



Saving threatened herons

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Abstract

Although many herons species have robust population statuses, the IUCN/Birdlife International Red List recognizes 12 heron species as being threatened. Common risks among some species include: large-size and forest, coastal and island environments. Habitat loss and change are overall the greatest threats to heron species worldwide. HeronConservation, the IUCN Heron Specialist Group, has, for over 40 years, organized and facilitated heron conservation globally. During this period, global, regional, national and species planning have all contributed to heron conservation action. Threatened species requires species-specific conservation action, but much conservation can be accomplished through larger scale efforts that incorporate the needs of herons. An effective strategy has been creating species working groups, which have facilitated the conservation of several species. Contemporary communication systems allow for interaction, information sharing, informal and formal planning to take place in an effective manner.

Key words: Ardeidae, bitterns, conservation, conservation planning, egrets, endangered species, herons, HeronConservation, IUCN Heron Specialist Group, species working groups, White-bellied Heron.

Introduction

Herons - birds classified within the family Ardeidae - are as a group nearly cosmopolitan in their distribution in non-polar regions with some species having accommodated notably well to the human-influenced environment. As a generalization, herons are medium- to relatively large-sized, long-legged, long-billed, long-necked birds, distinctive in neck morphology and in having powder down and pectinate toenails, foraging by wading

about in shallow water and roosting and nesting communally with one another (Kushlan and Hancock 2005). That said, among the more than five dozen or so species encompassed within the breadth of the group, each such familial generalization is violated in one way or another by one species or another. Morphology, systematics, behavior and biochemistry studies repeatedly confirm herons to be an evolutionarily cohesive group, as has been uniformly recognized for 250 years since Linnaeus referred all herons he knew

to his genus *Ardea* (Kushlan and Hancock 2005). Recent biochemical study has clarified relationships of species within the family, the most intriguing being the identification of species occupying a more basal position (Boat-billed Heron [*Cochlearius cochlearius*], Agami Heron [*Agamia agami*] and tiger-herons) contrasted with the remainder of the family (Kushlan and Hancock 2005, Hruska *et al.* 2023).

The actual number of species of extant herons is, perhaps surprisingly, unsettled. Hancock and Kushlan (1984) recognize 60 species; Kushlan and Hancock (2005) recognize 62; the IUCN/BirdLife International Red List recognizes 65 including the specific distinction of a large *Ardea*, the Great White Heron (*Ardea occidentalis*) (International Union for Conservation of Nature [IUCN] 2024). Future biochemical studies are sure to resolve additional presently uncertain relationships; and, it is likely, they will reveal now unrecognized species distinctions, such as among little egrets (*Egretta garzetta* subspecies) (Hancock and Kushlan 1984), among *Butorides*, among *Ardea herodias* and *A. cinerea* populations, and among several island forms including night herons (*Nycticorax*) and purple herons (*Ardea*) (Kushlan and Hancock 2005).

Hérons provide great advantages when it comes to their conservation. They tend to be flexible, and sometimes innovative, in their habits and habitat use. Being relatively long-lived, they exhibit life history strategies emphasizing adult survival such that successful nesting need not occur on an annual basis. This life-history strategy also means that life experience counts. Knowing the local landscape and its seasonal changes, willingness to try out novel options and observational learning are mechanisms allowing accommodation to seasonal and environmental change, individual survival and population resilience. As a result, 81% of the 65 extant heron species recognized by the Red List currently are not considered to be

under threat of extinction (IUCN 2024). As an example, Cattle Egrets (*Bubulcus ibis*), a poster-child example of heron adaptability, has massively increased their ranges within the last century by taking advantage of the human-shaped landscape. Global warming is expediting the long-term trend of heron species' inching their ranges poleward.

Often locally-abundant and culturally-appreciated, even common herons are not without their conservation challenges. Continued and enhanced protection of nesting areas, feeding habitat, migratory stopover and wintering grounds, as well as cessation of artificial mortality from hunting, egging, nuisance control and accidents all remain required concerns for local heron conservation action. Further, specific populations of otherwise widespread and overall secure species face threats to their stability or persistence locally or regionally. However, the resiliency of the preponderance of heron species and populations allows much of their conservation to be undertaken through broadly encompassing conservation practices rather than requiring species-specific interventions. Depending on locality and opportunities, such programs might include assuring the needs of local herons are incorporated into regional, landscape, and national policies for wetland and woodland management, protective countryside regulations, parks and protected areas, and site-specific conservation initiatives. Such initiatives could include identification and management of Wetlands of International Importance, shorebird reserve networks, flyway initiatives and Important Bird and Biodiversity Areas. HeronConservation has identified 1,723 Important Bird Areas across the globe that are of importance to herons (HeronConservation 2024). Appropriate conservation and management of these areas would accomplish much toward keeping common herons common.

Despite the overall well-being of and resiliency displayed by most of the heron species of the world, a few species are not so well positioned.

The IUCN/BirdLife Red List recognizes 12 heron species as Near Threatened or of higher conservation concern with one being Critically Endangered (IUCN 2024) (Table 1). Unfortunately, assuring these species do not become extinct cannot rely on the inherent adaptability of herons nor only multi-species or landscape-scale initiatives; the continued existence of these species requires direct conservation action through active, focused engagement, most effectively led by species champions and stakeholders who successfully engage pertinent conservation, scientific, institutional, political and local communities. Fortunately, research and conservation action in recent years has found approaches that provide hope for the future of even these most threatened of herons. As a result, it is quite possible, despite the drastic situation of a few species, that no extant heron species need go extinct. The objective of this paper is to share some of these approaches, successes and ongoing concerns.

Table 1. Heron species of greatest concern¹.

Critically Endangered	
	White-bellied Heron <i>Ardea insignis</i>
Endangered	
	White-eared Night Heron <i>Oroanassa magnifica</i>
	Malagasy Pond Heron <i>Ardeola idae</i>
	Madagascar Heron <i>Ardea humbloti</i>
	Great White Heron <i>Ardea occidentalis</i>
Vulnerable	
	Australasian Bittern <i>Botaurus poiciloptilus</i>
	Japanese Night Heron <i>Gorsachius goisagi</i>
	Slaty Egret <i>Egretta vinaceigula</i>
	Chinese Egret <i>Egretta eulophotes</i>
Near Threatened	
	Agami Heron <i>Agamia agami</i>
	Reddish Egret <i>Egretta rufescens</i>
	Forest Bittern <i>Zonerodius heliosylus</i>

¹ Common and scientific names follow IUCN (2024).

Organizing Heron Conservation

Conservation of herons, as is the case for nearly all conservation action, fundamentally depends upon on-the-ground, locally-based engagement protecting breeding sites, managing feeding habitats and inhibiting artificial mortality. These actions are often effectively led by individuals and organizations that become advocates champions, and organizers for the species' cause. Nonetheless, organization, planning and facilitation above the local scale has proven valuable, perhaps essential. The Heron Specialist Group, organized in 1982, has taken the lead in sponsoring and participating in initiatives at regional and global scales to facilitate heron conservation on the ground (HeronConservation n.d.a).

The most encompassing planning scale is global and is encompassed in the heron global action plan, *Conserving Herons* (Kushlan 2007). The text of this published conservation plan is now readily available on line (HeronConservation n.d.b). In order to provide the background for this plan, both the biology and the conservation needs of herons needed to be synthesized on a global scale. This was provided by the monographic publications, *Heron Conservation* (Kushlan and Hafner 2000) and *The Herons* (Kushlan and Hancock 2005). The specialist group's publication, *Journal of Heron Biology and Conservation* (www.heronconservation.org/jhbc), has provided a means for updating these understandings of the biology and conservation of herons.

Tracking the conservation status of heron species and populations is needed to identify changing needs and priorities. *Conserving Herons* provided a population level analysis of conservation status of the herons of the world. Since its publication, the HeronConservation community regularly participates in updating the conservation status of herons at the species level through the IUCN/BirdLife Red List process (IUCN 2024). The

Group also has assembled standard techniques for studying, inventorying and monitoring herons, making this information available on its website (www.heronconservation.org).

The values such global-scale planning and evaluation include: providing a common base of understanding, global perspectives, shared strategies and tactics, common nomenclature and identifying priority actions. Also, by identifying priorities from an international perspective, a global plan can be used to justify and validate specific efforts that might be proposed to meet these priorities. New information, new opportunities and new priorities are continuously being uncovered. Updating global action plans and other global information need not require a committee or hard-copy publication but rather can be accomplished continuously through open-sourced volunteered information from specialist group members.

The next stepdown in planning scale is at the multinational scale. For most species, this would occur within the context of multispecies planning such as regional waterbird plans and flyway-scale initiatives. Heron conservationists must be certain to be involved in such initiatives so that herons are “at the table” when needs, priorities and funding are being negotiated. In the Americas, such regional planning for herons was encompassed within the North American Waterbird Conservation Initiative that resulted in a multinational waterbird conservation plan, *Waterbird Conservation for the Americas*, which brought herons among other waterbirds into the ongoing evolution of bird conservation in North America (Kushlan *et al.* 2002, Kushlan 2012). It is crucial for the needs for heron conservation to be incorporated into opportunities provided by international flyway initiatives, such as the African Eurasian Migratory Waterbird Agreement (www.unep-aewa.org), the East Asian-Australasian Flyway Partnership (www.eaaflyway.net) and Regional

Flyways Initiative, and the Americas Flyway Initiative (www.birdlife.org/news/2023/09/22/americas-flyways-initiative-birds-connect-us/).

A crucial scale for heron conservation planning and implementation is national and subnational because this is the scale at which governmental conservation priorities are set, organized administratively and funded – if they are to be funded. It is also the scale at which laws and policies determine much of what heron conservation can hope to accomplish. Engagement of heron conservation is essential if the needs of herons are to be appropriately considered within the conservation framework of a nation, state or province. National planning follows on the global planning and evaluation models, i.e., first documenting the distribution, population size and conservation needs of species of herons found within a country to the extent practical. This should be followed by evaluating the appropriate relationships of heron conservation needs within national conservation regulations and processes, and identifying priority actions. Such national syntheses of biology, status and needs are essential first steps, reviews for Ecuador and Paraguay are recent examples (Cisneros-Herdia and Penaherrera-Romero 2022, Yanosky *et al.* 2023). Publication of peer-reviewed national analyses of heron status and conservation needs remains a high priority so as to establish accepted population bases for conservation action within a nation.

Some species require species-specific planning at whatever scale is appropriate. Detailed species-level planning for each threatened heron species, preferably set within the context of global and regional planning and implementation is essential as conservation action generally needs to extend beyond the benefits provided by multispecies and regional initiatives. Species planning and implementation of conservation measures can be markedly effective because they are specific to the most pressing needs of a species; they pinpoint the

most important do-able actions, identify important sites for protection and management, and enlist engagement and commitment of government, organizations and species champions. In some cases, a species can become recognized as an indicator of environmental health, valued as a natural patrimony of a country or a symbol of conservation action such as White-bellied Heron (*Ardea insignis*) in Bhutan and Great Egret in the United States. Because such action is species- and geographically-specific, it can take into account national and local regulations and opportunities. Because such action addresses the most pressing of issues, it can be efficient and cost effective.

Several decades of experience has shown that species planning takes place most effectively through a working group process. Species-specific heron working groups have arisen in various ways. Several such working groups are recognized and facilitated by HeronConservation. Other approaches also have been used such as being organized by an individual, organizations or funding entity. Whatever works for a species is welcomed. In all cases, partnerships and partnership groups are generally necessary as part of recovery implementation.

The working group process generally begins with discussions among those individuals having a concern for the wellbeing of a species, followed by one or more meetings to gauge interest and potential for concerted conservation action. If interest is sufficient, a decision is taken to form into a group to facilitate ongoing engagements. The first order of business, if necessary, is to work together to develop a better understanding of the distribution and population size of the species. At the same time, to the extent possible for each species, coordinated and collaborative research carried out by group members attempts to fill gaps in knowledge essential to conservation action. Continued communication and interaction among participants are essential, made more feasible

through electronic communications. Communication linkages build the network of participants eventually, hopefully, to encompass the species range.

The collaborative development of a first-version species action plan serves to clarify information gaps, assign responsibilities, identify conservation needs throughout the range, create monitoring programs, identify potential obstacles to recovery, provide measurable implementation goals and timelines and serves as a process to enhance group engagement and cohesiveness. As the group matures, understanding increases and conservation action gets underway; the plan should be updated regularly. Subplans might be created on geographical, political or subpopulation bases. A crucial part of the planning process is to identify financial resources available, whether through targeted grants, organizational commitments or government sources. A business plan as part of or separate from the species action plan may be used to identify how organizing and funding the recovery is to be done. Grants are usually needed but need not accrue to the working group itself but rather to individuals and institutions working within context of the group's plan. There is little reason for a working group to incorporate or create an independent charity as these roles can be played more efficiently by partner organizations. The important thing is that funding get to the ground level by whatever mechanisms are available, from whomever can deliver it, to whomever can achieve its goals, and that the funded activity be successfully carried out, evaluated and reported. Throughout the process, one of the most important roles of the working group is to maintain positive communication among its members and partner organizations. Maintaining the group can sometimes be harder than forming it, as it takes persistent leadership, engagement and successful fundraising.

Threats in Common

Twelve heron species are of most immediate concern at present (Table 1). They share characteristics associated with their threatened status. For most, of course, threats come in more than one variety and there is generally more than one threat to a threatened species persistence. Nonetheless some communalities emerge.

Size counts. Several species of *Ardea* are exceptionally large birds, including the Critically Endangered White-bellied Heron, second in size only to the Goliath Heron (*Ardea goliath*), which can stand 150 cm tall; and an even larger heron was extant until about 5,000 years ago (Kushlan and Hancock 2005). Although this great heron of the Middle-east went extinct, likely by being eaten by humans, the African Goliath Heron is relatively secure at the moment. But life as a large heron is not easy. In feeding, there needs to be a tradeoff between the energy used to catch prey and energetic return; so large herons tend to eat large and relatively infrequently-encountered fish. It is not unusual for a large heron to capture one or two fish a day. Standing around waiting for a large fish to come by is always tenuous. Also being large means that the nesting period is long, as the chicks need time to grow to fledging size. The longer the nesting period, the greater the risk of failure in any one year.

Two herons of conservation concern are large, the White-bellied Heron and the Great White Heron. They live in difficult foraging situations, the White-bellied Heron using forested wetlands especially rapidly-moving mountain streams and the Great White Heron using tropical marine shallows having clear water and nowhere to hide from their prey. Large herons are not so mobile as smaller ones, so they tend to have a limited repertoire, standing and waiting for a suitable fish to come by. These large-bodied heron species also represent large, rather sedentary and approachable food

source for people. Grey Herons (*Ardea cinerea*) were featured dishes in Medieval Europe (Kushlan and Hancock 2005).

Foraging at night also has its challenges, requiring both evolutionary adaptation and successful application of learned skills. Two species of concern are night herons, the White-eared Night Heron (*Oroanassa magnifica*) and the Japanese Night Heron (*Gorsachius goisagi*). Night herons are among the most widespread herons. As might be expected, night foraging is not all that easy. Other night heron species (*Gorsachius*, *Oroanassa*, *Calherodius*) are range-restricted and inhabit breeding and wintering areas subject to deforestation as well as other threats - the persistence of the White-eared Night Heron in southern China, for example, was confirmed by a bird being offered for sale at local market (Kushlan and Hancock 2005). Island and other isolated forms of night herons are more at risk than the official listings suggest; and so, additional biochemical studies are needed to determine their taxonomic and conservation status.

As suggested in the examples above, forest-dwelling heron species face challenges. Four species of concern are forest-dwelling herons: White-bellied Heron, White-eared Night Heron, Agami Heron and Forest Bittern (*Zonodius heliosylus*). These species depend not only on forests but on availability of specific aquatic habitats available within the forests. Documenting the conservation status of forest species is often problematic as inventory and censusing are so difficult over broad stretches of forest habitat. This uncertainty can lead to disagreement in opinions as to a forest species conservation classification depending on whether one gives more or less credence to the documentable population size or to the amount of potential habitat available to the species. Population status determination based on known nests or individuals are likely underestimations whereas those based on extent of possible habitat are likely

overestimations. So, in part, the official status of forest species of concern may be the result of limited data. Or, alternatively, the massive pattern of forest alteration – previous, underway or impending – around the world could not help but be potentially devastating to populations. It is without question that these birds are threatened by such rampant forest conversion on both breeding and non-breeding grounds.

In addition to forests, two other environments emerge associated with some heron species of concern, those using coastal environments and those restricted to islands. Tropical marine environments are particularly tricky for visually-feeding herons, as successful foraging in shallow, warm, clear water in the bright sunlight is not all that easy; the fish can see them coming. Chinese Egrets (*Egretta eulophotes*) nest and winter along the coast and Great White Herons and Reddish Egrets (*Egretta rufescens*) must deal with this exposed, low-productivity environment year-round.

Islands too pose challenges. The Black-crowned Night Heron (*Nycticorax nycticorax*) and its close relative the Rufous Night Heron (*Nycticorax caldonicus*), between them, are found on all the inhabited continents and many islands. However, this dispersal ability has also led to isolation on islands. Four of the five heron species that have recently gone extinct were island populations of night herons: the Mauritius Night Heron (*Nycticorax mauritianus*), Reunion Night Heron (*Nycticorax duboisi*), Rodrigues Night Heron (*Nycticorax megacephalus*) and Bermuda Night Heron (*Nyctanassa carcinocatactes*) (IUCN 2024). The fifth, New Zealand Little Bittern (*Ixobrychus novaehollandiae*), was also an island species. Japanese Night Heron, Malagasy Pond Heron (*Ardeola idae*) and Madagascar Heron (*Ardea humbloti*) are similarly island forms at risk (IUCN 2024). Heron species and subspecies (including an endemic race of Purple Heron (*Ardea purpurea madagascariensis*) in Madagas-

car face degraded habitat as well as hunting. The Malagasy Pond Heron winters in Africa, so habitat availability in this area is also of concern.

Marsh-dwelling bitterns, particularly species of the great bittern group, *Botaurus*, tend to be at risk. Each of the four species of great bitterns are in fact of long-term conservation concern facing challenges throughout their ranges. These species depend on thickly-vegetated marshes. Accurate population information is difficult to obtain because censusing such cryptic birds relies on intensive and extensive surveys in wetlands using call detection. Fortunately, large bitterns call mightily. The heron species of concern include a species of bittern, the Australasian Bittern (*Botaurus poiciloptilus*). Given that these birds are dispersed and territorial, significant areas of marshes having appropriate water conditions and management are needed. The marshes used by the Eurasian Bittern (*Botaurus stellaris*) are affected by drainage and cane harvest. One population of the Eurasian Bittern (*Botaurus stellaris capensis*) occurs in a disjunct distribution in southern Africa, and its breeding population status remains poorly determined (Kushlan 2007). Similarly, little is known about the Pinnated Bittern (*Botaurus pinnatus*) (Kushlan 2007). All of the great bitterns deserve additional study and further evaluation of conservation status of their various populations.

A common theme among heron species of concern is the role of habitat loss, change and degradation. In fact, habitat change is the greatest communality among the species known to be at risk. Some species such as White-bellied Herons, Great White Herons and Slaty Egret (*Egretta vinaceigula*) have limited habitat and geographic breadth and so are dependent on having appropriate conditions in relatively limited space. As noted above, forest-dwelling species are faced with forest clearing and conversion; great bitterns rely on very specific reed marshes that, depending on

location, face threats from drainage, conversion, exploitation and climatic change. Madagascar may be an epicenter for wetland habitat-change threats to herons of several species and subspecies. Thirty species of herons have been evaluated as decreasing; nearly all have suffered some aspect of habitat limitations (Kushlan 2007). Along with nesting site protection, habitat management that favors herons is an overarching need for conserving herons globally and locally.

Threatened Herons

White-bellied Heron - The heron species of greatest concern, globally, is the White-bellied Heron of Asia, the only heron currently-listed as Critically Endangered. Once called the Imperial Heron (*Ardea imperialis*), its known nesting pairs can be counted on one hand, and these counts vary frighteningly from year to year. In Bhutan, 1 to 5 nests have been found annually with the population there estimated to be between 14 and 30 individuals (Royal Society for Protection of Nature [RSPN] 2022); the total world population is estimated to be fewer than 60 birds. As a long-lived heron with such a small population size and wide dispersion, any adult mortality or nesting failure, artificial or otherwise, can have a significant global population impact. Its ecological situation is precarious as it only occurs in the foothills and lower elevations of the Himalayas to about 1,500 meters. It is a wary, easily disturbed bird, nesting singly in tall trees and foraging in undisturbed ponds, lakes and fast-flowing rivers, all of which are highly vulnerable to man-made and natural disturbances including water power development, gravel mining, pollution and hunting (e.g., Khandu 2022). In Bhutan, a national priority is the development of hydropower on its mountain rivers, which would affect habitat both upstream and downstream of dams. Encouragingly, recent results show it can at times habituate to human presence (Patgiri 2022).

As of the mid-1980s, only two nests had ever been reported (Hancock and Kushlan 1984). The species nesting was essentially rediscovered in 2003, with a report of a nest in Bhutan. Over the next two decades, the desperate situation of the species led to the development of an international conservation effort (Acharja 2022, Bida 2022, Goodman 2022). A key element of this initiative was the emergence of species champions, especially the Royal Society for the Protection of Nature in Bhutan, which began study and conservation measures soon after the 2003 discovery (RSPN 2019). Other crucial champions and partners joining over the following decades included Bhutan civil authorities, Bhutan Trust Fund for Environmental Conservation, the Bhutan hydroelectric sector, non-governmental organizations, and foundations, notably the leadership of Gemma Goodman of the British-based Synchronicity and George Archibald of the International Crane Foundation, and the support of the MAVA foundation (RSPN 2019).

Meetings of interested parties from across the species' range took place in 2014 and 2015 that led to creating a working group and developing a conservation strategy (Price and Goodman 2015, RSPN 2019, 2022, Goodman 2022, Royal Society for Protection of Nature and Department of Forests and Park Services 2022). As a result, understanding and acting on the needs of the species were increasingly engaged especially in the species' apparent stronghold in Bhutan. These actions included enhanced survey and monitoring, experimenting with research and monitoring techniques, expanding work in India and China, initial attempts at captive rearing and movement studies. The working group concluded that, given the species' extremely precarious status, undertaking the drastic measure of a captive breeding program was essential, requiring partnerships among governments, scientists in different countries, the zoo community and private industry. With this partner-rich support, the breeding center was built

in 2020 and the first chicks introduced there in 2021 (Royal Society for Protection of Nature and Department of Forests and Park Services 2022). Meanwhile inventory, research and monitoring continue in nearly all range countries and the specialist group continues to provide connectivity. Perhaps the most pressing need at this moment is to secure additional and continuing funding for the captive rearing center, including establishing an endowment. Continuing inventory, monitoring, habitat use and migration research across the species range remain priorities. Securing continuing institutional support for the activities of the working group is essential.

White-eared Night Heron - This night heron, restricted in range to southern China, northern Vietnam and northern India, was for years little known and was evaluated as Critically Endangered in 1994 (Collar *et al.* 1994, Pilgrim *et al.* 2009, Shafli 2018). The Heron Specialist Group early identified the species as high priority, raised concerns, and participated in surveys and status reviews (Fellowes *et al.* 2001). Fenqi He and colleagues later documented that the species habitat was far more widely distributed in China than previously thought including in protected areas and the range may not be as fragmented as then believed (He *et al.* 2007, 2011). The species conservation status was re-evaluated and, with an estimated world population of under 1,000 in 2000, the species was determined to be endangered (BirdLife International 2017a). The species is legally protected in China, although not in Vietnam. Local food hunting does occur. Its habitat is montane and sub-montane subtropical and tropical forest and associated rivers and marshes but also it is recorded in plantations and secondary-growth pine forest. Despite apparently showing some level of accommodation in habitat use, its principal threats remain related to habitat change and forest management including timber harvest and conversion to plantation planting and other forms of agriculture.

The species does not yet enjoy a global conservation action plan, although a local plan has been prepared in Vietnam (Dine 2012). Conservation action for this species requires an increase in the breadth of surveys, monitoring and modeling to achieve an accurate understanding of population size, dispersion and trend. Research is also needed to determine connectivity among the known sub-populations so as to understand the extent of the population's fragmentation. Telemetry studies are similarly needed to determine migration patterns and wintering sites of specific breeding groups. The encouraging recognition of the species, in some areas, as a symbol of forest conservation is welcome, a recognition that should not depend on its achieving any specific conservation assessment classification. Public awareness programs to inhibit hunting are needed wherever this activity may occur; and the species needs to be given official protection in countries where it occurs but is not now legally protected.

Malagasy Pond Heron - This heron breeds in Madagascar and nearby Mayotte, Réunion and Aldabra; it winters in Africa. Classified as Endangered, it has an estimated world population of under 2,500 birds and is declining (Rabarisoa *et al.* 2020, BirdLife International 2021). Its habitat primarily is freshwater wetlands, lakes, and rivers; although on Aldabra it uses mangrove swamps and shore lagoons (Pruvot *et al.* 2020, Rabarisoa and Hajanirina in review). In Madagascar, exploitation of its eggs and young and other disturbance to nesting sites remain threats. Foraging habitat is critical and this species has the ability to accommodate to prey variation throughout its breeding period (Pruvot and Rene de Roland 2021). So, in addition to nest site protection, adjacent foraging habitat also requires conservation attention. Overall, its main threats are habitat destruction such as conversion of wetlands for agriculture, deforestation, and urbanization. Another threat may be hybridization with the Squacco Heron (*Ardeola ralloides*) (Betleja 2023).

A conservation action plan for the Malagasy Pond Heron has been prepared. The Madagascar Pond-heron International Working Group has been established under the auspices of the African-Eurasian Migratory Waterbird Agreement (Ndang'ang'a and Sande 2008). The working group is composed of representatives of national authorities in consort with invited experts and conservation organizations. The group's goals include setting priorities for action and coordinating implementation of the action plan. Important sites have been identified range-wide and the breeding population is monitored. Although this heron's white breeding plumage is unmistakable, in winter plumage it closely resembles Squacco Herons, which adds difficulty to monitoring its status on its wintering grounds. The existence of an international working group composed of national representatives to oversee implementation of the recovery plan is encouraging. The work of such a fundamentally intergovernmental board might benefit from the conservation-action engagement of non-governmental organizations, alliances, scientists and private individuals either within or adjacent to the formal working group. The conservation issues for herons as a whole in Madagascar require active intervention to conserve and manage wetlands, to assure availability of water supplies for conservation, and to inhibit hunting. Monitoring of the breeding population needs to continue; and movement and telemetry studies to better pinpoint African wintering areas are needed to assure conservation of these habitats.

Madagascar Heron - Madagascar Heron is endemic to Madagascar, although there are records from the Comoro Islands and Mayotte. In Madagascar, it is restricted to the western part of the island. The current population, estimated as fewer than 1,500 individuals and moderately declining, is considered to be Endangered (BirdLife International 2016a, Rabarisoa 2022). Its main habitats are coastal areas and freshwater lakes and rivers.

Threats include overexploitation from hunting and egg collection and loss and degradation of its wetland habitats. Colony site monitoring and protection and habitat conservation are crucial actions for the species' conservation.

As is the case for the Malagasy Pond Heron, a principal conservation concern for the Madagascar Heron is preserving and managing remaining wetland habitat, which also benefits other waterbirds including the endemic race of the Purple Heron. The Madagascar Heron does not yet enjoy the attention of a specific working group or guidance of a conservation action plan. Perhaps as a complement to the government-based Madagascar Pond-heron Working Group, a primarily non-governmental, multispecies Madagascar Ardeidae Working Group might have value.

Great White Heron - This heron's range is primarily restricted to southern Florida and, to a lesser extent, Cuba (McGuire *et al.* 2019, BirdLife International 2020a). It inhabits shallow coastal marine lagoons and less frequently freshwater wetlands. Its principal population in Florida, although occurring primarily in protected areas, has been affected by habitat degradation (Powell 1983). This heron has recently, and belatedly, been recognized as a separate species (BirdLife International 2020a, Browning and Kushlan 2022). An important next step in its conservation is better to assess global population size, trend and distribution, especially in Cuba, Mexico, Venezuela and the Caribbean so as to be able to assess genetic structure and determine connectivity among populations.

The most critical action for the conservation of this species is to reverse quickly the deterioration of its principal habitat in Florida Bay, Florida, USA, especially to assure and increase and maintain its food supply. Although the Great White Heron National Wildlife Refuge is dedicated to the species, conservation action has not

progressed much beyond monitoring. This is a species in desperate need of a conservation action plan developed by government agencies, conservation groups and scientists for at least the Florida population. A working group would facilitate this accomplishment. Action in Florida should be accompanied by support for a complete inventory of the species in Cuba.

Australasian Bittern - This large bittern has an estimated world population of only 1,500-4,000 birds in New Zealand, New Caledonia and Australia where the population of about 1,300 birds is concentrated in New South Wales (Herring 2022). Although some subpopulations occur in natural wetlands (Fitzsimonds 2022), 500 to 1,000 birds are supported by rice farms (Herring *et al.* 2019), which has provided an opportunity to connect bittern conservation with rice field management through a heron conservation program called Bitterns in Rice (Bitterns in Rice Project n.d.). The project is a collaboration among the Rice Growers' Association of Australia, Birdlife Australia and others with significant governmental engagement. A conservation plan has been prepared and conservation meetings are held (Commonwealth of Australia 2022, New South Wales Government 2022). Critical research has provided models for co-management of rice fields in ways conducive to heron conservation to guide incentives for bittern-friendly rice farming (Bitterns in Rice Project 2016). However, despite increased attention, changes in water use management within rice fields provide additional threats to rice-inhabiting bittern populations, as do climate change and increasing droughts requiring the necessity of providing drought refuges (Herring *et al.* 2021, Herring 2022).

The Bitterns in Rice Project has shown marked success in bringing attention to the bittern and producing methods for co-management of rice fields. However, pressures to change agricultural practices in light of increasing drought can under-

mine this effort. Government intervention and support and conservation allocation of water supplies will be required. Natural wetlands in which the species nests need to continue to be preserved and managed appropriately wherever the bittern is found.

The several species of great bitterns face challenges everywhere, but conservation successes have also been achieved (White *et al.* 2006). Increased communication among great bittern biologists and conservation advocates among all the species would prove of great benefit, perhaps aided by the establishment of an international, multispecies great bittern working group.

Japanese Night Heron - This range-restricted species was classified as Endangered in 2000; but, more recent surveys have suggested that its population is larger than previously thought and so was reclassified as Vulnerable (BirdLife International 2020c). However, based on ongoing deforestation across breeding and wintering areas and trapping pressures across wintering grounds, the population is inferred to be undergoing a continued decline. The species nests almost entirely in Japan (with a few records from Taiwan and South Korea), winters in the Philippines and is transitory elsewhere (Kushlan and Hancock 2005, Oh *et al.* 2010). This species declined starting in the 1970s disappearing from many of its former breeding sites; but recent breeding surveys and records from the Philippines suggest a larger than previously known population (BirdLife International 2020c). The species uses a diversity of forest habitats, from patches to heavily forested for both nesting and wintering (Hamaguchi *et al.* 2014). It also uses swamps and rice fields. Ongoing deforestation across its range and hunting on its wintering grounds continue as threats and suggest a continued population decline.

The understanding that the species may be more abundant and widespread than previously thought

is encouraging. However, modeling should be accompanied by a thorough effort to conclusively document breeding population size and its specific dispersion within Japan and to assure that these sites are protected. Movement and telemetry studies are needed to clarify its wintering grounds and what specific threats to those sites might be mitigated.

Slaty Egret - With its breeding population concentrated principally in Botswana in the Okavango Delta and Chobe River, this heron has a restricted range and habitat availability. The population is considered to be fewer than 3,300 adult birds, declining, and is classified as Vulnerable (BirdLife International 2016c). It nests in seasonally flooded wetlands starting when water levels are beginning to recede from their seasonal peak (Kushlan and Hancock 2005). When not breeding, it disperses widely moving about, apparently in response to rainfall (Hancock *et al.* 2006). Considerable efforts have been made at discovering colony sites, with known sites in Botswana increasing from 3 to 12 in the past 20 years as have other records reported from outside the nesting season (Tyler 2005, 2024). Although suitable habitat appears to be available, its documented population remains small. A species action plan was published in 2012 (Tyler 2012). However, no working group has been established and so organized follow-up to the plan has been limited. Major threats include wetland conversion to agriculture, disturbance at foraging and nesting sites, impact of non-native floating plants and taking of eggs and fledgling birds.

As the breeding range of the species is relatively limited, the most crucial conservation action is creating permanent protection for more of the Okavango Delta, especially the northern Panhandle. Much of its habitat is accessible only with great difficulty in the wet season. Nonetheless, thorough and systematic monitoring efforts are needed and additional colony sites in Botswana

and possibly in other nearby countries should be identified and protected. Outreach programs, especially to the tourist sector, are needed to relay information on the impact of disturbance and how to avoid it.

Chinese Egret - This heron nests almost entirely on small, uninhabited islands off the Asian coastline, including mainland China, eastern Russia, and North and South Korea but has been extirpated from Taiwan and Hong Kong (BirdLife International 2016b). It is migratory, wintering in the Philippines and Malaysia (Li 2006). Its population is estimated to be under 10,000 birds and is declining long term, although its population may be stabilizing in China and previously unknown colonies have been discovered. It uses shallow tidal estuaries and bays, mudflats, fishponds and paddy-fields.

The species is legally protected in its breeding range countries, although egg harvest occurs. Its declining status is primarily due to the loss of estuaries and mudflats from reclamation and loss of breeding sites due to industrial, residential and agricultural development. Protecting nesting areas and feeding areas is essential, requiring incorporation of the species needs into regional and local conservation and development planning. Its wintering areas require better definition and monitoring, especially in its apparent areas of concentration in Malaysia and conservation measures enacted in important wintering areas.

Agami Heron - This unique heron nests, sometimes in huge colonies, in Central and northern to central South America but disperses widely in the non-breeding season, sometimes at great distances from the colony site (Reynaud and Kushlan 2004, Stier *et al.* 2017, Chen *et al.* 2022). Its nesting and reproductive success depends on the extent of the wet season. Much of its known population nest in a few large colony sites while its foraging areas include wide regions of forested wetlands and

streams. Among its other distinctive features are its plumage, its much-elongated morphology and its behavior (Kushlan and Hines 2016). Its forested habitat is under threat and so the species is classified as Near Threatened (BirdLife International 2023). A species conservation action plan has been published and a working group established that facilitates communication, reporting, monitoring, research, and conservation (Stier and Kushlan 2015).

The vulnerability of this species, owing to its nesting in a few large colonies, emphasizes the need for protection of these sites from disturbance, including egging, which has proven to be an effective conservation tactic for the species (Chen *et al.* 2022). Conservation of its feeding habitats is more difficult, and requires the species needs be considered within large habitat conservation efforts, especially the establishment and management of protected areas and reserves. Continuing engagement of the Agami Heron Working Group is essential as is increased funding and institutional support for its activities.

Reddish Egret - This heron occurs exclusively along tropical and subtropical coastlines from southern North America, through the Caribbean, and Central and northern South America with birds dispersing southward in non-breeding periods. Its restricted, patchily distributed habitat includes shallow lagoons, marine flats and shorelines, and small, protected island breeding sites. Because of its restricted and threatened habitat, it is considered to be Near Threatened (BirdLife International 2020b). An international working group was established in 2006 following an organizational workshop and status assessment (Green 2023). From 2006 to 2011, members of the group conducted coordinated research including genetics, established banding and telemetry programs to assess genetic population structure and movements, conducted inventory studies and established a network of stakeholders. Species

conservation action plans were completed in 2012 and 2021, as well as was regional planning (Wilson *et al.* 2014, Green *et al.* 2022).

The species is at risk because of its restriction to shallow tropical shores, which are under threat through much of its range. Although many of its known colonies are in protected areas, other important nesting and foraging areas should similarly be protected from development, environmental alteration and disturbance. The working group's plan (Tarbox *et al.* 2020) provides a ten-year set of measurable goals for the species and its subpopulations.

Forest Bittern - One of the least known herons, the Forest Bittern, also called the New Guinea Tiger-heron, is restricted to forests of New Guinea (Kushlan and Hancock 2005). Its estimated population is 7,000 or less and is considered Near Threatened (BirdLife International 2017b). But the species is rarely seen or reported so information is really not available on its population size (Pratt and Beehler 2015). However, its threats are clear. Habitat loss, including logging, deforestation and conversion of its forest habitat.

There are few herons for which the information base is so slim. Encouraging increased reporting, formal inventory and census where feasible, and basic biological research all are needed. However, its conservation is clearly linked to the health of New Guinea's forests and forest streams, which are among the most threatened in the world. Conservation of the species and its forests in Indonesia and Papua New Guinea is a matter of international concern and controversy given limited environmental responsiveness by the government to these threats.

Discussion

Aided by their accommodative abilities and re-

siliency, most heron species are not at immediate risk of extinction. However, some are, likely including 12 currently listed on the IUCN Birdlife International Red List. Threats to the persistence of the White-bellied Heron, Australasian Bittern, Malagasy Pond Heron and Great White Heron are indisputable and require immediate action. Others, such as White-eared Night Heron, Chinese Egret and Reddish Egret may actually be more secure than presently recognized. Some species, such as Japanese Night Heron, Slaty Egret, Agami Heron and Forest Bittern, suffer from critical information gaps inhibiting appropriate assessment of their conservation status and needs.

The Red List evaluates conservation status at a species level. However, specific populations are also at risk, including the Purple Herons of Madagascar (*Ardea purpurea madagascariensis*) and Cape Verde (*Ardea purpurea bournei*), the Grey Heron (*Ardea cinerea monicae*) of Mauritania, and the Eurasian Bittern (*Botaurus stellaris capensis*) in South Africa. These and such populations as the Lava Heron (*Butorides striata sundevalli*) of the Galapagos, little egrets (subspecies) and island night herons require genetic study. But irrespective of their taxonomic status, they clearly deserve formal conservation planning and action. For these and similar species and populations at risk, species-specific conservation action is needed.

For other herons, conservation most effectively involves preserving and managing their habitats, an effort best enacted through engagement in larger scale habitat, site and multispecies conservation programs. Examples include reserved area management, ecosystem restoration programs, waterbird and wetland management, watershed protection, important area networks, international conventions and flyway initiatives.

The working group model has proven a successful

approach. Guidance drawn from the histories of the White-bellied Heron Working Group and Reddish Egret International Working Group might be particularly useful. A yet untried approach is multispecies heron working groups, such as for the great bitterns or Madagascar herons. Such conservation planning takes a series of steps:

- recognition, of species champions,
- holding stakeholder conferences,
- establishing formal working groups,
- securing institutional support and salaried leadership of threatened status,
- identification,
- creating range-wide, regional and site-based conservation action plans,
- conducting needed research, inventory and monitoring programs,
- conducting population size and trend analyses,
- identifying risk factors,
- securing overhead and project funding,
- continual nurturing the working groups,
- building capacity for conservation action across the species range,
- enacting needed conservation actions,
- adaptively revising plans

Beyond species and site conservation planning and execution, global and regional analyses, syntheses, planning, prioritization and facilitation remain necessary. The global leadership of Heron Conservation, the IUCN Heron Specialist Group, has proven useful in this. However, it is the engagement of individual members and partners that makes such large-scale undertakings possible. Fortunately, there are now ways for individuals to contribute directly to international syntheses through electronic communication and online publishing facilitated by the specialist group. It is potentially possible for the current global action plan for herons, species accounts, national analyses and biological observations to be updated through volunteer contributions online

through the HeronConservation website.

Hérons likely will continue to be of popular, scientific, and conservation interest as they respond to changing environmental conditions. In 2022, the Heron Specialist Group celebrated the fortieth anniversary of its founding. Hopefully the next 40 years will see that common heron species continue to prosper, little known herons become better studied and seriously threatened herons are supported by successful conservation action.

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