ARIZONA QUAIL: SPECIES IN JEOPARDY?

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ABSTRACT

An overview of the 4 native species of quail in Arizona, their distribution, and habitats is presented. Possible threats to their long-term existence are explored. A discussion on harvest and hunters and the biological and political impacts hunters have in relation to quail distribution and abundance is presented. The concern with current management direction is addressed and recommendations made.

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INTRODUCTION

Arizona is blessed or cursed with a diversity of habitats and quail species. Quail are an important wildlife resource in Arizona. These birds are a source of recreation and enjoyment for thousands of consumptive and non-consumptive wildlife users and generate considerable economic benefits to local communities and to the State. Four species of Arizona quail (3 native and 1 introduced) are classified as game birds: Montezuma (*Cyrtonyx montezumae*), scaled (*Callipepla squamata*), Gambel's (*Callipepla gambelii*), and California (*Callipepla californica*). A fifth species, the masked bobwhite (*Colinus virginianus ridgwayi*) was extirpated at the turn of the century, and is now being reintroduced into southern Arizona by the United States Fish and Wildlife Service.

Gambel's Quail

The most widely distributed is the Gambel's quail. Gambel's quail are found in the deserts of Arizona, Colorado, Utah, New Mexico, Nevada, southern California, and northern Mexico (Gullion 1960). Bent (1932) thought birds occurring in Colorado were ''exotics'' (i.e., transplanted from California in the late 1900s) but other authors thought the birds were native (Mearns 1914, American Ornithologist Union 1957). The largest United States population of Gambel's quail occurs in Arizona. Of the 3 hunted quail, Gambel's is the most abundant in Arizona, found in a variety of habitats below 1,600 m elevation. It is strongly associated with arroyos, riparian areas, and habitats having a mesquite (*Prosopis velutina*) component. It also occurs in upland Sonoran desert, Mojave desert-scrub, scrub-invaded desert grassland, chaparral, oak woodland, Great Basin desert-scrub, and pinyon-juniper communities (Brown 1989). Gambel's quail are also common in brushy or waste areas adjacent to agriculture (Bent 1932, Gullion 1960, Johnsgard 1973). Because the species is easily trapped, it has been introduced into a number of areas outside its native range. Most of the occupied range is either federal or state lease land open to hunters holding a valid Arizona hunting license.

Gambel's quail are an arid-land species that are endemic to hot and dry habitats like the Sonoran desert. The Sonoran desert is a shrub/succulent dominated ecosystem where fires are rare events. Therefore, beyond annual grasses and forbs that respond to an abundance of seasonal rainfall, the Sonoran desert lacks perennial bunchgrasses. Since Gambel's quail evolved in the Sonoran Desert, they require significantly more woody vegetation than do the other native quail species in Arizona. For example, Brown (1989) reports that unlike the other quail species, Gambel's quail roost in shrubs and mast makes up a greater percentage of their diet compared to the diets of scaled quail and masked bobwhites. Gambel's quail also do not require perennial bunchgrasses to nest successfully. Often Gambel's quail nests are simply a depression in the litter near the base of a shrub (Brown 1989). On the semi-arid grasslands of the Buenos Aires National Wildlife Refuge (BANWR) south of Tucson on the international border with Mexico, Gambel's quail preferred shrub-dominated grasslands, riparian areas and thickets (King 1998). Indeed, Gambel's quail were more shrub-tolerant than masked bobwhites or scaled quail, and it was evident that herbaceous cover was not as an important habitat variable for Gambel's quail as it was for the other two species (King 1998). Gambel's quail populations have probably increased on semi-arid grasslands in Arizona over the past century

in response to shrub invasions that have prevailed as result of overgrazing and the accompanying reduction of lightening-induced fires. They are the most adaptable of Arizona's 4 native quail species as evidenced by their ability to maintain self-sustaining populations in the rapidly developing suburban environments of Phoenix and Tucson.

Scaled Quail

The geographic range of scaled quail overlaps that of the Gambel's quail in Arizona. Scaled quail are found in western Texas, New Mexico, and eastern Arizona, south into Mexico. They also extend into southeastern Colorado, southwest Kansas, and the Texas and Oklahoma panhandles. Scaled quail have been transplanted in eastern and central Washington and eastern Nevada (Aldrich and Duvall 1955). In Arizona, scaled quail are primary found in the southeastern portion of the state, with scattered populations along the Little Colorado River, from Springerville north to the Sanders-Chambers area (Brown 1989). The largest populations are found in the Sulphur Springs Valley, *bajadas* (the flat rolling hills at the bottom of western mountains) northeast of Oracle Junction, and the mountain foothills in the Altar Valley (Brown 1989). Populations north of the White Mountains, in eastern Arizona, may be a result of local introductions (Phillips et al. 1964). In Arizona, scaled quail inhabit desert grasslands at 1,060–1,400 m elevation (Brown 1989). Historically, scaled quail had a wider distribution in Arizona, but their range has contracted due to loss and alteration of grassland habitats (Rea 1973).

Unlike scaled quail in south Texas where habitats dominated by shrubs are preferred (Hammerquist-Wilson and Crawford 1987), scaled quail in Arizona prefer open grasslands. Brown (1989) stated that scaled quail prefer open semi-arid grasslands consisting of perennial bunchgrasses scattered with low shrubs and cacti. Similarly, (King 1998) reported that of the 3 quail species she studied on the BANWR, scaled quail seem to prefer open uplands dominated by perennial bunchgrasses with about 10% woody cover. In fact, open grasslands are so important to scaled quail that Brown (1989) stated that as woody cover invades grasslands, scaled quail begin to disappear and are gradually replaced by Gambel's quail.

Montezuma Quail

Montezuma quail are found primarily in Mexico. The northern most of 3 subspecies of Montezuma quail occurs in Arizona, New Mexico, and southwest Texas (Swarth 1909, Leopold and McCabe 1957). In Arizona, Montezuma quail occur primarily in the southeastern portion of the state, from the Baboquivari Mountains east to New Mexico, and from the Mexican border north to the Mogollon Rim (Swarth 1904, Bishop 1964). Montezuma quail occur over a wide range of elevations, between 1,219–2,743 m. They are primarily associated with evergreen Madrean pine-oak woodlands with a grassy under story (Leopold and McCabe 1957, Bishop 1964). Montezuma quail also occur in riparian habitats, ponderosa pine forest, and rarely in sub-alpine forests and meadows. Montezuma quail can be found in semi-desert grasslands and pinyon-juniper woodlands following years of above-average summer precipitation. The range of Montezuma quail in Arizona has contracted since European settlement (Davis 1982).

In Arizona, Montezuma quail are primarily found in encinal oak woodlands with a grass understory (Bent 1932). Previous research (Leopold and McCabe 1957, Brown 1982) suggested that the grass understory provides food and cover. Stromberg (1990) found Montezuma quail in Arizona preferred south-facing slopes for night roosting. Also, during the day they preferred hillsides with oak trees together with intermediate under-story vegetation. Similarly, Albers and Gehlbach (1990) characterized Montezuma quail feeding habitat in Texas as Madrean oak woodland on dry slopes with a tall grass under-story. They found tall grass cover predicted locations of feeding sites more often on a grazed ranch where tall grass cover was patchy.

There is currently a lot of interest in the Montezuma quail. It is a bird that holds a lot of mystique for bird hunters with dogs because of its general tendency to hold very tight, it occurs in a limited area, and the scenery where it is hunted is terrific. We like to compare Montezuma quail hunting to dry fly fishing native trout in high mountain streams. You may not catch very many, oh but what a great time trying. The attitudes of serious Montezuma quail hunters are probably similar to those of dry fly purists. They long for the solitude, scenic grandeur, and the action at the end of gun or line.

California Quail

The last species that can be hunted is the California quail. These are the remnants of transplant attempts in the 1960s. A small population may remain on some private lands in northeastern Arizona. The season is open to allow for an individual to take a bird if they happen upon one.

Masked Bobwhite

The masked bobwhite quail is a federally-listed endangered species (Code of Federal Regulations 2000), though it is in fact, a subspecies of northern bobwhite. It was not discovered and described as a species until around the turn of the 19th century by which time ornithologists who encountered it thought it was almost extinct (Brown 1904). Masked bobwhites were finally extirpated from the United States a few years after 1900 (Brown 1989). Naturalists of the time, and quail biologists today, attribute its near extinction to habitat destruction from livestock overgrazing (United States Fish and Wildlife Service 1995, Kuvlesky et al. 2000). Its historic geographic range has always been small, extending from possibly as far south as Guaymas, Sonora, Mexico through the grasslands of north central Sonora up to the Altar and Santa Cruz Valleys in Arizona. Today the masked bobwhites

distribution is reduced to approximately 49,000 ha of Sonoran savanna grassland on the BANWR in south central Arizona and possibly 100,000 ha of private ranchland in northwestern Sonora, Mexico. The largest population of wild genetic stock occurs on Rancho Carrizo, a large cattle ranch near Benjamin Hill, Sonora. A second, and much smaller wild population occurs on Rancho Grande, approximately 10 km south of Rancho El Carrizo. The population inhabiting the BANWR was established from chicks produced by a captive population maintained by the Refuge that originated from wild birds trapped in Sonora during the late 1960s. Captively propagated chicks have been released on the BANWR on an annual basis since the late 1980s.

Biologists who have studied masked bobwhites believe that most populations frequent the floodplains, drainages of rivers, and creeks where deeper, more poorly drained soils permitted the growth of dense herbaceous vegetation. However, these habitats were also favored by cattle, which were introduced by the thousands to Sonora, Mexico and southeastern Arizona during the mid-to-late 1800s. Since cattle concentrated on floodplains for the abundant food and shade these areas typically provided, essential herbaceous cover was significantly reduced, if not entirely eliminated, by <20 to 30 years of unmanaged grazing (Kuvlesky et al. 2000). The decline of the masked bobwhite in the United States and Mexico during the late 1800s, and its extirpation from Arizona, seemed to coincide with increasing cattle numbers and the simultaneous loss of essential habitats. Specific information on masked bobwhite habitat requirements was unavailable until several research projects were conducted recently on the BANWR (Goodwin 1982, Simms 1989, King 1998) and in Sonora (Guthery et al. 2000, Guthery 2001). These studies indicated that masked bobwhites require a reasonably tall, diverse herbaceous community, as well as about 20–25% woody cover on semi-arid grasslands. Additionally, it was apparent that masked bobwhites were indeed sensitive to overgrazing.

Though accurate census information is unavailable, BANWR biologists estimate that no more than 2,000 masked bobwhites currently exist in both countries. Therefore, the masked bobwhite continues to be threatened with extinction, particularly wild populations in Sonora where their continued existence remains tied to the grazing management decisions of private landowners. If the wild Sonoran populations disappear, maintaining populations from captive-reared chick releases will be a real challenge.

MANAGEMENT NEEDS

Gambel's Quail

Gambel's quail populations are strongly influenced by climatic factors, primarily precipitation. Of the 3 quail species, the Gambel's most strongly typifies the ''boom and bust'' population cycle. MacGregor and Inlay (1951) found no development of female Gambel's quail reproductive organs in the spring following a dry and cold winter. Swank and Gallizioli (1954) found that sharp annual differences in rainfall coincided with changes in Gambel's quail populations. They concluded that winter (Dec-Apr) rainfall was the primary factor limiting quail abundance. Campbell et al. (1973) also found Gambel's quail populations to be positively correlated with fall and winter rainfall amounts. Gambel's quail use water when available, but normally satisfy their needs with moisture contained in plant and insect foods (Vorhies 1928, Gorsuch 1934, Lowe 1955, Goodwin and Hungerford 1977). Availability of water sources is most important during the dry months of April–September (Goodwin and Hungerford 1977). Physiological studies have shown that Gambel's quail adjust kidney function to conserve water when water is scarce (Braun and Dantzler 1972, Williams et al. 1991).

Livestock grazing can also affect Gambel's quail populations. Early studies concluded that overgrazing had a deleterious effect on quail numbers (Gorsuch 1934, Griner et al. 1941, Kimball 1946). However, because they are not as dependent on herbaceous cover as other quail species that inhabit Arizona, Gambel's quail are probably more tolerant of grazing than masked bobwhites, scaled and Montezuma quail. The effects of hunting on Gambel's quail are generally considered compensatory for natural sources of mortality (Gallizioli 1965), and therefore not limiting. Quail harvests are strongly correlated with total October–March precipitation. As rainfall increases, so does the number of Gambel's and scaled quail harvested per hunter during the season. Record rainfall amounts for October–March during 1978, 1979, and 1980 were accompanied by high quail harvests. During the late 1980s, rainfall and quail harvests both declined.

Habitat conditions for all 3 quail species have changed to varying degrees, since the 1970s. Thousands of hectares of prime Gambel's quail habitat have been lost to suburban sprawl adjacent to major population centers (Phoenix and Tucson). As mentioned previously, Gambel's quail can persist in urban and suburban areas where native plant communities are partially retained. Such areas are almost always off-limits to quail hunting. Expansion of smaller towns and cities in southeastern Arizona has resulted in loss of habitat for scaled and Montezuma quail. Habitat changes on undeveloped public and private lands have likely occurred since the 1970s.

Scaled Quail

Grazing levels can affect scaled quail populations. Ligon (1937) reported scaled quail were negatively affected by excessive grazing in eastern New Mexico. He attributed grazing with widespread destruction of forbs, essential for scaled quail cover and food. Campbell et al. (1973) found scaled quail on moderately grazed New Mexico ranges with a variety of forb species for food and moderate amounts of brushy cover were more productive. Saiwana (1990) found moderate cattle grazing favored scaled quail food and cover

conditions in New Mexico. In Arizona, Bock and Bock (1988) also found more scaled quail on grazed sites compared with ungrazed sites. In south Texas, Campbell-Kissock et al. (1985) found quail were more abundant on high intensity, short duration pastures compared with pastures grazed year-long in drought conditions. Scaled quail evidently favored short duration pastures because these pastures had higher abundance of forbs and grass cover than pastures not included in the grazing system.

Medina (1988) found Lehmann lovegrass (*Eragrostis Lehmanniana*) was poor scaled quail habitat. He recommended burning and intensive grazing in habitats dominated by Lehmann lovegrass to reduce its cover and provide more foods for scaled quail. In other habitats, Bock and Bock (1988) found that fire had no effect on scaled quail numbers in a sacaton (*Sporobolus wrightii*) grassland in southeastern Arizona. Fall counts of scaled quail on burned and unburned grasslands were similar. Shrub density influences scaled quail habitat suitability. Homogenous grasslands without shrubs were unsuitable for scaled quail (Schemnitz 1961). Brown (1989) recommended thinning dense shrubs on ridges to improve habitat. Chaining large areas of bottomland in Texas was not recommended (Tharp 1971). In contrast, chaining a 10 km^2 desert area near Oracle Junction, Arizona, seemed to improve the habitat for scaled quail (J. Phelps, Arizona Game and Fish Department, personal communication) but there are no data to verify this. Griffing (1972) found quail on grasslands sprayed to control mesquite had heavier body weights than those on control areas. Earlier in the century, available surface water was thought important to quail survival (Grinnel 1927). In contrast, Snyder (1967) found that water was the least important of the 3 habitat requirements (food, water, cover). Campbell (1960) found that scaled quail used surface water especially in dry regions, but use was not great enough to justify the cost of guzzler construction. Similarly, supplemental feeding does not appear to be cost effective (Campbell 1959). However, Snyder (1967) recommended supplemental feeding on public lands to keep the birds available to hunters.

Montezuma Quail

Many authors suggested that some grazing levels decrease population numbers of Montezuma quail (Miller 1943, Leopold and McCabe 1957, Bishop 1964, Bishop and Hungerford 1965, Brown 1978, Brown 1982, Albers and Gehlbach 1990, Brennan 1993a), though direct mortality effects were never reported. Although the effects of grazing are not fully understood (Brennan 1993b), overgrazing can destroy key food sources, greatly reduces grass height that provides cover, and has coincided with severe declines and extirpations in some areas (Miller 1943, Leopold and McCabe 1957, Bishop 1964, Bishop and Hungerford 1965, Brown 1978, Brown 1982, Albers and Gehlbach 1990, Brennan 1993a). Brown (1978) reported that grazing did not limit production of food, but removal of >55% of available forage by weight did nearly eliminate quail populations by removing their escape/hiding cover. Brown (1978) recommended grazing levels should not remove >35–40% of annual herbaceous production. Albers and Gehlbach (1990) confirmed this conclusion. They suggested when grazing removed 40–50% of the grass height within occupied range, Montezuma quail could not survive within the habitat.

Forest management practices are also important to Montezuma quail. Leopold and McCabe (1957) noted that in the pine-oak belt in Mexico, neither logging nor frequent fires eliminated Montezuma quail as long as fencerows, gullies, and roadsides remained undisturbed. The Coronado National Forest has established standards and guidelines for forest management in high-quality Montezuma quail habitat. These call for retention of uncut areas interspersed with openings <46 m wide, and maximum forage utilization by livestock of 45% (by weight).

Masked Bobwhite

Masked bobwhite management largely involves improving and managing habitat because it is unlikely that this species will be removed from the federal endangered species list anytime in the near future, which means that legally hunting masked bobwhites is an unreasonable expectation. Nevertheless, masked bobwhite abundance could be increased if appropriate habitat management was implemented in Sonora, Mexico and the BANWR. Guthery et al. (2000) demonstrated that the habitat requirements of masked bobwhites and Texas bobwhites (*C. v. texanus*) were similar enough to justify using habitat management techniques that improve habitat for Texas bobwhites to improve habitats for masked bobwhites. Disking, chaining, and soil aerating were initiated on Rancho El Carrizo, Sonora during the early 1990s to improve masked bobwhite habitat with excellent results. Brush coverage was reduced on all of the areas mechanically manipulated and native grasses and forbs responded vigorously to the soil disturbance as soon as summer rains began. The United States Fish and Wildlife Service estimated that the mechanical operations improved almost 20,000 ha of masked bobwhite habitat on Rancho El Carrizo. Additionally, ranch owners improved almost 6,000 ha of habitat by installing a short duration grazing system, and by removing cattle or reducing stocking rates on important masked bobwhite pastures.

The mechanical methods used to improve masked bobwhite habitat on Rancho El Carrizo would no doubt improve masked bobwhite on the BANWR. However, it is unlikely that disking, chaining or soil aerating will ever be conducted on the Refuge, because any type of action that disturbs the soil surface is prohibited on National Wildlife Refuges for fear of disturbing archaeological sites or destroying endangered species, particularly plants. Habitat improvement could be implemented after an area designated for management has been totally surveyed for archeological sites and endangered species, and then only after appropri-

ate protective measures are put in place. In reality then, mechanical habitat improvement will never be implemented on the BANWR because staff and funding shortages will not permit the necessary pre-treatment surveys to be completed. Prescribed fire and livestock prohibition will remain the only habitat improvement measures utilized on the BANWR.

FUTURE MANAGEMENT

Where can we go from here? First let us do a reality check. Gambel's quail population fluctuations are primarily driven by the amount of rainfall that occurs in their habitats from October to March each year. In Gambel's quail habitats lots of rain means more quail, little rain means fewer quail in the fall. If the hunting pressure is reduced on the population following the winter it does not rain, will the reduction in hunting pressure increase the number of birds the next year? In the long run, the reduction will probably not change anything. Do agencies need to adjust the season length and bag limit in poor years to reduce the number of birds harvested and the number of hunter days? No, average quail hunters are, by and large, self-regulating. If the season is not very good and the catch-per-unit effort is low, average hunters do not harvest very many birds per day and they do not hunt very many days. Serious and dedicated hunters may hunt the same number of days as they normally do, and their catch-per-unit-effort may be higher than that of the average hunters, but still lower than in good years.

The big difference between average hunters and serious hunters is their comments on the bag and seasons. The average hunter hunts 1 to 3 days/year and harvests between 0 and a limit. In years of high quail populations, they may hunt a few more days and may harvest a few more birds/day, but in general their quail harvest does not vary much year to year. Changing the season length or the bag limit does not affect the outcome of their trips to hunt quail, thus they seldom voice recommendations to change the bag or season limit. They have accepted the fact that weather is driving the quail populations, or they may not care. Serious or dedicated quail hunters have a different view of quail management. They truly believe that changing the bag limit or season lengths will improve their quail hunting experience. In reality what they want is the same thing that the dry fly fisherman wants to be in the wilderness alone, pitting their skill against a wily quarry. If they see another person, fishing or hunting or not, or even if they think someone has set foot in, heaven forbid, their secret spot, they consider their enjoyment compromised. If the season is shortened or the bag limit is reduced to make the season unattractive, the belief is that the average hunter will not go. This is only true if there is a drastic reduction in either bag limit or season length.

Cost, however, does reduce the number of individuals hunting. If an additional charge is required to hunt, some of the average hunters will not go, unless the season is really good. This was observed when Arizona added a State Waterfowl Stamp requirement to hunt waterfowl. The number of individuals reporting hunting waterfowl dropped from 12,000 to 8,000 hunters, days/hunter, and birds/season/hunter increased, indicating that the average hunter was the one who stopped going. The total number of birds harvested did not change; they were just harvested by fewer hunters. There was no change on the impact to the population. There may have actually been a higher harvest. A similar result was observed when Arizona changed the fall turkey hunt from a general hunt to a permit hunt. Number of hunters was reduced by almost 50% yet the harvest remained unchanged. In both cases the net result was hunter recreation being provided was reduced.

Is this a good thing or a bad thing? It could be viewed in the political world as a bad thing. If these were voters that a political party was trying to get to vote as a block and the party leadership disenfranchised 25–50% of its party they would not stay in power very long. Today as agencies struggle to maintain hunter numbers and license sales, every effort should be made to provide as much hunter recreation as possible. If there is not a biological reason for reducing bag limits, shortening seasons or adding restrictions, we as researchers, managers, and quail hunters, should keep as many ''voters'' as possible on our side. We need individuals to be interested in the species and the sport. Hunters are our friends and we need them. They are powerful allies when we comment on forest management plans, land management plans, grazing allotment plans, housing developments, and other activities that reduce or affect suitability of thousands of hectares of quail habitat. Making statements that the proposed action will impact 90,000 quail hunters makes a bigger impression than the same statement using 45,000 quail hunters. The biggest threat to the future of quail hunting in the west, is the ''Avid'' quail hunter. We do not know what an ''avid'' quail is, and second if one looks at the definition of ''avid'' in the dictionary, it is not very pretty. An ''avid'' quail hunter could be considered greedy; in fact they might be ''greedy to the point of gluttony.'' Avid equals greedy, and glutton equals a person with a remarkably great desire or capacity for something. Most of these individuals have good intentions, but what they want is to reduce the bag limit and shorten the season or charge additional fees to hunt quail; the end result is fewer quail hunters. In a period in hunting history when every hunter is important to the continued ability of hunters to enjoy the sport these individuals are trying to implement strategies that will reduce their numbers. Wildlife agencies should be very careful when catering to the desires of these individuals, especially if these individuals are making money from the recreation being provided by wildlife. If indeed wildlife is held in the public trust, one of the first questions asked before any restrictive management activity is implemented on hunters should be ''Is there a biological benefit to the population or a negative consequence if not implemented?'' If there is no positive biological reason to

implement and no negative consequence if not implemented, then the next question should be ''If implemented will it reduce the number of hunters?'' If the answer is yes, the management activity should not be implemented. P. J. Daugherty, Northern Arizona University, School of Forestry, has said that American hunters come from a long line of poachers and when we settled here we were adamant that the King would not control the take of wildlife. As resource managers we should be very careful not to allow kingdoms, fiefdoms, or even elite clubs to be given special treatment when it comes to hunting privileges. Whether or not populations of quail in Arizona are in jeopardy is not the issue. There will be quail here long after the entire state is a city. Maybe not as many species nor as widely distributed, but they will be here. What is in jeopardy is quail hunting. It could very well become the sport of the rich and the elite, managed by the guides and special interest groups.

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