

Northern Harrier

(*Circus cyaneus*)

Legal Status

Federal: None

State: Species of Special Concern.



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Global and State Conservation Status: G5S3: Global Rank, G5 = Secure: Common; widespread and abundant; State Rank, S3 = Vulnerable: Vulnerable in the state due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

Recovery Plan: None.

Species Description and Life History

Northern harriers (*Circus cyaneus*) are the only representative of the cosmopolitan genus *Circus* in North America; they breed throughout North America, Europe, and Asia. It is a long-distance migrant and the most northerly breeding and most broadly distributed of all harriers (slender, narrow-winged hawks) (MacWhirter and Bildstein 1996). Northern harriers' degree of sexual dimorphism in plumage and their propensity for polygyny are exceptional among birds of prey (MacWhirter and Bildstein 1996). Northern harriers are a medium-sized hawk (45.7 to 60.9 cm [18 to 24 inches]), long-winged (101.6 to 116.8 cm [40 to 46 inches]), long-tailed with a distinctive white rump, and an owl-like facial disc; they are usually seen gliding unsteadily over marshes with their wings held in a shallow "V." Males generally have a pale gray back, head, and breast; while the larger females and young are brown above and streaked below.

Seasonal Patterns

Northern harriers are year round residents in California, with an influx of migrating birds from northern populations during winter. Breeding territories are occupied (including pair bonding and courtship periods) from approximately March through September with peak period in June/July. Fall migration occurs from August through December and the spring migration period is from February through May (MacWhirter & Bildstein 1996, Davis and Niemela 2008).

Breeding pairs and juveniles may roost communally in late autumn and winter (Smith and Murphy 1973).

Reproduction

Northern harriers are predominantly monogamous, but polygyny also regularly occurs and is positively associated with prey abundance (Simmons *et al.* 1986). Nests are constructed on the ground and are usually a relatively flimsy structure built of sticks, straws, or grasses on wet areas and a smaller cup of grasses on dry sites (Call 1978).

Northern harriers generally lay four to six eggs that are incubated for 29 to 39 days, then feed and brood nestlings until they fledge 29 to 34 days after hatching (MacWhirter and Bildstein 1996). Peak hatching period is in May and ranges from April through June. Harriers will lay replacement clutches when clutches are disturbed during laying or shortly thereafter (Simmons 1984).

Home Range/Territory Size

Territory size varies according to habitat type and prey availability (Martin 1987, and Temeles 1987). In Yolo County, California, Temeles (1987) documented that harriers adjusted territory size to maintain a constant prey base.

There is no information on breeding season home range or territory sizes from the Central Valley; however, studies from other regions provide information that may apply to the Yolo County breeding population. During the breeding season, home ranges vary according to habitat and prey availability, with a range of 170 to 15,000 ha (420 to 37,066 acres) (240-ha [593-acre] median, n = 8) reported from eight studies outside of California (Idaho, eastern Washington, Utah, Missouri and New Hampshire) (MacWhirter and Bildstein 1996).

Home ranges of females are smaller than males, probably due to females hunting closer to the nest (Call 1978) and more intensive territory defense by females, which can exclude males from higher quality habitat (Martin 1987). Breeding home ranges averaged 113 ha (279 ac) for females and 1,570 ha (3,879 ac) for males (Martin 1987). The home ranges of both sexes can expand by over 250 percent as the breeding season progresses and the young develop (Temeles in litt., cited in MacWhirter and Bildstein 1996). Because home ranges depend on the density of prey, home range sizes in Yolo County vary according to factors that affect rodent and bird prey abundance—such as annual variation in climate, habitat type, habitat patch size, adjacent land cover types, and density of predators.

The winter ecology of Northern harriers in Yolo County has been the subject of several important research studies by Temeles (1986, 1987, and 1989). These studies have shown that winter home range sizes are also closely tied to the abundance of mice and that, in some years, a harrier's home range is reduced by the number of other harriers intruding onto its territory. There is also a difference between the sexes in winter foraging ecology. The larger and more aggressive females tend to forage in fields with taller vegetation, hunt at slower speeds, and aggressively chase males away from high-quality foraging areas. This effectively results in smaller winter home ranges for

females. Temeles (1987) found that wintering females occupied mean territory size of 33.6 ha (83.0 ac), ranging from 3.9 ha (9.6 ac) to 124.9 ha (308.6 ac).

Foraging Behavior and Diet

Harriers hunt on the wing, using low patrol, quartering flights 1-9 m (3.3-29.5 feet) above open ground. Prey capture occurs following a dive from flight or hovering above prey (Bildstein 1988). Their owl-like facial ruffs and face structure aid in prey detection (MacWhirter & Bildstein 1996).

Harriers predominantly feed on small rodents, mainly microtus species. However, harriers are also generalists and include reptiles, amphibians, birds, and invertebrates in their diet (Terres 1980).

Harrier ecology is strongly correlated with prey availability. Microtus species tend to remain the dominant prey throughout the breeding season and microtus population cycles have been found to influence a variety of ecological factors. During mid and high ranges of microtus cycles, harriers exhibited greater nesting densities, clutch size, nest success, and presence of polygyny (Hamerstrom *et al.* 1985, Simmons *et al.* 1986).

Bernard *et al.* (1987) found that nesting or fledgling passerines became the second most important prey group for nesting harriers during the breeding season. Harrier nestling stages coincide with passerine nestling stages, providing abundant, easy prey (Bernard *et al.* 1987).

Habitat Requirements and Ecology

Nesting

Northern harriers roost and nest on the ground where tall grasses and forbs provide cover (Bent 1937). Harriers use habitats such as open wetlands, wet and lightly grazed pastures, dry uplands, upland prairies, wet grasslands, drained marshlands, croplands, shrub-steppe, meadows, open rangelands, desert sinks, and fresh and saltwater emergent wetlands (Bent 1937, MacWhirter and Bildstein 1996). There is an apparent preference, and higher reproductive potential, for sites that are near water (Simmons and Smith 1985) such as marshlands, seasonal wetlands, and other wet grasslands and prairies. Simmons and Smith (1985) reported that harriers nesting in wet sites (wetland fringe or wet meadows) were more successful than dry sites and wet sites were preferred in relation to their availability. Vegetational differences appeared to be less significant determinants of success than moisture.

While wet sites are preferred, upland sites are also selected, such as cultivated fields and grasslands, where wetlands are limited (Temeles 1987). In Yolo County, harrier nests were located in three different upland types, an uncultivated field of grasses and weeds, a cultivated rice field, and a cultivated field of clover (Temeles 1987). Harriers are also known to nest in wheat fields and similar agricultural landscapes; however, nests in hay

and grain fields may be at risk during early-summer harvesting activities before young fledge.

Harrier nests in upland fields are predominately surrounded by grasses and forbs, while harrier nests in wet areas are surrounded by marsh grasses and cattails (Hamerstrom & Kopeny 1981, Simmons & Smith 1985, Loughman & McLandress unpubl. data). Average height of vegetation around nests ranged from 32 to 61.2 cm (12.6 to 24.1 in) in the Suisun Marsh in neighboring Solano County (Loughman and McLandress unpublished data). Most harrier nest canopies are open. Simmons and Smith (1985) found concealed nests to be less successful. Loughman and McLandress (unpubl. data) found 71% of nests at Suisun Marsh and 93% of nests in northeastern California had no canopy cover.

Northern harriers have highest reproductive success at nest sites in wetlands that are close to foraging habitat with abundant prey (Simmons and Smith 1985). Nest site selection may be a compromise between the availability of a wetland nest site, proximity to optimum foraging habitat, and access to a mate with a high food provisioning rate (Simmons and Smith 1985). Prey abundance also influences nesting density, which typically ranges from 3.3 to 9 nests/square kilometer (1.3 to 3.5 nests/square mile) in suitable contiguous habitat – but has been reported up to 24.8 nests/square kilometer (9.6 nests/square mile) in areas of exceptionally high vole abundance (Loughman & McLandress unpublished data).

Foraging

Northern harriers forage in marshes, seasonal wetlands, irrigated pastures, annual grasslands, and agricultural fields, and may occasionally use vineyards. Similar foraging habitats are used throughout the year; however, use is dependent on prey abundance and prey availability. Martin (1987) showed that diet shifts were highly correlated with vegetation growth, which can be particularly evident in active agricultural fields. Harriers hunting alfalfa fields preyed on microtus until the vegetation reached 46 cm, after which time harriers stopped hunting alfalfa fields and shifted diets to reptiles and passerines. Following cutting, alfalfa fields were again used as diets shifted back to microtus.

As noted, female harriers defend territories, thereby excluding non-territorial males from preferred habitat. Thus, male harriers tend to have larger home ranges, and forage more in riparian and open habitats (Temeles 1987, MacWhirter & Bildstein 1996).

Species Distribution and Population Trends

Distribution

The Northern harrier occurs as a breeding bird across the northern United States and Canada, occurring throughout most of California and the central portion of the United States south to Texas. It is absent from desert regions and the southeastern parts of the

United States (Bildstein 1988, MacWhirter and Bildstein 1996). During winter, the northern harrier occurs throughout southern Canada and all of the United States, and as far south as Panama (Bildstein 1988, MacWhirter and Bildstein 1996).

In California, northern harriers inhabit annual grassland up to alpine meadow habitats, as high as 3,000 m (9,843 ft) (Garrett and Dunn 1981, Davis and Niemela 2008). They breed from sea level in the Central Valley to 1,700 m (5,577 ft) in the Sierra Nevada, and up to 800 m (2,625 ft) in northeastern California. They are also widespread winter visitors in suitable habitat. Some individuals migrate to winter in California; others migrate south to Central America or northern South America (Davis and Niemela 2008).

Population Trends

The number of breeding northern harriers in North America has declined in the twentieth century, due to loss of habitat through extensive draining of wetlands, monotypic farming, and reforestation of farmlands (USFWS 1987, Serrentino 1992). In the contiguous United States, Christmas Bird Count data from 1952 to 1971 indicate a 40 percent decline in wintering birds for that period, with local increases in California during the 1960s (Brown 1973). Breeding Bird Survey and Christmas Bird Count data suggest that the North American population has remained stable or declined slowly since the early 1960s (Collins and Wendt 1989, Kirk *et al.* 1995), with significant regional declines in the southwestern and central United States (USFWS 1987). In Canada, Breeding Bird Survey data suggest long-term significant harrier population increases in western mountain provinces, with declines in the prairies, particularly during 1982–1991; elsewhere, the numbers are stable (Kirk *et al.* 1995).

In California, the population has decreased historically (Grinnell and Miller 1944, Remsen 1978) and according to Breeding Bird Survey and Christmas Bird Count data, continues to decrease slowly (Sauer *et al.* 2004). However, the species can be locally abundant where suitable habitat remains free of disturbance from intensive agriculture and development. In both wetland and upland areas, the largest populations are typically associated with continuous tracts of undisturbed habitats that are dominated by thick vegetation growth (MacWhirter and Bildstein 1996). Locally, the number of breeding pairs and reproductive success is affected by prey availability, predation, nest-site quality, and weather (MacWhirter and Bildstein 1996).

Distribution and Population Trends in Yolo County

In Yolo County, northern harriers occur throughout all of the lowland areas and in the foothill grasslands. In general, their distribution is associated with irrigated cropland and irrigated pastureland common to the interior of the County, the seasonal wetlands and pasturelands of the Yolo Basin and southern panhandle, and the grassland foothills on the western edge of the valley floor. Other than on a very local basis, the nesting distribution of northern harriers has not been monitored in Yolo County. While the species is known to be widespread throughout the lowland areas of the County, CNDDDB reports no nesting records of this species. However, nests have been documented in seasonal wetlands,

permanent marshes, active and fallow rice fields, along the edges of large irrigation and bypass channels (such as Willow Slough Bypass), and in grain and other agricultural fields. The largest populations likely occur in the managed wetlands and pasturelands of the Yolo Basin south of Interstate 5, including the Conaway Ranch, Yolo Bypass Wildlife Area, and other private lands south to the southern end of the panhandle. Nest sites have also been documented along the wetland and grassy edges of large water conveyance channels (e.g., Willow Slough Bypass) and in hay and grain fields throughout the lowland portions of the County.

In Yolo County, northern harriers also appear to be in slow decline (Sauer et al. 2004 [Zamora Survey Route]). However, nest density and nest success is variable depending on weather conditions and the response of prey populations, particularly microtine rodents. Where relatively undisturbed open grasslands, pasturelands, marshes, and seasonal wetlands occur, such as the southern panhandle, Yolo Bypass Wildlife Refuge, and foothill grasslands, populations are likely more stable and nesting success higher than in the more intensive agricultural areas of the interior County. However, active harrier nests are regularly detected in active grain fields, fallow rice fields, and along the weedy and marshy edges of open irrigation or bypass channels.

Threats to the Species and Other Conservation Issues

Threats to breeding populations of northern harriers include destruction of wetland habitat, native grassland, and moist meadows, combined with the burning and plowing of nesting areas during early stages of the breeding cycle (Remsen 1978). MacWhirter and Bildstein (1996) have concluded that continued widespread destruction of freshwater and estuarine wetlands is the primary threat to breeding and wintering populations in the United States. In addition, conversion of native grassland prairies for monotypic farming has contributed to declines of local populations. In upland areas, mechanized agriculture and early mowing have increased the threat of nest destruction. Overgrazing of pastures and the advent of larger crop fields, fewer fencerows, and widespread use of insecticides and rodenticides have reduced prey availability and thus the amount of appropriate habitat for the species.

Within the plan area, threats to northern harriers are the result of continued urbanization of agricultural lands and conversion to unsuitable crop types. Threats to the species include:

- urbanization of grassland habitats along the western edge of the valley north of Winters;
- urbanization of agricultural lands in the West Sacramento Southport area between the Sacramento River and the Deep Water Ship Channel;
- urbanization of agricultural lands around the cities Woodland and Davis;
- conversion of grasslands to vineyards in the Dunnigan Hills; and
- conversion of hay, grain, and row crops to orchards in the northwestern corner of the valley floor.

The threats to the species may be partially offset, however, with an increase in managed wetland habitats in the County over the last several years, including:

- Davis Wetlands,
- Yolo Bypass Wildlife Refuge,
- Roosevelt Ranch Preserve north of the County Road 12,
- Conaway Ranch managed wetlands in the Yolo Bypass.

Supplemented by other existing refuges for northern harriers and other raptors, including the Grasslands Regional Park, the Hawk and Owl Reserve adjacent to the Yolo County landfill, and the marshlands and pasturelands of the southern panhandle, wetland habitats may have increased in Yolo County over the last several years.

Population trends and reproductive success are difficult to assess for the northern harrier. This is primarily due to the species' ground-nesting behavior and tendency to not flush from the nest until the observer is within 2 m (6.56 ft) of the nest, which makes it difficult to census (Lehman *et al.* 1998).

The population size may increase with some agricultural practices (e.g., grain crops), provided that cover and nesting habitat are preserved or enhanced. Because northern harriers can move nomadically from one area to another, they may expand their populations in response to local increases in prey population (MacWhirter and Bildstein 1996).

Furthermore, wetland preservation for waterfowl and habitat management practices for upland game birds are beneficial to the overall conservation of the species. Habitat management recommendations for the northern harrier include the acquisition and protection of undisturbed habitat in which early successional plants can grow and where dead vegetation is not removed. Prescribed burning and grazing are also recommended active management techniques in old fields and shrubby habitat to prevent re-vegetation. Finally, elimination of winter livestock grazing from wetland and grassland ecosystems is recommended to improve winter habitat (MacWhirter and Bildstein 1996).

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