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ON FOOD COMPOSITION OF FOUR HERON SPECIES

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Abstract

The wet weight and the maximum length of the aliment animal organisms found in the food samples obtained by the neck collar method in nestlings of Purple Heron *(Ardea purpurea)*. Night Heron *(Nycticorax nycticorax)*, Little Egret *(Egretta garzetta)* and Squacco Heron *(Ardeola ralloides)* have been studied by the author between 1985 and 1989. In all of the four heron species a significant consumption of fish and frogs was observed. Night Heron and Purple Heron tended to capture big fish in smaller numbers. The proportion of insects, fish and frogs was found to be best balanced in the food of Squacco Heron. The overlap inrespect to the body weight of the aliment animal organisms was strikingly high between Little Egret and Squacco Heron. The overlap in size exceeded 50% between Night Heron, Little Egret and Squacco Heron.

The food composition of Purple Heron and Night Heron shows the highest diversity. Consumption of small mammals was observed only in Purple Heron and Night Heron in 1989, when a definite mouse gradation occurred. On the basis of the obtained data the biomass consumption of the nestlings of an average heron colony can be calculated.

Introduction

The analysis of alimentation of heron species breeding in colonies is incomplete according to the literature. The methods used are far from being precise, especially in respect to the quantity and size of food. For these reasons a study the food composition of nestlings of four heron species breeding in the Nagy-tó heron colony (near Tiszaalpári) has been carried out by the author by the means of neck-ligation method. Besides the study of food composition, the aim of the present study was to establish the weight and size of the prey animal organisms fed to the nestlings by different heron species, as well as the biomass consumed during the growth of nestlings. From the data conclusions can be drawn concerning the relation of niche-overlap and niche-width of the four heron species.

The food composition of the four heron species has been studied in details by VASVÁRI (1931, 1939, 1954) and STERBETZ (1954, 1961) in the Carpathian basin. They were basically interested in stomach content, pellets and regurgitated food. Further data are based on studies of regurgitated food (SODHI 1985, SZLIVKA 1986), as well as onfield observations (FASOLA 1986, HAFNER et *al.* 1986).

Materials and Methods

The neck ligation method has been applied for the first time in singing birds by KLUIJVER (1933). Since then this very succesful method has been applied only rarely in big birds, and never in herons. In our investigation a modification of the above method was used: the base of the neck above the fourchette (furcula) was ligated by a suitable string in such a way that it did not obstruct the nestling's breathing but did not allow the nutriment to be swallowed. The nutriment was recovered from the pharynx by means of tweegers after massaging the food towards the beak.

Samples were collected altogether from 61 nestlings in 33 nests of Purple Heron *(Ardea purpurea)*, Night Heron *(Nycticorax nycticorax)*, Little Egret *(Egretta garzetta)* and Squacco Heron *(Ardeola ralloides)* (Table 1). Altogether 165 animal organisms were identified. Samples were taken only twice from the same nest to avoid the disturbance during feeding. The samples were kept in formalin solution. During the sampling procedure no nestling was founded or died.

The elaboration and identification has been carried out in laboratory by means of binocular microscope, based on PAPP (1943), MÓCZÁR (1969) and PINTÉR (1989, 1989).

The wet body weight and the maximum length of prey animal organisms were measured. In the data procening the extent of overlap was calculated on the basis of Schoener equation

$$c_{i_n} = 1 - \frac{1}{2} \Sigma |P_{1_i} - P_{1_i}|$$

The nutriment diversity (width) was calculated by equation

$$H|S| = -\Sigma P_i \ln P_i$$

and the evenness — on the basis of the formula

$$J = \frac{H}{H_{max}}$$

Results and Discussion

In the food of the four heron species studied Insecta, Pisces, Amphibia and Mammalia were found (Table 2). Besides these consumption of lizards, newts,snails and small mammals (mouse, shrew) is described in the literature (VASVÁRI 1931, 1939, 1954, STERBETZ 1954, 1961), and also SODHI (1985) and SZLIVKA (1986) detected annelids, shell-fish, ringed snake and bird nestlings. However, the percentage of those is negligable. All authors agree that the majority of prey animal organisms come from the following four groups: Insecta, Pisces, Amphibia and Mammalia. The nutriment of heron species is composed mainly from species belonging to the first three groups, regular consumption of mammals is observed only in Purple Heron and Night Heron, while in Little Egrets and Squacco Heron do not feed at all on these preys or only sporadicly.

Table 1. *Number of studied nests and nestlings of different heron species*

	Number of nests	Total number of nestlings
Purple Heron *(Ardea purpurea)*	3	6
Night Heron *(Nycticorax nycticorax)*	18	34
Little Egret *(Egretta garzetta)*	6	9
Squacco Heron *(Ardeola ralloides)*	6	12

Table 2. *Food composition of the four heron species studied*

	A. purpurea		*N. nycticorax*		*E. garzetta*		*A. ralloides*	
	n	w	n	w	n	w	n	w
INSECTA								
Ephemeridae larva							1	0,09
Anizoptera larva							1	0,88
Zygoptera larva					2	0,11		
Coenagrion puella							1	0,005
C. puella larva							3	0,037
Odonata spp.					2	0,4		
Diptera larva							1	—
Naucoris cimicoides							1	0,05
Notonecta glauca							2	0,24
Hidrous piceus larva			1	1,33				
Dytiscus sp.	1	0,9	1	0,1				
Acilius sulcatus					1	0,1		
Coleoptera sp.			1	—				
Dermatoptera					1	0,05		
Indet. Insecta							2	—
	1	0,9	3	1,43	6	0,66	12	1,302
PISCES								
Rutilus rutilus			1	8,4				
Scardinius eritrophtalmus			4	26,6				
Alburnus alburnus			1	6,8	11	2,74	1	0,09
Abramis brama			2	17,7	11	3,94		
Vimba vimba					1	0,13		
Tinca tinca			1	34,79				
Rhodeus sericeus amarus					10	22,32	10	1,32
Carassius carassius							1	8,2
Carassius auratus	5	108,6						
Cyprinus carpio					9	13,81	1	1,35
Misgurnus fossilis	1	7,4	1	5,8				
Ictalurus nebulosus			2	12,5	1	4,34		
Perca fluviatilis							6	2,46
Indet. Pisces	1	1,0	1	1,32				
	7	117,0	13	113,91	43	47,28	19	13,42
AMPHIBIA								
Anura tadpole	1	1,6	27	64,5	8	5,25	15	24,12
Rana ridibunda	1	20,3	2	25,8				
	2	21,9	29	90,3	8	5,25	15	24,12
MAMMALIA								
Microtus arvalis	2	20,4	3	20,45				

n = number of prey animal organisms; w = body weight/gr

The main nutriment of heron species are fish and frogs of different ages. The food composition significantly differs in different heron species. According to VASVÁRI (1931, 1954) Purple Heron and Little Egret are mainly piscivorous. This is proven by the distribution of prey animals according to the body weight shown in Fig. 1, but the fish consumption by Night Heron is also significant. If these results are compared with the distribution according to the number of individuals (Fig. 2), it can be seen that Purple Heron and Night Heron consume big fish in smaller numbers.

It should be taken into consideration that the collected samples originate from medium aged nestlings, since it was physically to apply ligation in very small nestlings,

while older nestlings left the nests if disturbed. Thus the nutriment of adult birds showed differ from those of nestlings probably in size and body weight. Besides this the difficulties in field did not allow, the collection of a significant number of samples, especially in the case of Purple Heron, thus making the comparison less accurate.

It can be seen from Fig. 1. and Fig. 2., that Little Egrets feed the nestlings with many small fish, while in the case of Night Heron frogs prevail in the prey. In both cases fish progenies and tadpoles, are the most common food, and these animals occur in high densities in that places. This suggests that the time of raising nestlings has developed to coincide with the periods of fish and frog swarming during the evolution.

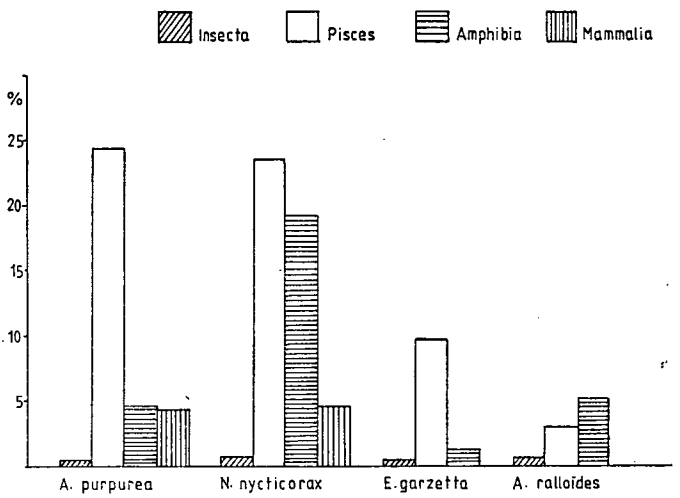

Fig. 1. Distribution of prey weight as percent of total weight

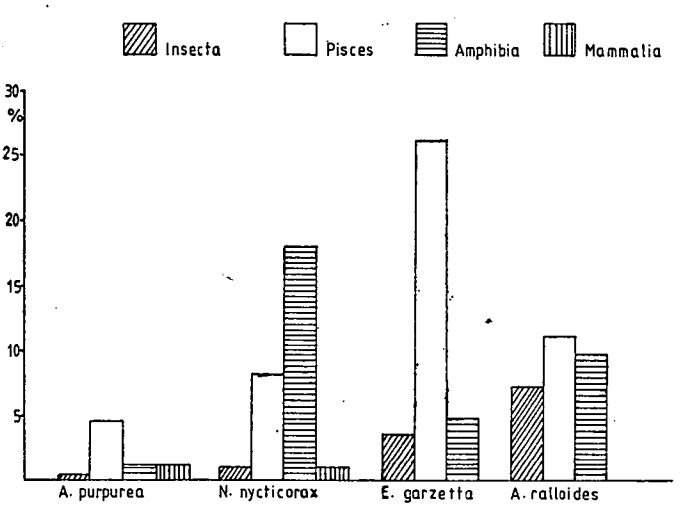

Fig. 2. Distribution of number of as percent of total number of individuals

Among the four heron species the balance of nutriment composition is the best in Squacco Heron, particularly in respect to the distribution according to the number of individuals. Fish species found in the samples agree well both with species composition and frequency of the results of investigations carried out by FARKAS (1989) in the Oxbov-lake of Lakitelek. This back-water is one of the main feeding area of herons. *Alburnus alburnus, Abramis brama, Carassius auratus* and *Cyprinus carpio* occur frequently in that back-water, and these species are often found in the nutriment of herons as well. From 26 fish species described by FARKAS (1989) 11 are found as prey of herons.

The overlap between the species was calculated from the distributions of aliment animal organisms according to both body weight (Table 3) and length (Table 4).

Table 3. *Overlap (C_{i_n}) of prey weight in the four heron species*

	A. purpurea	*N. nycticorax*	*E. garzetta*	*A. ralloides*
A. purpurea	—			
N. nycticorax	0,33	—		
E. garzetta	0,15	0,37	—	
A. ralloides	0,14	0,34	0,94	—

Table 4. *Overlap (C_{i_n}) of prey size in the four heron species*

	A. purpurea	*N. nycticorax*	*E. garzetta*	*A. ralloides*
A. purpurea	—			
N. nycticorax	0,26	—		
E. garzetta	0,08	0,65	—	
A. ralloides	0,002	0,55	0,67	—

The overlap between Purple Heron and Little Egret, and Purple Heron and Squacco Heron is not significant, it is generally about 0,3, while it is substantial between Little Egret and Squacco Heron. So these two species feed their nestlings with prey animals of similar body weight.

The data presented in Table 4 support the above findings, with the difference that there is a significant overlaps between Night Heron, Little Egret and Squacco Heron, which is most probably due to beak size and structure in the first place and also to body size (VASVÁRI 1939).

The diversity of aliment animal organisms in respect to body weight and size probably changes in relation to the body size of various heron species (Table 5), which is reflected by the value of evenness as well. However the use of different of samplesize it can cause distortion in diversity estimations. The values obtained for

Table 5. *Diversity of prey [H/S] according to weight and size, and evenness values of the four heron species*

	Weight H(S)	Evenness J	Size H(S)	Evenness J
A. purpurea	1,96	0,74	1,9	0,7
N. nycticorax	1,94	0,73	2,336	0,86
E. garzetta	1,02	0,46	1,522	0,73
A. ralloides	0,97	0,44	1,496	0,72

Night Heron are strikingly high, which are irrespective to distortions and it might be in causal relation with the frequency as well.

Naturally, the hunting habits can be decisive too, as well as the fact that during nestling raising Night Heron searches for food both day and night. The mainly diurnal Purple Heron hunts at night in this period as well, while the two other species—do not. Further difference in behaviour is that Night Heron flys long distances in serching for food while Purple Heron does not move far away, and Squacco Heron covers the smallest area (VASVÁRI 1931, 1939). The division of feeding area also influences prey capturing. FASOLA (1986) showed that in close to natural habitats Night Heron segregates from Little Egret in feeding areas, probably due to competitive interference.

The samples taken from the same nest showed that in majority of the cases the nestlings were feed with prey animal organisms belonging to the same species, being of nearly identical size in length. This supports the fact that once an adult bird is find a food patch e.g. fish progeny school, todpole groups, it try to make the maximal use of it.

Plant mass was found only in several samples of Night Heron. Most probably they were grasped together with the prey in case of less precise hits. VASVÁRI (1931) describes occurrence of plant remnants in Purple Heron too.

Mammals were not detected in samples collected between 1985 and 1988 but in field mice *(Microtus arvalis)* were found in the food composition of Purple Heron and Night Heron. Although a few were detected in our samples, the inspection of the nests of these two species resulted in finding both fur in pellets and mice in regurgitated food. This phenomenon was observed by us in June, 1989 in the heron colony situated in Pacsmag Lake, Tamási, (Transdanubia), where both fur and remnants of field mice were found not only in nests of Purple Heron and Night Heron, but also in that of Great White Egret *(Casmerodius albus)* and Grey Heron *(Ardea cinerea)*. This is most probably due to a strong gradation of field mice, which led to change in alimentation of the above heron species. Mammals were not found in nutriment of Little Egret and Squacco Heron. The significance of this finding has been emphasized in the literature too. VASVÁRI (1931, 1939) and STERBETZ (1954) found mammals in food composition of Purple Heron and Night Heron in every studied case, while in Little Egret and Squacco Heron it was observed only in few cases. The latter two species seem irrespective to the abundance of field mice, and no change occurred in the food composition so fish and frogs remained their chief food.

The number of breeding heron pairs was registered between 1985 and 1989 in the colony as well. During this period on average 160 pairs of Night Heron, 22 pairs of Little Egret, 14 pairs of Squacco Heron and 14 pairs of Purple Heron bred in the colony. From the average number of nestlungs raised by the herons and the weight of prey fed to one nestling, the amount of biomass exploited from the environment during 28 days of feeding can be calculated. Assuming three food hoarding trips per day the amount is 428.649 g, leaving the food consumed by the adult birds out of consideration.

Acknowledgements

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Négy gémfaj táplálék-összetételének vizsgálata Tiszaalpár térségében

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Kivonat

Szerző 1985—1989 között vörös gém *(Ardea purpurea)*, bakcsó *(Nycticorax nycticorax)*, kis kócsag *(Egretta garzetta)* és üstökösgém *(Ardeola ralloides)* fiókák nyakelkötéssel kapott táplálékmintáiból a táplálékállatok nedves tömegét és legnagyobb hosszát mérte. Mind a négy gémfaj hal- és békafogyasztása jelentős. A bakcsó és a vörös gém kisebb számú, de nagyobb méretű halakat zsákmányolt. A rovar, hal, béka aránya az üstökösgémnél a legkiegyenlítettebb. A táplálékállatok testtömeg szerinti átfedése a kis kócsag és az üstökösgém közt feltűnően nagy. A hosszméretátfedések a bakcsó, kiskócsag és üstökösgém közt 50% felettiek.

A vörösgém és a bakcsó táplálékösszetétele a leginkább diverz. Kisemlősök fogyasztása csak a vörös gémnél és a bakcsónál fordult elő 1989-ben, mely évben erős pocokgradáció volt. Az adatok alapján kiszámítható egy átlagos gémtelep fiókáinak biomassza-fogyasztása.

ИССЛЕДОВАНИЕ СОСТАВА ПИЩИ ЧЕТЫРЕХ ВИДОВ ЦАПЛИ В ОБЛАСТИ ТИСААЛПАР

Д. Молнар

В период 1985—1989 гг. автором исследован состав пищи птенцов четырех видов цапли: *Ardea purpurea, Nycticorax nycticorax, Egretta garzetta* и *Ardeola ralloides*, методом перевязывания шеи и измерением влажного веса и максимальной длины организмов, встречающихся в образцах пищи. У всех четырех видов значительно потребление рыбы и лягушек. Для *Nycticorax nycticorax* характерно потребление меньшего числа относительно более крупных рыб. Соотношение насекомых, рыб и лягушек является наиболее уравновешенным в пище *Ardeola ralloides*. Для *Egretta garzetta* и *Ardeola ralloides* наблюдалось подчеркнутое перекрытие по весу организмов, встречающихся в пище. Перекрытие организмов по длине тела превосходило 50% для *Nycticorax nycticorax, Egretta garzetta* и *Ardeola ralloides*.

Наиболее разнообразным является состав пищи *Ardea purpurea* и *Nycticorax nycticorax*. Потребление мелких млекопитающих наблюдалось только у *Ardea purpurea* и *Nycticorax nycticorax* в 1989 г. в связи со значительной градацией полевки. На основании полученных данных вычислено потребление биомассы птенцами средней колонии цапли.

Proučavanje sastav hrane kod 4 vrsta čaplja u okolišu Tiszaalpár

GY. MOLNÁR

Rezime

Autor je analizirao sastav hrane, vezivao je vrat čapljićima i merio je vlažnu masu i najveću dužinu grabljene životinje. Proučavao je sledeće vrste čaplja: srebrnasta čaplja *(Egretta garzetta)*, crvena čaplja *(Ardea purpurea)*, gak kvakavac *(Nycticorax nycticorax)* i žuta čaplja *(Ardeola, ralloides)*. Potrošnja ribe i žabe u svim slučajevima je značajna. Gak kvakavac i crvena čaplja su lovili veće ribe ali u manjem broju. Kod žutih čaplja je najuravnoteženija potrošnja bube, ribe i žabe. Težina grabljene životinje je skoro jednak kod ove dve vrste: gak kvakavac i žuta čaplja. Dužina grabljene životinje je isti više nego u 50% slučajevima kod gak kvakavca i srebrnaste žaplje. Sastav hrane crvene čaplje i gak kvakavca je najkolebljiva.

Potrošnja male sisavce je bio značajna samo 1989. godine to jest kod crvene čaplje i gak kvakavca, ali te godine gradacija pacova bila je jaka. Prema dobivenim podacima može se izračunati biomasu potrošene hrane čapljićima u slučaju jednog prosečnog skladište čaplja.