

Part Two of a Trilogy

Predation and Bobwhites: Social and Ecological Implications

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In the first article of this series, we described the complexity of the predator/quail issue. We outlined some of the major historical perspectives that have shaped the dominant predation paradigm in today's biological circles. We described how, in theory, predator abundance may contribute to observed low quail densities on some localized areas managed for quail in the Southeast. We also presented that, while no definitive predator studies have been conducted on bobwhite, a preponderance of studies conducted on predation of game birds have documented that predators reduced reproductive output and limited fall population size. We introduced the concept of the predator context, that is the composition and abundance of predators in time and space, and how it likely interacts with habitat to affect the "quality" of an area for bobwhite. Quality can be defined demographically as the survival and reproductive success of quail on a given area.

Finally we suggested that biologists, ourselves included, without methods to assess the predator context in relation to quail demographics may find themselves prescribing unnecessary habitat changes hoping to increase quail populations. We made these points to make clear the need for a sustained research effort to better understand how predation affects quail populations and how this is important to better management at the local scale - the scale of quail management in the Southeast. In this second article, we will describe current research activity with bobwhite and predators, including the cooperative project funded, in part, by Quail Unlimited.

A Cooperative Effort

In 1999, researcher members from the Southeast Quail Study Group met

with Quail Unlimited to discuss the potential for predator and habitat research. After lengthy debate on baseline information available, the kinds of research needed, and the costs and benefits of various research approaches, we decided to develop a cooperative research project between Quail Unlimited and members of the Southeast Quail Study Group that conduct research on quail demography and habitat. We determined that a study that manipulated predator density (predator removal) would be premature before we understood the nature of the relationship between relative abundance of predators and bobwhite productivity. Three scientists within the SEQSG already had ongoing radio-telemetry studies measuring bobwhite productivity and habitat use on 12 sites in Georgia, Florida, Mississippi, and Tennessee. However, these studies had not been monitoring predator abundance because of funding constraints. Funds provided by QU would be used to measure the types and relative abundance of predators, that is the predator context, on these sites with active telemetry and habitat research to determine if reproductive success was correlated to predator abundance. This infusion of QU funds leveraged the half million dollars already being allocated to bobwhite research by state and private institutions and helped to facilitate cooperation among these research groups. This will allow us to accomplish far more than either QU or any of the individual researchers could alone. This cooperative project is unique in that it is the first time in the history of quail research that an effort has been made to establish a relationship between predator abundance and quail abundance and demography, ideas first advanced by Herb Stoddard and Aldo Leopold over

50 years ago. This is critical, because the first step in the scientific process is to observe a phenomenon in question. If predators are not related to quail demographics, the result of our research should be similar to Figure 1a, showing that reproductive performance, survival or density vary independently of low or high predator contexts when habitat is well managed. This outcome would support the often-heard claim that quail populations are limited by habitat only. If the local predator context explains

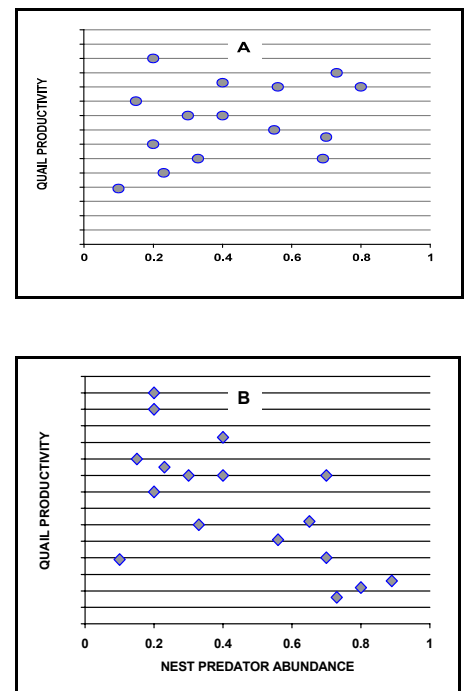


Figure 1. Hypothetical graphs showing two potential outcomes of the cooperative research project. The top graph (A) shows an example of what the results should look like if there we find no relationship between nest predator abundance and quail reproductive productivity across study areas. The lower graph (B) shows what the research results might look like if nest predator abundance, across areas, was negatively related to quail reproductive success.

some of the variation in reproductive performance, survival or density, then the results should mirror Figure 1b, showing that as the predator context increases or exceeds some threshold, quail survival and reproduction decline regardless of habitat. This result would support the idea that under certain conditions, predators reduce the “quality” of an area for quail. Notice in Figure 1b, that even at low predator abundance some populations of quail will show poor reproductive performance as well. We believe this is because factors other than habitat and predators, such as weather, can cause lower than expected reproduction in some years and there will always be some error in our measurements of predator abundance and quail demography.

We established rigid criterion as to which study sites would receive QU funding to support predator monitoring. The project study areas were limited to those with on-going radio-telemetry research to measure quail nesting and survival parameters. These sites had to be at least 2000 acres in size with an active quail habitat management program, a GIS system that mapped available habitat, and annual estimates of quail population size. At appropriate times, relative abundance of predators is measured using a series of scent stations for mid-sized mammalian predators. A “scent station” is a circle of sand, 1 meter in diameter, with a special scent tablet placed in the center. The odor from the tablet attracts nest predators from the local vicinity to the sand ring, at which they leave a foot print signifying their presence. The proportion of scent stations visited by nest predators provides an index to the relative abundance of mammalian nest predators among

the study areas.

We specifically chose to avoid areas with poor habitat because we wanted to see if predator abundance explained much of the variation in production of young and spring and fall populations when habitat was presumably not limiting. We reasoned that if predators limit quail on areas of good to excellent habitat, then they are also likely to be limiting in areas of poor habitat (for quail not predators). Potential study sites include private quail lands, state-owned wildlife management areas, and demonstration areas, such as Tall Timbers Research Station in Florida and Ames Plantation in Tennessee. Study areas are distributed across a broad range of Southeastern physiographic regions from the Red Hills region, to sandy Lower Coastal Plain, to Black Prairie, to Upper Coastal Plain. Study sites vary in habitat composition from farmland mixed with cut-overs, to upland pine woods managed using traditional techniques of prescribed-fire and disking.

The primary objective of this project is to determine the relationship between bobwhite productivity and relative abundance of all medium-sized mammalian predators. However, there are several other significant potential outcomes of this cooperative



project. First, as we obtain more data over the course of the project, we will be capable of testing which predator populations in the Southeast appear to be most responsible for reducing quail reproduction. For example, does one opossum = one raccoon = one armadillo = one snake in their relative propensities for depredating quail nests. Research centered at Tall Timbers is beginning to shed some new light on what predators are actually depredating quail nests (See side bar). Second, this research will provide clues to what types of landscapes tend to have high predator contexts, and which have low predator contexts. Third, if the results of our research are similar to figure 1b, then this information will be useful for researchers interested in selecting sites with high predator abundance for testing the effects of predation management on quail populations. Finally, the most exciting potential outcome of this research to quail managers may be development of standardized methods for measuring predator abundance so that any quail manager can determine if the quail population on the land they are managing may be limited by high predator abundance. If predator numbers exceed some threshold beyond which quail production is suspect, investment in predator management may be cost-effective relative to other management practices. Otherwise, if predator numbers are naturally low, predator management may be a waste of time and money. The precedent for this is the highly successful Integrated Pest Management in agriculture (See side bar). Ultimately, this type of information needs to be developed so that the professional wildlife management community can provide the knowledge and

tools needed for developing integrated predation management.

First Year Results:

In 1999, nest predator abundance was measured in conjunction with quail demographics on 10 areas in Tennessee, Mississippi, Florida and Georgia. The survival and reproductive output of a total of 420 radio-tagged quail were determined on these sites during April through October. Results of this research are presented in Figure 2 and 3. Figure 2 shows the relationship found between relative abundance of mammalian predators and the number

of hatched nests produced per hen over the entire breeding season. Figure 3 demonstrates the relationship between incubated by males. The total population production index is a collective measure of survival, nesting the total population production of successful nests, including those and nesting success for an entire nest season for a cohort of radio-tagged bobwhite. This composite index provides important additional insights over “nests produced/female” because many “lost” nests are actually incubated by males, and males often hatch a significant proportion of nests (30%). The x-axis on both graphs is a measure of scent station visitations by known nest predators, including armadillo, raccoon, skunk, fox, opossum and bobcat.

These graphs illustrate that hatching of nests by hens and total population productivity were negatively related to predator abundance even in areas of good to excellent habitat. These relationships were statistically significant ($P < 0.05$). It is important to point out that nest predator abundance appeared to vary up to 5-fold among the study areas in 1999, assuming our index of predators was linearly related to predator abundance. These data support our ideas that the predator context varies across time and space, with apparent ramifications for quail

production. While these findings are interesting, they are only a beginning to unraveling the mysteries of predation as a process. No single research project can answer all questions and this one is no different in that it has strengths and weaknesses. However, with the funding from quail enthusiasts and Quail Unlimited together, this research has already opened the eyes of those entrenched in the “predation has no effect” paradigm and has helped in garnering additional funding for more detailed research. It is worth noting that these findings are yet preliminary and simply represent the first step in the scientific process. Recall that earlier we said observing and characterizing a phenomenon or process is the *first step*

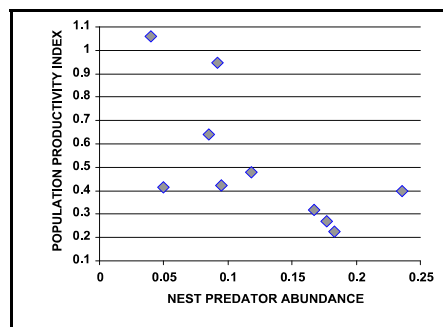


Figure 2. Number of hatched nests produced per radio-tagged female bobwhites over the entire breeding season in relation to scent station visitations of nest predators (raccoon, opossum, skunk, fox, bobcat, and armadillo) on 10 study areas in 1999. As nest predator abundance increased across areas, the number of nests successfully hatched per radio-tagged hen declined.

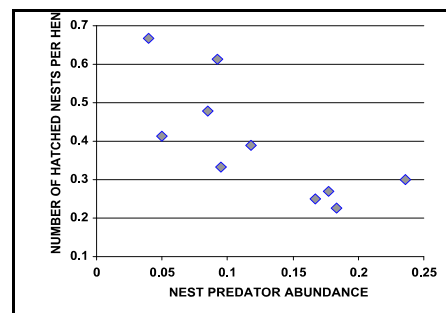


Figure 3. The number of nests hatched per radio-tagged bobwhite (males and females) in relation to scent station visitation rates by nest predators (raccoon, opossum, skunks, foxes, bobcat and armadillos) on 10 study areas in 1999. As nest predator abundance increased across areas, total productivity of the quail population declined.

in the scientific method. Relationships such as we have observed between predator abundance and quail productivity do not necessarily imply causal relationships because they may be false or actually caused by some other unmeasured but correlated factor.

However, they provide the informed groundwork for the second part of the scientific method in which solid testable hypotheses are formulated and then tested with controlled, manipulative experiments. *Reliable knowledge* concerning ecological processes results from completion of the scientific process through rigorous controlled and replicated experiments, something that has been lacking in the past. Our research lays the foundation for formulation and rigorous testing of hypotheses regarding effects of mammalian predators on bobwhite productivity.

To date, our research indicates that predator context *appears* to explain a significant amount of variance in the demographic success of quail populations in good habitat. Other key findings include large variation in the predator context across areas. This is not to minimize the importance of habitat - which remains the key to regional population declines and the key to local populations as well - but simply to act as a siren that we need a sustained research effort on habitat and predation to achieve an understanding of if, when, and how predators limit quail populations. We need to provide tools to managers so they may measure the predator context and determine what actions, if any, are needed. We need to understand regional variation in the process of predation in quail populations and be able to predict what landscapes and habitat deficiencies predispose quail to predation. Ultimately, we need information to guide predation management systems that do not harm the image of our sport and profession and ultimately to help people better manage for quail at the local scale.

In summary, Quail Unlimited, through contributions by individuals, chapters, and national conservation

programs with Budweiser and the National Fish and Wildlife Foundation, is participating in the largest, most comprehensive regional study of bobwhite and predation ever attempted. QU funds are being leveraged at a more than 10:1 ratio in a cooperative project that utilizes the expertise and infrastructure of four Universities, two private research foundations, four state wildlife agencies, and numerous private landowners to answer questions at a scale and resolution not previously attempted. This research is contributing to a new understanding of the process of predation and the population consequences for quail. In the end, quail populations, quail managers, and quail enthusiasts will be the ultimate benefactors of this investment. 

Agricultural Experience

Agricultural producers have realized tremendous gains in food and fiber production through the control of insect pests and disease. However, the prophylactic use of insecticides and herbicides began to subside with the advent of integrated pest management (IPM). The idea of IPM is to use pesticides only when it makes economic sense and to use sound cultural practices to reduce the need for pesticides (they understand to a point how and why pests attack plants and prescribe management to reduce vulnerability). Use of pesticides is often avoided or reduced through good crop management - planting on time, correct tillage, crop spacing, seed quality, careful use of fertilization and other techniques.

This concept has not been utilized in quail management and research. The idea being to use best habitat management practices to manage predation first, then if predation remains excessive and no more habitat solutions exist, removal of predators may be needed. For the most part, the best quail managers are doing this when they leave large nesting blocks rather than small patches, remove habitat that predators rely on, manage juxtaposition of essential resources to minimize movement, and manage winter and summer cover to protect quail from avian predation. Researchers at the University of Georgia demonstrated how thickly planted pine stands increase avian predation on quail. So, thinning of pine stands is an example of managing predation through habitat manipulation. Research by the Albany Area Quail Project is demonstrating how hardwood removal may reduce winter predation. Similarly, research by Tall Timbers, Mississippi State University, and Ames Plantation is showing how landscape structure influences vulnerability to avian predators. All of these projects move us closer to developing IPM type tools to mitigate the effects of predation through habitat management. A key outcome of the cooperative research project described in this article may be tools to measure when nest predator abundance is above "economic thresholds" and therefore, predator removal is a biologically-sound component of predation management.

Palmer, W. E., L. W. Burger and D. C. Sisson. 2001. Predation and bobwhites: Social and ecological implications: part two of a trilogy. *Quail Unlimited Magazine* Vol. 21(2):6-10.