relief, and for the Alpine folding in which that earlier complex structure and relief had their origin?

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A Suggested Method for Estimating Pre-Hunting Season Status of Scaled Quail Populations

It is desirable in game management to have practical, quantitative "yardsticks" which can be applied to game populations in order to aid the administrator in formulating well-advised harvesting regulations.

The following suggestion relative to estimating the population status of scaled quail (*Callipepla squamata pallida*) may have value, though admittedly there are no known instances in which it has been tried on an extensive scale. The type of range favored and the coveying habits of the species render it relatively easy for experienced field personnel to net scaled quail alive in numbers after the fall covey-gather. The grown young-of-the-year can easily be distinguished with great certainty from all other age classes by minor, but apparently constant, differences in the plumage. Hence, the age ratio thus established indicates the degree of success of brood survival in that year up to the time the observations were made. Brood survival, indicated by the ratio between young-of-the-year and adults, presumably is a reliable index of the state of vigor of the population as a whole, and should therefore also be a good index of the actual abundance of the species when large areas are considered, except in grossly underpopulated range. It is now well established that in quail, as in other upland game birds, it is the bird-of-the-year that provides most of the shooting (Steen, M. O. *Trans. 9th N. A. Wildlife Conf.*, 1944, 331).

For the six to eight weeks prior to date of setting the quail hunting regulations—say, from about the middle of September to the middle of November—a great deal of pertinent information could be secured by one or more two-man crews, each provided with two jeeps equipped with small hauling trailers, if these crews are assigned to net and examine as many quail as possible in as many key areas as possible of the administrative unit concerned. It should then be possible to ascertain the actual age ratio among a sizable sample of the quail population. The netted quail, of course, could be released unharmed at the trapping site as soon as they had been processed.

The technique of netting quail by means of the modified fyke net with long, V-shaped wings of cord netting is probably too well known among game men to merit detailing here. Suffice it to say that whole coveys may often be maneuvered into such nets by two or three experienced men, on foot, on horseback, or with the aid of vehicles. Trapping the birds in fairly large numbers is unquestionably, a practical matter. J. S. Ligon (in a paper published by the New Mexico Game and Fish Commission, Santa Fe, 1946) gives particularly complete directions as to this procedure.

A. C. Bent (*Bull. U. S. nat. Mus.*, 1932, 162, 54) states that scaled quail undergo a complete molt in August and September, at which time the young-of-the-year become practically indistinguishable from the full adults except for the retention of the first two juvenile primaries in each wing. The writer has found this criterion difficult to apply, but fortunately there is another easier and possibly more accurate method (Leopold, A. S. *J. wildlife Management*, 1939, 3[3], 261; and FIGGE, H. *Proc. 26th ann. conf. west. ass. state game fish commissioners*, 1946, 161). This method depends on the retention of the juvenile primary covert feathers until the bird is well into its second summer (age 15–18 months). These juvenile primary coverts are conspicuously mottled with a whitish or buffy color. In the fully mature adult condition, assumed after the first postnuptial molt, they are plain bluish gray. This method of distinguishing age classes is considered to be extremely accurate, and has been used personally by the writer in quail investigations in New Mexico with very satisfactory results. Incidentally, it appears to work as well for Gambel's quail (*Lophortyx gambeli*) and Texas bob-whites (*Colinus virginianus texanus*) as for scaled quail. The method is used as standard procedure for aging quail at the New Mexico State Game Farm (personal communication from Superintendent James L. Cox). Furthermore, Ligon, an outstanding authority on upland game, has also used this method extensively in aging quail and considers it to be extremely reliable (personal communication).

The age ratio is easily secured from the raw data. For example, a ratio of 1000 young to 1000 adults would give an age ratio of one young to each adult, or two young to each pair, assuming a 1:1 sex ratio and all birds breeding. Such an age ratio over a large area in the fall before the hunting season would indicate poor brood survival, and presumably a general unthrifty condition of the quail population. A restricted season and bag limit would apparently be indicated for that year. On the other hand, suppose the raw data to be 1500 young to 500 adults. The resulting age ratio would be three young to each adult, or six surviving young to each pair. This would indicate rather good brood survival, and presumably a thrifty condition of the quail population. A longer season and a more liberal bag limit could accordingly be endured by the quail without unduly cutting into next year's breeding stock.

Besides securing age class data, this suggested procedure could also be made to yield extremely valuable basic data as to prevailing sex ratios and, by making banding of each bird trapped a routine part of the procedure, could aid in gradually building up very useful statistics relative to survival and movements of the banded birds.

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