Lake Bolshoye is a freshwater lake (area 3450 ha, max. depth 29m.). Mineralization of the water is 0.2 - 0.4 g/l. The amphipods in this lake are found mainly in thickets of Chara from the waters' edge to a depth of 5m. In the food of the crustaceans charophyte algae predominate, while remains of chironomid larvae, cladocerans and diatom algae are found.

The pond of the Uzhursk fish-farm is a drainage water-body 3 ha in area and max. depth 2m. The water is hydrocarbonate-soda, mineralization is not greater than 0.4 g/l. The crustaceans are found over the whole water-body in thickets of pondweed (Potamogeton), Myriophyllum and Typha. In the digestive tract are recorded detritus, remains of cladocerans, higher aquatic plants and green algae.

In the experiments with amphipods from L. Belyo, adult individuals of D. salinus, the mean weight of which, from the result of weighing 2000 examples, equalled 0.076 mg, were taken as food. In flasks of capacity 200-300 ml were placed 1-3 amphipods. The concentration of food at the beginning of the experiment comprised 30-50 specimens of Diaptomus to one flask, so that on average it corresponded to the density of diaptomids in the lake. The time of exposure in the flask was 2-4 hours. The differenc between the predetermined quantity of food and its quantity at the end of the experiment was taken as equal to the ration of the crustaceans.

In the experiments with amphipods from the pond and L. Bolshoye the food consisted of higher aquatic plants: in the first case pondweed, in the second Chara. In a flask of 0.7 - 1.0 l volume were placed 5 - 10 crustaceans and weighed vegetation was added, first of all dried on filter-paper. The quantity of food varied from 88 to 470 mg. After the experiment the remains of the plants were collected, dried on filter-paper and weighed. The time of exposure equalled one day. The experiments in all cases were carried out at a temperature range of 17 - 22°.

For balancing the data obtained at different temperatures, it was assumed that the rate of feeding in crustaceans conforms to the same temperature dependence as the intensity of metabolism, therefore all data were taken to 20°C by readjustment, done with Krogh's curve (Vinberg, 1956). In all we carried out 105 experiments with crustaceans from L. Belyo (70 during daylight and 35 at night), 27 experiments with animals from the pond and 58 experiments from L. Bolshoye.

The dependence of the rate of food consumption on body weight in the investigated animals is well described by an exponential equation of the type:

$$C = pW^k$$

where C + the calculated ration for the whole organism (mg/day); W = the weight of the animal in mg; p and k are constants.
For evidence of the exponential relationships were used the logarithmic form of the equation:

$$\log C = \log p + k \log W$$

and we determined the linear correlation (r) between log C and log W. Coefficients of regression were calculated by the method of least squares (Lakin ,1973). The obtained coefficients of correlation (Table 1) indicate the extremely close relationship between ration and body weight in the studied animals.

The rate of consumption of food in the crustaceans from L. Belyo in different times of daylight was not definitely distinguished. At night time it decreased and did not exceed 30% of the daytime value. Therefore in the calculation of the value of the diel ration, only the daylight data were taken. The reduction of the rate of consumption of food by night probably can be explained by the lowering, in the darkness, of the visual reaction of the crustaceans to the victim. The intensity of feeding (C_x) of individuals from Lake Belyo with increasing size was reduced proportionally to the body weight to the power -0.33, i.e. it was expressed by the equation: $C_x = 0.56W^{-0.33}$, where $C_x = C/W$

For the amphipods from the pond this relationship was expressed by the equation:

$$C_x = 0.27W^{-0.33}$$

for crustaceans from Lake Bolshoye:

$$C_x = 1.12W^{-0.41}$$

If the indicated relationship is broadened to the limiting value of the size of the amphipods, which did not come into the experiments, then the ration during life declines in the first case from 84% to 11% of body weight, in the second from 40% to 5% and in the third from 130% to 17%.

The dependence of the ration on body weight in the amphipods from Lake Bolshoye was calculated only for individuals of the summer generation, appearing in June-August. In crustaceans of the autumn generation in the range of experimental temperatures (17 - 22°), a depression of the feeding processes was observed. In contrast to summer individuals the maximum rate of food consumption by the autumn crustaceans was found within the range 14-16^{o} (Table 2).

Evidently, the temperature history of the development of the individual shows up in the temperature optimum of food consumption, therefore it was not possible to combine the result of experiments with individuals of different generations.

In the derived equations (Table 1) for individuals of the summer generation, living in various conditions and consuming different food, the constant k appeared comparatively similar. In the report of L.M. Sushchenya (1975) for the class of crustaceans k is within the limits 0.34 - 0.94. In Orchestia bottae from the order Amphipoda from the Black Sea the value of k did not differ from that obtained by us (0.67).

The difference of constant p was more significant, but fully explained. The low value of this factor in amphipods of the pond population is explained not as much by living conditions as by the kind of offered food. Evidently, pondweed, used in the experiment as food, does not correspond to the favourite food and in the conditions of a short-term experiment, is avoided by the crustaceans. Similar results were obtained by V.G. Stroikina (1957) for amphipods from Lake Sevan. According to her data on the feeding of the crustaceans on animal food their daily ration comprised about 40% of body weight, but feeding on vegetable food was 2.6 - 13.3%. As evidence of what is said can be taken the values of the rate of metabolism in the amphipods, obtained by experimental methods:

$$P = 0.24W^{0.75}$$

where P is the value of the rate of metabolism in kilocalories/day; W = weight, mg. If it is considered, that the caloricity of pondweed is not more than 0.8 kcal/g (Lake Khakassin, 1976), then the ration of the crustaceans does not even offset the demand in metabolism.

The differences in the energetic value of the food of the amphipods in the two studied lakes shows up in the ration of the amphipods. According to unpublished data of L.D. Mitsukova the caloricity of Diaptomus represents on average 1.0 kcal/g, of Chara 0.6 kcal/g. If the ration is expressed in energetic units the constants p in the equation would have more similar values: for amphipods of Lake Belyo 0.56, for amphipods of Lake Bolshoye 0.67.

Thus, the relationship of the ration to bodyweight in Gammarus lacustris is well approximated by an exponential equation, and the exponent slightly depends on the conditions of living and the quality of the food.

REFERENCES

Vinberg G.G. (1956). Intensity of metabolism and food consumption of fish. Minsk, 256pp

Lakin G.F. (1973). Biometry. Moscow, 342pp

Trudy Krasnoyarsk. Otdeleniya Sibrybniiproekt (1976). Lake Khakassin and its fish-cultural importance. Krasnoyarsk. 11, 206pp

Stroikina V.G. (1957). Trudy Sevanskoi gidrobiol. St. AN Arm SSR, 15, 89-109

Sushchenya L.M. (1975). Quantitative estimation of the feeding of crustaceans. Minsk, 206pp

Table 1

Parameters of exponential equations, combining ration and body weight in *G. lacustris*.

Water body	W	p	k	G/gp	Gk	r	Kind of food
L. Belyo	3-115	0.56	0.67	0.030	0.037	0.91	Diaptomus
Pond	7- 56	0.27	0.67	0.100	0.088	0.82	Pondweed
L. Bolshoye	1- 44	1.12	0.59	0.002	0.023	0.96	Chara

Table 2

Diel ration (mg) of amphipods of L. Bolshoye under different temperatures.

t^o	Summer generation W = 3 mg.	Autum generation W = 11 mg.
7	-	1.57 ± 0.24
9	1.30 ± 0.14	3.64 ± 0.36
12	1.83 ± 0.19	-
14	2.24 ± 0.27	4.10 ± 0.41
18	-	3.61 ± 0.29
20	2.44 ± 0.21	2.65 ± 0.21

Notice