# Full house

## the Burrowing Parrots of Patagonia

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Photo: Christina Büßer

**Imagine the largest colony of parrots in the world. With over 35,000 active nest burrows the Burrowing Parrots (*Cyanoliseus patagonus*) of El Cóndor, Patagonia, Argentina, hold this impressive distinction. Birds in the colony are the nominate subspecies *Cyanoliseus p. patagonus*. Counts during the 2001-02 breeding season showed that the colony extended along 9 km (5.6 mi) of a sandstone cliff facing the Atlantic Ocean in the province of Río Negro, Patagonia, and contained 51,412 burrows, an estimated 37,527 of which were active. Additionally, 6,500 parrots not attending nestlings were found to be associated with the colony during the 2003-04 breeding season. To our knowledge this population is the largest known colony for the entire order Psittaciformes (Parrots and Cockatoos).**

Some key features of the breeding biology of Psittaciformes contributing to the fragility of the order, include the almost invariable habit of nesting in holes, the commonly monogamous breeding system, and the absence of territorialism beyond the immediate vicinity of the nest, which contributes in several species to conspicuous breeding colonies. In addition, for most parrot species there is still a lack of basic biological data, which are necessary for the identification of specific threats, the monitoring of populations, and the evaluation of the conservation measures to be taken.

Burrowing Parrots are colonial Psittaciformes. In Argentina, the species occurs from the Andean slopes in the north-west of the country to the Patagonian steppes in the south. Generally, they inhabit bushy steppes, marginal xerophyte (adapted to live in dry conditions) forests, grassland and farmland but they require sandstone, limestone or earth cliffs to excavate their nest-burrows. The species is migratory, occupying the breeding colonies some months before laying and leaving them gradually as the young fledge. Adult Burrowing Parrots excavate their own nest-

Photo: Petra Quillfeldt

*The coastal cliffs of north-eastern Patagonia are home to a truly spectacular colony of Burrowing Parrots or Patagonian Conures. The colony is susceptible to many threats from erosion and paragliding to beach-goers and poachers. Detailed study of the biology and behaviour of the birds provides invaluable information for their conservation.*

burrows. The nesting pairs use burrows that they have dug in previous seasons, but they enlarge the burrows every year. Each burrow is occupied by a single pair, who are socially and genetically monogamous and provide intensive biparental care. They lay one clutch of two to five eggs per year.

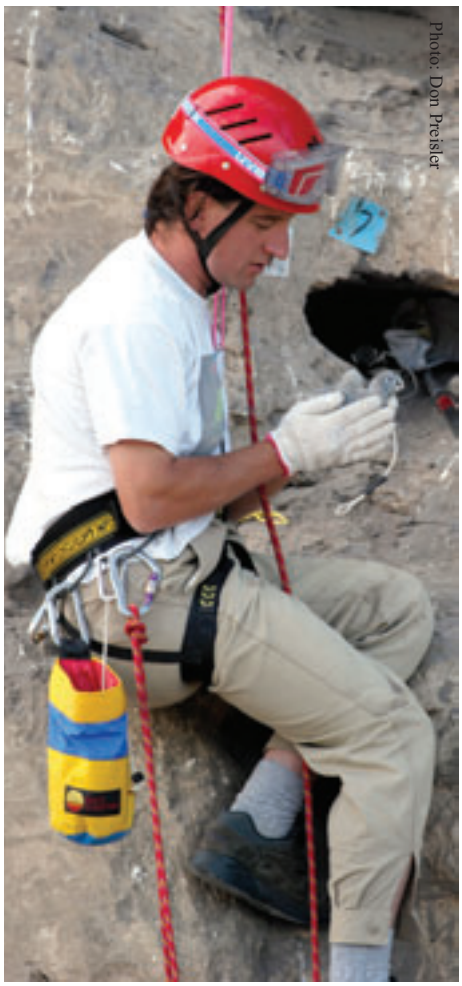
The conservation status of Burrowing Parrots was last studied in the early 1980s. Formerly very common in Argentina, they are now only regionally abundant and have disappeared from large parts of the country. The decline of the species in Argentina is a result of conversion of grasslands to croplands, hunting, trapping for the pet trade and persecution as a crop pest. Burrowing Parrots are officially considered an agricultural pest in Argentina although the damage to agriculture is a local phenomenon. Several scientists have observed that their diet is comprised mainly of wild seeds, fruits and berries. Burrowing Parrots have also been described feeding on soft parts of plants and we observed buds and other soft vegetable matter in crop contents of nestlings especially during their first weeks. Therefore, except for some marginal agricultural areas and discrete events, damage to agriculture is not intense (see also *PsittaScene Vol 17 No 4: 10-11*). Despite this, lethal methods of control have been carried out in various years, without objective quantification of real damage and adequate consideration of alternatives and consequences.

The aims of our study were to describe the Burrowing Parrot colony, to investigate patterns of daily movements to the feeding grounds during the breeding season, patterns of nestling provisioning and flock size. We also studied the proportion of Burrowing Parrots not attending nestlings but present at the colony during the breeding season. With this information, we aim to provide a baseline for further monitoring and conservation of this remarkable colony.

## Study area

Our study was carried out at the Burrowing Parrot colony mentioned above which is located 3 km (1.9 mi) west of the mouth of the Río Negro River, Patagonia, Argentina. The easternmost part of the cliff is mainly composed of soft sandstone, whereas the westernmost part contains a very compact layer of clay at the bottom, which is not used by the parrots, and layers of soft sandstone on top. The habitat surrounding the colony is characterised by bushy steppes and marginal xerophyte forests. Much of the land is used for crop production and low-density cattle grazing.

We used a sector of the easternmost kilometre of the colony for detailed studies. The study sector is 30 m (98 ft) long, 25 m (82 ft) high and contains about 500 nests. A total of 96 to 109 nests were monitored by direct observation through climbing the cliff. The number of nests monitored varied between years due to the collapse of nests and parts of the cliff, which occurs frequently in this part of the colony. We could not find a suitable place for monitoring nests in more westerly sectors of the colony, mainly because in the very few sectors suitable for safe climbing the density of nests is too low to obtain a representative sample. In addition, most sectors of the colony can be accessed only during the few hours in which low tide exposes the beach.




*Direct observation of nest burrows and nesting birds is accomplished by climbing the cliff in the few suitable areas that provide safe access. Author Juan Masello inspects a young Burrowing Parrot chick.*

## Nest counts and description

The number of nest-entrances in the entire length of the colony was counted from photographs. For the densest part of the colony (the easternmost 4.2 km or 2.6 miles), a complete series of 58 photographs was taken. For the westernmost 4.8 km (3 mi), where nests are sparser, sample photographs were taken every 450 m (1/4 mi), and the total number of nests was extrapolated from these samples. We used the data from the study sector to estimate the percentage of nest-entrances that correspond to active nests in the entire colony. We assumed that the different sectors of the cliff are equally suitable for the parrots for the following reasons: (1) parrots use sandstone layers of similar geological characteristics and belonging to the same geological formation both in the east and west of the colony; (2) the surrounding habitat is identical; and (3) the regime of tides does not differ noticeably between east and west. The only factor that differs appreciably between parts of the colony is the degree of human disturbance by beach tourists, which is highest in the east. The present methodology could therefore underestimate breeding success in the colony because the study site is subject to human disturbance during the last 2 weeks of the nestling period.

We validated the accuracy of our nests-counts from photographs by comparing this data with direct counts. To describe the dimensions and shape of Burrowing Parrot nests, 40 nests were selected in the study sector. Nest-entrances were measured with a rule, and the depth of the nest was measured with a telescopic stick.

The height of the cliffs where the colony is located range from 11 to 27 m (36 to 90 ft) above sea level. Nests were found in layers of soft sandstone between 3 m (10 ft) above the average level of high tide and 0.5 m (1.6 ft) from the top of the cliff. No nests were found in the compact layer of clay at the bottom of the westernmost half of the colony.

The total number of nest-entrances counted along the colony was 53,443. In the study sector, 96.2% of inspected burrows had one entrance, and 3.8% had two entrances. Assuming that the proportion of burrows to nest-entrances is homogeneous within the colony, we estimated that the entire colony contains 51,412 burrows. The compact clay layer in the west does not seem to be suitable for the parrots, as no nest-entrances were observed in it, and this structural variation in the cliff (i.e. more soft sandstone layers in the east than in the west of the colony) appears to be the main factor affecting the distribution of nests in the cliff.

The burrows are depressed cylinders dug in the softest layers of sandstone. Some burrows have two entrances leading to a single nest-chamber and occasionally single entrances lead to two nest-chambers, although only rarely do the latter contain two broods. The burrows follow the stratification of the cliff. The nest-entrances are elliptical, with the major axis horizontal (width range 14-49 cm or 5.5-19 in) and the minor axis vertical (height range 8-25 cm or 3-10 in). Most of the burrows are about 1.5 m (5 ft) deep, but vary from 0.6 m (2 ft) to more than 3.5 m (11 ft). The

nest chamber is about the same width as the nest-tunnel but is higher because the parrots dig a shallow cavity in which the eggs are laid and nestlings are raised.

## Provisioning activity

Burrowing Parrots have evolved behavioural mechanisms to cope with fluctuations in food supply, which include flexible time-budgets in adults, and flexible growth rates in chicks. During drought, poorly fed chicks may retard growth processes in response to dietary restrictions. As a result, they may still fledge successfully despite severe food shortages during their development, and breeding success alone would poorly describe the quality of the season. Therefore, chick-growth and feeding rates are important parameters for monitoring.

During December 2001, provisioning activity patterns were determined using a video system consisting of a black-and-white miniature camera, with six infrared light emitting diodes (LEDs) as the light source, and a built-in microphone. The video system was placed in the entrance-tunnel and directed toward the nest-chamber but the nest was not modified in any way.

Three accessible nests were chosen and provisioning activity was recorded during 4 days at the first and second nests and during 3 days at the third nest. Further recording was not possible because the video system broke down during heavy rain. All recordings were done close to the time when nestlings reach peak mass (i.e. maximum demand for food), and in nests with brood-sizes close to the mean brood-size for that period in order to allow comparisons between nests. All other monitoring activities in the study sector were suspended during recordings in order to avoid possible disturbance of provisioning activities. For the same reason, recordings were done only during days without tourists on the beach. We recorded the time of adult arrival, the time of adult departure and whether feeding of the nestlings occurred.

During our monitoring, nestlings were fed 3-6 times per day. In all three monitored nests and observation days, both adults stayed in the nest overnight. The arrival of the adults in the evening was always followed by feeding of the nestlings. All nestlings were fed again in the early morning, before the adults left the nest. Adults departed early and returned to the nests 4-6 hours later. There was a peak of feeding activity at this time when 75% of the pairs returned to feed the nestlings. Feeding activity was less synchronous during the afternoon. All recorded departures from and arrivals at the nest, except for one departure, were by both parents.

## Daily movements and flock sizes

From the colony, Burrowing Parrots used two main flight routes to the feeding areas. We recorded flight activity over 3 days during the period of maximum nestling provisioning activity (i.e. all the nestlings in the study sector had hatched but none had yet fledged). With binoculars, observations were made from the top of a hill with a clear 360° view of the surrounding area. We recorded the number of parrots, the flock sizes and the flight direction. Tests of inter-observer reliability revealed that flock-size was simple to determine.

As expected, daily movements of foraging flocks mirrored the feeding of nestlings at the colony. We found that adults made 1-4 trips per day to the feeding grounds with a pronounced peak in numbers immediately after sunrise, and another peak when the birds returned to the colony about 4 h later. Flying activity in the afternoon showed no such synchronization. In late afternoon very few individuals were observed flying to the feeding places. Parrots not attending nestlings but roosting in the village of El Cóndor during the night (see page 6) may join breeding birds flying to the feeding grounds and contribute to the morning peak of flight activity.

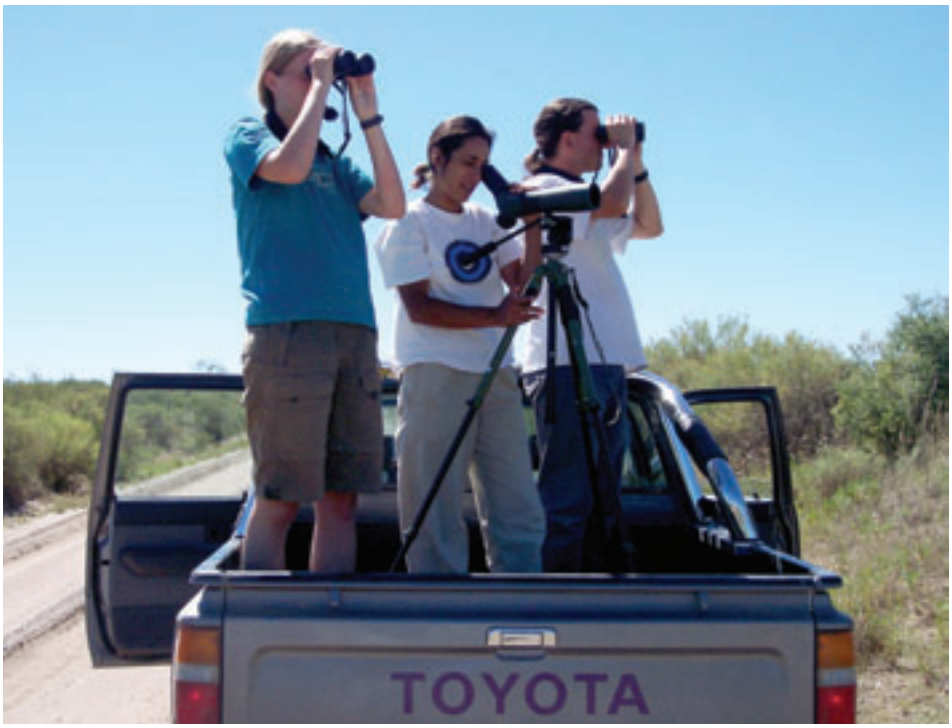
Our observations follow a common pattern of daily activity in Psittaciformes which consists of an active period beginning at sunrise and lasting several hours, followed during the middle of the day by a period of inactivity or reduced activity. Activity recommences a few hours before sunset through until sunset. In most studies, the decrease or break in activity appears to occur around the hottest part of the day and is related to the need to avoid activities requiring elevated metabolic rates in that period. The relatively mild temperatures during December in north-eastern Patagonia (daily maximum temperatures ~27°C or 80°F), compared with those in habitats of other parrot species, could be a reason for the activity observed at El Cóndor during midday and the afternoon. Alternatively, the relatively low or sparsely distributed food supply in the Patagonian steppes may force the birds to forage throughout the day.

Burrowing Parrots are among the species in which large flocks are common. Adults travelled in flocks of up to 263 parrots to the feeding grounds in early mornings and in smaller flocks later in the day. Overall, the most frequent flock size was two, indicating that the pair is the basic social unit during the breeding season. Single Burrowing Parrots were also observed flying to the feeding grounds. A number of hypotheses have been put forward to explain variation in flock-sizes, some of which focus on the distribution of food, some on the degree of aridity, some on the level of feeding competition and others on predation.

Photo: JDG

*Parrots show great variation in flock sizes between species although the primary social unit appears to be the pair, or pairs with additional individuals that are likely to be young of the year.*

Photo: Roberto Ure




*Petra, Juan and a student make counts of commuting birds on their way to feeding areas. These counts along important flight-lines can provide useful monitoring data. They are often most useful as indices of abundance if carried out over long periods of time.*

The large flocks observed in our study during early mornings, together with the aridity of the region around the Burrowing Parrot colony at El Cóndor, are in line with the hypothesis of aridity as a determinant of flock-size, and, as in many other parrot species, the pair was the basic social unit. Further studies on flock-size outside the breeding season would be necessary to test adequately the hypothesis of aridity as a determinant of flock size in Burrowing Parrots. But for this it would be necessary first to discover the wintering places, which are still unknown.

## Daily flights to the feeding areas

Over 6 days in December 2004 and January 2005 we searched exhaustively for feeding flocks of Burrowing Parrots around the colony. This ~1400 km2 (540 sq mi) area has only three roads and a few accessible tracks. The land is privately owned and permission of the landowners is necessary to enter the fields. An average of 120 km (75 mi) of roads and tracks were covered at low speed in each of the surveys. Parrot flocks were easily detected in this flat and almost treeless area.

In January 2005, we conducted an aerial survey of the area mentioned above. Observations were carried out from a Cessna 182, at an altitude of 150 m (500 ft) covering a total linear distance of 400 km (250 mi). Two observers each covered a 180° view to the right and left side of the plane. We recorded the flock sizes and the flight direction. The locations of feeding flocks and their linear distance to the colony at El Cóndor were calculated with the use of a global positioning system.

The habitat surrounding the Burrowing Parrot colony at El Cóndor is rapidly being transformed to agricultural land. Our results suggest that the birds may perform long daily movements in order to reach the remaining large patches of natural vegetation. The combined results of terrestrial and aerial surveys over 2 consecutive breeding seasons showed that feeding flocks of Burrowing Parrots regularly travel 58 and 66 km (36 and 41 mi) over the two main routes to the feeding areas. Sixty-four feeding flocks where located in patches of natural vegetation, six were found in pastures, and only two were located close to crops in an irrigated area (see also *PsittaScene Vol 17 No 4: 10-11*). Although most of the feeding flocks were small, supporting an earlier observation that the Burrowing Parrots disperse in small flocks to feed in patches of natural vegetation, we also observed several large feeding flocks up to 100 individuals. The nature and distribution of their food resources undoubtedly influences the daily movements of the parrots. Species exploiting ephemeral or widely dispersed food resources may be forced to travel long distances to find suitable feeding locations.

## Non-breeders attending the colony

Video observations in the 2001-02 breeding season indicated that breeding pairs of Burrowing Parrots spend the night with their young in the nest during the nestling period. These observations were confirmed by direct inspection of nests in the study sector during the late evening in the 2003-04 breeding season. Thus, Burrowing Parrots roosting outside of nests during the nestling period were not attending nestlings. Between the end of November and the end of December, flocks of Burrowing Parrots spend the night in the village of El Cóndor, roosting mainly on power lines. The village and its peripheral streets are the only roosting place associated with the colony in a 30 km (18 mi) radius. On two nights in December 2003 a team of six trained people, in two vehicles, counted all Burrowing Parrots in the village at dusk. The counts were done

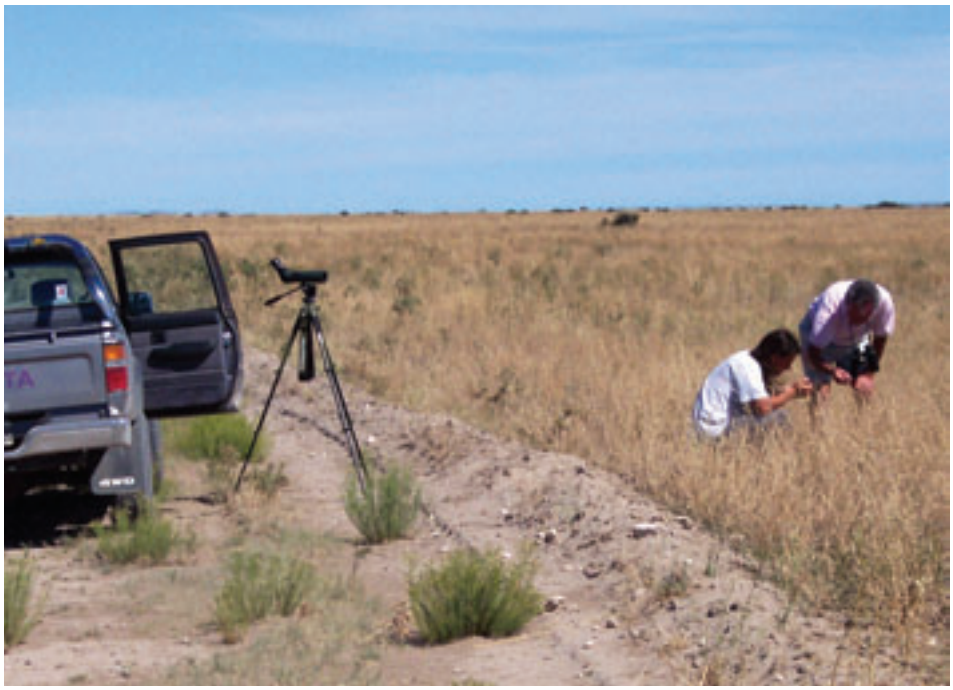
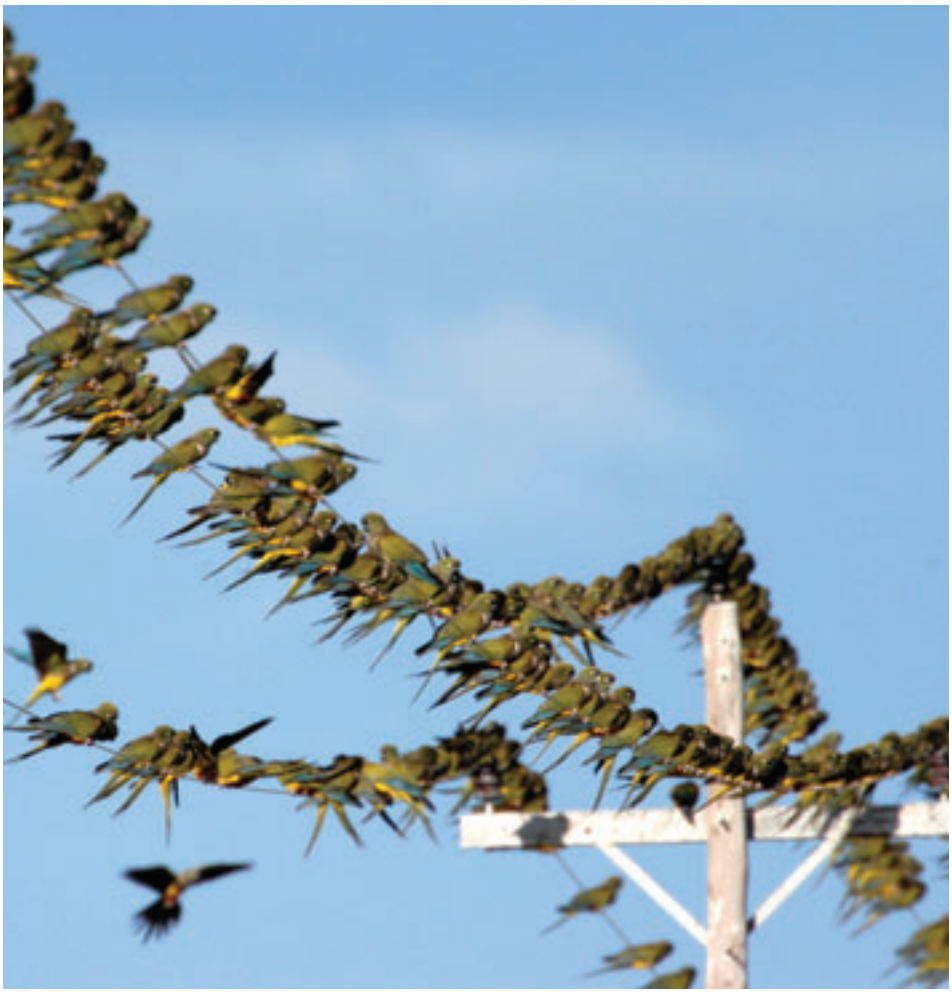


Photo: Petra Quillfeldt

*Protecting the parrot colony requires a good knowledge of the foraging needs of this population and the identification and protection of the feeding areas that support it.*

Photo: Don Preisler



*Thousands of Burrowing Parrots line the power lines in the village of El Cóndor, Patagonia, Argentina to roost. Since breeding birds spend the night with their chicks in the nest burrows, these birds are all non-breeders associated with the colony.*

after the late broods hatched and well before the first sightings of fledglings outside their burrows. Thus all the counted parrots were close to the beginning of their second year of life or older.

We counted an average of 6,471 non-breeders associated with the colony over two separate count days. These non-breeders may have been birds that had attempted to breed but failed, birds that had not yet attempted to breed, or young birds digging nests to be used in later breeding seasons.

## Threats to the colony and the necessity of monitoring

The extraordinary size of this colony has not been described until now, although earlier estimates indicated that the colony extended between 5 and 10 km (3-6 mi) along the cliffs. The importance of the colony has so far been largely overlooked, and it has no legal protection at present (see also *PsittaScene Vol 17 No 2: 12-14*).

The number of threats is large, and some are difficult to control. The major threat to the Burrowing Parrot feeding areas is the loss of natural vegetation. The annual rate of clearance of the native vegetation has been estimated at 3.7%. In addition, large sectors of the steppes are burnt every year, supposedly in order to protect private property from natural fires. At the top of the cliff supporting the colony of Burrowing Parrots, vegetation is cleared annually with the use of heavy machinery apparently to protect power lines from natural fires. This, combined with the burning of the margins of the road that runs along the top of the cliff, leads to much erosion in some sections and poses a serious threat to the stability of parts of the cliff supporting the colony. Rain often falls as violent thunderstorms and areas of soil unprotected by vegetation are easily washed away.

In addition, the colony itself has been seriously threatened during the last 25 years by a range of assaults. Parrots have been poisoned in an attempt to reduce their numbers. A section of the colony was dynamited to allow the building of a pedestrian and car access close to the beach below the cliff. Cars cause disturbance and erosion along the beach below the cliff. At the same time trapping for the pet trade has been intense at times and adult birds continue to be shot by tourists while bringing food to the nestlings. In addition, the expansion of the village has brought buildings to within less than 30 m (100 ft) of the first nests. Commercial extraction of sand and intense paragliding activity in some years causes further disturbance.

Earlier reports indicated that the highest densities of nests were in the easternmost kilometre of the Burrowing Parrot colony at El Cóndor. During the first years of our study (1998-2000), we observed the same pattern. Present data show that the densest sector is now the second easternmost kilometre of the colony. This apparent displacement of birds could be related to high levels of human disturbance detailed above. All these activities affect mainly the easternmost kilometre of the colony.

The colony should be closely monitored until legal protection can be achieved or a conservation management plan reduces human pressure.

## Conclusions

We have identified basic parameters for subsequent monitoring of the colony. This information will help in determining population trends and to measure progress of conservation efforts. The most imminent threats to the colony are the impact of the expanding nearby village, including the access road to the beach, and the diverse tourist activities taking place only metres from the nests. We recommend regular annual population studies of this colony in its entirety, including formal, regular population estimates, studies of breeding success, chick growth and feeding rates and measurement of recruitment and loss from the colony. The number of non-breeders associated with the colony should also be monitored, and as an additional index of abundance, counts from stationary locations should be continued. Radio-tracking should be carried out for breeding adults in order to determine precisely the feeding areas, and for fledglings to estimate survival rates.

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An update of the web page is coming soon!