

TEN YEARS OF THE SANTA CRUZ FLATS RAPTOR COUNT

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ABSTRACT: Between 2006 and 2015, I coordinated an annual one-day January raptor count at the Santa Cruz Flats. Teams of volunteers surveyed designated sections of the 900 km² area. The goal was to determine which raptor species winter there, their relative numbers, and population trends over time. This paper evaluates the data collected for 20 species of raptor. Although the 10-year time span is too short to identify any definitive trends, over the last five years of the count there were declines in the numbers of three species—28% decline for Northern Harrier (*Circus cyaneus*), 17% for American Kestrel (*Falco sparverius*), and 13% for Red-tailed Hawk (*Buteo jamaicensis*). White-tailed Kite (*Elanus leucurus*) and Barn Owl (*Tyto alba*), observed in the first years of the count, have not been reported since 2009 and 2012, respectively. The mean for Crested Caracara (*Caracara cheriway*) has increased 28% over the most recent five years of the count. For most species, the annual difference was too small to suggest any trends. The survey will be continued to obtain data over a longer time period.

Many raptor species winter in southern Arizona, some in relatively large numbers, augmenting resident populations. Santa Cruz Flats, northwest of Tucson in southern Pinal County, is one of the principal areas attracting these winter visitors. It is located in the basin of the Santa Cruz River, which, with its diversion channels, flows intermittently northwest across the county to the Gila River. The area encompasses approximately 900 km² and has a mean elevation of 500 m. To the northeast it is bordered by the Picacho Mountains, to the south by the Silverbell Mountains, and to the west by the Sawtooth Mountains. Some 100 years ago, this area supported a thriving grassland, an ecosystem known as the Sonoran Savanna Grassland (Brown 2014). There is evidence that in some portions of the Flats, pronghorn (*Antilocapra americana*), Northern "Masked" Bobwhite (*Colinus virginianus ridgwayii*), White-tailed Hawk (*Buteo albicaudatus*), and other grassland animals inhabited the area, but none of those species is now found there (Brown 2014, Brown and Glinski 2009). An influx of homesteaders in the early twentieth century brought grazing animals and cultivation, and over time the fragile grassland ecosystem was destroyed.

Today, many barren areas in the Santa Cruz Flats are the source of some of the most severe dust storms in the state (Brown 2014). About 560 km², however, have been converted to irrigated agriculture. Fields of cotton, alfalfa, maize, wheat, barley, and sorghum share the area with two sod farms, several pecan and pistachio groves, a dairy farm, sheep farms, and a large cattle feedlot. Adjacent to the active fields, fallow parcels have grown up to mesquite (*Prosopis* spp.), creosote bush (*Larrea tridentata*), fourwing saltbush (*Atriplex canescens*), Fremont's desert thorn (*Lycium fremontii*), and other shrubs. Some areas never cultivated, particularly on the bajadas to the north and south, are dominated by saguaro (*Carnegiea gigantea*), palo verde (*Cercidium* spp.), and mesquite; cattle graze in this habitat, which contains a scattering of livestock tanks.

This mosaic of agricultural and desert habitat is home to abundant rodents, thousands of wintering sparrows, a large population of doves, and many insects, all of which offer a ready food supply for raptors. Clumps of tamarisk (*Tamarix* spp.), Mexican palo verde (*Parkinsonia aculeata*), palms (*Phoenix* spp.), and hay barns provide roosting sites for owls. For the past couple of decades, birders have been regularly visiting the Santa Cruz Flats in the winter to observe raptors, particularly Crested Caracara (*Caracara cheriway*), which has been increasing in numbers, and for Mountain Plover (*Charadrius montanus*), Sagebrush Sparrow (*Artemisiospiza nevadensis*), and other wintering birds. At least 156 species of birds have been reported at the Santa Cruz Flats between November and January (Jenness and Pearson unpub. data). However, no systematic count of raptors had been made until 2006, and no part of the area is included in a Christmas Bird Count circle. Beginning in January 2006, volunteers have conducted a one-day raptor count every year in the Santa Cruz Flats.

METHOD

The count has been conducted on the third Saturday of January in each year except 2007, when it was held on the fourth Saturday. During the first three years of the count, the survey area was 810 km². The area was divided into three approximately equal sections, with one team covering each section. In 2009, an additional 88 km² was added to the north end of the area and the survey area was divided into four sections, each surveyed by one team (Fig. 1). Since then, with the exception of 2010 when only three teams covered the expanded area, four teams have surveyed the area. Each team was composed of three to six volunteers, with the total participants in all teams ranging from nine in 2006 to 19 in 2012. The mean number of volunteers for the 10-year period was 13.9. A total of 53 volunteers have participated in at least one count. Although there has been turnover during the 10 years, continuity has been maintained, with experienced volunteers returning to the teams each year.

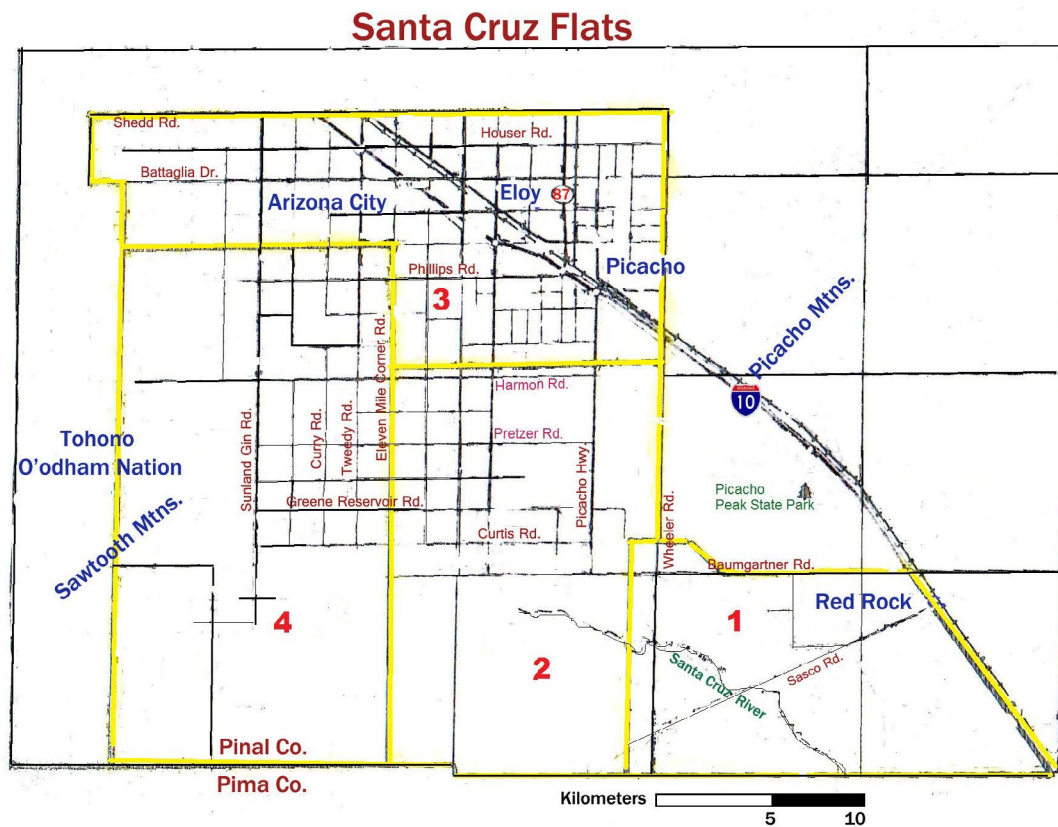


Figure 1. Map of Santa Cruz Flats showing the division of the survey area into four sections.

The teams were typically in the field six to eight hours between 08:00 and 16:00. Each team had at least one spotting scope and normally used one vehicle. They drove as many farm roads as they could in their sections, stopping frequently to scope fields and pastures, power poles, wooded edges, etc. and to check barn lofts and tamarisk groves. To minimize double reporting, teams noted the time and location of the less common species. In a few species, more than one subspecies and several plumage forms show up in the winter, and where possible these were noted by the teams. Volunteers also tallied two species of vulture—Black Vulture (*Coragyps atratus*) and Turkey Vulture (*Cathartes aura*). North American vultures are no longer considered to be closely related to most raptors (AOU 1998), but for the purposes of the survey we defined raptors behaviorally, not taxonomically, to include all "birds of prey," including hawks, eagles, kites, vultures, falcons, and owls. Beginning with the 2008 count, I conducted predawn owling for two to three hours. The annual tally for each species observed, with a breakdown by team, is posted on the AZFO website (AZFO 2015).

RESULTS

Twenty species of raptors and vultures have been reported in the first 10 years of the survey. The total annual number of individuals has ranged from 236 to 448 (mean = 341; SD = 68.97). The results are presented in Table 1.

Ten years is insufficient to determine long-term raptor population trends (Hussell and Inzunza 2008). However, the results obtained for Northern Harrier (*Circus cyaneus*), Red-tailed Hawk (*Buteo jamaicensis*), and American Kestrel (*Falco sparverius*) are at least suggestive (Table 2).

The mean number for each species was higher in the first five years of the count than in the latest five years. The decline is even more striking

when the figures are adjusted for the larger area surveyed and more volunteer hours invested in the later years. The mean decline is most notable for Northern Harrier, which averaged 28% fewer individuals in the last five years, with its lowest two years in 2014 (n=12) and 2015 (n=12). The figures for American Kestrel and Red-tailed Hawk are less revealing. Even though the mean for American Kestrel was lower in the last five years, the highest number (n=66) reported for this species was in 2015. It remains to be seen whether the 2015 total for this species was exceptional or is part of a longer-range fluctuation.

Table 1 Total numbers for 20 raptor species observed on one-day January surveys, 2006-2015

Species	06	07	08	09	10	11	12	13	14	15	Mean
Black Vulture	2	47	1	82	3	13	113	48	12	114	43.5
Turkey Vulture	0	1	0	1	0	0	0	5	6	3	1.6
White-tailed Kite	2	2	0	8	0	0	0	0	0	0	1.2
Bald Eagle	0	0	0	0	0	0	0	0	1	0	0.1
Northern Harrier	41	30	36	35	21	14	54	25	12	12	28.0
Sharp-shinned Hawk	2	5	0	0	1	0	0	1	0	6	1.5
Cooper's Hawk	6	4	1	6	1	2	6	7	1	2	3.6
Harris's Hawk	0	0	0	2	6	4	3	0	4	4	2.3
Red-tailed Hawk	198	163	167	167	152	117	155	167	148	153	158.7
Ferruginous Hawk	6	9	5	9	4	7	11	4	7	9	7.1
Golden Eagle	0	0	0	0	0	0	0	0	1	0	0.1
Barn Owl	2	5	2	2	1	0	5	0	0	0	1.7
Western Screech-Owl	0	0	0	0	1	1	1	0	0	0	0.3
Great Horned Owl	0	1	5	8	4	10	5	9	9	12	6.3
Burrowing Owl	1	1	4	0	0	1	2	3	7	7	2.6
Crested Caracara	2	20	8	13	27	22	33	30	12	28	19.5
American Kestrel	63	55	58	62	43	37	40	34	55	66	51.3
Merlin	2	7	3	3	2	1	6	0	3	1	2.8
Prairie Falcon	6	7	8	3	7	6	11	8	6	6	6.8
Peregrine Falcon	2	1	1	2	4	1	3	1	0	2	1.5

Table 2 Trends for Northern Harrier, Red-tailed Hawk, American Kestrel, 2006-2015

Year	Total Party Hours	Totals by Year			Individuals/Party Hour		
		Harrier	Red-tail	Kestrel	Harrier	Red-tail	Kestrel
2006	22.0	41	198	63	1.9	9.0	2.9
2007	24.5	30	163	55	1.2	6.7	2.2
2008	21.0	36	167	58	1.7	8.0	2.8
2009	28.5	35	167	62	1.2	5.9	2.2
2010	20.5	21	152	43	1.0	7.4	2.1
2011	27.0	14	117	37	0.5	4.4	1.4
2012	26.8	54	155	40	2.0	5.8	1.5
2013	26.5	25	167	34	0.9	6.3	1.3
2014	26.5	12	148	55	0.5	5.6	2.1
2015	27.7	12	153	66	0.4	5.7	2.4
Mean 2006-15	25.1	28.0	158.7	51.3	1.1	6.5	2.1
Mean 2006-10	23.3	32.6	169.4	56.2	1.4	7.4	2.4
Mean 2011-15	26.8	23.4	148	46.4	0.9	5.5	1.7
% difference	13%+	28%-	13%-	17%-	36%-	26%-	29%-

A drop in the number of White-tailed Kites (*Elanus leucurus*) was also revealed. Observed in three of the first four years of the count, none has been reported in the past six years. This corresponds, in general, with the paucity of recent reports for this species anywhere in the Santa Cruz Flats; since January 2012, there have been only three reports (eBird 2012, AZFO Seasonal Reports 2008). Though this is considered an essentially nonmigratory species, observers during the Atlas surveys 1993-2000 found that White-tailed Kites in Arizona were irregularly local residents, apparently shifting their distribution with prey availability (Corman 2005).

The first 10 years of the survey saw an increase in the number of Crested Caracaras foraging and roosting in the Santa Cruz Flats during the winter months and the year-round residence of a few nesting pairs (Jenness 2016). In the first five years of the count, the mean number reported was 14; over the second five years, the mean was 25. The high count was in 2012 ($n=33$); the low count was in 2006 ($n=2$). Other reports in the two winters 2013-14 and 2014-15 suggest that there were more than 100 caracaras wintering in the area (Jenness 2016).

In species with consistently small numbers and no discernible pattern during the 10-year period, the small variations may be due to chance. These species include Sharp-shinned Hawk (*Accipiter striatus*), Cooper's Hawk (*Accipiter cooperii*), Ferruginous Hawk (*Buteo regalis*), Merlin (*Falco columbarius*), Peregrine Falcon (*Falco peregrinus*), and Prairie Falcon (*Falco mexicanus*) (Fig. 2).

Harris's Hawks were reported in six of the 10 years; with one exception, all of those reports pertained to one or two resident family groups along Cripple Creek Road between Coachway and Baumgartner roads.



Figure 2. Prairie Falcon, 19 January 2013. Photo by Nathan Williams

Numbers of Black Vultures have varied from one to 114. This wide range does not reveal a significant pattern. It more likely reflects the chance of finding carrion dumps that have attracted large numbers of vultures. In 2015, for example, 104 of 114 vultures observed were located at two sheep carcass dumps at opposite ends of the survey area. One of those dumps was in the area added in 2009. Resident in the Santa Cruz Flats with year-round roosts (Jones 2005), Black Vultures likely nest in the nearby Silverbell, Picacho, Sawtooth, and Newman mountains. Turkey Vultures are migratory and only a few are reported in the Santa Cruz Flats each winter, although they winter farther north in the valley west of Phoenix, at a lower elevation than the Santa Cruz Flats. Their numbers, however, appear to be increasing. In the first seven years of the survey, only two Turkey Vultures were reported; in the last three years, a total of 14 were reported.

The number of Burrowing Owls reported has increased, with a total of six (mean = 1.2) in the first five years of the count and 20 (mean = 4.0) in the latest five years. This probably does not reflect an increase in the population, but greater experience in knowing where to find them. This owl is likely a year-round resident in the Santa Cruz Flats, although it is easier to detect in spring and summer (C. Conway pers. comm.).

The number of Barn Owls (*Tyto alba*) reported has dropped. A total of 17 were reported in six of the first seven years, but none was reported during the last three years of the survey--although a few individuals have been reported at other times (eBird 2012, per. ob.). When predawn owling was introduced in the third year of the count, the number of Great Horned Owls reported substantially increased. In the first two years, a total of only one (mean = 0.5) Great Horned Owl was reported; in the eight years since, four to 12 have been reported each year totaling 62 (mean = 7.8). In three years, predawn owling detected a Western Screech-Owl at the same location along Sasco Road, but despite searches in suitable habitat no others have been found.

Although at least one Golden Eagle (*Aquila chrysaetos*) is typically reported in the Santa Cruz Flats each winter, it has been reported only once on the raptor survey. In the same year, 2014, a Bald Eagle (*Haliaeetus leucocephalus*), much rarer at the Flats, was also reported. Accidental raptors reported from the Santa Cruz Flats since 2006 within a few weeks of the count date include Spotted Owl (*Strix occidentalis*), 8 January 2014 (AZFO Seasonal Reports 2008) and Northern Saw-whet Owl (*Aegolius acadicus*), 28 December 2007 (AZFO Seasonal Reports 2008).

Several field-identifiable subspecies have been reported on the survey (AZFO 2015). The most commonly recorded Red-tailed Hawk subspecies is the "Western" (*B. J. calurus*), which has a continuum of adult plumage trends from light to dark. Ornithologists have divided these into light, light intermediate, intermediate (rufous), dark intermediate, and

dark (Wheeler 2003). Our reporters counted light (89%), rufous (4%), and dark (7%) forms. The "Harlan's" (*B. J. harlani*) subspecies breeds in Alaska and winters for the most part in the south-central United States (Wheeler 2003; Fig. 3). It is rare in Arizona, but it has been reported in nine of the 10 years of the count, the totals ranging from one to five (mean = 2.2). This subspecies also has a spectrum of plumage forms, usually separated as light and dark morphs. In Arizona, the dark form is more common and the one observed on the raptor count. "Fuertes" Red-tailed Hawk (*B. J. fuertesi*) is found from southern Texas and northern Mexico west to southern New Mexico and Arizona (Wheeler 2003). Annual totals for this subspecies during the survey have ranged from 0 to 20 (m = 6.3), but due to inexperience in identifying this subspecies, these figures are likely not accurate. The Ferruginous Hawk has a range of color morphs. The light morph is most common in southern Arizona, and 68 of 71 Ferruginous Hawks observed during the raptor count have been of this form.

Two subspecies of Merlin are found wintering at the Santa Cruz Flats; the light "prairie" or "Richardson's" (*F. c. richardsonii*) and dark "taiga" or "boreal" (*F. c. columbarius*). Merlins have been reported all but one year (mean = 2.8), with a breakdown of *columbarius* (mean = 1.7) and *richardsonii* (mean 1.1).



Figure 3. "Harlan's" Red-tailed Hawk, 20 January 2013. Photo by Muriel Neddermeyer

DISCUSSION

Raptor presence at the Santa Cruz Flats, as in other areas, is likely related to available prey and, for those species employing pause-travel foraging tactics, sufficient elevated perches (Widén 1994). As of yet, we do not know which habitats or which crops in the survey area make the highest prey populations available to wintering raptors. Although this study is not intended to explain changes in wintering populations at the Santa Cruz Flats, it seems possible that the apparent decline in Northern Harrier, Red-tailed Hawk, and American Kestrel numbers may be connected to changes in the acreage of cultivated crops. In particular, we hypothesized that changes in the acres of cotton planted and harvested might be a factor, and that fewer acres of cotton and more acres of alfalfa and other crops would attract more prey species and thus more raptors. From figures for the acreage planted of cotton, alfalfa, barley, wheat, sorghum, and maize in Pinal County in 2005-10, an extrapolation was made for the Santa Cruz Flats, assuming the same ratios (T. Helentjaris 2012 unpub. data). Using these figures, no correlation between crop acreage and the number of raptors was apparent.

There are several difficulties with this approach to analysis. The idea that cotton does not attract as many prey species as other crops is at this point still based on impressions rather than quantifiable evidence. We have no statistical knowledge as to which crops have the most food value per acre, which are subjected to the most pesticides, and which attract the most prey species or what those prey species are.

We have observed that the stage of cultivation appears to affect a given field's attractiveness to raptors. For example, caracaras often forage in freshly plowed or disked fields, including cotton fields, where there are freshly killed or injured rodents and insects. They are sometimes joined by smaller numbers of Red-tailed Hawks or Northern Harriers, or an occasional Ferruginous Hawk. One year, a team observed 28 Red-tailed Hawks feeding together on the ground while the field was being plowed. Freshly cut alfalfa fields attract raptors for the same reason. Fields with corn and sorghum stubble are attractive to some raptors, particularly harriers. Tilled fields that have been sitting for a while with no stubble or vegetation appear to attract the fewest raptors.

The reason for the absence of roosting Barn Owls in the last three survey years is unclear. With the exception of one tamarisk stand, all of the traditional roosts in tamarisk, palo verde, and barn lofts are extant. The most important factor is likely the availability of prey. Similarly, the reasons for the recent absence of White-tailed Kite are uncertain. This small-mammal specialist hunts over open grassland and agricultural fields, particularly alfalfa and grain (Dunk 1995). In the past several years, there has been an increase in mixed alfalfa/grass production at the Santa Cruz Flats, which should attract the prey White-tailed Kites feed on, but this has apparently not been the case.

Studies elsewhere have shown that anthropogenic changes, particularly power lines, telephone poles, and water reservoirs, in desert habitats have led to increases in the numbers of some raptor species and decreases in others (Duerr 2015). Changes of this type at the Santa Cruz Flats may have a bearing on raptor numbers, but have yet to be studied. Another factor possibly affecting fluctuations in raptor numbers at the Santa Cruz Flats are conditions on the breeding grounds, including disruption or destruction of nesting habitat, decline of prey sources, and inclement weather.

FURTHER STUDY

A study of the relationship between crop production and prey availability could help shed more light on the changing number of raptors wintering at the Santa Cruz Flats. It will also be useful to obtain data over a longer time period; to that end, we plan to continue the annual raptor count. The one change planned is the addition of a fifth team within the current survey area. This will allow each team more time to cover its section, which will now be slightly smaller.

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