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SOME POSSIBLE ANTHROPOGENIC THREATS TO BREEDING ANDEAN CONDORS (*VULTUR GRYPHUS*)

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It is important to understand possible threats species might suffer, especially for those species that are difficult to study and often endangered, such as large, long-lived raptors. Particularly for these species, it may be difficult to reverse or remove the effects of anthropogenic threats to populations. One very costly time during a raptor's lifetime is the breeding season (Alcock 1998, Hanssen et al. 2005). For large, long-lived raptors, the loss of a year's reproductive investment and the loss of breeding areas can be detrimental for the population (Newton 1979). The Andean Condor (*Vultur gryphus*) is classified as "near threatened" globally and is included in CITES I, with some populations extirpated in part of its range in South America (BirdLife International 2004). Among the primary threat to condors is human-induced mortality, a result of the mistaken belief that condors will harm livestock. Farmers also poison and trap condors unintentionally when they try to kill pumas and foxes (see review in Lambertucci 2007). Andean Condors avoid feeding on road-kills (Speziale et al. 2008, Lambertucci et al. 2009a) and currently depend almost exclusively on exotic wild and domestic species managed by humans (Lambertucci et al. 2009b). However, human threats during the breeding season have not been studied.

There are few data available on Andean Condor reproduction and nesting characteristics (del Hoyo et al. 1994, Lambertucci 2007), and only one published record of Andean Condors breeding in Argentina (Lambertucci and Mastrantuoni 2008). However, it is known that younger individuals have higher mortality rates than older individuals of this species (Temple and Wallace 1989). The few Andean Condor nests that have been described are generally situated on cliffs inaccessible to predators, with good winds in the immediate area (del Hoyo et al. 1994, Ferguson-Lees and Christie 2001). We here describe some characteristics of Andean Condor nest sites that might make this species vulnerable to human disturbance, particularly in areas of increasing human population.

METHODS

Our study areas were in (1) the Río Negro province of northwest Argentine Patagonia (41°S and 71°W) and (2)

in Santa Cruz province, more than 1000 km to the south (50°S and 73°W). Habitats in the study areas include a heterogeneous mosaic of woodlands and steppes (Cabrera 1976); both areas are hilly and provide ridges and cliffs appropriate for condors. These areas are mostly rural, with low human population density (<1 person/km²), and dominated by large livestock farms.

Condor nests in the study area were discovered opportunistically between 1998 and 2007, and each nest described here was used at least once during those years. We recorded the location and altitude of each nest and the distance to nearest urban area and/or communal roost using a Global Positioning System (Garmin eTrex®, Kansas City, Missouri, U.S.A.). Heights of nests relative to ground or water were estimated with a clinometer. We monitored nests with a spotting scope (20–60×) and binoculars (10 × 50).

RESULTS AND DISCUSSION

Nest on the Ground. We documented one nest (Querencia) on the ground in a large cave (900 m asl), north of Argentino Lake, in the Santa Cruz province. This nest was found active in March 2003, with a chick of ca. 3 mo old. This location was unusual in that people and predators were easily able to walk into the cave. The region around the nest included many cliffs with ledges and caves near the nest, and a large communal roost 7 km from the nest. We found evidence of mammalian carnivores, including puma (*Puma concolor*) and culpeo fox (*Pseudalopex culpaeus*) near the nest, but little human activity in the area.

Nesting on the ground does not appear to be rare in the Cathartidae family. California Condors (*Gymnogyps californianus*), Turkey Vultures (*Cathartes aura*), and Black Vultures (*Coragyps atratus*), have been reported as nesting on the ground or in very accessible places (Snyder et al. 1986, del Hoyo et al. 1994, Barbar et al. unpubl. data). Wallace et al. (1983) observed similarly accessible nests of Andean Condors in Peru. Snyder et al. (1986) proposed that California Condors may use low nest sites to prevent nestlings from falling from the nest. Observations of Andean Condors' nestlings falling from nests in Argentina, Chile, and Ecuador also support this idea, although all the fallen nestlings fledged (Pavez and Tala 1995, INEFAN 1997, Lambertucci and Mastrantuoni 2008, L. Sympson pers. comm.). More data are needed on the availability of inaccessible nest sites, the risks that falling nestlings face, and predation risks in non-cliff nests. In our study areas, the primary threats for condors are from humans (BirdLife

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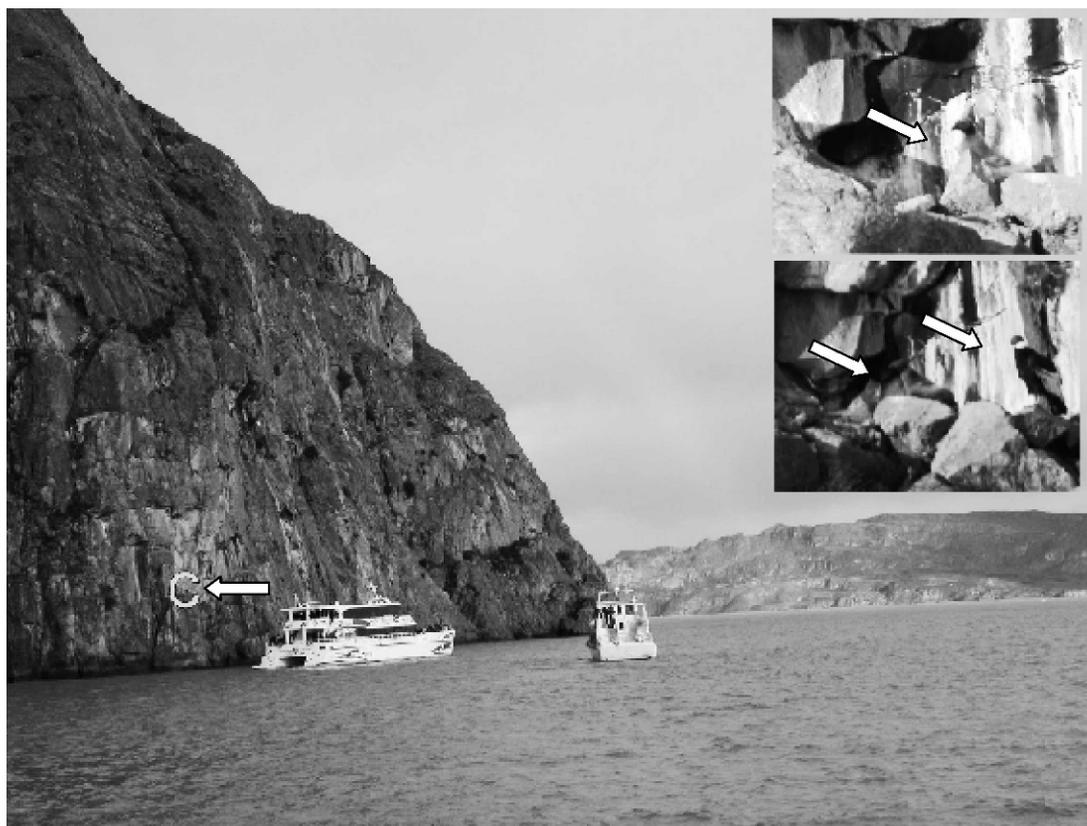


Figure 1. Andean Condor nest (Boca del Diablo) surrounded by tourist boats (principal picture; closest boat is ca. 70 m from the nest). Inset right top: male nestling in nest on a cliff almost 15 m above the water. Inset right bottom: nestling with a female adult. Santa Cruz, Argentina (photos: R. Bava).

International 2004, Lambertucci 2007, Speziale et al. 2008, Lambertucci et al. 2009a, 2009b), and the incidence of human presence is increasing in isolated places, making it easier to access nests and interrupt the breeding cycle. In addition, nestlings may be easily removed from ground nests; in October 2003, we found a young female (ca. 10 mo old) in the garden of a house in the city of El Bolsón in Argentine Patagonia. The immature bird had been taken from a farm ca. 50 km from El Bolsón before fledging. The collection of eggs and nestlings in the past was thought to account for a significant decrease in California Condor population (Koford 1953).

Nest on a Climbing Area. We documented a nest on a vertical cliff (approximately 1150 m asl) in the Río Negro province during November 2006, in an area increasingly used for mountain sports, where at least two rock climbers disturbed the nest during incubation. Following that disturbance, the adults abandoned the nest and the egg was lost. This problem may increase in the near future because areas used by nesting condors are generally good areas for rock-climbing. Within the study region, climbers are nei-

ther regulated nor registered. Although some disturbed California Condors did not abandon their nests, others were affected by disturbances in the breeding areas (Koford 1953, Verner 1978, Snyder and Snyder 2000). Variable responses might be associated with individual variation in tolerance of disturbance (Verner 1978, Snyder et al. 1986, Snyder and Snyder 2000).

Nests over Water. We documented one nest (Boca del Diablo), first documented in May 1998 and observed again in March 2007, at the edge of Argentino Lake, Los Glaciares National Park, Santa Cruz province (200 m asl). This nest was located on a cliff almost 15 m above the water on the lakeshore (Fig. 1), 8 km from a large communal roost. Because this is an important tourist destination, two or three tourist boats passed by the nest area twice per day, sometimes within 100 m of the nest, in order to observe the condors (Fig. 1).

In December 2007, another similar nest, on a cliff 30 m over the water, was found at Nahuel Huapi Lake, more than 1000 km to the north of Argentino Lake, in an area heavily used by fishing boats. In these cases, the fledglings



Figure 2. Fledgling Andean Condor (from the Habsburg) nest, attempting to land on the arm of a person at an observation deck on the top of the nest cliff (photos: N. Puñalef/J. Gambeta).

must fly strongly to avoid drowning, even during their first flights. Another problem associated with these nests may be the human-related disturbances, such as tourist or fishing boats (Fig. 1). Such disturbance may make birds fly, and forcing inexperienced fledglings to fly (even unintentionally) may pose a high risk for nestlings in a nest over water.

Nest Near an Urban Area. One nest (Habsburg) was observed active in October 2005, in a cave in a rocky outcrop on the southwest face of a cliff on the Otto hill, near a country club (1100 m asl; see Lambertucci and Mastrantuoni 2008 for details). The distance from the base of the outcrop up to the nest cave was around 40 m. This site is ca. 7 km from the city of San Carlos de Bariloche (population 130 000) in Río Negro province. The distance from the nest to the nearest house was ca. 500 m. We recorded a person climbing to the nest and reaching the entrance in January 2006 while a nestling (ca. 2 mo old) observed the human activity. During our observation period the nestling (ca. 8 mo old) fell to the ground and remained there for nearly one month. The adult condors flew over and fed the nestling regularly, and people walked by close to it. When the fledgling was 14 mo old (February 2007), we noted that it flew very close to people at the top of the nest cliff,

where an observation deck exists. In one case, it even landed on the arm of a man (Fig. 2). In 2007, the nest was reused.

It is significant to note that people visited this nest only after the end of incubation, in contrast to the situation at the rock-climbing area. Thus, the problem in this case was not the abandonment of the nest, but habituation of the fledgling to people. California Condors that have been in contact with humans tend to be very friendly (Snyder and Snyder 2000, Meretsky et al. 2000), but this behavior generally is not beneficial for the condor's survival, considering that the primary threats for these birds are human-related (Lambertucci 2007).

Nest in a Frequently Burned Area. One nest (Fragua) was located at San Ramón farm (950 m asl), 30 km northeast of San Carlos de Bariloche, Río Negro, an area where humans often start fires either unintentionally (e.g., camping activities) or intentionally (because people are permitted to harvest firewood from burnt stands). The nest was only ca. 300 m from an Andean Condor communal roost, but was on a different and lower cliff. In January 1998, a large fire (burning >20 000 ha) started in the region around the nest while a nestling was still in the nest. We observed two adult condors flying nearby and roosting at

the nest despite the fire. We returned to the nest 2 wk after the fire and discovered the nestling still alive. Although condors may reuse their nests several times (Koford 1953, Lambertucci and Mastrantuoni 2008, L. Sympon pers. comm., S. Lambertucci pers. obs.), to date this nest has not been reused.

CONCLUSIONS

More attention should be paid to possible modern anthropogenic risks for the Andean Condor, particularly during the breeding season. Disturbance of adults at the nest is considered to be an important cause of nest failure for California Condors (Verner 1978). In Andean Condors, we found that human disturbances during incubation can result in abandonment of the nest. Nesting in caves over water or on the ground may not have posed a serious risk historically; however, it may have become one with increasing human populations. Although we have not tested responses of Andean Condors to various disturbances, we recommend avoiding and prohibiting nest visits during incubation to prevent nesting failure. We also suggest that regulation or guidelines for tourism near nests, breeding areas, and roosts are important for this species' reproductive success, and we recommend additional public education to alert citizens to threats to this species during the breeding season. Given the threat of population decline or extinction for the Andean Condors, the evaluation of effects of human disturbance during the breeding season is an important component of an effective conservation strategy for this species.

POSIBLES AMENAZAS ANTRÓPICAS PARA LA ANIDACIÓN DEL CÓNDOR ANDINO (*VULTUR GRYPHUS*)

RESUMEN.—Las especies grandes, longevas y de baja tasa reproductiva, como muchas rapaces, son particularmente sensibles a la disminución de sus poblaciones e incluso a la extinción. Uno de los momentos más críticos en la vida de estas especies es la reproducción. Detectamos nidos de Cóndor Andino (*Vultur gryphus*) y describimos las características de sus sitios de anidación que pueden implicar un riesgo para la reproducción exitosa de esta especie frente a un aumento en las densidades humanas en Patagonia, Argentina. Encontramos nidos en el suelo, en una zona de escalada, en acantilados sobre el agua, cercano a una ciudad y en un área con fuegos recurrentes. Recomendamos considerar los posibles riesgos modernos de origen antropogénico para el Cóndor Andino, especialmente durante la estación reproductiva.

[Traducción del equipo editorial]

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