

CONFLICTING OPINIONS ON HARVEST MANAGEMENT: WHY DO THEY EXIST?

FRED S. GUTHERY, Caesar Kleberg Wildlife Research Institute, Texas A&M
University-Kingsville, Kingsville, TX 78363

Abstract: The effects of harvest on quail populations remain controversial, despite research on the issue since the 1930s. This paper explains how the controversy began, why it has persisted, and what can be done to obtain a unified outlook on quail harvest management. Early researchers made errors in design of studies and interpretation of results; the resulting misinformation has survived in the minds of quail hunters and managers. Whether quail harvest is compensatory or additive is a fuzzy concept with no single answer. The concepts, additivity and compensation, are not particularly useful in scientific harvest management. Because quail populations respond to density dependent processes, it is possible to show that populations may decrease with harvest, remain stable with harvest, or increase with harvest. Managers on specific areas should find the spring density that maximizes spring-to-fall increase in quail populations and harvest to attain this density. This is called maximum sustained yield management.

1101

Introduction

If one reads the popular and technical literature on management of the quail harvest, one becomes utterly confused. One sees statements like: "Eighty percent of them are going to die anyway so harvest doesn't matter." "Bobwhite populations can sustain 70% harvest." "Harvest is more additive than compensatory." "Harvest should be reduced during population lows."

Why do beliefs differ? Do we have chaos? Are we operating on correct principles. Do conflicting opinions suggest something about the very nature of the beast of harvest management? Can we unify thinking on quail harvest management? I set out in this paper to make some sense of the conflicting opinions and recommendations. The first section deals with foundation research and thinking and the evolution of beliefs. The next addresses the fuzz that develops when, to draw an analogy, cups may be half empty and half full. The third section shows how the devious beast of harvest management makes anything possible under the sun. We will conclude that certain hotly debated issues in quail harvest management don't deserve the attention they receive. We will find that quail harvest may be scientifically managed to meet population objectives set by the harvest manager.

Stephen J. Gould wrote a book, *The Mismeasure of Man*, wherein he showed how the scientists of yesteryear mismeasured, misread and misinterpreted data on human beings. The outcome was a set of false beliefs which persist today. False beliefs do not improve the lot of humankind nor the competence of the quail harvest manager.

In the United States, original thinking on the management of wildlife began to flourish in the 1930s. These must have been heady times for wildlife biologists, because new ideas were pouring forth from Aldo Leopold and Paul L. Errington, among others.

Back then, almost every man in wildlife management was by avocation a hunter. And to a man, they loved the wildlife they hunted. Of this we can be pretty certain.

Errington thought early on that harvesting quail doesn't matter. He thought there would be no more nor no fewer quail whether you harvest them or not. He said there exists a doomed surplus, and if you don't take the surplus through recreational harvest, nature will take it for you.

Can you imagine how pleasing the Errington concept must have been to hunters who managed wildlife? They had theoretical justification for hunting the very animals so dear to their hearts.

One assumes Erringtonism was much discussed over bracing toddies at many a gathering of wildlife professionals. If an idea is repeated enough, it becomes a belief. Somebody said, "I wouldn't have seen it if I hadn't believed it with my own eyes." Beliefs have this effect. Let's see how the belief--harvest doesn't matter because it takes only surplus birds--has corresponded with facts. A historical chronology begins.....

About 1930. Paul L. Errington observes what he calls a **threshold of security** in Wisconsin bobwhite populations. He finds fairly constant densities (the threshold) of bobwhites in spring. Mortality from predators seems to relax after populations reach the threshold level; i.e., few quail die from predation after numbers reach the threshold level.

The phrase "doomed surplus" relative to quail first appears in print in an article by Errington and Hamerstrom (1934). They have conducted field tests in Iowa to determine if the threshold concept operates when human harvest is added to predator losses. The research is poorly designed by present-day standards and the article is of little general value.

Glading and Saarni (1944) publish an article in *California Fish and Game*. These authors conclude you can harvest more than 25% of California quail with little effect on the average fall population.

The conclusion of Glading and Saarni matches poorly with results they reported. California quail on the hunted area experience an average fall-spring mortality of 47.0%, whereas quail on a check area (not hunted) experience mortality of 28.9%. Harvest mortality is almost a direct addition to natural mortality. The check area, it turns out, butts up against and partially surrounds the hunted area. Quail from the check area can and do, by Glading and Saarni's observations, move into the hunted area. These authors do not realize the power ingress has in minimizing the effects of harvest mortality and stabilizing harvested populations.

Think of it this way. You can harvest every quail from a population every year if replacements move in from surrounding areas. Holy smoke! We'd be recommending 100% harvest!

Wildlife researchers design experiments so that results which emerge can be trusted. The Glading-Saarni study had an extremely bad design. Results of the study cannot be accepted according to any known principle of logic.

Baumgartner (1944) compares bobwhite populations on hunted and check areas in Oklahoma. He concludes removal of 20 to 55% of the fall population has no conspicuous effect on the breeding population from year to year.

Baumgartner's data show 55.5% mortality from fall to spring on the hunted area versus 26.5% on the check area. Harvest doubles the overwinter mortality rate. The only way spring densities can be equal on the hunted and check areas is if fall densities start higher on the hunted areas. Baumgartner, in fact, admits the hunted area has a "more favorable distribution of food and cover" than the check area. Strictly interpreted, Baumgartner's results show spring populations on hunted areas with better habitat are about the same as spring populations on unhunted areas with poorer habitat.

Errington (1945) admits in print he is wrong about the constant threshold concept. The threshold, he says, is variable. Moreover, he says, catastrophes such as blizzards don't count in his theory.

This admission by Errington should have laid the doomed surplus concept to rest. However, the belief had formed. It spread like a computer virus on the Internet through the minds of wildlife managers, outdoor writers and hunters. Researchers "found" support for the belief, just as nineteenth century anthropologists "found" an association between heavy eyebrows and criminal behavior.

The results of field research within the past two decades do not support the early thinking on harvest management. A consensus is developing among wildlife biologists: harvest adds to natural mortality to some degree.

We have the luxury of hindsight in viewing early research in quail harvest management. The early workers were, without doubt, dedicated and honest; the nature of this paper in no way reflects on their integrity. Moreover, present-day researchers undoubtedly labor under false beliefs.

Additivity and Compensation

Your car may have fuzzy logic circuits in its computer apparatus. These circuits increase fuel economy, among other applications.

Fuzzy logic is a new way of thinking about truth. Fuzzy logicians argue that, say, a statement on the effects of harvest on quail populations is most likely to be part true and part not true and very unlikely to be completely true or false.

Consider these statements: "Quail harvest mortality is compensatory." "Quail harvest mortality is additive." Oh, what fuzz!

Compensatory mortality occurs when the losses due to harvest and losses due to natural agents intercompensate. If losses due to harvest increase, losses due to natural agents decline. If intercompensation is absolute, harvest has no effect on total losses. The shooting of one bird miraculously generates life for another.

Additive mortality occurs when losses due to harvest add to losses due to natural agents. If additivity is absolute, each bird shot reduces the after-season population by exactly one bird.

Whether harvest mortality is compensatory or additive has important implications on harvest management. If it is compensatory, harvested and not harvested populations are about the same. If it is additive, harvested populations may be lower than not harvested populations.

Absolute compensation or absolute additivity are possible. Absolute compensation would occur if you exacted a harvest and all surviving birds died from some catastrophe. In this case the population is the same--zero--with or without harvest. Absolute additivity would occur if no birds died from natural causes. Between these extremes, compensation and additivity are fuzzy concepts.

Here is an example of the fuzziness. Suppose a population of quail is expected to experience 50% overwinter mortality if it is not hunted. Suppose further that a manager decides to harvest 50% of the birds present at the start of hunting season. The total mortality rate, with the harvest, will be 75%. Now if harvest mortality is absolutely compensatory, the total mortality would be 50%. If it is absolutely additive, the total

mortality would be 100%. That total mortality is 75% indicates the harvest is at once compensatory and additive.

Now considering the statement, "Harvest mortality is compensatory," we conclude the statement is about 50% true and 50% not true based on the above example. Our cup of quail harvest theory is half empty and half full.

The natural mortality rate without harvest influences our conclusions on additivity and its topsy-turvy counterpart, compensation. Here is a remarkable outcome of harvest management theory. If we consider the time from start to end of a normal hunting season, we can say the net loss to the population for each bird shot roughly equals the survival rate in the absence of harvest.

Suppose a population would experience 50% mortality with no harvest. Then 50% of the birds would survive without harvest. Moreover, only 50% of the birds shot would debit the after-season population. For example, the harvest of 100 birds would result in a net loss of 50 birds at the end of hunting season.

So if we consider the statement, "Hunting mortality is additive," we find its degree of truth increases as natural survival rate increases. The degree of truth for compensation increases as natural survival rate declines.

Time also enters the picture. Suppose hunting season lasts one second. Hunters arrive early, find coveys, level their shotguns and blast away when season opens.

The statement, "Harvest mortality is additive," is 99.99999% true with a one-second season. The degree of truth in the statement decreases as length of the hunting season increases. On the flip side, the degree of truth in the statement, "Harvest mortality is compensatory," increases as length of the season increases. Neither statement ever becomes 100% true except in the extreme circumstances discussed above (100% survival or 100% mortality).

Notice that to this point we have discussed additivity and compensation as these intertwined concepts relate to the hunting period. If we expand the period of consideration, we add fuzziness to the additivity-compensation issue. For example, if we harvest a quail population in only one year and return ten years hence to measure the effects of harvest, we will find compensation has a high degree of truth.

The above example is deliberately outrageous. It merely illustrates that when a biologist or sportswriter or hunter talks about additivity or compensation, one must know the time frame in her mind. Otherwise, we have the blind-men-and-elephant syndrome: one blind man feels a leg and concludes the elephant is like a tree, another blind man feels the tail and concludes the elephant is like a rope,

A second important time frame is from the start of one hunting season to the start of the next. When some people address additivity-compensation they refer to this period. We'll consider this time period in the next section. Here are the key points in this section:

1. Additivity and compensation of harvest mortality are hopelessly intertwined. The degree of truth in either concept varies with period of reference and quail survival rates.
2. Generally, but not always, quail populations subject to harvest will have lower after-season densities than populations not subject to harvest. This premise holds based on theory and field research.
3. Perhaps the concepts, additivity and compensation, are like Don Quixote's windmills. We can joust with them till the universe suffers heat death and we won't gain much. There must be a better way.

Density Dependent Production

Let us first establish some definitions. The word "hunting" does not necessarily mean the killing of quail. A management biologist from a state wildlife agency might say, "Hunting season regulations don't make much difference, regardless of the number of quail," or, "Hunting doesn't make any difference." These statements are time-tested and largely true.

In contrast, the word "harvest" means the killing of quail. Herein we are discussing harvest, which is different from hunting.

The annual cycle of a quail population includes three periods of relevance to harvest management: from start to end of hunting season, from end of hunting season to start of breeding season and from start of breeding season to start of hunting season. To simplify this paper, we will assume hunting season ends at about the time breeding season begins. The assumption, which holds for states such as Texas, eliminates the second period from consideration.

In the second section, we concluded harvest of quail generally reduces the number of breeders, but not necessarily in a one-to-one fashion. An example showed that the harvest of 100 quail might reduce the breeding population by 50 quail.

What does the size of the breeding population have to do with the number of quail available at the start of the next hunting season?

Upland gamebirds--grouse, pheasants, quail--show a general tendency for breeding populations with lower densities to be more productive than breeding populations with higher densities. Paul L. Errington observed this effect in bobwhite and ring-necked

number of quail that can be harvested from a management area down through the years.

Under sustained-yield management, the fuzzy notions of additivity and compensation take a background role. In fact, we can ignore them if we so desire, drop them almost out of our thoughts. We are interested in applying a harvest that will leave a desired density of breeders.

We choose the density of breeders based on information contained in Errington's reverse-S pattern. We want the breeding density that maximizes the spring-to-fall increase in population size.

Conclusion

The very nature of quail harvest seems to be such that we may predict conflicting opinions and recommendations. Theory says conflicting opinions are expected and internally consistent. The practical ramifications for the quail harvest manager on a specific ranch or hunting lease are as follows. One needs to obtain estimates of fall and spring density each year. From these records, one may estimate the spring density that leads to the maximum spring-to-fall increase. One should, in turn, harvest fall populations such that the maximizing spring population is reached.

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