National Quail Symposium Proceedings

Volume 4 Article 61

2000

Quail Modeling Workshop Summary

Fred S. Guthery
Texas A&M University

QUAIL MODELING WORKSHOP SUMMARY

Fred S. Guthery[1]
Caesar Kleberg Wildlife Research Institute, Texas A&M University-Kingsville, Kingsville, TX 78363

Simulation models may be used to identify deficiencies in empirical databases, develop hypotheses for testing in the field, and examine alternative management scenarios. This modeling workshop dealt with 6 models covering (1) schematic habitat management; (2) the effects of size and density of woody cover patches on usable space; (3) population behavior in stochastic environments; (4) population behavior under alternative hunting scenarios; (5) nesting attempts per hen for nesting seasons with different characteristics; and (6) production under multiple-brooding with nesting seasons of different characteristics.

Simulation modeling provides a valuable tool for understanding and prediction of the behavior of quail individuals and populations. Once an acceptable model for behavior is found, management alternatives may be simulated by altering the value of variables within the model. For example, a population model could be used to evaluate the potential response of a population to management of predation on nests. The modeler would in this case raise the probability of nest success, taking into account competing risks such as trampling, abandonment, flooding, and other loss sources. The modeler might also have to adjust for density-dependent effects on the survival of chicks and adults and the future production of adults. One of the greatest values of modeling comes from thinking through the processes that lead to an outcome or prediction, as the predator example illustrates.

When constructing a model, the modeler usually will want to base the value used for variables in a model on empirical data. In a model of quail demography we would prefer empirical data on daily survival rates for age classes, probability of multiple-brooding, frequency of renesting, and the relation between survival and production and density, among other variables. We also need to know the probability distributions (normal, uniform, Weibull, beta, gamma, and so on) for variables such as daily survival rates if we want to incorporate natural variation in the model. A realistic model usually reveals the existence of weak or nonexistent empirical data. The modeling process, therefore, helps to identify important data gaps, and therefore helps to focus field research efforts.

The purpose of the modeling workshop was to explore a variety of models that may be used for evaluating habitat management alternatives, exploring population behavior of quails with or without hunting, and examining various aspects of production. Two habitat models, PROFILE and GENBUSH, were examined. PROFILE allowed the user to alter the structure and composition of vegetation and to evaluate habitat suitability. The model permits an array of woody cover conditions from open prairie to closed-canopy forest. Likewise, ground cover can be altered from none to tall and dense. GENBUSH is designed to evaluate usable space under various scenarios for size and density of woody cover objects. PROFILE could be used in extension applications (showing clients the nature of bobwhite habitat). GENBUSH would be useful in exploring management options on Conservation Reserve Program fields or abandoned farmland that is deficient in woody cover.

The basic population model evaluated (DD2) let quail populations vary about demographic capacities (something like carrying capacity) during spring and autumn. Density dependence was invoked in population behavior by creating a stochastic tendency for populations to trend toward demographic capacities. The population model could be used to evaluate alternative scenarios for harvest management, population viability, potential response of quail populations to changes in climate (frequency and severity of weather catastrophes), and related applications.

Production models explored included NEST, SUCCESS, and DOUBTRIP. NEST is a simple model that returns nesting attempts per hen under alternative properties of the laying season, i.e., the rate at which hens in a population enter laying condition and the number of days available for laying in a particular season. An estimate of the number of nesting attempts per hen is necessary to obtain probability of nest success given n attempts and estimating age ratios. SUCCESS returns properties of the nesting effort under user-defined properties of the nesting season. DOUBTRIP estimates production (percent summer gain, age ratios) in the presence of double- and triple-brooding. This model demonstrates the need for information on empirical variables including the rate at which hens enter laying condition, mean clutch size, probability of success on any nesting attempt, survival rate of adults and chicks, and number of days in the laying season. The model predicts that multiple-brooding has relatively minor effects on total production in comparison with single-brooding, given up to 3 nesting attempts. This outcome of multiple-brooding occurs in part because the probability of a hen laying 3 successful clutches is low. Also, and perhaps more importantly, time limits opportunities for multiple-brooding in any particular nesting season.

In summary, ecological modeling forces one to think through a natural process in considerable detail. This logical process helps to identify gaps in knowledge. The process also improves science and management by providing perspectives and insights not obtainable by pure empiricism.

Citation: Guthery, F.S. 2000. Quail modeling workshop summary. Page 240 *in* L.A. Brennan, W.E. Palmer, L.W. Burger, Jr., and T.L. Pruden (eds.). Quail IV: Proceedings of the Fourth National Quail Symposium. Tall Timbers Research Station, Tallahassee, FL.

[1] Present address: Department of Forestry, Oklahoma State University, Stillwater, OK 74078.