ORNITOLOGIA NEOTROPICAL 23: 107–112, 2012

CRITICAL PARAMETERS FOR PSITTACINE CONSERVATION: A SYMPOSIUM OVERVIEW

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Key words: Psittacidae, population viability analysis, reintroduction, climate, abundance, reproduction

INTRODUCTION

Birdlife International currently classifies 49 of the 155 known species of Neotropical psittacines as threatened with extinction (Birdlife International 2012), making this one of the most endangered bird families in the region. Further, over the past decade there has been a substantial increase in research conducted on Neotropical psittacines, as evidenced by numerous recent publications (e.g., Myers & Vaughan 2004, Renton 2004, Brightsmith et al. 2005, White et al. 2005, Rodríguez-Castillo & Eberhard 2006, Sanz & Rodríguez-Ferraro 2006, White et al. 2006, Koenig et al. 2007, Nunes & Galetti 2007, Matuzak et al. 2008, Monterubio-Rico et al. 2009, De Labra et al. 2010, Vigo et al. 2011, Carneiro et al. 2012, and many others) as well as presentations at the recent International Ornithological Congress (IOC) in Brazil.

Nevertheless, specific knowledge regarding the key parameters necessary to promote successful parrot conservation remains yet elusive. As a group, psittacines are generally non-territorial, flocking, canopy dwelling species that present unique challenges to researchers and managers. Consequently, traditional ornithological theory and techniques do not always transfer or readily apply to members of this avian taxon. Therefore, we developed a symposium bringing together psittacine biologists whom have developed novel and successful techniques for studying these birds. Indeed, because of the special challenges posed by psittacines, the information presented in this symposium should also be useful for biologists working on a wide array of ornithological taxa.

Because of the inherent difficulties and associated expense of psittacine research, such information should help improve both the focus and efficacy of current and future work, thereby facilitating the efficient acquisition of reliable knowledge. This point is particularly relevant in times of economic difficulties and uncertainties, as presently faced by many – if not most – Neotropical ornithological researchers. Accordingly, this symposium consisted of presentations which provided a pragmatic synthesis of the latest available information on what are currently some of the most relevant research and conservation issues in psittacine conservation, such as the use of population viability models to identify the most important life history parameters for survival and recovery of wild psittacine populations, the most effective methods to estimate critical parameters such as reproductive success and population density, the effects of global climate change on population dynamics, and how to promote parrot conservation by maximizing the success of psittacine captive release and reintroduction projects.

RESULTS

The symposium took place 11 November 2011 at the Centro de Convenciones in Cusco, Peru and consisted of the following 5 presentations and associated speakers/institutions, including a brief summary of each:

1. **¿Cuáles son las variables que realmente importan?: lecciones del modelaje de *Ara macao* y *Ara ambiguus* con Vortex.—Juan Cornejo/ Texas A&M University, USA**

Summary: Vortex es un programa de simulación estocástico para el análisis de viabilidad de poblaciones, con el que se modelan las interacciones entre parámetros poblacionales y biológicos de la especie elegida. El modelo permite probar los efectos de diferentes escenarios en la tasa de crecimiento o en el riesgo de extinción de una población en un determinado periodo de tiempo, y de esta manera comparar y determinar las mejores opciones de manejo. Mediante un análisis de sensibilidad podemos explorar el efecto relativo de los diferentes parámetros en el comportamiento del modelo, identificando los más críticos, y así poder determinar las prioridades de investigación de aquellos en los que existan incertidumbres. Los análisis realizados de la viabilidad de la población de la guacamaya roja (*Ara macao cyanoptera*) en Guatemala, y de la guacamaya verde (*Ara ambiguus*) en Costa Rica, identificaron que los factores biológicos con mayor impacto sobre su sobrevivencia son la tasa de mortalidad de adultos (en especial de las hembras), y el porcentaje de hembras que reproducen exitosamente cada año. Como otros psitácidos con ciclos de vida caracterizados por la baja fecundidad, la alta sobrevivencia anual de adultos y la alta longevidad, estas especies se verán beneficiados por acciones de manejo enfocadas a que haya suficientes nidos y estén protegidos, así como a evitar la cacería de adultos y controlar las especies invasoras. El modelaje de poblaciones de psitácidos mediante Vortex ofrece la posibilidad de entender mejor la relación entre los diferentes parámetros intrínsecos y extrínsecos que las gobiernan, así como determinar las acciones más adecuadas para su recuperación y sobrevivencia.

2. **Estimating reproductive success in large parrots: advantages and disadvantages of direct versus indirect methods.—Donald Brightsmith/ Texas A&M University, USA**

Summary: Reproductive success is a fundamental parameter for any animal population, especially those with inherently low reproductive rates, such as "large" parrots (e.g., *Ara* spp.). Changes in reproductive success may portend significant changes in population trajectory and species ecology, yet are notoriously difficult to accurately assess for large parrots. Direct methods such as active nest-checks are commonly employed, and have advantages of providing insights into causes of nest failures, chick health and growth rates, and reductions in poaching by active protection. However, such methods are also labor intensive (i.e., expensive), time-consuming, require specialized equipment, and may alter nest success due to disturbance. We examined the use of indirect methods, such as group size counts, for assessing reproductive success in Scarlet Macaws (*Ara macao*) in southeastern Peru. We found that these methods have the advantages of lower costs, are not biased by nest type, do not disturb active nesting efforts, and provide reasonable estimates of the proportion of the breeding population. Notwithstanding, such methods may not work for all species, and have an inherent bias because the numbers of non-family groups are difficult to ascertain. Nevertheless, in situations where parrots congregate regularly in flocks, indirect methods can be a valuable tool for estimating nesting success, percent of females nesting, percent of young in the local population, and for rapidly detecting cases of complete or near-complete nesting failures.

3. **The importance of inter-annual variability due to climatic factors on breeding success: the case of the Burrowing Parrots of Patagonia and the El Niño Southern Oscillation.— Juan Masello/Max Planck Institute of Ornithology, Germany**

Summary: The El Niño Southern Oscillation is an irregular and recurrent climatic and meteorological phenomenon that has diverse and profound effects on both global and local weather patterns. In this study, the effects of this phenomenon on breeding success of Burrowing Parrots (*Cyanoliseus patagonus*) in the Argentinean Patagonia were examined. El Niño events resulted in substantial increases in precipitation and primary productivity during the parrot nesting season (Oct–Feb), with concomitant and significant shifts in mean hatching dates, brood size, and fledglings produced. Overall, Burrowing Parrots nested earlier and produced more and healthier young during El Niño versus "La Niña" (i.e., drier) years. The parrots appeared sensitive to subtle changes in local weather patterns. Accordingly, slight changes in global climate patterns have the potential to profoundly impact psittacine ecology. Because few studies have examined the role of climate in psittacine population dynamics, additional research is recommended with other such species to understand more completely the effects of climatic fluctuations on the processes that govern breeding success in psittacines.

4. **Psittacine reintroductions: common denominators of success. – Thomas White/United States Fish & Wildlife Service, Puerto Rico**

Summary: With 28% of the 350 species of parrots considered threatened, numerous conservation efforts have been initiated for these species. As example, the restoration or establishment of new populations has increasingly relied on reintroductions as a conservation strategy, often with mixed or inconclusive results. This study (see White et al. 2012) examined the results and methodologies of 47 distinct releases and reintroductions of psittacines in nine different countries worldwide over the past 25 years to identify common denominators of successful efforts. To do so, researchers established a uniform and objective definition of reintroduction success (first-year survival > 0.50 and released birds breeding with conspecifics, either captive-reared or wild), and applied generalized linear models and information-theoretic model selection to identify significant predictor variables. Several likely predictors of successful psittacine reintroductions were identified. Among these, predation and predation mitigation had the greatest influence on reintroduction success, with habitat quality at the release site and post-release food supplementation exhibiting lesser, but nevertheless significant, effects on success. The study also introduced SWOT analysis, a novel and empirical form of environmental assessment, for objectively evaluating suitability of potential reintroduction sites.

5. **Abundance and abundance shifts in the world's parrots. – Stuart Marsden/Manchester Metropolitan University, United Kingdom**

Summary: Among the 350 species of parrots worldwide, most have no reliable or current estimate of abundance or population trends. This study reviewed 77 papers, theses and technical reports for data on parrot population densities across habitats in order to 1) identify important gaps in knowledge, 2) examine patterns of parrot abundance, and 3) look for commonalities in responses to land use changes (i.e., abundance shifts). Results indicated that only about 25% of parrot species had a density estimate, with no estimates for any species in half of the world's parrot genera. Moreover, data availability differed across continents – Asia had a high proportion of species with density estimates (22 of 58 spp) and Africa a relatively low proportion (2 of 22). Comparisons of abundance shifts across forest habitats were available for one in five species. Comparisons between primary forest and selectively logged forest dominated, with very few comparisons between different anthropogenic habitats. Threatened species were just as likely to have a density estimate, and less likely to have a comparison of abundance across habitats, as non-threatened species. Variability in abundance was relatively low in the "parakeets" – commonness in genera like *Pyrrhura* appears predictable. For some genera (e.g. *Ara*), there was a general upper bound to abundance (<5 individuals/km^2) but much variation – extreme rarity cannot be predicted. In yet other genera (e.g., *Cacatua*, *Pionus*, *Amazona*), most species are rare but there is a "tail of commonness" in a few species (e.g., little-traded species or island forms). We apparently can, to a certain extent, predict likely abundance – but not responses to environmental changes. Although we now have a suite of methods, especially distance sampling, that produce results reasonably effectively, newer methods such as presence-only models may have an important role to play in "bypassing" the need for extensive bird surveys.

CONCLUSIONS

The presentations which comprised this symposium represent several currently emerging concepts and issues in the ecology and management of Neotropical psittacines. As knowledge has grown not only of psittacine ecology in general, but also climatic phenomenon, analytical techniques, and conservation strategies such as reintroductions, this provides us with increasing opportunities – and challenges – for improving conservation efforts for this increasingly threatened avian family. The growing numbers of Neotropical parrot biologists also constitute an invaluable resource as sources of new ideas for promising research and conservation applications. Moreover, in light of current and most likely future economic limitations in the region, creative efforts to develop novel, practical and inexpensive means to acquire needed ecological information and apply effective conservation measures in the field are increasingly needed. While some aspects are, to at least some degree, within our control (e.g., improvements in analytical techniques), others such as factors associated with climate changes are certain to create new and unpredictable conservation scenarios and attendant challenges. We believe the topics covered by these 5 presentations provide useful and valuable guides for both future investigations and the practical application of existing knowledge to meet these current and future challenges to psittacine conservation.

ACKNOWLEDGMENTS

We are grateful to the Schubot Exotic Bird Health Center – Department of Veterinary Pathobiology of Texas A&M University, and the United States Fish and Wildlife Service – Puerto Rican Parrot Recovery Program for support provided to D. Brightsmith and T. White, respectively. We also thank the symposium speakers for their participation and valuable contributions to this effort.

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