

in advanced-age broods is highly variable (Kockert et al. 1983). Young falcons hatch close together, and fledge after about 40 days. There is high mortality of young falcons, 74% in one study (Shor 1975).

Ecology and Habitat Relationships

Prairie falcons select nesting eyries in cliffs or escarpments. The landscapes surrounding their nests sites are often semi-arid open lands, sagebrush basins or grasslands (Marti and Braun 1975). Nests are usually in rock cavities in sheer cliffs with overhanging ledges and a broad vista. Most nests are within pothole-like cavities in cliffs about 30 m high (Runde and Anderson 1986). Prairie falcons also nest in rock crevices and old stick nests used by other species. Home ranges of 26 to 141 km squared have been noted (Craighead and Craighead 1956). Birds and mammals make up the majority of their food base in varying proportions (Peterson et al. 1977, Boyce 1985, Squires et al. 1989). Prairie falcons suffer from many local problems, including pesticides, grassland conversions, and disturbance of nesting areas.

Detection Methods

The same survey protocol described for the peregrine falcon applies to the prairie falcon. These species can share similar habitat and nesting chronology in our area, although prairie falcons may arrive in nesting cliffs earlier (Appendix A, Table 2). The vocalization "jüink, jüink, jüink" made by an adult prairie is indicative of the presence of young falcons.

Merlin (*Falco columbarius*)

Merlins are found in the north of North America and Eurasia (Johnsgard 1990). Merlins nest in northwestern Alaska, throughout Canada, and into the northern prairie states: Montana, the Dakotas, Wyoming, and western Nebraska. The southernmost extension of the merlin's North American range is into central Wyoming and

eastern Idaho (Craig and Craig 1989). No verified merlin nests have been reported within the Greater Yellowstone region in recent years, although merlins are occasionally seen within the area during the breeding season (Craig and Craig 1989). Surveys for nesting merlins are needed within the Greater Yellowstone Ecosystem.

Merlins are listed as species of special concern in Idaho and Montana, a priority 2 species in Wyoming, and as a sensitive species by the Bureau of Land Management. Population declines have been attributed to eggshell thinning due to pesticides and conversion of grassland/shrub habitats to cropland (Fox 1971, Becker 1984).

Local Occurrence

M. Whitfield has seen merlins within the study area on two occasions during the breeding season. Both sightings were of adults in sage-dominated habitats. We did not detect any merlins in 1994.

Reproductive Biology

Males typically arrive in breeding areas before females (Becker 1984). New pair bonds are formed each year. Courtship features as many as 14 displays and 4 primary vocalizations (Feldsine and Oliphant 1985). Merlins typically occupy breeding territories in April, and lay eggs in May (Becker 1984, Craig and Craig 1989). Although they usually nest in stick nests of other species, merlins also can nest in tree cavities or cliff scrapes. Black-billed magpie nests with mud cups and stick canopies are often the nest site of choice (Sieg and Becker 1990). They may decorate nests with greenery.

Clutch sizes average about 4 eggs (Becker 1984). The female does most of the incubation, except when the male brings in food. Incubation lasts 28-32 days (26 days/egg). The female helps with hunting after only one week of brooding. Nestlings develop rapidly, and may fly at 26 to 33 days after hatching (Becker 1984). The young start to catch prey (insects) after only 2 weeks of

flight, and are independent of adults after 5 weeks of flight.

Merlins typically have low population densities, and forage up to 9 km from a nest site. Home range sizes have been suggested to range from 13 to 28 square km (Becker 1984).

Ecology and Habitat Relationships

Areas of mixed grasslands and deciduous trees, often quaking aspen, are favored breeding areas (Hodson 1976 from Sieg and Becker 1990). Nesting habitat in southeastern Montana included dry ponderosa pine types (Becker 1984). Most merlin nests documented in Montana have been constructed by black-billed magpies (Sieg and Becker 1990). Such nests can be found in coniferous or deciduous stands. Although Watson (1979) found merlins nesting in conifer forest in Great Britain, the adults were still foraging over open grassland habitats. The type of tree used is thought to be related primarily to the presence of a suitable nest (Sieg and Becker 1990), with no preference for tree species.

Preferred hunting habitat is a patchy mix of sagebrush and open grassland (Becker and Sieg 1987). In their feeding, merlins are strongly bird adapted, but also take a few small rodents and bats (Hodson 1978, Becker 1984). Birds are 75 to 100% of prey and mammals less than 7%. They also eat a few insects. Prey are typically small to medium sized passerines, such as horned larks, sparrows, and thrushes. Merlins are daytime hunters, mostly in early morning and late afternoon to dark.

Methods of Detection

Merlins are rare within our study area and therefore specific nesting habitat and nesting chronology is lacking. Survey efforts can be narrowed by the presence of defensive, adults vocalizing during the nesting period of mid-April (courtship) to mid-May (egg-laying) (Becker 1977).

American Kestrel (*Falco sparverius*)

The American kestrel is the most common and widely distributed hawk in North America, with an estimated 1.2 million pairs (Johnsgard 1990). Approximately 1/4 of these pairs are thought to winter in North America. Idaho is among those states with the greatest numbers of kestrels in the west, with a reportedly stable kestrel population (Platt and Enderson 1989). Aside from the southeastern population which is "threatened" in Florida, the American kestrel does not carry any special Federal or State status.

Local Occurrence

Kestrels are among the most common raptors in the study area and throughout eastern Idaho. We have seen kestrels at all elevations and within or near all habitat types in the study area. Kestrels were seen or heard in seven sample sections.

Reproductive Biology

Kestrels return from wintering grounds to this area in late March to early April. Pairs are very vocal as they complete aerial displays and courtship feeding. Males select and defend territories, and the pair selects a nesting cavity together. Kestrels often displace woodpeckers, and compete with screech owls and other species for suitable cavities (Balgooyen 1976).

Clutch sizes are around 4 eggs (Heintzelmann and Nagy 1968, Balgooyen 1976). Both adults incubate, although the female completes about 80% of this task. Incubation takes about 30 days, with fledging about 30 days later.

Ecology and Habitat Relationships

The American kestrel is a secondary cavity nester; it uses nesting cavities which were excavated by other species. As such, the kestrel is dependent on the northern flicker over much of its distribution (Balgooyen 1976). Kestrels

have an extremely wide ecological tolerance relative to elevation, tree species and type of forested environment. Kestrel distribution is strongly influenced by the availability of adequate nesting cavities and perches. Home ranges may be as small as .68 square km if there sufficient cavity nesting opportunities (Smith and Murphy 1973).

Since over 95% of forages are initiated from a perch, and prey is usually taken at ground level, perches within open areas are important habitat features (Balgooyen 1976). Hunting usually occurs over open terrain, with a preference for open, exposed ground in vegetated areas. Open savanna-like areas and forest edges are preferred.

Two potential threats that could occur locally to this species are the loss of cavity trees and pesticide contamination through ingestion of insects, insect eating birds or small mammals. Highly valued cavity trees are aspen and cottonwood.

Detection Methods

Adult kestrels are highly vocal during the nesting cycle, and although relatively small, are very visible because they are very active. Nests are usually within .25 miles of observed birds during the nesting season. Nest searches are conducted by systematic ground surveys for cavities. Active nesting cavities can best be detected by visually tracking adult male prey deliveries and listening for food-begging juveniles prior to fledging. Note Appendix A, Table 2 for nesting chronology.

Great-horned Owl (*Bubo virginianus*).

The great-horned owl is found throughout the Americas in a broad range of habitats (Johnsgard 1988). Great-horned owls are relatively sedentary in that they may remain within breeding territories year around. Migration to more southern areas may occur in years of poor prey availability. Despite continued losses due to shooting and collision with vehicles, this species is successful in much of its range. Local declines

have been noted in areas of habitat destruction.

Local Occurrence

The great-horned owl is probably our most common nocturnal raptor. The great-horned owl is a generalist, and lives in a great variety of habitats throughout the study area and the mountains around the area's periphery. The great-horned owl is often found nesting and/or roosting in mature riparian cottonwood forests along major tributaries, but prefers to hunt in open fields and forest edges. We also find the owls in the willow-swamp community and nearby pasture lands, with nests located in aspen stands or isolated cottonwoods. We have heard calling great-horned owls in riparian bottoms all over the study area, and also in conifer-covered foothill areas and in the lower elevations of major mountain canyons. We detected great horned owls in three sample sections.

Reproductive Biology

In other studies, adult pairs begin to roost together in late December after being nearly solitary throughout the fall, courtship begins in January, and egg laying occurs in late February (e.g Petersen 1979). Incubation lasts from 26-35 days, with 30 days probably an average for uninterrupted incubation (Gilkey et al. 1943). The young owlets grow rapidly in the first month, and regularly leave the nest to climb into nearby trees to hide in the branches at 5-6 weeks of age. They may fly short distances at 45 days of age, but are not proficient flyers until 9 or 10 weeks old. The young owls are dependent upon the adults for long periods, and may not disperse from the adult territory until as late as mid-winter (Petersen 1979). Young owls are downy until 3-4 weeks of age (Johnsgard 1988). In 1993 incubation was initiated at Teton Valley great-horned owl nests in late March-early April (Whitfield and Maj 1994).

Clutch sizes for great-horned owls tend to be relatively small, averaging from 2.05 to 2.59 across several geographic regions (Murray 1976).

Houston (1971, 1975) reported that brood sizes were largest and eggs were laid earlier during years when prey were abundant. He also noted that more nonbreeding occurred in years when prey were scarce, and that nests were located in more diverse locations (less remote and sheltered) when prey were abundant.

Ecology and Habitat Relationships

It is hard to characterize the habitat of great-horned owls; this species is a generalist, and lives in a great variety of habitats (Austing and Holt 1966). Basic habitat needs are a nest site, roost site, and hunting area. Nests are usually stick nests built by other birds, such as red-tailed hawks or herons; great-horned owls also use cliff nests, ledges, and caves. Roosts are selected for maximum daytime concealment, conifers are favored. Hunting areas are usually relatively open areas, but woodlands or areas with scattered trees are also used. Generally, nesting territories are in open, mature deciduous forests (cottonwoods or aspen) near water. Breeding territories are estimated from several studies (Johnsgard 1988) at 150-250 acres in size.

Great-horned owls adapt to local conditions and take many kinds of prey. These owls usually take larger prey than other owls, all the way from insects to domestic cats and marmots, geese and herons. They often perch on vantage points such as telephone poles and make short flights to prey. They apparently hunt more by sight than most owls, and often hunt in the evening hours before dark.

Leading causes for great-horned owl mortalities continue to be highway collisions and shooting. Educational efforts that emphasize the value of birds of prey might benefit this species particularly, because their habit of perching on roadside poles makes them susceptible to shooters. Although this species is notably secretive, we have located nesting great-horned owls near farm homes and agricultural areas. Great-horned owls often nest in habitats that are human dominated; but generally in local sites that are secluded and little visited by people.

Forested areas near nest structures and roosts should be protected to afford security cover to owls. Active nest sites should be avoided during the nesting season as disturbance can cause nesting failures.

Detection Methods

Ubiquitous as this owl is, great horned owl nests are no less difficult to locate than other owls or raptors in general. Preliminary locations of nests can be triangulated from by the territorial calls of both male and female. Males regularly roost within 100 m of nesting females during incubation (Rohner et al. 1992). The female will usually respond vocally to the male within the first hours of sunset and sunrise. It is during the first hour after sunset and the first hour before sunrise that triangulation of both vocalizing adults can provide a preliminary location of the nests. A ground or aerial search for the nest follows, looking for the presence of owls by searching for signs such as feathers, pellets, and white-wash. The "triangulation and search" survey technique is recognized as time-intensive and that playing taped vocalizations could increase the efficiency of nest searches. This method however, is thought to be less disturbing to nesting birds than is the use of territorial calls.

Broadcast vocalizations have been effectively used to detect great horned owls (Morrell et al. 1991). The detection of great horned owls using broadcast calls can be improved by conducting the surveys on calm nights in January between midnight and 0600, during a waxing moon. (Morrell et al. 1991). The general application of broadcast conspecific calls in eliciting owl responses is described by Smith and Carpenter 1981, Johnson et al. 1981 and Fuller and Mosher 1981, 1987.

Long-Eared Owl (*Asio otus*)

Long-eared owls range broadly across southern Canada and the northern 2/3 of the United States, generally in woodland and forested habitats (Johnsgard 1988). This species is

also found across Asia and Europe at similar latitudes. Forest cutting, particularly in riparian habitats, have caused declines of this species in America, but the long-eared owl is not listed as a species of concern by any agencies in Idaho or Wyoming.

Local Occurrence

We have seen or heard long-eared owls in habitats that feature mixed conifer (mostly open Douglas-fir) and aspen stands and in dense cottonwood riparian forests. We located two long-eared owl broods after fledging in Douglas-fir stands near the river. We found long-eared owls in two sample sections.

Reproductive Biology

The breeding season for long-eared owls is apparently prolonged by variation in initiation of egg laying from mid-March to late May (Bent 1938). We have heard adult males singing in the study area in mid-April. The incubation period is approximately 25 days, but hatching may be prolonged over several days for a large clutch (Johnsgard 1989). Owlets fledge at about 35 days, and gradually become independent at about 2 months of age. We found 2 broods of food-begging fledglings (3 and 4 in number) near the South Fork Snake River on 7/13 and 7/31/93, which suggests hatching in latter May. Marks (1986) reported a minimum of 3.7 fledged young per successful nest in southwestern Idaho, with clutch sizes expected to be near 5 on average (Murray 1976).

Ecology and Habitat Relationships

During the breeding season, long-eared owls are associated with coniferous, deciduous, or mixed composition forests and forest edges (Johnsgard 1988). Long-eared owls use old corvid nests almost exclusively (Marks 1986). During winter, coniferous woods may be very important as roosting cover (Craighead and Craighead 1956). Large numbers of these owls will some-

times congregate at favored winter roosts (Bent 1938). Roost trees may be used repeatedly over the years.

Long-eared owl populations decline in areas where habitats are lost, particularly favored forest areas and riparian habitats. Habitat around any identified roosts should be protected, since these sites often are of long-term value to the species.

Methods of Detection

The same survey protocol using conspecific territorial calls as described for great-horned owls applies for long-eared owls. Note the preferred habitat and nesting chronology of the long-eared owl (Appendix A, Table 3). Nest searches can be further enhanced by triangulation of calling territorial adults as described for great-horned owls. Long-eared owls will nest on platforms formed by mistletoe clumps which can be very common in some coniferous stands. Nests can be very difficult to locate. Both long and short eared owls will roost in semi-colonial groups in the winter. Roosts sites are generally densely vegetated either conifers or deciduous stands at low elevations where temperatures are moderate (pers. comm. D. Holt). Roosts sites are located from the ground by surveying suitable habitat. Surveys of such areas should occur at twilight when foraging birds may be more detectable.

Short-Eared Owl (*Asio flammeus*)

The short-eared owl is a circumpolar species that resides across Canada and approximately the northern half of the United States, usually in open areas such as meadows and marshes (Johnsgard 1988). Northern populations of this owl are migratory in winter, with movements as far south as Mexico and Central America. The short-eared owl is on the Audubon Society's blue list of declining species but has not been recognized as a species of special concern by federal or state agencies in Idaho or Wyoming.