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A QUANTITATIVE ESTIMATION OF PREDATORY BIRDS' PRESSURE UPON GAME BIRDS' POPULATIONS IN THE CENTRAL REGION OF THE EUROPEAN PART OF THE USSR

V. M. Galushin

(USSR)

The predator-prey problem is viewed differently by the hunter and the ornithologist. Nothing may be said against it as this difference is in essence a reflection of the actual and inevitable difference in the approach to the natural communities including game animals. The ornithologist regards the predatory animal first of all as a fully-fledged, even essential, member of ecosystems. Obviously, he is quite right. On the other hand, the hunter regards predatory animals, and justifiably, as a competitor.

This contradiction which is objective in the long run, is not dangerous to the integrity of the natural communities as well as to game management. The danger comes from subjectivism and a one-sided approach in the attempts to solve this contradiction. This is particularly so when measures to intensify game management are being implemented in practice or when suggestions on the conservation of nature are being realized.

Some of this contradiction is quite worth being considered. In such a situation one can see clearly the necessity of particularly thorough, scrupulous and perhaps even pedantic research aimed at revealing the genuine ecological significance of predators, obtention of objective data clearly and convincingly characterizing the various aspects of their significance for agriculture and forestry and their influence upon game populations.

Hence the need of somewhat universal and at the same time relatively simple index to meet the requirements.

The Quantitative Estimation of Predation Through Calculation of the Index of Predatory Pressure

Our many years' investigation of predatory birds and participation in debates on their role in nature and game management convince us that to a certain extent the above-mentioned conditions are made by a so-called **index of predatory pressure** (sometimes it is called an index of predatory influence or more simply, index of predation). **It is expressed in the percentage of the individuals taken by all predators out of the total number of potential victims within the area under study for a definite period of time.**

For a numerical representation of the index of predatory pressure (or IPP) by predatory species "A" out of the population of the prey species

abundant and varied than in the Vladimir station (Table 1). On the other hand, this important similarity also attracts attention: the notorious enemy of game birds, *viz* the goshawk *(Accipiter gentilis)* so hated by all hunters is to be found in the last lines of both lists not exceeding 5-6% of the total number of birds of prey in the stations.

Table 1

A number of breeding pairs of birds of prey within Oka (350 sq km, including 87 sq km) of key area) and Vladimir (250 sq km) stations, Central Region of European part of the USSR

Predatory species	Oka station, 1956-1958				Vladimir station, 1963-1965		
	Number of pairs		per 100 sq km	Ratio in %	Number of pairs	per 100 sq km	Ratio in %
	Within key area* in 1956	Within the whole station					
Goshawk — *Accipiter gentilis*	1	2	0.6	2.2	2	0.9	5.7
Sparrow Hawk — *Accipiter nisus*	—	4	1.1	4.4	4-6	1.9-2.9	15.2
Montague's Harrier — *Circus pygargus*	—	1	0.3	1.1	—	—	—
Black Kite — *Milvus korschun*	23-16	32-37	9.1-10.6	37.8	2-3	0.9-1.4	6.6
Sea-Eagle — *Haliaetus albicilla*	1	0-1	0-0.3	0.8	—	—	—
Spotted Eagle — *Aquila clanga* .	4	9	2.6	10.0	—	—	—
Common Buzzard — *Buteo buteo* . .	4	17-22	4.8-6.3	21.1	17-23	8.1-11.0	57.2
Honey Buzzard — *Pernis apivorus*	—	3-7	0.9-2.0	5.6	0-5	0-2.4	8.7
Short-toed Eagle — *Circaetus ferox*	—	1	0.3	1.1	—	—	—
Osprey — *Pandion haliaetus*	—	1	0.3	1.1	—	—	—
Hobby — *Falco subbuteo*	—	6-8	1.7-2.3	7.8	—	—	—
Kestrel — *Falco tinnuculus*	—	3-11	0.9-3.1	7.0	1-4	0.5-1.9	6.6
Total . . .	33-26	83-102	23.7-29.2	100.0	32-40	15.2-19.0	100.0

Note: *The column includes only those predators which feed on waterfowl and meadow birds within a key area.

Another ill-famed enemy of game bird, *viz* the marsh harrier *(Circus aeruginosus)* is absent altogether. The dominating position in the Vladimir station belonged to the reputed exterminator of harmful rodents, *viz* the common buzzard *(Buteo buteo;* 57% of the total number) while in the Oka station to the same common buzzard (21%) together with the omnivorous black kite *(Milvus korschun;* 38%).

Table 2

Indexes of predatory pressure (IPP) upon game birds' populations at Vladimir station (210 sq km) during summer seasons in 1963-1965

Potential prey species	Total number of individuals (ad+juv) of game birds within station in June	IPP, i.e. percentage of individuals taken by predators out of the total number of game birds		
		IPP by common buzzard (*Buteo buteo*) 17-23 pairs	IPP by goshawk (*Accipiter gentilis*) 2 pairs	Total IPP
Hazel Grouse (*Tetrastes bonasia*)				
1963	1,400	0.4	5.0	5.4
1964	1,400	1.6	5.2	6.9
1965	1,200	4.8	4.2	9.0
Black Grouse (*Lyrurus tetrix*)				
1963	1,000	—	2.1	2.1
1964	1,100	2.1	1.6	3.7
1965	1,200	—	1.7	1.7
Capercaillie (*Tetrao urogallus*)				
1963	600	—	1.8	1.8
1964	500	—	2.0	2.0
1965	500	—	1.4	1.4
Fowl-like birds (*Galliformes*) including unidentified				
1963	3,000	0.7	4.3	4.9
1964	3,000	1.9	4.5	6.4
1965	2,900	2.3	3.7	6.0

Table 3

Indexes of predatory pressure (IPP) upon waterfowl's and meadow birds' populations at the key area (87 sq km) of Oka station in summer of 1956

Potential prey species	Total number of individuals (ad+juv) of game birds within key area in June	IPP, i.e. percentage of individuals taken by predators out of the total number of game birds from 1st of June till 10th of August 1956					
		by kite (*Milvus korshun*) 23-16 pairs	by spotted eagle (*Aquila clanga*) 4 pairs	by sea-eagle (*Haliaetus albicilla*) 1 pair	by goshawk (*Accipiter gentilis*) 1 pair	by common buzzard (*Buteo buteo*) 4 pairs	Total IPP
Ducks (*Anatidae*)	1,700	5.5	4.1	1.0	1.5	—	12.1
Common Quail (*Coturnix coturnix*)	2,100	1.8	—	—	—	—	1.8
Corn Crake (*Crex crex*)	8,500	0.8	0.3	0.1	—	0.3	1.5

Thus the analysis of the ratios between the numbers of different species of birds of prey can in itself serve as a good criterion for a tentative estimation of the importance of predatory birds for game management in one or another region.

Food Spectors and Food Rationing: The same rations compel one to give due attention to the peculiarities of feeding of common and the more numerous species of predatory birds such as common buzzard, kite, goshawk, spotted eagle *(Aquila clanga)*, etc. For logic can be found in an assumption once put forward that, for example, the most common birds of prey in our forests, *viz* the common buzzard in the years of a sharp decline in its basic food, *viz* mice and voles, switch over to very different kinds of food including the younglings of fowl-like birds.

The collection of materials on the feeding of birds of prey was aimed not only and not to a substantial extent at the traditional determination of the food spectors (i.e. **percentage** ratio of various species in the prey), rather it was aimed at calculating the food rationing of individual pairs and their entity (i.e. the **number** of various species of animals killed by birds of prey within a certain period of time; in our case within the period of feeding the young). Incidentally the latter task required performing rather labour-consuming, round-the-clock observations of the nests of birds of prey. The spectors of food for most of the species calculated by our materials did not on the whole differ much from the known ideas in that regard.

Thus in the prey of the goshawk, game birds constituted 25% while in the prey of sparrow hawk *(Accipiter nisus)* they were absent altogether (more evidence of the absurdity of including them among species harmful for game management).

The spotted eagle and sea eagle *(Haliaetus albicilla)* are far from being indifferent towards waterfowl (respectively 20% and more than 50% in their general food spectors). In the prey of black kite, ducks—even though they are abundant in the Oka sanctuary—played a secondary part (we shall, however, discuss in more detail below the nature of the black kite-duck relationships). A substantial clarification was obtained perhaps regarding only this food spector of the most common and seemingly study species, *viz* the common buzzard. The once widely accepted methodology of studying the food of birds of prey by analysing the food remnants and, particularly, their pellets often led to a complete exclusion of the practically untraceable digested frogs from the lists of prey of the common buzzard. Or more often the frogs were assigned the role of accidental food. Systematic observation near the nests and the samples of prey taken reveal a different and important role of frogs in the food of the common buzzard. While in the years when rodents were abundant, frogs accounted on an average for about 12% of the total food spector, in the years when the number of field voles *(Microtus arvalis)* decreased the proportion of frogs in the food of the common buzzard reached 30-40% for majority of pairs and even 80% for selected pairs. At the same time, contrary to assumptions often put forward even in such "famine" years for the young of fowl-like birds their food change only marginally. From a comparison of the food spectors of the common buzzards in years with different availability of food it certainly follows that their main and fond prey is various voles (which as a matter of fact, nobody doubts) while the main substitution is frogs (which was doubted by many).

More complex were food relations of another abundant bird of prey, *viz* the black kite with ducks in the Oka station. Aware of the sanitary inclinations of the species we undertake specific research of the food brought by it to the nests. It was discovered that up to 80% of the exa-

mined ducks and their younglings had actually been picked up by the kites while already dead or wounded (by hunters, agricultural implements, etc.) rather than caught.

Thus the picture of the real IPP of the black kites on the populations of waterfowl within the key area near the Oka sanctuary was substantially different from the ideas founded solely on the determination of the total food spector.

So the calculation of the number and the food spector in themselves already allow one to form an idea of the character of the predatory influence on the population of game bird in this or that region.

Another step for a more clear, quantitative estimation of predatory influence on the populations of preys is determination of the rationing of food, i.e. the number of the individual animals of various species caught by the predatory birds on the territory under study within a certain time limit: 24 hours, a week, a month, a nestling season, etc.

Obtaining materials necessary for such calculations requires performing a considerable amount of observation at the nests and in the hunting places of the predators.

Without going beyond the scope of the specificity of the present paper let us touch upon only part of the rationing including game birds.

In the Oka station the loss caused by birds of prey to the populations of ducks on the 87 sq km territory of the key area was noticeable. Thus, in 1956 each brood of black kites killed on an average less than 5 ducklings (all the black kites hunting within the key area caught about 90 ducklings in the course of the summer), each brood of spotted eagle — roughly 15-18 duck and ducklings. On the whole, the loss in the population of the ducks in 1956 was over 200 birds, mostly ducklings. The high number of birds of prey in the sanctuary certainly affect the results.

In the Vladimir station the food rationings of birds of prey were different. Here each pair of common buzzards caught on an average two younglings of fowl-like birds within a nestling season (all common buzzards — 20-70 birds in different years) while a pair of goshawk — 20-30 times more (both the pairs inhabiting the area caught some 100-120 fowl-like game birds). On the whole the damage to the number of game birds caused by birds of prey on a considerably larger territory of the Vladimir station (210 sq km) constituted 130-170 birds, almost exclusively younglings within the nestling season.

Indexes of Predatory Pressure

By including in the programme of field work a complex of rather labour-consuming calculations of the number and productivity of prey species, the researcher obtains everything necessary for a quantitative estimate of the scope of the IPP on the populations he is interested in. In our calculations we used the maximum, i.e. the June number both of adult birds and younglings as our initial data.

The results of our calculations of the IPP on the populations of some of the game birds in the Vladimir (fowl-like birds) and Oka (ducks and meadow birds) stations are given in Tables 2 and 3 respectively.

In the Vladimir hunting ground the index of predatory pressure was insignificant—on the whole it was 5-6% in relation to the fowl-like birds. It is important that 60-85% of this pressure normally caused only by the 2 pairs of goshawks inhabiting this area. On the other hand the 10 times bigger number of common buzzards catches 2-6 times less fowl-like birds. Only once in the year of a complete absence of field voles (1956) the IPP by the common buzzards on the populations of fowls equalled the IPP by the goshawks. But even in such exceptional conditions it did not

go beyond the limit of 5% (i.e., about 60 individuals out of the total number of fowl younglings caught by all the common buzzards).

In the key area of the Oka station the predatory pressure on waterfowl was more noticeable. Here the IPP on the populations of ducks is twice as much as in the Vladimir station. Here the main role is played by the black kite (5.5% of IPP) and spotted eagle (4.1%). Solitary pairs of sea eagle and goshawk are of little significance. What should be emphasized is that even under such seemingly strong pressure of predation on the duck populations in the area under consideration, no trend of reduction in the number of population was observed from year to year. On the contrary in the semi-protected zone round the Oka sanctuary, due to the strict keeping of the hunting rules and regulations, the number of ducks in this area increased from year to year, perhaps slowly but steadily: in the autumn of 1956—573 ducks were registered within the controlled spot; in 1957—560; 1958—567; 1959—817; 1960—902; 1961—952.

The IPP upon the population of common quail *(coturnix coturnix)* and corn crake *(Crex crex)* was 6-8 times weaker, possibly because of their more permanent bias for hiding or partly owing to their greater number (corn crake, for example). Incidentally a similar IPP was observed on the very huge population of purching birds *(Passeriformes)* in the Vladimir station (about 1.5%) entirely due to the activeness of the sparrow hawk.

Concluding Remarks

Having calculated the above-mentioned indexes of predatory pressure, the author found himself confronted with the puzzling question: five per cent, is it much or little? Or, in the light of purely applicable uses: is it necessary to apply sanctions to birds of prey to reduce the scope of this damage caused to game birds? (With respect to the IPP upon ducks in the Oka sanctuary, this question is groundless as the investigated territory was part of a reservation.)

Though, generally speaking, it is difficult to answer such questions uniformly, in the specific conditions of our research, 5% of the entire population of fowl-like birds killed by birds of prey is undoubtedly very little. Even for a support hunting ground. Therefore, the author thinks that all attempts to "protect" game from such an "oppression" of the birds of prey in these conditions are not only useless but even harmful.

Firstly, the above-mentioned 5% are quite natural and necessary for the normal existence of population rates of death. Besides, one should not neglect the selective importance of such predatory pressure.

Secondly, about half of the loss is caused by only 2 pairs of goshawks which constitutes less than 6% of the total number of birds of prey in the area under study. Moreover, attempts to find and catch unawares these very, and the most undesirable 6% (which are at the same time exceptionally hideous and cautious) will require as the experiment shows, unjustifiable expenditure of time and funds. The author intentionally refrains here from repeating the generally known sad consequences of the all-out fight against birds of prey at random, without any selections.

Thirdly, common buzzards account for half of the damage caused by birds of prey. One can easily imagine the scope of the damage which can be caused to agriculture if the idea is accepted of large scale extermination of vole-eating common buzzards in order to save 1.5-2% hazel grouse *(Tetrastes bonasia)*. In this case each saved young of the hazel grouse may cost half a ton of grain lost due to rodents.

It remains to be added that in the course of reconsidering the official standing of birds of prey in the hunting legislation in the USSR the indexes of predatory pressure discussed above have played along with

other materials a certain role. They have become sort of a counterpoint to the measures envisaged for control of the so-called "harmful" birds of prey. A real possibility emerged to assess the economic effect of these measures as against the scope of damage caused to game by birds of prey.

The result is well known. Now in all the Union Republics of the Soviet Union extermination of birds of prey everywhere is prohibited by new legislation and recompense for their destruction have been cancelled. The official standing of birds of prey in most of the countries of the world does not at present cause particular alarm for their fate.

But a factor exists, the ignorance of which can reduce to zero the achievements. This factor is the views and convictions of hunters themselves regarding the significance of birds of prey.

It would be naive to believe that the resentment on the part of the hunters towards any predatory animals—resentment accumulated for centuries—will disappear once some good bills are passed. An extensive long term and effort-consuming propagation of the genuine knowledge of birds of prey is what is needed. Extensive and convincing evidence of their real significance in various natural and economic conditions, including their role in game management, is necessary. Moreover this evidence must be convincing not only and not as much for the specialists as for the public at large, for those who hunt.

The author hopes that indexes of predatory pressure might become part of such evidence.

ОПЫТ ОПРЕДЕЛЕНИЯ РАЗМЕРОВ ИЗЪЯТИЯ, ОСУЩЕСТВЛЯЕМОГО ХИЩНЫМИ ПТИЦАМИ ИЗ ПОПУЛЯЦИЙ ПЕРНАТОЙ ДИЧИ В ЦЕНТРЕ ЕВРОПЕЙСКОЙ ЧАСТИ СССР

В. М. Галушин

(СССР)

Традиционная, в какой-то мере резонная, противоречивость подхода охотников и орнитологов к проблеме «хищник — жертва» с несомненностью требует обобщенного и вместе с тем простого и доходчивого свидетельства природного и хозяйственного, в том числе охотохозяйственного, значения хищников.

Применительно к хищным и охотничьим птицам было найдено, что одним из таких достаточно убедительных свидетельств может стать так называемый «показатель хищного изъятия» (он же «показатель хищного воздействия», «индекс хищничества» или, как в английском тексте данного сообщения, «показатель хищного давления»). Он означает выраженный в процентах размер изъятия, осуществляемого совокупной популяцией хищников какого-либо района из поголовья обитающих здесь видов-жертв за определенный период времени.

X_a^A — показатель изъятия, осуществляемого на исследуемой территории хищным видом «А» из популяции вида «а»;

N^A — общая численность вида «А» на данной территории в количестве особей или, в наших исследованиях, в числе гнездящихся пар;

P_a^A — среднее количество особей вида «а», поедаемое каждым хищником (или чаще выводком) за избранный отрезок времени (в нашей работе — за гнездовой период);

n_a — общая численность вида «а» в пределах исследуемой территории.

Расчет показателя хищного изъятия для пары видов «А» и «а» ведется по формуле

$$X_a^A = \frac{N^A \cdot P_a^A}{n_a} \cdot 100\%.$$

Исследования воздействия хищных птиц на поголовье видов-жертв велись в течение 12 лет (1956—1967 гг.) на стационарах в пределах Европейского Центра СССР (примерно 270 тыс. $км^2$). Основные материалы были получены с ключевого участка (87 $км^2$ заливных лугов с озерами) Окского стационара (350 $км^2$ одноименного заповедника, его охранной зоны и окрестностей) и их Владимирского стационара (210 $км^2$ в пределах спортивно-охотничьего хозяйства на западе Владимирской области).

Результаты исследований, приведенные в табл. 2 и 3, показывают, что суммарное изъятие, осуществляемое в 1963—1965 гг. пернатыми хищниками из популяций куриных птиц (около трех тысяч взрослых и молодняка на начало июня) Владимирского стационара, составляло за каждое лето 5—6% их общего поголовья. Более половины этого воздействия (3,7—4,5%) приходилось на две пары ястребов-тетеревятников, тогда как 17—23 гнездящихся здесь в эти годы пар обыкновенных канюков вылавливали от 0,7% (1963 г.— пик численности серых полевок) до 2,3% (1965 г.— депрессия численности мышевидных грызунов) общего поголовья куриных. В добыче других пернатых хищников Владимирского стационара дичь не отмечена. Такой пресс хищничества даже в условиях спортивно-охотничьего хозяйства следует признать несущественным, ибо он вполне укладывается в рамки нормальной естественной смертности в популяциях куриных. Попытки же избавить дичь от такого «гнета» могут привести и не раз приводили к массовому истреблению канюков, пустельг и других полезных видов, что является прямым и немалым ущербом сельскому хозяйству.

Благодаря режиму заповедности численность хищных птиц (табл. 1) и соответственно их воздействие на популяции утиных в пределах ключевого участка Окского стационара были выше — в 1956 г. 12% изъятия, осуществляемого коршунами (23—16 пар), большими подорликами (4 пары), орланами-белохвостами (1 пара), тетеревятниками (1 пара) и канюками (4 пары). Однако строгое соблюдение охотничьих правил и другие меры в охранной зоне Окского заповедника полностью компенсировали урон, наносимый пернатыми хищниками утиным, численность которых не падала, а год от года несколько возрастала. Воздействие хищников на популяции луговых птиц — коростеля и перепела — не превышало 2%.

Приведенные здесь показатели хищного изъятия наряду с другими материалами сыграли определенную положительную роль при обсуждении и коренном изменении официального статуса хищных птиц. В результате на всей территории СССР было прекращено повсеместное преследование хищных птиц и, главное, запрещена выплата каких бы то ни было вознаграждений за их уничтожение.

В этих условиях особо важным фактором стало отношение к пернатым хищникам широких кругов охотников-любителей. А отсюда одна из главных задач сегодня — получение все новых и новых материалов, убедительно показывающих реальное значение хищных птиц в природе, сельском, лесном и охотничьем хозяйствах. Опыт показывает, что расчет показателей хищного воздействия — достаточно надежный путь для этого.