ЮБИЛЕЙНА НАУЧНА КОНФЕРЕНЦИЯ ПО ЕКОЛОГИЯ (СБОРНИК С ДОКЛАДИ)
Ред. Илиана Г. Велчева, Ангел Г. Цеков ● Пловдив, 1ви ноември 2008 ● стр. 194-199

PROCEEDINGS OF THE ANNIVERSARY SCIENTIFIC CONFERENCE OF ECOLOGY
Eds. Iliana G. Velcheva, Angel G. Tsekov ● Plovdiv, November 1st 2008 ● p. 194-199

DIET COMPOSITION OF THE EURASIAN OTTER AND CO-EXISTING GREY HERON IN A FISH FARM DURING THE SPRING-SUMMER SEASON IN BULGARIA

Dilian G. Georgiev

Department of Ecology and Environmental Conservation, Faculty of Biology, University of Plovdiv, Tzar Assen Str. 24, BG-4000 Plovdiv, Bulgaria, e-mail: diliangeorgiev@abv.bg

Abstract. Our study was aimed on estimation of the species diversity and number of prey of two piscivorous predators in a fish ponds area, and to calculate the trophic niche breadth and their overlap in the same habitat. We studied the area of fish farms near Nikolaevo Town, Kazanlashka Valley (Southern Bulgaria). Otter spraints (n = 48) were gathered from various substrates on banks of the ponds. Grey heron pellets and food remains (bones, scales, hair and feathers) (n > 100 items) were collected from beneath their nesting colony on trees near the farm. The taxonomical diversity of the Gray heron's diet was about two times higher compared with that of the otter. When considering the percent of minimal individual numbers in both diets (F_{ex}), we found that fish was the predominant prey. The main food source species for both predators was the crucian carp. The trophic niche of the Grey heron was broader (B_A = 0.3) than the otter's (B_A = 0.1). A relatively high overlap level of the niches was estimated (O_{piqi} = 0.6). The fact that the dominant food of both predators studied was a non-indigenous fish species to Europe, considered as a pest in the fish farms, determined the otter and the Grey heron more likely as salutary animals in the area and the seasons under this study.

Key words: Eurasian otter, Grey heron, diet.

INTRODUCTION

Two fish eating predators, the Eurasian otter (*Lutra lutra*) and the Grey heron (*Ardea cinerea*), often are considered as pests in the areas with fish breeding activities, and despite that they are protected in the countries of Europe sometimes are illegally killed by pond owners (CARSS, 1994; CONROY and CHANIN, 2002). The poaching in the areas with fish breeding activities is a critical factor especially for the Bulgarian otters (GEORGIEV, 2007). Despite this fact the two species we studied still are considered as widely distributed and abundant in the country (SIMEONOV *et al.,* 1990; GEORGIEV, 2007). Till now there is a lack of information about the otter's trophic niche overlap with this piscivorous predator bird. In Bulgaria the diet of the

Grey heron was not studied in detail and there was not any data on its diet in the area of fish farms (SIMEONOV *et al.,* 1990). Also there was no any study on a particular fish farm considering the otter diet. The fish pond breeding activities are known to be widely distributed in Bulgaria, and the micro dam wetlands are considered as important sites for the vertebrate fauna in its plains (NANKINOV, 2004). Our study was aimed on the following tasks: 1. to estimate the species diversity and number of the prey of the two predators in a fish pond area; 2. to calculate the trophic niche breadth and their overlap in the same habitat.

MATERIALS AND METHODS

We studied the area of fish farms near Nikolaevo Town, Kazanlashka Valley (Southern Bulgaria). This was a large area of shallow ponds with depth no more than 2 meters, usually 1-1.5 meters. The total surface of the area was 2.6 km^2 and was with 8.3 km circumference. Some of the basins were densely occupied by *Typha* sp., but usually there were open waters with grassy banks. The ponds were fed by canalized waters of the Tundza River which passes northward. The main fish species reared in the ponds mostly during spring and summer was the carp (*Cyprinus carpio*) but also the pike (*Esox lucius*), silver (*Hypophtalmychtis molitrix*) and bighead carp (*Hypophtalmychtis nobilis*) were bred there at the same time.

The study was undertaken during the spring and summer of 2005 and 2006 when the herons were most closely connected with the area during or just after the nesting season. Otter spraints (n = 48) were gathered from various substrates on banks of the ponds. The reason for such a small sample size was the poor quantity of marking sites found on all banks of the ponds being walked on foot. The Grey heron pellets and food remains (bones, scales, hair and feathers) (n > 100 items) were collected from beneath their nesting colony on trees near the farm (about 20-28 nesting couples according TILOVA *et al.,* 2005). This fish farm is the largest one in central Bulgaria (TILOVA *et al.,* 2005) and we consider that the birds and the otters mainly fed in this habitat, as well as the otters are known to have restricted home ranges (KRUUK, 2006), and the nesting Grey herons – hunting territories (VAN VESSEM *et al.,* 1984). Though the presence of some prey remains brought in vagrant predator stomachs from distant areas could not be excluded. The food components were determined using keys mainly by DAY (1966), MARZ & BANZ (1987), and POPOV & SEDEFCHEV (2003). The collected material was dried and stored in plastic bags. In the laboratory the spraints and pellets were softened in 75% ethanol to separate the prey items. A reference collection of fish bones and scales made especially for this study and the whole animal collections of the Faculty of Biology of Plovdiv University were also used. The mollusks were identified on the base of shell morphology, insects of various chithin remains, fish of opercula, praeopercula and pharyngeal teeth, reptiles of scales and vertebras, amphibians of pelvis and skull, birds and mammals by feathers, hair and skull remains. For the quantification study the minimal number of individuals preyed was accepted and measurements were taken using a caliper. It was assessed by paring and measuring food remain structures. Prey occurrence was expressed as per cent frequency (F_x = number of

individuals from a given taxa/total number of individuals registered). The trophic niche breadth (B_A) was calculated using Levin's formula, and the trophic niche overlap (O_{piqi}) – the MACARTHUR and LEVIN'S formula (KREBS, 1989).

RESULTS AND DISCUSSION

The taxonomical diversity of the Gray heron's diet was about two times higher compared with that of the otter. In the food of the heron we registered at least 20 species of prey: 1 snail species, 5 insect species, 9 fish species, 1 amphibian species, 3 reptile species, 1 bird species, and 3 species of mammals. The otter diet in the fish-ponds area represented minimum 11 taxa: 1 insect, 7 fish, 1 amphibian, 1 reptile, and 1 bird species.

When considering the percent of minimal individual numbers in the heron food remains and pellets, and in the otter spraints (F_{ex}), we found that in both food spectrums the fish was a predominant item (Figure 1). In the otter's diet it was 74.5%, while in the heron's it had lower value – 38.7%. The insects were very rare in the diet of the otter in this habitat and season (1.8%) but it was the second most common food for the Grey heron with a percent frequency of 38.2%. Even in first case an occasional swallowing of insect remains by stomach contents of fish could be supposed in second also the direct preying on invertebrates was evident. Despite that insects were abundant in the heron diet their small biomass could not compare with other larger vertebrate prey and their importance as a food source can be considered as negligible. The secondary otter food in the fish ponds were frogs (18.2%) which had a relatively low percent in the herons prey remains (7.2%). With a similar but higher value in the birds' food were the mammals (8.1%). The last prey category was not found in the otter spraints collected. In the herons diet only a single snail specimen was registered (0.9%). The reptiles were with same percents in both of the predator foods (3.6%). With low quantities were the birds in the Grey herons' and otters' diets, respectively 2.7% and 1.8%. While the small bird amounts in the otter food is typical as a whole for the species (KRUUK, 2006), our data was distinct from some others about the heron from other areas. This fact is typical for the Grey heron breeding colonies having a site varied main food (DRAULANS et al., 1987). The main food source and for both predators in our study area was the crucian carp (*Carassius auratus gibelio*) too. In the otter diet it was 41.8%, and in herons one – 20.7%. Both of the food spectrums were distinct by their secondary prey species. The carnivore's second food source was the marsh frog (*Rana ridibunda*) with 10.9%, and the birds' was the mole cricket (*Gryllotalpa gryllotalpa*) with 14.4%.

The fish species farmed in the ponds were with low percents of occurrence in both of the predator diets. The carp (*Cyprinus carpio*) had 5.5% in the otter food, and 4.6% in the Grey heron's. The percent of pike (*Esox lucius*) (also artificially bred in the area) were respectively 1.8% and 0.9%. The bighead/silver carp (*Hypophtalmychtis* sp.) was singly registered in the heron's diet only (0.9%).

The trophic niche of the Grey heron was broader ($B_A = 0.3$) than the otter's ($B_A = 0.1$). The trophic niche overlap studied maximal detailed differentiation of the

prey categories (29 distinct groups of prey, see Table 1). A relatively high overlap level of the niches was estimated (O_{piqi} = 0.6).

Table 1. *Diets and trophic niches of the otter (Lutra lutra) and the Grey heron (Ardea cinerea) co-existing in a fish farm area during the spring-summer season of Southern Bulgaria. Legend: n – minimal number of preys, $\%F_x$ – percent frequency of the individual preys, B_A – trophic niche breadth, O_{piqi} – trophic niche overlap.*

Prey item	***Lutra lutra***		***Ardea cinerea***	
	n	**$\%F_x$**	**n**	**$\%F_x$**
Radix ovata	0	0.0	1	0.9
Gryllotalpa gryllotalpa	0	0.0	16	14.6
Cetonia sp.	0	0.0	1	0.9
Scrabaeidae sp.	0	0.0	1	0.9
Dytiscidae sp.	0	0.0	1	0.9
Coleoptera sp.	0	0.0	15	13.6
Heteroptera sp.	0	0.0	1	0.9
Insecta sp.	1	1.8	7	6.4
Esox lucius	1	1.8	1	0.9
Rutilus rutilus	0	0.0	9	8.2
Alburnus alburnus	1	1.8	1	0.9
Abramis brama	0	0.0	1	0.9
Pseudorasbora parva	1	1.8	1	0.9
Cyprinus carpio	3	5.5	5	4.6
Carassius sp.	23	41.8	23	20.9
Hypophtalmichtis sp.	0	0.0	1	0.9
Lepomis gibbosus	2	3.6	0	0.0
Perca fluviatilis	8	14.6	1	0.9
Pisces sp.	2	3.6	0	0.0
Rana ridibunda	6	10.9	8	7.3
Rana sp.	4	7.3	0	0.0
Emys orbicularis	0	0.0	1	0.9
Sauria sp.	0	0.0	1	0.9
Natrix sp.	2	3.6	3	2.7
Aves sp.	1	1.8	3	2.7
Erinaceus concolor	0	0.0	1	0.9
Sylvaemus flavicollis	0	0.0	2	1.8
Microtus sp.	0	0.0	2	1.8
Rodentia sp.	0	0.0	4	3.6
Total	55	100.0	110	100.0
B_A	**0.1**		**0.3**	
O_{piqi}	**0.6**			

CONCLUSIONS

This study represents useful results that are relevant to the understanding and mitigation of a conflict between humans and the conservation of predators because of the use of biological resources. The paper could be used when the compensatory payments to the fish breeders having piscivorous predators in their area begin to develop as a practice in Bulgaria.

As a whole it could be concluded that in the fish farm studied in spring-summer season the otter was preying mostly on fish, while the Grey heron was feeding mainly on fish, insects and partly on mammals. Despite such differences both trophic niches were relatively highly overlapped. Possibly because of its availability in the habitat predominant prey for both predators was the crucian carp. The fact that their dominant food was a non-indigenous fish species to Europe, considered as a pest in the fish farms known to compete with the farmed carp species (MCDOWALL, 2000), determined the otter and the Grey heron more likely as salutary animals in the area and the seasons under this study.

ACKNOWLEDGEMENTS

I am very grateful to Mr. Shane Clark (NGO "Green Balkans") for the priceless help when editing the English language of this paper.

REFERENCES

CARSS, D. 1994. Killing of piscivorous birds at Scottish Fin fish farms, 1984-87. Biol. Conserv. 68: 181-188.

CONROY, J., CHANIN, P. 2002. The status of the Eurasian Otter (*Lutra lutra*) in Europe – a review. IUCN OSG Bull. Special Issue, Vol. 19A, pp. 7-28.

DAY, M. 1966. Identification of feather and hair remains in the gut and faeces of stoats and weasels. J. Zool. 148: 201-217.

DRAULANS, D., PERREMANS, K., VAN VESSEM, J., POLLET, M. 1987. J. Zool. 211: 695-708.

GEORGIEV, D. 2007. Otter (*Lutra lutra* L.) mortalities in southern Bulgaria: a case study. IUCN OSG Bull. 24: 36-40.

KREBS, C. 1989. Ecological methodology. Harper Collins Publisher, New York.

KRUUK, H. 2006. Otters: ecology, behaviour and conservation. Oxford University Press, Oxford.

MARZ, R., BANZ, K. 1987. Gewöll – und Rupfungskunde. Academie Verlag, Berlin.

MCDOWALL, R. 2000. The Reed field guide to New Zealand freshwater fishes. Reed, Auckland.

NANKINOV, D. 2004. Breeding totals of the ornithofauna in Bulgaria. Green Balkans Publisher, Plovdiv.

POPOV, V., SEDEFCHEV, A. 2003. The Mammals of Bulgaria. Vitosha Publsher, Sofia. (In Bulgarian).

SIMEONOV, S., MICHEV, T., NANKINOV, D. 1990. Fauna Bulgarica: Aves, Vol. 1. BAS Publisher, Sofia.

TILOVA, E., GEORGIEV, D., IVANOV, I., STOEV, I. 2005. Ornito-fauna of the Nikolaevo fish-breeding pond. Sci. Stud. Plovdiv Univ. Anim. 41: 123-134. (In Bulgarian).

VAN VESSEM, J., DRAULANS, D., DE BONT A. 1984. Movements of radio-tagged Gray herons *Ardea cinerea* during the breeding season in a large pond area. Ibis 126: 576-587.

ХРАНИТЕЛЕН СПЕКТЪР НА ВИДРАТА И СИВАТА ЧАПЛА СЪВМЕСТНО СЪЩЕСТВУВАЩИ В РИБОВЪДНО СТОПАНСТВО В БЪЛГАРИЯ ПРЕЗ ЛЕТНИЯ ПЕРИОД

Дилян Г. Георгиев

Катедра „Екология и ООС“, Факултет по Биология,
ПУ„Паисий Хилендарски“, ул. „Цар Асен“ 24, 4000 Пловдив,
e-mail: diliangeorgiev@abv.bg

(Резюме)

Нашето изследване имаше за цел да проучи качествения и количествения състав на хранителния спектър на два рибоядни хищника в района на рибовъдно стопанство – европейската видра (*Lutra lutra*) и сивата чапла (*Ardea cinerea*). Ние изследвахме рибовъдните басейни в близост до град Николаево, Казанлъшка долина (Южна България). Събирани са екскременти на видра (n = 48) както и погадки, и хранителни остатъци на сива чапла (n > 100). Установихме, че таксономичното разнообразие на храната на сивата чапла е около два пъти по-богато от това на видрата. Трофичната ниша на чаплата (B_A = 0.3) е по-широка от тази на видрата (B_A = 0.1). Установяваме относително голямо препокриване на трофичните ниши на двата хищника (O_{piqi} = 0.6). Отчитайки процентното съотношение на минималния брой установени индивиди (F_{ex}), регистрираме рибата като основна храна и за двата вида хищника. Основният хранителен ресурс за тях е каракудата. Фактът, че основната храна и на двата изследвани вида е риба считана за вредител в рибовъдните стопанства ги определя по-скоро като полезни през проучвания сезон в района на изследване.