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# THE SPRING AND SUMMER NUTRITION OF THE 300—500 G PIKE-PERCH (*LUCIOPERCA LUCIOPERCA* L.) IN LAKE BALATON IN 1968. II. THE CALCULATION OF THE CONSUMPTION, DAILY AND MONTHLY RATIONS

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The study of natural food resource and digestive enzymes of fish began at the end of the last century, then realizing the importance of digestion rate in fish production (RICKER, 1946) the attention was concentrated upon to estimate the quantity of food turnover. Nowadays it became of primary interest to determine on the basis of stomach contents analysis and results achieved in connection with digestion experiments the daily ration and daily consumption of food under natural conditions.

For estimating the daily and monthly ration and the daily (24 hours) food consumption of fish several methods are known (SURBER, 1930; BAJKOV, 1935; DARNELL and MEIEROTTO, 1962; SEABURG and MOYLE, 1964; FORTUNATOVA, 1950 cit. POPOVA, 1967).

MOLNÁR and TÖLG elaborated (1961) an X-ray method to estimated under laboratory conditions the length of time necessary for stomach evacuation on predatory fish belonging to different groups of water temperature. HUNT (1960) measured volumetrically with the method of water displacement the rate of digestion in some species of fish, WINDELL (1966, 1967) determined the dry content of the digestible part of food in individual digestive phases in common sunfish.

Our home literature in this line is rather poor hardly got beyond the study of qualitative-quantitative composition of fish food under natural conditions, and that too is only in connection with the investigation of Lake Balaton.

Among the fishes of Lake Balaton, in respect of stomach contents investigations, pike-perch is the most thoroughly studied species. For the quality and quantity of the seasonal food of 300—500 g pike-perch are fairly well known (WOYNÁROVICH, 1959; BIRÓ and ELEK, 1969), and the periods necessary for the evacuation on stomach at different temperatures are precisely deliniated (MOLNÁR and TÖLG, 1962; MOLNÁR et al. 1967) thus, possibility was offered to estimate the daily and monthly consumption of pike-perch on the basis of food quantity found in the stomachs, further, it became possible to calculate the daily and monthly rations and to infer data concerning the intensity of their feeding.

## Methods

In our calculations we made good use of the data already published in a previous paper (BIRÓ and ELEK, 1969). On the basis of measured and estimated total weight of food taken at the time of the last intake of food we divided the stomach contents into 6 groups and calculated the distribution of feeding pike-perch according to the number of individuals within each stomach contents weight-group. We have established by weight-groups the original total body weight of fish serving for food found in the stomachs of pike-perch (WOYNÁROVICH, 1959; BIRÓ and ELEK, 1969), calculated the group means, the standard deviations and variation coefficients. We made good use of *Arrhenius equation*, also employed by MOLNÁR et al. (1967), in calculating the periods necessary for the evacuation of stomachs at different temperatures for the average monthly temperature of the water of Lake Balaton (on the basis of temperatures taken in front of our Institute). The periods necessary for the evacuation of the stomach were given in hours, of which we could calculate the number of monthly intake of food (feeding intensity). The daily and monthly consumption have been calculated, on the basis of BAJKOV (1935) method, grouping according to stomach contents weights, in the case of each feeding pike-perch, by the following formula:

$$\text{daily consumption} = \frac{\text{average amount of food in the stomach}}{} \cdot \frac{24}{\text{rate of digestion}}$$

then the average was taken from the results obtained.

The daily and monthly rations were obtained from the data of consumption. We have estimated the extreme values of consumption and rations on the basis of minimum and maximum weights of the stomach contents.

## Results

*Feeding intensity*

The original body length and weight of the ingested fish for food were estimated to a fair accuracy by the backbone, pharyngeal bones, operculum and the scales. Conclusions were drawn from the stomach evacuation periods in the function of average water temperature to the number of monthly intake of food *(Table 1)*. In March, at a temperature of 5.9 °C in the water the time

*Table 1*

| | *t* | *y* | *i* |
|---|---|---|---|
| March | 5.9 | 247.2 | 3 |
| April | 15.7 | 65.0 | 11 |
| May | 20.3 | 45.7 | 16 |
| June | 19.3 | 48.9 | 15 |
| July | 22.7 | 39.2 | 19 |
| August | 21.0 | 43.6 | 17 |

t = average water temperature in °C; y = time of digestion in hours (period of stomach evacuation); i = number of intakes of food per month.

necessary for stomach evacuation, compared to warmer months, was 4—6 times longer, which period, as the temperature rose, became shorter, attaining a 1—3 day period; the intake of food recurred in every 1—2 days. In March, the length of time necessary for digestion exceeded 10 days, rendering about 3 intakes of food; in April, this number lessened to 3 days which means that 11 intakes of food may take place. The most intensive period for intake of food occurred in July when the total amount of ingested food required only about a day and a half to pass from the stomach to the pylorus fulcrum and the intestine, calculating the time length in 6-month average: this value was the shortest, in actual fact in meant about 19 intakes of food per month.

*Consumption*

The measured and estimated total weight of stomach contents of feeding pike-perch showed varying values between March and August, the highest values were reached in March and July, while the lowest occurred in June. The nutritional mean calculated for one pike-perch ($\Sigma$ x/n) may only be informative in the light of real consumption *(Table 2)*. During the period of investigation most pike-perch stomachs contained not more than 1—5 g food, 6—10 g or more was only found sporadically. The stomach contents within the appropriate weight group, the divergence from average and variational coefficients were almost the same. The food weight per individual distribution is

*Table 2*

| | *N* | *n* | $\Sigma x$ | $\Sigma x/n$ |
|---|---|---|---|---|
| March | 206 | 140 | 1265 | 9.35 |
| April | 112 | 88 | 682 | 7.75 |
| May | 135 | 121 | 889 | 7.35 |
| June | 65 | 46 | 410 | 8.91 |
| July | 257 | 232 | 1746 | 7.52 |
| August | 145 | 117 | 826 | 7.06 |

N = total number of examined pike-perch; n = number of feeding pike-perch; $\Sigma$x = total weight of stomach contents of n-number of pike-perch in grams $\Sigma$x/n= average of food falling to one feeding pike-perch in grams.

falling short of normal considering feeding pike-perch *(Figs 1—6)*. In March, the calculated daily consumption was rather low in spite of the fact that the total food weight found in the stomach was comparatively high (1265 g). In the following months the amount of daily consumption increased until July. The consumption was most intensive in July: in average 4.6 g/ individual per day, while the August value fell back to the level of May. According to our calculations the food consumption for March was 2.7g/ individual per month, this value greatly increased in April, and gradually reached the value 87.5 g/individual per month by July, then in August this value decreased. The total consumption calculated for one pike-perch in the spring and summer months

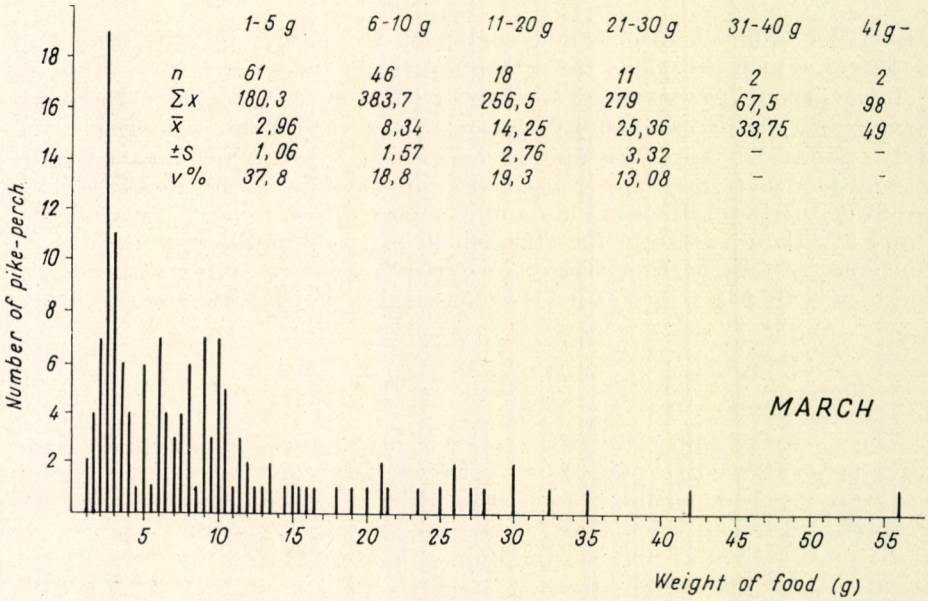


*Fig. 1.* The distribution of feeding pike-perch according to the weight of stomach contents per number of individuals in different months.
Sequence of numbers within the weight groups of stomach contents:
n = number of feeding pike-perch;
Σx = total weight of stomach contents of n-number of pike-perch in grams;
x̄ = arithmetical mean of food weight groups;
±s = standard deviation;
v% = variational coefficient

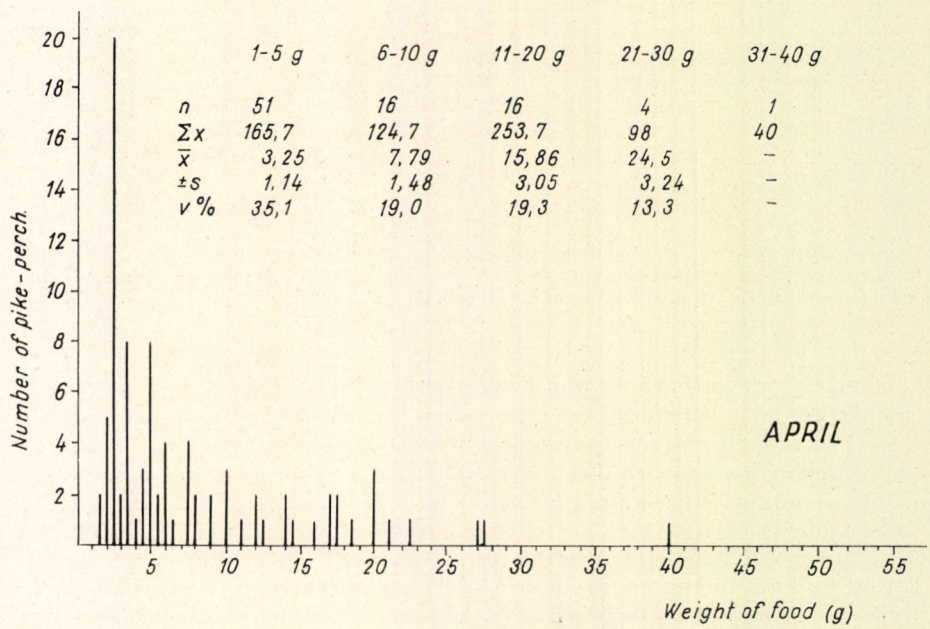


*Fig. 2*

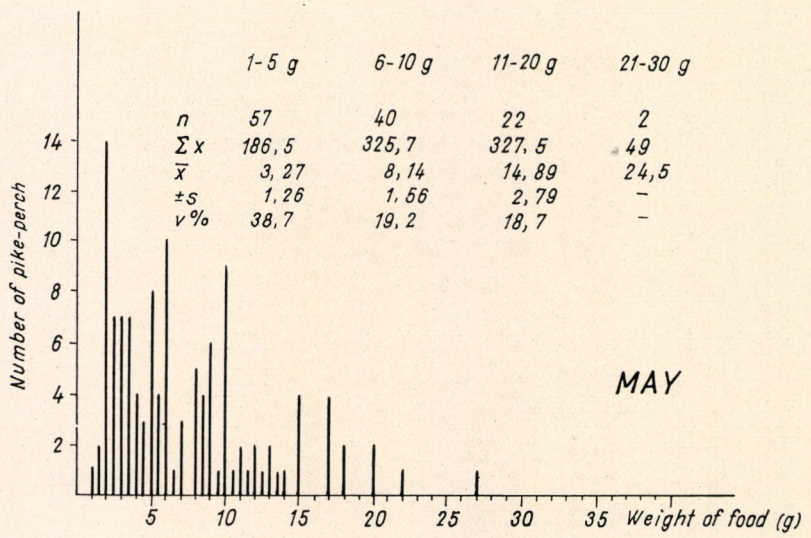


*Fig. 3*

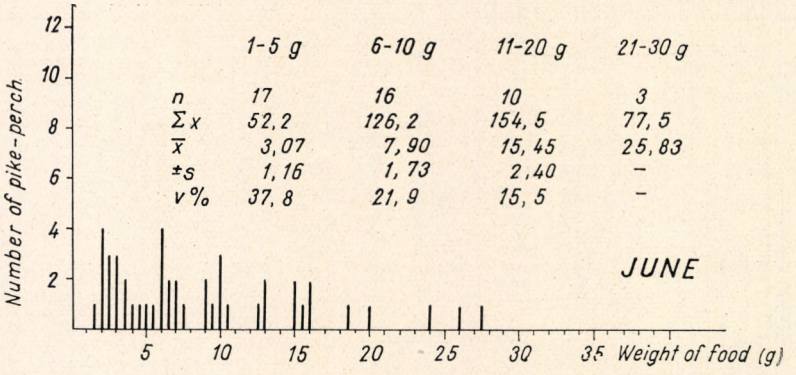


*Fig. 4*

was 315 g *(Table 3)*. The estimated minimum and maximum daily and monthly consumption data diverge to a great extent from the average when the extreme values of the weights of stomach contents are considered *(Table 4)*.

## *Daily ration*

According to our data on fourth grade pike-perch in Lake Balaton the daily ration (i.e. the weight of the daily consumed food per the percentual average body weight of 390 g pike-perch) in the spring and summer months of 1968 was 0.87%; monthly ration 13.45%. On six monthly totalizing we found that the amount of ingested fish reached only 80.73% of the average

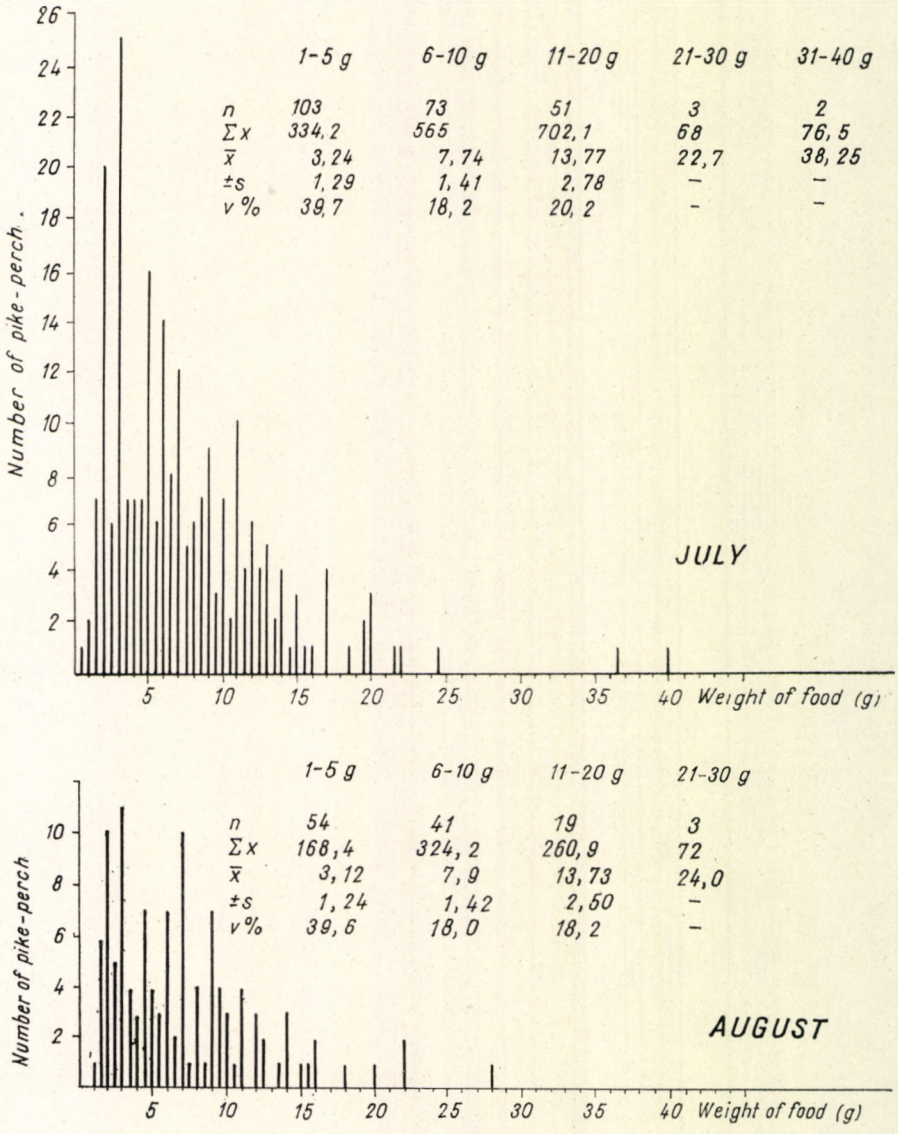


*Fig. 5*

*Figs 2—6.* Explanation see under *Fig. 1*

body weight of pike-perch *(Table 3)*. The relative indices of consumption in average extreme values gave 0.24—3.76% per day and 1.75—57.05% per month *(Table 5)*.

*Table 3*

| | $D_c$ | $M_c$ | $D_r$ | $M_r$ |
|---|---|---|---|---|
| March | 0.9 | 2.7 | 0.23 | 0.69 |
| April | 2.9 | 31.5 | 0.74 | 8.07 |
| May | 3.9 | 61.7 | 1.00 | 15.82 |
| June | 4.4 | 65.6 | 1.12 | 16.82 |
| July | 4.6 | 87.5 | 1.17 | 22.41 |
| August | 3.9 | 66.0 | 1.00 | 16.92 |
| Total | 20.6 | 315.0 | 5.26 | 80.73 |
| Average | 3.4 | 52.5 | 0.87 | 13.45 |

$D_c$ = daily consumption in grams; Mc = monthly consumption in grams; Dr = daily ration; $M_r$ = monthly ration

*Table 4*

| | $D_c$ | | $M_c$ | |
|---|---|---|---|---|
| | min. | max. | min. | max. |
| March | 0.09 | 5.44 | 0.29 | 16.33 |
| April | 0.55 | 14.77 | 6.09 | 162.45 |
| May | 0.53 | 14.18 | 8.40 | 226.84 |
| June | 0.73 | 13.47 | 11.02 | 202.04 |
| July | 0.31 | 24.50 | 5.82 | 465.27 |
| August | 0.55 | 15.41 | 9.36 | 262.04 |
| Total | 2.76 | 87.77 | 40.98 | 1334.97 |
| Average | 0.46 | 14.63 | 6.83 | 222.50 |

$D_c$ = daily consumption in grams; $M_c$ = monthly consumption in grams (minimum and maximum values)

*Table 5*

| | $D_r$ | | $M_r$ | |
|---|---|---|---|---|
| | min. | max. | min. | max. |
| March | 0.03 | 1.40 | 0.07 | 4.20 |
| April | 0.14 | 3.80 | 1.56 | 41.65 |
| May | 0.13 | 3.64 | 2.15 | 58.16 |
| June | 0.19 | 3.45 | 2.83 | 51.80 |
| July | 0.79 | 6.30 | 1.50 | 119.30 |
| August | 0.14 | 3.95 | 2.40 | 67.20 |
| Total | 1.42 | 22.54 | 10.51 | 342.31 |
| Average | 0.24 | 3.76 | 1.75 | 57.05 |

$D_r$ = daily ration; $M_r$ = monthly ration (minimum and maximum values in the average body weight percentage of 390 g pike-perch)

## Discussion

Observations in connection with the intake of food as well as the investigations concerning this draw attention to the decisive importance of temperature influencing the length of time necessary for the digestion of food. MOLNÁR et al. (1967) stressed that generally pike-perch only consume further amount of food if the stomach contents are already liquefied and passed down into the pylorus fulcrum and intestine. There are observations to the effect that the digestive period is a function of the quality of food (WINDELL, 1966, 1967; POPOVA, 1967) and that a smaller amount of food is digested in shorter period of time than a bigger amount (BARRINGTON, 1957; HUNT, 1960). DARNELL and MEIEROTTO (1962) in investigating black bullheads *(Ictalurus melas)* came to the conclusion that the digestion of the standard food is an indicator to the digestion of other food-items.

According to our observations the majority of pike-perch in Lake Balaton ($\gtrapprox$ 76%) only consumed 1—2 fish consisting mainly of bleak *(Alburnus alburnus)* ($\gtrapprox$ 46%) (BIRÓ and ELEK, 1969). Thus taking bleak as the standard food, its relative stomach evacuation periods serve as essential footing to estimate the average ration and consumption (MOLNÁR and TÖLG, 1962; MOLNÁR et al. 1967).

Under experimental conditions the rate of digestion is the function of different stress-effects depending on the sensibility of the fish (WINDELL, 1966). Under natural conditions besides temperature the rate of consumption and the time necessary for digestion are the function of the physiological conditions (condition, age, body length, etc.). It has been established that the turnover of food in young fish in comparatively higher than in the older specimens, and that their rate of digestion is faster. The differences existing between the qualiative and quantitative composition of stomach contents bear revelance to the body length, growth, density of population and the inter- and intraspecific competition of the fish (RICKER, 1946; SEABURG and MOYLE, 1964).

According to investigations under experimental conditions carried out on pike-perch it was found that the rate of digestion was 8—9 times higher in summer than in winter (MOLNÁR et al. 1967), therefore it might be expected that the rate of consumption increase by a similar scale.

The feeding intensity and consumption determined on the basis of stomach evacuation periods are to a great extent influenced by the environmental factors existing in Lake Balaton. The differences between the calculated and measured values may be explained in the physiology of pike-perch, in the accessibility of natural food resources, in its distribution as well as in the selection.

Pike-perch is a seratim feeding animal, in its rhythm of life longer on shorter starving periods may be observed stemming perhaps from physiological reasons, e.g. in April before spawning (WOYNÁROVICH, 1959). Intensive intake of food occurs in the summer months perhaps because the vast shoals of fry of the nutritive fish appear and because of the higher water temperature (BIRÓ and ELEK, 1969). RADAKOV (1961, 1965) says that it is more difficult for the predatory fish to gain its prey from shoals than taking from sporadically occurring individuals, however, in certain instances the opposite is true, e.g. in winter when the motility of fish is somewhat impeded. The accessibility of

food, besides temperature, fundamentally influences the number of pike-perch with a full stomach and the ones with an empty stomach. Certain species (individuals) appear in greater numbers at sites where the nutritional conditions are more favourable (RICKER, 1946).

The ingested prey's original weight indicates that the greatest amount of food reaches the stomach in early spring and at the end of summer *(Table 2)*. The "factor of voracity" in the pike-perch of Lake Balaton (WOYNÁROVICH, 1959) is low mainly because of environmental and food accessibility circumstances. In six monthly average only a more 0.2—0.5% of the examined fish reached food intake of 10% of body weight, or of a near value (BIRÓ and ELEK, 1969: food coefficient). The distribution of pike-perch according to the mass of stomach contents shows that only a small number of the fourth grade pike-perch reaches satiety *(Figs 1—6)*. Two-year old specimens of *Abramis* and *Blicca* would mean sufficient amount of nourishment, of which one specimen would suffice to reach the degree of satiety, on the other hand, the significantly smaller bleak *(Alburnus alburnus)* and ruffe *(Acerina cernua)* on which pike-perch feed means of course under-nourishment.

It is a well known fact that pike-perch is a cautious pedatory animal fastidious in respect of shape and size and usually consumes the same type of fish throughout its life (WOYNÁROVICH, 1959; SEABURG and MOYLE, 1964).

The amount of the consumed food of the 300—500 g pike-perch rarely exceeds two per cent of the body weight *(Table 3)*. The divergences from average (individual variations) may be attributed to the nutritional possibilities for the food stock of the Lake seems to be sharply deliniated to certain areas as based on the investigations carried out on stomach contents (BIRÓ and ELEK, 1969). According to the investigations of DAWES (1930) it may be assumed that a smaller quantity of food be better utilized, i.e. the utilization of food in the case of pike-perch of Lake Balaton must be of a good efficiency. From this it follows that at different water temperatures full stomachs do not realize the same values in respect of fish production. The relative index of daily consumption indicates a low level of food turnover in the case of pike-perch. According to WINDELL (1966, 1967) the "actual daily rations" falling between the extreme values of maximum and minimum of the daily rations are in close connection with growth and production *(Tables 3—5)*. The daily and monthly rations are decisive factors on the rate of uneven growth influenced by under-nourishment (TÖLG, 1961).

In comparing our data to foreign results it is revealed that pike-perch of Lake Balaton from quantitative point of view are poorly fed. The yearly consumption of pike-perch inhabiting Volga delta is 2.02—2.39 kg taking one kilogram body weight (POPOVA, 1967). KARPEVICH, A. F. (cit. in: RICKER, 1946) in investigating pike-perch of Sea of AZOV *(Stizostedion lucioperca)* found that the monthly consumption in the winter-summer period varied between 0 and 1.5 times of body weight. In summer the daily ration reached 5% of body weight (average 0.58, taking into consideration the total quantity it was near 7.0 per year). The annual consumption of the whole population was 309.000 tons, i.e. 7.8 tons per km$^2$, according to his estimation.

SEABURG and MOYLE (1964) in investigating the summer nutrition of fish inhabiting two lakes of warm water situated in west Minnesota, observed that the centrarchid panfishes, among them walleye *(Stizostedion vitreum)*, had a daily ration of 1—2% of the body weight.

To give a sufficiently correct answer on the question that how inter- and intraspecific competition influence the rations in the function of fish-population density is only possible after an examination of food consumed by different species of fish (primarily of the introduced eel) and the estimation of fish stock.

## Summary

Author established on the basis of six monthly experimental periods that the 300—500 g pike-perch inhabiting Lake Balaton feed most intensively in July: stomach evacuation occurs every day and a half meaning that the animal is capable to consume food 19 occasions per month.

The total weight of stomach contents of feeding pike-perch was 410 g in June, the lowest value, while in March and July it was 1265 and 1745 g, respectively, having been the highest value. The nutritional average falling to one pike-perch is only informative in nature because great differences occurred when compared with the calculated daily consumption.

The daily and monthly consumption of one pike-perch is small, in an average it only yields 3.4 g and 52.5 g. The quantity of food consumed over a period of six months was 315 g, which is 80.73% of the body weight.

On the basis of the data obtained it became clear that the food turnover of the fourth grade pike-perch inhabiting Lake Balaton is rather low.

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## REFERENCES

BAJKOV A. D. (1935): How to estimate the daily food consumption of fish under natural conditions. — *Trans. Amer. Fish. Soc.* **65,** 288—289.

BARRINGTON C. J. W. (1957): The alimentary canal and digestion, pp. 109—161. — In BROWN M. E. (Ed.) *The Physiology of Fisches,* Vol. I. *New York, Acad. Press, Inc.*

BIRÓ P., ELEK L. (1969): The spring and summer nutrition of the 300—500 g pike-perch *(Lucioperca lucioperca* L.) in Lake Balaton in 1968. I. Data bearing relation to the nutritional conditions proceeding the destruction of fish in 1965. — *Annal. Biol. Tihany* **36,** 135—149.

DARNELL R. M., R. R. MEIEROTTO (1962): Determination of feeding chronology in fishes. *Trans. Amer. Fish. Soc.* **9,** 313—320.

DAWES B. (1930): The absorption of fats and lipids in the plaice. — J. *Marine Biol. Assoc. U. K.* **17,** 75 102. (Cit.: BWOWN, M. E.: The Physiology of Fishes 1, *New York, Acad. Press,* 1957, 146.).

HUNT B. P. (1960): Digestion rate and food consumption of Florida gar, warmouth, and largemouth bass. — *Trans. Amer. Fish. Soc.* **89,** 206—210.

MOLNÁR Gy., I. TÖLG (1961): Untersuchung der Magenverdauung des Zanders *(Lucioperca lucioperca* L.) mittels einer röntgenologischen Methode. — *Acta Biol. Hungaricae* **11,** 103—108.

MOLNÁR Gy., I. TÖLG (1962): Experiments concerning gastric digestion of pike-perch *(Lucioperca lucioperca* L.) in relation to water temperature. — *Acta Biol. Hung.* **13,** 231—239.

MOLNÁR Gy., E. TAMÁSSY, I. TÖLG (1967): The gastric digestion of living, predatory fish, pp. 135—149. In GERKING S. D. (Ed.) *The Biological Basis of Freshwater Fish Production. — Oxford, Blackwell Sci. Publ.*

Popova O. A. (1967): The "predator-prey" relationship among fish, pp. 359—376. — In Gerking S. D. (Ed.) *The Biological Basis of Freshwater Fish Production.* — *Oxford, Blackwell Sci. Publ.*

Radakov D. V. (1961): Радаков Д. В.: Об особенностях оборонительного поведения стай некоторых пелагических рыб. — *Труды Инст. Морф. Живот.* **39,** 47—71.

Radakov D. V. (1965): Радаков Д. В.: О значении стаи для хищных рыб при поимке добычи. — Сборн. «Питание хищных рыб и их взаимоотношения с кормовыми организмами». — *Акад. наук СССР* 173—178.

Ricker W. E. (1946): Production and utilisation of fish populations. — *Ecol. Monogr.* **16,** 373—391.

Seaburg K. G., J. B. Moyle (1964): Feeding habits, digestion rates, and growth of some Minnesota warmwater fishes. — *Trans. Amer. Fish. Soc.* **93,** 269—285.

Surber E. W. (1930): A quantitative method of studying the food of small fishes. — *Trans. Amer. Fish. Soc.* **60,** 158—163.

Tölg I. (1961): Über die Ursache des Nahrungsmangels des Balaton-Zanders *(Lucioperca lucioperca* L.) und Begründung des Nahrungsersatz-planes. — *Annal. Biol. Tihany* **28,** 179—195.

Windell J. T. (1966): Rates of digestion in blugill sunfish. — *Invest. Indiana Lakes Streams,* **7,** 185—214.

Windell J. T. (1967): Rates of digestion in fishes, pp. 151—173. — In Gerking S. D. (Ed.) *The Biological Basis of Freshwater Fish Production.* — *Oxford, Blackwell Sci. Publ.*

Woynárovich E. (1959): A 300—500 g súlyú (IV. osztályú) süllő (Lucioperca sandra Cuv. et Val.) táplálkozása a Balatonban. — *Annal. Biol. Tihany* **26,** 101—120.

# A 300—500 G SÚLYÚ (IV. OSZTÁLYÚ) BALATONI SÜLLŐ *(LUCIOPERCA LUCIOPERCA* L.) TAVASZI-NYÁRI TÁPLÁLKOZÁSA 1968-BAN II. A NAPI ÉS HAVONKÉNTI TÁPLÁLÉKFOGYASZTÁS, TÁPLÁLÉK ARÁNY SZÁMÍTÁSA

*Biró Péter*

## Összefoglalás

Szerző hat hónapra terjedő vizsgálatok során megállapította, hogy a 300—500 g súlyú balatoni süllők júliusban táplálkoztak legintenzívebben: másfél naponkénti gyomorkiürülések mellett havi 19 esetben fogyaszthattak újból táplálékot.

A táplálkozó süllők gyomortartalmának összsúlya júniusban volt a legkisebb (410 g), márciusban és júliusban a legtöbb (1265 g, illetve 1746 g). Az egy süllőre jutó táplálékátlag csak tájékozódásra alkalmas adat, mert a számított naponkénti fogyasztással összevetve nagy különbségek adódtak.

Egy süllő napi és havi táplálékfogyasztása kis mennyiségű, átlagosan 3,4 g, illetve 52.5 g volt. Hat hónap alatt elfogyasztott táplálék 315 g-nak adódott, ami a testsúly 80,73%-át jelenti.

A kapott adatok alapján is nyilvánvaló a IV. osztályú balatoni süllők táplálékforgalmazásának alacsony szintje.

A táplálkozó és éhező süllők aránya 1965-től a táplálkozók javára tolódott el, azonban a táplálék mennyiségileg kevesebb volt, mint tíz évvel ezelőtt. A táplálkozók számával az elfogyasztott táplálékmennyiségek nem állnak megfelelő arány bn, sőt a balatoni IV. osztályú süllők táplálkozási lehetőségei a süllőállomány számbeli csökkenése ellenére sem javultak számottevően.

# ПИТАНИЕ БАЛАТОНСКОГО СУДАКА IV.-ОГО РАЗМЕРА (ВЕС 300—500 Г) ВЕСНОЙ И ЛЕТОМ 1968 ГОДА. II. РАСЧЕТЫ СООТНОШЕНИЯ КОРМА И ПОТРЕБЛЕНИИ ПИЩИ В ДЕНЬ И МЕСЯЦ

*П. Биро*

В ходе исследований, продолжавшихся шесть месяцев, было установлено, что питание балатонского судака весом 300—500 г самое интенсивное в июле: предполагая, что через полтора дня их желудок опустошается они могли принимать пищу в 19 раз по месяц.

Вес содержимого желудка питающихся судаков самым низким оказался в июне (410 г), а самым высоким, — в марте и июле (1265 г и 1746 г). Среднее количество корма, расчитанного на одного судака, носит только ориентировочный характер, т. к. существует большая разница между расчитанными и потребленными количествами пищи.

Дневное и месячное потребления судака были низкие: в среднем 3,4 г и 52,5 г. Пища, потребленная в течении 6 месяцев, равняется 315 г, что соответствует 80,73% веса тела рыб.

На основе полученных данных ясно, что оборот пищы балатонских судаков IV.-ого размера находится на низком уровне.