

Recent Advances in Parrot Research and Conservation

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Parrots (Psittaciformes), with about 400 species widely distributed across continents and oceanic islands, stand out among birds for their poor conservation status [1]. According to the IUCN Red List [2], almost 30% of parrot species are threatened with extinction and c. 15% are classified as near threatened. Moreover, almost 60% of all species are experiencing global population declines. Several threats to parrots, such as habitat loss, persecution, and wildlife trade, have recently been addressed globally [3–5]. However, detailed studies on distribution, biology, ecology, population dynamics, population genetics, and specific conservation threats are lacking for most species. The need for further research is exemplified by recent splits of species and descriptions of new species (e.g., [6]) and by the ecological functions of parrots, such as seed dispersal, which have been overlooked until recent years (e.g., [7]). Given the ecosystem services they can provide, the conservation of parrot populations contributes to the health of the habitats in which they live.

The attractiveness of parrots has led to their intensive transport to foreign pet markets around the world [5]. In addition, international trade has caused several parrot species to establish populations outside their native ranges, often resulting in flourishing populations that contrast with the poor conservation status of many native populations. However, studies on non-native populations have been limited mainly to two species of parakeets (the ring-necked parakeets *Psittacula krameri* and the monk parakeet *Myiopsitta monachus*). Much more research is needed on these non-native parrot populations, including aspects such as their establishment and spread processes, population dynamics, potential impacts (negative and positive [8]) on their recipient habitats and communities, the need (or not) for control and/or eradication, or their ecological functions in their invaded regions.

The Special Issue ‘Ecology and Conservation of Parrots in Their Native and Non-Native Ranges’ offers 23 new research studies and four reviews, thanks to the contribution of 123 authors working in different academic institutions and NGOs in 22 countries. Overall, it combines and synthesizes recent research on native and non-native parrot populations, filling gaps in several research areas, compiling state-of-the-art methodological aspects, and advancing the conservation of threatened species.

This volume progresses the study of parrot distribution and abundance. Along with a review of approaches to modeling parrot distributions [9], other studies advance the prediction of future parrot distributions by taking into account their food plant distributions in Bolivia [10], or show the combination of site-occupancy modeling and citizen science to improve range distributions, and roost-counts to estimate parrot populations in Brazil [11]. Roost counts have also allowed estimations of the global population of a Neotropical parrot species [12]. However, this is not feasible for most parrot species, so roadside surveys are proposed to estimate the relative abundances of entire parrot communities in different biomes around the world [13].

Another group of papers deals with little-known aspects of parrot ecology, such as diseases, movements, or ecological functions. A study on selected bacteria and viruses found



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Chlamydia but not beak and feather disease virus (BFDV) in Brazil [14]. A retrospective study also failed to find BFDV in Australia, Argentina, and New Zealand [15], while a new BFDV genotype has recently been found in non-native Spanish parakeet populations [16], and a three-decade study investigated the diversification of this virus and the subsequent waves of infection in Mauritius [17]. Moreover, satellite telemetry of even a few individuals revealed information highly relevant to the conservation of a macaw species in Bolivia [18], and a study of the foraging ecology of another species in Argentina revealed once again the important seed dispersal role of parrots for key plants in the ecosystems where they live [19].

A review compiles the different genetic tools available for the study of parrot evolution, biology, and conservation [20]. Examples of the useful application of these molecular approaches are the demonstration of genetic distinctiveness of isolated parrot populations in Brazil [21], the study of population genetics of wild and captive populations in Mexico and Bolivia [22], and the identification of the geographic origin of traded individuals in Mexico [23].

The wildlife trade is one of the main threats to parrots, and a literature review summarizes actions taken to tackle the illegal parrot trade, making recommendations for improving future efforts [24]. Also related to illegal trade, other papers developed a capture pressure index in Ecuador [25], assessed peoples' perception of poaching to improve conservation programs in Venezuela [26], and demonstrated that parrot poaching is not random but selected for the most attractive species in Colombia [27], and that selective parrot poaching affects parrot populations in Indonesia [28].

Several other papers deal with in situ and ex situ management for parrot conservation. These range from techniques to increase chick survival in the wild [29], to the study of stress physiology in relation to the breeding success of captive individuals destined for reintroductions [30], the challenges faced in establishing reintroduced populations [31,32], and the use of a new technique that could allow the establishment of released individuals in places where parrots are absent [33].

Finally, an updated review has identified 166 introduced parrot species in 120 countries worldwide, of which 60 species have naturalized populations, and 11 species have bred outside their native ranges [34]. The study of naturalized parakeets' home ranges in Spain [35] adds to the scarce information available on the ecology of introduced parrot populations.

We hope that this Special Issue will encourage further research on this fascinating and endangered group of birds.

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