Macaw conservation in the Tambopata National Reserve, Peru: evaluation of tourism impacts and population management techniques

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Background

The Amazon basin encompasses 7 million km^2, of which 5.5 million km^2 are covered by rainforest. The Amazon rainforest is home to incredibly diverse flora and fauna, with the highest numbers of bird, frog, butterfly and tiger beetle species in the world. Here is also one of the highest levels of tree diversity globally, with more than 200 species per hectare. This complex, highly biodiverse ecosystem is extremely susceptible to damaging environmental pressures such as industrial development, agriculture, logging, poaching and climate change.

There are over 500 recorded species of bird in the Amazon rainforest of southeast Peru, including up to 20 species of macaw and parrot. Macaws serve as "flagship species" for the ecosystem, being regarded as a quintessential symbol of the Amazon rainforest and its conservation. Although classified as species of Least Concern (IUCN Red List), the blue-and-yellow macaw (*Ara ararauna*) and the scarlet macaw (*Ara macao*) populations in particular are dwindling. This could be a result of fewer nesting sites through logging activities, lack of sufficient nutrients and low fledging rates. These threats, and macaws' naturally low reproductive rates, mean that research is crucial in order to determine the steps required to conserve these species.

As major seed predators, macaws and other parrots are engaged in an "evolutionary race" with plant species, which have developed a protection mechanism where their seeds contain chemical defences – toxins that are either distasteful or harmful to birds that eat them. Macaws engage in geophagy

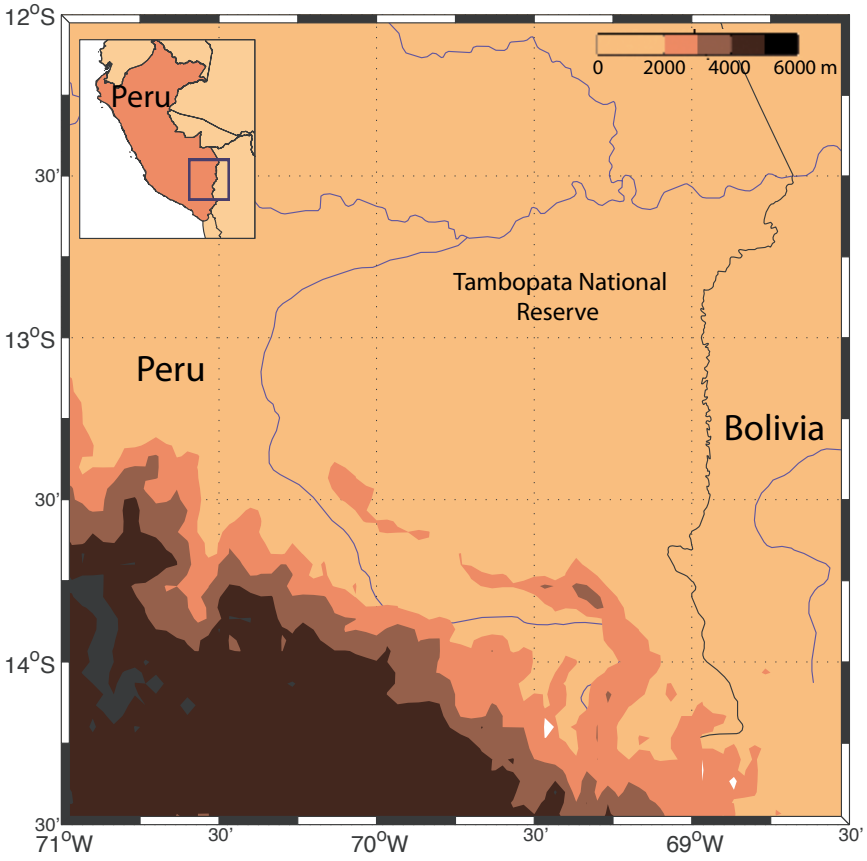

Figure 1. The research is based within the Tambopata National Reserve, southeast Peru.

(eating soil) as a way to counter these toxins. Geophagy occurs at clay licks – special deposits of clay found along riverbanks – where macaws and parrots gather in large numbers to consume clay, which is high in sodium.

The Tambopata National Reserve is a nationally protected area of tropical lowland forest in the Peruvian Amazon. The Reserve was created by the Peruvian government in 1990 to protect the watersheds of the Tambopata and Candamo Rivers, and surrounding rainforest. The world's largest clay lick, Colpa Colorado, is found here among the many clay licks of the Tambopata River. Almost 5,000 people inhabit the Reserve, making a living from slash and burn agriculture, small-scale gold mining, timber extraction, hunting and fishing, all of which threaten the forest and its biodiversity. A network of organisations and communities exist within the Reserve, with the aim of preserving biodiversity by improving awareness of the value of leaving the forest standing.

Project overview

The Earthwatch project is based at the Tambopata Research Centre (TRC), within the Tambopata National Reserve (Figure 1). The research is led by Dr Donald Brightsmith with the goal of further understanding the macaw population through long-term monitoring, particularly at clay licks surrounding the TRC, and working with local political representatives and organisations to achieve effective habitat conservation. The current research is building on several years of study before and since

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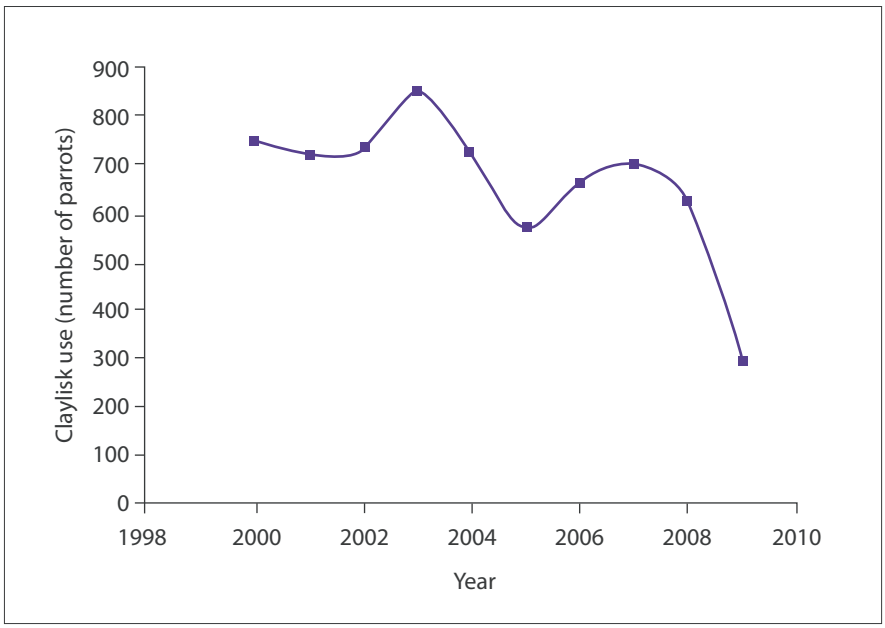

Figure 2. Year on year change in clay lick use by parrots at Colpa Colorado (TRC).

Earthwatch support began in 2001. Maps of clay licks in the region have been developed and specific clay lick sites, such as Colpa Colorado, provide perfect locations for the project research. Research objectives include:

- Continuation of long-term monitoring of macaw and parrot use of the clay lick at TRC
- Calculating the minimum number of birds of each species of parrot and macaw visiting the clay lick during peak activity periods at TRC
- Evaluating the potential of monitoring macaw populations based on birds feeding at geophagy sites
- Documenting behaviour of scarlet macaw chicks and adults inside nests
- Documenting incubation behaviour of adult scarlet macaw
- Observing feeding rates and other interactions between scarlet macaw parents and chicks
- Observing direct competition, aggression and other interactions among scarlet macaw chicks
- Comparing methods for estimating reproductive success
- Estimating macaw and parrot densities
- Monitoring long-term changes in scarlet macaw nesting success
- Training young Peruvian scientists
- Evaluating disturbance generated by the tourism industry to recommend appropriate remedial action to lodges and government organisations

Volunteers help to develop and evaluate techniques for increasing the reproductive output of wild macaws, expand the knowledge of macaw nesting behaviour, increase the understanding of the complexities of clay lick use, determine parrot population densities to aid conservation planning and monitor the impacts of tourism on clay lick activity.

Outcomes and actions

Analysis in 2009 of data collected during monitoring of scarlet macaw nests from 2001 to 2007, revealed that rainfall greatly reduces activity at the nests. The average time between one adult leaving and another entering the nest varied from 59 minutes during dry periods, to 124 minutes with rainfall. Further research will correlate this data set with that of chick growth, to see if weather-related reductions in adult activity rate translate into a reduction in chick growth and/or an increase in chick starvation. The data on nest attendance, reproductive success, nest types, chick growth and survival are now being explored in depth and the interrelationships among the data sets will provide new insights in to the reproductive ecology of this species and psittacines (parrots, macaws, and parakeets) in general. This monitoring is important given the inconsistent weather patterns, which may be attributable to climate change.

The research has also revealed how large macaws show niche-separation in terms of nest site selection. Blue-and-yellow macaw show preference for aguaje palm (*Mauritia flexuosa*) and red-and-green macaw (*Ara chloropterus*) for ironwood trees (hardwoods), whereas scarlet macaw appear to be more flexible in their choice of nesting sites. This information has implications for determining the effects of logging and other types of habitat degradation on macaw reproduction rates, and provides evidence of the need for conservation of these tree species.

In 2009, transects were conducted at three sites along the Tambopata River, using distance sampling techniques to improve macaw population estimates. Five transects were divided into 5km sections and the encounter data collected were sufficient to calculate density estimates for 15 of the 18 parrot species encountered on transects. The most common species recorded was the Mealy parrot (*Amazona farinosa*). Overall, parrot density was significantly higher in floodplain forest than high forest and in floodplain forest significantly more parrots were present during the dry season than the wet season. The research results were comparable to those from other neotropical bird surveys for the same genera, allowing the confident conclusion that they represent bird densities for the two major forest types in southeast Peru – floodplain and high forest. Seasonal changes in density related to habitat types appear to be more important than seasonal movements related to clay lick presence as most species showed seasonal increases in floodplain forest during the dry season regardless of clay lick use. This information has consequences for management of the protected area, as areas where parrots exhibit higher densities need to be considered for conservation activities and habitat maintenance.

The long-term dataset on clay lick use was utilised to highlight the importance

Artificial nests are providing crucial habitat to maintain species survival and their use by the macaws is helping scientists to understand nesting and breeding behaviour.

of clay lick management in meetings held in December 2009 with the managing body for the Tambopata National Reserve and the National Service for State Protected Areas (Servicio Nacional de Áreas Naturales Protegidas por el Estado; SERNANP). Results showed that in 2009, overall bird use had decreased by as much as 80% (Figure 2) and the clay lick could be coming to the end of its useful life for the birds. The Colpa Colorado site has historically seen the largest gatherings of individuals and species visiting of any clay lick in the world, with up to 150 macaws recorded at a single observation. However, macaw numbers appear to have declined at the site during 2009. The Tambopata River no longer reaches the base of the massive clay cliff, deposition of soft sediments has started to occur, and the available clay lick area has been covered by encroaching grass, cecropias and other secondary vegetation. The sodium rich layers preferred by the macaws have been covered with inedible pebbles from higher up on the cliff. The Earthwatch data on daily and long-term clay lick feeding patterns have been used by SERNANP for the creation of a management plan for the area, which was implemented in January 2010. Vegetation and land slide debris were cleared from the clay lick to improve bird access, and the research team will monitor recovery going forward.

Scientist profiles

Dr Donald Brightsmith holds a PhD in Zoology from Duke University, an MSc in Wildlife Ecology from the University of Arizona and a BSc in Natural Resources from Cornell University, all in the USA. His specialties are tropical ecology, ornithology and wildlife conservation. He has worked on parrots in Peru since 1993 and has led macaw research at Tambopata since 1999.

Alan Lee is a PhD candidate at Manchester Metropolitan University, UK. He has a BSc Honours in Zoology and Botany from the University of the Witwatersrand in South Africa as well as a Diploma in Computing from the Open University in the UK. Alan has been working with Earthwatch since 2002.

Collaborative organisations

- Schubot Exotic Bird Health Centre, Texas A&M University, USA
- Amazon Conservation Association, USA, Peru and Bolivia
- Rainforest Expeditions, Peru

Project website

www.earthwatch.org/europe/exped/brightsmith.html

Key Publications

Brightsmith, D.J., Holle, K.M. & Stronza, A. (2008) Ecotourism, Conservation Biology, and Volunteer Tourism: a mutually beneficial triumvirate. *Biological Conservation*, **141**: 2832-2842.

Brightsmith, D.J., Taylor, J. & Phillips, T.D. (2008) The roles of soil characteristics and toxin adsorption in avian geophagy. *Biotropica*, **40**: 766-774.

Renton, K. & Brightsmith, D.J. (2009) Cavity use and reproductive success of nesting macaws in lowland forest of southeast Peru. *Journal of Field Ornithology*, **80**: 1-8.