UNIVERSITY OF WISCONSIN
COLLEGE OF AGRICULTURE
MADISON

DEPARTMENT OF AGRICULTURAL ECONOMICS

New Soils Building
February 20, 1935

Dr. Paul L. Errington
Iowa State College
Ames, Iowa

Dear Paul:

There are two English journals, the Journal of Ecology and the Journal of Animal Ecology, both of which are sponsored by the British Ecological Society. I know nothing about the Journal of Ecology. Elton is the editor of the Journal of Animal Ecology and in my opinion it would be a highly appropriate medium for your paper. Elton's address is: Charles Elton, University Museum, Oxford.

I am glad to see McAtee's favorable comments and I, too, find myself influenced by them. I still feel unable to give you an intelligent vote, however, because of my inability to understand the bottom of page 3. You have made it clear what you mean by "mobile populations," but from there to the bottom of the page I am totally lost. Since I cannot follow your thread of logic to the end, I am not in a position to vote on whether there is enough new material in the paper to safeguard you against a charge of repetition.

I agree with your comments on McAtee's points through the fourth one. The fifth leads me to wonder whether McAtee really fully understands you.

I do not understand your own O.K. of the sixth one, since in discussing carrying capacity you are discussing variations in the condition of a single area rather than differences between areas.

I have marked in red one additional point where the phrasing seems to me obscure.

I think I have a real quail man in Hawkins. He is turning up some new stuff which I think will eventually be a real addition to your quail study. I am anxious for you to get better acquainted with him, and for him to get the benefit of your coaching. We will all look forward to your return to Madison. I will be here, as I am tied up with classes.

Yours sincerely,

Aldo

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# OVER-POPULATIONS AND PREDATION: A RESEARCH FIELD OF SINGULAR PROMISE*

By Paul L. Errington.

Recent publication[1] has been made of evidence supporting a modification of the broad principle advanced by McAtee[2] that "predation tends to be in proportion to population" and later restated by him to conclude "..... the proportion, however, rising and falling progressively with the increase or decrease in numbers of the available food organisms"[3]. McAtee's emphasis upon availability of prey being the chief factor governing the food habits of predatory species has been particularly substantiated by our ecological studies on bob-white (Colinus virginianus virginianus (LINN.) in north-central states.

McAtee, summarizing the results of a tremendous amount of research (80,000 bird stomach examinations) in a short statement, neither intended nor attempted to discuss in full detail the food habits of, or the effects of predation on, any individual species. From the standpoint of a concise generalization pertaining to predators and prey as a whole, McAtee's principle of proportional predation may be about as close to the truth as we are capable of arriving.

Fundamental as this may be, we need further amplification of predator and prey relationships to give a clearer insight into the mechanics of predation. Its exceptions, its modifications, its pertinent corollaries, within the limits of our knowledge and our capacities for investigation, are in need of a great deal more scientific sorting and digestion than they have thus far received.

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1. Errington, Paul L. Vulnerability of Bob-white populations to Predation. Ecology, 15(2):110-127, 1934.
2. McAtee, W. L. Effectiveness in nature of the so-called protective adaptations in the Animal Kingdom, chiefly as illustrated by the food habits of Nearctic birds. Smithsonian Misc. Coll. 85(7). (Publ. 3125). 1932.
3. _____. Rejoinder to papers on protective adaptations. Proc. Roy. Ent. Soc. of London, 81:113-126. 1933

*Journal Paper No. ___ of the Iowa Agr'l Expt. Station, Ames, Iowa. Proj. No. 330.

defining "material" here first time you use it, not here



In the case of the bob-white, availability as prey to predatory species is not necessarily in proportion to population, ~~an inevitable~~ This conclusion ~~to be drawn from~~ existant winter field data[4] for the north-central states. is clearly indicated by the We have, for bob-white, recorded winter survials of strong populations with very little loss from natural enemies.

Material or heavy predation upon vigorous adult winter bob-whites appeared largely confined to that proportion of the population which was in excess of the capacity of the environment properly to accomodate. Aside from those that may have been weak, injured, or individually handicapped from some similar cause, the birds that bore the brunt of predation were the ones situated in inferior or over-crowded habitats and hence dangerously exposed to attack by reason of their insecurity of position.

Incidental or accidental predation (distinguished from "material" predation) attending well-situated populations, as measured to date, has been so low (rarely greater than 6% per 90 days) that it probably has not greatly exceeded what would have been the natural winter mortality from age and miscellaneous accidents alone, had there been no predators.

So far as we have been able to ascertain, the apparent definiteness of maximum winter carrying capacity of a given environment for bob-white is governed by the quality and distribution of food and cover and by the intolerance of the bob-white as a species toward over-crowding. As populations ascend past the maximum carrying capacity of the land, they become vulnerable to predation in proportion to their surplus, seemingly irrespective of kinds and numbers of predators ordinarily present.

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4. Errington, Paul L. The wintering of the Wisconsin bob-white. Transactions of the Wisconsin Acad. Sci., Arts and Letters, 28:1-35. 1933.

We have fragmentary evidence that this thesis of population vulnerability - or population security, if one wishes to think of it in that light - applies to species other than bob-white under winter conditions. Indeed, it conceivably may apply to many species showing territorial intolerance as non-breeding adults. (Territorial intolerance in the breeding season should probably not be considered in connection with the present discussion because of the variables introduced by mating behavior).

Perhaps many species not showing any conspicuous territorial intolerance may have population levels at which they are no longer materially vulnerable to predation, or, in other words, rendered unavailable to predators by virtue of their security of position. I would suspect that any one of numerous species may have a virtually ineradicable residuum which would not have to be a small residuum. We have records of bob-white populations as substantial as a bird per four acres - about the highest density that we have been able to census with desired accuracy - being so well situated as winter adults as to be practically untouchable by natural enemies, including those known to be of formidable types.

From this it may be justifiable to suggest that McAtee's principle might be more truly applicable to over-populations rather than simply to populations as they may occur in nature. But then the question may arise if most ~~distinctly~~ ~~motile~~ populations may not in actuality be more or less over-populations for their particular environmental niches, except probably for species that are highly specialized, decadent, or have been reduced to low densities on account of exploitation or persecution by man, epizootics, temporary emergencies, etc.

Apart from populations consisting mainly of immature animals which exhibit varying degrees of helplessness, I would think that invertebrate populations especially and populations of the more prolific vertebrates may often be essentially over-populations. In the latter event it may not make a great

a great deal of difference whether one may say that predation is in proportion to population or to over-population.

It may make vastly more difference which is the case, however, if one's problem is to evaluate the role of predation in the life history of some species of esthetic, scientific, or economic consequence.

Here is a research field barely scratched and a field of almost endless potentialities. It is a field to demand the utmost in investigational background, ecological technique, ingenuity, and interpretation. Its difficulties constitute a challenge, as does its basic importance to a balanced human society.

What do we know about what actual effect predation may have upon animal populations? Next to nothing, in the overwhelming majority of instances. The all inclusive "anti-vermin" complex of some sportsmen, with its extravagences and its dogmas, is but one manifestation of our lack of knowledge, whatever else it may be in analysis. The perennial controversies among scientists themselves point to a continued need of studying predation both from the standpoints of predator and of prey; if possible, simultaneously and in the same areas and under conditions favoring the acquisition of salient ecological data.