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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

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The food of pike-perch has been extensively investigated (LUKÁCS, 1932 a, 1932b, ENTZ and LUKACSOVICS, 1957), the hoard of data, however, dwells upon only peculiar characteristics. The detailed study of this subject was first undertaken in 1950. On the basis of investigation extending over the period of three years using a great quantity of material WOYNÁROVICH (1959) elucidated with accuracy the qualitative and quantitative conditions of the nutrition of 300—500 g (fourth grade) pike-perch. The slow and uneven growth rate of the pike-perch became known through the meticulous study carried out by TÖLG (1961). He pointed out that there was a qualitative deterioration of lacustrial stand, drew attention to the disadvantageous conditions of life, furthermore, made mention of the grave conditions caused by scarcity of food and their possible origin.

Before launching our investigations we assumed, partly because of the causes resulting in the destruction of fish in 1965, partly because of the fish fauna complementation (introduction of eel) and of course of the continual eutrofication and the effects of several other factors (anthropogenic effect — SEBESTYÉN, 1967) including the accumulation of pesticide (BARON et al. 1967) in the food-chain, that the nutritional conditions might have changed as it was described by WOYNÁROVICH (1959) some ten years ago.

Accordingly, our work has been informative in nature in order to obtain information on the assumed trend and degree of change having taken place in the nutrition of the fourth grade pike-perch in Lake Balaton.

Material and methods

The material for our investigations has been collected by a special stomach-pump (WOYNÁROVICH, 1958) in 1965 and 1967 (415 and 175 stomach content, respectively), and again in 1968 (920 stomach content). The stomach contents were preserved each in a separate nylon bag containing 4% formalin and the samples were sealed until working up.

Simultaneously with stomach pumping we have taken the weight of each pike-perch in grams, before and after the evacuation of the stomach. The average weight of the fish under investigation was found to be 390 g. We have

identified the fish remains where it was possible, have taken the length of them (longitudo corporis) or when it was not possible simply estimated it together with the appropriate body weight in grams. In cases when identification was impeded by far advanced digestion we entered notes like "unidentifiable fish remains" *(Cyprinida* or *Percida backbone*, etc.).

Knowing the length and weight of fish remains derived from pike-perch stomachs we could draw conclusions on the growth rate and the length distribution of nutritive fish. For the correct body length and weight estimation of fish remains we had as basis a large number of control measurements taken on live fish; for our purposes naturally average values have been used

Results

1. *The quality of food in 1965, 1967 and 1968*

In 1965 the specific distribution of the 332 fish remains the following order of frequency occurred: *Lucioperca lucioperca* > *Acerina cernua* > *Alburnus alburnus*. 67.8% of the fish serving for food were Percids 21.1% Cyprinids and the unidentifiable remains with other families of fishes together amounted to 11.1%. The proportion of feeding pike-perch and those with empty stomachs was 41,2 : 58.8% *(Table 1, Fig 1)*.

Table 1

The monthly and specific distribution of fish remains found in the stomachs of the examined pike-perch in 1965

Period	Aug.	Sept	Oct.	Total
No. of examined specimens	208	99	108	415
Having taken food	86	35	50	171
Empty	122	64	58	244
Lucioperca lucioperca	70	33	27	130
Acerina cernua	63	1	29	93
Alburnus alburnus	27	3	15	45
Abramis brama	7	3	3	13
Pelecus cultratus	5	1	5	11
Lucioperca volgensis	—	2	—	2
Scardinius erythrophthalmus	1	—	—	1
Others	12	7	18	37
Total fish remains	185	50	97	332
Dreissena polymorpha	1	—	—	1

In 1967, 325 fish remains were found in the stomachs of pike-perch. It was interesting to note that compared to the previous year the order of frequency displayed a reversed pattern *Alburnus alburnus* > *Acerina cernua* > *Lucioperca, lucioperca*, furthermore, a great fluctuation could be evidenced concerning the number of consumed species. The percentual proportion of the main groups was as follows: Cyprinids 56,3%, Percids 39.7%, while the rest

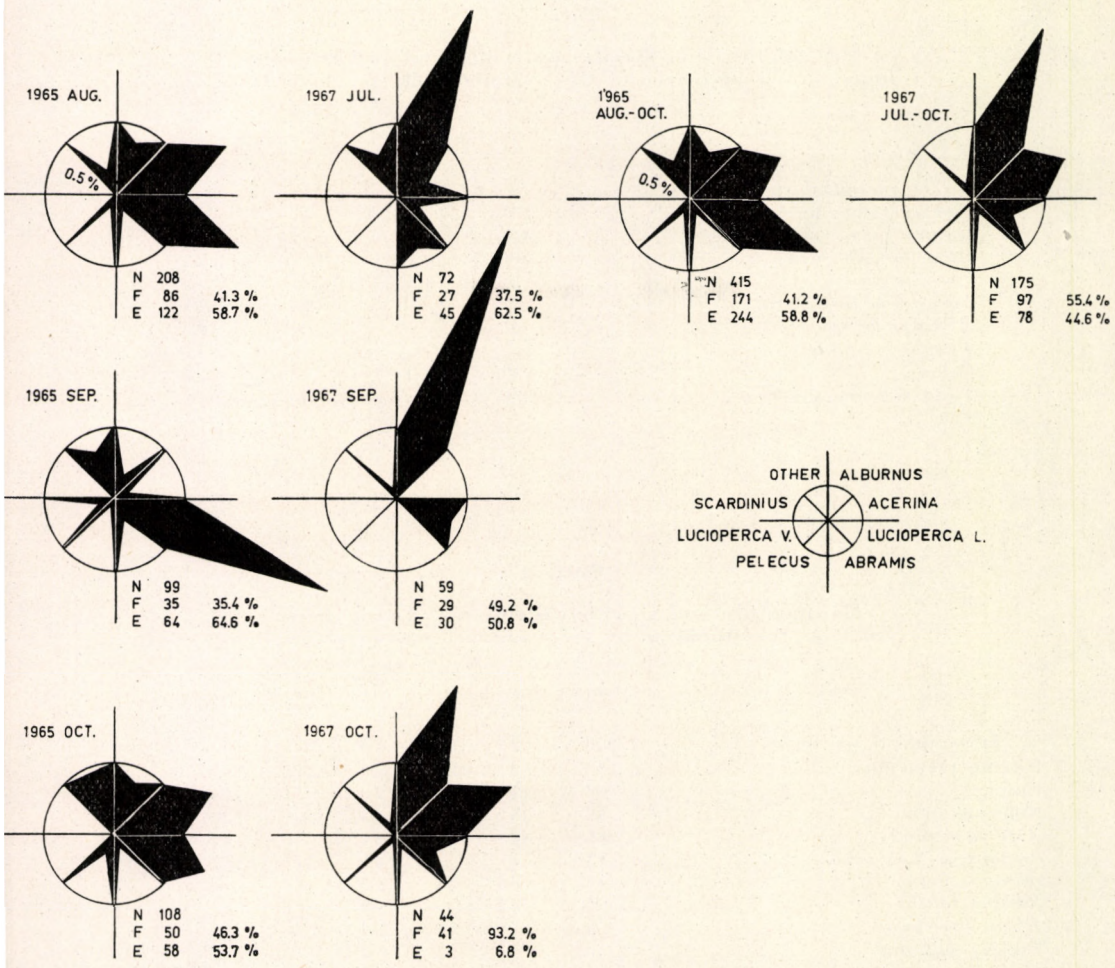

Fig. 1. The food habits of the fourth grade pike-perch 300—500 g in monthly and three monthly contraction. The percentual distribution of fish species serving for food in the years of 1965 and 1967. N = number of examined pike-perch stomachs, F = number of stomachs containing food (feeding pike-perch), E = number of empty stomachs (pike-perch with an empty stomach)

was taken un in the remaining 4%. The proportion of feeding pike-perch and those with empty stomachs was 55.4 : 44.6% *(Table 2. Fig.* 1).

In 1968, out of the 300—500 g pike-perch in all 18 species of fishes were identified after the examination of stomach contents. On rare occasions we encountered a stray specimen of frog skeleton *(Rana* sp.), a newt *(Triturus* v. *vulgaris)* and a leech *(Hirudinea* sp.). Seldom we came across in the food remains of *Dreissena polymorpha* and *Lithoglyphus naticoides*, however, we were able to identify quite frequently the fragments of varecs (mainly of *Potamogeton* spp.). In the stomach contents of 744 feeding pike-perch we determined 1290 fish remains, besides these 226 unidentifiable remains were found. The three most important fishes serving as food occurred in the same order

Table 2

The monthly and specific distribution of fish remains found in the stomachs of the examined pike-perch in 1967

Period	July	Sept	Oct.	Total
No. of examined specimens	72	59	44	175
Having taken food	27	29	41	97
Empty	45	30	3	78
Alburnus alburnus	19	35	113	167
Acerina cernua	3	—	88	91
Lucioperca lucioperca	2	7	29	38
Abramis brama	5	—	8	13
Pelecus cultratus	—	—	3	3
Others	4	1	8	13
Total fish remains	33	43	249	325

Table 3

The monthly and specific distribution of fish remains found in the stomachs of the examined pike-perch in 1968

Period	March	Apr.	May.	June	July	Aug.	Total
No. of examined specimens	206	112	135	65	257	145	920
Having taken food	140	88	121	46	232	117	744
Empty	66	24	14	19	25	28	176
Alburnus alburnus	89	38	70	33	248	120	598
Acerina cernua	65	81	11	11	71	41	280
Lucioperca lucioperca	13	1	—	11	160	12	197
Abramis brama	14	8	24	5	21	7	79
Rutilus rutilus	5	4	28	6	3	2	48
Blicca bjoerkna	4	7	9	2	1	5	28
Pelecus cultratus	16	2	4	1	1	2	26
Lucioperca volgensis	5	—	—	—	3	4	12
Scardinius erythrophthalmus	—	—	—	1	2	1	4
Rhodeus sericeus amarus	1	2	—	1	—	—	4
Perca fluviatilis	2	—	—	1	—	1	4
Leucaspius delineatus	1	—	—	—	—	1	2
Cobitis taenia	1	—	—	—	—	1	2
Gobio fluviatilis	—	1	—	—	—	1	2
Cyprinus carpio	—	1	—	—	—	—	1
Tinca tinca	1	—	—	—	—	—	1
Esox lucius	—	—	—	1	—	—	1
Anguilla anguilla	—	1	—	—	—	—	1
Unidentifiable	57	19	41	18	70	21	226
Identified	217	146	146	73	510	198	1290
Total fish remains	274	165	187	91	580	219	1516
Triturus v. *vulgaris*	1	—	—	—	—	—	1
Rana sp.	1	—	—	—	—	—	1
Hirudinea sp.	—	—	—	—	—	1	1
Dreissena polymorpha	—	4	1	—	—	1	6
Lithoglyphus naticoides	—	1	1	—	1	1	4
Water-weed fragments	1	2	—	—	2	10	15

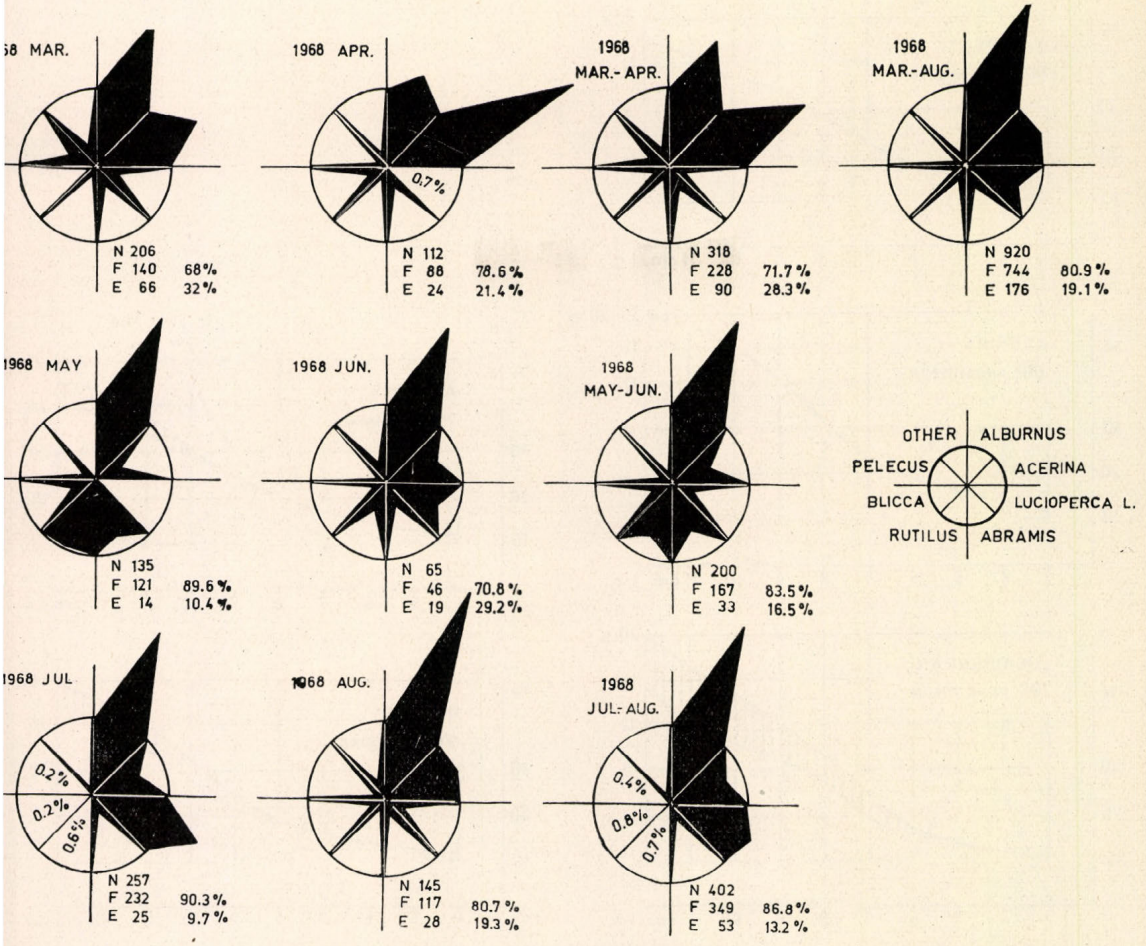

Fig. 2. The food habits of the fourth grade pike-perch 300—500 g in monthly, bimonthly and six monthly contraction. The percentual distribution of fish species serving for food in the year 1968. (N, F, E cf. *Fig. 1)*

of frequency as in 1967. The one heading the list in April was ruffe *(Acerina cernua)*, while in the other months bleak *(Alburnus alburnus)* was the dominant species. Differences could also be observed in the consumption of occasional species for feeding. Among them the most significant is, from frequency point of view, the fry of its own species and bream *(Abramis brama)* together with roach *(Rutilus rutilus)*. A large proportion of the food in July was pike-perch fry and the fry of bream with its one year old specimens, while in May roach was the most dominant occasional prey-fish. The food comprised 61.46% of Cyprinids, 38.2% of Percids and the remaining 0.36% was taken up by several fish families (Cobitidae, Esocidae, Anguillidae). The proportion of feeding pike-perch and those with empty stomachs was 80.9 : 19.1% *(Table 3, Fig. 2)*.

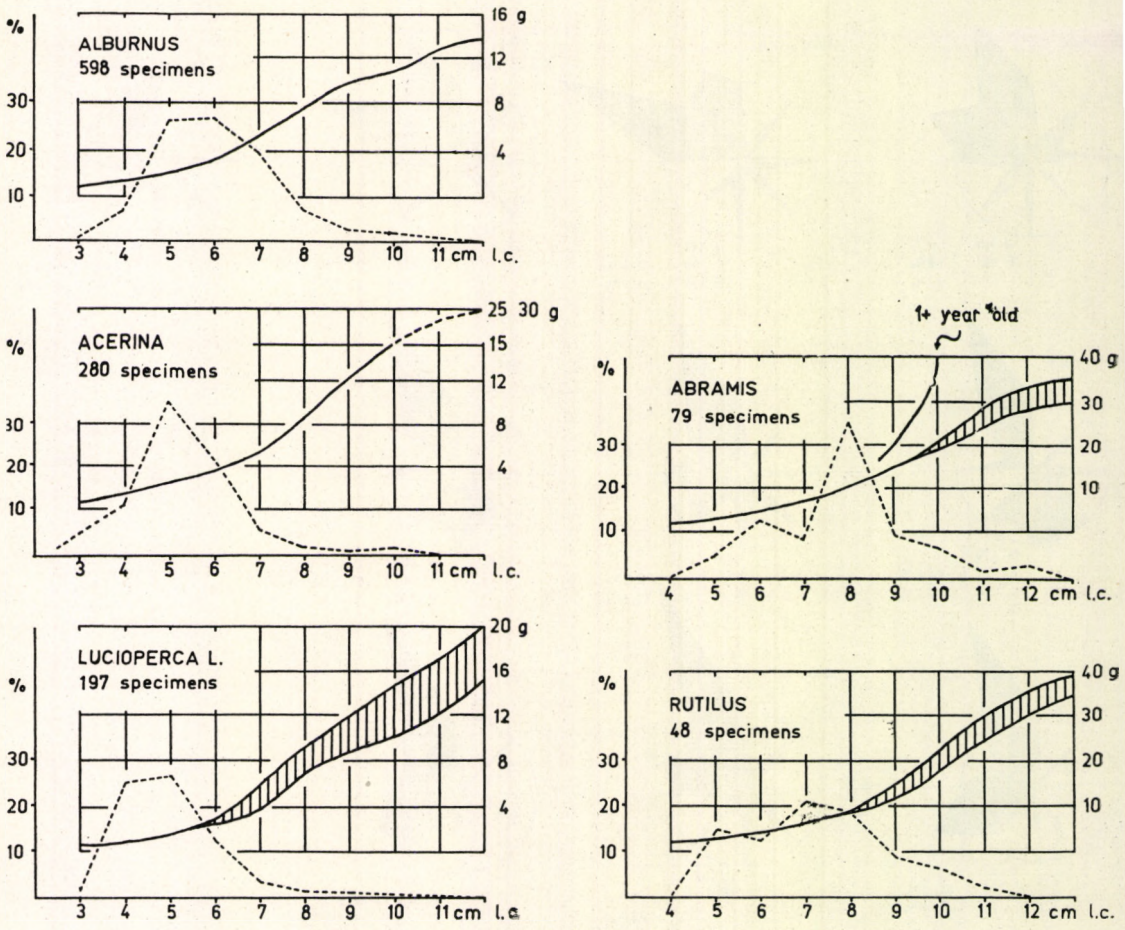

Fig. 3. The percentual distribution in size of the most frequently occurring 5 fish found in the stomachs (broken line), and the weight values corresponding to body sizes (full line) given in grams (1968)

The pike-perch of this order of magnitude mainly consumed specimens of 5—6 cm in length, the somewhat larger ones 7—10 cm came second and these two groups were in fact the basis for their food. They did not consume longer specimens than 12 cm *(Fig. 3)*.

2. *Quantitative conditions in 1968*

The quantitative evaluation of stomach contents was partly based on the number of fish found in the stomach and partly on the measured or estimated weight. According to the number of fish found in the stomachs the percentual distribution data of feeding pike-perch unanimously show that the most frequent type of feeding was to consume only one fish (45.6% in the average of 6 months), less consumed 2 or 3 fish. More than this, 4, 5, 6 . . ., etc. specimens

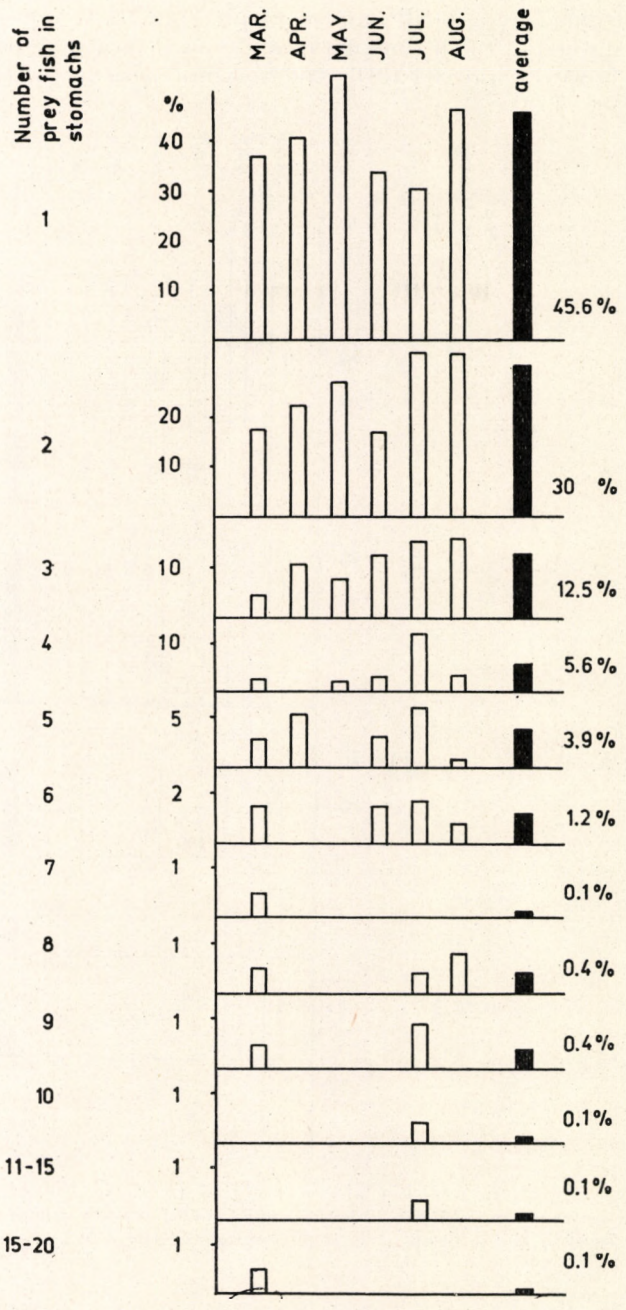

Fig. 4. The percentual distribution of feeding pike-perch according to the number of fish remains found in the stomachs in 1968. The percentual distribution of pike-perch consuming 1, 2, etc. specimens of fish for food, found in the stomachs, is plotted on the ordinate

were only consumed by a small number of pike-perch. At one single occasion we have encountered 19 fish remains in a stomach of a pike-perch in March, this number, however, proved to be the maximum, so far *(Fig. 4)*.

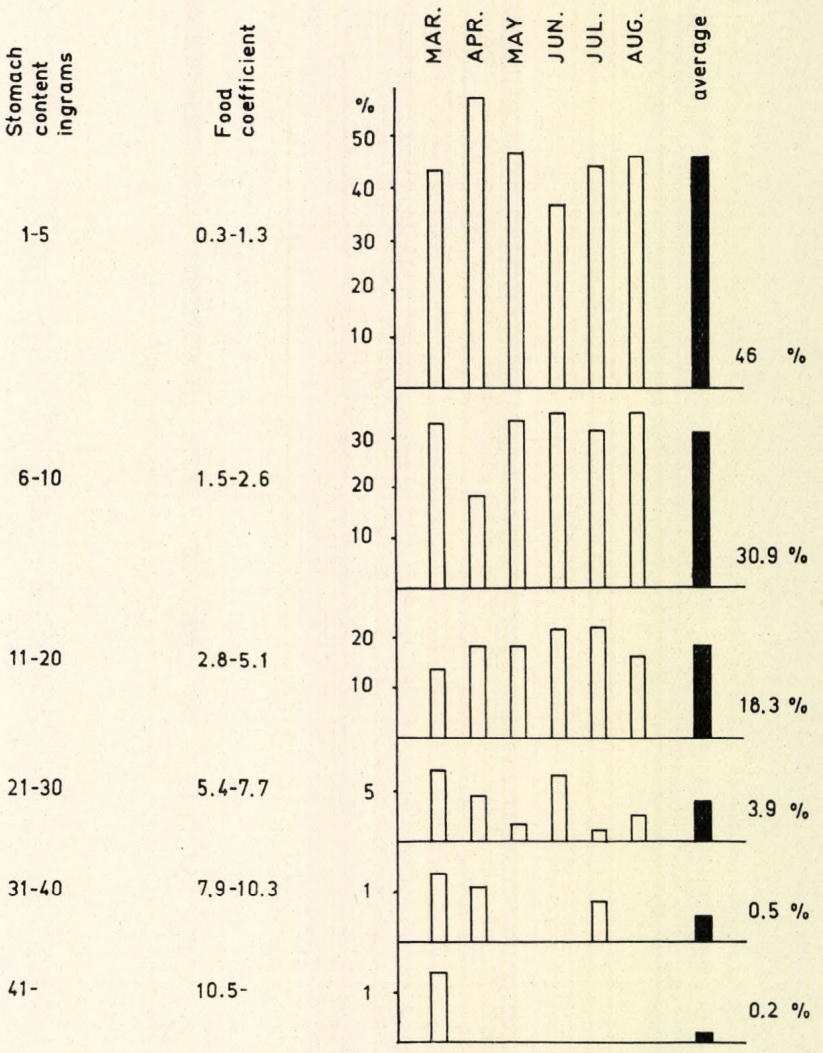

Fig. 5. The percentual distribution of feeding pike-perch in the different stomach-content weight groups (1968). The food coefficient values mean the weight of the food in the average weight percentage of the 390 g pike-perch

The food coefficient values in the case of the fourth grade pike-perch from Lake Balaton are extremely low and they change from one month to the other. Out of the 744 feeding pike-perch this value, calculated in the average of six months at 46%, is 0.1—1.3; at 30.9% it is 1.5—2.6; at 18.3% it is 2.8—5.1. A higher food coefficient has been observed only in a small number of

pike-perch *(Fig. 5)*. The nutritional mean falling to one pike-perch in the spring and summer periods is 6.2 g, while for the same period this number is 7.9 g when a feeding animal is concerned *(Fig. 6)*.

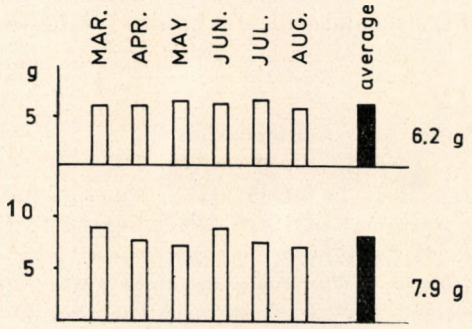

Fig. 6. Upper line: nutritional mean in grams falling on 1 pike-perch (both feeding specimens and those without food).
Lower line: nutritional mean in grams falling on 1 feeding pike-perch

3. *The catch of pike-perch in Lake Balaton in the past 8 years (1960—67)*

From fishery point of view the pike-perch of Lake Balaton is grouped according to the following: fourth grade: 300—500 g; third grade: 500—1000 g; second grade: 1000—1500 g; first grade: above 1500 g. One decade ago the average distribution according to the individual number of the catch was as follows: 75% from the fourth grade, 20% from the third, 2% from the second and 3% from the first grade (WOYNÁROVICH, 1959).

The quantity of annual pike-perch catch between 1960 and 1967 displayed the following variations:

	Grade				Total (q)
	IV	III	II	I	
1960	962	415	73	134	1584
1961	1093	420	73	180	1766
1962	780	362	68	175	1385
1963	990	496	97	133	1716
1964	972	425	108	154	1659
1965*	396	129	33	43	601
1966	283	245	57	65	650
1967	367	238	103	108	816
	5843	2730	612	992	10 177

* *Note:* On the spring of the year marked with an asterisk as the result of pesticide materials poluting the lake, according to the estimation of RIMANÓCZY, about fifty waggons (5000 q) of fish perished, of which about 40% was pike-perch (BARON et al. 1967)

Since 1965 the catch of pike-perch has decreased by more than fifty per cent, and the proportion of catch in the different weight groups has also greatly changed. After 1965, the restriction imposed on the fishing of lower weight categories brought about an increase in the individual number of pike-perch in the groups of the second and first grades taking the total of the catch.

Discussion

A gradual change may be observed in the qualitative composition of pike-perch stomachs examined in 1965, 1967 and 1968. In 1965 the autumn food mainly consisted of *Lucioperca lucioperca* and *Acerina cernua*, while in 1967 firstly bleak *(Alburnus alburnus)*, secondly ruffe *(Acerina cernua)* were dominant for food supply. In the first year the number of specimens with empty stomachs was greater than that of the feeding animals *(Table 1, Fig. 1)*. It is clearly shown in the data of 1968 that the primary food of the fourth grade pike-perch was bleak *(Alburnus alburnus)* and the second in line was ruffe *(Acerina cernua)*. Their proportion in the food was nearly 2 : 1 *(Table 3, Fig. 2)*.

Woynárovich (1959) reports ruffe as the main source of food for pike-perch. In the past few years the *Acerina* population has numerically decreased in Lake Balaton, which fact does not only come from the noted frequency of ruffe in stomach contents but also from the low number of individual specimens in our catch. The population of ruffe, likewise to other quality fish, was drastically decreased by the fish destruction of 1965 (Tölg, personal communication). The constant cause of progressive extinction of stock should be sought for in the gradual change takint place in environmental conditions for years back (Tölg, 1961; Sebestyén, 1967).

Bleak is more important than ruffe as the food of pike-perch, especially for its ideal shape, digestibility and nutritive value: about the double of ruffe's. The habitats of pike-perch and bleak are rather close to one another, from vertical point of view they are readily separable (Woynárovich, 1959; Tölg, 1961). There is about a 2—3 m thick layer of feculent water between bleak inhabiting a water layer near the surface, and pike-perch, rather inhabiting the bottom part of the water (Woynárovich, 1959). The rather low water-level in 1968 might have abolished these border-lines, for it was readily conceivable from the stomach contents that pike-perch consumed from almost every age-group of bleak living in the lake. The most frequent of them were specimens with 5—6 cm long body, living close to the water surface *(Fig. 3)*. In mixed shoals, too, the adult specimens rather frequented places nearer to the habitat of pike-perch, consequently, the preponderance of bleak of 5—6 cm in length in the food of pike-perch just proves an active vertical movement in search for nourishment of the consuming animal. According to the data published by Fortunatova (1949) the majority of pike-perch of the Caspian Sea and in the delta of Volga feed on fish of 10 cm long. It is clearly seen from the above that pike-perch consume for them easily available and the most appropriate sized fish.

Because of the seasonal presence or absence of the other observed species they may only be regarded as incidental nourishment. Further species can be

added to the food-list of the fourth grade pike-perch: *Scardinius erythrophthalmus, Leucaspius delineatus, Tinca tinca* and the eel *(Anguilla anguilla)*. Besides these, it was the first occasion that we noted the consumption of newt *(Triturus* v. *vulgaris)* and frog *(Rana* sp.). In August only in one case did we note the remains of a leech *(Hirudinea* sp.) in a stomach content. FORTUNATOVA (1949) also reported frog consumption of 1.7% in the delta of Volga, and SIROVATSKY (1953) took the same observation at Veselov reservoir with a percentage of 1.1.

According to the literature discussing the most varied water types the nutritional basis of pike-perch comprises fish coming in masses available both regionally and seasonally. The food of pike-perch in seas and in rivers varies with respect to available, thus, during migration from seas to the mouth of the rivers in order to multiply, from regional point of view, their composition can be rather divergent. CHUGUNOVA (1931) reported that the main food of pike-perch inhabiting the Sea of Azov was *Harengula delicatula,* the second place was occupied by the species of *Benthophilus* and *Gobiidae,* and *Percarina maetoica.* In the Ribinsk reservoir and at the delta of Vistula pike-perch mainly consume *Osmerus eperlanus,* when this is absent other littoral species are taken as food *(Rutilus, Abramis, Blicca,* etc.*)* ROMANOVA, 1956; FILUK, 1962; FILUK and ŻMUDZIŃSKI, 1965). The pike-perch inhabiting the Veselov reservoir mainly feed on *Rutilus, Abramis* and *Knipowitschia longicaudata* (SIROVATSKY, 1953), while in Lake Gopło and in Vistula in Poland the greater part usually is Cyprinids (BUDZYŃSKA et al. 1956; HOROSZEWICZ, 1964).

We may conclude in connection with the variety of food that in the food composition of pike-perch living in Lake Balaton considerable gaps occur regionally, that is, at the catching places of pike-perch the bed-profile significantly influences the individual character of the habitat (open water, reed-grass range) accordingly, pike-perch obtain variable food both of quality and quantity. Starting from the northeastern basin passing down towards Balatonszemes, and the environs of Fonyód in the southwest, the examination of stomach contents prove a somewhat better nutritional condition, although, it still fall far from sufficient.

The importance of nutrition of the different fish consumed by pike-perch changes seasonally, thus, the nourishment within the identical water region may be of different constitution (FORTUNATOVA, 1949; SIROVATSKY, 1953; ROMANOVA, 1956). This statement is likewise applicable to the whole area of Lake Balaton (LUKÁCS, 1932a, b; WOYNÁROVICH, 1959).

Our data also emphasize the seasonal role of species found in the food *(Tables 1—3, Figs. 1—2).* Bleak is a very important species for nourishment both in spring and in the summer, but in April ruffe too comes into prominence. The generally narrow nutritional conditions are somewhat eased by the appearance of great shoals of pike-perch fry and of other species' in July. The nutritional importance of roach *(Rutilus rutilus)* has increased compared to previous years. It was rather striking, that species usually inhabiting bottom layer were scare in stomach contents *(Cobitis, Gobio).* The fact, that in what frequency a species may occur as food, is not only the function of feeding intensity of pike-perch but it also depends on the success of spawning of the species in question, of its accessibility and last but not least on the population density of the species. This problem would be well complemented by a close investigation dealing with the nutrition of the introduced eel population.

Consequently, our investigations call for a study of nutritional and populational problems based on a more extensive research work.

The intake of food of fish is a function of environmental and physiological factors (condition, etc.), thus, the number of consumed fish is regulated by the appetite of the predatory fish, the individual density of fish serving as food and by its accessibility (WOYNÁROVICH, 1959). It is very unlikely to assume that those specimens which consume only one fish each suffice their food requirement, of course, it is even wilder to conjecture that they starve on their own accord. The speed of digestion — considering poikilotherm animals — is greatly dependent on the temperature of the environment: in the case of pike-perch in Lake Balaton this speed in the summer period is some 8—9 times faster than in winter (MOLNÁR et al. 1967). The time elapse between two intakes of food can be estimated from the period of time necessary for digestion under the appropriate temperature conditions, consequently, the total amount of food consumed can be calculated duly considering seasonal change for a whole year (POPOVA, 1967; WINDELL, 1967). If for a 100% stomach fullness of pike-perch we take 10% body weight (WOYNÁROVICH, 1959) then in the spring and summer periods of 1968 the nutritional basis for the examined specimens of pike-perch was very low, in actual fact, it was a mere 2% taking body weight.

However, the weight of the actual intake of food in the majority of pike-perch was much below this given value *(Fig. 5)*.

Examining pike-perch WOYNÁROVICH (1959) found food in the stomach in 62.5% of the animals, while the 37.5% of them were without food. He assumes that a thinner pike-perch stock may taken in more food at similar density of nutritive fish but a thin pike-perch population may only gather its food at a scanty stock of nutritive fish with a worse efficacity. According to the data collected during the investigations, it might be assumed that owing to the decrease of stock, the percentual proportion of feeding individuals increased since 1965. On the other hand, the nutritional mean falling to one feeding pike-perch has decreased by 1.2 g compared to the amount consumed ten years ago *(Fig. 6)*. This clearly shows, that although an increase could be observed in the number of feeding individuals the amount of food consumed however, was less in the case of the fourth grade pike-perch in Lake Balaton, indicating an undernourishment.

In connection with the overall low values of the food coefficient for the sake of comparison it is well to mention, that the prey- predatory fish weight proportion of 2—5 years old pike-perch in Gopło Lake, Poland, was 2.4—4.8% BUDZYŃSKA et al. 1956), while this proportion in the delta of Volga was 5.1 (POPOVA, 1967). In other data this value fluctuates between 5—9; the really high food coefficient is around 20 (FORTUNATOVA, 1949).

Under fish breeding conditions or water regions with good supply of food 1 kg increase of weight may only be reached by 5—10 or 15 kg nutritional fish (RIBIÁNSZKY and WOYNÁROVICH, 1962; CHUGUNOVA, 1931). In Lake Balaton, if we consider the nutritional mean (6.2 g) as basis falling to one pike-perch, which is equivalent with about the weight of two 6 cm long bleak then far to many bleak should be consumed of the size and weight just mentioned. Pike-perch of the fourth grade in Lake Balaton at the scanty stock of nutritive fish obtain the quantity necessary for growth at a disproportionately longer period of time — compared to artificial fisheries — which circumstance explains the

slow and uneven growth: they are 1—6 dkg when one year old, 5—15 dkg at a 2 years, 8—50 dkg at 3 years, 15—60 dkg at 4 years, and they only reach one kg at 5 years of age (RIBIÁNSZKY and WOYNÁROVICH, 1962).

The established number of fish calculated on the basis of stomach content investigations gives a fair approximation of the insufficiency of available food. Our data also lead us to the conclusion that the scarcity of food in the past few years, even though the number of pike-perch decreased, is still an existing problem nowadays.

Summary

Fish remains found in the stomachs show the following order of frequency considering only the most important species: *Lucioperca lucioperca* > *Acerina cernua* > *Alburnus alburnus*, this sequence was displayed in 1965, however, in the years 1967 and 1968 the above order was reversed. Significant seasonal and regional fluctuations have been observed in the consumption of occasional species for feeding.

According to the number of fish found in the stomachs the most frequent type was which consumed only one specimen (45.6%), two specimens (30%) while the individuals consuming 3 specimens were scarce (12.5%). More than three specimens, consumed by one pike-perch, gave only 5.6—0.1%.

According to the evaluation of the weight of the consumed food 46% of the feeding pike-perch has taken 1—5 g, 30.9% 6—10 g and only 18.3% has taken 11—20 g of food. The respective values of food coefficient of these weight data are extremely low: only 3.9—0.2% of the pike-perch has reached a food coefficient higher than 5.4.

The proportion of feeding pike-perch and pike-perch with empty stomach from 1965 shifted to the benefit of the feeding type, however, the quantity of available food decreased, compared to the value ten years ago. The number of the feeding animals is not in proportion with the consumed food quantity in spite of the fact that a decrease was observed in the number of the pike-perch population and the feeding conditions of the fourth grade pike-perch in Lake Balaton have not improved considerably.

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A 300—500 G SÚLYÚ (IV. OSZTÁLYÚ) BALATONI SÜLLŐ [LUCIOPERCA LUCIOPERCA (L.)] TAVASZI-NYÁRI TÁPLÁLKOZÁSA 1968-BAN I. ADATOK AZ 1965. ÉVI HALPUSZTULÁST KÖVETŐ IDŐSZAK TÁPLÁLKOZÁSI VISZONYAIHOZ

Biró Péter és *Elek László*

Összefoglalás

A gyomrokban talált halmaradványok között 1965-ben gyakoriság szerint a *Lucioperca lucioperca, Acerina cernua, Alburnus alburnus* volt a legfontosabb táplálékhalak sorrendje, 1967 és 1968 években ennek fordítottja. Alkalmi táplálékhalfajok fogyasztásában jelentős szezonális és regionális fluktuációt tapasztaltunk.

Gyomrokban talált halak száma szerint leggyakoribbak az 1 db halat evők (45,6%), 2 db-ot (30%) és a 3 db-ot fogyasztók (12,5%) voltak. Nagyobb számú halat a süllőknek 5,6—0,1%-a fogyasztott.

A táplálkozó süllők közül az elfogyasztott táplálék súlyszerinti kiértékelését illetően 46% 1—5 g-ot, 30,9% 6—10 g-ot, 18,3% 11—20 g-ot fogyasztott. E súly-adatoknak megfelelő táplálék-koefficiens értékek igen alacsonyak: 5,4-nél magasabb táplálékhányadost a süllőknek csak 3,9—0,2%-ánál tapasztaltunk.

ПИТАНИЕ БАЛАТОНСКОГО СУДАКА IV.-ОГО РАЗМЕРА (ВЕС 300—500 Г) ВЕСНОЙ И ЛЕТОМ 1968 ГОДА. I. ДАННЫЕ К УСЛОВИЯМ ПИТАНИЯ В ПЕРИОД ПОСЛЕ МАССОВОЙ ГЫБЕЛИ РЫБ В 1965 ГОДУ

П. Биро и *Л. Элек*

Порядок наиболее важных кормовых рыб, установленных на основе остатков рыб в желудке, в 1965 году был: *Lucioperca lucioperca*, *Acerina cernua*, *Alburnus alburnus;* а в 1967 и 1968 годах был найдён противоположен этому ряд. В потреблении случайных кормовых рыб было найдено значительное сезонное и территориальное колебание.

Исследованные судаки по числу рыб, обнаруженных в их желудках, разделялись следующим образом: 45,6% из них одну рыбу, 30% употребляла 2 рыбы. 5,6—0,1 процентов судаков ели больше чем 3 рыб.

Из питающихся судаков по весу принятого корма были получены следующие данные: 46% принимал 1—5 г корма; 30,9% 6—10 г; и 18,3% 11—20 г. Коэффициенты корма соответствующие этим весам очень низкие: это значение превосходило 5,4 только у 3,9—0,2 процентов судаков.

Соотношение питающихся судаков и судаков с пустым желудком изменилось в пользу питающихся с 1965 года, но общее количество питательных веществ было ниже, чем 10 лет тому назад. Количество употребляемого корма не соответствует числу питающихся рыб, и несмотря на то, что общее число судаков понизилось, условия питания балатонского судака IV.-ого размера существенно не улучшались.