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Selected Abstracts From the Literature

Differential flight responses of sympatric raptor species to weather conditions and extreme temperature events. Naves-Alegre L, García-Mayoral H, Mornt J, et al. *Ecol Evol*. 2025;15(2):e70658.

Climate change is an important topic because it impacts all species; however, how climate change impacts species can vary based on that species' "normal interaction" with their environment. For example, reptiles that are temperature sex-dependent may experience increased bias toward 1 sex because of climate change. While this is well documented, the impacts of climate change on birds are not well studied. Birds can be greatly affected by changes in atmospheric conditions because this can impact flight speed, direction, or strategy. In this study, the authors assessed flight-related parameters in 3 GPS-tagged raptors (golden eagle [*Aquila chrysaetos*], Bonelli's eagle [*Aquila fasciata*], and Spanish eagle [*Aquila adalberti*]) based on weather conditions. The authors found that the 3 species varied in flight patterns despite similar environmental conditions (eg, temperature, precipitation, wind speed, and atmospheric pressure). Moreover, each species exhibited unique responses to heatwaves, reflecting their adaptive flexibility. For example, Bonelli's eagle displayed comparatively minor adjustments in its flight strategy during periods of extreme temperature, in contrast to the pronounced behavioral variations observed in the golden eagle. The authors found that their study provided some new insight into the impacts of extreme weather (eg, heatwaves) on raptors and that these birds may respond differently to these challenges. Further study to assess how extreme weather events impact survival and fitness because of the altered demands on energy expenditure and foraging is much needed to ascertain the long-term prospects for these important species.

The eye of the largest forest raptor, the harpy eagle (*Harpia harpyja*): Morphologic observations and reference values for selected ophthalmic tests. Lopes Grego A, de Moraes W, Moore BA, et al. *Vet Ophthalmol.* 2025. doi: 10.1111/vop.70014 (online ahead of print).

They call her the queen of the jungle. Harpy eagles (*Harpia harpyja*) are the largest forest-dwelling raptor species and have been extirpated from many parts of their range. To protect this species, it will be important for conservation programs to collect baseline clinical data from these birds in rehabilitation facilities, zoological institutions, and head start programs. The purpose of this paper was to describe the relevant morphological features of the harpy eagle eye and provide baseline data for selected ophthalmic diagnostic tests. Twenty-nine clinically normal harpy eagles were evaluated in this study. The birds were examined under physical restraint. The following tests were used to evaluate the eagles: Schirmer tear test, culture of normal conjunctival flora, slit-lamp biomicroscopic examination of adnexa and anterior segment, rebound tonometry, applanation tonometry, central corneal thickness, palpebral fissure length, B-mode ultrasound, and ocular biometry. The measurements collected from the eyes were like other species of eagles. For example, the average rebound and applanation tonometry readings were 14 and 15 mm Hg, respectively. The conjunctiva of the lower eyelid was found to have a distinct cartilaginous plate adjacent to the conjunctival epithelium. Common bacterial isolates from the conjunctiva included *Escherichia coli* (32.8%), *Enterobacter* spp (15.5%), and *Streptococcus* spp (10.3%). These data can serve as baseline measures for those working with ex situ birds to improve their care and management.

Direct and indirect effects of pesticide exposure on the gut microbiota of a farmland raptor. Bariod L, Fuentes E, Millet M, et al. *J Hazard Mater*. 2025;5: 485:136857.

Pesticides are responsible for several different pathological conditions in vertebrates; however, recent studies in humans have shown that certain pesticides can even affect the richness and function of the gastrointestinal microbiome. Alterations to this dynamic system can lead to dysbiosis and longer-term impacts on the endocrine and immune systems, among others. Unfortunately, this relationship remains understudied in wild birds despite knowing these chemicals negatively impact raptors. In this study, the authors sought to measure the association between pesticide concentrations in blood and gut microbiota in Montagu's harrier (*Circus pygargus*). The authors found differences between the sexes, with high body condition and high pesticide concentration females exhibiting more bacterial richness and diversity than males. The dominant phylum was Proteobacteria, but differences in the abundance of specific phyla and genera were observed according to pesticide load.

For example, Bacteroidota and *Leifsonia* were found at higher levels in birds with higher pesticides, while there were lower levels of *Burkholderia* in these same birds. The differences in microbiota by contamination level suggest more work is needed to evaluate the health of these animals, especially those that are vulnerable. Moreover, these findings reinforce that as top predators, raptors can serve as important sentinels in their ecosystems.

Raptors without resistance: No evidence for endogenous inhibition of rattlesnake venom metalloproteinases in a Great Plains raptor assemblage. Balchan NR, Crowther TW, Kratz G, et al. *Toxicon*. 2025;256:108275.

Snake venoms are potent chemicals that have evolved to assist snakes with the capture of prey. Studies on venoms have found that they are linked to the ecosystems that snakes inhabit. As might be expected, venom resistance has been found in mammalian prey species as an adaptive response; however, few studies have assessed this in snake predators. Moreover, studies into the potential resistance in avian systems are lacking. Because raptors are predators of venomous snakes, they could serve as a good avian model for assessing the presence of venom resistance in birds. In this study, the authors assayed sera from several Great Plains raptors against snake venom metalloproteinases (SVMPs) of the prairie rattlesnake (*Crotalus viridis*) to determine whether raptor sera display elevated SVMP inhibition compared with a naïve avian model (chicken; *Gallus gallus*) and whether birds that are primary predators of rattlesnakes have a different effect on SVMP compared with raptors not known to feed on rattlesnakes. The authors found that raptors do possess elevated SVMP inhibition in comparison to chickens; however, the level of inhibition remains low and is unlikely to be biologically significant in detoxifying venoms. The authors also found no difference in the inhibitory potential of different raptor sera based on the level of rattlesnake predation. The general lack of SVMP inhibition across raptors reinforces the complexity associated with venom resistance and the likelihood that these mechanisms are poorly developed in birds.

Fall and rise of a threatened raptor: Unraveling long-term population dynamics with spatially explicit integrated models. Badia-Boher JA, Hernández-Matías A, Mañosa S, et al. *Ecol Appl.* 2025;35:70013e.

As the saying goes, a model is only as good as its data. When developing population dynamic models, it is important to include birth, immigration, death, and emigration data. However, it can be difficult to collect and incorporate data from these 4 different groups. Fortunately, the advent of integrated population models with spatial mark-recapture models has enabled scientists to better classify demography and dispersal data. In this study, the authors integrated count, reproduction, mark-recapture, and dispersal data to allow for separate modeling of these life stages. This allowed for a fine-scale estimation of population dynamics and the estimation of central population parameters and stages that have traditionally been elusive in demographic studies (eg, sexually mature nonbreeders). A long-lived Bonelli's eagle (*Aquila fasciata*) population from Western Europe (1986–2020) was the species used to evaluate the effectiveness of the authors' proposed modeling methods. The authors found that this population experienced considerable decline and subsequent recovery. The model found that there was initially a decrease but a subsequent increase in sexually mature nonbreeders associated with changes in the breeding population. They also found a change in the average population functioning from a sink to a neutral contributor, shedding light on the flexibility and drivers of sink-source dynamics. The model was able to provide important insight into the central role of nonbreeder survival and dispersal for population recovery, suggesting that the conservation action plan for this species should not only focus on breeding populations but all adults. Because of the quality of the data, this model was better prepared to build a more complete assessment of the population dynamics for this species of eagle, which should allow scientists to develop better-informed conservation action plans.

Psittacine beak and feather disease in 2 free-living great green macaws: A case report and literature review. Olivares RWI, Bass LG, Sáenz-Bräutigam A, et al. *J Vet Diagn Invest*. 2025. doi: 10.1177/1040638 7251333410. Online ahead of print.

Psittacine beak and feather disease (PBFD) is caused by *Circovirus parrot*. The disease primarily affects captive birds; however, in this report, the authors confirm PBFD in 2 free-living great green macaws (*Ara ambiguus*). These birds were found to be depressed and have classic lesions of feather loss. The diagnosis was confirmed by gross lesions and polymerase chain reaction (PCR) testing in 1 bird and gross and histologic lesions, PCR testing, viral sequencing, and in situ hybridization in the second bird. Mild beak discoloration and feather loss were observed in both birds. Bronchopneumonia and severe lymphoid depletion with intracytoplasmic and intranuclear botryoid inclusion bodies in the cloacal bursa were confirmed histologically. Viral DNA extracted from paraffin-embedded cloacal bursa tissue had 100%

nucleotide and 100% amino acid identity with strains of PBFD virus isolated from captive birds in multiple countries. This represented the first report of PBFD in free-living great green macaws.

A standardized ethogram for the Psittaciformes. Yamila Viol L, da Silva Bachetti E, Barçante L, et al. *Behav Processes*. 2025;226:105172.

Ethograms are important tools to guide researchers and clinicians working to understand the behavior of a species. Standardization of an ethogram is important to ensure that the data collected are reliable and repeatable. Because there is no standardized ethogram for Psittaciformes in the literature, these authors aimed to create an ethogram for these birds. Data were collected from scientific articles to standardize the names and descriptions of the behaviors of Psittaciformes. Scopus and Web of Science platforms were used to perform searches, and select papers were evaluated to identify the terminology used for the behaviors and their description. The authors compiled an ethogram for these birds based on 102 behaviors divided into 11 behavioral categories. The category "activity" had the highest number of behaviors assigned, but only 5% of the species (21/421) in the order were covered. The majority (76%) of the published ethograms were created by the authors rather than coming from previously published literature. These findings further reinforce the need to have a standardized ethogram for these birds to facilitate future studies in this group. The standardized ethogram developed in the present study was designed to facilitate behavioral research with more precise definitions and to help unify and compare behavioral research between Psittaciformes.

Innovative flavoring behavior in Goffin's cockatoos. Zewald JS, Auersperg AMI. *Curr Biol.* 2025;35:1107–1112.

Have you ever dunked your cookie in some milk? Dunking behavior can be a foraging innovation in animals, too. There are 5 functions associated with this behavior, including soaking, cleaning, flavoring, drowning, and transporting liquid. Most of the observations associated with animals dunking food are anecdotal or based on experimental studies. These authors have previously reported an innovative dunking behavior in a group of Goffin's cockatoos (*Cacatua goffiniana*). In that original case, the birds were observed to soak dry food. In the current report, the authors observed the cockatoos dunking dry food in soy yogurt. The authors suggested this was likely done to flavor their food; this had only been previously reported in Japanese macaques. In the current experimental study, 2 types of soy yogurt and water were provided, and 50% (9/18) of the cockatoos dragged their food through the yogurt. Moreover, the birds showed an overall preference for blueberry-flavored yogurt over neutral yogurt. This combination of quantitative and qualitative results suggests that the cockatoos use yogurt to flavor their food, preferring this combination over the yogurt flavor alone. Because not all cockatoos dunked their food in yogurt, the authors speculated that this represented a second food preparation innovation in this species and the first report of food flavoring evidence outside the primate lineage.