Western States

Chukar and Gray Partridge

Management Guidelines

Sponsored by the **Western Association of Fish and Wildlife Agencies**

2017

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Introduction

Chukar (*Alectoris chukar*) and gray partridge (*Perdix perdix*) are popular game birds through much of the western U.S.; both are native to Eurasia and introduced to North America (Figs. 1 and 2). Chukars were introduced into the U.S. in 1893 (Christensen 1996) and gray partridge may have been introduced as early as the late 1700s in New Jersey (Carroll 1993). Partridge are important game birds in many western states, with established populations across vast areas of public and private lands. Because these species can thrive in human-altered landscapes, threats to their habitat are not as significant when compared to native upland game birds (e.g., greater sage-grouse [*Centrocercus urophasianus*], Columbian sharp-tailed grouse [*Tympanuchus phasianellus columbianus*], Gambel's quail [*Callipepla gambelii*], and mountain quail [*Oreortyx pictus*]). Chukars are capable of surviving in areas where habitat has been degraded by invasive annual grasses and fire, and gray partridge thrive in habitats co-dominated by grassland and agricultural land cover. Chukar populations have expanded to the point where hunting seasons are held annually in Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, Oregon, Utah, Washington, Wyoming, and British Columbia. There are also huntable populations of gray partridge in 10 western states (ID, MT, NE, NV, ND, OR, SD, UT, WA, and WY) and 3 western Canadian provinces (AB, BC, and SK). Chukar and gray partridge hunting opportunities have become increasingly important to western hunters as populations of native upland game species and ring-necked pheasants (*Phasiaunus colchicus*) have declined in recent decades. With their ability to thrive in degraded or disturbed environments, partridge may continue to provide important hunting opportunities into the future; however, managers must better understand basic needs of these species to ensure sustainable populations.

The Western States Chukar and Gray Partridge Management Guidelines (Guidelines) have been developed under the auspices of the Western Association of Fish and Wildlife Agencies' (WAFWA) Western Bird Conservation Committee. Development of the Guidelines is part of a continuing effort to establish species-specific conservation strategies to guide resource planning and on-the-ground habitat management initiatives. Geographic coverage of the Guidelines is limited to the range of chukar and gray partridge within the western U.S. and Canada. Assessments of partridge species outside this range are not included in the Guidelines.

Goal

The goal of these Guidelines is to foster management of chukar and gray partridge populations, and to the extent practicable, habitats that support them in order to provide sustainable harvest opportunities that reflect preferences and desires of hunters.

Objectives

Primary objectives of these Guidelines are to encourage activities to

1. Identify current distribution and management status of chukar and gray partridge;
2. Create population indices for chukar and gray partridge within each state (to encourage recreational use when appropriate);
3. Identify threats to chukar and gray partridge populations and their habitats;
4. Identify research needs for chukar and gray partridge;
5. Provide management recommendations for chukar and gray partridge;
6. Evaluate economic impacts of partridge hunting;
7. Promote hunting opportunities for chukar and gray partridge;
8. Gauge hunter opinions and measure satisfaction with chukar and gray partridge hunting opportunities.

The Guidelines are organized into 5 sections, beginning with natural history descriptions for chukar and gray partridge, and followed by sections about research needs, status and management, economic value of partridge hunting, and policy recommendations. Information for the middle 3 sections was derived primarily from responses to an informal survey of upland game staff from jurisdictions within western ranges of chukar and gray partridge.

Chukar hunters, John Day River Canyon, Gilliam County, Oregon. Photo by David Budeau.

Figure 1. Current (2017) distribution of chukar in western North America. Map developed from state range maps, Breeding Bird Survey (Sauer et al. 2017), and eBird point data (Sullivan et al. 2009).

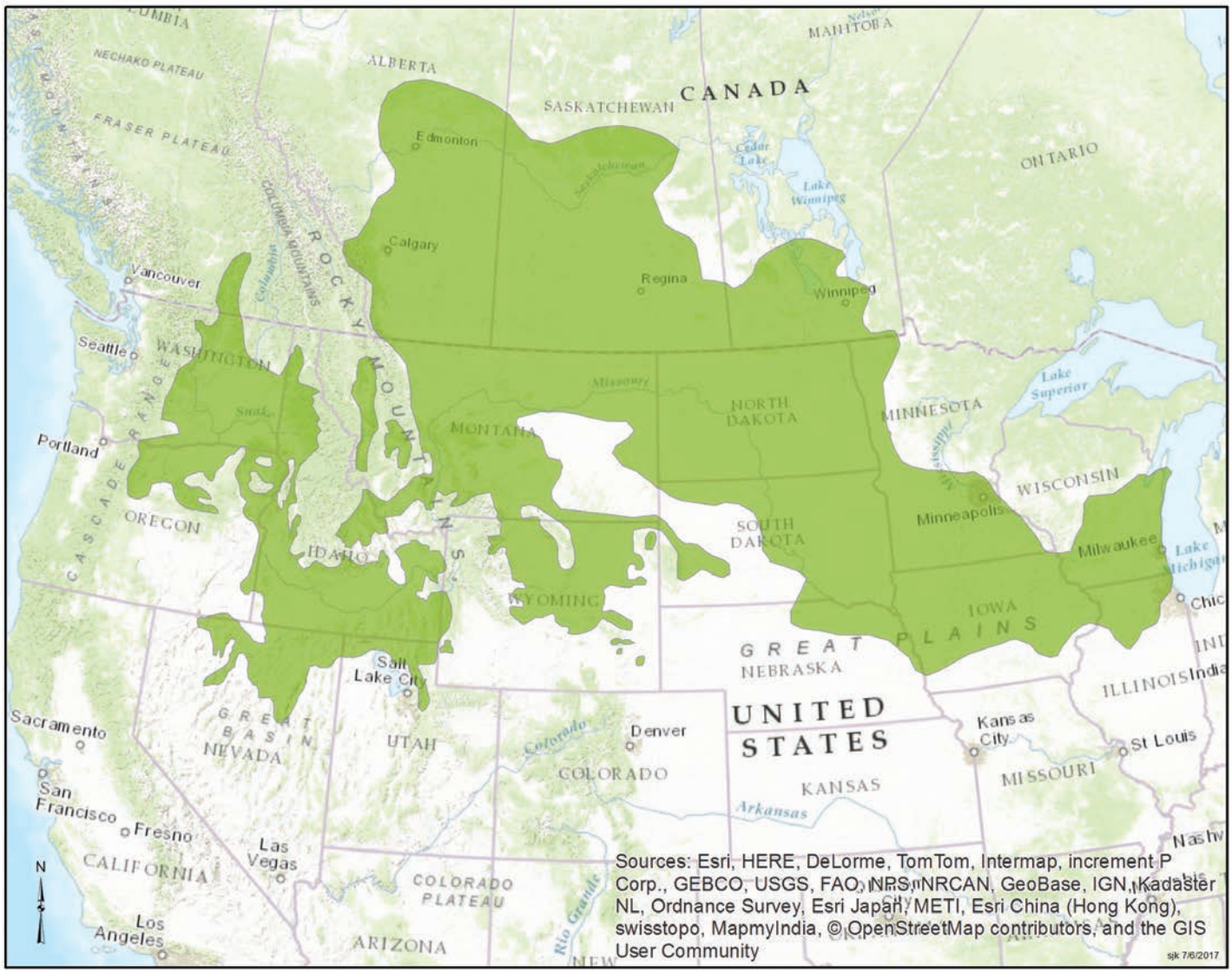


Figure 2. Current (2017) distribution of gray partridge in western North America. Map developed from state range maps, Breeding Bird Survey (Sauer et al. 2017), and eBird point data (Sullivan et al. 2009).

Species Descriptions

Chukar

Chukar. Photo by David Budeau.

Description

Chukars are a member of the "red-legged partridges" in the genus *Alectoris*. There currently are 7 recognized species within this genus (ITIS 2017), although the number of species is subject to some debate. The 7 species are

1. Rock partridge, *Alectoris graeca*
2. Red-legged partridge, *Alectoris rufa*
3. Barbary partridge, *Alectoris barbara*
4. Arabian partridge, *Alectoris melanocephala*
5. Chukar, *Alectoris chukar*
6. Przevalski's partridge, *Alectoris magna*
7. Philby's partridge, *Alectoris philbyi*

The species that is now well-established in the western U.S. is *Alectoris chukar*, or chukar, and sometimes referred to as "Indian Chukar" because many of the birds initially translocated to North America originated from the Port of Karachi in India (Christensen 1970). Recent molecular data supports this assessment (Barbanera et al. 2009).

All members of the genus *Alectoris* exhibit monomorphic characteristics between genders, meaning their coloration and general appearance are nearly identical. There are some subtle size differences, with males being slightly larger than females. Hume and Marshall (1880) took measurements from 100 birds collected in India and found full grown males generally weighed 22–23 ounces (623–652 g) while females weighed 15–17 ounces (425–482 g). Christensen (1970) collected 20 adult wild birds in Nevada which averaged 21.7 ounces (615 g) for males and 17.7 ounces (502 g) for females. Woodard et al. (1986) took measurements from pen-reared chukars and found gender could be determined from tarsus length with 95% accuracy at 10 weeks of age (M ≥60 mm, F <60 mm) and 86% accuracy in adult chukar (M ≥61 mm, F <61 mm).

Other specific measurements collected by Baker (1922) from birds in India include the following, which were not distinguished by gender because of overlap in size:

1. Wing: 146–180 mm
2. Tail: 78–105 mm
3. Bill: 19–21 mm

Chukars are boldly marked with many dark vertical stripes on the flanks and red bills and legs, but are amazingly cryptic, even in the sparsely vegetated habitat they frequent. Baker (1922) provided a comprehensive description of the plumage: "Forehead and lines through the eye, down the neck and meeting as a gorget between the throat and upper breast, black; next the forehead pure grey, this color running back as an indistinct supercilium, often albescent posteriorly; crown vinous red changing to ashy on hind neck and again to vinous red on back and scapulars, and then once more to ashy on lower back, rump and upper tail coverts; ear-coverts dull chestnut; middle tail feathers ashy drab, outer feathers the same but pale chestnut on the terminal half; outer

scapulars with pure pale gray centres; smaller and median coverts and innermost secondaries like the back; outer wing-coverts ashy; primaries and secondaries brown with a yellowish buff patch on the centre of the outer webs; point of chin and below gape black; lores, cheeks, chin and throat white tinged with buff to a varying extent; below the black gorget the breast is ashy-tinged more or less with brown and vinous at the sides, the lower breast being generally a pure French grey; abdomen, vent, thighs and lower tail coverts chestnut-buff or buff; feathers of the flanks gray at the base, with two black bars divided by pale buff and with chestnut tips."

A chukar bill normally is a deep red with a dusky coloration on the culmen and nostrils. Margins of eyelids also are a deep red or crimson color. Legs and feet of the species are deep red or coral pink with dusky brown to blackish claws (Christensen 1970).

Reproduction

Chukars are classified as monogamous, although extra-pair copulations are likely. The male generally remains with its mate through completion of a clutch and may remain through brood rearing. Pair formation typically begins as early as February and extends through late March. Pairing and nest initiation is influenced by photoperiod, temperature, and food availability. In years with limited food resources, pairing may be short or nonexistent with a resulting lack of nest initiation and reproduction. Mates are selected using several specific calls used by both genders. The male will display with his head down, neck extended, and one wing extended until the tip touches the ground. As pairs are established, the covey begins to disperse and each pair searches for an appropriate territory. Nesting territories are defended, especially near the actual nest site. Boundaries of territories do not seem to be very well defined. When nesting conditions are extremely poor, coveys may reassemble after a few weeks without attempting to nest (Christensen 1996).

Nests are mere depressions scratched in the ground (Christensen 1954) and lined with dry grass, stems, and feathers. Nests often are well hidden amongst rocks and under cover of shrubs and grasses. Female chukars also nested under rocks within or near talus slopes or associated rock outcroppings (Robinson et al. 2009). Females begin laying eggs in early to mid-April and the bulk of incubation takes place in May. Chukars are persistent nesters, often renesting after nest failure, with later nesting attempts hatching into August (Christensen 1970). However, a second brood per season is unlikely. Clutch sizes range from 10 to 21 eggs (mean = 15–16) and incubation lasts 24 days (Mackie and Buechner 1963).


Hen with brood in nest. Photo by Randy Larsen.

After hatching, precocial chicks leave the nest and are cared for by one or both of the paired adults (Christensen 1970). At 10 days, chicks typically are capable of flight (Harper et al. 1958). After 3 weeks or less, broods begin to mix, often at watering sites. Adults may leave these sites with a mix of chicks from other broods, or without their respective brood entirely. By 9 weeks of age, chicks resemble adults with barring on their flanks, and developed throat and ear patches. By 16 weeks, chukars have adult plumage and size. At 18 weeks, chicks generally are not distinguishable from adults in the field (Alkon 1982).

Timing and quantity of precipitation can affect reproductive success in upland game bird species by influencing composition, quantity, and condition of food plants and vegetative cover (e.g., Heffelfinger et al. 1999, Flanders-Wanner et al. 2004, Gibson et al. 2017). Similarly, weather is thought to play an important role in chukar reproductive success by influencing availability of food and cover. Variation in precipitation at relatively small scales can result in varying productivity in the same general area. Annual fluctuations in populations correlate well with drought years and years of high precipitation. We assume heavy precipitation and cold weather during early brood rearing can result in chick mortality as evidence suggests for other partridge species (Gates 1973, Giordano et al. 2013, Bro et al. 2014).

Mortality and Survival

Known predators of adults and chicks include bobcat (*Lynx rufus*), Cooper's hawk (*Accipiter cooperii*), coyote (*Canis latrans*), golden eagle (*Aquila chrysaetos*), great horned owl (*Bubo virginianus*), prairie falcon (*Falco mexicanus*), red-tailed hawk (*Buteo jamaicensis*), and sharp-shinned hawk (*Accipiter striatus*) (Christensen 1996). Robinson et al. (2009) found chukar annual survival ranged 3–19%, with 33% of mortality attributed to avian predation, 8% to hunter harvest, and 3% to mammalian predators; 56% of mortalities were of undetermined cause. Researchers surmised nearly

one-half of predation events coincided with the autumn raptor migration period, which occurs from September to November throughout the range of chukar in the western U.S. Wild chukar generally show low incidence of disease and disease-caused mortality (Christensen 1970).

Habitat Requirements

Chukars inhabit some of the roughest and most inhospitable habitats of any upland game bird species. Within their native range, the Himalaya, Hindu Kush, Karakorum, and Kunlun mountains present some of the most rugged terrain found anywhere in the world. Deep canyons and mountain valleys with streams and rivers within elevational ranges of 4,000–6,000 feet (1,219–1,828 m) provide the most suitable habitat within this region. However, chukars have been found to inhabit mountain slopes and peaks as high as 16,000 feet (4,876 m) (Hume and Marshall 1880).

In North America, the Great Basin, with its basin and range topography, closely mimics chukar habitat found in India, Pakistan, Afghanistan, and China (Christensen 1970). Valleys lie at 4,000–5,000 feet (1,219–1,524 m) throughout much of the Great Basin, and surrounding mountain ranges often exceed 10,000 feet (3,048 m). Many of these mountain ranges have extensive cliff formations, rocky outcrops, steep talus slopes, and canyon bottoms with small to moderately-sized streams supporting riparian vegetation. Other regions in North America, such as the foothills of the Rocky Mountains and larger river drainages of the Pacific Northwest (e.g., Snake, Columbia, John Day, Deschutes, and Salmon), offer these types of habitat as well.

Even though there often are similarities with respect to chukar habitat, such as those features described above, there is variation throughout the existing species range in North America. Populations occur from below sea level in Death Valley, California (Harper et al. 1958) to >12,000 feet (3,658 m) in the White Mountains of California and Nevada (Christensen 1996). Within the Great Basin, 4 broad vegetation types were identified to further characterize the species' habitat: 1) Northern Desert Shrub, 2) Salt Desert Shrub, 3) Pinyon-Juniper, and 4) Mountain Brush. For further information on these habitat categories, refer to Christensen (1996) or Molini (1976). With the exception of the salt desert shrub community (where shrubs such as shadscale [*Atriplex confertifolia*], bud sagebrush [*Picrothamnus desertorum*], fourwing saltbush [*Atriplex canescens*], and quailbush [*Atriplex lentiformis*] are more dominant), sagebrush (*Artemisia* spp.) usually is the dominant shrub species. Within these communities, native understory species of both grasses and forbs have been negatively affected by exotic plants such as redstem filaree (*Erodium cicutarium*) and cheatgrass (*Bromus tectorum*). These exotic species provide common food items for chukar; however, habitats comprised of native shrubs and perennial grasses, rather than vast landscapes converted to exotic forbs and grasses, seem to be associated with more productive populations (S. P. Espinosa, Nevada Department of Wildlife, and J. M. Knetter, Idaho Department of Fish and Game, personal communication).

In general, cover for chukars often is provided by rocky outcrops, talus slopes, and vegetation. Roosting sites are closely associated with rock outcrops (usually at the base) and the periphery of talus slopes. Ahlborn (1990) reported "optimum year-round habitat includes 25-50% steep, rocky or talus slopes, rock outcrops, cliffs and bluffs with 50% sagebrush and cheatgrass, near brushy stream drainages with grasses and water" as derived from Galbreath and Moreland (1953) and Christensen (1970).

Home Range and Movement

Limited information is available on movements of chukar in the western U.S. and Canada. And the lack of radio telemetry studies makes defining annual home range size difficult. Phelps (1955) determined daily movements of >1.0 mi^2 (2.6 km^2), but Walter (2000) found summer home range size in eastern Oregon was 42–62 acres (17–25 ha) and most daily movements were <820 feet (250 m). Johnsgard (1973) reported coveys may travel 2.0–3.0 mi (3.2–4.8 km) to reach water during dry periods.

Chukars can make long-distance movements, and in some cases, in a fairly short amount of time. For example, Harper et al. (1958) recorded chukar moving 19.9 miles (32 km) in 3 months and 32.8 miles (52.8 km) in 2 years. Similarly, within a 3-month period, Christensen (1970) reported a chukar that was trapped, released 27.2 km away from the trap site, returned, and was killed 82 days later.

Seasonal movements of chukars are most commonly influenced by snowpack. Chukars can dig or scratch through ≤8 inches (20 cm) of snow for food (Ahlborn 1990). When snow becomes too deep, they will move to south-facing slopes exposed by solar radiation or wind, or low elevations with less or no snow, to find food. Once snow recedes, chukars will follow the snowline upslope.

Calico Mountains, Washoe County, Nevada. Photo by Shawn Espinosa.

Food Habits

Like other members of the order Galliformes, chukars forage on the ground and often scratch to uncover seeds or subterranean shoots or bulbils. Chukars consume a wide range of food items, with 72 different items identified in an Oregon study, but only 18 distinct items occurred in >3% of crops examined (Walter and Reese 2003). Chukars move continually while foraging and can range widely. Summer foraging is more likely concentrated around available water sources.

Food items are variable across the species' range, but there does appear to be ≥3 staples in chukar diets: cheatgrass, redstem filaree, and fiddleneck (*Amsinckia* sp.) seeds. The following food studies have been conducted across the range of chukar in the western U.S.:

1. Alcorn and Richardson (1951), central and west-central Nevada (41 crops);
2. Christensen (1952), western Nevada (29 crops);
3. Galbreath and Moreland (1953), Washington;
4. Sandfort (1954), Colorado;
5. Harper et al. (1958), southern California;
6. Weaver and Haskell (1967), western and north-central Nevada (105 crops);
7. Zembal (1977), Death Valley, California (132 crops);
8. Cole et al. (1995), Hawaii (19 crops);
9. Walter and Reese (2003), eastern Oregon (203 crops);
10. Churchwell et al. (2004), Hells Canyon, Idaho and Oregon.

In the Nevada investigations, seeds of cheatgrass, redstem filaree, and rough fiddleneck were the most abundant food items. Other important seeds included Indian ricegrass (*Achnatherum hymenoides*), pinyon pine (*Pinus edulis*), sunflower (*Helianthus* spp.), and tansy mustard (*Descurainia pinnata*). Green leaves of cheatgrass and bluebunch wheatgrass (*Pseudoroegneria spicata*) apparently were important during winter months. Galbreath and Moreland (1953) found diets mainly consisted of cheatgrass seeds, grass leaves, and wheat. In Death Valley, California, Zembal (1977) found cheatgrass seeds were the most common food item. Earlier research by Harper et al. (1958) found redstem filaree, fiddleneck seeds, and green grass leaves were the 3 highest-ranking food items in adult diets within the Temblor Range, California; whereas insects made up the majority of chick diets. In eastern Oregon, Walter and Reese (2003) found cheatgrass seeds were the most common food item (87.5% of crops), while leaves and shoots of grasses, predominately cheatgrass, were present in 58.6% of examined crops. Subterranean bulbils of prairie star (*Lithophragma* sp.) were found in 46.4% of crops, and arthropods were found in 26.4% of crops with grasshoppers (Orthoptera) being the most common taxon. Prairie

starflower roots or bulbils also were commonly consumed by chukar (and gray partridge) in Hells Canyon of Idaho and Oregon (Churchwell et al. 2004).

Interestingly, Walter and Reese (2003) found ingested lead pellets in 5.7% of gizzards (n = 123) and Larsen et al. (2007*a*) found ingested lead shot in 10.7% of gizzards examined (n = 75) in Utah. A follow-up and more widespread sampling effort found evidence of ingested lead shot in 10.8% of 481 samples in western Utah (Bingham et al. 2015). From a sample of 283 chukar gizzards collected in Oregon, 3.9% were found to have ingested lead shot (Weiner et al. 2009). Evidence of ingested lead shot in wild chukars is a conservation concern because Bingham (2011) observed morbidity and mortality in captive chukars dosed with a single number 6 (2.77 mm) lead pellet.

Water Needs

Water is a fundamental need for chukars, as it is for all organisms, and is available in 3 forms. Metabolic water is a byproduct of processes such as metabolism or the break-down of fat. Pre-formed water is found in food items, and varies tremendously from one food source to another. Seeds, for example, contain relatively little pre-formed water, whereas insects and tubers or bulbils have relatively high amounts. Free water is that available for drinking. Relative use of free water by chukars appears to depend heavily on time of year and amount of precipitation, as well as moisture levels in food items consumed seasonally. As weather warms and chukars switch from consumption of succulent plant parts (e.g., shoots, leaves, flower parts) to relatively dry seeds, adult birds and chicks in many areas congregate near sources of free water (Christensen 1996). Larsen et al. (2010) found a strong association with free water during summer for 3 of 4 chukar populations in western Utah. The fourth population, however, did not show a spatial pattern associated with free water because they made use of succulent plant parts such as wild onion (*Allium* sp.) bulbs, resulting in 30% greater moisture content in their diets.

Chukars take advantage of many sources of free water, including small rivers and streams, springs, seeps, water developments, and even water in mine shafts (Christensen 1970). In Utah, Larsen et al. (2007*b*) found chukars watered during daylight hours with a modal hour from 1200 to 1300 hours daylight savings time, and use of free water was limited from November through May. They also noted a relationship between shrub canopy cover and use of water sources. Chukars were observed using free water sources with ≥11% shrub canopy cover and not water sources with canopy cover below this threshold. Increasing canopy cover beyond the 11% threshold did not increase observed water source use, and Larsen et al. (2007*b*) suggested shrubs around sources of free water helped minimize perceived risk of predation. Experimental removal of access to free water in western Utah resulted in increased movement and decreased survival of adults during summer months when temperatures were high and succulent food items limited (Larsen 2008).

Distribution and Abundance

Since the late 1800s chukars were introduced to many areas of North America, but failed to establish in most. The Great Basin portion of California, Idaho, Nevada, Oregon, and Utah offers the most suitable habitat and is the stronghold for self-sustaining populations of chukar (Fig. 1). However, chukar populations also occur in Arizona, British Columbia, Colorado, Montana, Washington, and Wyoming (Christensen 1996). Chukar populations also are established on several of the Hawaiian Islands.

Environmental conditions play an important role in annual fluctuations in chukar populations (Christensen 1996); changes can be dramatic, with population highs nearly 10 times greater than lows (Molini 1976). Several attempts have been made to estimate chukar density using leg-band returns (Harper et al. 1958) or aerial surveys (Molini 1976). Based on helicopter surveys in Nevada, Molini (1976) estimated high densities of chukar were 30–50 birds/mi^2 (12–19/km^2) and medium densities were 16–29 birds/mi^2 (7–11/km^2). More recently, Nevada Department of Wildlife conducted systematic aerial surveys from 2008 to 2015 and estimated chukar density at a high of 82 birds/mi^2 (32/km^2) in 2011 and a low of 41 birds/mi^2 (18/km^2) in 2013 (S. P. Espinosa, personal communication). Aerial surveys of 2 plots in southwest Idaho conducted from 1984 to 2010 yielded estimated partridge (chukar along with any gray partridge) densities ranging from a high of 139 birds/mi^2 (53/km^2) in 1987 to a low of 13 birds/mi^2 (5/km^2) in 1993 (J. M. Knetter, personal communication).

Legal Status and Harvest

Chukar are considered a game bird in Arizona, British Columbia, California, Colorado, Hawaii, Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming (Table 1). Daily bag limits range from 3 (parts of HI) to 8 (ID, MT, and OR).

Gray Partridge

Gray partridge. Photo by Artel/Shutterstock.

Description

The gray partridge is a medium-sized partridge, sometimes referred to as Hungarian partridge, or simply "Huns." Body mass of specimens vary regionally from 13.6 to 17.6 ounces (385–500 g), with larger birds occurring in the northern plains compared to those in the Midwest and East (Carroll 1993). Cramp (1980) recognized 8 subspecies of gray partridge. However, a long history of introductions from Europe and widespread rearing on game farms in the early 20th century obscures differences in taxonomic status. Little information on subspecific taxonomy of North American populations is available, but release records suggest most populations are *Perdix perdix perdix*, from Europe (Carroll 1993).

Sexual dimorphism is subtle in gray partridge, but males are slightly larger than females (Cramp 1980). Carroll (1993) describes distinguishing characteristics of gray partridge as: "Total length: 30.5-33.0 cm; mass 385-500 g. Overall color is gray to brown. In adults, distinctive facial coloration extending to the throat is tan to orange; generally brighter and more extensive in males. Dark brown patch on breast, often horseshoe-shaped; although variable in size, appears to be more developed in males. Wings short and round, with 10 primaries heavily mottled; little mottling of foreneck and back. Tail short and chestnut-colored." In the hand, one can easily determine gender of gray partridge by observing scapular feathers. Males have a thin, longitudinal yellow to buff stripe running down the rachis. In females, this stripe is thicker, and 2 to 4 horizontal buff crossbars are present.

Gray partridge male scapular feathers. Photo by Jason Robinson.

Gray partridge female scapular feathers. Photo by Jason Robinson.

Gray partridge have a high mortality rate, short lifespan, and high reproductive potential. Populations are highly dynamic and can exhibit large annual variation in abundance. Although hunted in many areas of Europe and North America, predation and weather are believed to have the greatest impacts on population numbers. Mendel and Peterson (1980) reported seasonal density changes demonstrated annual population turnover rates up to 78%,

Gray partridge shoulder feathers. Left and right—female (note thick buff stripe along rachis and horizontal buff crossbars), center—male (lack of crossbars and thin stripe along rachis). Photo by Jason Robinson.

even under light hunting pressure. While widely studied in Europe and in eastern North America, little information is available on gray partridge populations in the Great Basin and Intermountain West; therefore, regional management of this species is minimal. Intensive field studies are necessary to determine limiting factors (e.g., nest success, chick survival) for populations in these areas.

Reproduction

Gray partridge are monogamous and pairs are most often formed between coveys; however, intra-covey pairing occurs among previously paired adults (Jenkins 1961, Weigand 1977). Both males and females attempt to breed in the first year after hatch (Potts 1986). Dates of breeding-pair formation vary considerably with region and weather conditions. Courtship has been observed in Wisconsin during January, with final pairing occurring from mid-February to mid-March (McCabe and Hawkins 1946, Church 1980). In Washington, pairs appeared during the first week of February (Knott et al. 1943, Yocom 1943). In Idaho, pairs appear during mid-January (J. M. Knetter, personal communication). Females choose males and often drive all other females away, especially for intra-covey pairings. Adult females almost always mate with adult males (Weigand 1980). Once paired, males often use threat displays or attack unmated males that attempt to court their mates (Jenkins 1961).

Gray partridge nest initiation varies regionally. Egg laying has been documented in late-April through early May in Wisconsin (McCabe and Hawkins 1946, Gates 1973, Church 1984*a*), and in early May in New York (Church 1984*b*), North Dakota (Carroll et al. 1990), and Saskatchewan (Hunt 1974). Peak nest initiation occurs during early May in Wisconsin, and mid- to late May in New York, South Dakota, and North Dakota (Hupp et al. 1980, Church 1984*b*, Carroll et al. 1990). The incubation period is 21–26 days (McCabe and Hawkins 1946).

Whether males or females select a nest site is unclear, but most nesting occurs in the winter home range of the female (Church 1980, Potts 1986). Carroll (1989) summarized gray partridge nesting studies in North America and found a shift from use of hay fields and pastures during the 1940s to fence rows, roadsides, and shrub shelterbelts in the 1970s and 1980s. Gray partridge will also use cereal grain fields for nesting; however, Carroll (1989) found these to be primarily renest attempts. In North Dakota, Carroll and Crawford (1991) found vegetation at roadside nests was dominated by smooth brome (*Bromus inermis*) and several woody shrubs (e.g., rose [*Rosa* spp.] and western snowberry [*Symphoricarpos occidentalis*]). In South Dakota, nest sites were dominated by smooth brome (Hupp et al. 1980). In Great Britain, hedgerows are important habitat for nesting; the more dead grass in the understory of hedgerows, the higher the breeding density (Potts 1986, Rands 1986). Little information exists on gray partridge nest site characteristics in the Great Basin and Intermountain West.

Gray partridge produce among the largest clutches of any bird species. Church (1984*a*) summarized North American studies and reported an average clutch size of 16.1 and a mean hatching success of 32% (range 16–40%). Carroll et al. (1990) reported an average clutch size of 17 (n = 32, range 10–22). Chicks usually leave the nest within a day of hatching (Yeatter 1934).

If a nest is destroyed before hatching, gray partridge are persistent renesters and may initiate ≤4 nests in a single season; however, clutch size declines during the season and with each successive nest (Jenkins 1961, Birkan et al. 1990). Renesting attempts cease during July (Church 1984*a*, Church 1984*b*, Carroll et al. 1990). Although gray partridge will renest after a failed nest attempt, there is only one reported case of a female renesting after losing a brood (Carroll 1993).

Mortality and Survival

Habitats of gray partridge are typified by short growing seasons and little precipitation during the late-spring and summer periods; therefore, the primary factor likely influencing reproductive success and annual production is the amount of precipitation received during key periods of the year. Weather had strong effects on recruitment and

Brownlee Reservoir, Washington County, Idaho. Photo by Jeff Knetter.

overwinter mortality in Montana (Weigand 1980), New York (Church and Porter 1990*a*), Wisconsin (Church 1980), and Great Britain (Potts 1986). Increased mortality has been correlated with severe winter weather, specifically deep or crusted snow (Potts 1986, Panek 1990).

In general, gray partridge are short-lived, with high mortality rates. For winter-captured birds in Montana, life expectancy was 1.8 years for adults, 0.9 years for immature males, and 0.8 years for immature females; maximum longevity was 4 years (Weigand 1980). In adults, Carroll (1993) observed nesting females had the highest mortality rates. Potts (1986) observed high chick mortality due to decreased insect availability. Furthermore, Mendel and Peterson (1980) observed decreased production associated with severe spring and summer weather. In Idaho and Montana, relative survival (based on age and gender ratios of wings collected from hunters) of juvenile gray partridge was similar for males and females, which also suggests no differential vulnerability by age (Mendel and Peterson 1980, Swenson 1986). Potts (1986) and Carroll (1992) reviewed autumn-winter mortality rates for populations throughout the world and reported a range of 49–86%.

Predation is an important source of gray partridge mortality; typically greatest during nesting, brood-rearing, and winter (Potts 1980, Carroll et al. 1990, Church and Porter 1990*b,* Carroll 1993). Nest predators include striped skunk (*Mephitis mephitis*), red fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), domestic dog, domestic cat, and American crow (*Corvus brachyrhynchos*) (Gates 1973, Hupp et al. 1980, Church 1984*b*, Carroll et al. 1990). Consequently, females on nests are often killed by some of these predators (Potts 1986, Carroll et al. 1990). High mortality rates, mainly from raptors, corresponded with periods of limited food availability in New York (Church and Porter 1990*a*) and North Dakota (Carroll 1989).

Data on occurrence and effect of diseases and parasites on gray partridge in North America are limited. In the Great Lakes region, Yeatter (1934) observed one bird with symptoms of avian tuberculosis and infection rates of 14.5% of *Heterakis* sp. and 31.6% of *Dispharynx spiralis* among wild partridge. Yocom (1943) found *Heterakis gallinae* (*H. gallinarum*) in low numbers in wild gray partridge from the Palouse Prairie in eastern Washington, but observed no other endoparasites. Bendell and Lisk (1957) observed *Dispharynx nasuta* in partridge populations in Ontario. Wright et al. (1980) reported gray partridge chicks were susceptible to *Histomonas* infections via transmission of *H. gallinarum* from ring-necked pheasants.

In Great Britain, diseases and parasites of gray partridge have been well documented (Carroll 1993). Potts (1986)

reported parasitic worms (*Trichostrongylus tenuis*, *Syngamus trachea*, and *H. gallinarum*) were associated with deaths of a large percentage of partridge which died of natural causes in southern England. Further, Potts (1986) suggested *T. tenuis* might be responsible for increased chick mortality via infected females when partridge populations are at high densities.

Habitat Requirements

Gray partridge generally are associated with fertile soils and natural grasslands of flat or gently rolling terrain. A combination of cereal grains and herbaceous cover in the form of hayfields, grasses, weedy vegetation, and extensive shelterbelts provides preferred habitat (Carroll 1993). However, availability of permanent nesting cover likely is a limiting factor in extensively cultivated landscapes. In summer, partridge generally use agricultural fields (i.e., cereal grains and row crops) and grasslands, but also use roadsides and shelterbelts. In winter, crop stubble (especially cereal grains) and woody cover are preferred (Carroll 1993). During severe winter weather with deep snow (>10 cm), woody cover near farmsteads may be important (Schulz 1980, Weigand 1980, Carroll 1993). On the Palouse Prairie in Idaho, permanent cover (e.g., fencerows, farmsteads, roadside and railroad right-of-ways, waterways, idle grass, brush and timber, pasture, and hay) was preferred during late spring, summer, and autumn. During winter, plowed stubble was preferred and winter wheat generally was avoided (Mendel 1979).

No data on habitat preferences of gray partridge that inhabit canyon grasslands and mountainous areas in the Great Basin and Intermountain West are available.

Home Range and Movement

Gray partridge in North America are considered non-migratory, with seasonally variable home ranges in agricultural landscapes that correspond to spring-autumn (breeding, nesting, and brood-rearing) and winter periods (Carroll 1993). Movements within seasonally occupied ranges are relatively small. Seasonal ranges varied from a low of 20.3 acres (SD = 22.2, n = 5; 8.2 ha ± 9.0) in North Dakota (brood groups with chicks <2 weeks, Carroll et al. 1990) to 766 acres (310 ha) during autumn (also in ND, Hupp et al. 1980). From New York through the northern Great Plains, seasonal home ranges of coveys comprised of adults generally ranged 175–290 acres (71–117 ha; Smith et al. 1982, Carroll 1989, Carroll et al. 1990, Church and Porter 1990*b*). Home ranges may be restricted during periods of deep snow and cold temperatures (Schulz 1980). No data on home range and movements of gray partridge that inhabit canyon grasslands and mountainous areas in the Great Basin and Intermountain West are available.

Food Habits

The gray partridge diet is comprised mostly of plant materials, which includes seeds of domestic crops and weeds in crop fields. As opportunistic feeders, gray partridge consume a large variety of foods, which include seeds of wheat, barley, oats, corn, and sunflower; seeds of wild plants including foxtail (*Setaria* spp.), wild buckwheat (*Polygonum* spp.), ragweed (*Ambrosia* spp.), and common Russian thistle (*Salsola kali*), and insects (i.e., Orthoptera and Lepidoptera) (Kobriger 1980, Melinchuk 1981, Hupp et al. 1988). Insects are important in diets of chicks and include leafhoppers (Cicadellidae), flies (Diptera), ants (Formicidae), grasshoppers and crickets (Orthoptera), plant bugs (Miridae), sawfly larvae (Hymenoptera), Lepidoptera larvae, Carabidae, Staphylinidae, and cereal aphids (Aphidae) (Kobriger 1980, Erpelding et al. 1986, Potts 1986, Hupp et al. 1988). Diets vary seasonally; comprised mostly of insects in summer, seeds of wild plants in fall, seeds of crop plants in winter, and green leafy vegetation during spring (Kobriger 1980, Melinchuk 1981, Hupp et al. 1988).

Based on the examination of 112 gray partridge crops over 2 years, Churchwell et al. (2004) identified 16 items consumed during autumn in Hells Canyon of Idaho and Oregon. Primary food items by volume and frequency were prairie star root nodules and unidentified vegetation (green grass and forbs), but other frequent food items included fiddleneck seed, bulbous bluegrass (*Poa bulbosa*) stem-base, and Scotch thistle (*Onopordum acanthium*) seed. We are not aware of any other studies of gray partridge food habits in canyon grasslands and mountainous areas in the Great Basin and Intermountain West.

Water Needs

Gray partridge water needs remain relatively unknown in the western United States. However, Porter (1955) reported gray partridge in western Utah require free water in dry desert areas. Yeatter (1934) believed gray partridge in the Great Lakes region meet their water requirements by utilizing dew and succulent foods.

Owyhee Mountains, Owyhee County, Idaho. Photo by Jeff Knetter.

Distribution and Abundance

Gray partridge are not native to North America. They were introduced to many parts of the world, with the first documented introductions in North America during the 1790s. During the 19th and 20th centuries, additional releases occurred in >30 states and provinces (Carroll 1993); by the 1930s, >230,000 gray partridge had been released (Yeatter 1934).

Primary range of gray partridge includes the northern plains from northwest Iowa to southern Alberta (Carroll 1993; Fig. 2). In general, range of gray partridge in eastern North America has contracted; populations no longer exist in Indiana, Michigan, or Ohio. Although typically associated with cultivated lands, gray partridge are also found many miles from agriculture in canyon grasslands and mountainous areas in the Great Basin and Intermountain West.

Densities of gray partridge vary considerably and all published estimates are from agricultural landscapes. Little data on population densities of gray partridge that inhabit canyon grasslands and mountainous areas in the Great Basin and Intermountain West are available. However, Porter (1955) reported densities in northwest Utah of 1 bird for every 155 acres. In Great Britain, Potts (1986) suggested the greatest population densities occurred prior to the 1960s; spring density in 1952 on managed estates was about 65 pairs/mile2 (25 pairs/km2) and declined to 13 pairs/mile2 (5 pairs/km2) by 1985. In Wisconsin, Church (1980) estimated 4.4–5.4 pairs/mile2 (1.7–2.1 pairs/km2), whereas Carroll (1993) observed <3 pairs/mile2 (<1 pair/km2) in North Dakota. Hunt (1974) reported 11.1 pairs/mile2 (4.3 pairs/km2) in Saskatchewan. Fall population density estimates ranged 83–140 birds/mile2 (32–54 birds/km2) in Saskatchewan (Hunt 1974), 39–218 birds/mile2 (15–84 birds/km2) in Idaho (Mendel and Peterson 1980), and 124 birds/mile2 (48 birds/km2) in South Dakota (Ratti et al. 1983).

Legal Status and Harvest

Gray partridge are game birds in all states and provinces within their current (2017) western range: Alberta, British Columbia, Idaho, Montana, Nebraska, Nevada, North Dakota, Oregon, Saskatchewan, South Dakota, Utah, Washington, and Wyoming (Table 1). Daily bag limits range from 3 (NE and ND) to 8 (ID, MT, and OR).

Research Needs

Demography and Population Dynamics

Few data exist to develop individually-based or population-level demographic models to ascertain finite rate of population change for either chukar or gray partridge. A basic understanding of mechanisms driving population change can assist managers in identifying tools to maintain or enhance populations. While detailed research efforts (i.e., local scale) to develop such models are needed, there might be intermediate steps to examine population dynamics through harvest statistics or indices of abundance. Regional harvest data (or other abundance indices) could be used with density-dependent or -independent state-space models (Dennis et al. 2006) to evaluate general dynamics of these populations and begin to examine roles of landscape configuration, wildfire, drought, timing of precipitation, etc., as they relate to short- and long-term fluctuations in populations. From that assessment, a number of hypotheses could be generated and tested using replicated local-scale studies. The goal of such research would be to identify management practices that could maximize annual productivity.

Population Monitoring

Chukar

Few state wildlife agencies have designed monitoring programs to estimate chukar abundance. However, Nevada conducts aerial (helicopter) surveys within established plots to estimate chukar density, and Oregon conducts roadside surveys within known chukar habitat to determine number of birds per mile. There are some monitoring programs to assess production of chicks in a given year (e.g., CA and OR). Depending on needs of a wildlife agency to ascertain abundance, several options may be worth exploring in terms of efficacy of these methods. To estimate breeding populations, rigorous aerial surveys (perhaps some adjustments to NV's existing method) on a subset of study areas could yield a minimum density estimate (see McDonald et al. 2014 for the conceptual approach). If fall populations are of greater interest, population reconstruction may provide useful estimates (see Broms et al. 2010). However, data requirements of reconstruction techniques (gender and age ratios at harvest, ancillary data on survival and harvest susceptibility) could limit efficacy (Broms et al. 2010). Either or both methods may have merit if abundance is of interest. Additionally, localized but intensive banding efforts could be replicated across the range to estimate abundance and several demographic rates, and may be the most cost-effective approach. Remote cameras placed at water sources frequented by brood groups may also provide a cost-effective method to estimate annual production (chicks per adult) and relative abundance.

The Western States Partridge Working Group developed a list of research needs which would improve our understanding, and possibly management, of chukar populations. The following list of chukar research needs should not be considered complete or final:

1. Develop a consistent and efficient fall index of chukar abundance;
2. Identify habitat requirements of chukar populations;
3. Determine effects of large scale wildfire on chukar populations;
4. Identify year-round limiting factors (including weather) for chukar populations;
5. Determine population characteristics and document seasonal distribution;
6. Conduct an economic analysis of chukar hunting in the western U.S. and Canada;
7. Develop effective and consistent harvest survey methods;
8. Determine age and gender structure of harvested populations.

Gray Partridge

Currently, no state wildlife agency attempts to estimate population size of gray partridge; however, Idaho, Iowa, North Dakota, and Oregon conduct roadside surveys as indices to gray partridge abundance and production. Idaho

and North Dakota also collect hunter-harvested wings to determine population characteristics (i.e., age and gender ratios). North Dakota conducts rural mail carrier surveys during April to assess breeding population trends. Currently, harvest trends are collected in at least 8 states (ID, NV, ND, OR, SD, UT, WA, and WY).

To maintain or enhance gray partridge populations at levels necessary to meet demands for hunting and viewing, determination of current population status is necessary. Mechanisms which regulate short- and long-term population fluctuations need to be assessed to improve our understanding of factors that influence gray partridge populations.

As with chukar, the Western States Partridge Working Group developed a list of research needs that can improve our understanding of gray partridge populations. The following list of those research needs should not be considered complete or final:

1. Determine limiting factors of gray partridge populations;
2. Develop an effective and consistent survey method to determine population trends;
3. Determine influences of anthropogenic land use on gray partridge population dynamics (e.g., changes in agricultural practices, implementation of Farm Bill programs, etc.);
4. Determine effects of large wildfire on gray partridge populations in the Great Basin;
5. Identify habitat requirements of gray partridge populations;
6. Determine population characteristics and document seasonal distribution;
7. Develop effective and consistent harvest survey methods;
8. Conduct an economic analysis of gray partridge hunting in the western U.S. and Canada;
9. Determine age and gender structure of harvested population.

West Coyote Hills, Lake County, Oregon. Photo by Dave Budeau.

Status and Management of Partridge in the West

Population Size and Distribution of Partridge

Chukar and gray partridge are introduced species with self-sustaining, wild populations in many western states. Many states have both species of partridge, while states such as California and Colorado only have chukar, and others (SD and ND) only have gray partridge.

No state or province attempts to estimate population size, but 5 states report conducting surveys to index chukar population trends: California, Idaho, Nevada, Oregon, and Utah (Fig. 3). Of the states conducting chukar surveys, 3 have used aerial surveys (ID, NV, and UT) to estimate density, but Idaho discontinued aerial surveys after 2010. Two states used roadside surveys to estimate production or chukars/10 miles (16.1 km). Oregon and North Dakota conduct roadside surveys for gray partridge production, while aerial surveys were used in Idaho through 2010 to assess partridge density (both species combined). Idaho and North Dakota use hunter-harvested wing surveys to determine population demographics. Rural mail carrier routes during April are used to assess breeding population trends in North Dakota. No other states reported conducting surveys for population trends of gray partridge.

Season Frameworks

Sixteen western states and provinces provided information on partridge hunting season structure. All states offer seasons that generally are 3 to 4 months in length (Table 1). Most of the seasons start in late September or early October and end in January, with 2 states extending their season into early February. Colorado and Montana offer the earliest season start (1 Sep), and Colorado ends their season first (30 Nov). Both Utah and Nevada have partridge seasons extending into February, with Utah ending the latest (15 Feb).

Daily bag limit for partridge ranges from 3 to 8 birds among western states and provinces. In some states (e.g., MT, NE, NV, and OR) both chukar and gray partridge count toward an aggregate daily bag limit, while in other states (e.g., ID, UT, WA, and WY) there are separate daily bag limits for each species. In all jurisdictions possession limit is 3 times the daily bag limit, except in Nebraska and North Dakota, where possession is 4 times the daily bag.

Figure 3. Chukar population trends (2004–2015) in 5 western states, presented as a percentage of each state's most recent 10-year average.

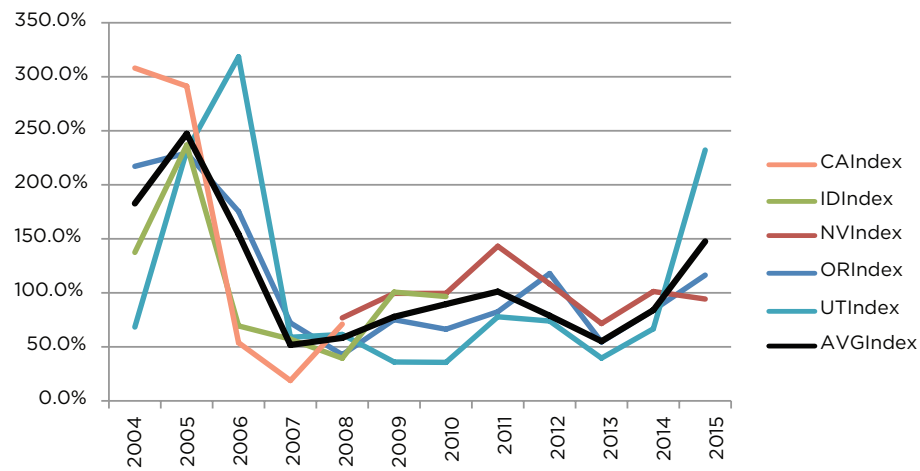


Table 1. Chukar and gray partridge hunting season structure and bag limits (2016) for 17 western states and provinces.

State/ Province	Species	Season		Bag limit	
		Start	End	Daily	Possession
AB	Gray	1 Sep	15 Jan	5	15
AZ	Chukar	1 Sep	15 Feb	5	15
BC	Chukar/ Gray	1 Oct	30 Nov	5/3	15/9
CA	Chukar	3rd Sat. in Oct	4th Sun. in Jan	6	18
CO	Chukar	1 Sep	30 Nov	4	12
HI	Chukar	1st Sat. in Nov	Last Sun. in Jan	3 to 8[a]	
ID	Chukar/ Gray	3rd Sat. in Sep	31 Jan	8 ea.	24 ea.
MT	Chukar/ Gray	1 Sep	1 or 10 Jan	8[b]	24[b]
NE	Chukar/ Gray	Last Sat. in Oct	31 Jan	3[b]	12[b]
NV	Chukar/ Gray	2nd Sat. in Oct	1st Sun. in Feb	6[b]	18[b]
ND	Gray	10 Sep	8 Jan	3	12
OR	Chukar/ Gray	Sat. closest to 8 Oct	31 Jan	8[b]	24[b]
SK	Gray	15 Sep	7 Dec (non-resident), 31 Dec (resident)	4	8[c]
SD	Gray	3rd Sat. in Sep	1st Sun. in Jan	5	15
UT	Chukar/ Gray	Last Sat. in Sep	15 Feb	5 ea.	15 ea.
WA	Chukar/ Gray	1 Oct	16 Jan	6 ea.	18 ea.
WY	Chukar/ Gray	1 Oct	31 Jan	5 ea.	15 ea.

[a] Varies by Island.

[b] In the aggregate for both daily and possession limits.

[c] Season limit.

Harvest

Ten western states provided information about partridge hunters and harvest; 8 states offered chukar hunting opportunities (CA, CO, ID, NV, OR, UT, WA, and WY). Over the 2005–2015 time period, these states collectively averaged approximately 50,000 hunters, with each hunter spending 5.1 days afield/season and harvesting 6.0 chukar/season. Recent (2015) annual chukar harvest averaged approximately 200,000 birds, but harvest collectively exceeds 500,000 birds in above-average years. Harvest data for each state were standardized relative to their most recent 10-year average, and comparisons suggest similar harvest trends among states (Fig. 4).

Gray partridge harvest was reported for 8 western states (ID, NV, OR, ND, SD, UT, WA, and WY). Collectively these states harvested approximately 83,000 birds in 2014; which was below the 10-year average for all reporting states (Fig. 5). Harvest is collectively about 150,000 birds in these same states during above-average years. From 2005 to 2015, these 8 states collectively averaged about 42,000 gray partridge hunters who each spent an average of 5.4 days afield and harvested 3.1 gray partridge/season.

Management Issues

Among Great Basin states, loss of habitat or reduced habitat quality due to wildfire, or effects of multiple fires in some areas, is a management concern. Loss of nesting and brood-rearing habitat and post-fire invasion of non-native annual grasses and other invasive weed species likely are reasons for reduced habitat quantity and quality following fire. Relatedly, there is concern about potential impacts of climate change, which could increase drought conditions and reduce available water or efficacy of guzzlers to capture and maintain water. Some states identified lack of reliable population surveys and constraints on guzzler installation and maintenance as management issues. Colorado has significant interest in expanding distribution of chukar to increase small game hunting opportunities.

Danskin Mountains, Elmore County, Idaho. Photo by Jim Shurts.

In the western portion of their range, gray partridge and chukar can be sympatric, but gray partridge use tilled agricultural landscapes to a greater degree than chukar. For gray partridge, impacts of "clean farming," as well as agricultural practices such as fall plowing, ditch burning, and increased use of herbicides and pesticides were identified as negatively influencing gray partridge populations. As with chukar, wildfire, or multiple wildfires for some areas, that reduces availability of shrub cover and taller-statured, deep-rooted, perennial bunch-grasses, may have depressive effects on gray partridge populations in the western portion of their range, particularly during winter. Expansion of the non-native annual grass, medusahead rye (*Taeniatherum caput-medusae*), also was identified as a specific concern. The general lack of understanding about habitat requirements and population dynamics of gray partridge in the West, and variables which influence these parameters, were identified as a management issues in need of further research.

Figure 4. Chukar harvest trends (2005-2015) in 7 western states, presented as a percentage of each state's most recent 10-year average.

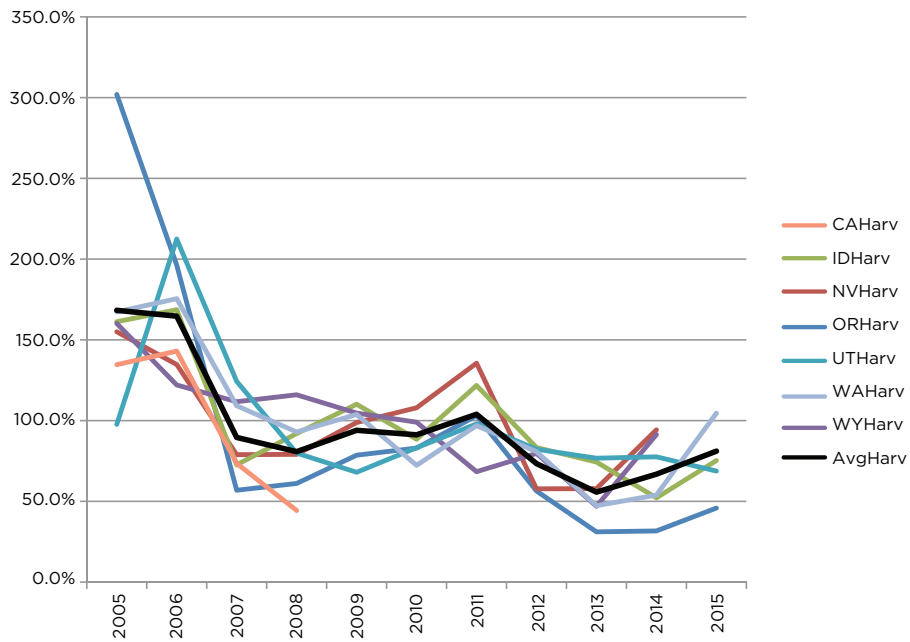
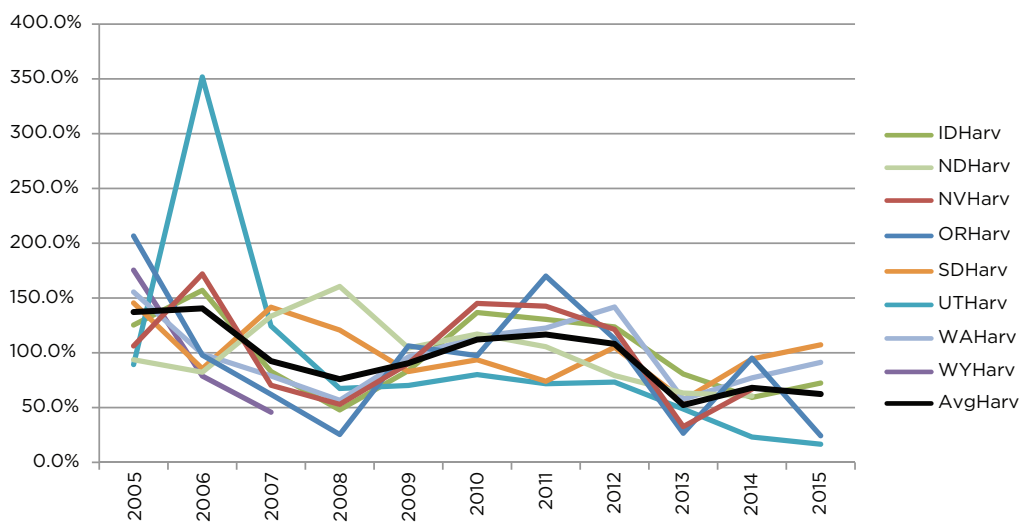


Figure 5. Gray partridge harvest trends (2005-2015) in 8 western states, presented as a percentage of each state's most recent 10-year average.



Economic Value of Partridge Hunting

Gray partridge retrieve, Washington County, Idaho. Photo by Jeff Knetter.

Surveys have not been conducted to specifically determine economic benefit of partridge hunting in the West. However, economic impact from partridge hunting for many small rural communities is thought to be significant. Some communities, such as Winnemucca, Nevada, have recognized the importance of partridge hunting to their local economy and the Winnemucca Convention and Visitor's Authority actively promotes the opportunity.

In Nevada, chukar is the most pursued upland game bird species in the state by a margin of nearly 7:1. Upland game bird hunting in Oregon is the number one reason for non-resident hunting day trips and accounts for 27% of overnight hunting trips by non-residents; partridge represent approximately 30% of harvested upland birds. In Idaho, 26% of upland game bird hunters pursue partridge species, and in Utah, 17% and 2% of upland game bird hunters pursue chukar and gray partridge.

Economic contribution of partridge hunters in the West likely is >$40 million/year. In Idaho, upland game bird hunters spend on average approximately $138/hunter/day. If this figure is applied to the collective average of 250,000 chukar hunter-days/year in 8 states (2005–2014), chukar hunters spend approximately $34.5 million each year. Similarly, Utah estimated upland game bird hunters spend about $780/hunter/season. Thus, estimated economic contribution of an average 49,000 chukar hunters across 8 western states (2005–2014) exceeded $38.2 million. These estimates do not include those hunting only gray partridge and include only those states responding to the survey.

Several sportsmen's organizations that provide support for chukar and gray partridge conservation and management have been formed over the years:

1. The Nevada Chukar Foundation
2. Carson Valley Chukar Club (Gardnerville, NV)
3. Pershing County Chukars Unlimited (Lovelock, NV)
4. Utah Chukar and Wildlife Foundation
5. Water for Wildlife Foundation (Lander, WY)
6. Sportsmen for Fish and Wildlife

These organizations host fundraisers for habitat enhancements for chukar and gray partridge as well as other upland game species. Their economic influence on small, rural communities, as well as their subsequent contributions to partridge-related projects, especially as matching funds for Pittman-Robertson Wildlife Restoration Grant funding, could be of significance and should be acknowledged.

Chukar and gray partridge hunt, Brownlee Reservoir, Washington County, Idaho. Photo by Jeff Knetter.

Gray partridge hunters, Box Elder County, Utah. Photo by April Robinson.

Policy Recommendations

Managing for chukar and gray partridge in the western U.S. will not only benefit these species, but add value to habitats important to many other wildlife species. For example, habitat in the Great Basin supporting robust chukar populations also supports a range of species from greater sage-grouse to bighorn sheep (*Ovis canadensis*). Similarly, grassland habitats that support gray partridge also support grassland obligates, many of which are species of concern, from bobolink (*Dolichonyx oryzivorus*) to Columbian sharp-tailed grouse. Despite the need for more information on partridge responses to management in western states, life histories and habitat associations of these species are understood well enough to make the following broad policy recommendations:

1. Support Federal conservation programs that promote structurally suitable habitats for nesting and brood-rearing gray partridge and chukar.

    a. Federal conservation programs have potential to improve habitat on millions of acres across state boundaries.

    b. Over the past >30 years, the Conservation Reserve Program (CRP) has proven itself as one of the most important "Farm Bill" programs for wildlife, including gray partridge.

    c. Programs such as the Natural Resources Conservation Service's Sage-grouse Initiative (SGI), Environmental Quality Improvement Program (EQIP), and Conservation Stewardship Program (CSP) provide private landowners with incentives to improve habitats for multiple species, including chukar and gray partridge.

2. Maintain public access to lands offering partridge hunting.

    a. Promoting hunting access and opportunities for gray partridge and chukar will increase the value of western lands for all wildlife and, in turn, benefit the economy of rural communities.

    b. Because of the relative ease of participation, hunting for partridge and other game birds can be used to promote initiatives for hunter recruitment, retention, and reactivation.

3. Promote additional water access sites for partridge and other wildlife where appropriate.

    a. Increasing availability of water for the benefit of wildlife and local communities can be achieved through a range of activities, including installation of guzzlers and landscape-scale riparian restoration.

    b. The SGI's Mesic Habitat Conservation Strategy provides assistance to properly manage scarce water resources important for ranching and wildlife. Proper management will benefit sage-grouse, gray partridge, and chukar, particularly during brood-rearing.

4. Support state and federal wildfire response preparedness and restoration projects or initiatives in partridge habitats.

    a. Wildfire is one of the greatest threats to long-term viability of sagebrush-steppe habitat in the Great Basin and other parts of the West.

    b. Pre-positioning fire suppression assets and supporting development of Rangeland/Rural Fire Protection Associations (RFPAs) can shorten time to initial response, and reduce risk of landscape-scale fires.

    c. Address "gaps" identified in the WAFWA report "Wildfire and Invasive Species in the West: Challenges That Hinder Current and Future Management and Protection of the Sagebrush-steppe Ecosystem" (Mayer et al. 2013), such as:

        i. Land management agencies would benefit from a long-term pre- and post-fire restoration funding initiative to secure dedicated funding to ensure appropriate fuels

and vegetation management is accomplished and sagebrush ecosystems can be restored following wildfire;

ii. Update and improve seeding methods, seed mixes, and equipment used for post-fire rehabilitation or habitat restoration;

iii. Protect important and intact habitats from wildland fire using an approach similar to that applied to Wildland Urban Interfaces.

5. Support invasive plant control.

   a. Invasive plants can result in permanent type-conversions of habitat, which reduce or eliminate habitat quality for partridge and other wildlife.

   b. Management options are limited and restoration success has been elusive when attempting to treat some invasive species (e.g., cheatgrass, medusahead rye), which highlights the need to develop innovative treatment methods and technology.

   c. The issue of invasive plants is not mutually exclusive from the issue of wildfire. Therefore, implement recommendations provided in the WAFWA Wildfire and Invasive Species Initiative Working Group's "Invasive Plant Management and Greater Sage-grouse Conservation: A Review and Status Report with Strategic Recommendations for Improvement" (Ielmini et al. 2015).

Chukar and gray partridge hunt, Elko County, Nevada. Photo by Shawn Espinosa.

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