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Conservation Status and Threats of Rallidae:

a Global Assessment

A THESIS

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Erin R. Lehnert

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Dr. Christopher Butler — Major Advisor

Dr. Victoria Jackson — Committee Member

Dr. Auriel Fournier — Committee Member

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who taught me to love the wild things,
and have always encouraged me to chase them

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ABSTRACT OF THESIS
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Abstract:

The avian family Rallidae is one of the most widespread avian families of the world. Rallidae greatly exceeds the other families within the order Gruiformes in sheer number of species, taxonomic complexity, geographical distribution, and ecological niche. At the time of this writing, there is no comprehensive, readily accessible, and up-to-date compilation of the conservation status of the world's rallids. This thesis provides a brief global overview of the status of rallids worldwide, focusing primarily on regional endemics and threatened species, and identifies the main threats and the associated particular knowledge gaps.

The International Union for the Conservation of Nature (IUCN) Red List has a vast database of plants and animals found worldwide. The Red List Index (RLI) measures trends in regards to the risk of extinction; the data available for Rallidae species provides a broad measure of the overall population trend for some of the more cooperative, readily accessible, or targeted species. For many rallids, this is the only current trend indicator available on a regional or global basis. Data of avian families of similar size, equivalent global distributions, and similar lifestyles were also obtained from the RLI to compare for conservation status and population trends to place the circumstances of rallids in context; the families chosen were Anatidae, Cuculidae, Alcedinidae, and Corvidae. A chi-squared test showed significant ($p<0.05$) differences when comparing Rallidae population trends and conservation status to these four families.

Listed threats to Rallidae were obtained from the IUCN and literature searches for the family and species listed as threatened. A chi-squared test showed a significant ($p<0.05$) number of insular species to have a threatened conservation status when compared to widespread species. Further focus was primarily on endemic and near-endemic species due to the inherent risk to these species as a result of their life history. Invasive species and habitat degradation or destruction were the primary threats identified. Wetland conservation is of special concern, as the majority of Rallidae species utilize this habitat. Internationally designated Important Bird Areas, Endemic Bird Areas, and associated sites designated under the Ramsar Convention were searched for mentions of rallids.

In conclusion, Rallidae species are understudied and vast gaps in knowledge exist, particularly for species in remote locations and developing countries. The majority of rallids classified as Least Concern have decreasing or unknown population trends and should be reclassified as Data Deficient until more research is undertaken. The eradication of invasive species, particularly of mammalian predators, is essential to many endemic and near-endemic species recoveries. Habitat protections headed by BirdLife International and the Ramsar Convention are making headway worldwide, and with further research and environmental action the future of Rallidae is in turn better understood and protected.

Introduction & Review of the Literature

The avian family Rallidae is one of the most widespread avian families of the world (Garcia-R. et al. 2014, Garcia-R. et al. 2019). Belonging to the order Gruiformes, which contains 10-12 modern families depending on authority, Rallidae greatly exceeds the other Gruiform families in sheer number of species, taxonomic complexity, geographical distribution, ecological parameters, and their range of body masses (from 25g to 2500g, Livezey 1997). The 143 extant and 24 recently extinct species currently recognized by BirdLife International (2018a) are incredibly diverse, and the precise number of species is debated with scattered fossil records and ongoing genetic studies (Olson 1973b, Taylor 1996, Livezey 1997, Zelenkov et al. 2017, BirdLife International 2018a). There are 41 genera currently included in Rallidae, though this may be subject to change in the future with ongoing genetic research (Livezey 1997, BirdLife International 2018a). Relationships between Rallidae genera are poorly resolved (Wood et al. 1982, Wood and Schnell 1986, Livezey 1997, Houde 2009, Garcia-R. et al. 2014). Many rallids are poorly represented in museum collections, with some extinct rallids better represented than their extant cousins (Wood et al. 1982, Wood and Schnell 1986, Livezey 1997).

While many rallids are restricted to small geographic regions, others are incredibly widespread (Feduccia 1996, Livezey 1997). Although those birds included in Rallidae represent only a fraction (2.4%) of the approximately 10,000 avian species found worldwide, its members populate six continents (all but Antarctica) and many islands of the Pacific, Atlantic, and Indian Oceans (Garcia-R. et al. 2014, BirdLife International 2018a). Rallids' affinity for colonizing islands and insular or flightless speciation has led to a number of unique, endemic populations worldwide (Olson 1973b,

Livezey 1997, McNab and Ellis 2006, Garcia-R. et al. 2014). Spatial isolation was a substantial driver for endemisim, and while tropical regions and temperate zones contain a large proportion of rail species, small oceanic islands hold the highest rates of endemism (Garcia-R. et al. 2019)

Rallids can be found in a wide variety of habitats including freshwater and saltwater marshes, grasslands from the lowlands to alpine regions, mangroves, tropical and cloud forests, sparsely vegetated atolls, and temperate woodlands (Livezey 1997). Many species of rails are sedentary, others are migratory, and some, such as King Rails (*Rallus elegans*) and Clapper Rails (*Rallus crepitans*), will utilize both migratory and sedentary habits (Livezey 1997, Sibley 2001, Garcia-R. et al. 2014). Those species that do migrate have the capacity for vagrancy over incredibly long-distances, which contrasts remarkably with the distinct reluctance to fly when pursued that is present in most rallid species, and also contrasts with the surprising frequency of permanent flightlessness within the family (Olson 1973a, Olson 1973b, Ripley 1977, Taylor 1996, Livezey 1997, McNab and Ellis 2006).

While studies exist of the more common and widespread species, there is a dearth of information about the less common or reclusive members of the family (BirdLife International 2018a). Conducting surveys for rallids can be challenging: their reclusive nature, reluctance to fly when pursued, excellent camouflage, and nocturnal habits mean that many species are incredibly hard to detect (Sauer 1998). Monitoring the numbers of many species is difficult, and for several species the extent of range, population, and

overall status is unknown or exists only with outdated research (Butler et al. 2014, BirdLife International 2018a).

As a family, the breeding strategies of rallids are incredibly varied; while most rallids are monogamous, others practice polygyny, polyandry, promiscuity, cooperative breeding, or intraspecific brood parasitism (Sibley 2001, Dey et al. 2012, Winkler et al. 2015). Rallids tend to have large clutch sizes for birds of their size (9-21 eggs) and the chicks are semi-precocial upon hatching, though the number of young raised to maturity is generally small (Fredrickson 1969, Silkas et al. 2002). Most rallids are opportunistic omnivores, with a varying diet that includes plant material, invertebrates, fish, amphibians, other birds, and small mammals (Livezey 1997, Sibley 2001, Ciach 2007, Lardjane-Hamiti et al. 2015, Winkler et al. 2015). The source and amount of food eaten vary largely depending on the time of year and seasonal availabilities, with a tendency towards animal matter during the breeding season and plant matter during the colder months (Robert et al. 1997, Sibley 2001, Lardjane-Hamiti et al. 2015, Merritt 2016). This high degree of adaptability and omnivorous diet undoubtedly aids rallids in world colonization, but their tendency to specialize following colonization also invites vulnerability to drastic change.

As rallids have an affinity for colonizing islands, a number of unique, endemic species exist worldwide as a result of insular speciation; 16 genera are monotypic, and with many gaps in the fossil record, their taxonomy is highly debated (Wood et al. 1982, Wood and Schnell 1986, Livezey 1997, Houde 2009, Garcia-R. et al. 2014). Thirty-two extant species have reduced flight capabilities, and 19 of these have lost the ability to fly

entirely (Feduccia 1996, Houde 2009, Garcia-R. et al. 2014). Birds lose the ability to fly when that ability is no longer absolutely necessary for survival under the pressures of natural selection, whether flying was necessary for escaping predators, foraging, or reaching safer nesting locations (McNab 1994a, Livezey 2003).

Any organism with a restricted or limited range faces an increased risk of extinction. Endemic species and near-endemic species are more likely to be threatened (Tershy et al. 2015). An extreme weather event, the introduction of an exotic species, changing climate, or habitat loss from human activities have an amplified effect on isolated populations where there is no influx of new genetic material or individuals from outside the impacted area (Frankham 1997, Terborgh et al. 2001, Tershy et al. 2015). Islands are often refugia, void of land-based predators for birds, and the vast majority of flightless species can be found on islands (Livezey 1997, Garcia-R. et al. 2014). Flightless birds on islands are particularly susceptible to anthropogenic influences, putting these birds at further risk (Livezey 1997, Sibley 2001, Livezey 2003, McNab and Ellis 2006, Winkler et al. 2015). Abrupt environmental changes, such as those that typically follow human colonization, have historically caused the extinction of many insular species (Feduccia 1996, Garcia-R. et al. 2014, Winkler et al. 2015).

It is estimated that prior to human expansion, there would have been one to four endemic rallids on most islands in the South Pacific, depending on the size of the island (McNab and Ellis 2006). This may have totaled to approximately 2,000 species, an estimate that Livezey (2003) found extreme. Current estimates based on fossil evidence from cultural sites in Oceania indicate 460 to 1,600 extinct rallids extirpated long before

they were described, most of which were flightless (Feduccia 1996, Sibley 2001, McNab and Ellis 2006, Winkler et al. 2015). The Hawaiian archipelago alone had 11-12 flightless rallid species, all of which are now extinct (Olson and James 1991, McNab and Ellis 2006). The evolution of flightlessness in Rallidae, which is thought to be a response to limited resources in the absence of mammalian predators, may be one of the most extensive examples of convergent evolution among vertebrates in planetary history (McNab 1994a, b, McNab and Ellis 2006). One-third of all extant flightless bird species belong to Rallidae (McNab 1994a, Livezey 2003).

Flightless birds face different but more consequential threats from invasive species and anthropogenic influence than flighted birds (McNab and Ellis 2006, Tershy et al. 2015). Threats from invasive species such as rats (*Rattus* sp.), cats (*Felis catus*), and mongooses (Herpestidae) are particularly hazardous (McNab and Ellis 2006, Tershy et al. 2015). There are 19 flightless rallid species extant today, all endemic to small islands and representing 55% of endemic rallids.

In the last 500 years, more than 90% of avian extinctions have been species found on islands (Johnson and Stattersfield 1990, Bond et al. 2019). All 26 rallid species to have gone extinct in this time period were described from observations of live birds on remote islands where invasive species, hunting, and loss of habitat caused change too rapid for adaptation of the highly specialized birds (Sibley 2001, Winkler et al. 2015, Bond et al. 2019). Change brought by the introduction of predators, especially to populations of flightless rallids, was particularly hazardous. As shown in Figure 1, invasive species are listed as the primary contributing cause for extinction.

The St. Helena Rail (*Aphanocrex podarces*) and St. Helena Crake (*Zapornia astrictocarpus*), both endemic to the United Kingdom Overseas Territory island of St. Helena in the southern Atlantic Ocean were first noted in 1502, and are the first described rallid species to go extinct, following the influx of invasive species and hunting with Western European colonization (Olson 1973b, 1977, Boev 2015, BirdLife International 2018a). The ecological consequences of colonization were not understood or considered during that time period in history. Records of bird extinction often have to be extrapolated from journal entries of when the species was last mentioned, and frequently decades will pass before it is noted that a particular bird hasn't been seen in some time. In the case of the St. Helena Rail, it was exterminated sometime after 1656, when living birds were observed by traveler Peter Mundy (Olson 1973b, 1977, Steadman 1999, BirdLife International 2018a). The only records the St. Helena Crake's existence were dated in 1502 (Olson 1973b, Boev 2015, BirdLife International 2018a). It can be presumed that the birds succumbed quickly.

This scenario is similar for the many islands who lost described rallid species, including New Zealand, Ascension, Réunion, Mauritius (home of the infamous Dodo [*Raphus cucullatus*], whose fate was similar), Tahiti, Hawaii, Kosrae, Marquesas, and the Mascarene Islands (BirdLife International 2018a). Human activities during World War II caused the extinction of the Laysan Rail (*Porzana palmeri*) of the Hawaiian Island of Laysan and the Wake Island Rail (*Gallirallus wakensis*) of Micronesia's Wake Island. Specifically, invasive species brought by the military and sequential habitat changes brought to the island with a military installment, were the direct causation for the loss of

the Laysan Rail (Baldwin 1945). The Wake Island Rail was hunted to extinction by Japanese soldiers stranded on the island during the war (Olson and Rauzon 2011). More recently, Fiji's flightless Bar-winged Rail (*Nesoclopeus poecilopterus*) has not been observed since 1973 and is most likely extinct, as a result of the incursion of invasive mongooses and feral cats to the island (Holyoak 1979). It is with these relevant historical occurrences, where the vulnerability of insular rails is emphasized by events that led to their extinction, the fate of extant endemic and near-endemic species is of great concern. These 24 extinct Rallidae species are included in Appendix A, with information of their former range and the last year recorded.

While rails are extremely diverse in habit and distributions, wetlands are considered to be the ancestral habitat for the family and the majority of rallids spend at least a portion of their life in or around wetlands, and even species attuned to life in dry uplands are able to swim (Livezey 1997, Sibley 2001, Garcia-R. et al. 2014). From a global perspective, wetlands are endangered or in a state of active decline, either from direct anthropogenic influences or climate change and sea-level rise (Dugan 1993, Nicholls et al. 1999). Wetlands are among the most productive ecosystems in the world, but human activities have led to the loss of more than half of the wetland ecosystems of North America, Europe, eastern Asia, and Australia that existed prior to the early 20th century (Moreno-Mateos et al. 2012). Restoration efforts have been widely attempted with varying degrees of success (Moreno-Mateos et al. 2012). Larger wetlands (>100 ha), those with a higher degree of hydrologic exchange, and those in tropical climates tend to

show improvements on a faster average than those of smaller size, in temperate zones, or in a depression area (Moreno-Mateos et al. 2012).

Wetland Policy

Migratory species spend parts of their annual cycle in different regions of the world, and it is the multijurisdictional responsibility of all parties involved to protect migratory species and their habitat. Policies of individual countries exist in varying degrees around the world, and some do remarkably well in protecting their migratory birds (e.g., France and Venezuela have protections in place for more than 80% of their migratory birds, Runge et al. 2015). However, others have protections for less than 10% of their migratory bird species (e.g., China and India, Runge et al. 2015). In the United States, the Migratory Bird Treaty Act of 1918, is an agreement between the United States and Great Britain (acting on behalf of Canada) which protects more than 800 migratory non-game birds, making it illegal to pursue, take, hunt, capture, kill, or sell birds, feathers, nests, or eggs (16 U.S.C. §§ 703–712. 1918). In contrast, the countries of Central Asia and North Africa stand out for their low protection coverage for migratory birds (Runge et al. 2015).

In 1971, an international treaty called the Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat, commonly known as the Ramsar Convention and named for the city in Iran where it was originally ratified, was signed by seven countries: Australia, Finland, Greece, Iran, Norway, South Africa, and Sweden (Ramsar Convention Secretariat 2006). The Ramsar Convention's mission is

"the conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development" (Ramsar Convention Secretariat 2006). The Ramsar Convention is active in a broad range of technical areas and policy, and as of February of 2018, the Democratic People's Republic of North Korea became the 170th contracting party to have signed the treaty (Rodríguez and Valencia 2004, BirdLife International 2018b). The United States signed in 1986 (Ramsar Convention Secretariat 2006). The Ramsar Convention works towards formulating a wetland-friendly sustainability policy of conservation, restoration, and sustainable use of wetlands reaching across political borders and has designated more than 2,000 sites encompassing more than two million square kilometers of wetland. Additionally, the Ramsar Convention works in association with six International Organization Partners, including Birdlife International and Wetlands International, among others (BirdLife International 2001, Ramsar Convention Secretariat 2006, Koester 2014, BirdLife International 2018b).

Many of these Ramsar sites also overlap with Birdlife International's Important Bird and Biodiversity Areas (IBAs) and Endemic Bird Areas (EBAs): sites of international significance for the world's birds and other biodiversity, and areas of land important for habitat-based bird conservation due to the habitation of restricted-range bird species. More than 12,000 IBAs and 218 EBAs have been identified worldwide, in nearly every habitat type. The process of identifying IBAs is still in progress in New Zealand, Chile, New Guinea, Antarctica, and the world's oceans (BirdLife International 2014b, 2019a).

Another partnership that works with the Ramsar Commission is the Alliance for Zero Extinction (AZE), and is comprised of 100 non-governmental organizations designated for biodiversity conservation. The AZE works to prevent species extinctions by identifying and safeguarding the last known location of an 'Endangered' or 'Critically Endangered' species. Many of the AZE sites overlap with IBAs and EBAs. (Alliance for Zero Extinction 2018, BirdLife International 2019a).

At the time of this writing, there is no comprehensive, readily accessible, and up-to-date compilation of the conservation status of the world's rallids. In this paper I provide a global overview of the status of rallids worldwide, focusing primarily on regional endemics and threatened species, especially in relation to jurisdictional responsibility. While no actions can be taken for extinct species, those lost within the last 400 years are mentioned as a contrast and warning to similar endemics still extant today. I outline the main reasons why rallids are threatened and the associated particular knowledge gaps.

Methodology

I searched for the summaries of the recognized Rallidae species using data obtained from Birdlife International's 2018 International Union for the Conservation of Nature (IUCN) Red List. BirdLife International is a global partnership organization and world leader in bird conservation that aims to conserve birds, global diversity, bird habitat, and working with people towards natural resource sustainability (BirdLife

International 2019b). At the time of this writing, there are 143 extant and 24 extinct species within Rallidae recognized by Birdlife International.

Precise population estimates are only available for 65 species (BirdLife International 2018a). In general, the reclusive habits of many rallids make them difficult study subjects (Sauer 1998). Additionally, the remote locations and small islands they inhabit are other obstacles to researchers. The Red List Index (RLI) provides a broad measure of the overall population trend for some of the more cooperative, readily accessible, or targeted species (Butchart et al. 2004, Butchart et al. 2006, BirdLife International 2018a). For many rallids, this is the only current trend indicator available on a regional or global basis. The trend categories in the RLI are based on the movement of species through the categories used by the IUCN Red List in response to measured deterioration or improvement (Butchart 2008). This method excludes re-categorizations as a result of revised taxonomy or improved knowledge. The population trend directions are classified by the IUCN as increasing, stable, decreasing, and unknown (BirdLife International 2018a). The threats to individual species were classified by the IUCN/Conservation Measures Partnership threats classification scheme (Salafsky et al. 2008). Threat analysis was conducted for threatened species, excluding those classified as 'Extinct', 'Near Threatened', 'Least Concern', or 'Data Deficient'.

The IUCN Red List organizes flora and fauna species into categories of extinction risk based on quantitative criteria using information on the size, structure, and trends of population and range (IUCN 2001). Species that are categorized as 'Vulnerable', 'Endangered', and 'Critically Endangered' are collectively referred to as 'threatened'

(IUCN 2001). The 'Data Deficient' category applies when there is insufficient information for adequate classification (Butchart and Bird 2009). The 'Possibly Extinct' category refers to a small number of Critically Endangered species which, without evidence of the contrary, have a small chance that they may be extant and therefore should not be listed as Extinct until adequate research has found otherwise (IUCN 2001, Butchart et al. 2006).

To place the circumstances of rallids in context, I obtained data from four comparable avian families to compare conservation status and population trends (BirdLife International 2018a). The four families I selected for comparison have a similar number of recognized specie, equivalently global widespread distributions, and land-based or semi-aquatic lifestyles (as opposed to pelagic): Anatidae (ducks, geese, and waterfowl; 165 species), Cuculidae (cuckoos; 149 species), Alcedinidae (kingfishers; 120 species), and Corvidae (crows, jays, and magpies; 171 species, BirdLife International 2018a). I used a Pearson's chi-squared (χ^2) test to compare the listed population trends and conservation statuses between each of these four families and Rallidae

For the purposes of this thesis, the term "endemic" refers to a species found only on one island or within a single country (Merriam-Webster 2019). I use the terminology "near-endemic" to refer to a species found within a constrained range but is shared by two or three countries due to the placement of political borders. For example, the island of New Guinea is shared by the sovereign nations of Indonesia and Papua New Guinea. There are several insular rallid species found solely on the island of New Guinea, but due to the boundary between the two countries these Rallidae species are classified as a near-

endemic and not endemic species. I used a Pearson's chi-squared (χ^2) test to compare the number of threatened species between species that are widespread and those with restricted (endemic and near-endemic) ranges.

For the purposes of this analysis, species were grouped by geographic region into Eurasia, Africa, the Americas, or Oceania & Australia. Those species that migrated between two or more regions were assigned based on their breeding region (e.g., species that breed in Europe and overwinter in Africa are grouped within Eurasia). Species endemic to the islands of the Southern Atlantic were grouped with the Americas due to their relative proximity to South America. Madagascar and the surrounding islands in the Indian Ocean are grouped within Africa. The islands of the western Pacific Ocean near mainland Asia and Australia were grouped with either Eurasia or Australia & Oceania based on their location in reference to the Wallace Line (Metcalfe et al. 2001, Holt et al. 2013). Species with Extinct in the Wild status were left out of calculations of population trend due to their artificial population control in captive breeding programs.

A complete dossier of the species included in Rallidae, both extinct and extant, is attached to the end of this document in Appendix A. This details each species, its range, conservation status, population trends, and preferred habitat. Additionally, special note is made of those species which are endemic, near-endemic, or flightless.

Additionally, the database of Internationally designated Important Bird Areas (IBAs), Endemic Bird Areas (EBAs) and associated sites designated under either the Alliance for Zero Extinction and the Ramsar Convention were searched for mentions of rallids to ascertain the level of protections worldwide. Typically, the Ramsar Convention

looks to conserve wetlands for all wetland birds, but when special mention was made of rallids inhabiting IBAs, EBAs or AZE and Ramsar sites, the country in question was investigated more in depth for the protections allotted. The Ramsar Convention and Birdlife International keep an extensive list of conservation actions within countries. Occasionally, regional assessments of IBAs mentioned endemic, near-endemic, or threatened rallid species in specific countries; the relevant countries were then hand-picked to mention in this document to assess threat levels to the relevant rallids. Countries not mentioned in the IBA regional assessments, but known to have endemic, near-endemic, or threatened rallids existing within their boundaries, were also singled out for analysis. (BirdLife International 2001, 2002, 2005, 2009, 2014b).

Results and Discussion

Population Trends

Of the 142 species extant in the wild, nearly half are experiencing declines (63 species, 44.4%). Thirty (21.1%) are stable, and, encouragingly, four (2.8%) are increasing: the Eurasian Coot (*Fulica atra*), Slaty-breasted Rail (*Gallirallus striata*), Sora (*Porzana carolina*), and Virginia Rail (*Rallus limicola*) These four species have widespread distributions and are generally tolerant of human presence, and have likely taken advantage of unrelated conservation projects (Conway et al. 1994, Foque et al. 2009, Harisha and Hosetti 2018). The remaining third of rallids have unknown population trends (45 species, 31.7%) due to the absence of information and research. See Figure 2

for the population trend of Rallidae and Appendix A for a list of each Rallidae species and their population trends.

Of those with trend estimates, 65% of Rallidae species are in decline. Divided by geographic region, the majority of species in decline are in the Americas, Africa, and Eurasia with 25, 17, and 15 of the total 63 species, respectively. See Figure 3 for the population trend by geographic region. Trends with an unknown status constitute nearly one-third of extant rallid species, primarily from the geographic regions of the Americas and Oceania & Australia.

Conservation Status

Of the 167 rallid species, 93 (55.7%) are classified as Least Concern, 14 (8.4%) as Near Threatened, and 19 (10.8%) as Vulnerable. The higher priority classifications include nine (6%) Endangered, five (3%) Critically Endangered, and one (0.6%), the Guam Rail (*Gallirallus owstoni*) of the United States territory of Guam, is Extinct in the Wild (BirdLife International 2018a). Only two (1.2%) species are identified as Data Deficient: the Colombian Crake (*Neocrex colombiana*), near-endemic of northwestern South America, and the Philippine endemic Brown-banded Rail (*Lewinia mirifica*). Twenty-four species are extinct. See Figure 4 for the conservation status of rallids and Appendix A for a list of each Rallidae species and their conservation status. As shown in Figure 5, when grouped by geographic region, it is evident that, in general, half of the species in a given region are categorized as Least Concern.

The nine Endangered species are all endemic to small islands or single countries. Seven of the nine have decreasing population trends, while New Zealand's South Island Takahe (*Porphyrio hochstetteri*) and the Lord Howe Woodhen (*Gallirallus sylvestris*) of Australia's Lord Howe Island are considered to have stable populations; both of these flightless species have established captive breeding programs in place (Grueber and Jamieson 2011, Eddleman 2015, Gee 2018). The other seven species include the Talaud Rail (*Gymnocrex talaudensis*) of Indonesia, the Okinawa Rail (*Gallirallus okinawae*) of Japan, and Plain-flanked Rail (*Rallus wetmorei*) of Venezuela, the Junín Rail (*Laterallus tuerosi*) of Peru's alpine Lago Junín region, the Bogotá Rail (*Rallus semiplumbeus*) of Columbia's capital region of Bogotá, and Madagascar's Slender-billed Flufftail (*Sarothrura watersi*) and Sakalava Rail (*Amaurornis olivieri*).

Four of the five species categorized as Critically Endangered are endemic to small oceanic islands. Three of these are found in the Pacific: the New Caledonian Rail (*Gallirallus lafresnayanus*) of New Caledonia, the Makira Moorhen (*Gallinula silvestris*) of the Solomon Islands, and the Samoan Moorhen (*Gallinula pacificus*) of Samoa. The fourth insular endemic is the Zapata Rail (*Cyanolimnas cerverai*), found on the main island of Cuba in the Caribbean. The last Critically Endangered species is the White-winged Flufftail, which exists in two small disjunct populations in Africa: one in Ethiopia, and the second on the border of South Africa and Zimbabwe.

Comparison with Select Avian Families

The number of rallid species that have unknown population trends (n = 45 of 143 species) is significant when compared with that of each individual family (Anatidae, n = 14 of 165 species, $p < 0.0001$, ducks, geese, and waterfowl; Cuculidae, n = 1 of 149 species, $p < 0.0001$, cuckoos; Alcedinidae, n = 8 of 120 species, $p < 0.0001$, kingfishers; Corvidae, n = 1 of 171 species, $p < 0.0001$, crows, jays, and magpies). There are significantly fewer rallid species with stable population trends (n = 28) than in the Cuculidae (n = 79, $p < 0.0001$) and Corvidae (n = 53, $p = 0.0055$) families. The relatively few rallids with increasing population trends (n = 2) is significantly smaller than the number of species in Anatidae (n = 33, $p < 0.0001$) and Corvidae (n = 17, $p = 0.0046$). See Figure 6 for the population trends of Rallidae, Anatidae, Cuculidae, Alcedinidae, and Corvidae.

In conservation status, the number of listed 'Endangered' Rallidae species (n = 9) is significantly higher than the numbers of species in Cuculidae (n = 2, $p = 0.035$) and Alcedinidae (n = 2, $p = 0.035$). There are significantly more Rallidae species classified as 'Vulnerable' (n = 19) than Cuculidae species (n = 7, $p = 0.019$). Additionally, there are significantly fewer Rallidae species listed as 'Least Concern' (n = 93) than there are in the Anatidae (n = 122, $p = 0.04$) and Cuculidae (n = 130, $p = 0.013$) families. See Figure 7 for the conservation status of Rallidae, Anatidae, Cuculidae, Alcedinidae, and Corvidae.

Endemic and Near-Endemic Species

The population trends of endemic and near-endemic species reflect the statistics of the family as a whole. There are 69 extant rallid species (48.3% of 143 total extant species) endemic or near-endemic to a single island or isolated region. Of these, 37 (53.6%) have decreasing population trends. This is similar to the state of the family as a whole, where nearly half are experiencing declines (63 species, 44.4%). Endemic and near-endemic species constitute 58.7% of Rallidae species with declining population trends. Fifteen species (21.7%) are categorized as having stable population trends, which also collaborates with the family statistic of 21.1% (30 species). There are no increasing population trends for endemic and near-endemic species, as all four listed have widespread ranges. Sixteen species (23.2%) have unknown population trends with the need for more research. This also reflects the overall state of the family, where nearly a third (45 species, 31.7%) have unknown population trends. Endemic and near-endemic species constitute 35.5% of all Rallidae species with unknown population trends. See Figures 8 and 9 for the population trends and conservation status of endemic and near-endemic rallids.

Dividing rails into endemic and near-endemic versus widespread species shows that those with restricted ranges are significantly more threatened ($n = 33$, $p < 0.0001$). Thirty-three endemic or near-endemics are threatened (47.8% of 69 species, 17 Vulnerable [24.6%], 10 Endangered [14.5%], five are Critically Endangered [7.2%], and one is Extinct in the Wild [1.4%], Figs. 8 and 9). Endemic and Near-endemic species

account for 97% of threatened rallids (33 of 34 threatened species), as shown in Figure 10.

Threats

Assessing the various threats to rallids is a complex and somewhat subjective task. BirdLife International (2019) has an inventory using an extensive network of correspondents and published literature, that lists exotic and invasive species, agriculture, and direct and indirect hunting as the most potent threats to rallids worldwide. The categories used include residential and commercial development; agriculture and aquaculture; energy production and mining; biological resource use; human intrusions and disturbance; natural system modifications; invasive and other problematic species, genes, and diseases; pollution; climate change and severe weather. The loss or degradation of habitat, particularly the draining of wetlands, seems to be the most conspicuous threat to rallids worldwide (Dahl and Allord 1979, Dugan 1993, Junk 2012, Merritt 2016). Incursions of invasive species are well-studied threats to island species, but have also been documented continental species (Croll et al. 2005, Jones et al. 2008, Harper and Bunbury 2015, Oppel et al. 2016, Dueñas et al. 2018). An estimated 37% of extant rallid species are ecologically at risk of extinction as a direct result of habitat destruction and fragmentation or from the introduction of exotic species (BirdLife International 2018a). Hunting is also mentioned, as large flightless birds have historically been hunted to extinction as a food source and birds might also be killed in traps not intended for them, but is less well documented for Rallidae (Eddleman 2015).

Agriculture and aquaculture practices, especially those that lead to the complete or partial destruction of habitat, remain one of the noticeable threats to both insular and continental rallids (BirdLife International 2018a). In Indonesia, industrialization and conversion of wild places is well-established in eastern region, and with the pressure of increasing populations without environmental protections, the wild places of western Indonesia are increasingly at risk (BirdLife International 2014a, b, Chaon *Pers. comm*.). Ecotourism has benefited some of the outlying islands, but the lack of information hinders conservation efforts (BirdLife International 2014a, b, Chaon *Pers. comm*.). Some of the endemic rallids, such as the Isabelline Bush-hen (*Amaurornis isabellina*), Barred Rail (*Gallirallus torquatus*), and Talaud Bush-hen (*Amaurornis magnirostris*) are more tolerant to disturbance. Others, like the Blue-faced Rail (*Gymnocrex rosenbergii*), Talaud Rail, and Snoring Rail (*Aramidopsis plateni*), are rarely observed and presumed more sensitive to disturbance. The Invisible Rail (*Habroptila wallacii*) and New Guinea Flightless Rail (*Megacrex inepta*) do well with both natural and cultivated sago palm (*Metroxylon sagu* Rottb.) swamps, though the need for arable soil in agriculture is draining many of the swamplands (USDA Plants 2018). The island of Talaud, where the Bush-hen and Talaud Rail reside, remains as one of the few refuges without substantial human pressures, but its limited terrain and unprotected state mean that circumstances for the island could change quickly (BirdLife International 2014b, 2018a, Chaon *Pers. comm*.).

Islands warrant a unique level of attention for the sheer volume of biodiversity and endemic species, despite the small percentage of land area they represent (5.3% of

Earth's land area, Tershy et al. 2015). The four primary drivers for the loss of insular species are invasive species, habitat loss, pollution, and overexploitation (Tershy et al. 2015). For rallids, threats for insular species are predominantly from invasive species, habitat loss to aquaculture and agriculture, and overexploitation from direct and indirect hunting practices (biological resource use, BirdLife International 2018a). Whereas for continental rallids, the main threats are posed from habitat loss and modification, and from direct and indirect hunting (BirdLife International 2018a). Additionally, insular rallids tend to have smaller clutch sizes than their continental cousins, theoretically increasing difficulty in restoring population after depression (Silkas et al. 2002). See Figure 11 for threats to insular and continental rallid species.

Invasive species, particularly mammalian predators, are an important aspect of global change that alter ecosystem processes and functions significantly (Medina et al. 2011, Tershy et al. 2015, Dueñas et al. 2018). More than half of extinctions worldwide from a known cause have been due to invasive species and overexploitation (Dueñas et al. 2018). The introduction of mammalian predators to islands worldwide, whether incidentally or purposefully, has had substantial repercussions on endemic species (Russell et al. 2015). More than 60% of vertebrate extinctions since 1500 CE have been on islands, and half of these have been as a direct result of invasive species (Russell et al. 2015, Tershy et al. 2015). The relatively small population size and limited range of insular species makes them more vulnerable to extinction and endangerment than continental species (Tershy et al. 2015). Additionally, insular species have a lesser degree of genetic diversity and lack behavioral, morphological, and life-history related defenses

against predators invasive and human (Frankham 1997, Terborgh et al. 2001, Blumstein and Daniel 2005, Köhler and Moyà-Solà 2009, Tershy et al. 2015).

Of all the mammalian predators that have taken advantage of human movements, rodents, especially members of the *Rattus* genus, in particular have been overwhelmingly successful (Atkinson 1985, Jones et al. 2008). Rats and mice occur on an estimated 80% of islands worldwide, and have contributed to 40% of all bird extinctions (Atkinson 1985). Rats are opportunistic omnivores and have a high degree of adaptability that has allowed them to colonize virtually all habitat types (Harper and Bunbury 2015). Rodents cause significant damage to island ecosystems through competition with indigenous species, direct predation, and the alteration of ecosystem energy pathways (Croll et al. 2005). Their adverse impact on birds has been well documented, and almost all tropical seabird and landbirds can be affected by rats (Jones et al. 2008, Croxall et al. 2012, Harper and Bunbury 2015, Oppel et al. 2016, Bond et al. 2019). An estimated 2000 avian extinctions in the past 3500 years on islands in the South Pacific can be attributed to predation by rats (Harper and Bunbury 2015).

Feral and outdoor cats are increasingly common in areas with human populations, and are dietary generalists that will predate many species of prey (Medina et al. 2011). Cats are particularly dangerous to flightless species, though they may pose a threat to flighted birds as well (Medina et al. 2011). In many locations, cats were deliberately introduced to control rodent and rabbit populations (Nogales et al. 2004). Cats have played a role in more than 14% of extinctions to bird, reptile, and mammal species

worldwide, and are the principal threat to 8% of Critically Endangered birds, reptiles, and mammals (Galbreath and Brown 2004, Medina et al. 2011, Tershy et al. 2015).

Eradicating invasive species is an effective tool for conservation, however, it is frequently a daunting, costly, and controversial task (Tershy et al. 2015). Eradicating rats from large islands is generally undertaken with the widespread dispersal of poisoned bait, though the risks involved can be high in terms of non-target species death (Oppel et al. 2016). However, with the successful removal of rats, ecosystems typically rebound and avian populations have shown quick recoveries without rats predating nests (Atkinson 1985, Jones et al. 2008, Oppel et al. 2016). Cats are often controversial to eradicate due to their status as a common pet and the ethical animal welfare battles against control methods (Robertson 2008, Cowan and Warburton 2011). Cats have been eradicated from at least 48 islands, using trapping and hunting, introduced disease, poisoning, or a combination of these methods (Nogales et al. 2004). Studies of cat eradications have shown near-immediate improvement in the annual survival rates of adult birds (Wolf 2002, Keitt and Tershy 2003, Nogales et al. 2004).

National Jurisdictional Responsibility

With five threatened species (Talaud Rail, Talaud Bush Hen, Blue-faced Rail, Invisible Rail, and Snoring Rail), Indonesia has more threatened rallids than any other country, with Colombia, Ecuador, Madagascar, and New Zealand each having three species. However, when examining rallids with decreasing population trends and those that are unknown by country, the numbers are more pronounced. Indonesia is again the

frontrunner with 25 of the total 32 rallid species (12 decreasing, 13 unknown), followed by Brazil with 24 of 31 total species (11 decreasing, 13 unknown), and Colombia with 21 of 27 total species (eight decreasing, 15 unknown). The most important countries, in terms of the endemic or near-endemic species, are the island countries of Indonesia (14 species, eight endemic), Papua New Guinea (seven species, two endemic), Madagascar (seven species, all endemic), and Australia (five species, four endemic). The island of New Guinea is shared by Indonesia and Papua New Guinea, and has six endemic insular species, some shared by the two countries, but others are found only on the eastern or western side of the political border of Indonesia and Papua New Guinea. The number of endemics on this island is only surpassed by Madagascar, which has seven species alone. See Figure 12 for endemic and near-endemic species by country. Brazil, Ecuador, Argentina, the Philippines, and the Solomon Islands are the other forerunners for number of species.

Countries with extant endemic flightless rails include: Indonesia (three), New Zealand (two), Papua New Guinea (two), Australia (two), the Solomon Islands (two), St. Helena, Ascension and Tristan da Cunha (two), the Philippines (one), the United States (Guam, one), Pitcairn (one), France (New Caledonia, one), Japan (one), and Samoa (one). New Zealand has the largest concentration of extant flightless birds: 16 extant species, including two rails (Grueber and Jamieson 2011).

Many of these countries have taken drastic efforts to protect their flightless birds. Australia's flightless Lord Howe Woodhen has a stable population following decades of directed effort at eradicating exotic mammalian species from the island and captive

breeding efforts (Eddleman 2015). Following the rediscovery of New Zealand's South Island Takahe in 1948, which had been presumed extinct since 1898, efforts to save the bird have persisted for decades (Grueber and Jamieson 2011). Takahe underwent an extreme genetic bottleneck and forced relocation to New Zealand's alpine regions to escape predation, but have today been reintroduced to a newly predator-free Kahurangi National Park (Grueber and Jamieson 2011, Gee 2018). Long-term conservation actions have also benefitted the Extinct in the Wild species, the Guam Rail (Micronesia, United States), which has been maintained in captivity since 1983, when 21 wild individuals were brought to a captive breeding facility (Haig et al. 1994, Fontenot et al. 2006).

Important and Endemic Bird Areas and Wetlands

There are 12,922 Important Bird Areas identified around the world, as of January 2019 (BirdLife International 2018c). The Ramsar Convention also designates wetland sites, but these sites have no protections in place unless the country where the site exists becomes party to the agreement and places its own protections in place. Important Bird Areas are an umbrella over other areas that are protected or found to be important. The Ramsar Convention focuses on wetlands, and Important Bird Areas that are on wetlands will often overlap; thus, focusing on IBAs will include wetlands as well as other habitat areas. Other designations that will fall under the IBA umbrella are Endemic Bird Areas (EBAs) and Alliance for Zero Extinction (AZE) sites. Endemic Bird Areas hold two or more restricted range (<50,000 km^2) species, and the area is designated by their combined ranges to define the EBA geographically (Stattersfield et al. 1998, Fishpool et

al. 2001, BirdLife International 2019a). The Alliance for Zero Extinction (AZE) sites are key biodiversity areas where greater than 95% of an Endangered or Critically Endangered species resides for at least one life history segment, and 1,483 species worldwide inhabit designated sites (Alliance for Zero Extinction 2018). Some rallids are designated in EBA or AZE sites, such as Cuba's Zapata Rail in the AZE Ciénaga de Zapata, but as one protected area will benefit all the species found within, these sites not designated for rallids yet maintain importance.

Migratory bird species require a complement of interconnected sites for the whole of their annual cycle. Recent research by Runge et al. (2015) focusing on the IBAs included in the Ramsar Convention found large gaps and inadequacies in migratory bird conservation, particularly in Africa, South America, China, and India. More than eight thousand IBAs have been designated for migratory bird species, but Runge et al. (2015) found the vast majority of the 800+ specified migratory species (97%) to lack protection for the whole of their annual cycle. (BirdLife International 2014b, Runge et al. 2015).

Important Bird Areas face danger from a wide range of threats, namely from unsustainable agricultural practices and human disturbance, but the majority of IBAs face threats from multiple sources. Birdlife International chose the 356 most threatened IBAs for analysis of threats, and found that those IBAs with wetlands are particularly threatened, followed closely by forests and grasslands (BirdLife International 2014b, a). See Figures 13 and for threats to Important Bird Areas and threatened habitat types.

The Americas

In the Americas, wetlands have long declined in quality and quantity due to drainage, filling, and overall impairment (Mora et al. 2011). Approximately 89.4 million hectares of wetland existed prior to European settlement in the area that would become the continental United States. Societal priorities, technological advances, and historical events have had an overall destructive influence on wetlands in the country, with more than half of the country's wetlands destroyed by 1980, a process that was incentivized for decades (Dahl and Allord 1979, 1991). Public perception on the value and necessity of wetlands has changed dramatically in the last half century, and due to recent federal regulations and mitigation efforts, the total acreage within the United States has stabilized (Dahl 2006, Mora et al. 2011).

North American wetlands have many taxa listed as species of concern but are typically managed to maintain hunted waterfowl populations and associated biotic and abiotic communities, and so may not meet the needs of other waterbirds (Sterling 2008, Mora et al. 2011, Fournier et al. 2017). In recent years, efforts to create or restore wetlands have increased in the United States (Mora et al. 2011). The capability of created or restored wetlands to support their targeted communities varies from case to case, and landscape attributes such as road density, anthropogenic development, fragmentation, and isolation cause decreasing diversity trends in bird communities (Martin et al. 1997, Mora et al. 2011). There are 964 identified Important Bird Areas in North America, but the majority are small (528 < 10,000 ha) and most (872) are have protections that cover less than half of the area (BirdLife International 2001, 2014b, 2018c, Fig. 15).

In South America, it is estimated that up to 20% of the continent may be occupied by wetlands, with the prominent types being intermittent interfluvial wetlands and river floodplains (Junk 2012). Despite their participation in the Ramsar Convention, the few collaboration efforts between countries of South America are insufficient in establishing protections (Junk 2012, Koester 2014). There are 1,126 identified IBAs in South America, and 694 of these have legal protections that cover less than half of the area or protections are nonexistent (BirdLife International 2018c). A further 52 sites have a pending or unknown legal status. Until recent years, the low human population density in many wetland areas in South America has provided a level of protection; however, pressure from the human population growth and climate change is increasing (Junk 2012). (Alliance for Zero Extinction 2018, BirdLife International 2018a, 2018c, 2019a).

There are 449 identified IBAs in Central America and the Caribbean, and 208 of these have legal protections that cover less than half of the area (BirdLife International 2018c). Protection status for 69 of the 449 sites is unknown (BirdLife International 2018c). There are 30 Alliance for Zero Extinction sites, one of which is an AZE site for Cuban endemic Zapata Rail, on the main island of Cuba at Ciénaga de Zapata (Alliance for Zero Extinction 2018, BirdLife International 2018a, 2018c, 2019a, Figs. 16 and 17).

Eurasia

The European continent has a wide range of wetland types that reflects its regional diversity of climates, hydrology, and animal, plant, and human life. In the 20th century, many wetlands were degraded by pollution or drained for agriculture and

urbanization. Increasing conservation awareness has decreased the advance of human pressures on wetlands, though pressure prevails in most areas. (Hughes 1995)

In Europe, a total of 4,891 IBAs have been designated by BirdLife International. The Ramsar Convention has legal protections in place for and protected 3,122 of these IBAs and the 5 included AZE sites (BirdLife International 2018c). BirdLife partners challenge threats to IBAs with legal suits in hundreds of cases yearly. In the year 2014 alone, BirdLife International filed 63 cases involving IBAs protections, typically with breaches of EU environmental protection laws (BirdLife International 2014b, Fig. 18).

One rallid, the Corncrake (*Crex crex*) is designated as a species of global conservation concern in Europe (BirdLife International 2014b). The presence of Corncrake, with a threshold of 60 individuals, is grounds for designating an IBA, and has resulted in several IBAs in Europe, such as Norway's Nordre Øyeren & Sørumsneset (BirdLife International 2014b). Other rallids observed in European IBAs and Ramsar Sites and mentioned in the regional document (BirdLife International 2001), though not considered threatened and so without a special note other than to indicate presence, include the Common Moorhen (*Gallinula chloropus*), Western Swamphen (*Porphyrio porphyrio*), Eurasian Coot, and Red-knobbed Coot

Countries across Central Asia stand out as having a low percentage of protected areas for migratory species (Runge et al. 2015). In Asia, a total of 2,293 IBAs have been identified in the 28 countries from Pakistan to Indonesia to the Russian Far East. Of the contracting parties within Asia, only Bangladesh, Hong Kong, Mongolia, Nepal, Pakistan, Thailand, and the Philippines have designated more than 20% of their potential

Ramsar sties as of 2005. Indonesia, Myanmar, South Korea, and Vietnam have the least coverage, with less than 5% of their sites designated by 2005. In Birdlife International's regional report (2005), there are 17 bird species that do not have adequate coverage in IBAs, three of which are rallids endemic to Indonesia: the Snoring Rail, Blue-faced Rail, and the Talaud Rail. Two other threatened rallids are included in Asia's IBAs and Ramsar Sites documentation, the Japanese endemic Okinawa Rail and more widespread Swinhoe's Rail (*Coturnicops exquisitus*), found in disjunct populations in Japan, North and South Korea, China, Mongolia, and Russia (BirdLife International 2005, 2018a, Fig. 19).

China is the second largest and most biologically diverse country in the Eurasian region, and while it hosts almost all types of wetland (excluding only Arctic Tundra and tropical peat swamp forest), many of its wetlands, particularly those in the east, exist under extreme pressure from disturbance and human usage (BirdLife International 2005). In recent years China has been progressive in wetland conservation, however large gaps and inadequacies remain, especially in the east. China's intertidal habitats on the Yellow Sea, which are rapidly decreasing with land reclamation, are a part of the East Asian – Australasian flyway. One rallid, the Swinhoe's Rail, is listed as a special species of concern and recorded in three Ramsar Sites that overlap with IBAs: in Zhalong Nature Reserve (210,000 ha, Heilongjiang Province), Poyang Hu Wetlands (464,664 ha, Jiangxi Province), and Dongting Hu Wetlands (500,000 ha, Hunan Province, BirdLife International 2005, Runge et al. 2015, BirdLife International 2018c).

Indonesia is a vast archipelago of more than 17,500 islands, of which 6,000 are inhabited (Embassy of the Republic of Indonesia 2017). Indonesia merits special concern with more endemic and near-endemic rallids than any other country. Indonesia's geographical placement makes for difficult taxonomic classifications. Rallids that are found on the Asian side of the Wallace Line are included within the Eurasian subgrouping in this thesis, and those on the Australian side are included in Australia & Oceania. The most extensive wetlands are found in the western end of the country, on Java, Sumatra, and Borneo's Kalimantan. Only two Ramsar sites have been designated, one in Kalimantan and one in Sumatra, but an additional 47 potential sites have been identified in the country. (BirdLife International 2005, Holt et al. 2013).

Japan is a densely populated, mountainous country, where the majority of its human population lives in the coastal lowlands (World Population Review 2019b). Large freshwater wetlands exist on Kyushu and Hokkaido. Thirteen Ramsar sites have been designated in Japan, and additional 112 are proposed: one of which, Hotokenuma in northern Tōhku, records the Swinhoe's Rail as a species of concern that is present in the site. The Endangered endemic Okinawa Rail can be found on the island of Okinawa, but is more associated with forest habitats and is not found in any proposed or existing Ramsar sites. Yambaru, of the northern Okinawa forest, is a designated AZE site for six species, including the Okinawa Rail. (BirdLife International 2005, Ozaki et al. 2010, Alliance for Zero Extinction 2018).

The Democratic People's Republic of North Korea is the newest contracting party to the Ramsar Convention, and has yet to designate Ramsar sites. The country does,

however, have several important wetlands on the eastern coast and in the Demilitarized Zone that are part of the Australasian-East Asian flyway. There is a compiled list of wetlands and 25 IBAs and proposed sites that will hopefully enter the convention in the next few years. The Swinhoe's Rail has been recorded in one IBA: Lake Kwangpo (4,500 ha, South Hamgyong Province) and adjacent rice paddies. (BirdLife International 2005).

In Russia, the extensive steppe, taiga, and tundra wetlands support vast numbers of wetland birds, most of which migrate along the Australasian-East Asian flyway between breeding and wintering grounds. Russia has designated 34 Ramsar sites, and has 118 additional potential sites. The Swinhoe's Rail has been recorded in two of these: Torey Lakes (172,500 ha, Chita Province), and Khanka Plain (380,000 ha, Primorye Territory). (BirdLife International 2005).

Australia & Oceania

Australia has identified 314 IBAs covering nearly 44 million ha of land, 26 million of which are specifically designated for globally threatened species (BirdLife International 2009). Nearly 17% of their IBAs overlap with their 171 Ramsar sites. Australia has more than 300 endemic avian species, including 7 rallids, and exceeds the efforts of most other countries to identify habitats of importance to birds in addition to wetlands: they also include rainforest, savanna, and arid grass- and shrublands. Many of their IBAs are outside of protected zones, but the Australian government works with property owners to aid conservation efforts. The legalities of the Ramsar Convention imposes legal management obligations that make it difficult to negotiate with

landowners, so not all of their IBAs are currently eligible to become Ramsar Sites. There is an AZE site on Lorde Howe Island, designated for the Lorde Howe Woodhen. (BirdLife International 2009, Alliance for Zero Extinction 2018, BirdLife International 2018c, 2019a).

Islands that are isolated with reduced human pressure remain important to bird populations, particularly for migratory species that utilize the Australasian-East Asian flyway. The Oceania countries of Fiji, Kiribati, New Zealand, Palau, Papua New Guinea, the Marshall Islands, and Samoa are all contracting parties of the Ramsar Convention. There are six Ramsar Sites in the region, with two in Papua New Guinea, and one in each of Samoa, Palau, the Marshall Islands, and Fiji. Three additional sites are in the process of nomination in Samoa, the Marshall Islands, and Fiji. Kiribati, the Cook Islands, Tonga, and Nauru are in the process of designating their IBAs. At the regional level there are many policies, plans, and partnerships to aid countries in the process of getting legislation into place to protect wetlands (SPREP 1999, Ellison 2009, Figs. 20 and 21).

In eastern Indonesia, east of the Wallace line, the largest wetlands are in Irian Jaya. There are no designated Ramsar Sites east of the Wallace Line, but two proposed sites have identified rallids in their IBAs: Blue-faced Rail in Rawaw Aopa Watumohai (105,194 ha, Sulawesi Island), and Invisible Rail in Rawa Sagu Ake Jailolo (10 ha, Maluku Island, BirdLife International 2005, Holt et al. 2013). (BirdLife International 2005, Holt et al. 2013).

Indonesia's island of Talaud, where the Talaud Bush-hen and Talaud Rail reside, remains as one of the few refuges without substantial human pressures, but its limited

terrain and unprotected state mean that circumstances for the island could change quickly (BirdLife International 2014b, 2018a, Chaon *Pers. comm*.). Talaud's Karakelang Utara is an AZE site for the Talaud Rail (Alliance for Zero Extinction 2018). Karakelang Utara is also an IBA with no existing protections (BirdLife International 2019a).

Wetlands in Papua New Guinea, where there are nine endemic or near-endemic rallids, are more heavily developed than those in more remote areas of Oceania (World Population Review 2019a, Chaon *Pers. comm*.). The freshwater ecosystems and ecology are relatively well-studied compared to other countries in the region, but with the large scale and complexity of these habitats, there remains a great deal to research. The vast lakes, marshes, swamps, and floodplains of Papua New Guinea support large populations of waterbirds in addition to local human communities (Chaon *Pers. comm*.). The Papua New Guinea and Solomon Islands archipelago supports the most diverse bird faunas of the Pacific Island region. Papua New Guinea was the first of the Pacific Islands to sign the Ramsar Convention, with several sites representing the wide range of wetlands in the country (Osborne 1988, Mayr and Diamond 2001, Kailola 2003, Ellison 2009).

The Solomon Islands, which has four endemic rallids, is not party to the Ramsar Convention (Koester 2014, BirdLife International 2018b). This archipelago country consists of 906 islands, which saw major action during World War II between the United States and Japan in Guadalcanal (Embassy of Solomon Islands 2018). Ethnic violence and civil unrest over the decades after the war ended meant that the island ecosystems were largely exploited for resources (Mayr and Diamond 2001, Ellison 2009). The Solomon Islands have some of the most extensively developed wetlands in the region,

and high rates of ecotourism with minimum restrictions (Mayr and Diamond 2001, Ellison 2009). Populations of birds, amphibians, reptiles, and marine species on the islands are in severe decline (Mayr and Diamond 2001, Ellison 2009). Some conservation programs have begun in the Solomon Islands, one in particular features a site in the Makira Mountains targeting conservation of the Critically Endangered rallid, the Makira Moorhen, but further actions are needed (Mayr and Diamond 2001, Ellison 2009, Alliance for Zero Extinction 2018). The AZE Site on East Makira is designated solely for the Makira Moorhen, though it has not been observed for 50 years (Mayr and Diamond 2001, Ellison 2009, Alliance for Zero Extinction 2018, BirdLife International 2019a).

Africa

A comprehensive network of IBAs has been identified across the 58 countries and territories, totaling 1,228 IBAs and covering 7% of the African region. The effective protection and management of these sites, a relatively low percentage of the area of each country, is a realistic goal that would make a significant contribution to the conservation of many bird species (Fishpool et al. 2001, Fig. 22).

Research focusing on the Important Bird Areas found particularly large gaps and inadequacies in migratory bird conservation and protected areas in North Africa (Runge et al. 2015). On the African continent and the surrounding islands, only 586 of the 1,228 total IBAs have been protected under the Ramsar Convention (BirdLife International 2002). Many migratory species in Europe and Asia migrate to Africa to overwinter; as such, Ramsar sites in Africa were selected by identifying areas where greater than 1% of

the total population estimate of a wetland bird species was present, and by including flyway populations (BirdLife International 2002). Twenty-seven rallids are included in the Ramsar IBAs for the African continent and surrounding islands, seven of which are designated of special concern: White-winged Flufftail (*Sarothrura ayresi*), Slender-billed Flufftail, Corncrake, Rouget's Rail (*Rougetius rougetii*), Inaccessible Island Rail (*Atlantisia rogersi*), Sakalava Rail, and Gough Moorhen (*Gallinula comeri*, BirdLife International 2002, Runge et al. 2015).

There are four Endemic Bird Areas (EBAs) on the islands surrounding the African continent where Rails are the named protected species: Gough Island (Gough Moorhen), Tristan Islands (Inaccessible Island Rail,), and two locations in Madagascar, the East Malagasy Wetlands (Madagascar rail, *Rallus madagascariensis*) and West Malagasy Wetlands (Sakalava Rail, Stattersfield et al. 1998, Fishpool et al. 2001, BirdLife International 2019a).

Conclusions

Rallidae include a small portion of avian species, but are a diverse family with their worldwide distribution and dynamic life history. There are 41 genera currently included in Rallidae, though relationships between genera are poorly resolved, and this may be subject to change in the future with ongoing genetic research. However, despite their widespread distribution, being found from alpine regions to mangrove swamps, they are, as a whole, an understudied family. While studies exist of the more common and widespread species, there is a dearth of information about the less common or reclusive

members of the family. Many rallids are poorly represented in museum collections, with some extinct rallids better represented than their extant cousins. Assessments by BirdLife International (2018a) point to declining populations, and the research sited is generally outdated. This possibly makes population estimates overstated, or have no known populations trends or numbers.

Spatial isolation was a substantial driver for endemisim, and while tropical regions and temperate zones contain a large proportion of rail species, the highest rates of endemism are found on small islands. Species with restricted ranges, particularly those who are flightless, are more susceptible to environmental changes or events. Invasive species and habitat loss continue to be the main driver of avian extinctions, more than 90% of which have occurred to island-restricted species. The 69 endemic and near-endemic rallids are the last remaining species of several hundred, if not up to~2,000, island endemics exterminated by human expansion, and the continuing biodiversity of the family is dependent on additional research.

While studies of the more common and widespread species are accessible, there is little information about the less common or reclusive members of the family. More research, especially towards the species with decreasing population trends, is the first step towards protecting rallids. With in-depth study and adequate environmental protections, this unique, remarkable family of birds might continue to persist in the wild places of the world.

Global Overview

More rallids should be listed as Data Deficient than there are currently. Less than half of rallid species (n = 67) have enough existing data to give good estimates of their population. The population trends for rallids show cause for concern: 45 species (31.7%) are unknown and 63 (44.4%) are declining. For many of the unknown and declining species, the population estimation is not recent, and with the amount of change happening in essential habitats, estimates of population sizes cannot be accurate. Very little research exists for the more reclusive species, particularly in developing countries or those recovering from social conflict, and those with significant habitat destruction rates.

It is probable that the majority of species listed as Least Concern are, in reality, Data Deficient, and when research is eventually conducted it will find them to be in a state of decline with action necessary to save the species. Of the 93 species classified as Least Concern, 68 (73%) have decreasing (n = 30, 32.2%) or unknown (n = 38, 40.8%) population trends, and all species classified as Near Threatened (n = 13) have decreasing (n = 11) or unknown (n = 2) population trends. Of those species currently not considered threatened (IUCN categories of Least Concern, Near Threatened, or Vulnerable), only 21% have increasing or stable population trends.

With endemic and near-endemic species, it is even more defined: only 18.6% (n = 11) have stable population trends and a quasi-present population estimate. Endemic and near-endemic species constitute 88.2% of threatened species, and the number of species with decreasing or unknown population trends between the 69 endemic and near-endemic species is substantial: 53.6% are decreasing (n = 37) and 23.2% are unknown.

These statistics, when compared to those of the similar avian families Anatidae, Cuculidae, Alcedinidae, and Corvidae, show that the predicament of Rallidae is significant, whether by their state of understudy or with threatened conservation status. Rallidae has significantly more unknown population trends, and significantly fewer species with stable or increasing population trends than any of the four families. There are significantly more species threatened than there are in Cuculidae and Alcedinidae, and significantly fewer species listed as Least Concern as there are in Anatidae and Cuculidae.

Endemic & Near-endemic Species

Any organism with a restricted or limited range faces an increased risk of extinction, and endemic or near-endemic species are more likely to be threatened. In the last 500 years, more than 90% of avian extinctions have been species found on islands. An extreme weather event, the introduction of an exotic species, changing climate, or habitat loss from human activities have an amplified effect on isolated populations where there is no influx of new genetic material or individuals from outside the impacted area. Species with wide ranges are slightly less at risk than those with restricted ranges, though they are still susceptible to many of the same threats, e.g. habitat degradation or destruction or changing climate. The numbers of widespread species with unknown or declining population trends is similar to the endemic and near-endemic species, however they represent a smaller portion of the whole: 36.5% (n = 27) of widespread species are decreasing, and 39.1% (n = 39) are unknown.

The four primary drivers for the loss of insular species are invasive species, habitat loss, pollution, and overexploitation. The complete eradication of invasive species on islands, particularly that of predatory vertebrates, is essential for native island species. While this is costly and time-consuming, it is a tool for conservation that has been proven effective. The islands that have succeeded in exterminating invasive species have created refugia for conservation and biodiversity. New Zealand, as a frontrunner to this effort, has completely eradicated invasive vertebrate predators from 10% of more than 600 offshore islands area, and aims to completely exterminate them from the entire country.

Captive breeding efforts for 'Critically Endangered' and 'Extinct in the Wild' species are effective at staving off extinction as a last resort. Australia, New Zealand, Japan, and the United States have done well in this with their species in grave need. Australia's Lord Howe Woodhen, though still Critically Endangered, is one of the few Rallidae species with an increasing population trend, thanks to successful reintroduction to their newly predator-free island following captive breeding and invasive eradication programs.

For the island countries of Indonesia, Madagascar, Papua New Guinea, Australia, the Solomon Islands, St. Helena, the Philippines, Pitcairn, Japan, and Samoa, the invasive species problem is of particular importance. Endemic species, especially those that are flightless, are especially vulnerable to invasive predators. This also applies to the Hawaiian Islands and New Caledonia, which are under the jurisdiction of the United States and France, respectively. In Colombia, Ecuador, Brazil, and Argentina, invasive

species are not as large of a concern as they are on islands, but research and monitoring of their endemic and flightless species remains critical.

National Jurisdictional Responsibility

Environmental policies of individual countries exist in varying degrees around the world, and some do remarkably well in protecting their migratory birds and habitat, particularly their wetlands. Historically, it was common practice worldwide to drain wetlands for human use, whether this was to make way for agricultural fields to feed populations or to develop them for building. Wetlands were, generally, seen as an unpleasant and unfavorable occupation of land that could be put to 'better' use, and as a result wetlands have long declined in quality and quantity due to drainage, filling, and overall impairment. Thankfully, this viewpoint is gradually changing with greater understanding of wetlands as refugia for biodiversity, water quality and reservoirs, or protection from hurricane and storm events.

Developing countries or those recovering from social conflict generally have high rates of habitat destruction. For example, in Madagascar and Indonesia, where there are high numbers of endemic and threatened species, there are very few protected areas and deforestation and wetland conversion rates are high. Without environmental protections and the enforcement thereof, the species here and in similar circumstances will continue to be at risk.

Migratory species spend parts of their annual cycle in different regions of the world, and it is the multijurisdictional responsibility of all parties involved to protect

migratory species and their habitat. Actions in the last 50 years have added protections to all migratory birds and to habitat. International policies, such as the Ramsar Convention and the Migratory Bird Treaty Act of 1918, and International Organization Partners, such as BirdLife International and the Alliance for Zero Extinction, have made inroads to protecting birds and their habitat. The global effort for conservation of IBA and Ramsar Sites is perhaps the most important and effective measure to protect migratory and sedentary birds. Rallidae species have an affinity for wetlands, and both migratory and sedentary species benefit from direct and indirect wetland protection. The continuation and implementation of international treaties in this changing world will help conservation of rallids worldwide.

Educating the general public about the importance of protecting wetlands, birds, and nature in general as an active part of this world, and not just as a resource to be exploited, will be by far the most effective conservation tool. This will, in turn, aid the continuation of international policy to protect natural areas with increased understanding of the importance of wild areas. We cannot protect what we know nothing about, and so research into declining or unknown species is imperative. Programs that eradicate invasive species and promote captive breeding have been shown to be successful, and maintaining the biodiversity of all natural areas depends on further research, education, and priority conservation action.

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Figures

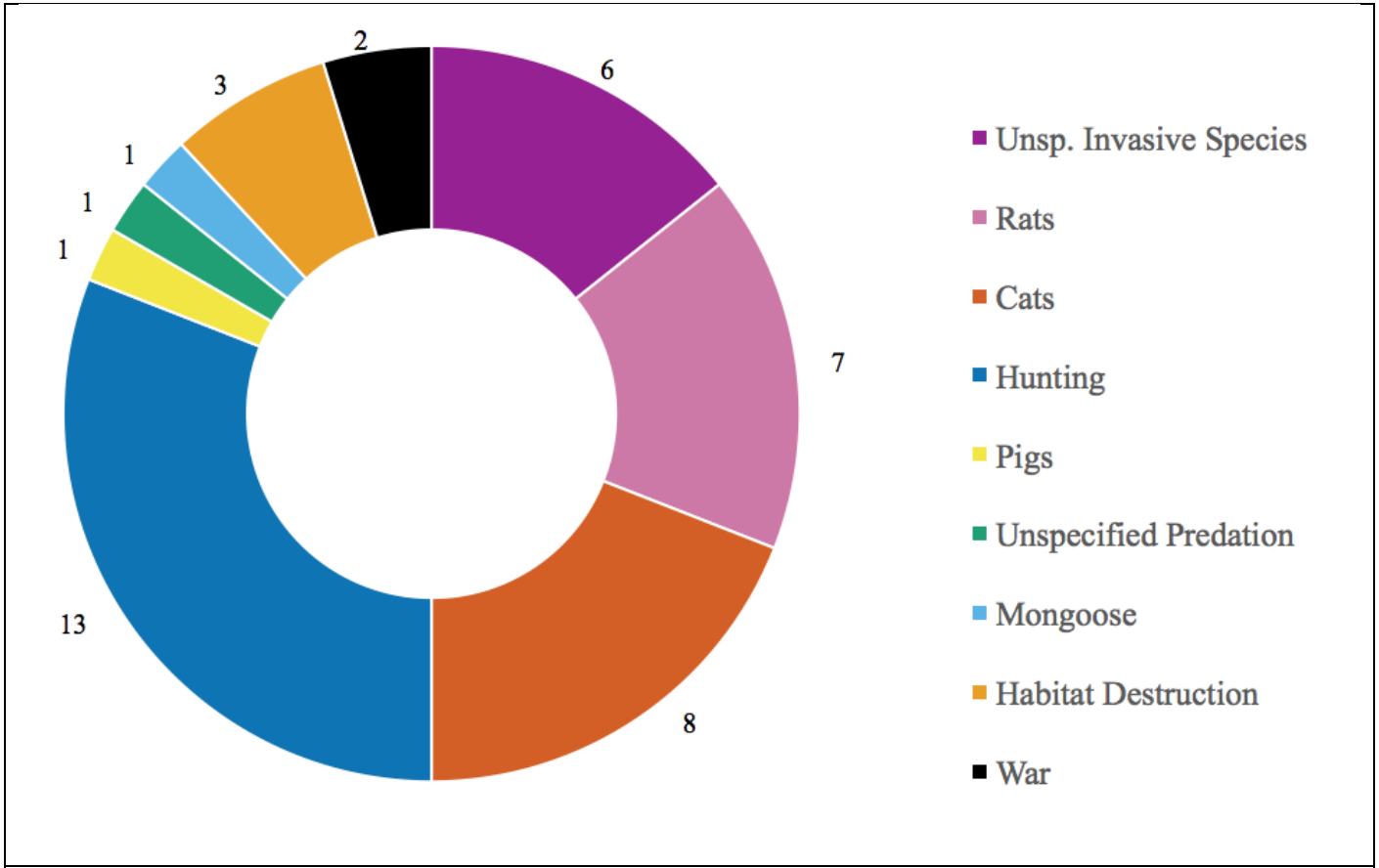

Figure 1: Cause of extinction for Rallidae species
Note that more than one cause may be evident for some species.

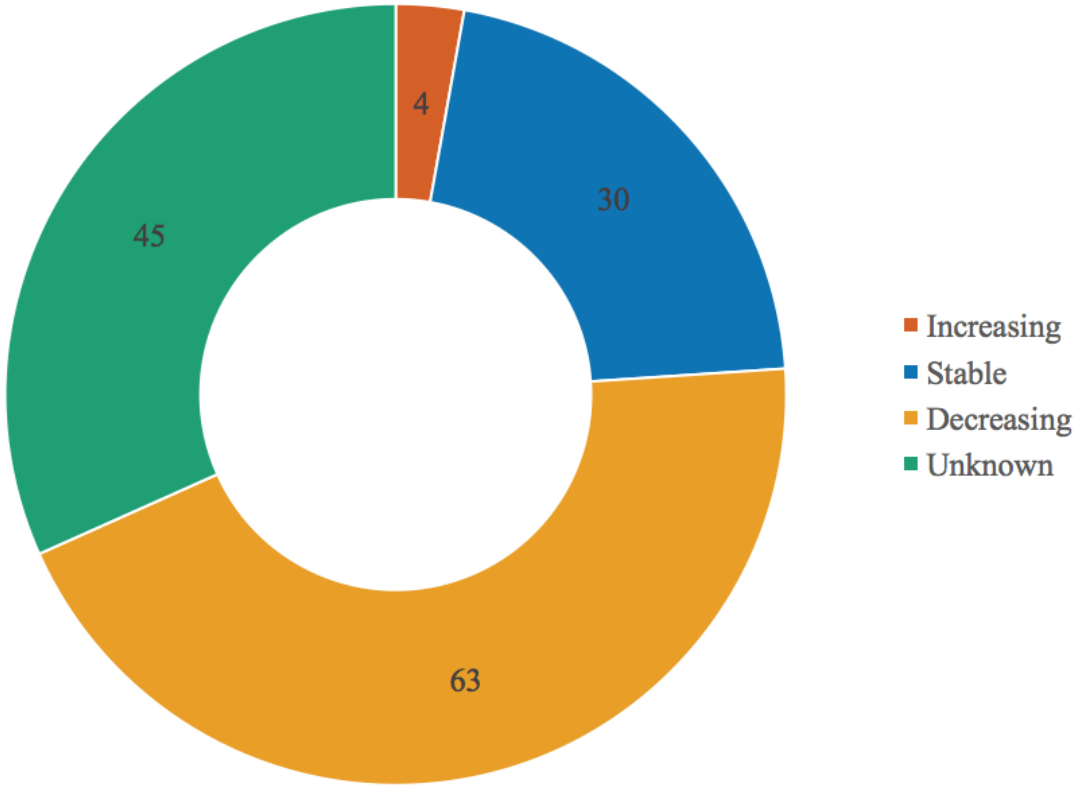

Figure 2: Population trends of Rallidae
Data labels indicate the number of species in each category of population trend.

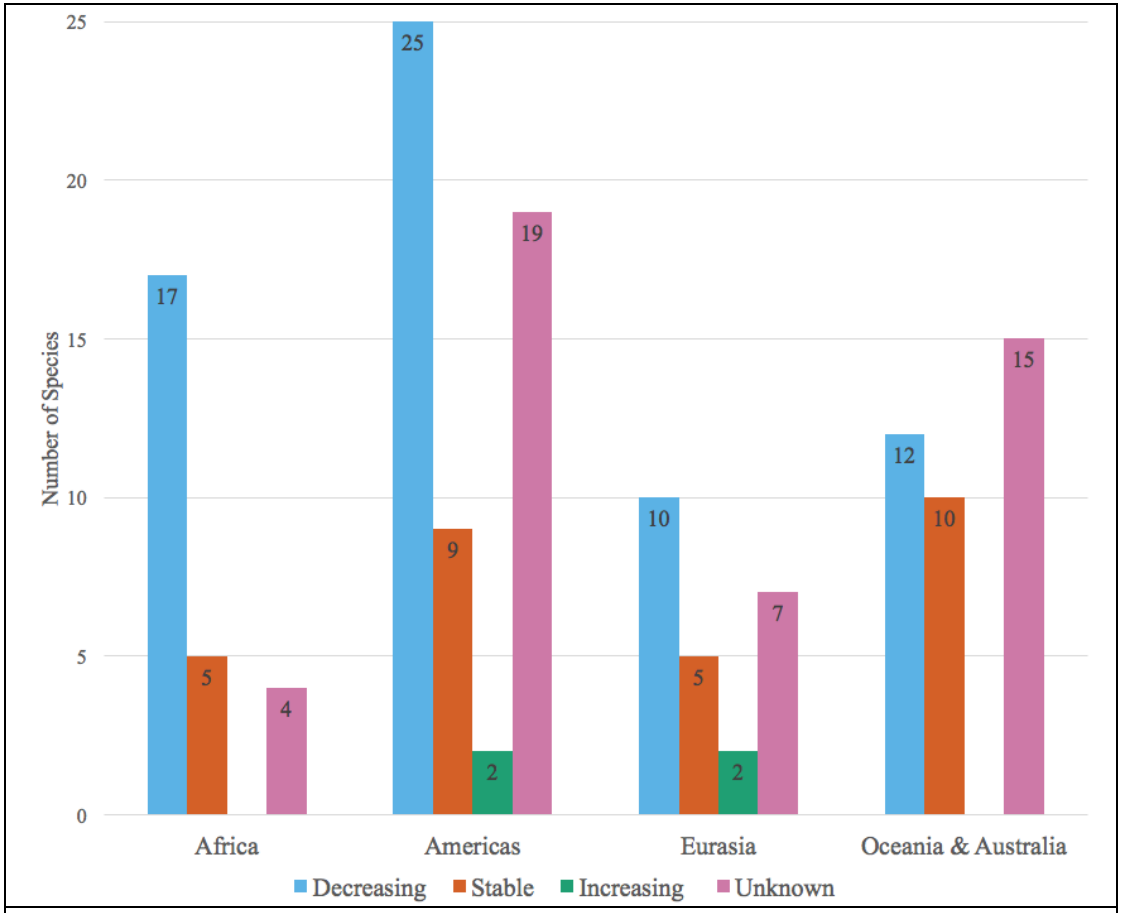

Figure 3: Rallid population trend by geographic region.

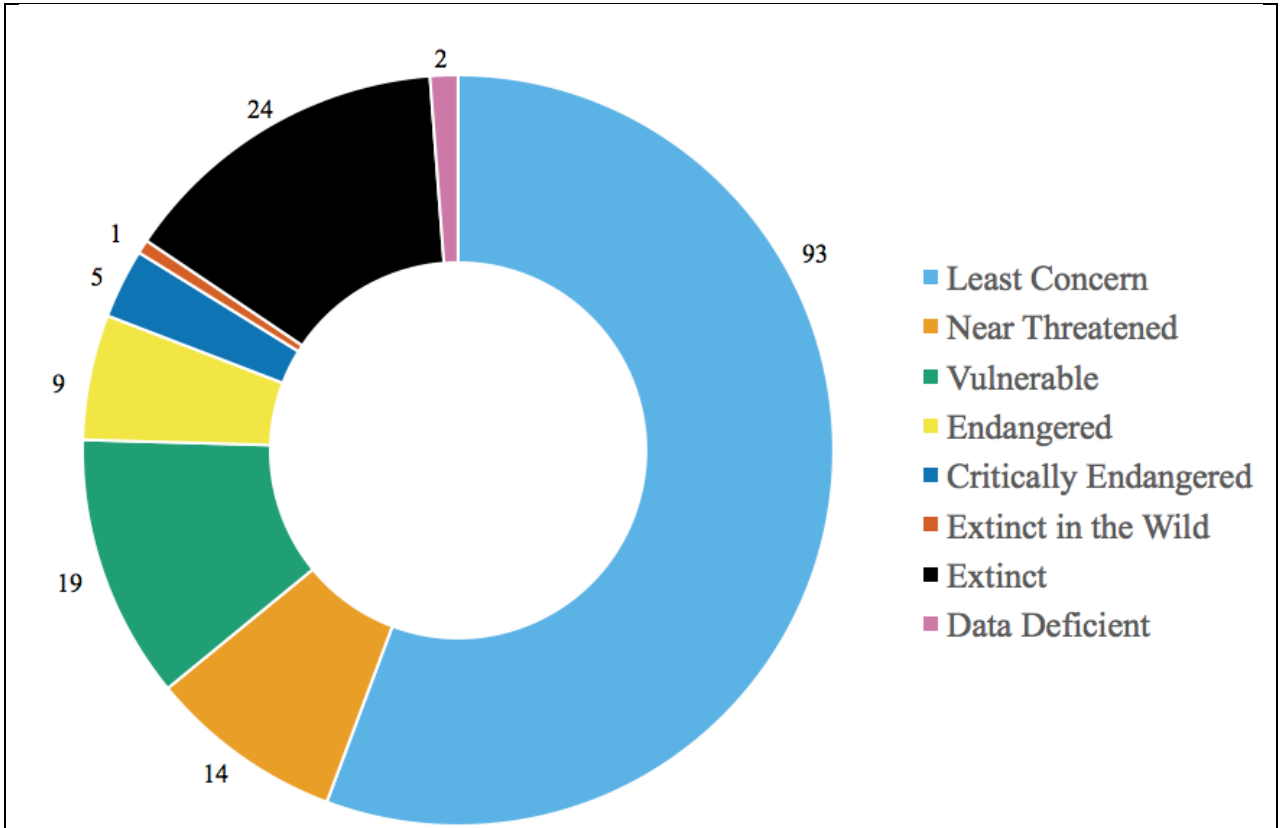

Figure 4: Conservation status of Rallidae
Data labels are number of species in each category

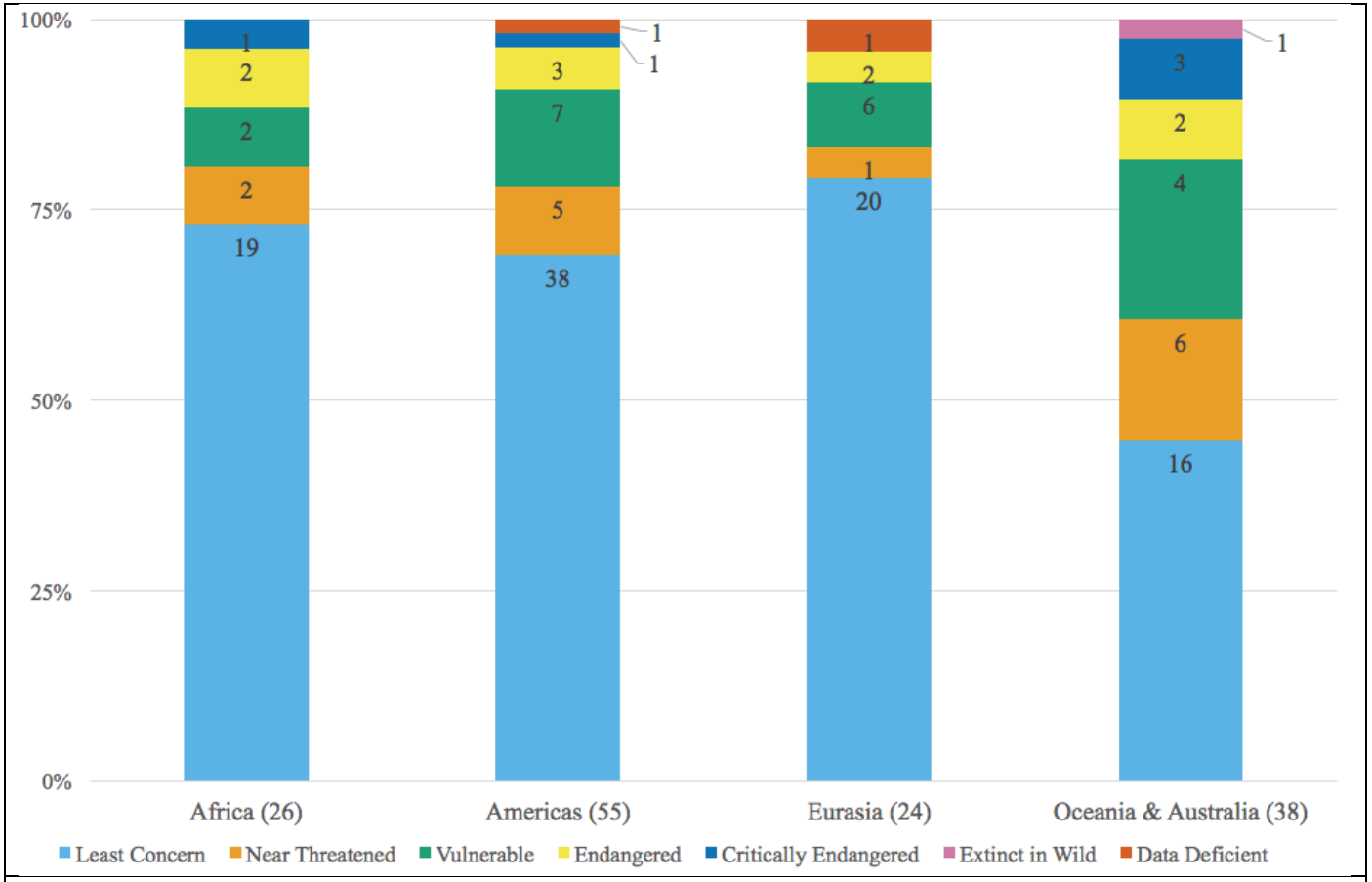

Figure 5: Conservation status of rallids by geographic region.
Data labels are the number of species in each category. Numbers in parenthesis are the total number of species for that major geographic region. Extinct species are not included.

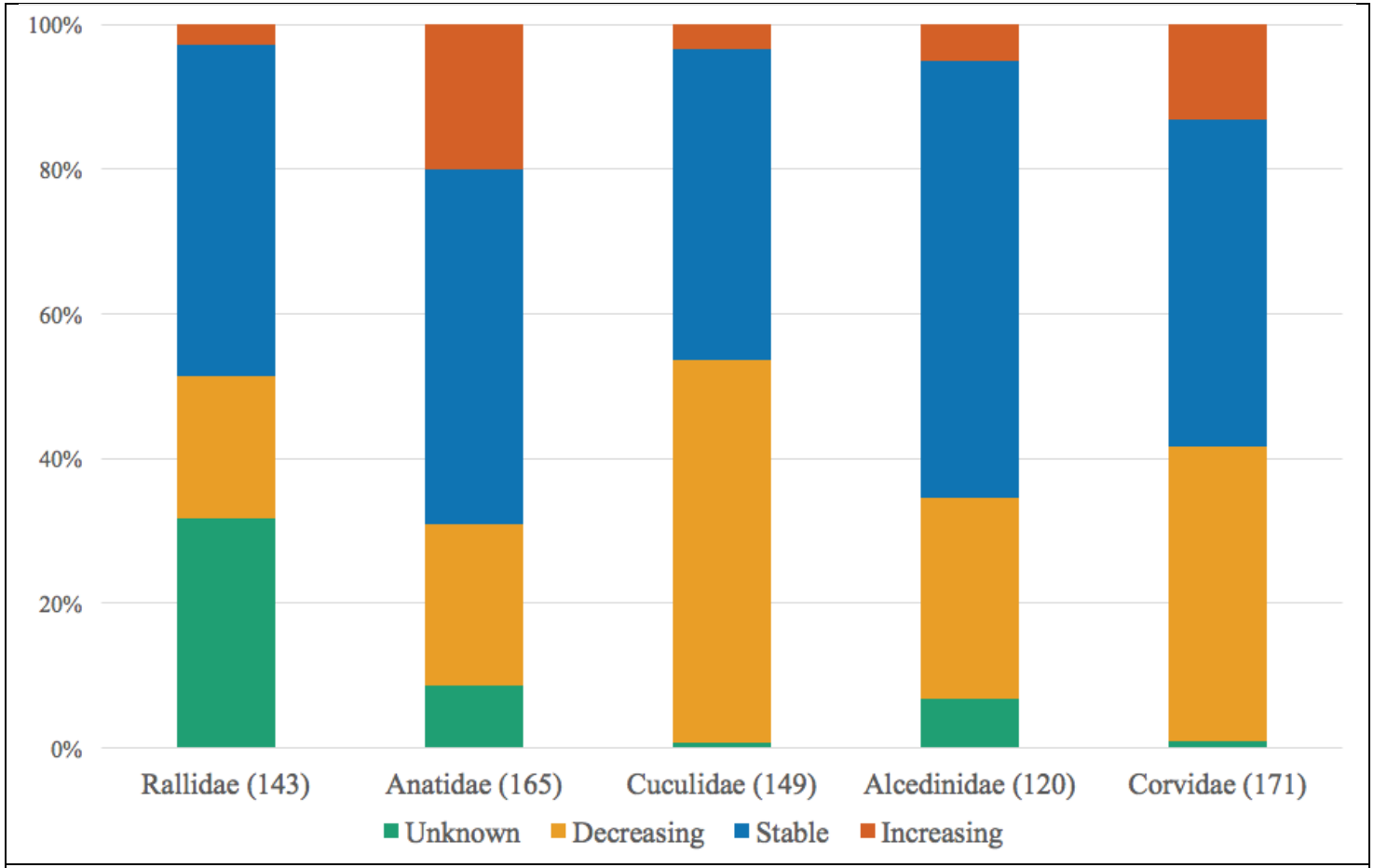

Figure 6: Population trends of Rallidae and selected avian families
Numbers in parenthesis indicate the number of species in each family.

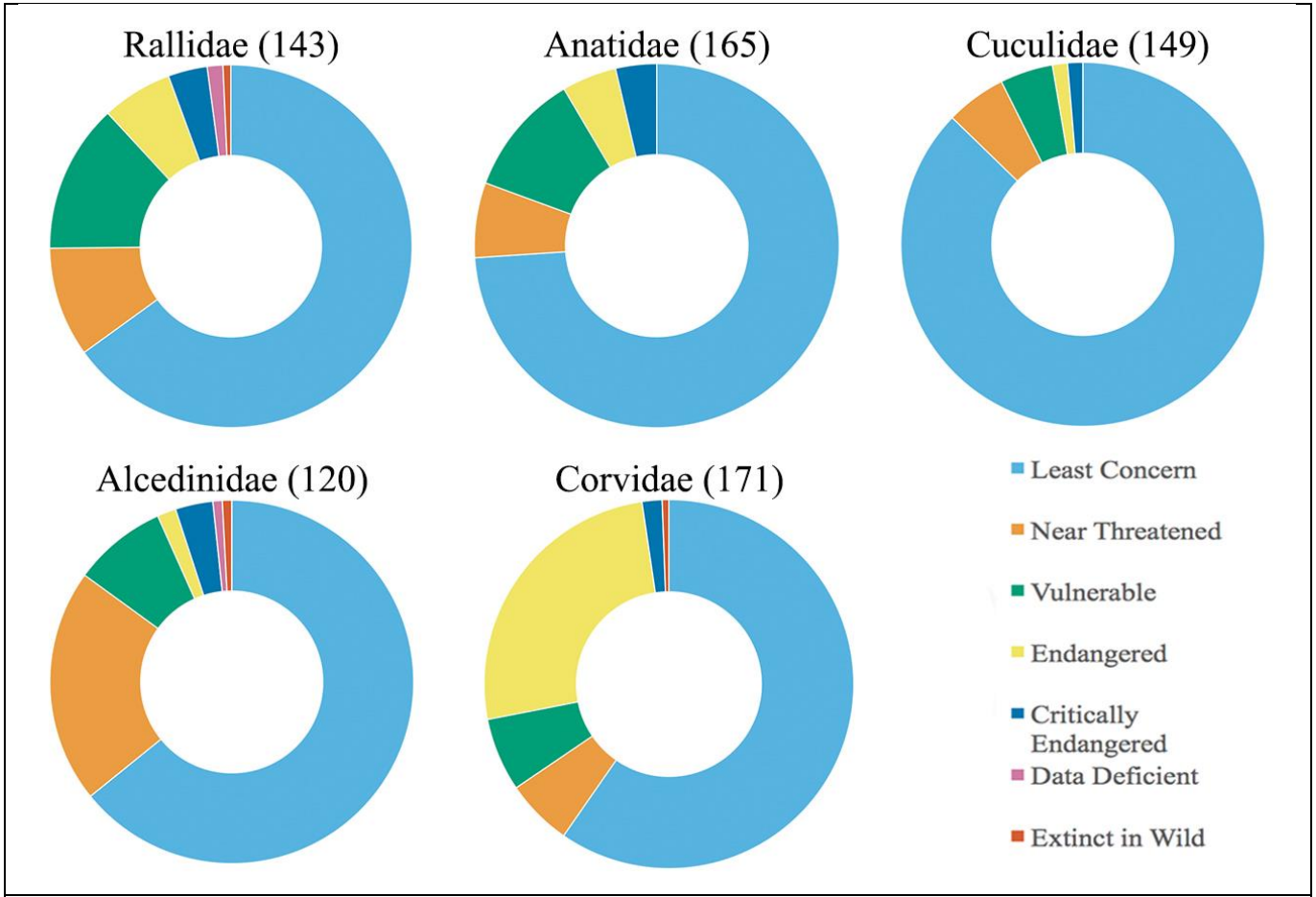

Figure 7: Conservation status of Rallidae, Anatidae, Alcedinidae, Corvidae, and Cuculidae. Numbers in parenthesis indicate the number of species in each family.

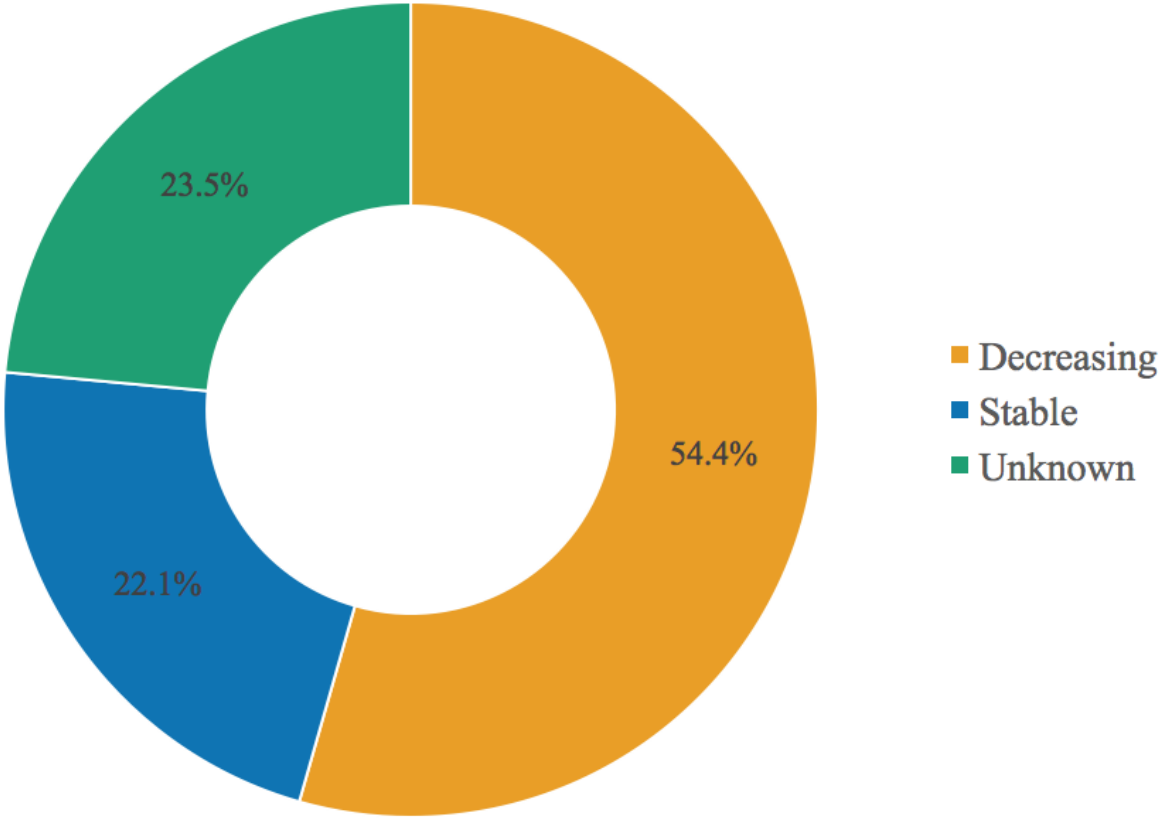

Figure 8: Population trend of endemic and near-endemic rallids
Note that Extinct in the Wild species are excluded from this figure

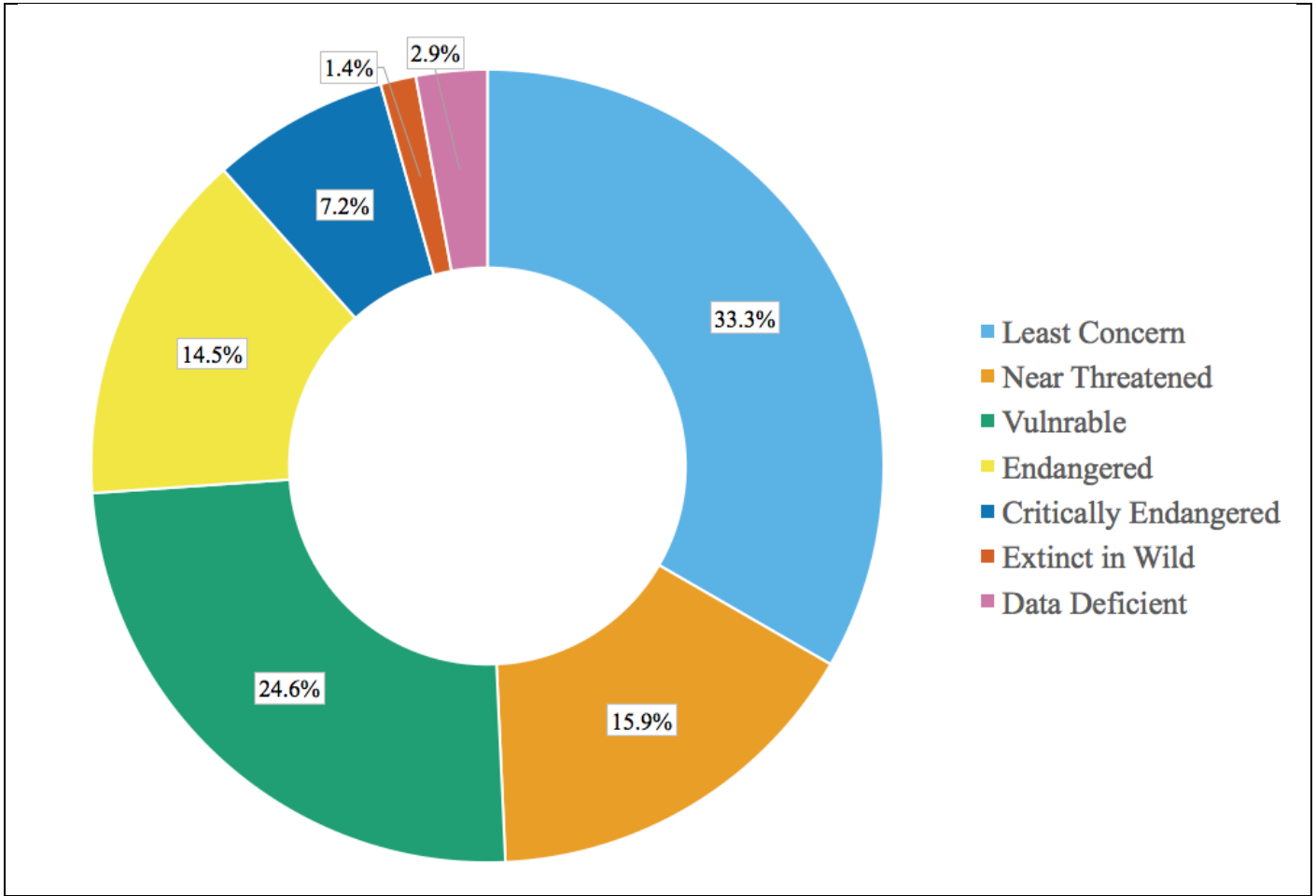

Figure 9: Conservation status of endemic and near-endemic rallids

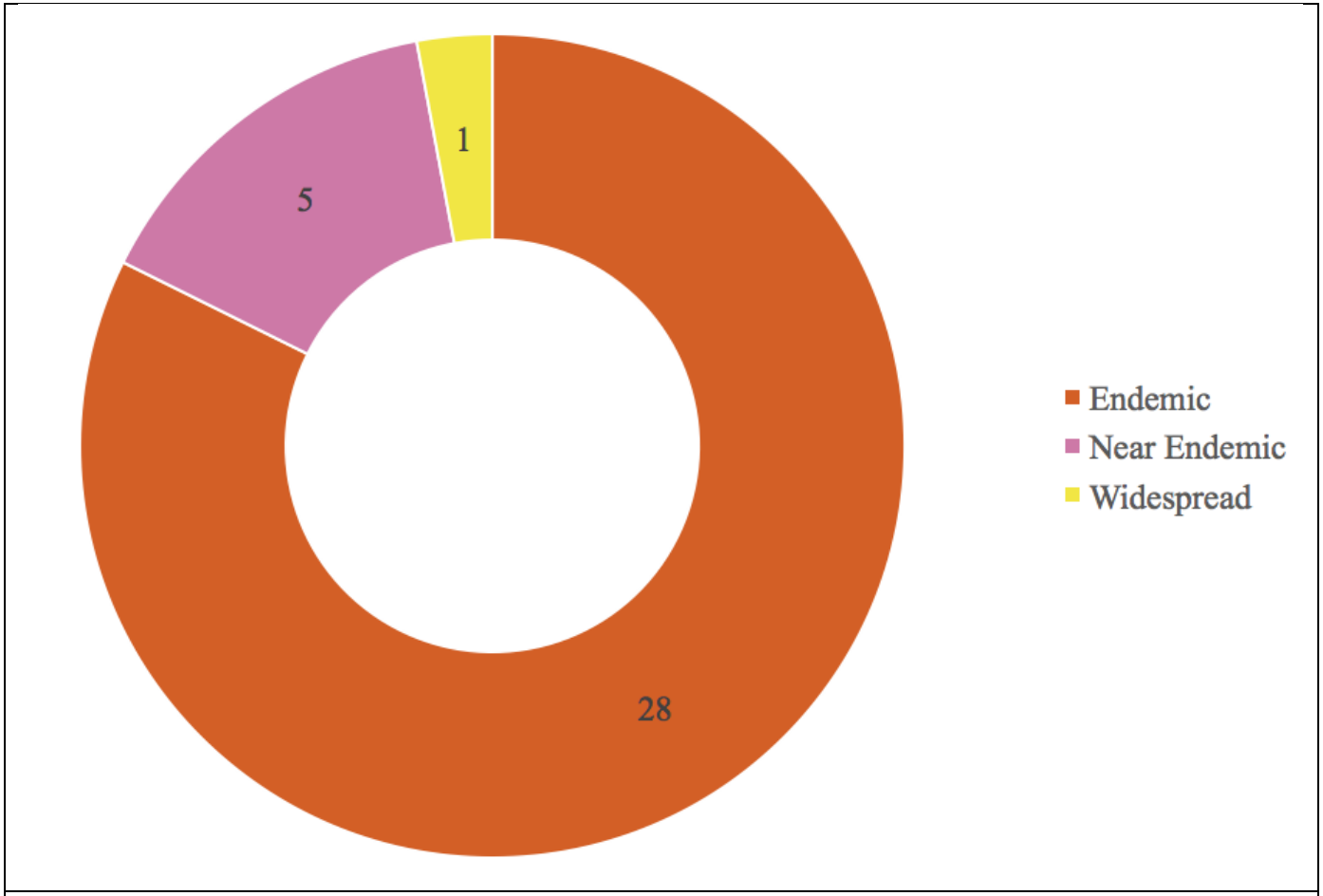

Figure 10: Distribution of threatened Rallidae species.
Data labels indicate the number of species in each category.

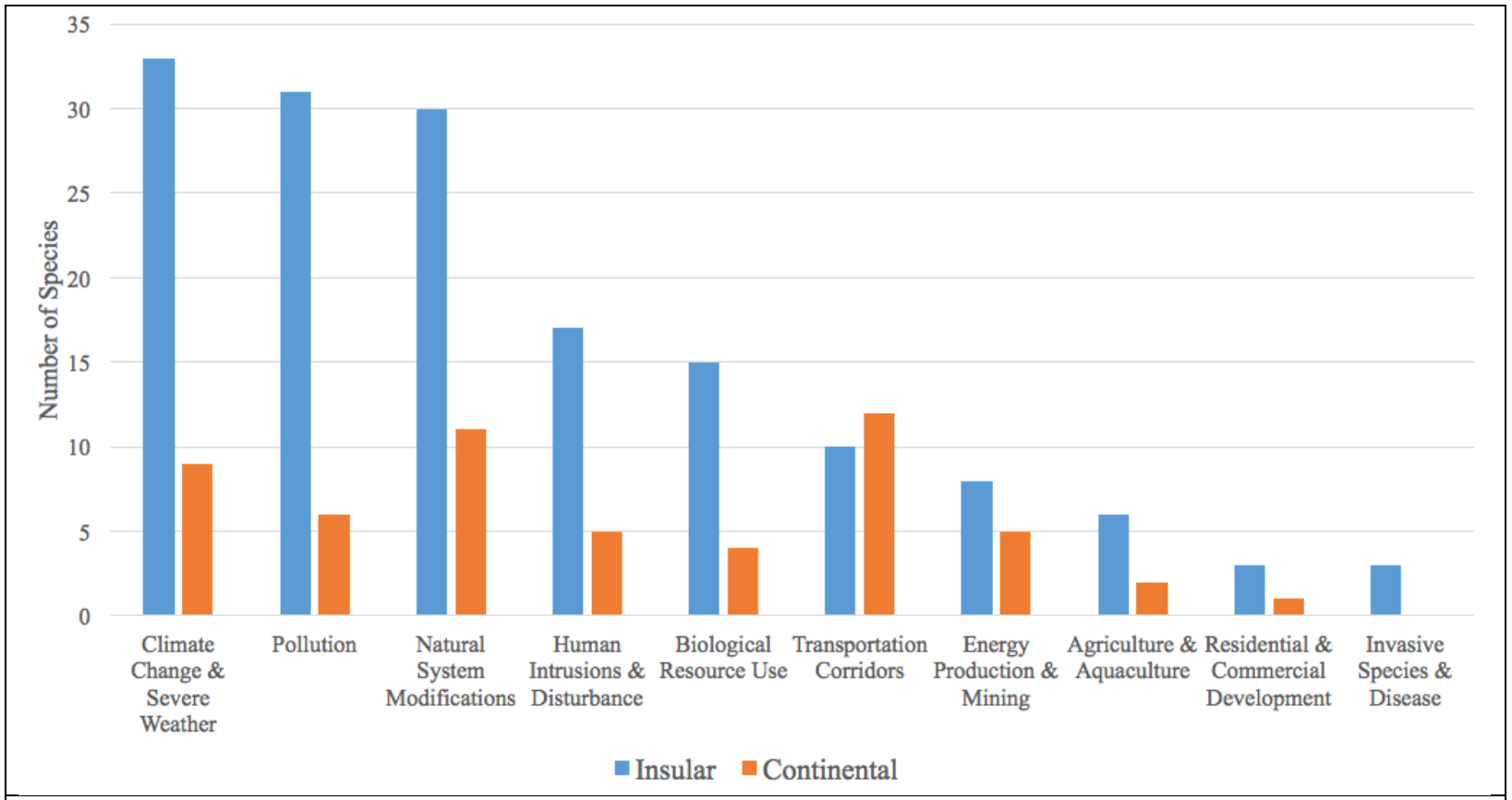

Figure 11: Threats to insular and continental Rallidae species
(BirdLife International 2018a)

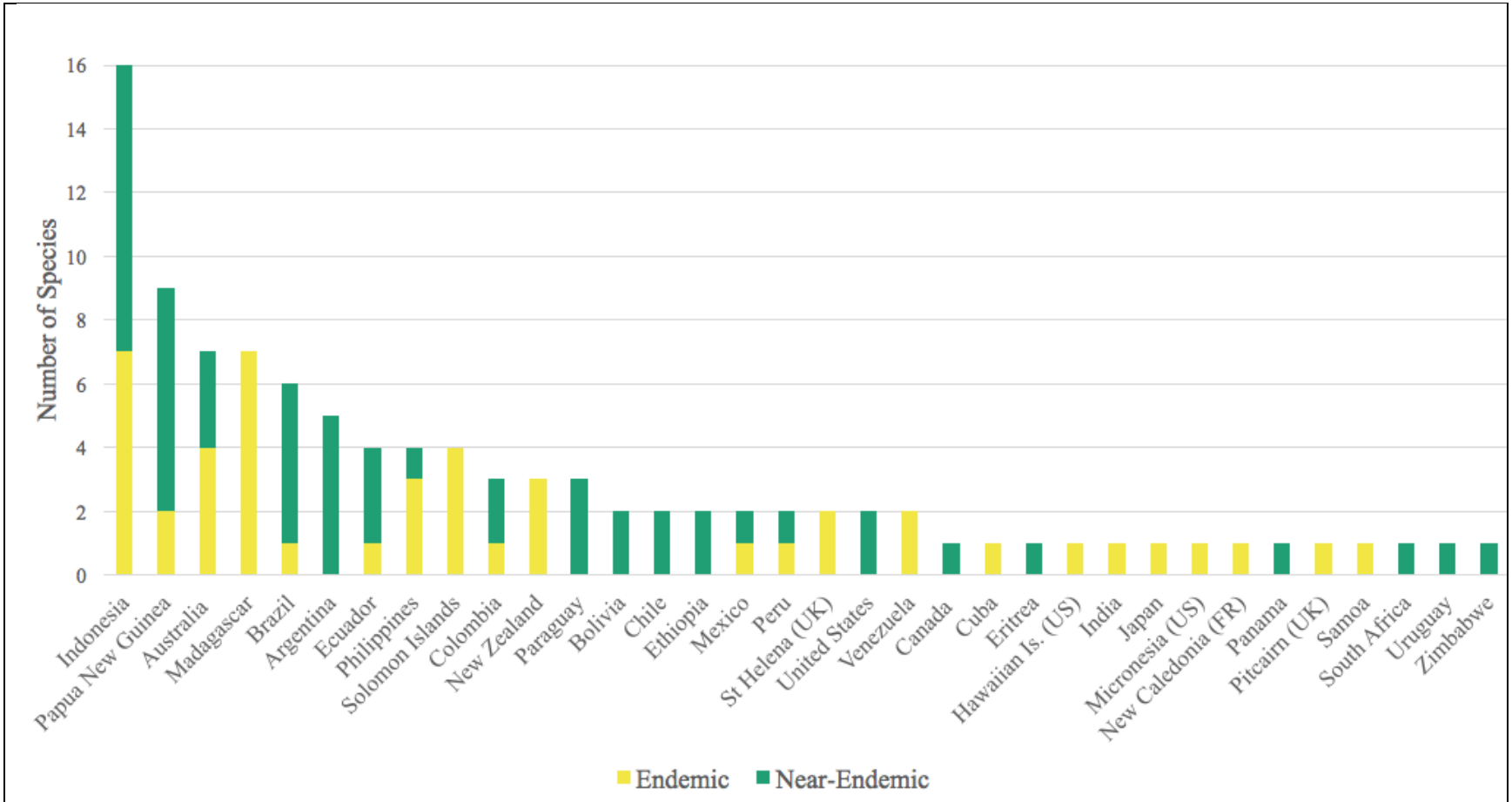

Figure 12: Number of endemic or near-endemic rallid species by country.
Note that near-endemic rallids are listed under each country of residence.

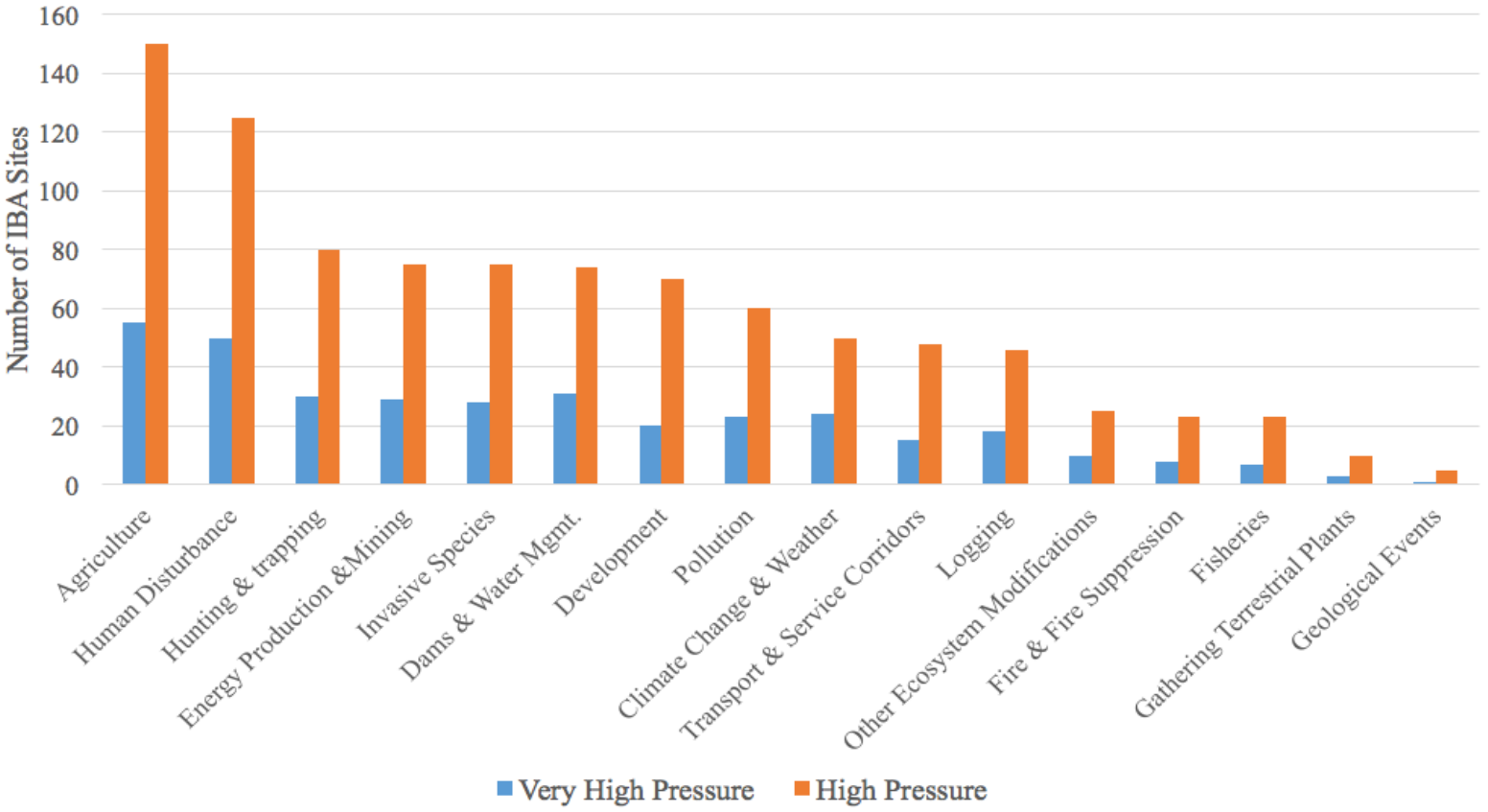

Figure 13: Threats to Important Bird Areas
The 356 IBAs most at risk were classified by the nature of risk by Birdlife International. Note that many IBAs face risks from more than one source.

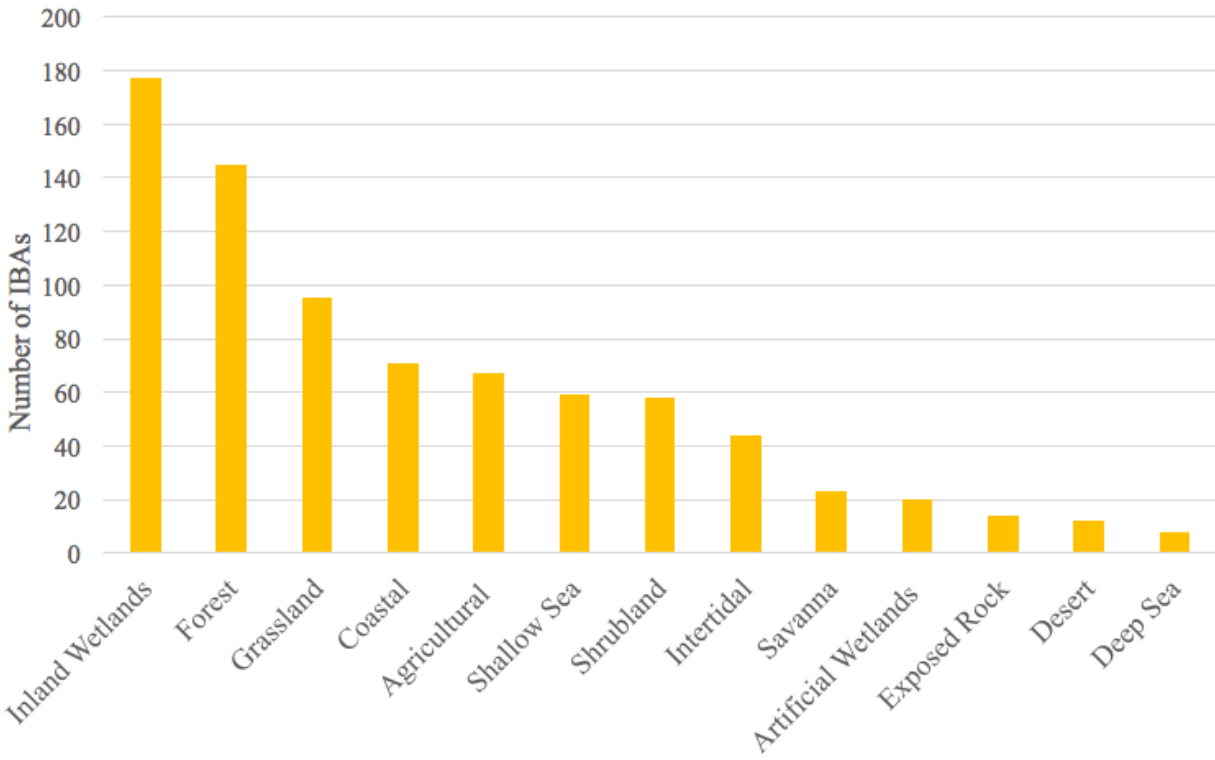

Figure 14: Threatened habitat types in Important Bird Areas
The 356 IBAs most at risk were classified by habitat type by Birdlife International.

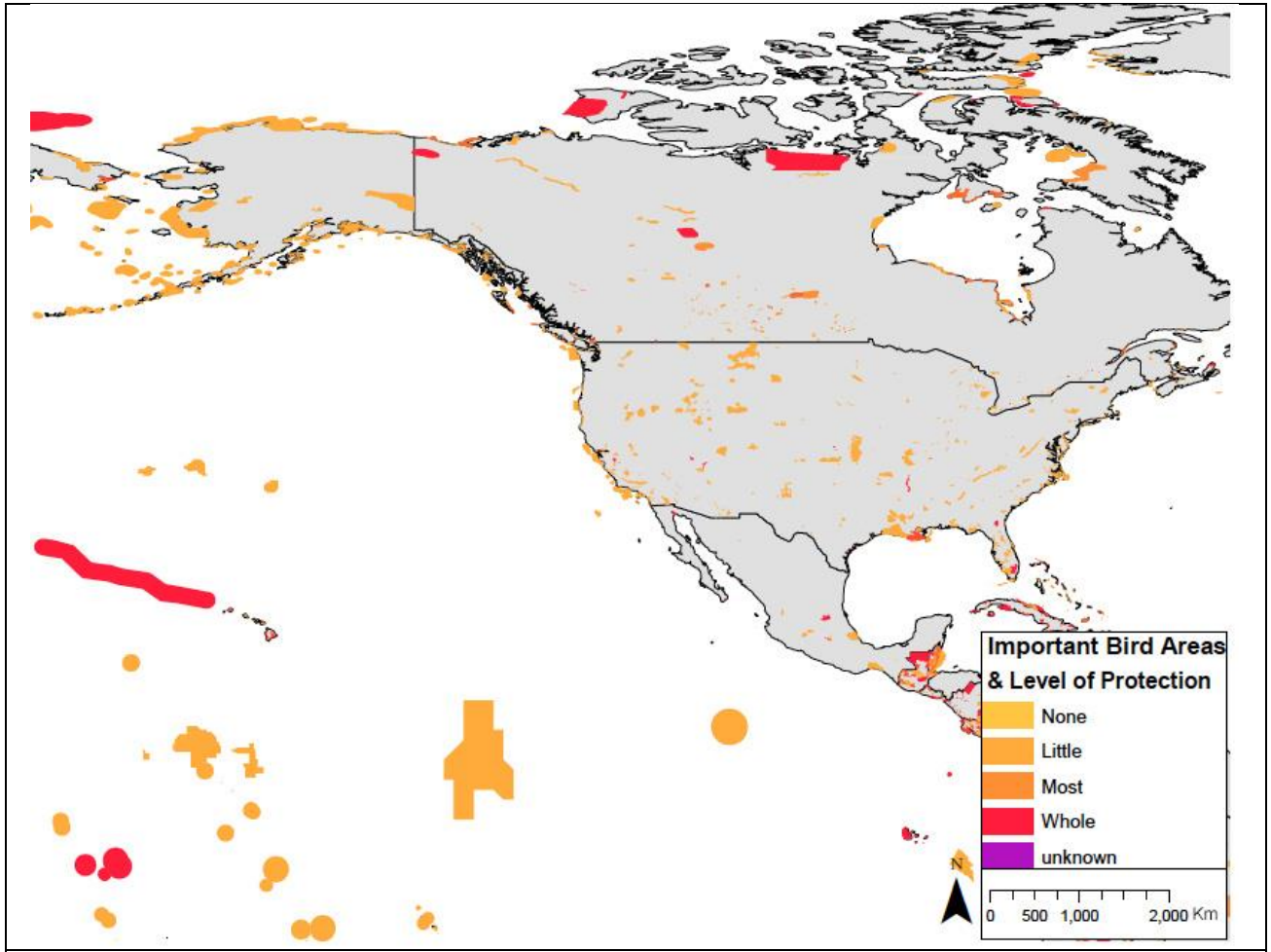

Figure 15: Important Bird Areas and their Level of Protection in North America (BirdLife International 2018c)

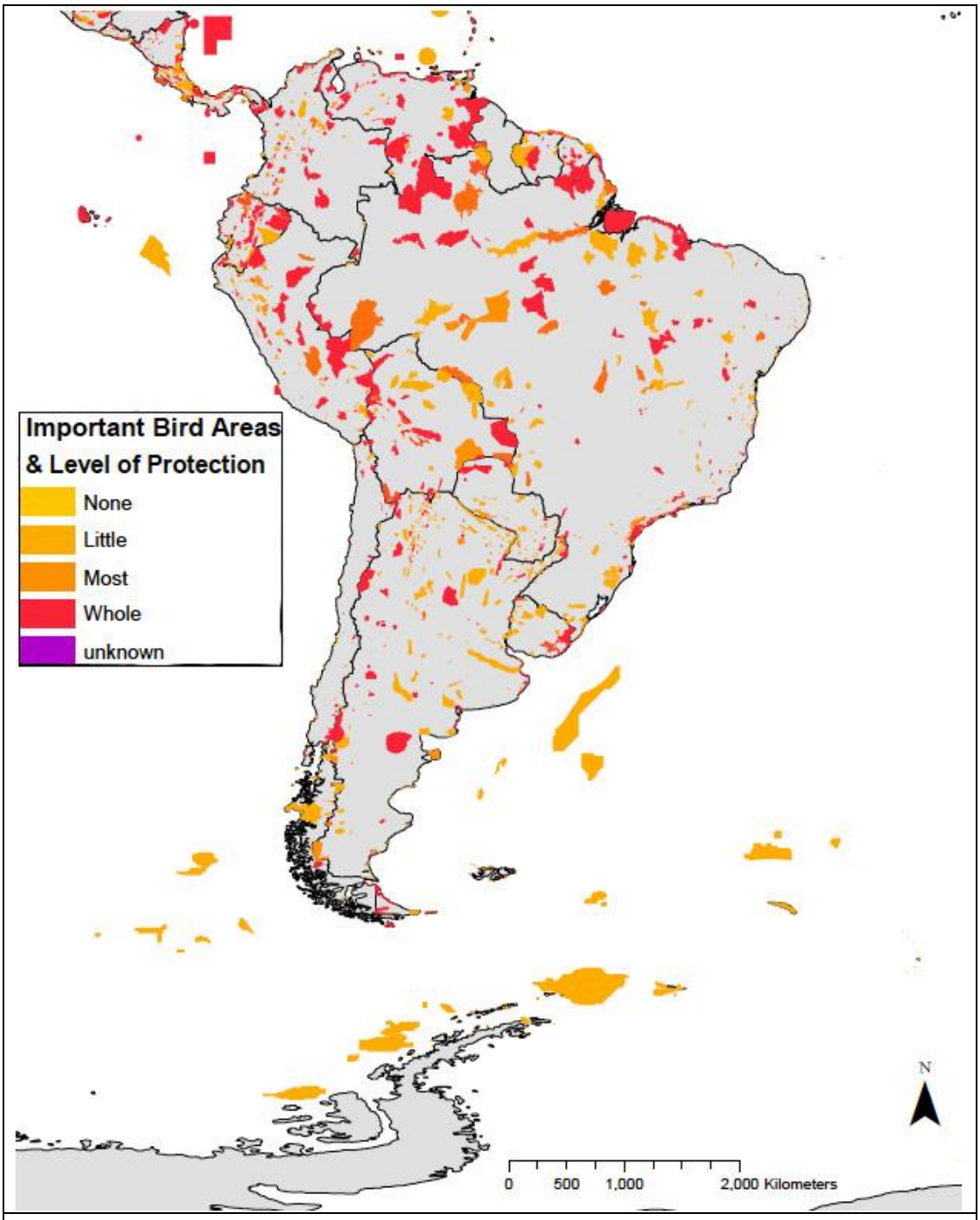

Figure 16: Important Bird Areas and their Level of Protection in South America (BirdLife International 2018c)

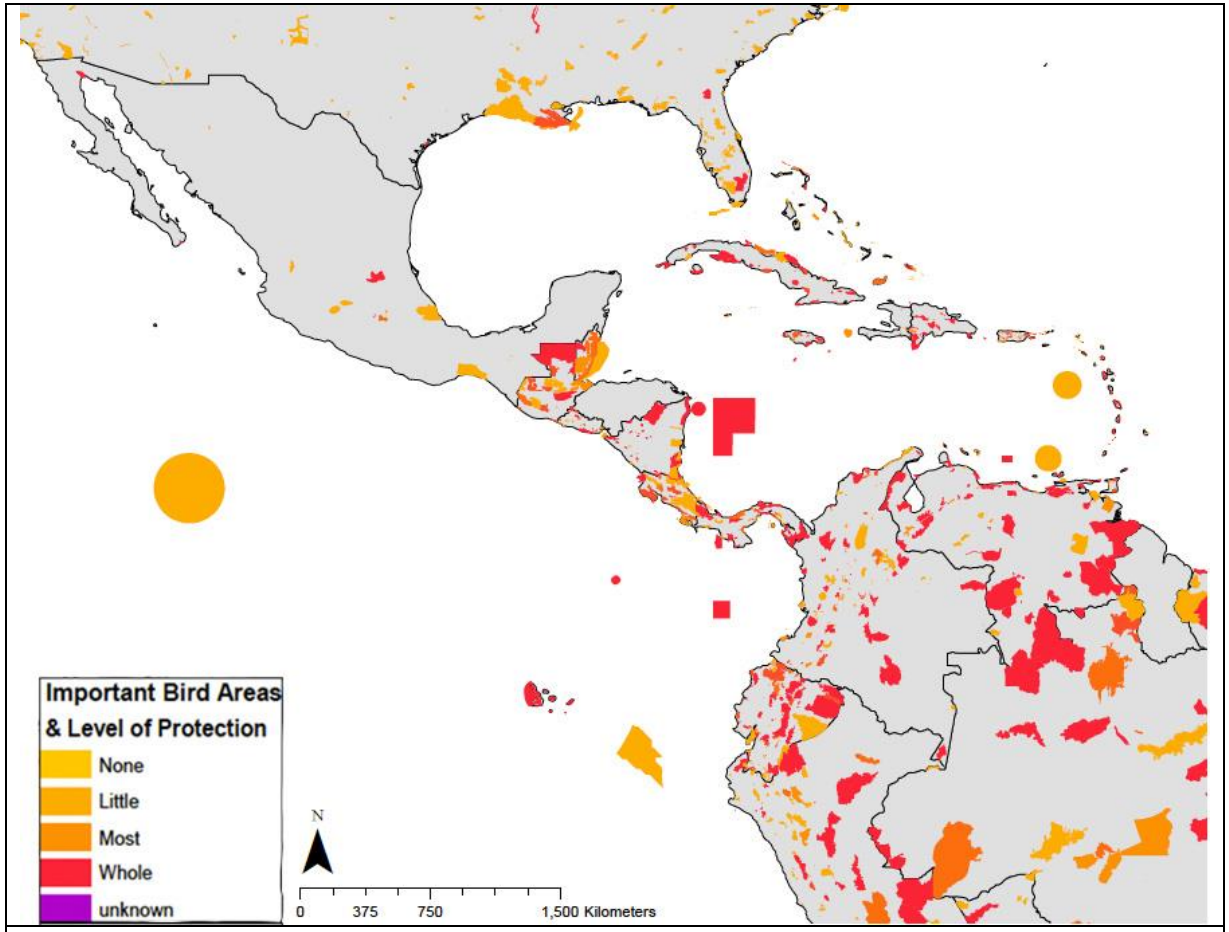

Figure 17: Important Bird Areas and their Level of Protection in Central America & the Caribbean
(BirdLife International 2018c)

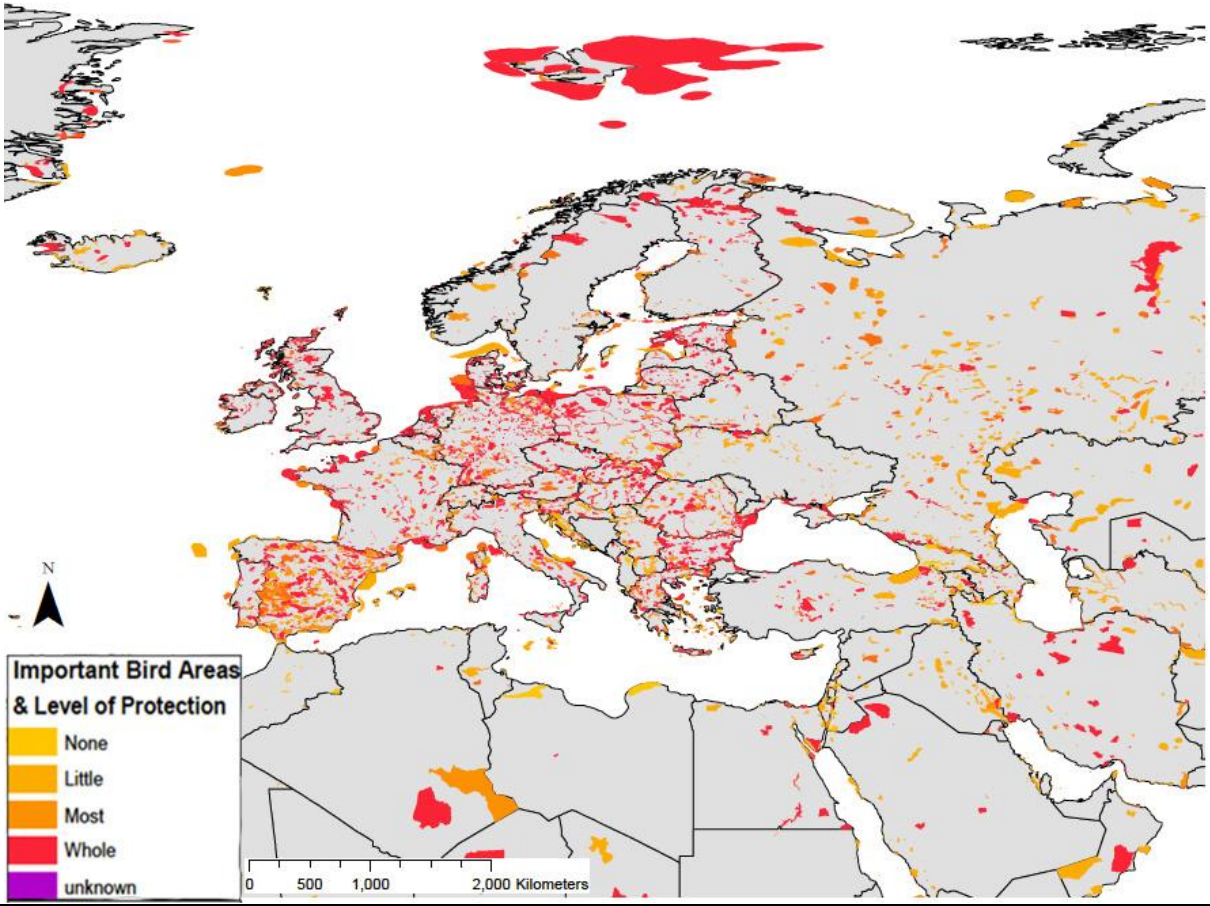

Figure 18: Important Bird Areas and their Level of Protection in Europe (BirdLife International 2018c)

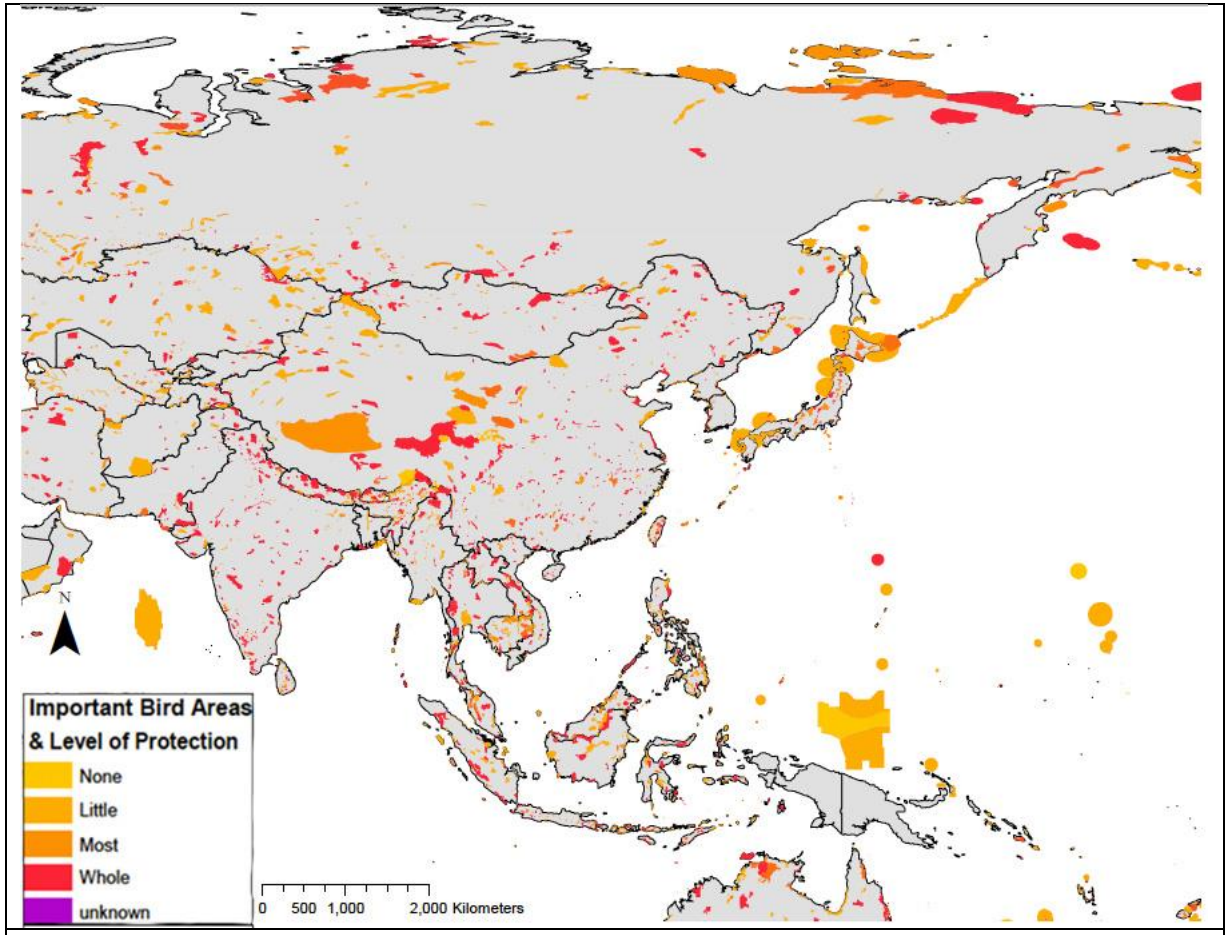

Figure 19: Important Bird Areas and their Level of Protection in Asia (BirdLife International 2018c)

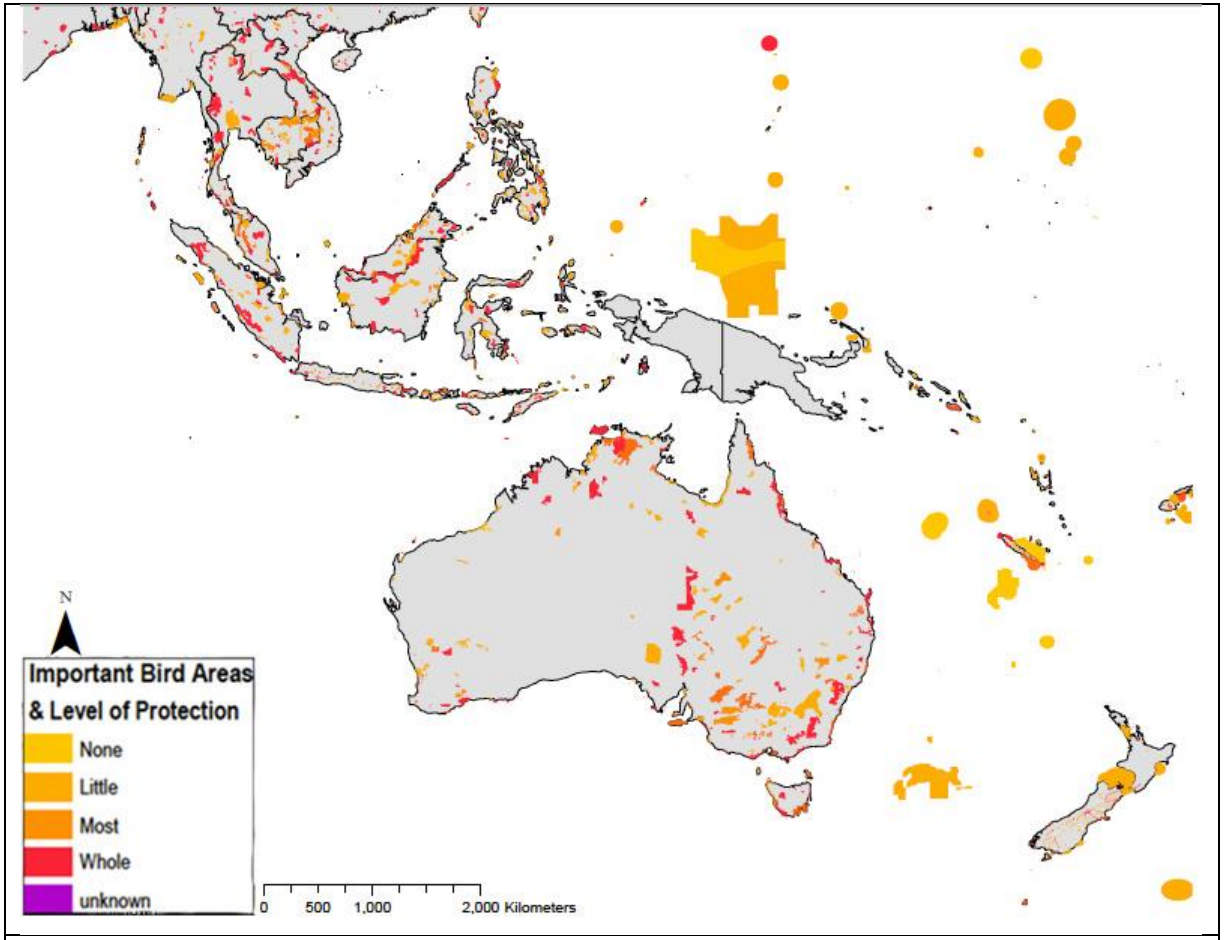

Figure 20: Important Bird Areas and their Level of Protection in Australia & Oceania (BirdLife International 2018c)

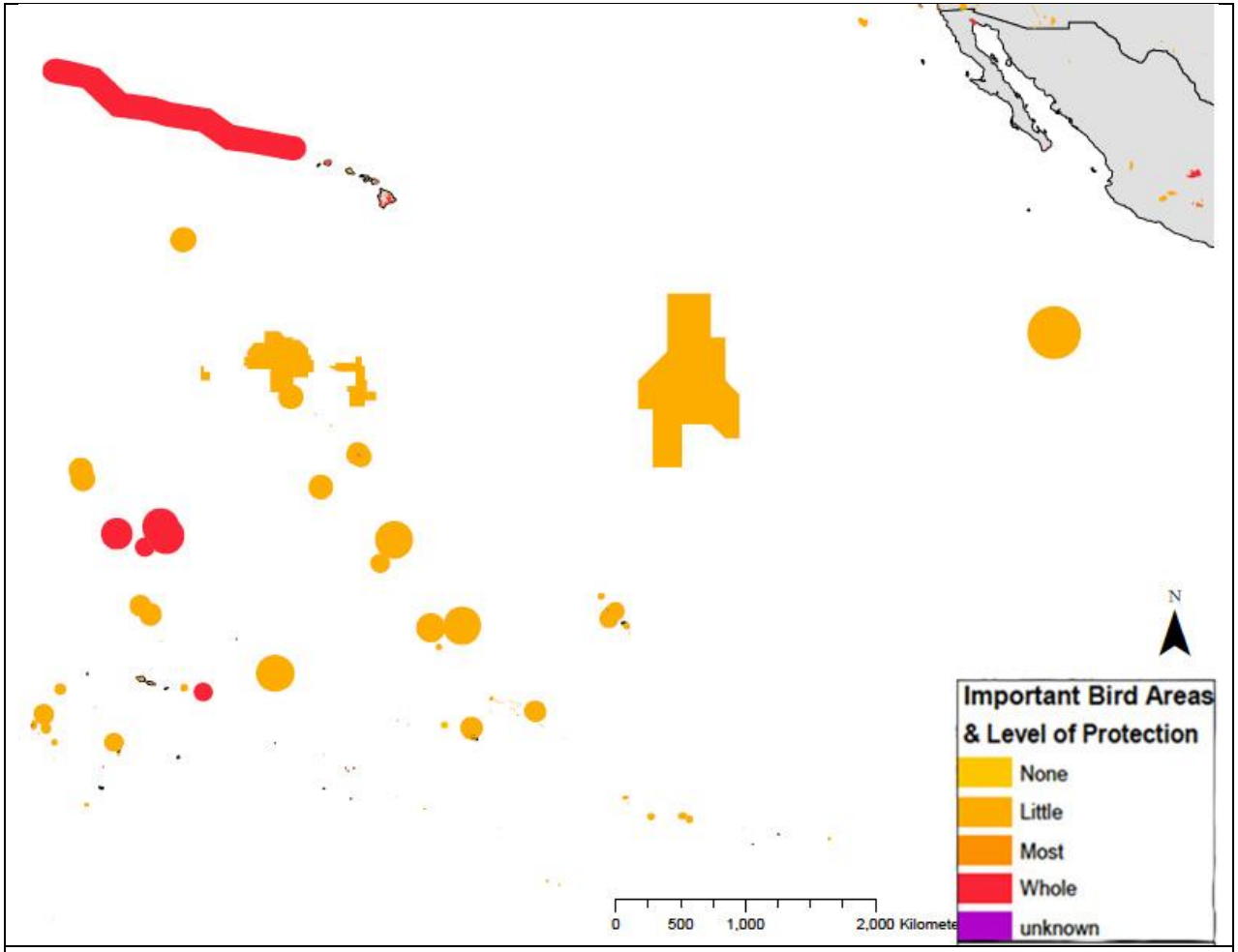

Figure 21: Important Bird Areas and their Level of Protection in Hawaii and the South Pacific (BirdLife International 2018c)

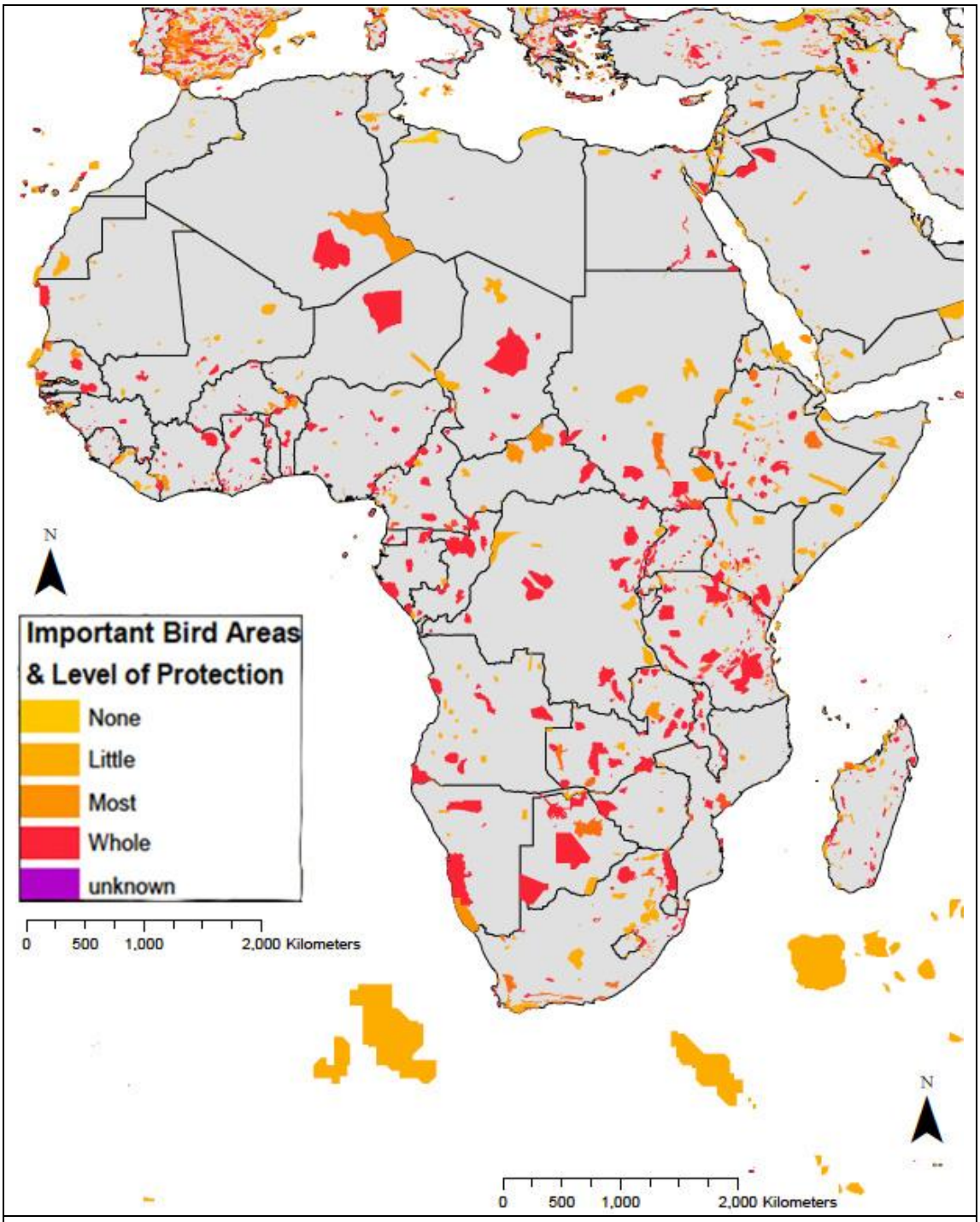

Figure 22: Important Bird Areas and their Level of Protection in Africa (BirdLife International 2018c)

Appendices

Appendix A: Annotated index of rallid species

	Scientific Name	Common Name	Status	Population	Country	Habitat
1	*Aenigmatolimnas marginalis*	Striped Crake	LC	Decreasing	Angola; Botswana; Cameroon; Congo, The Democratic Republic of the; Côte d'Ivoire; Gabon; Ghana; Kenya; Malawi; Mozambique; Namibia; Nigeria; South Africa; Tanzania, United Republic of; Uganda; Zambia; Zimbabwe	Wetlands (inland), Grassland, Savanna, Artificial/Aquatic & Marine
2	*Amaurolimnas concolor*	Uniform Crake	LC	Decreasing	Belize; Bolivia, Plurinational States of; Brazil; Cayman Islands; Colombia; Costa Rica; Ecuador; French Guiana; Guatemala; Guyana; Honduras; Mexico; Nicaragua; Panama; Peru; Puerto Rico; Venezuela, Bolivarian Republic of	Artificial/Terrestrial, Forest
3	*Amaurornis akool*	Brown Crake	LC	Unknown	Bangladesh; China; Hong Kong; India; Myanmar; Nepal; Pakistan; Viet Nam;	Artificial/Terrestrial, Artificial/Aquatic & Marine, Wetlands (inland)
4	*Amaurornis flavirostra*	Black Crake	LC	Unknown	Angola; Benin; Botswana; Burkina Faso; Burundi; Cameroon; Central African Republic; Chad; Congo, The Democratic Republic of the; Congo; Côte d'Ivoire; Djibouti; Equatorial Guinea; Ethiopia; Gabon; Gambia; Ghana; Guinea-Bissau; Guinea; Kenya; Liberia; Malawi; Mali; Mauritania; Mozambique; Namibia; Niger; Nigeria; Rwanda; Senegal; Sierra Leone; Somalia; South Africa; South Sudan; Sudan; Swaziland; Tanzania, United Republic of; Togo; Uganda; Zambia; Zimbabwe	Wetlands (inland), Artificial/Aquatic & Marine, Grassland, Marine Coastal/Supratidal
5	*Amaurornis isabellina*	Isabelline Bush-hen	LC	Unknown	Indonesia Endemic to Sulawesi	Wetlands (inland), Artificial/Terrestrial, Grassland

6	*Amaurornis magnirostris*	Talaud Bush-hen	VU	Decreasing	Indonesia Endemic to Talaud Island	Forest, Artificial/Terrestrial, Shrubland
7	*Amaurornis moluccana*	Pale-vented Bush-hen	LC	Unknown	Australia; Indonesia; Papua New Guinea; Solomon Islands	Wetlands (inland), Artificial/Terrestrial, Shrubland, Forest, Grassland
8	*Amaurornis olivacea*	Philippine Bush-hen	LC	Unknown	Philippines Endemic	Shrubland, Wetlands (inland), Grassland
9	*Amaurornis olivieri*	Sakalava Rail	EN	Decreasing	Madagascar Endemic to Sakalava region	Wetlands (inland), Introduced vegetation
10	*Amaurornis phoenicurus*	White-breasted Waterhen	LC	Unknown	Bangladesh; Bhutan; British Indian Ocean Territory Brunei Darussalam; Cambodia; China; Christmas Island; Hong Kong; India; Indonesia; Japan; Korea, Republic of; Lao People's Democratic Republic; Macao; Malaysia; Maldives; Myanmar; Nepal; Oman; Pakistan; Philippines; Singapore; Sri Lanka; Taiwan, Province of China; Thailand; Timor-Leste; United Arab Emirates; Viet Nam;	Wetlands (inland), Marine Coastal/Supratidal, Shrubland, Forest, Artificial/Terrestrial, Grassland, Artificial/Aquatic & Marine
11	*Anurolimnas castaneiceps*	Chestnut-headed Crake	LC	Decreasing	Bolivia, Plurinational States of; Colombia; Ecuador; Peru; Brazil	Forest, Artificial/Terrestrial
12	*Aphanapteryx bonasia*	Red Rail	EX	Extinct	Mauritius	Forest
13	*Aphanocrex podarces*	St Helena Rail	EX	Extinct	Saint Helena, Ascension and Tristan da Cunha	Other
14	*Aramides axillaris*	Rufous-necked Wood-Rail, Gray-necked Wood Rail	LC	Unknown	Belize; Colombia; Costa Rica; Ecuador; El Salvador; French Guiana; Guatemala; Guyana; Honduras; Mexico; Nicaragua; Panama; Peru; Suriname; Trinidad and Tobago; Venezuela, Bolivarian Republic of	Forest

15	*Aramides cajaneus*	Gray-necked Wood-Rail	LC	Stable	Argentina; Belize; Bolivia, Plurinational States of; Brazil; Colombia; Costa Rica; Ecuador; El Salvador; French Guiana; Guatemala; Guyana; Honduras; Mexico; Nicaragua; Panama; Paraguay; Peru; Suriname; Trinidad and Tobago; Venezuela, Bolivarian Republic of; Uruguay	Forest, Wetlands (inland)
16	*Aramides calopterus*	Red-winged Wood-Rail	LC	Decreasing	Brazil; Ecuador; Peru Near-endemic	Wetlands (inland), Forest
17	*Aramides mangle*	Little Wood-Rail	LC	Unknown	Brazil Endemic	Artificial/Terrestrial, Marine Coastal/Supratidal, Forest
18	*Aramides saracura*	Slaty-breasted Wood-Rail	LC	Decreasing	Argentina; Brazil; Paraguay Near-endemic	Forest, Wetlands (inland)
19	*Aramides wolfi*	Brown Wood-Rail	VU	Decreasing	Colombia; Ecuador Near-endemic	Forest
20	*Aramides ypecaha*	Giant Wood-Rail	LC	Decreasing	Argentina; Brazil; Paraguay; Near-endemic	Forest, Wetlands (inland), Artificial/Terrestrial
21	*Aramidopsis plateni*	Snoring Rail	VU	Decreasing	Indonesia Endemic to Sulawesi Flightless	Forest, Shrubland
22	*Atlantisia rogersi*	Inaccessible Island Rail	VU	Stable	Saint Helena, Ascension and Tristan da Cunha Endemic to Inaccessible Island Flightless	Shrubland, Grassland
23	*Canirallus oculeus*	Grey-throated Rail	LC	Decreasing	Cameroon; Central African Republic; Congo; Congo, The Democratic Republic of the; Côte d'Ivoire; Equatorial Guinea; Gabon; Ghana; Guinea; Liberia; Nigeria; Sierra Leone; Uganda	Forest, Wetlands (inland)
24	*Coturnicops exquisitus*	Swinhoe's Rail	VU	Decreasing	Japan; Korea, Democratic People's Republic of; Korea, Republic of; China; Mongolia; Russian Federation	Wetlands (inland), Artificial/Terrestrial
25	*Coturnicops notatus*	Speckled Rail	LC	Decreasing	Argentina; Bolivia, Plurinational States of; Brazil; Colombia; Guyana; Paraguay; Uruguay; Venezuela, Bolivarian Republic of	Grassland, Wetlands (inland), Artificial/Terrestrial
26	*Coturnicops noveboracensis*	Yellow Rail	LC	Stable	Canada; United States of America Near-endemic	Wetlands (inland)

27	*Crex crex*	Corn Crake	LC	Stable	Albania; Algeria; Armenia; Austria; Azerbaijan; Bahrain; Belarus; Belgium; Bosnia and Herzegovina; Bulgaria; China; Congo, The Democratic Republic of the; Congo; Croatia; Cyprus; Czech Republic; Denmark; Egypt; Estonia; Ethiopia; Finland; France; Georgia; Germany; Greece; Hungary; Iran, Islamic Republic of; Iraq; Ireland; Israel; Italy; Jordan; Kazakhstan; Kenya; Kuwait; Kyrgyzstan; Latvia; Lebanon; Liechtenstein; Lithuania; Luxembourg; Macedonia, the former Yugoslav Republic of; Malawi; Mauritania; Moldova; Mongolia; Montenegro; Morocco; Mozambique; Netherlands; Norway; Oman; Palestinian Territory, Occupied; Poland; Portugal; Qatar; Romania; Russian Federation; Saudi Arabia; Serbia; Slovakia; Slovenia; South Africa; South Sudan; Spain; Sri Lanka; Sudan; Swaziland; Sweden; Switzerland; Syrian Arab Republic; Tajikistan; Tanzania, United Republic of; Tunisia; Turkey; Turkmenistan; Ukraine; United Arab Emirates; United Kingdom; Uzbekistan; Yemen; Zambia; Zimbabwe	Wetlands (inland), Grassland, Savanna, Artificial/Terrestrial
28	*Crex egregia*	African Crake	LC	Stable	Angola; Benin; Botswana; Burkina Faso; Burundi; Cameroon; Central African Republic; Chad; Congo, The Democratic Republic of the; Congo; Côte d'Ivoire; Equatorial Guinea; Gabon; Gambia; Ghana; Guinea; Kenya; Lesotho; Liberia; Malawi; Mali; Mozambique; Namibia; Nigeria; Rwanda; Sierra Leone; South Africa; South Sudan Sudan; Swaziland; Tanzania, United Republic of; Togo; Uganda; Zambia; Zimbabwe	Wetlands (inland), Artificial/Terrestrial, Artificial/Aquatic & Marine, Grassland, Savanna
29	*Cyanolimnas cerverai*	Zapata Rail	CR	Decreasing	Cuba Endemic	Wetlands (inland)
30	*Diaphorapteryx hawkinsi*	Hawkins's Rail	EX	Extinct	New Zealand	Unspecified
31	*Dryolimnas augusti*	Reunion Rail	EX	Extinct	Reunion	Unknown
32	*Dryolimnas cuvieri*	White-throated Rail	LC	Stable	Madagascar Endemic	Marine Intertidal, Forest, Wetlands (inland),

						Shrubland, Artificial/Aquatic & Marine
33	*Erythromachus leguati*	Rodrigues Rail	EX	Extinct	Mauritius	Unspecified
34	*Eulabeornis castaneoventris*	Chestnut Rail	LC	Unknown	Australia; Indonesia Near-endemic	Wetlands (inland), Grassland, Marine Intertidal, Forest
35	*Fulica alai*	Hawaiian Coot	VU	Stable	United States of America Endemic	Wetlands (inland), Artificial/Aquatic & Marine, Marine Coastal/Supratidal
36	*Fulica americana*	American Coot	LC	Decreasing	Anguilla; Antigua and Barbuda; Aruba; Bahamas; Barbados; Belize; Bermuda; Bolivia, Plurinational States of; Canada; Cayman Islands; Colombia; Costa Rica; Cuba; Curaçao; Dominica; Dominican Republic; El Salvador; Guatemala; Haiti; Honduras; Jamaica; Martinique; Mexico; Montserrat; Nicaragua; Panama; Puerto Rico; Saint Barthélemy; Saint Kitts and Nevis; Saint Lucia; Saint Pierre and Miquelon; Saint Vincent and the Grenadines; Turks and Caicos Islands; United States; Venezuela, Bolivarian Republic of; Virgin Islands, British; Virgin Islands, U.S.	Wetlands (inland), Marine Intertidal
37	*Fulica ardesiaca*	Andean Coot	LC	Unknown	Argentina; Bolivia, Plurinational States of; Chile; Colombia; Ecuador; Peru	Wetlands (inland)
38	*Fulica armillata*	Red-gartered Coot	LC	Unknown	Argentina; Bolivia, Plurinational States of; Brazil; Chile; Falkland Islands (Malvinas); Paraguay; South Georgia and the South Sandwich Islands; Uruguay	Wetlands (inland)
39	*Fulica atra*	Eurasian Coot	LC	Increasing	Afghanistan; Albania; Algeria; Armenia; Australia; Austria; Azerbaijan; Bahrain; Bangladesh; Belarus; Belgium; Bhutan; Bosnia and Herzegovina; Bulgaria; Burkina Faso; Cambodia; Chad; China; Croatia; Cyprus; Czech Republic; Denmark; Egypt; Estonia; Ethiopia; Faroe Islands; Finland; France; Georgia; Germany; Greece; Hong Kong; Hungary; Iceland; India; Indonesia; Iran, Islamic Republic of; Iraq; Ireland; Israel; Italy; Japan; Jordan; Kazakhstan; Korea, Democratic People's Republic of; Korea, Republic of; Kuwait; Kyrgyzstan; Lao People's Democratic Republic; Latvia; Lebanon; Libya;	Wetlands (inland), Grassland, Artificial/Aquatic & Marine, Marine Coastal/Supratidal, Marine Neritic

					Liechtenstein; Lithuania; Luxembourg; Macedonia, the former Yugoslav Republic of; Malaysia; Mali; Malta; Mauritania; Moldova; Mongolia; Montenegro; Morocco; Myanmar; Nepal; Netherlands; New Zealand; Niger; Nigeria; Northern Mariana Islands; Norway; Oman; Pakistan; Palestinian Territory, Occupied; Philippines; Poland; Portugal; Qatar; Romania; Russian Federation; Saudi Arabia; Senegal; Serbia; Singapore; Slovakia; Slovenia; Spain; Sri Lanka; Sudan; Sweden; Switzerland; Syrian Arab Republic; Taiwan, Province of China; Tajikistan; Thailand; Timor-Leste; Tunisia; Turkey; Turkmenistan; Ukraine; United Arab Emirates; United Kingdom; Uzbekistan; Viet Nam; Western Sahara; Yemen;	
40	*Fulica cornuta*	Horned Coot	NT	Decreasing	Argentina; Bolivia, Plurinational States of; Chile Near-endemic	Wetlands (inland)
41	*Fulica cristata*	Red-knobbed Coot	LC	Decreasing	Angola; Botswana; Congo, The Democratic Republic of the; Eritrea; Ethiopia; Kenya; Lesotho; Madagascar; Malawi; Morocco; Mozambique; Namibia; Rwanda; South Africa; Spain; Swaziland; Tanzania, United Republic of; Uganda; Zambia; Zimbabwe	Wetlands (inland), Artificial/Aquatic & Marine, Marine Coastal/Supratidal
42	*Fulica gigantea*	Giant Coot	LC	Stable	Argentina; Bolivia, Plurinational States of; Chile; Peru Flightless as Adult	Wetlands (inland)
43	*Fulica leucoptera*	White-winged Coot	LC	Stable	Argentina; Bolivia, Plurinational States of; Brazil; Chile; Falkland Islands (Malvinas); Paraguay; South Georgia and the South Sandwich Islands; Uruguay	Wetlands (inland)
44	*Fulica newtonii*	Mascarene Coot	EX	Extinct	Reunion	wetlands (inland)
45	*Fulica rufifrons*	Red-fronted Coot	LC	Stable	Argentina; Brazil; Chile; Falkland Islands (Malvinas); Paraguay; Peru; South Georgia and the South Sandwich Islands; Uruguay	Wetlands (inland)
46	*Gallicrex cinerea*	Watercock	LC	Decreasing	Bangladesh; Bhutan; Brunei Darussalam; Cambodia; China; India; Indonesia; Japan; Korea, Democratic People's Republic of Korea, Republic of; Lao People's Democratic Republic; Malaysia; Maldives; Myanmar; Nepal; Pakistan; Philippines; Russian Federation	Artificial/Terrestrial, Wetlands (inland), Artificial/Aquatic & Marine

					(Eastern Asian Russia); Singapore; Sri Lanka; Taiwan, Province of China; Thailand; Viet Nam	
47	*Gallinula angulata*	Lesser Moorhen	LC	Unknown	Angola; Benin; Botswana; Burkina Faso; Burundi; Cameroon; Central African Republic; Chad; Congo, The Democratic Republic of the; Côte d'Ivoire; Equatorial Guinea; Ethiopia; Gabon; Gambia; Ghana; Guinea-Bissau; Guinea; Kenya; Lesotho; Liberia; Malawi; Mali; Mauritania; Mozambique; Namibia; Niger; Nigeria; Rwanda; Senegal; Sierra Leone; Somalia; South Africa; South Sudan; Sudan; Swaziland; Tanzania, United Republic of; Togo; Uganda; Zambia; Zimbabwe	Artificial/Aquatic & Marine, Marine Coastal/Supratidal, Grassland, Wetlands (inland)
48	*Gallinula chloropus*	Common Moorhen	LC	Stable	Afghanistan; Albania; Algeria; Angola; Armenia; Austria; Azerbaijan; Bahrain; Bangladesh; Belarus; Belgium; Benin; Bosnia and Herzegovina; Botswana; Brunei Darussalam; Bulgaria; Burkina Faso; Burundi; Cambodia; Cameroon; Cape Verde; Central African Republic; Chad; China; Comoros; Congo, The Democratic Republic of the; Congo; Côte d'Ivoire; Croatia; Cyprus; Czech Republic; Denmark; Djibouti; Egypt; Eritrea; Estonia; Ethiopia; Finland; France; Gambia; Georgia; Germany; Ghana; Greece; Guam; Guinea-Bissau; Guinea; Hong Kong; Hungary; India; Indonesia; Iran, Islamic Republic of; Iraq; Ireland; Israel; Italy; Japan; Jordan; Kazakhstan; Kenya; Korea, Democratic People's Republic of; Korea, Republic of; Kuwait; Kyrgyzstan; Lao People's Democratic Republic; Latvia; Lebanon; Lesotho; Liberia; Libya; Liechtenstein; Lithuania; Luxembourg; Macao; Macedonia, the former Yugoslav Republic of; Madagascar; Malawi; Malaysia; Maldives; Mali; Malta; Mauritania; Mauritius; Mayotte; Micronesia, Federated States of ; Moldova; Mongolia; Montenegro; Morocco; Mozambique; Myanmar; Namibia; Nepal; Netherlands; Niger; Nigeria; Northern Mariana Islands; Norway; Oman; Pakistan; Palau; Palestinian Territory, Occupied; Philippines; Poland; Portugal; Qatar;	Wetlands (inland), Artificial/Aquatic & Marine, Marine Coastal/Supratidal

					Réunion; Romania; Russian Federation (Eastern Asian Russia, Central Asian Russia, European Russia); Russian Federation; Rwanda; Saint Helena, Ascension and Tristan da Cunha; Sao Tomé and Principe; Saudi Arabia; Senegal; Serbia; Seychelles; Sierra Leone; Singapore; Slovakia; Slovenia; Somalia; South Africa; Spain; Sri Lanka; Sudan; Swaziland; Sweden; Switzerland; Syrian Arab Republic; Taiwan, Province of China; Tajikistan; Tanzania, United Republic of; Thailand; Togo; Tunisia; Turkey; Turkmenistan; Uganda; Ukraine; United Arab Emirates; United Kingdom; Uzbekistan; Viet Nam; Yemen; Zambia; Zimbabwe	
49	*Gallinula comeri*	Gough Moorhen	VU	Stable	Saint Helena, Ascension and Tristan da Cunha (Tristan da Cunha) Endemic Flightless	Grassland, Wetlands (inland), Shrubland
50	*Gallinula galeata*	Common Gallinule	LC	Stable	Anguilla; Antigua and Barbuda; Argentina; Aruba; Bahamas; Barbados; Belize; Bermuda; Bolivia, Plurinational States of; Bonaire, Sint Eustatius and Saba (Saba, Sint Eustatius); Brazil; Canada; Cayman Islands; Chile; Colombia; Costa Rica; Cuba; Dominica; Dominican Republic; Ecuador; El Salvador; French Guiana; Grenada; Guadeloupe; Guatemala; Guyana; Haiti; Honduras; Jamaica; Martinique; Mexico; Montserrat; Nicaragua; Panama; Paraguay; Peru; Puerto Rico; Saint Barthélemy; Saint Kitts and Nevis; Saint Lucia; Saint Martin (French part); Saint Vincent and the Grenadines; Sint Maarten (Dutch part); Suriname; Trinidad and Tobago; Turks and Caicos Islands; United States; Uruguay; Venezuela, Bolivarian Republic of; Virgin Islands, British; Virgin Islands, U.S.	Marine Coastal/Supratidal, Wetlands (inland), Artificial/Aquatic & Marine
51	*Gallinula nesiotis*	Tristan Moorhen	EX	Extinct	Saint Helena, Ascension and Tristan da Cunha (Tristan da Cunha)	Wetlands (inland), Shrubland

52	*Gallinula pacifica*	Samoan Moorhen	CR	Unknown	Samoa Endemic Flightless	Forest
53	*Gallinula silvestris*	Makira Moorhen	CR	Unknown	Solomon Islands Endemic to Mkira Is. Flightless	Forest
54	*Gallinula tenebrosa*	Dusky Moorhen	LC	Unknown	Australia; Indonesia; New Caledonia; Papua New Guinea; Timor-Leste	Wetlands (inland), Marine Neritic, Artificial/Terrestrial, Marine Coastal/Supratidal, Artificial/Aquatic & Marine
55	*Gallirallus australis*	Weka	VU	Decreasing	New Zealand Endemic Flightless	Marine Intertidal, Wetlands (inland), Marine Coastal/Supratidal, Grassland, Forest, Shrubland
56	*Gallirallus calayanensis*	Calayan Rail	VU	Stable	Philippines Endemic Flightless	Forest
57	*Gallirallus dieffenbachii*	Dieffenbach's Rail	EX	Extinct	New Zealand	Shrubland, Grassland
58	*Gallirallus insignis*	Pink-legged Rail	NT	Decreasing	Papua New Guinea Endemic Flightless	Forest
59	*Gallirallus lafresnayanus*	New Caledonian Rail	CR	Unknown	New Caledonia Endemic Flightless	Forest
60	*Gallirallus modestus*	Chatham Rail	EX	Extinct	New Zealand	Shrubland, Grassland
61	*Gallirallus okinawae*	Okinawa Rail	EN	Decreasing	Japan Endemic Flightless	Artificial/Terrestrial, Forest, Wetlands (inland)
62	*Gallirallus owstoni*	Guam Rail	EW	Extinct in Wild	United States of America Endemic to Guam Flightless	Forest, Savanna, Grassland, Shrubland, Artificial/Terrestrial

63	*Gallirallus pacificus*	Tahiti Rail	EX	Extinct	French Polynesia	Other
64	*Gallirallus philippensis*	Buff-banded Rail	LC	Stable	American Samoa (United States of America); Australia; Cocos (Keeling) Islands; Fiji; Indonesia; New Zealand; Niue; Norfolk Island; Palau; Papua New Guinea; Philippines; Samoa; Solomon Islands; Timor-Leste; Tonga; Vanuatu; Wallis and Futuna	Forest, Marine Coastal/Supratidal, Shrubland, Grassland, Rocky areas (e.g. inland cliffs, mountain peaks), Wetlands (inland), Artificial/Terrestrial, Artificial/Aquatic & Marine, Marine Intertidal
65	*Gallirallus rovianae*	Roviana Rail	NT	Decreasing	Solomon Islands Endemic Flightless	Shrubland, Artificial/Terrestrial, Forest
66	*Gallirallus striatus*	Slaty-breasted Rail	LC	Increasing	Bangladesh; Brunei Darussalam; Cambodia; China; India; Indonesia; Lao People's Democratic Republic; Malaysia; Myanmar; Philippines; Singapore; Sri Lanka; Taiwan, Province of China; Thailand; Viet Nam	Shrubland, Artificial/Aquatic & Marine, Forest, Grassland, Artificial/Terrestrial, Wetlands (inland)
67	*Gallirallus sylvestris*	Lord Howe Woodhen	EN	Stable	Australia Endemic to Lord Howe Is. Flightless	Forest
68	*Gallirallus torquatus*	Barred Rail	LC	Unknown	Indonesia; Philippines Near-endemic	Grassland, Wetlands (inland), Artificial/Terrestrial, Marine Coastal/Supratidal
69	*Gallirallus wakensis*	Wake Island Rail	EX	Extinct	United States of America	Shrubland
70	*Gymnocrex plumbeiventris*	Bare-eyed Rail	LC	Unknown	Indonesia; Papua New Guinea Near-endemic	Wetlands (inland), Forest, Grassland
71	*Gymnocrex rosenbergii*	Blue-faced Rail	VU	Decreasing	Indonesia Endemic	Forest, Wetlands (inland), Shrubland
72	*Gymnocrex talaudensis*	Talaud Rail	EN	Decreasing	Indonesia Endemic	Wetlands (inland)
73	*Habroptila wallacii*	Invisible Rail	VU	Decreasing	Indonesia Endemic to Sulawesi Flightless	Wetlands (inland), Forest

74	*Himantornis haematopus*	Nkulengu Rail	LC	Decreasing	Angola; Cameroon; Central African Republic; Congo, The Democratic Republic of the; Congo; Côte d'Ivoire; Equatorial Guinea; Gabon; Ghana; Guinea; Liberia; Nigeria; Sierra Leone; Togo; Uganda	Wetlands (inland), Artificial/Terrestrial, Forest
75	*Hypotaenidia immaculata*	Santa isabel Rail	NT	Unknown	Solomon Islands Endemic	Wetlands (inland), Forest, Artificial/Terrestrial
76	*Hypotaenidia tertia*	Bougainville Rail	NT	Decreasing	Papua New Guinea Endemic to Buka and Bougainville Is.	Artificial/Terrestrial, Forest, Wetlands (inland)
77	*Laterallus albigularis*	White-throated Crake	LC	Unknown	Colombia; Costa Rica; Ecuador; Honduras; Nicaragua; Panama	Wetlands (inland)
78	*Laterallus exilis*	Gray-breasted Crake	LC	Unknown	Argentina; Belize; Bolivia, Plurinational States of; Brazil; Colombia; Costa Rica; Ecuador; French Guiana; Guatemala; Guyana; Honduras; Nicaragua; Panama; Paraguay; Peru; Suriname; Trinidad and Tobago; Venezuela, Bolivarian Republic of	Artificial/Terrestrial, Wetlands (inland)
79	*Laterallus fasciatus*	Black-banded Crake	LC	Unknown	Brazil; Colombia; Ecuador; Peru	Shrubland, Artificial/Terrestrial, Forest
80	*Laterallus jamaicensis*	Black Rail	NT	Decreasing	Argentina; Belize; Brazil; Chile; Costa Rica; Cuba; Dominican Republic; Guatemala; Haiti; Honduras; Jamaica; Mexico; Panama; Peru; Puerto Rico; United States of America; Virgin Islands, U.S.;	Marine Intertidal, Wetlands (inland)
81	*Laterallus leucopyrrhus*	Red-and-white Crake	LC	Unknown	Argentina; Brazil; Paraguay; Uruguay	Wetlands (inland)
82	*Laterallus levraudi*	Rusty-flanked Crake	EN	Decreasing	Venezuela Endemic	Artificial/Aquatic & Marine, Grassland, Wetlands (inland)
83	*Laterallus melanophaius*	Rufous-sided Crake	LC	Unknown	Argentina; Bolivia, Plurinational States of; Brazil; Colombia; Ecuador; Guyana; Paraguay; Peru; Suriname; Uruguay; Venezuela, Bolivarian Republic of	Wetlands (inland)
84	*Laterallus ruber*	Ruddy Crake	LC	Unknown	Belize; Costa Rica; El Salvador; Guatemala; Honduras; Mexico; Nicaragua	Wetlands (inland)
85	*Laterallus spilonota*	Galapagos Rail	VU	Decreasing	Ecuador Endemic to Galapagos Is.	Forest, Grassland, Wetlands (inland), Artificial/Terrestrial
86	*Laterallus tuerosi*	Junin Rail	EN	Decreasing	Peru Endemic	Wetlands (inland)

87	*Laterallus viridis*	Russet-crowned Crake	LC	Unknown	Bolivia, Plurinational States of; Brazil; Colombia; Ecuador; French Guiana; Guyana; Paraguay; Peru; Suriname; Venezuela, Bolivarian Republic of	Grassland, Savanna, Artificial/Terrestrial
88	*Laterallus xenopterus*	Rufous-faced Crake	VU	Decreasing	Bolivia, Plurinational States of; Brazil; Paraguay Near-endemic	Grassland
89	*Lewinia mirifica*	Brown-banded Rail	DD	Unknown	Philippines Endemic to Luzon Is.	Forest, Grassland, Shrubland
90	*Lewinia muelleri*	Auckland Islands Rail	VU	Stable	New Zealand Endemic to Auckland Is.	Forest, Grassland, Shrubland
91	*Lewinia pectoralis*	Lewin's Rail	LC	Decreasing	Australia; Indonesia; Papua New Guinea Near-endemic	Wetlands (inland), Forest, Marine Intertidal, Grassland
92	*Megacrex inepta*	New Guinea Flightless Rail	LC	Decreasing	Indonesia; Papua New Guinea Endemic to New Guinea Is. Flightless	Forest
93	*Mentocrex beankaensis*	Tsingy Wood-rail	NT	Decreasing	Madagascar Endemic	Forest, Rocky areas (e.g. inland cliffs, mountain peaks)
94	*Mentocrex kioloides*	Madagascar Wood-rail	LC	Decreasing	Madagascar Endemic	Wetlands (inland), Forest
95	*Micropygia schomburgkii*	Ocellated Crake	LC	Unknown	Bolivia, Plurinational States of; Brazil; Colombia; Costa Rica; French Guiana; Guyana; Paraguay; Peru; Suriname; Venezuela, Bolivarian Republic of	Grassland, Savanna
96	*Mundia elpenor*	Ascension Crake	EX	Extinct	Saint Helena, Ascension and Tristan da Cunha	Shrubland
97	*Neocrex colombiana*	Colombian Crake	DD	Unknown	Colombia; Ecuador; Panama Near-endemic	Wetlands (inland), Grassland
98	*Neocrex erythrops*	Paint-billed Crake	LC	Unknown	Argentina; Bolivia, Plurinational States of; Brazil; Colombia; Ecuador; French Guiana; Guyana; Panama; Paraguay; Peru; Suriname; Trinidad and Tobago; United States of America; Costa Rica; Venezuela, Bolivarian Republic of	Wetlands (inland), Artificial/Terrestrial, Grassland
99	*Nesoclopeus poecilopterus*	Bar-winged Rail	EX	Extinct	Fiji	Forest
100	*Nesoclopeus woodfordi*	Woodford’s Rail	NT	Unknown	Solomon Islands Endemic Flightless	Wetlands (inland), Artificial/Terrestrial, Forest

101	*Pardirallus maculatus*	Spotted Rail	LC	Unknown	Argentina; Belize; Bolivia, Plurinational States of; Brazil; Cayman Islands; Chile; Colombia; Costa Rica; Cuba; Dominican Republic; Ecuador; El Salvador; French Guiana; Guatemala; Guyana; Haiti; Mexico; Panama; Paraguay; Peru; Suriname; Trinidad and Tobago; United States of America; Uruguay; Venezuela, Bolivarian Republic of	Wetlands (inland)
102	*Pardirallus nigricans*	Blackish Rail	LC	Unknown	Argentina; Bolivia, Plurinational States of; Brazil; Colombia; Ecuador; Paraguay; Peru; Venezuela, Bolivarian Republic of	Wetlands (inland)
103	*Pardirallus sanguinolentus*	Plumbeous Rail	LC	Stable	Argentina; Bolivia, Plurinational States of; Brazil; Chile; Ecuador; Falkland Islands (Malvinas); Paraguay; Peru; South Georgia and the South Sandwich Islands; Uruguay	Wetlands (inland)
104	*Porphyrio albus*	White Swamphen	EX	Extinct	Australia	Other
105	*Porphyrio alleni*	Allen's Gallinule	LC	Decreasing	Angola; Benin; Botswana; Burkina Faso; Burundi; Cameroon; Central African Republic; Chad; Congo, The Democratic Republic of the; Congo; Côte d'Ivoire; Djibouti; Equatorial Guinea; Ethiopia; Gabon; Gambia; Ghana; Guinea-Bissau; Guinea; Kenya; Lesotho; Liberia; Madagascar; Malawi; Mali; Mozambique; Namibia; Niger; Nigeria; Rwanda; Senegal; Sierra Leone; South Africa; South Sudan; Sudan; Tanzania, United Republic of; Togo; Uganda; Zambia; Zimbabwe;	Wetlands (inland), Artificial/Aquatic & Marine, Grassland
106	*Porphyrio caerulescens*	Reunion Gallinule	EX	Extinct	Reunion	Forest
107	*Porphyrio flavirostris*	Azure Gallinule	LC	Unknown	Argentina; Bolivia, Plurinational States of; Brazil; Colombia; Ecuador; French Guiana; Guyana; Paraguay; Peru; Suriname; Trinidad and Tobago; United States; Venezuela, Bolivarian Republic of	Wetlands (inland)
108	*Porphyrio hochstetteri*	South Island Takahe	EN	Stable	New Zealand Endemic to South Is. Flightless	Artificial/Terrestrial, Forest, Grassland

109	*Porphyrio kukwiedei*	New Caledonia Gallinule	EX	Extinct	New Caledonia	Wetlands (inland)
110	*Porphyrio mantelli*	North Island Takahe	EX	Extinct	New Zealand	Grassland
111	*Porzana martinica*	Purple Gallinule	LC	Decreasing	Antigua and Barbuda; Argentina; Aruba; Bahamas; Barbados; Belize; Bermuda; Bolivia, Plurinational States of; Brazil; Canada; Cayman Islands; Chile; Colombia; Costa Rica; Cuba; Dominica; Dominican Republic; Ecuador; El Salvador; Falkland Islands (Malvinas); French Guiana; Guatemala; Guyana; Haiti; Honduras; Jamaica; Martinique; Mexico; Montserrat; Nicaragua; Panama; Paraguay; Peru; Puerto Rico; Saint Barthélemy; Saint Kitts and Nevis; Saint Lucia; Saint Vincent and the Grenadines; Suriname; Trinidad and Tobago; Turks and Caicos Islands; United States; Uruguay; Venezuela, Bolivarian Republic of	Wetlands (inland)
112	*Porphyrio paepae*	Marquesan Swamphen	EX	Extinct	French Polynesia	Unknown
113	*Porphyrio porphyrio*	Western Swamphen	LC	Unknown	Afghanistan; Algeria; American Samoa; Angola; Australia; Azerbaijan; Bangladesh; Bhutan; Botswana; Burkina Faso; Burundi; Cambodia; Cameroon; Central African Republic; Chad; China; Congo, The Democratic Republic of the; Côte d'Ivoire; Croatia; Egypt; Ethiopia; Fiji; France; Gambia; Ghana; Guinea-Bissau; India; Indonesia; Iran, Islamic Republic of; Iraq; Italy; Kazakhstan; Kenya; Kuwait; Lao People's Democratic Republic; Lesotho; Liberia; Madagascar; Malawi; Malaysia; Mali; Mauritania; Mauritius; Morocco; Mozambique; Myanmar; Namibia; Nepal; New Caledonia; New Zealand; Niger; Nigeria; Niue; Pakistan; Palau; Papua New Guinea; Philippines; Portugal; Qatar; Russian Federation; Rwanda; Samoa; Senegal; Sierra Leone; Singapore; Solomon Islands; South Africa; Spain; Sri Lanka; Sudan; Swaziland; Syrian Arab Republic; Tanzania, United Republic of; Thailand; Timor-Leste; Togo; Tonga; Tunisia; Turkey;	Wetlands (inland), Artificial/Aquatic & Marine, Marine Coastal/Supratidal

					Turkmenistan; Uganda; United Arab Emirates; Vanuatu; Viet Nam; Zambia; Zimbabwe	
114	*Porphyriops melanops*	Spot-flanked Gallinule	LC	Stable	Argentina; Bolivia, Plurinational States of; Brazil; Chile; Colombia; Paraguay; Peru; Uruguay	Wetlands (inland)
115	*Porzana albicollis*	Ash-throated Crake	LC	Unknown	Argentina; Bolivia, Plurinational States of; Brazil; Colombia; French Guiana; Guyana; Paraguay; Peru; Suriname; Trinidad and Tobago; Venezuela, Bolivarian Republic of	Wetlands (inland), Grassland
116	*Porzana astrictocarpus*	St Helena Crake	EX	Extinct	Saint Helena, Ascension and Tristan da Cunha (Tristan da Cunha)	Other
117	*Porzana atra*	Henderson Crake	VU	Stable	Pitcairn Endemic to Henderson Is. Flightless	Forest
118	*Porzana bicolor*	Black-tailed Crake	LC	Decreasing	Bhutan; China; India; Lao People's Democratic Republic; Myanmar; Nepal; Thailand; Viet Nam	Forest, Artificial/Terrestrial, Grassland, Wetlands (inland)
119	*Porzana carolina*	Sora	LC	Increasing	Anguilla; Antigua and Barbuda; Aruba; Bahamas; Barbados; Belize; Bermuda; Bonaire, Sint Eustatius and Saba (Sint Eustatius); Canada; Cayman Islands; Colombia; Costa Rica; Cuba; Dominica; Dominican Republic; Ecuador; El Salvador; Grenada; Guatemala; Guyana; Haiti; Honduras; Jamaica; Martinique; Mexico; Montserrat; Nicaragua; Panama; Peru; Puerto Rico; Saint Barthélemy; Saint Kitts and Nevis; Saint Lucia; Saint Pierre and Miquelon; Saint Vincent and the Grenadines; Sint Maarten (Dutch part); Trinidad and Tobago; Turks and Caicos Islands; United States of America; Venezuela, Bolivarian Republic of; Virgin Islands, British; Virgin Islands, U.S.	Wetlands (inland), Artificial/Aquatic & Marine, Marine Coastal/Supratidal
120	*Porzana cinerea*	White-browed Crake	LC	Unknown	Australia; Brunei Darussalam; Cambodia; Fiji; Indonesia; Malaysia; Micronesia, Federated States of; New Caledonia; Palau; Papua New Guinea; Philippines; Samoa; Singapore; Solomon Islands; Thailand; Timor-Leste; Vanuatu	Artificial/Aquatic & Marine, Grassland, Wetlands (inland), Marine Coastal/Supratidal, Artificial/Terrestrial, Forest

121	*Porzana flaviventer*	Yellow-breasted Crake	LC	Unknown	Argentina; Belize; Bolivia, Plurinational States of; Brazil; Cayman Islands; Colombia; Costa Rica; Cuba; Dominican Republic; El Salvador; French Guiana; Guatemala; Guyana; Haiti; Jamaica; Mexico; Nicaragua; Panama; Paraguay; Puerto Rico; Suriname; Trinidad and Tobago; Uruguay; Venezuela, Bolivarian Republic of	Wetlands (inland)
122	*Porzana fluminea*	Australian Crake	LC	Unknown	Australia Endemic	Wetlands (inland), Artificial/Aquatic & Marine, Artificial/Terrestrial, Forest, Marine Intertidal, Marine Coastal/Supratidal
123	*Porzana fusca*	Ruddy-breasted Crake	LC	Decreasing	Bangladesh; Bhutan; Cambodia; China; India; Indonesia; Japan; Korea, Democratic People's Republic of; Korea, Republic of; Lao People's Democratic Republic; Malaysia; Myanmar; Nepal; Pakistan; Philippines; Russian Federation; Singapore; Sri Lanka; Taiwan, Province of China; Thailand; Timor-Leste Viet Nam	Wetlands (inland), Artificial/Terrestrial, Artificial/Aquatic & Marine, Grassland
124	*Porzana monasa*	Kosrae Crake	EX	Extinct	Micronesia, Federated States of	Wetlands (inland), Marine Intertidal, Forest
125	*Porzana nigra*	Tahiti Crake	EX	Extinct	French Polynesia (Tahiti)	Other
126	*Porzana palmeri*	Laysan Rail	EX	Extinct	United States of America	Grassland
127	*Porzana parva*	Little Crake	LC	Stable	Bahrain; Iran, Islamic Republic of; Jordan; Lebanon; Palestinian Territory, Occupied; Saudi Arabia; Sudan; Syrian Arab Republic; Turkmenistan; Yemen; Albania; Armenia; Austria; Belarus; Bosnia and Herzegovina; China; Croatia; Czech Republic; Estonia; Finland; France; Georgia; Germany; Kazakhstan; Kyrgyzstan; Latvia; Lithuania; Montenegro; Netherlands; Poland; Romania; Russian Federation; Serbia; Slovakia; Slovenia; Sweden; Switzerland; Turkey; Uzbekistan; Algeria; Azerbaijan; Belgium; Bulgaria; Cyprus; Egypt; Ethiopia; Greece; India; Iraq; Israel; Italy; Kuwait; Libya; Malta; Mauritania; Morocco; Nigeria; Oman; Pakistan; Senegal; Tajikistan; Tunisia; Ukraine;	Artificial/Aquatic & Marine, Grassland, Wetlands (inland)

					Zambia; Hungary; Macedonia, the former Yugoslav Republic of; Moldova; Spain	
128	*Zapornia paykullii*	Band-bellied Crake	NT	Decreasing	China; Indonesia; Korea, Democratic People's Republic of; Korea, Republic of; Malaysia; Thailand; Viet Nam; Russian Federation	Grassland, Wetlands (inland)
129	*Porzana porzana*	Spotted Crake	LC	Stable	Afghanistan; Albania; Algeria; Armenia; Austria; Azerbaijan; Bahrain; Belarus; Belgium; Bosnia and Herzegovina; Botswana; Bulgaria; Burundi; Chad; China; Congo, The Democratic Republic of the; Croatia; Cyprus; Czech Republic; Denmark; Egypt; Eritrea; Estonia; Ethiopia; Finland; France; Georgia; Germany; Ghana; Greece; Hungary; India; Iran, Islamic Republic of; Iraq; Ireland; Israel; Italy; Jordan; Kazakhstan; Kenya; Kuwait; Kyrgyzstan; Latvia; Lebanon; Lesotho; Liberia; Libya; Lithuania; Luxembourg; Macedonia, the former Yugoslav Republic of; Malawi; Malta; Mauritania; Moldova; Montenegro; Morocco; Mozambique; Netherlands; Nigeria; Norway; Oman; Pakistan; Palestinian Territory, Occupied; Poland; Portugal; Qatar; Romania; Russian Federation; Saudi Arabia; Senegal; Serbia; Slovakia; Slovenia; South Africa; South Sudan; Spain; Sudan; Sweden; Switzerland; Syrian Arab Republic; Tajikistan; Tanzania, United Republic of; Tunisia; Turkey; Turkmenistan; Ukraine; United Arab Emirates; United Kingdom; Uzbekistan; Yemen; Zambia; Zimbabwe	Wetlands (inland), Artificial/Aquatic & Marine, Grassland
130	*Porzana pusilla*	Baillon's Crake	LC	Unknown	Afghanistan; Albania; Algeria; Angola; Australia; Austria; Azerbaijan; Bahrain; Belarus; Belgium; Bosnia and Herzegovina; Botswana; Bulgaria; China; Congo, The Democratic Republic of the; Croatia; Cyprus; Czech Republic; Egypt; Ethiopia; France; Germany; Greece; Hungary; India; Indonesia; Iran, Islamic Republic of; Iraq; Israel; Italy; Japan; Jordan; Kazakhstan; Kenya; Korea, Democratic People's Republic of; Korea, Republic of; Kuwait; Kyrgyzstan; Lao People's Democratic Republic; Lebanon; Libya;	Marine Intertidal, Wetlands (inland), Artificial/Aquatic & Marine, Grassland

					Macedonia, the former Yugoslav Republic of; Madagascar; Malawi; Malaysia; Malta; Mauritania; Moldova; Mongolia; Montenegro; Morocco; Mozambique; Myanmar; Namibia; Nepal; Netherlands; New Zealand; Oman; Pakistan; Palestinian Territory, Occupied; Papua New Guinea; Philippines; Portugal; Romania; Russian Federation; Rwanda; Saudi Arabia; Senegal; Serbia; Singapore; Slovenia; Somalia; South Africa; Spain; Sri Lanka; Sudan; Swaziland; Switzerland; Tajikistan; Tanzania, United Republic of; Thailand; Tunisia; Turkey; Turkmenistan; Uganda; Ukraine; Uzbekistan; Viet Nam; Yemen; Zambia; Zimbabwe	
131	*Porzana sandwichensis*	Hawaiian Rail	EX	Extinct	United States of America	Forest
132	*Porzana spiloptera*	Dot-winged Crake	VU	Decreasing	Argentina; Brazil; Uruguay Near-endemic	Wetlands (inland), Marine Coastal/Supratidal, Grassland
133	*Porzana tabuensis*	Spotless Crake	LC	Unknown	American Samoa; Australia; Cook Islands; Fiji; French Polynesia; Indonesia; Micronesia, Federated States of; New Caledonia; New Zealand; Niue; Papua New Guinea; Philippines; Pitcairn; Samoa; Solomon Islands; Timor-Leste; Tonga	Artificial/Aquatic & Marine, Wetlands (inland), Artificial/Terrestrial, Shrubland, Marine Intertidal, Rocky areas (e.g. inland cliffs, mountain peaks)
134	*Rallicula forbesi*	Forbes's Forest-rail	LC	Stable	Indonesia; Papua New Guinea Endemic to New Guinea Is. Near-endemic	Forest
135	*Rallicula leucospila*	White-striped Forest-Rail	NT	Decreasing	Indonesia Endemic to New Guinea Is.	Forest
136	*Rallicula mayri*	Mayr's Rail	LC	Stable	Indonesia; Papua New Guinea Endemic to New Guinea Is. Near-endemic	Forest
137	*Rallicula rubra*	Chestnut Forest-Rail	LC	Stable	Indonesia; Papua New Guinea Endemic to New Guinea Is. Near-endemic	Forest
138	*Rallina canningi*	Andaman Crake	LC	Decreasing	India Endemic to Andaman Is.	Forest, Wetlands (inland)

139	*Rallina eurizonoides*	Slaty-legged Crake	LC	Decreasing	Cambodia; China; India; Indonesia; Japan; Myanmar; Palau; Philippines; Singapore; Sri Lanka; Taiwan, Province of China; Thailand; Viet Nam	Wetlands (inland), Forest, Artificial/Aquatic & Marine, Artificial/Terrestrial, Shrubland
140	*Rallina fasciata*	Red-legged Crake	LC	Unknown	Brunei Darussalam; Indonesia; Lao People's Democratic Republic; Malaysia; Myanmar; Philippines; Singapore; Thailand; Viet Nam	Artificial/Aquatic & Marine, Wetlands (inland), Grassland, Artificial/Terrestrial
141	*Rallina tricolor*	Red-necked Crake	LC	Unknown	Australia; Indonesia; Papua New Guinea Near-endemic	Forest, Wetlands (inland)
142	*Rallus antarcticus*	Austral Rail	VU	Decreasing	Argentina; Chile Near-endemic	Wetlands (inland)
143	*Rallus aquaticus*	Western Water Rail	LC	Decreasing	Afghanistan; Albania; Algeria; Armenia; Austria; Azerbaijan; Bahrain; Belarus; Belgium; Bosnia and Herzegovina; Bulgaria; China; Croatia; Cyprus; Czech Republic; Denmark; Egypt; Estonia; Faroe Islands; Finland; France; Georgia; Germany; Greece; Hong Kong; Hungary; Iceland; India; Iran, Islamic Republic of; Iraq; Ireland; Israel; Italy; Jordan; Kazakhstan; Kuwait; Kyrgyzstan; Latvia; Lebanon; Libya; Liechtenstein; Lithuania; Luxembourg; Macedonia, the former Yugoslav Republic of; Madagascar; Malta; Moldova; Montenegro; Morocco; Myanmar; Netherlands; Norway; Oman; Pakistan; Palestinian Territory, Occupied; Poland; Portugal; Qatar; Romania; Russian Federation; Saudi Arabia; Serbia; Slovakia; Slovenia; Spain; Sweden; Switzerland; Syrian Arab Republic; Taiwan, Province of China; Tajikistan; Tunisia; Turkey; Turkmenistan; Ukraine; United Arab Emirates; United Kingdom; Uzbekistan; Yemen	Wetlands (inland), Artificial/Aquatic & Marine, Grassland
144	*Rallus caerulescens*	African Rail	LC	Unknown	Angola; Botswana; Burundi; Cameroon; Congo, The Democratic Republic of the; Congo; Ethiopia; Gabon; Kenya; Lesotho; Malawi; Mozambique; Namibia; Rwanda; South Africa; South Sudan; Sudan; Swaziland; Tanzania, United Republic of; Uganda; Zambia; Zimbabwe	Artificial/Aquatic & Marine, Wetlands (inland), Grassland

145	*Rallus crepitans*	Clapper Rail	LC	Decreasing	Anguilla; Antigua and Barbuda; Bahamas; Barbados; Belize; Cayman Islands; Cuba; Dominica; Dominican Republic; Guadeloupe; Haiti; Jamaica; Martinique; Mexico; Montserrat; Panama; Puerto Rico; Saint Kitts and Nevis; Saint Lucia; Saint Vincent and the Grenadines; Turks and Caicos Islands; United States of America; Virgin Islands, British; Virgin Islands, U.S.	Marine Intertidal, Forest, Wetlands (inland)
146	*Rallus elegans*	King Rail	NT	Decreasing	Canada; Cuba; Mexico; United States of America	Wetlands (inland)
147	*Rallus indicus*	Eastern Water Rail	LC	Decreasing	China; Japan; Korea, Democratic People's Republic of; Korea, Republic of; Mongolia; Russian Federation; Thailand; Bangladesh; Hong Kong; India; Lao People's Democratic Republic; Myanmar; Nepal; Taiwan, Province of China; Viet Nam	Artificial/Aquatic & Marine, Wetlands (inland), Grassland
148	*Rallus limicola*	Virginia Rail	LC	Increasing	Bahamas; Canada; Colombia; Cuba; Ecuador; Guatemala; Mexico; Peru; Puerto Rico; Saint Pierre and Miquelon; United States of America	Wetlands (inland)
149	*Rallus longirostris*	Mangrove Rail	LC	Decreasing	Brazil; Colombia; Ecuador; French Guiana; Guyana; Peru; Suriname; Trinidad and Tobago; Venezuela, Bolivarian Republic of	Wetlands (inland), Marine Intertidal, Forest
150	*Rallus madagascariensis*	Madagascar Rail	VU	Decreasing	Madagascar Endemic	Forest, Wetlands (inland)
151	*Rallus obsoletus*	Ridgway's Rail	NT	Decreasing	Mexico; United States of America Near-endemic	Wetlands (inland), Marine Intertidal, Forest
152	*Rallus semiplumbeus*	Bogota Rail	EN	Decreasing	Columbia Endemic	Grassland, Wetlands (inland)
153	*Rallus tenuirostris*	Aztec Rail / Mexican Rail	NT	Decreasing	Mexico Endemic	Wetlands (inland)
154	*Rallus wetmorei*	Plain-flanked Rail	EN	Decreasing	Venezuela Endemic	Forest, Marine Coastal/Supratidal
155	*Rougetius rougetii*	Rouget's Rail	NT	Decreasing	Eritrea; Ethiopia Near-endemic	Wetlands (inland), Shrubland, Artificial/Terrestrial, Grassland

156	*Sarothrura affinis*	Striped Flufftail	LC	Decreasing	Kenya; Lesotho; Malawi; Mozambique; South Africa; South Sudan; Sudan; Swaziland; Tanzania; Zambia; Zimbabwe	Shrubland, Artificial/Terrestrial, Wetlands (inland), Grassland
157	*Sarothrura ayresi*	White-winged Flufftail	CR	Decreasing	Ethiopia; South Africa; Zimbabwe Near-endemic	Grassland
158	*Sarothrura boehmi*	Streaky-breasted Flufftail	LC	Decreasing	Angola; Benin; Burundi; Cameroon; Congo, The Democratic Republic of the; Congo; Equatorial Guinea; Gabon; Kenya; Malawi; Rwanda; Tanzania, United Republic of; Uganda; Zambia; Zimbabwe	Wetlands (inland), Grassland, Artificial/Aquatic & Marine
159	*Sarothrura elegans*	Buff-spotted Flufftail	LC	Stable	Angola; Cameroon; Congo, The Democratic Republic of the; Congo; Côte d'Ivoire; Equatorial Guinea; Gabon; Guinea; Kenya; Liberia; Malawi; Mozambique; Nigeria; Rwanda; Sierra Leone; South Africa; South Sudan; Sudan; Swaziland; Tanzania, United Republic of; Uganda; Zambia; Zimbabwe	Artificial/Terrestrial, Shrubland, Forest, Wetlands (inland)
160	*Sarothrura insularis*	Madagascar Flufftail	LC	Stable	Madagascar Endemic	Grassland, Wetlands (inland), Forest, Artificial/Terrestrial, Shrubland
161	*Sarothrura lugens*	Chestnut-headed Flufftail	LC	Decreasing	Angola; Cameroon; Congo, The Democratic Republic of the; Gabon; Rwanda; Tanzania, United Republic of; Zambia	Grassland, Savanna, Wetlands (inland), Artificial/Aquatic & Marine
162	*Sarothrura pulchra*	White-spotted Flufftail	LC	Decreasing	Angola; Benin; Burundi; Cameroon; Central African Republic; Congo, The Democratic Republic of the; Congo; Côte d'Ivoire; Equatorial Guinea; Gabon; Gambia; Ghana; Guinea-Bissau; Guinea; Kenya; Liberia; Nigeria; Rwanda; Senegal; Sierra Leone; South Sudan; Sudan; Tanzania, United Republic of; Togo; Uganda; Zambia	Wetlands (inland), Forest, Artificial/Terrestrial
163	*Sarothrura rufa*	Red-chested Flufftail	LC	Decreasing	Angola; Botswana; Burundi; Cameroon; Central African Republic; Congo, The Democratic Republic of the; Congo; Ethiopia; Gabon; Kenya; Liberia; Malawi; Mozambique; Namibia; Nigeria; Rwanda; Sierra Leone; South Africa; Swaziland; Tanzania, United Republic of; Togo; Uganda; Zambia; Zimbabwe	Artificial/Aquatic & Marine, Wetlands (inland), Grassland
164	*Sarothrura watersi*	Slender-billed Flufftail	EN	Decreasing	Madagascar Endemic	Artificial/Terrestrial, Wetlands (inland), Shrubland

165	*Tribonyx hodgenorum*	Hodgen's Waterhen	EX	Extinct	New Zealand	Unknown
166	*Tribonyx mortierii*	Tasmanian Nativehen	LC	Unknown	Australia Endemic to Tasmania Flightless	Wetlands (inland), Artificial/Terrestrial, Grassland
167	*Tribonyx ventralis*	Black-tailed Nativehen	LC	Stable	Australia Endemic	Wetlands (inland), Artificial/Aquatic & Marine, Artificial/Terrestrial

(BirdLife International 2018a, Gill and Donsker 2019)

Appendix B: Thesis Summary Document

Thesis Title
Conservation status, threats, and priority actions of rallids: a global assessment
Literature Review

Erin R Lehnert
College of Mathematics and Science

Christopher Butler, Ph.D.
Advisor

Statement of Problem or Issue

At the time of this writing, there is no comprehensive, readily accessible, and up-to-date compilation of the conservation status of the world's rallids.

Brief Summary of the Literature

The avian family Rallidae is one of the most widespread avian families of the world. Rallidae greatly exceeds the other families within the order Gruiformes in sheer number of species, taxonomic complexity, geographical distribution, and ecological niche. At the time of this writing, there is no comprehensive, readily accessible, and up-to-date compilation of the conservation status of the world's rallids. This thesis provides a brief global overview of the status of rallids worldwide, focusing primarily on regional endemics and threatened species, and identifies the main threats and the associated particular knowledge gaps.

Thesis Statement (Hypothesis)

Rallidae are an understudied avian family, and many species are misclassified with a Least Concern status when there is no documentation of population trends or when the population is known to have a negative trend.

Statement of Research Methodology

The International Union for the Conservation of Nature (IUCN) Red List has a vast database of plants and animals found worldwide. The Red List Index (RLI) measures trends in regards to the risk of extinction; the data available for Rallidae species provides a broad measure of the overall population trend for some of the more cooperative, readily accessible, or targeted species. For many rallids, this is the only current trend indicator available on a regional or global basis. Data of avian families of similar size, equivalent global distributions, and similar lifestyles were also obtained from the RLI to compare for

conservation status and population trends to place the circumstances of rallids in context; the families chosen were Anatidae, Cuculidae, Alcedinidae, and Corvidae.

Listed threats to Rallidae were obtained from the IUCN and literature searches for the family and species listed as threatened. Further focus was primarily on endemic and near-endemic species due to the inherent risk to these species as a result of their life history. Invasive species and habitat degradation or destruction were the primary threats identified. Wetland conservation is of special concern, as the majority of Rallidae species utilize this habitat. Internationally designated Important Bird Areas, Endemic Bird Areas, and associated sites designated under the Ramsar Convention were searched for mentions of rallids.

Confirmation, Modification, or Denial of Thesis (Brief Summary of Findings)

Rallidae species are incredibly understudied and vast gaps in knowledge exist, particularly for species in remote locations. The majority of birds classified as Least Concern have decreasing or unknown population trends and should be reclassified as Data Deficient until more research is undertaken.

Statement of the Significance of Findings

Rallidae are an understudied avian family, and with further research, action can be taken to protect these birds before they become critically imperiled.

Suggestions for Future Research

The eradication of invasive species, particularly of mammalian predators, is essential to many endemic and near-endemic species recoveries. Habitat protections headed by BirdLife International and the Ramsar Convention are making headway worldwide, and with further research and environmental action the future of Rallidae is in turn better understood and protected.