

THE STATE
OF TAIWAN'S BIRDS



2024



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Preface

This report is the second national bird report compiled for Taiwan and represents the product of years of study and collaboration across the country's bird conservation community. It offers an updated, evidence-based overview of Taiwan's avian biodiversity, drawing on the latest data from government agencies, citizen science projects, research networks, and conservation organizations.

The information presented here is vital not only for local stakeholders and policymakers, but also for the international community. Migratory species account for three-quarters of Taiwan's avian diversity. This reflects Taiwan's position as a key transit, stopover, and wintering site along the East Asian–Australasian Flyway—one of the world's major migratory bird routes. It also highlights the country's responsibility in conserving critical habitats used by birds throughout their annual journeys. The need for coordinated, transparent, and science-informed conservation across the flyway has never been more urgent. This document is part of Taiwan's ongoing effort to support the survival of the many species that depend on the EAAF.

We hope this report serves not only as a resource for researchers and decision-makers, but also as an invitation to deepen public engagement and cross-border cooperation in safeguarding bird species and their habitats.



Highlights

686

Bird species which occur in Taiwan

47

Threatened bird species in Taiwan

7

Threatened bird species
whose numbers have
increased

14

Species of breeding bird
whose numbers have
declined

2

Species of migratory
waterbirds whose numbers
have declined

8,000+

Active eBirders who contribute their
observations

1,150,000+

Completed bird checklists logged
since 1972

List of Abbreviations

BBS Taiwan	Taiwan Breeding Bird Survey
CBD	Convention on Biological Diversity
GBF	Global Biodiversity Framework
GBIF	Global Biodiversity Information Facility
NYBC Taiwan	Taiwan New Year Bird Count
TBN	Taiwan Biodiversity Network
TBIA	Taiwan Biodiversity Information Alliance
TaiBIF	Taiwan Biodiversity Information Facility

Red List Abbreviations

NE	Not Evaluated
DD	Data Deficient
LC	Least Concern
NT	Near Threatened
VU	Vulnerable
EN	Endangered
CR	Critically Endangered
PRE	Possibly Regionally Extinct
EW	Extinct in the Wild
EX	Extinct

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Introduction: From Observations to Indicators

Achieving Nature-Positive Growth by 2030

In December 2022, the second part of the 15th Conference of the Parties (COP 15) to the United Nations Convention on Biological Diversity (CBD) was held in Montreal, Canada. During this meeting, the Kunming-Montreal Global Biodiversity Framework was adopted, setting a core objective of achieving “nature-positive” outcomes by 2030 and reversing the global decline in biodiversity. Biodiversity indicators were highlighted as essential tools for assessing current conditions and tracking progress over time.

Despite this emphasis, many targets remain underdeveloped, and some still lack corresponding indicators. The absence of effective indicators was a key reason for the failure to achieve the Aichi Biodiversity Targets (2011–2020). As of 2020, there were 254 composite species indicators globally—211 of which were concentrated in Europe, with none representing Asia¹. It was not until 2020 and 2023 that India² and Taiwan³, respectively, launched national-level bird indicators. This marked the beginning of avian indicator development at the national scale in Asia.

Citizen science has emerged as an effective approach for rapidly collecting large volumes of biological observation data and is particularly suited to long-term national monitoring. With the widespread adoption of mobile networks and smart devices, communication and data sharing have become more accessible than ever. These technological and social shifts have significantly expanded the scope

of citizen science, ushering in a new era in which anyone can contribute to scientific research.

In Taiwan, citizen science initiatives over the past decade have contributed 89% of the Taiwan Biodiversity Network’s 26 million records. These data are available at <https://www.tbn.org.tw/> and are continuing to increase.

Birds, Excellent for Citizen Science and Indicator Development

Birds are a unique taxonomic group with high mobility, making them good indicators of environmental change. Compared to other biological groups, they are relatively easy to observe and identify—and their beauty and behavior naturally capture public interest. As a result, birds have become the most widely studied taxonomic group, drawing the attention of both scientists and the general public. Many ecological theories have been developed over the years through avian research and more than half of the world’s citizen science databases are filled with bird data. Taiwan is no exception. Birders across the country have become invaluable contributors to citizen science.

Taiwan’s advantage lies in its well established network of bird societies and a flourishing of civic groups related to nature observation. The bird society network, represented by the Taiwan Wild Bird Federation, has corresponding local partner

¹ Fraixedas, S., Lindén, A., Piha, M., Cabeza, M., Gregory, R., & Lehikoinen, A. (2020). A state-of-the-art review on birds as indicators of biodiversity: Advances, challenges, and future directions. *Ecological Indicators*, 118, 106728.

² SoIB. (2020). State of India’s birds 2020: Range, trends and conservation status. The SoIB Partnership., 50.

³ Lin, D. L., Ko, J. C. J., Amano, T., Hsu, C. T., Fuller, R. A., Maron, M., ... & Lee, P. F. (2023). Taiwan’s Breeding Bird Survey reveals very few declining species. *Ecological Indicators*, 146, 109839.

A photograph of a small bird, likely a sparrow, with brown and white plumage, perched on a thin, light-colored branch. The bird is facing right, and its beak is slightly open. The background is a soft, out-of-focus grey.

organizations in almost every city and county in Taiwan. This on-the-ground system of sharing and support makes it easy to promote citizen science projects for birds across the country.

From Observations to Conservation Actions

Taiwan's first national bird report was published⁴ in 2020, drawing heavily on data from citizen science projects. That same year, researchers used data from the Taiwan New Year Bird Count to assess population trends for 31 species of wintering waterbirds, providing valuable insights into migratory patterns along the East Asian–Australasian Flyway⁵.

In 2023, data from the Taiwan Breeding Bird Survey was used to analyze trends for 107 breeding bird species, leading to the development of three multispecies indicators: the Taiwan Forest Bird Indicator, the Taiwan Farmland Bird Indicator, and the Taiwan Introduced Bird Indicator. Results showed that between 2011 and 2019, forest and farmland indicators⁶ showed overall positive trends, though some species experienced notable declines.

This system—from citizen science data collection to indicator development and trend monitoring—is now well-established and updated annually. Ongoing actions include continued data collection, indicator updates, threat reassessments, and the planning of targeted conservation measures. Together, these efforts form the backbone of Taiwan's long-term bird monitoring and conservation framework, allowing researchers to detect environmental changes earlier as well as evaluate conservation measure effectiveness.

⁴ Lin D. L. and Pursner S. 2020. (Eds.) State of Taiwan's Birds 2020, Taiwan Endemic Species Research Institute, Taiwan Wild Bird Federation.

⁵ Lin, D. L., Tsai, C. Y., Pursner, S., Chao, J., Lyu, A., Amano, T., ... & Fuller, R. A. (2023). Remote and local threats are associated with population change in Taiwanese migratory waterbirds. *Global Ecology and Conservation*, 42, e02402.

⁶ Lin, D. L., Ko, J. C. J., Amano, T., Hsu, C. T., Fuller, R. A., Maron, M., ... & Lee, P. F. (2023). Taiwan's Breeding Bird Survey reveals very few declining species. *Ecological Indicators*, 146, 109839.

The Red List of the Birds of Taiwan



Taiwan Biodiversity Research Institute, Ministry of Agriculture /
Taiwan Wild Bird Federation

In 2023, the Taiwan Biodiversity Research Institute and the Taiwan Wild Bird Federation completed the second assessment of Taiwan's threatened bird species, resulting in the publication of *The Red List of the Birds of Taiwan, 2024*. Between the publication of the first national Red List report in 2016 and the second assessment, population trend analysis for both common breeding birds and wintering waterbirds was conducted. This greatly improved the ability to assess the threat levels for Taiwan's avifauna.

However, results were mixed. According to the 2024 report, a total of 318 species were included in the assessment: six taxa were classified as Critically Endangered, 12 taxa as Endangered, 29 taxa as Vulnerable, 41 taxa as Near Threatened, and 229 taxa as Least Concern. Compared with the 2016 assessment results, the threat level for 26 species had increased while the threat level for 30 species had decreased.

Comparisons of 2016 and 2023 Assessment Results:

- ◆ Of the 232 bird species listed as Least Concern in 2016, the 2024 report showed that the threat level for 212 species remained unchanged. Meanwhile 14 species were uplisted to Near Threatened, and six species were uplisted to Vulnerable (Figure 2a).
- ◆ Of the 31 species listed as Near Threatened in 2016, the 2024 report showed that the threat level for 15 species remained unchanged. Additionally, 14 species were downlisted to Least Concern, one species was uplisted to Vulnerable, and one species was uplisted to Endangered (Figure 2b).
- ◆ Of the 33 species listed as Vulnerable in 2016, the 2024 report showed that the threat level for 19

species remained unchanged while three species were downlisted to Least Concern, nine species were downlisted to Near Threatened, and two species were uplisted to Endangered (Figure 2c).

- ◆ Of the 13 species listed as Endangered in 2016, the 2024 report showed that the threat level for nine species remained unchanged while one species was downlisted to Near Threatened and another three were downlisted to Vulnerable (Figure 2d).
- ◆ Of the six species listed as Critically Endangered in 2016, the 2024 report showed that the threat level for five species remained unchanged, while one species was uplisted to Possibly Regionally Extinct (Common Buttonquail *Turnix sylvaticus*).
- ◆ Of the 302 species that were listed as Not Applicable in 2016, the 2024 report showed that the threat level for 301 species remained unchanged, with just one species being uplisted to Near Threatened (Aleutian Tern *Onychoprion aleuticus*).
- ◆ Of the 67 species which were Not Evaluated in 2016, the 2024 report showed that one species was newly assessed as Near Threatened (Warbling White-eye *Zosterops japonicus*), and one species was listed as Data Deficient (White-faced Plover *Anarhynchus dealbatus*). The status of the Black-chinned Fruit Dove (*Ptilinopus leclancheri*) was also adjusted from Data Deficient in 2016 to Not Applicable in 2023.
- ◆ The results reveal that threats to Taiwan's bird populations are increasing and there may be a number of factors not yet fully understood that are affecting these populations. In the future, more resources from both domestic and international sources will be needed to address the conservation needs of these species.



Table P1. Status and Threat Level for Bird Species in 2024 Red List

	CR	EN	VU	NT	LC	DD
Endemic Species		2	2	4	24	
Endemic Subspecies	1	2	4	9	36	
Non-endemic Residents	1	2	11	6	38	
Summer Visitors	1	1	1		12	
Winter Visitors	2	1	6	7	65	
Transient Migrants	1	4	5	6	39	
Seabirds				2	3	
Outlying Island Breeders			2	5	11	1

Figure P1. →

Comparison of assessment results for the *The Red List of the Birds of Taiwan* in 2016 and 2024 (CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern; DD = Data Deficient; NE = Not Evaluated).

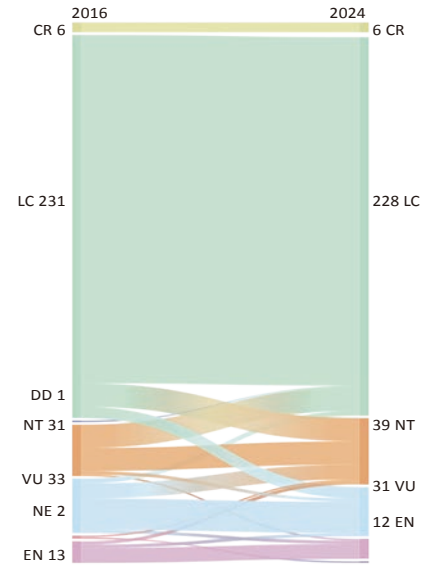


Figure P2. Changes in the 2024 threat status for species listed as (a) Least Concern, (b) Near Threatened, (c) Vulnerable, and (d) Endangered in 2016.

Species Name	Scientific Name	Taiwan Status 2016	Taiwan Status 2024	Population Trend (in Taiwan)	Global Status 2024
Endemic Species: 8 Species					
Taiwan Yellow Tit	<i>Machlolophus holsti</i>	NT	VU ▲	Decline	LC
Styan's Bulbul	<i>Pycnonotus taivanus</i>	VU	NT ▼	Decline	VU
Morrison's Fulvetta	<i>Alcippe morrisonia</i>	LC	NT ▲	Decline	LC
White-whiskered Laughingthrush	<i>Trochalopteron morrisonianum</i>	LC	NT ▲	Decline	LC
Taiwan Hwamei	<i>Garrulax taewanus</i>	EN	EN	Decline	NT
Taiwan Thrush	<i>Turdus niveiceps</i>	NT	NT	DD	LC
Taiwan Rosefinch	<i>Carpodacus formosanus</i>	LC	VU ▲	Decline	LC
Taiwan Bullfinch	<i>Pyrrhula owstoni</i>	VU	EN ▲	Decline	LC
Endemic Subspecies: 16 Species					
Ring-necked Pheasant	<i>Phasianus colchicus formosanus</i>	CR	CR	Decline	LC
Taiwan Green Pigeon	<i>Treron formosae formosae</i>	VU	VU	Stable	NT
Slaty-breasted Rail	<i>Lewinia striata taiwana</i>	NT	NT	DD	LC
Australasian Grass-Owl	<i>Tyto longimembris pithecopis</i>	EN	EN	DD	LC
Ryukyu Scops Owl	<i>Otus elegans botelensis</i>	NT	NT	Stable	NT
Collared Owlet	<i>Taeniopteryx brodiei pardalotum</i>	VU	NT ▼	Stable	LC
Himalayan Owl	<i>Strix niviculum yamadae</i>	NT	NT	DD	LC
White-backed Woodpecker	<i>Dendrocopos leucotos insularis</i>	NT	NT	Stable	LC
Yellowish-bellied Bush Warbler	<i>Horornis acanthizoides</i>	NT	NT	Decline	LC
Vinous-throated Parrotbill	<i>Suthora webbiana bulomacha</i>	NT	EN ▲	Decline	LC
Dusky Fulvetta	<i>Schoeniparus brunneus</i>	LC	NT ▲	Decline	LC
Eurasian Nuthatch	<i>Sitta europaea formosana</i>	VU	NT ▼	Stable	LC
Crested Myna	<i>Acridotheres cristatellus formosanus</i>	EN	NT ▼	Stable	LC
Little Forktail	<i>Enicurus scouleri fortis</i>	VU	VU	Stable	LC
Plumbeous Water Redstart	<i>Phoenicurus fuliginosus</i>	LC	VU ▲	Decline	LC
Alpine Accentor	<i>Prunella collaris fennelli</i>	VU	VU	Stable	LC
Non-endemic Residents: 20 Species					
Mandarin Duck	<i>Aix galericulata</i>	VU	VU	DD	LC
Blue-breasted Quail	<i>Synoicus chinensis</i>	EN	EN	DD	LC
Philippine Cuckoo-Dove	<i>Macropygia tenuirostris</i>	VU	VU	DD	LC
Pheasant-tailed Jacana	<i>Hydrophasianus chirurgus</i>	VU	NT ▼	Increase	LC
Small Buttonquail	<i>Turnix sylvaticus</i>	CR	CR (PRE) ▲	Regionally Extinct	LC
Little Tern	<i>Sterna albifrons</i>	NT	NT	Decline	LC
Mountain Hawk-Eagle	<i>Nisaetus nipalensis</i>	EN	VU ▼	Stable	NT
Black Eagle	<i>Ictinaetus malaiensis</i>	NT	NT	Increase	LC
Black Kite	<i>Milvus migrans</i>	VU	VU	Increase	LC
Tawny Fish-Owl	<i>Ketupa flavipes</i>	EN	VU ▼	DD	LC
Brown Wood-Owl	<i>Strix leptogrammica</i>	VU	NT ▼	DD	LC
Grey-headed Woodpecker	<i>Picus canus</i>	VU	VU	DD	LC
Large Cuckooshrike	<i>Coracina macei</i>	VU	VU	Decline	LC
Black-naped Oriole	<i>Oriolus chinensis</i>	VU	VU	Increase	LC
Long-tailed Shrike	<i>Lanius schach</i>	VU	VU	Decline	LC
Oriental Skylark	<i>Alauda gulgula</i>	LC	VU ▲	Decline	LC
Pacific Swallow	<i>Hirundo tahitica</i>	LC	NT ▲	Decline	LC
Chestnut Munia	<i>Lonchura atricapilla</i>	VU	VU	Stable	LC
Russet Sparrow	<i>Passer cinnamomeus</i>	EN	EN	Stable	LC
Eurasian Tree Sparrow	<i>Passer montanus</i>	LC	NT ▲	Decline	LC



Species Name	Scientific Name	Taiwan Status 2016	Taiwan Status 2024	Population Trend (in Taiwan)	Global Status 2024
Summer Visitors: 3 Species					
Watercock	<i>Gallicrex cinerea</i>	VU	EN ▲	DD	LC
Chinese Crested Tern	<i>Thalasseus bernsteini</i>	CR	CR	Decline	CR
Fairy Pitta	<i>Pitta nympha</i>	EN	VU ▼	Decline	VU
Winter Visitors: 16 Species					
Falcated Duck	<i>Mareca falcata</i>	VU	VU	Decline	NT
Eurasian Teal	<i>Anas crecca</i>	VU	NT ▼	Decline	LC
Baer's Pochard	<i>Aythya baeri</i>	CR	CR	DD	CR
Eurasian Curlew	<i>Numenius arquata</i>	VU	VU	Decline	NT
Ruddy Turnstone	<i>Arenaria interpres</i>	LC	VU ▲	Decline	LC
Temminck's Stint	<i>Calidris temminckii</i>	VU	NT ▼	DD	LC
Sanderling	<i>Calidris alba</i>	LC	NT	Stable	LC
Common Snipe	<i>Gallinago gallinago</i>	LC	VU ▲	Decline	LC
Wood Sandpiper	<i>Tringa glareola</i>	LC	NT ▲	Decline	LC
Saunders's Gull	<i>Saundersilarus saundersi</i>	CR	CR	Decline	VU
Oriental Stork	<i>Ciconia boyciana</i>	EN	EN	DD	EN
Black-faced Spoonbill	<i>Platalea minor</i>	NT	VU ▲	Increase	EN
Eurasian Kestrel	<i>Falco tinnunculus</i>	LC	VU ▲	Decline	LC
Peregrine Falcon	<i>Falco peregrinus</i>	LC	NT ▲	Stable	LC
Blue Rock-Thrush	<i>Monticola solitarius</i>	LC	NT ▲	Decline	LC
Red-throated Pipit	<i>Anthus cervinus</i>	LC	NT ▲	Decline	LC
Transient Migrants: 16 Species					
Far Eastern Curlew	<i>Numenius madagascariensis</i>	EN	EN	DD	EN
Bar-tailed Godwit	<i>Limosa lapponica</i>	VU	VU	DD	NT
Black-tailed Godwit	<i>Limosa limosa</i>	VU	VU	DD	NT
Great Knot	<i>Calidris tenuirostris</i>	EN	EN	Decline	EN
Red Knot	<i>Calidris canutus</i>	VU	VU	Decline	NT
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	LC	NT ▲	Decline	VU
Curlew Sandpiper	<i>Calidris ferruginea</i>	LC	NT ▲	DD	NT
Spoon-billed Sandpiper	<i>Calidris pygmaea</i>	CR	CR	DD	CR
Grey-tailed Tattler	<i>Tringa brevipes</i>	NT	NT	DD	NT
Nordmann's Greenshank	<i>Tringa guttifer</i>	EN	EN	DD	EN
Aleutian Tern	<i>Onychoprion aleuticus</i>	NA	NT ▲	Decline	VU
Chinese Egret	<i>Egretta eulophotes</i>	VU	VU	DD	VU
Oriental Scops-Owl	<i>Otus sunia</i>	LC	NT ▲	DD	LC
Ijima's Leaf Warbler	<i>Phylloscopus ijimae</i>	VU	VU	DD	VU
Yellow-breasted Bunting	<i>Emberiza aureola</i>	EN	EN	Decline	CR
Yellow Bunting	<i>Emberiza sulphurata</i>	VU	NT ▼	DD	LC
Seabirds: 2 Species					
Swinhoe's Storm-Petrel	<i>Hydrobates monorhis</i>	NT	NT	DD	NT
Streaked Shearwater	<i>Calonectris leucomelas</i>	NT	NT	Decline	NT
Outlying Island Breeders: 8 Species					
Eurasian Oystercatcher	<i>Haematopus ostralegus</i>	NT	NT	DD	NT
White-faced Plover	<i>Charadrius dealbatus</i>	NE	DD	DD	DD
White-throated Kingfisher	<i>Halcyon smyrnensis</i>	NT	NT	Stable	NT
Pied Kingfisher	<i>Ceryle rudis</i>	VU	NT ▼	Stable	LC
Blue-tailed Bee-eater	<i>Merops philippinus</i>	LC	VU ▲	Decline	LC
Black Paradise-Flycatcher	<i>Terpsiphone atrocaudata</i>	NT	NT	DD	NT
Collared Crow	<i>Corvus pectoralis</i>	VU	VU	Stable	VU
Warbling White-eye	<i>Zosterops japonicus</i>	NE	NT ▲	DD	LC

Part 1.

The Status and Trends of Taiwan's Birds

1. Breeding Birds

 Taiwan Biodiversity Research Institute, Ministry of Agriculture / Taiwan Wild Bird Federation /
Institute of Ecology and Evolutionary Biology, National Taiwan University

The conservation of breeding birds is a national priority—and a significant responsibility. Because this resource-intensive stage of a bird's life cycle occurs entirely within the country, the status of breeding birds serves as a vital indicator of Taiwan's environmental health.

The Taiwan Breeding Bird Survey is a citizen science project initially launched in 2009 to monitor long-term population trends of breeding birds in Taiwan. It was the first systematic nationwide survey in the history of bird conservation in Taiwan and a pioneering project in the East Asian region.

The BBS Taiwan takes place annually during the breeding season, from March to June. Volunteers conduct surveys using the point count method. These can be conducted at any time between 15 minutes before sunrise and 3 hours after sunrise under favorable weather conditions. While at the site, surveyors must observe and record all bird species heard and seen over a six-minute period. For further details on the survey methodology, please refer to the Taiwan Breeding Bird Survey website (<https://sites.google.com/a/birds-tesri.twbbs.org/bbs-taiwan/>).

In 2023, an analysis of BBS Taiwan data for 105 breeding bird species over the period of 2011 to 2021 was conducted to better understand population trends. In total, 20 species showed a significant increase in numbers, while 14 species showed a

significant decrease. The other 71 species showed no significant change. Of the 20 species showing significant population growth, 13 were forest-dependent. These include the Taiwan Partridge (*Arborophila crudigularis*), Asian Emerald Dove (*Chalcophaps indica*), Taiwan Barbet (*Psilopogon nuchalis*), Grey Treepie (*Dendrocitta formosae*), Maroon Oriole (*Oriolus traillii*), Coal Tit (*Periparus ater*), Black Bulbul (*Hypsipetes leucocephalus*), Taiwan Cupwing (*Pnoepyga formosana*), Snowy-browed Flycatcher (*Ficedula hyperythra*), Plain Flowerpecker (*Dicaeum minullum*), Fire-breasted Flowerpecker (*Dicaeum ignipectus*), Grey-headed Woodpecker (*Picus canus*), and Swinhoe's Pheasant (*Lophura swinhoii*). Four were farmland-dependent, including the Eastern Spot-billed Duck (*Anas zonorhyncha*), Spotted Dove (*Spilopelia chinensis*), Black-winged Kite (*Elanus caeruleus*), and Grey-throated Martin (*Riparia chinensis*). The other three preferred other habitats or used both forest and farmland habitats. This group included the Malayan Night Heron (*Gorsachius melanolophus*), Common Kingfisher (*Alcedo atthis*), and Green-backed Tit (*Parus monticolus*).

Among the 14 species showing significant population decline, five were forest-dependent. This group included the Yellowish-Bellied Bush-Warbler (*Horornis acanthizoides*), White-whiskered Laughingthrush (*Trochalopteron morrisonianum*), Taiwan Rosefinch (*Carpodacus formosanus*), Dusky Fulvetta (*Schoeniparus brunneus*), and Morrison's



Fulvetta (*Alcippe morrisonia*). Six of the species were farmland-dependent, including the Long-tailed Shrike (*Lanius schach*), Oriental Skylark (*Alauda gulgula*), Pacific Swallow (*Hirundo tahitica*), Striated Swallow (*Cecropis striolata*), Plain Prinia (*Prinia inornata*), and Eurasian Tree Sparrow (*Passer montanus*). The other three species had different habitat preferences, including the Plumbeous Water Redstart (*Phoenicurus fuliginosus*), Vinous-throated Parrotbill (*Sinosuthora webbiana*), and Light-vented Bulbul (*Pycnonotus sinensis*).

In addition, the analysis revealed that trends for certain species were near the threshold of statistical significance, narrowly avoiding classification as showing significant population declines. Regardless of statistical outcomes, the survival of these species warrants urgent attention. These include the Yellow-bellied Prinia (*Prinia flaviventris*), Rufous-capped Babbler (*Cyanoderma ruficeps*), Taiwan Bullfinch (*Pyrrhula owstoni*), Lesser Coucal (*Centropus bengalensis*), Steere's Liocichla (*Liocichla steerii*), and Taiwan Bamboo-Partridge (*Bambusicola sonorivox*).

The findings suggest that bird species inhabiting high mountains, such as the Yellowish-bellied Bush-Warbler (*Horornis acanthizoides*), White-whiskered Laughingthrush (*Trochalopteron morrisonianum*), and Taiwan Rosefinch (*Carpodacus formosanus*), may face survival threats due to climate change.

On the other hand, for species like the Long-tailed Shrike (*Lanius schach*), Oriental Skylark (*Alauda gulgula*), Plain Prinia (*Prinia inornata*), Eurasian Tree Sparrow (*Passer montanus*), and Vinous-throated Parrotbill (*Sinosuthora webbiana*) it is the degradation and disappearance of farmland and grassland habitat which is affecting them. The Plumbeous Water Redstart (*Phoenicurus fuliginosus*) and Light-vented Bulbul (*Pycnonotus sinensis*) were previously listed as Near Threatened species. Yet after reviewing data collected up until 2021, it is clear both species are experiencing significant declines. Compared to previous studies, where only the Taiwan Bamboo-Partridge (*Bambusicola sonorivox*) and Morrison's Fulvetta (*Alcippe morrisonia*) showed population decreases, this time the number of species with significantly declining population trends has increased to 14, signaling a much more concerning situation.

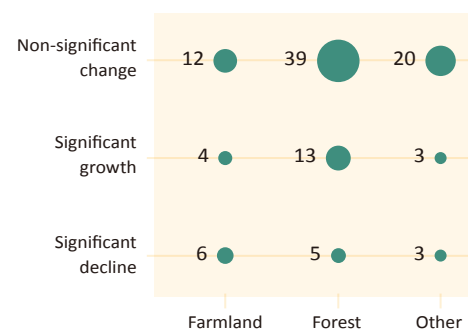
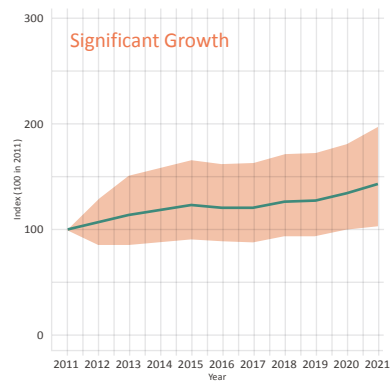


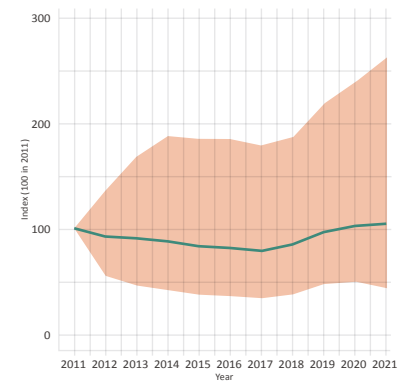
Figure 1.1.1. Summary of the population trends for 105 breeding bird species between 2011 and 2021 (credit: Da-Li Lin).

Trends for Forest Birds

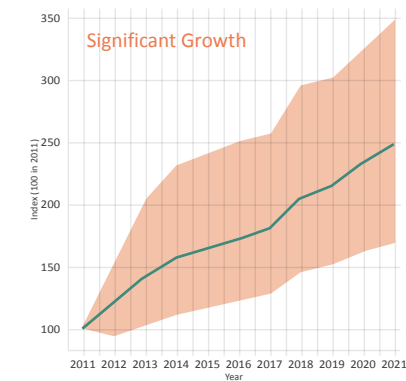
Taiwan Partridge (G)



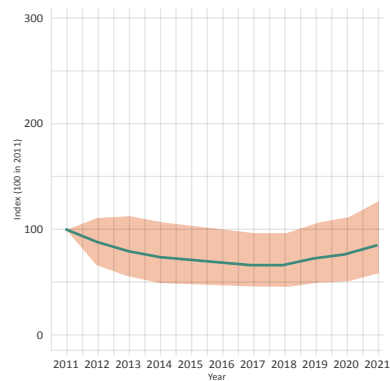
Ashy Wood-Pigeon (N)



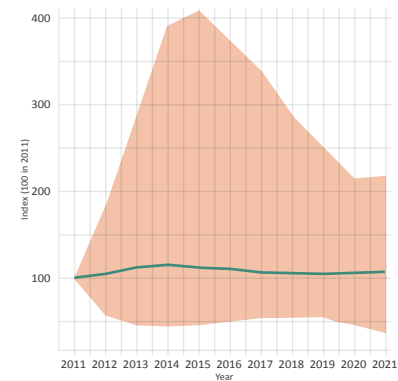
Asian Emerald Dove (G)



White-bellied Green-Pigeon (N)



Whistling Green-Pigeon (N)



Crested Serpent Eagle (N)

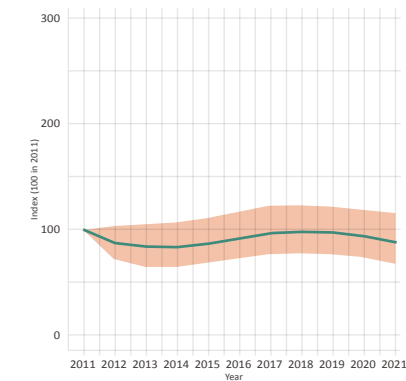
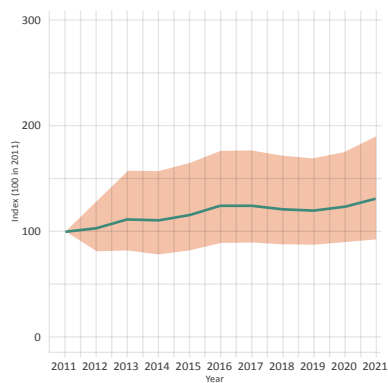


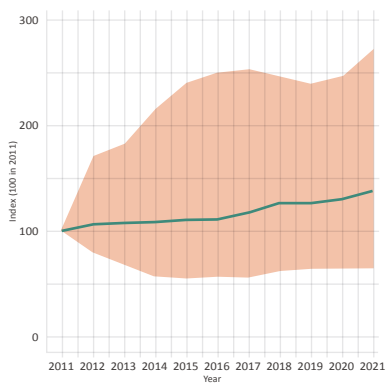
Figure 1.1.2. Population trends for 57 forest bird species between 2011 and 2021. The red line represents the median, while the upper and lower limits correspond to the 97.5th and 2.5th percentiles, respectively (G = Growth, D = Decline, N = Non-significant Change).



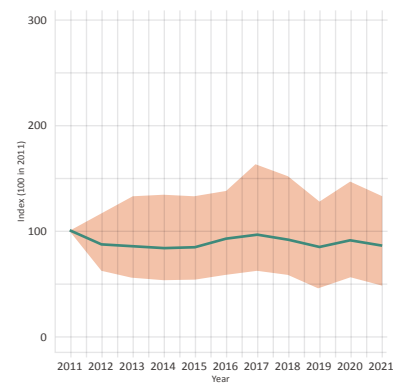
Crested Goshawk (N)



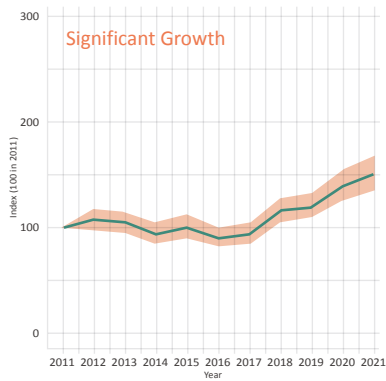
Black Eagle (N)



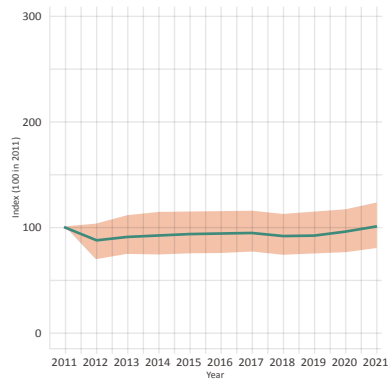
Besra (N)



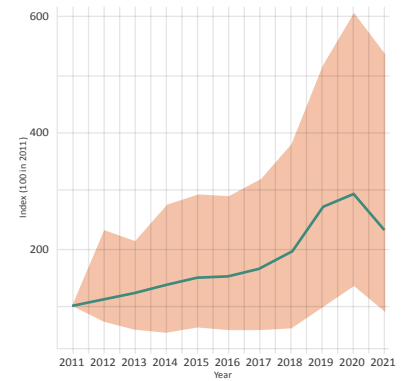
Taiwan Barbet (G)



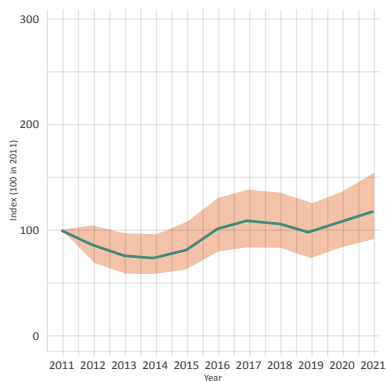
Gray-capped Pygmy Woodpecker (N)



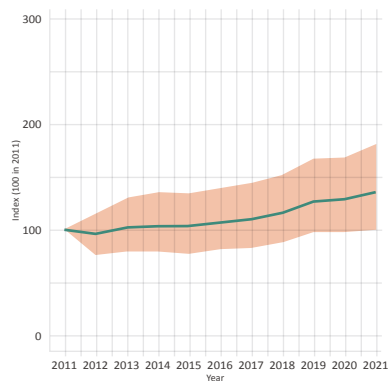
White-backed Woodpecker (N)



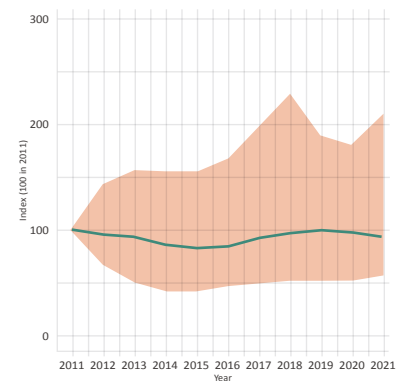
Gray-chinned Minivet (N)



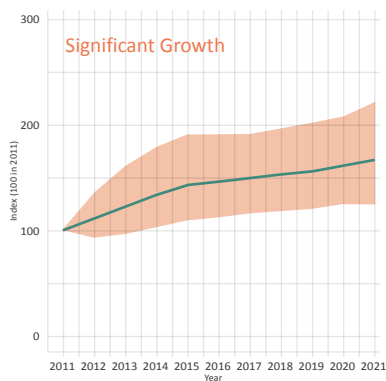
White-bellied Erpornis (N)



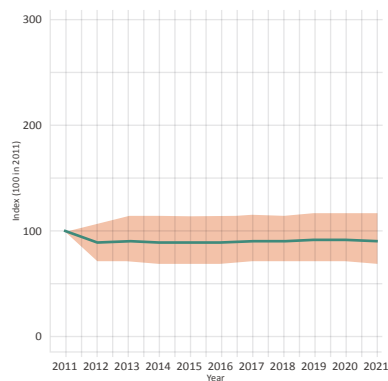
Black-naped Oriole (N)



Maroon Oriole (G)



Bronzed Drongo (N)

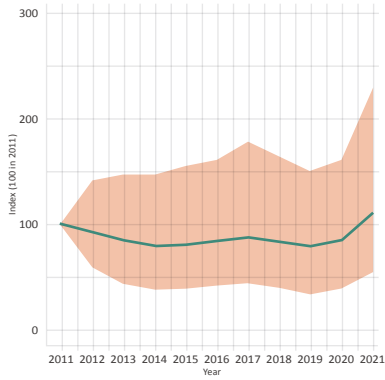


Black-naped Monarch (N)

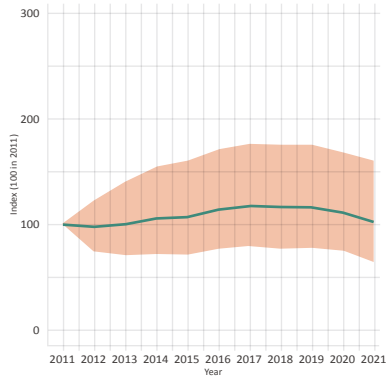




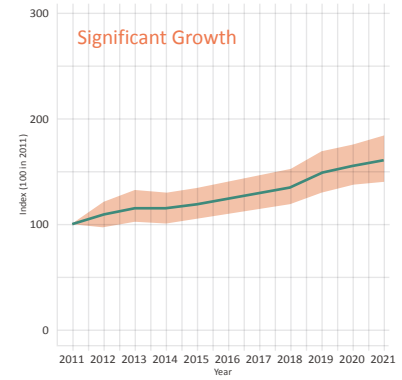
Eurasian Jay (N)



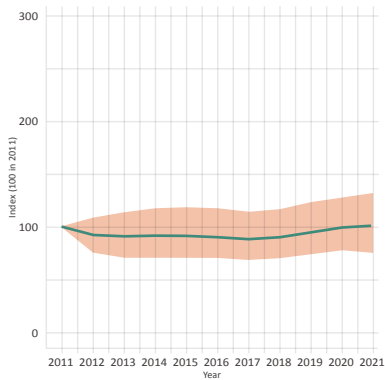
Taiwan Blue-Magpie (N)



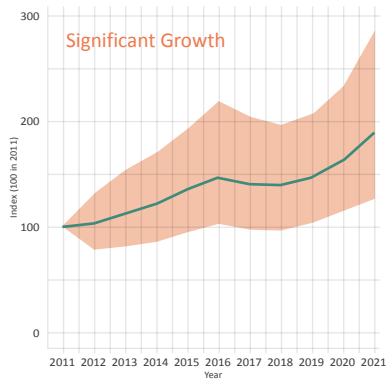
Gray Treepie (G)



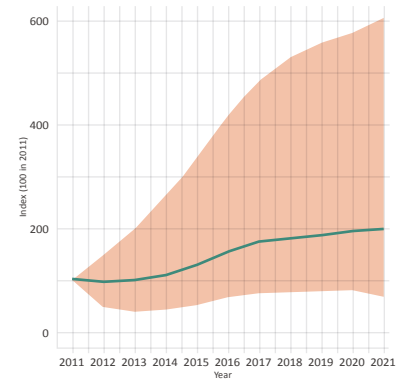
Large-billed Crow (N)



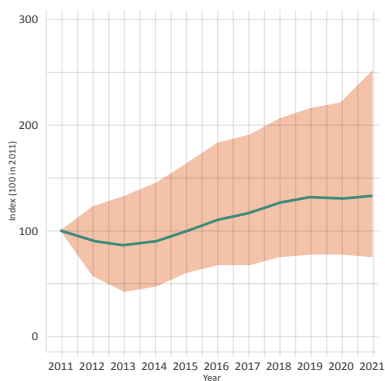
Coal Tit (G)



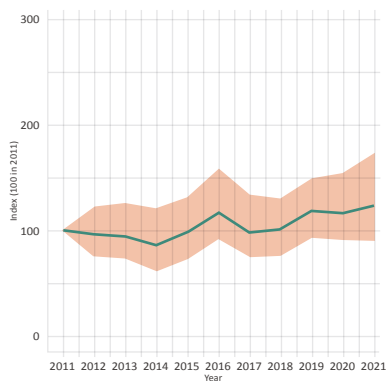
Chestnut-bellied Tit (N)



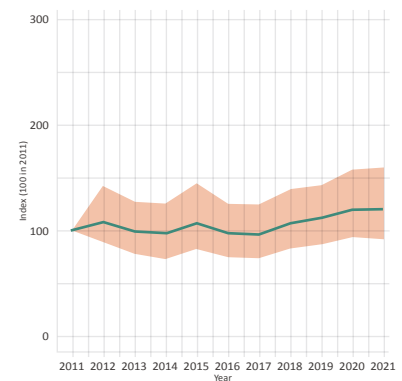
Eurasian Nuthatch (N)



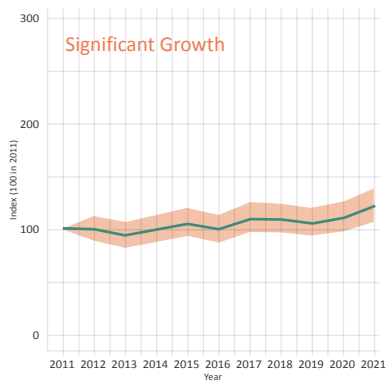
Eurasian Wren (N)



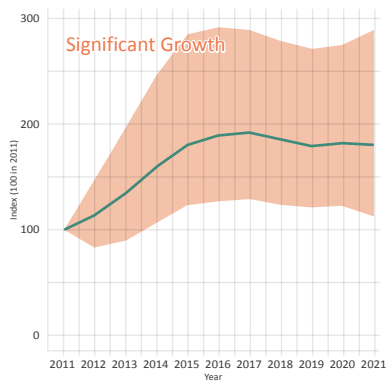
Collared Finchbill (N)



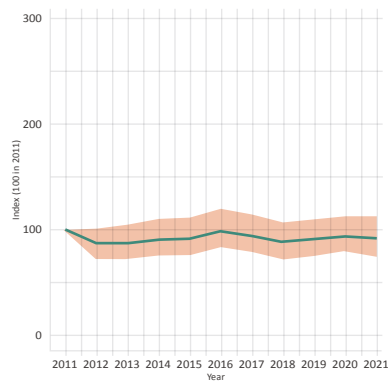
Black Bulbul (G)



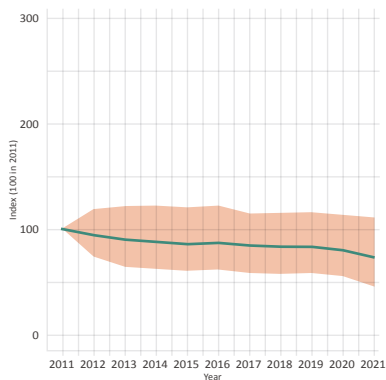
Taiwan Cupwing (G)



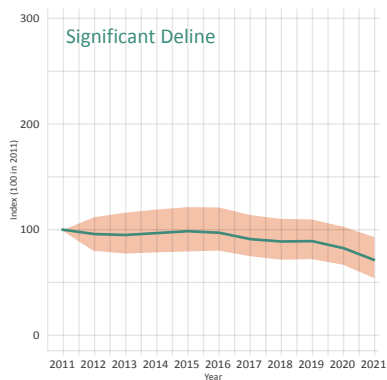
Rufous-faced Warbler (N)



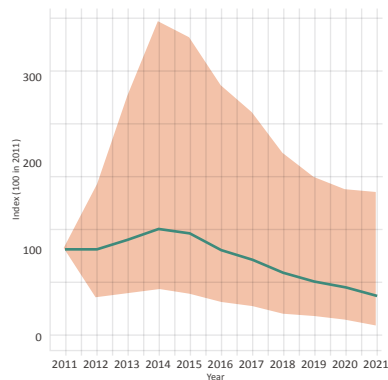
Brownish-flanked Bush-Warbler (N)



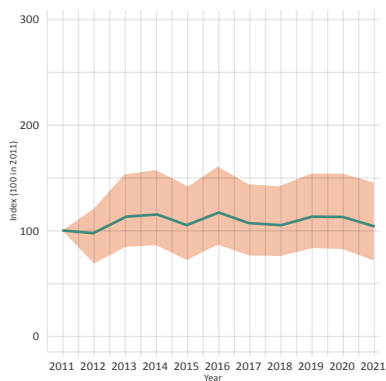
Yellowish-bellied Bush Warbler (D)



Golden Parrotbill (N)



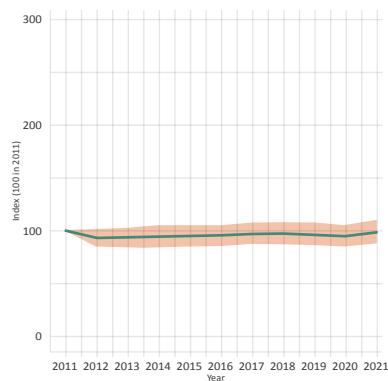
Taiwan Yuhina (N)



Rufous-capped Babbler (N)

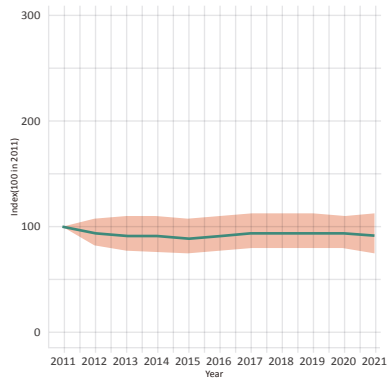


Taiwan Scimitar-Babbler (N)

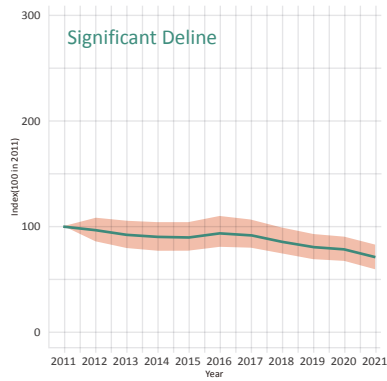




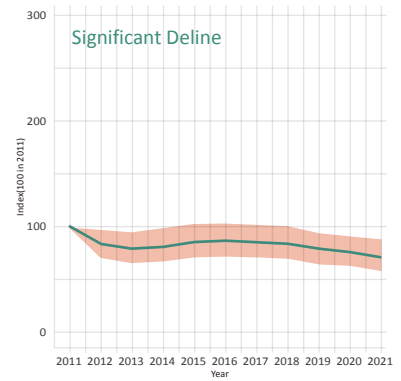
Black-necklaced Scimitar-Babbler (N)



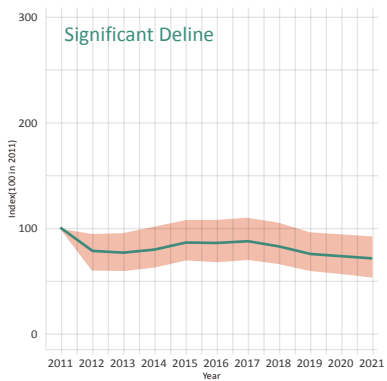
Dusky Fulvetta (D)



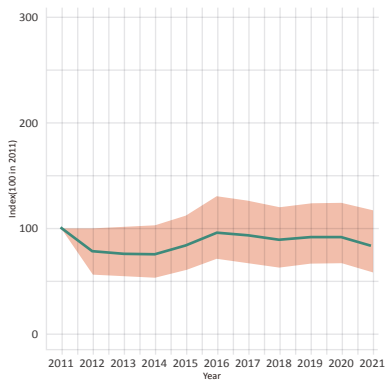
Morrison's Fuvetta (D)



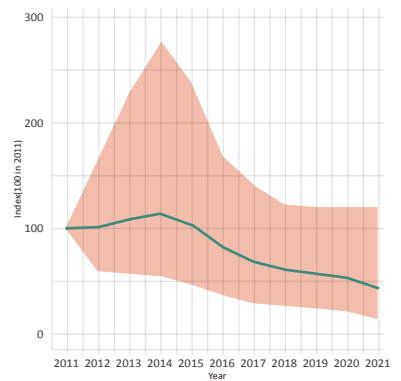
White-whiskered Laughingthrush (D)



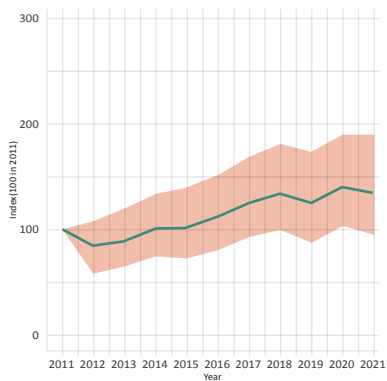
White-eared Sibia (N)



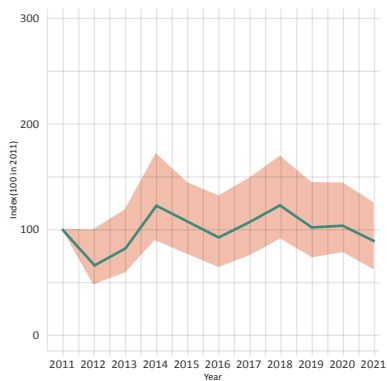
Taiwan Barwing (N)



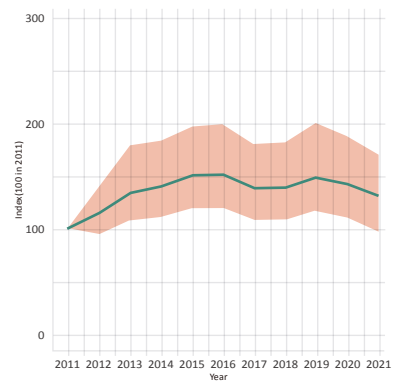
Taiwan Vivid Niltava (N)



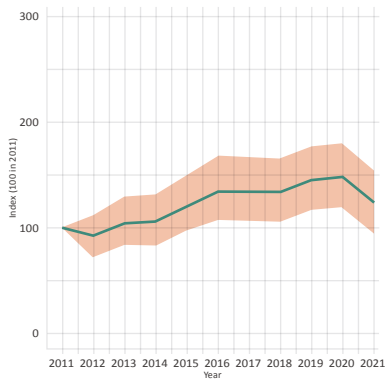
Taiwan Shortwing (N)



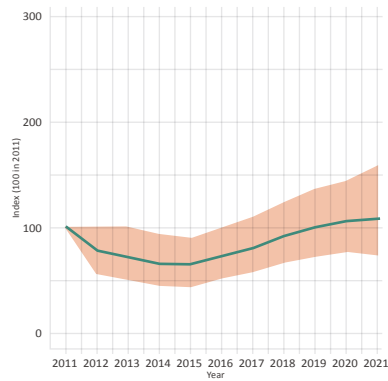
Taiwan Whistling Thrush (N)



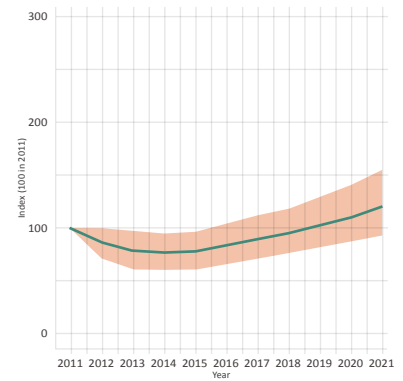
White-tailed Robin (N)



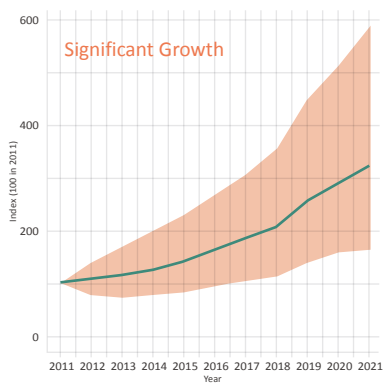
White-browed Bush-Robin (N)



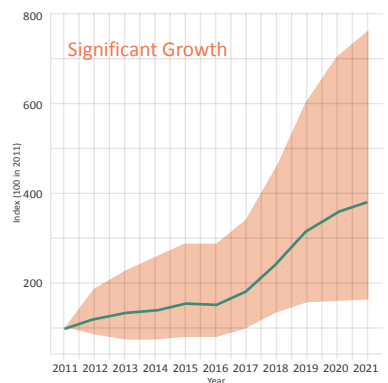
Collared Bush-Robin (N)



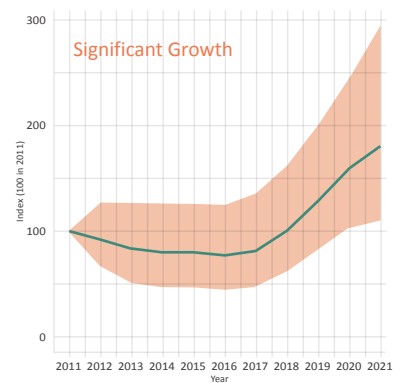
Snowy-browed Flycatcher (G)



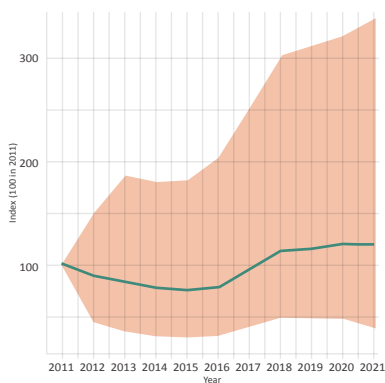
Plain Flowerpecker (G)



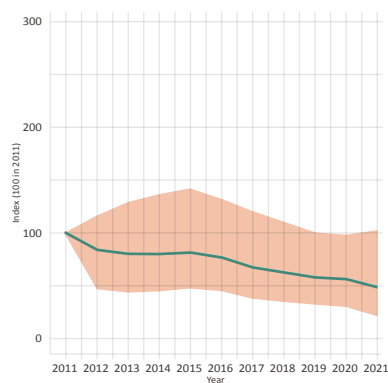
Fire-breasted Flowerpecker (G)



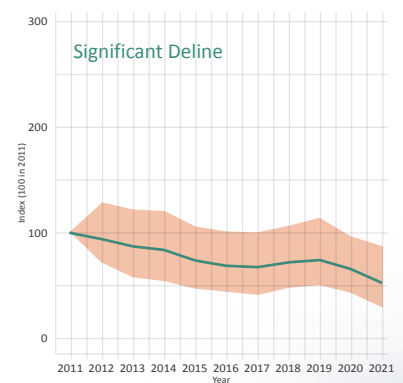
Brown Bullfinch (N)



Taiwan Bullfinch (N)

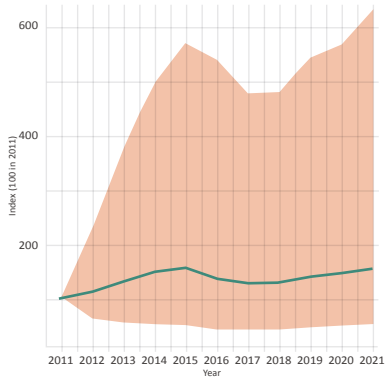


Taiwan Rosefinch (D)

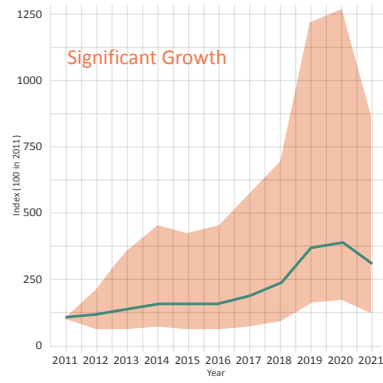




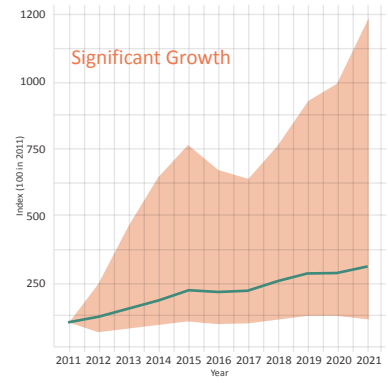
Rufous-crowned Laughingthrush (N)



Gray-headed Woodpecker (G)

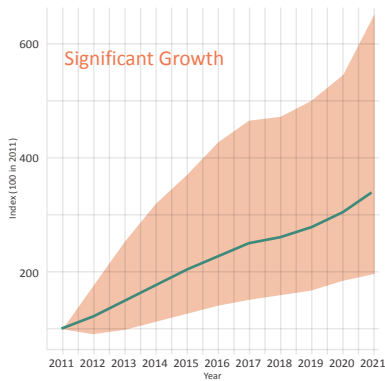


Swinhoe's Pheasant (G)

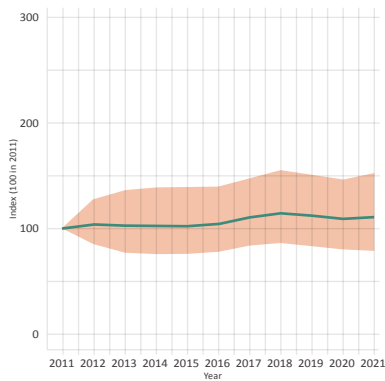


Trends for Farmland Birds

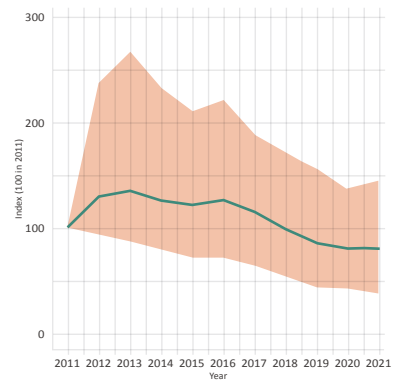
Eastern Spot-billed Duck (G)



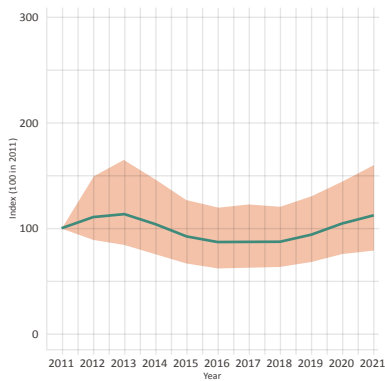
Ring-necked Pheasant (N)



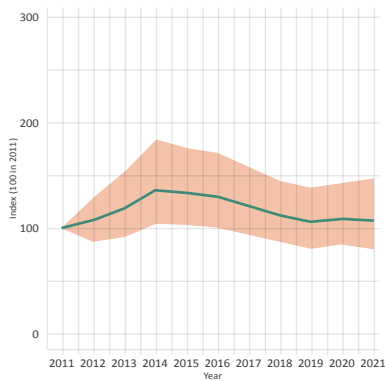
Barred Buttonquail (N)



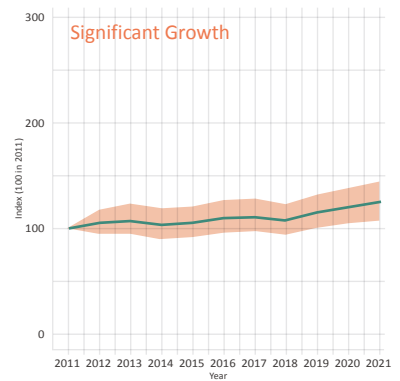
White-breasted Waterhen (N)



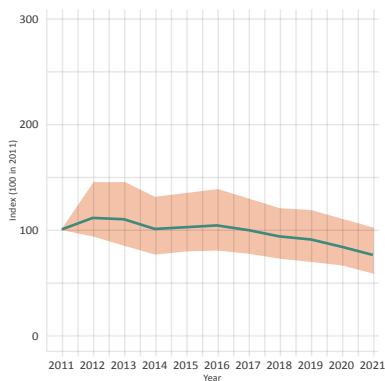
Eurasian Moorhen (N)



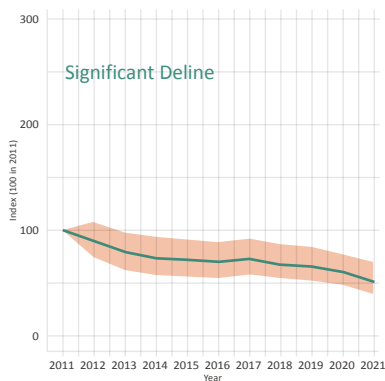
Spotted Dove (G)



Lesser Coucal (N)



Long-tailed Shrike (D)



Black Drongo (N)

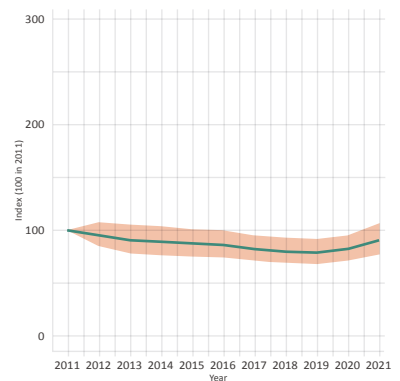
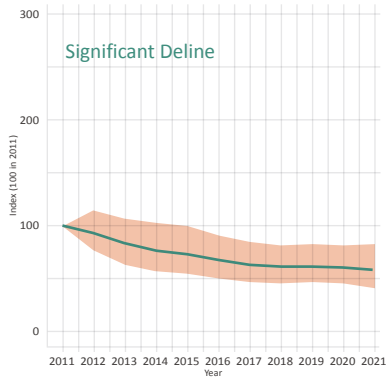


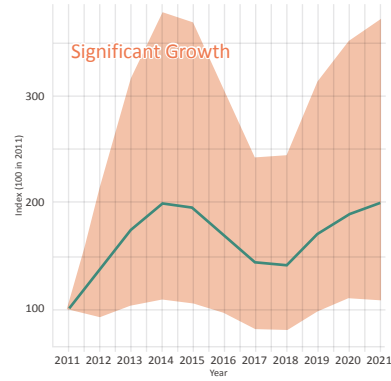
Figure 1.1.3. Population trends for 22 farmland bird species between 2011 and 2021. The red line represents the median, while the upper and lower limits correspond to the 97.5th and 2.5th percentiles, respectively (G = Growth, D = Decline, N = Non-significant Change).



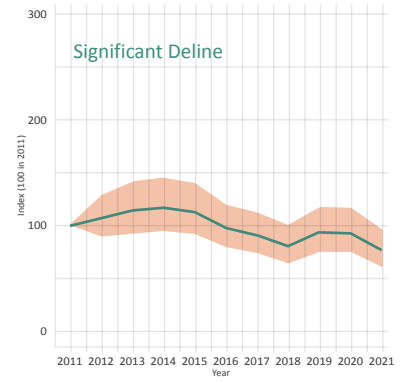
■ Oriental Skylark (D)



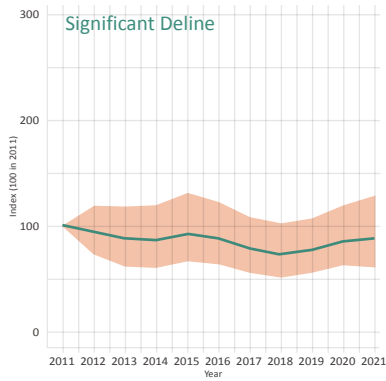
■ Gray-throated Martin (G)



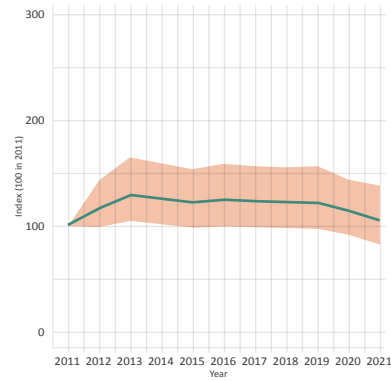
■ Pacific Swallow (D)



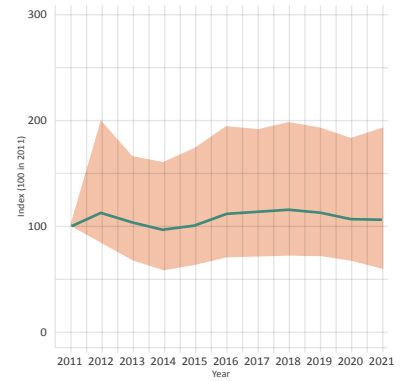
■ Striated Swallow (D)



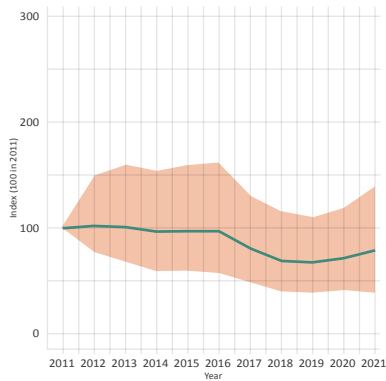
■ Zitting Cisticola (N)



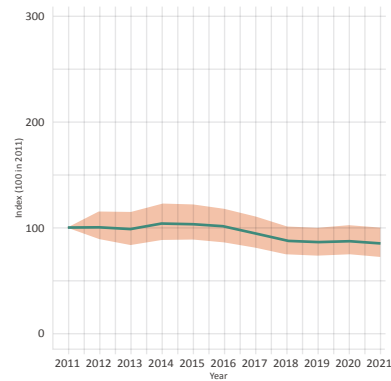
■ Golden-headed Cisticola (N)



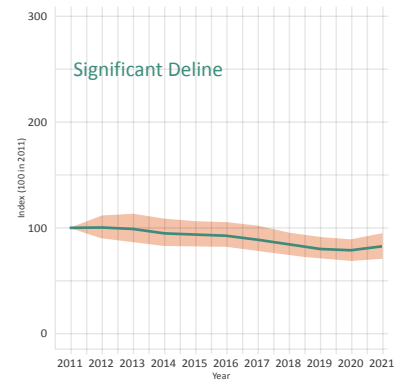
■ Striated Prinia (N)



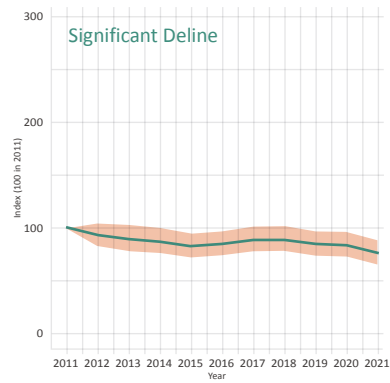
■ Yellow-bellied Prinia (N)



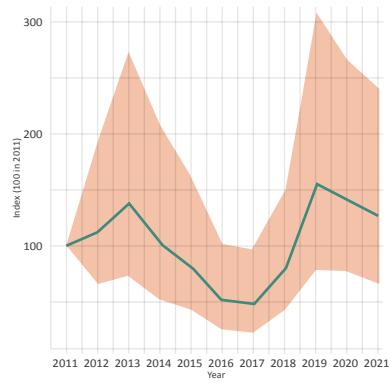
■ Plain Prinia (D)



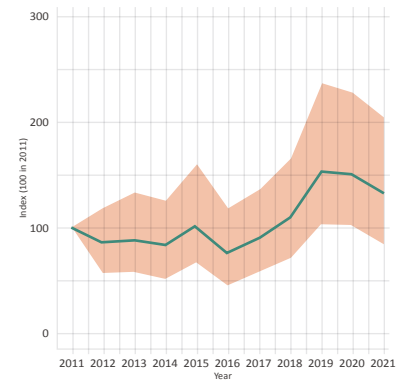
■ Eurasian Tree Sparrow (D)



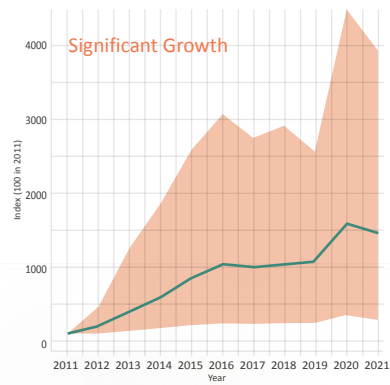
■ White-rumped Munia (N)



■ Nutmeg Munia (N)



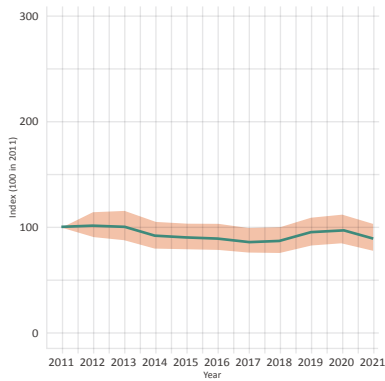
■ Black-winged Kite (G)



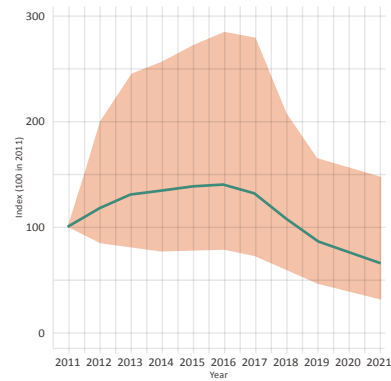


Trends for Birds which Prefer Other Habitats

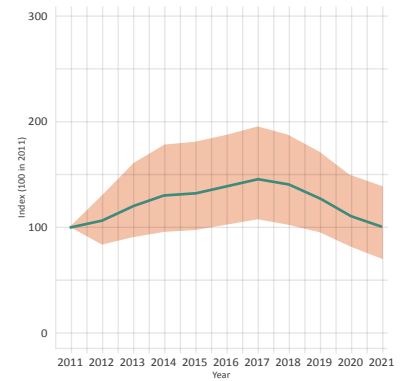
Taiwan Bamboo-Partridge (N)



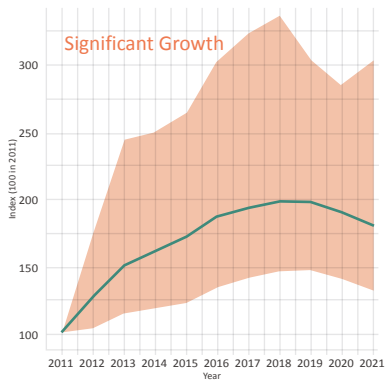
Little Grebe (N)



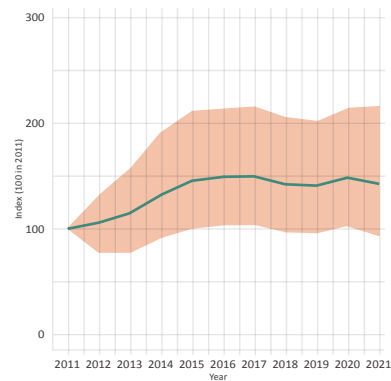
Black-crowned Night-Heron (N)



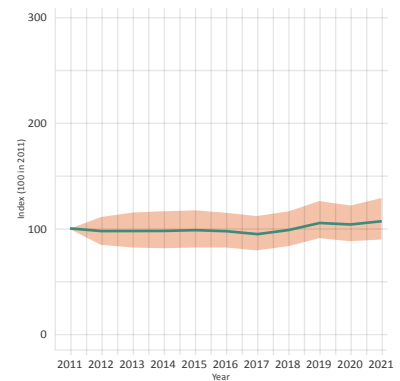
Malayan Night-Heron (G)



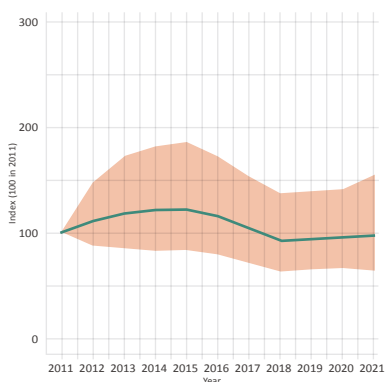
Oriental Turtle-Dove (N)



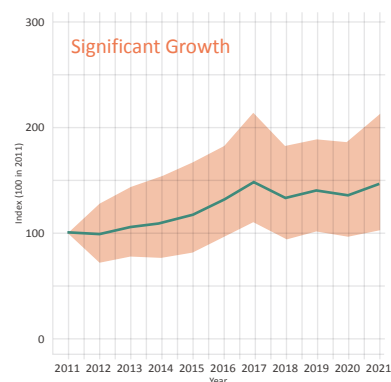
Red Collared-Dove (N)



House Swift (N)



Common Kingfisher (G)



Asian House-Martin (N)

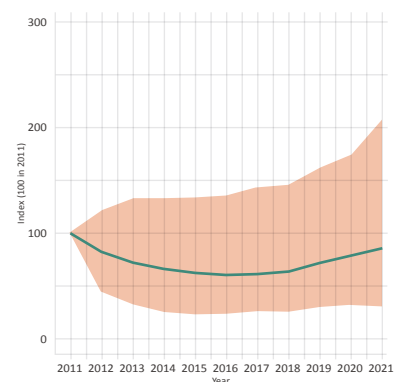
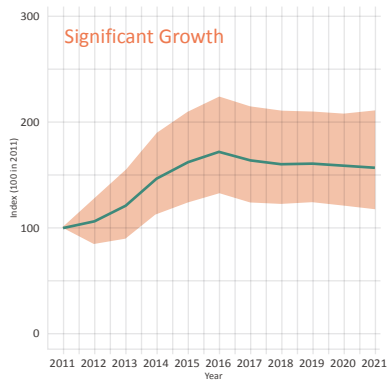
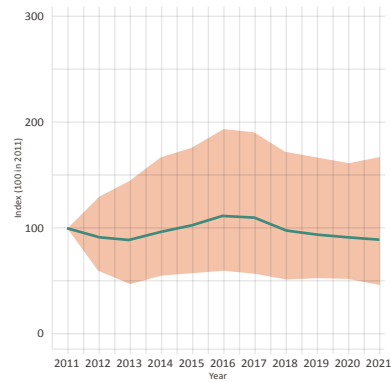


Figure 1.1.4. Population trends for 28 bird species which prefer types of habitat other than forest or farmland between 2011 and 2021. The red line represents the median, while the upper and lower limits correspond to the 97.5th and 2.5th percentiles, respectively (G = Growth, D = Decline, N = Non-significant Change).

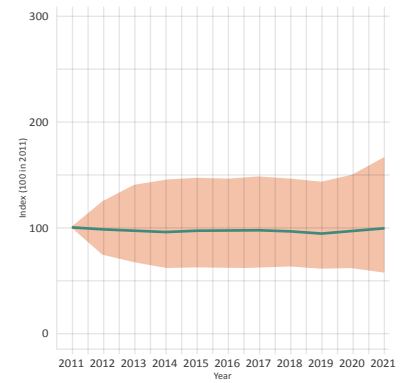
Green-backed Tit (G)



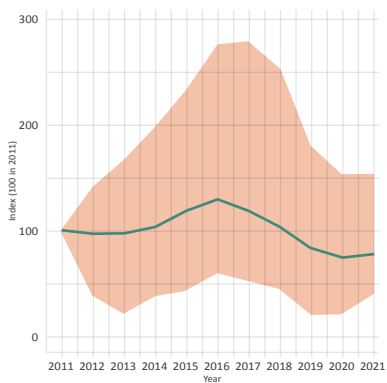
Yellow Tit (N)



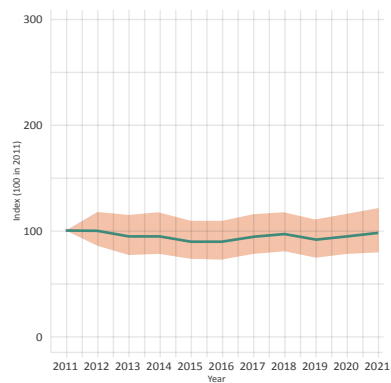
Black-throated Tit (N)



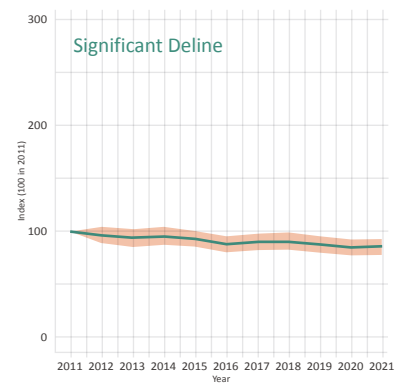
Brown Dipper (N)



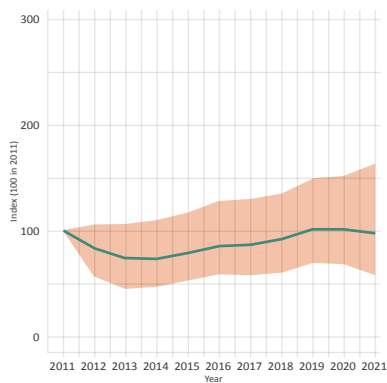
Styan's Bulbul (N)



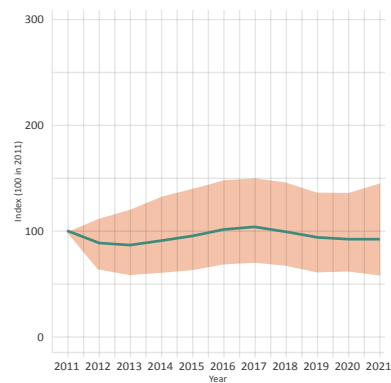
Light-vented Bulbul (D)



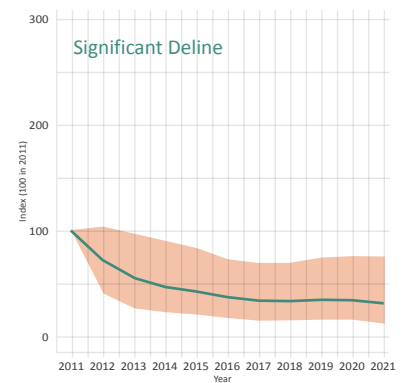
Flamecrest (N)



Taiwan Fulvetta (N)

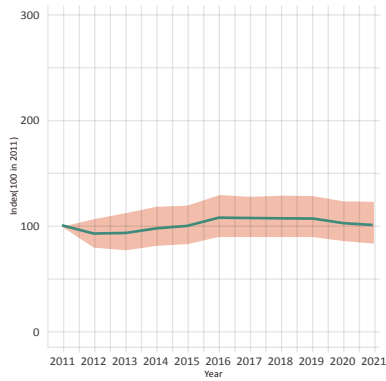


Vinous-throated Parrotbill (D)





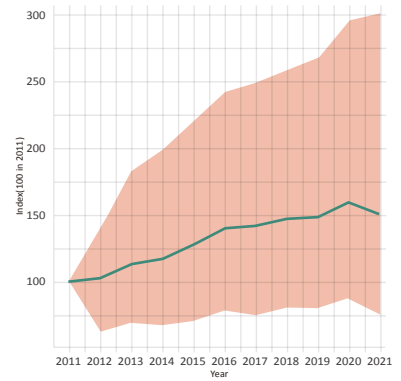
Swinhoe's White-eye (N)



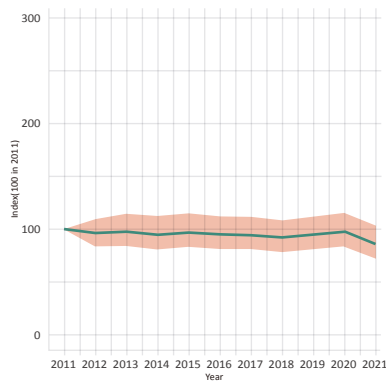
Taiwan Hwamei (N)



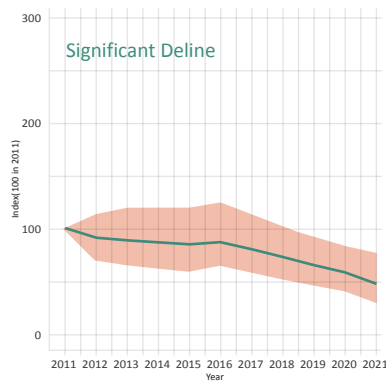
Rusty Laughingthrush (N)



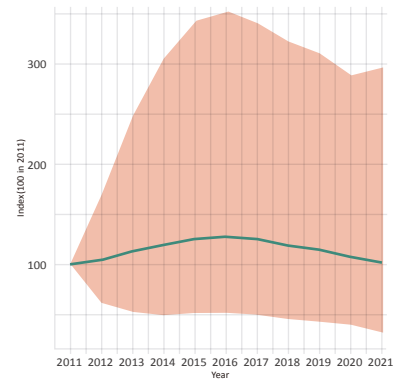
Steere's Liocichla (N)



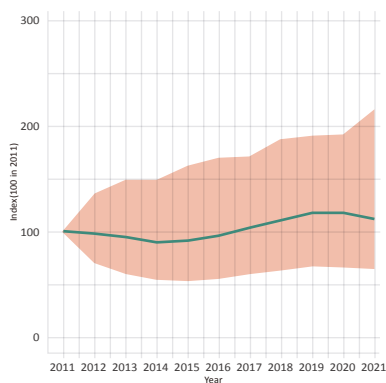
Plumbeous Water Redstart (D)



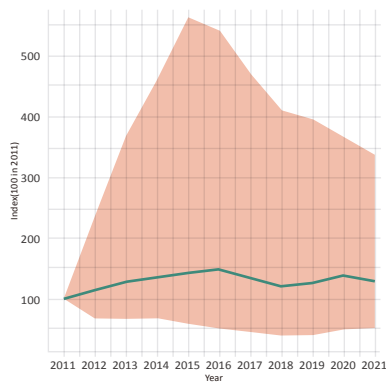
Crested Myna (N)



Alpine Accentor (N)



Little Forktail (N)



2. Migratory Waterbirds



Taiwan Biodiversity Research Institute, Ministry of Agriculture / Taiwan Wild Bird Federation /
Wild Bird Society of Taipei / Kaohsiung Wild Bird Society

The loss of intertidal mudflats is an important factor behind the rapid decline in the number of migratory waterbirds along the East Asian-Australasian Flyway (EAAF). Intertidal mudflats provide diverse ecosystem functions and services that sustain biodiversity and protect coastal areas. They not only support many invertebrates, which serve as an important food source for migrating waterbirds, but also buffer coastal areas from the impact of shoreline erosion and rising sea levels. Unfortunately, these sites of critical importance continue to be lost around the world, especially in the Yellow Sea region and the Korean Peninsula⁷.

For Taiwan proper, numbers of Common Snipe (*Gallinago gallinago*) and Wood Sandpiper (*Tringa glareola*) have declined significantly, while those of Northern Shoveler (*Spatula clypeata*), Eurasian Wigeon (*Mareca penelope*), Eurasian Coot (*Fulica atra*), Pied Avocet (*Recurvirostra avosetta*), and Caspian Tern (*Hydroprogne caspia*) have increased significantly. Meanwhile, for the migratory bird hotspots of the Yilan Plain, the Changhua Coast and the Chianan Coast, changes and trends varied. Migratory waterbirds which used the Yilan Plain experienced the most serious declines, with a total of nine species experiencing significant decreases, and no species showing significant increases. Meanwhile, along the Changhua Coast, four species decreased significantly while one species increased significantly. Lastly, along the Chianan Coast, only one species decreased significantly while 11 species showed significant increases⁸.

Further analysis revealed that the loss of mudflats around the Yellow Sea and the reduction of rice paddies in the Yilan Plain were the two primary factors contributing to the decline in the number of wintering waterbirds in Taiwan. This highlights the importance of habitat preservation as well as the biodiversity conservation function of rice paddy ecosystems. It also illustrates how tenuous the situation is for migratory waterbirds, as they encounter considerable threats at both their stopover sites and wintering grounds. Moreover, it reinforces the need for appropriate land use and agricultural management policies to help improve the chances of survival for migratory waterbirds.

Tracking birds that travel halfway around the world—crossing over 20 countries—is no easy task. Although surveys have been conducted in many nations along the East Asian–Australasian Flyway, maintaining consistent coverage across the full route of migration remains a major challenge. Taiwan's birders, however, contribute a vital piece to this puzzle. Because these species pass through numerous countries during their annual journeys, assessing their status, trends, and conservation needs requires cross-border cooperation. Only through such transnational collaboration can appropriate conservation actions be effectively planned and implemented.

⁷ Murray, N. J., Phinn, S. R., DeWitt, M., Ferrari, R., Johnston, R., Lyons, M. B., ... & Fuller, R. A. (2019). The global distribution and trajectory of tidal flats. *Nature*, 565(7738), 222–225.

⁸ Lin, D. L., Tsai, C. Y., Pursner, S., Chao, J., Lyu, A., Amano, T., ... & Fuller, R. A. (2023). Remote and local threats are associated with population change in Taiwanese migratory waterbirds. *Global Ecology and Conservation*, 42, e02402.



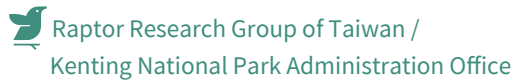
Northern Shoveler	0.58	▲	1.03	▲	-54.00	●		
Eurasian Wigeon	210.00	▲	3.13	▲	-64.00	●		
Eastern Spot-billed Duck	0.11	●			-15.00	●		
Northern Pintail	0.40	●	0.68	●	212.00	●		
Green-winged Teal	0.24	●	-0.37	●	-62.00	▼	-0.72	●
Tufted Duck	0.26	●	2.59	▲	-98.00	▼		
Eurasian Coot	161.00	▲	17.94	▲	-23.00	●		
Black-winged Stilt	0.30	●	-0.20	●	68.00	●	-0.54	●
Pied Avocet	2.66	▲	2.82	▲			44.66	●
Grey Plover	0.65	●	0.26	●	-53.00	●	0.95	●
Pacific Golden Plover	-0.10	●	2.58	▲	-47.00	●	-0.47	●
Lesser Sand Plover	0.11	●	8.13	▲				
Greater Sand Plover	1.60	●					1.58	●
Kentish Plover	0.40	●	1.94	▲	-71.00	▼	0.01	●
Little Ringed Plover	-0.38	●	-0.10	●	-49.00	▼	4.32	▲
Eurasian Curlew	-0.38	●	0.89	●				
Ruddy Turnstone	-0.36	●					-0.23	●
Long-toed Stint	-0.61	●	-0.63	●	-34.00	●		
Red-necked Stint	1.45	●	2.31	●	-93.00	▼		
Sanderling	-0.47	●					-0.86	▼
Dunlin	-0.09	●	1.44	▲	-71.00	▼	-0.50	●
Common Snipe	-0.62	▼	-0.99	▼	-70.00	▼	-0.98	▼
Common Sandpiper	-0.16	●	-0.25	●	-55.00	▼	-0.72	▼
Common Greenshank	-0.24	●	0.31	●	-72.00	▼	2.51	●
Marsh Sandpiper	0.25	●	2.04	●	-45.00	●	-0.37	●
Wood Sandpiper	-0.38	▼	-0.75	●	-34.00	●	-0.98	▼
Common Redshank	-0.10	●	-0.05	●				
Saunders's Gull	130.00	●						
Black-headed Gull	55.00	●	1.30	▲	-100.00	●		
Caspian Tern	1.77	▲	1.64	▲				
Whiskered Tern	3.23	●	3.47	●				
	Taiwan Proper		Chianan Coast		Yilan Plain		Changhua Coast	
	Region							

▲ Significant growth ▼ Significant decline ● Non-Significant change

Figure 1.2.1. Population trends and changes for 31 species of migratory waterbirds in Taiwan Proper, the Chianan Coast, the Yilan Plain, and the Changhua Coast from 2014 to 2022.



3. Migratory Raptors



Raptors are apex predators and also function as important keystone species. During migration, large numbers travel long distances, and their arrival and departure at breeding sites, wintering grounds, and stopover locations can significantly affect local biological communities. These movements represent substantial, periodic shifts in top-level consumers that influence ecosystem dynamics across their migratory range.

Taiwan is located along the East Asian-Australasian Flyway. From September to October, hundreds of thousands of raptors pass through Taiwan on their way to their wintering grounds. Most of these are Chinese Sparrowhawks (*Accipiter soloensis*) and Grey-faced Buzzards (*Butastur indicus*). Though fewer in number, other migratory raptors which can be seen at this time include the Osprey (*Pandion haliaetus*), Eastern Marsh-Harrier (*Circus spilonotus*), Oriental Honey-buzzard (*Pernis ptilorhynchus*), Japanese Sparrowhawk (*Accipiter gularis*), Peregrine Falcon (*Falco peregrinus*), Eurasian Hobby (*Falco subbuteo*), and Eurasian Sparrowhawk (*Accipiter nisus*).

Since 2004, the Raptor Research Group of Taiwan and the Kenting National Park Administration Office have been recording all transiting raptors, with a special focus on tracking Chinese Sparrowhawk and Grey-faced Buzzard numbers. The annual surveys take place at the Lingxiao Pavilion in Kenting National Park from September 1st to October 31st each year.

The Chinese Sparrowhawk migrates through Taiwan in September, with peak passage numbers occurring between September 15 and September 24 each year. The median number of Chinese Sparrowhawks recorded annually between 2004 and 2021 was approximately 146,000 individuals. From 2004 to

2015, the data shows an annual decline in recorded numbers, reaching a low of 59,290 individuals. However, the population increased rapidly afterward, peaking at 270,669 individuals in 2020.

The Grey-faced Buzzard migrates through Taiwan in October, reaching peak passage numbers between October 11th and October 16th each year. The median number of Grey-faced Buzzards recorded annually between 2004 and 2021 was approximately 44,000 individuals. During this period, the annual number of Grey-faced Buzzards recorded increased from 23,000 in 2004 to approximately 118,000 in 2021.

Overall, the number of Chinese Sparrowhawks and Grey-faced Buzzards recorded each year continues to increase.

For Grey-faced Buzzards, whether in Japan where they breed, Taiwan where they transit, or the Philippines where they winter, all three countries are actively promoting environmentally friendly agriculture and working to create 'Satoyama-style' landscapes. These rural areas harmonize the coexistence of humans and nature. The Grey-faced Buzzard depends on such environments for its survival. In October 2023, the 3rd International Summit for the Grey-faced Buzzard and Migratory Raptors was held in Kenting. During the event, participants discussed the potential for collaborative conservation of migratory raptor species. Such efforts are extremely challenging and require cooperation from all nations along the migratory path. Strong consensus already exists among these countries regarding the Grey-faced Buzzard. There is good potential to establish a comprehensive monitoring and conservation mechanism along its entire migration route in the future.

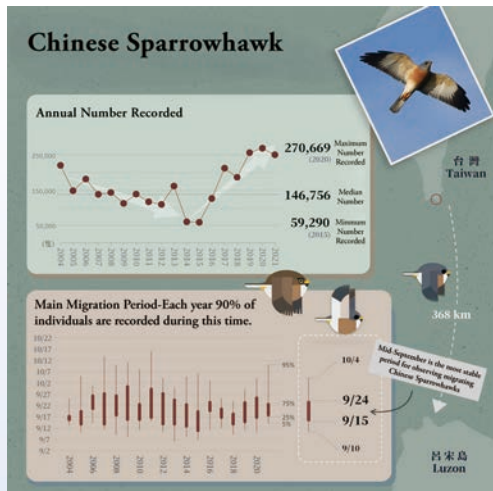


Figure 1.3.1. Population trends of migrating Chinese Sparrowhawks in Kenting National Park from 2014 to 2021.



Figure 1.3.2. Population trends of migrating Grey-faced Buzzards in Kenting National Park from 2014 to 2021.



Part 2.

A Closer Look: The Status and Trends of Specific Bird Species

1. Black-faced Spoonbill



Taiwan Wild Bird Federation / Wild Bird Society of Tainan /
Taiwan Black-faced Spoonbill Conservation Association

The Black-faced Spoonbill (*Platalea minor*) is endemic to East Asia and is an important migratory waterbird in Taiwan, playing a significant role in the country's conservation history. Breeding primarily along the western coast of the Korean Peninsula, the species migrates south to winter in locations such as Kyushu Island, the Pearl River Estuary, northern Vietnam, Taiwan, Hong Kong, and southern China's Hainan Island. Listed as Endangered by the IUCN, the Black-faced Spoonbill is a key conservation species that has garnered substantial international attention.

Population numbers for the Black-faced Spoonbill are primarily based on the results of the International Black-faced Spoonbill Census. The census is coordinated by the Hong Kong Bird Watching Society, in collaboration with stakeholders from various countries along the bird's range. Each January, the synchronized count is conducted in places including Hong Kong, Taiwan, Japan, South Korea, Vietnam, Thailand, and China. In Taiwan, the Taiwan Wild Bird Federation coordinates the effort, engaging with local bird societies and other surveyors to conduct the census.

According to the 2023 International Black-faced Spoonbill Census, the global wintering

population reached a historic high of 6,603 individuals. Of this, the number of Black-faced Spoonbills wintering in Taiwan surpassed 4,000 for the first time, with a total of 4,228 recorded. This accounted for 65% of the global population, and was an increase of 404 individuals compared to 2022. Taiwan's wintering population of Black-faced Spoonbills is mainly concentrated in areas such as Tainan City, Kaohsiung City, and the mouth of Jhoushui River. This demonstrates the importance of Taiwan's southwestern coastal wetlands for the globally threatened species. As key wintering grounds, they influence the global population dynamics of the Black-faced Spoonbill.

In the past, Black-faced Spoonbills in Taiwan faced threats such as botulism poisoning, but the impact of this threat has decreased in recent years. However, it remains essential to continue monitoring population numbers and potential risks. These include avian influenza and possible habitat loss due to the expansion of renewable energy infrastructure—all of which could pose potential risks to the species' population.



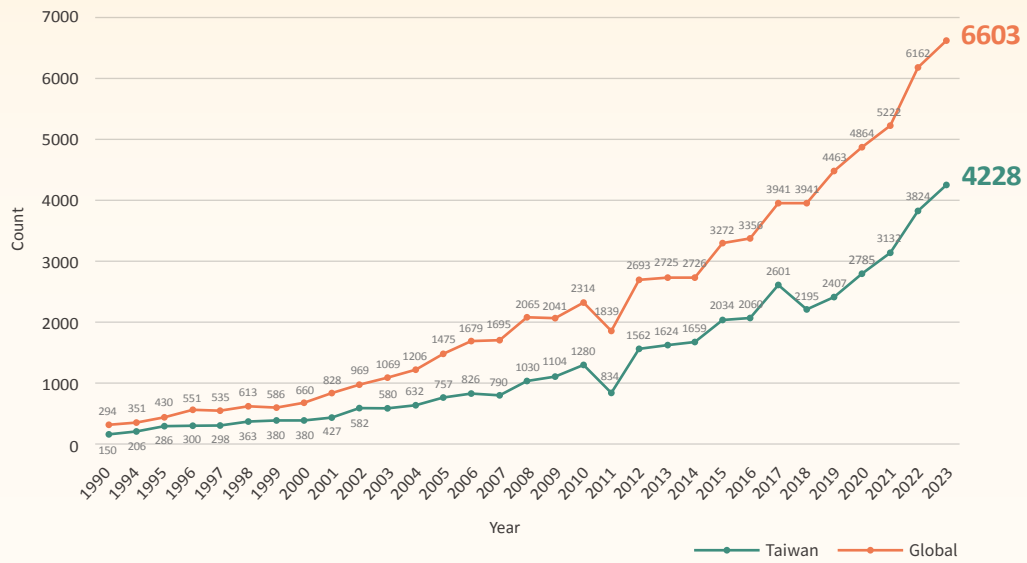


Figure 2.1.1. Population trends of the Black-faced Spoonbill globally and in Taiwan from 1990 to 2023.

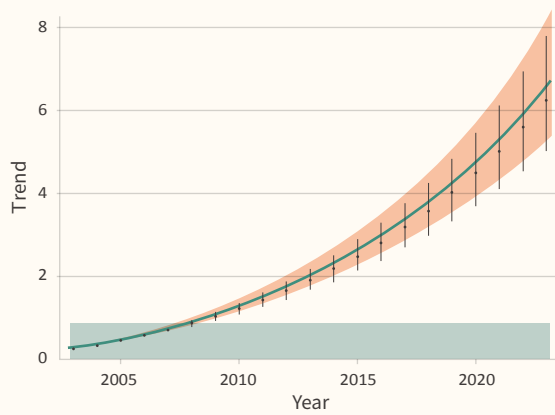


Figure 2.1.2. Population trends of the wintering Black-faced Spoonbill population in Taiwan from 2003 to 2023. The green line indicates a significant population increase during this period.

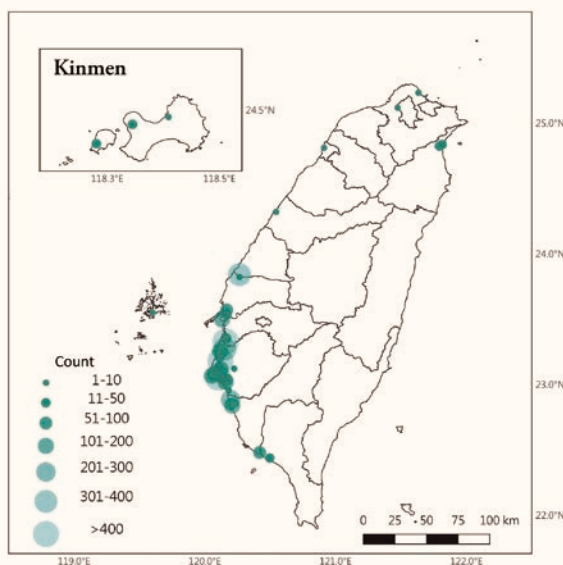


Figure 2.1.3. Distribution map of wintering Black-faced Spoonbills in Taiwan in 2023.

2. Black Kite

 Raptor Research Group of Taiwan /
Institute of Wildlife Conservation, National Pingtung
University of Science and Technology /
Bureau of Animal and Plant Health Inspection and
Quarantine, Ministry of Agriculture

The Black Kite (*Milvus migrans*) has a wide distribution spanning Asia, Europe, Africa, and Oceania. There are sizable populations in many countries such as in India, where viewing several thousand Black Kites in one place is common. Globally, the Black Kite population is not seriously threatened and the species is categorized by the IUCN as Least Concern (LC). Historically, it was quite common in Taiwan as well. However, in the latter part of the 20th century, likely due to excessive pesticide use, Taiwan's population experienced severe decline. As a result, it is classified as Vulnerable (VU) at the national level.

Since 2013, the Raptor Research Group of Taiwan has monitored the Black Kite population in Taiwan. Survey teams, composed of volunteers from across the country, conduct synchronized counts of dusk congregations. These take place on agreed upon days in September and December at known Black Kite roosting sites from 3 pm until sunset.

Results from the 2022 survey effort showed a record-high number of 879 individuals. The highest number was observed in New Taipei City's Gongliao District (268 individuals), where

nearby reservoirs serve as important roosting sites. Overall, there has been a noticeable increase in Black Kite numbers in both northern and southern Taiwan, with many birdwatchers reporting more frequent observation.

Additionally, tracking data from a satellite-tagged individual known as "Little Eggplant" confirmed the presence of migratory individuals within Taiwan's Black Kite population. While further research is needed, this data suggests that migration in and out of the local population is a contributing factor to population dynamics.

In recent years, the Bureau of Animal and Plant Health Inspection and Quarantine, under the Ministry of Agriculture, has actively promoted policies and conservation measures aimed at reducing the use of rodenticides and pesticides. As a result, the Black Kite population has increased significantly in recent years, making it a notable example of ongoing recovery for an apex predator in Taiwan. It is hoped that in the near future, Black Kites filling Taiwan's skies will once again be a common occurrence.



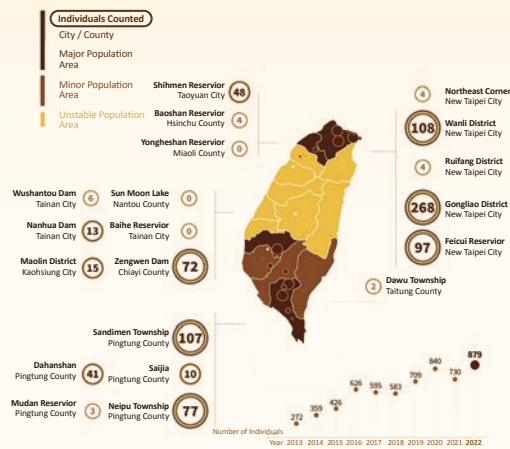


Figure 2.2.1.
Results of the 2022 Black Kite Synchronized Survey.

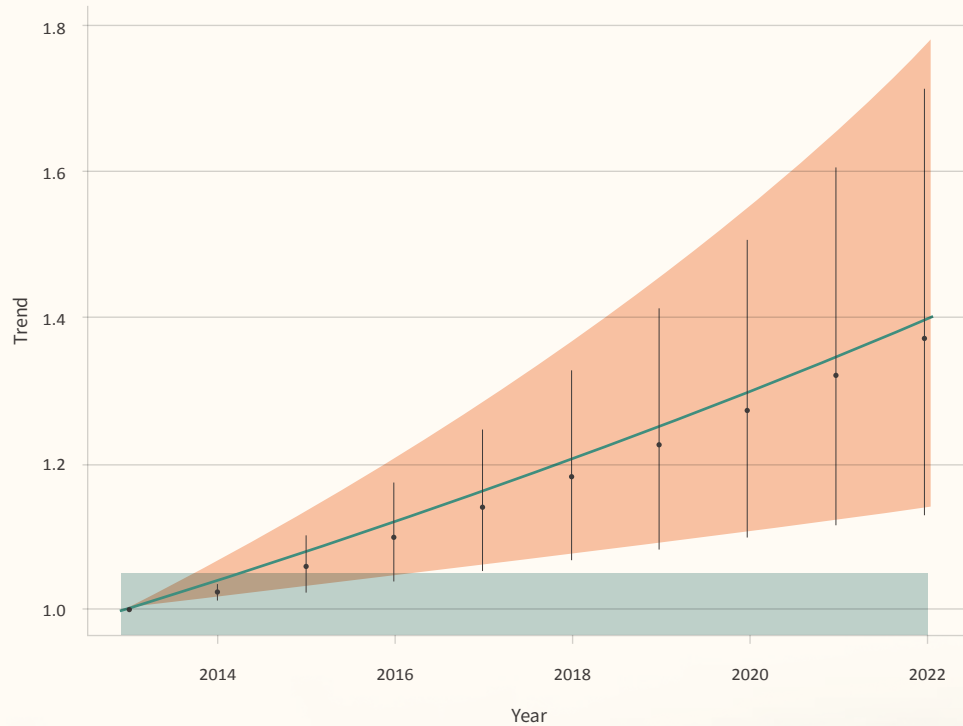


Figure 2.2.2. Black Kite population trends based on autumn counts conducted in Taiwan from 2013 to 2022. The green line indicates a significant population increase during this period (credit: Lin Hui-shan).



3. Pheasant-tailed Jacana

 Wild Bird Society of Tainan /
Pheasant-tailed Jacana Conservation Park



The Pheasant-tailed Jacana (*Hydrophasianus chirurgus*) can be found in South and Southeast Asia, southern China, the Philippines, and Taiwan. Although quite common in many parts of its range, such as India, it is severely threatened in Taiwan. Taiwan's population was originally distributed widely throughout lowland wetlands and could be found as far north as Yilan County and as far south as Pingtung County. However, during the second half of the 20th century, wetland and rice paddy habitats disappeared as Taiwan underwent rapid development. This, combined with pesticide poisoning and excessive hunting, led to a steep decline in Pheasant-tailed Jacana numbers. Eventually they were only found in small pockets in southwestern Taiwan's Chianan Plain area.

In 1990, the Ministry of Transportation and Communications planned to build Taiwan's high-speed railway. The piers for certain portions of the line were slated for some of the last important jacana habitats: the Hulupi and Deyuanpi areas in Guantian District, Tainan City. After an environmental impact assessment was conducted, the Taiwan High-Speed Rail Corporation was told it

must propose measures for the protection of breeding areas for wildlife such as the Pheasant-tailed Jacana and the Painted Snipe before construction could begin. This led the company to lease 15 hectares of land in Guantian from the Taiwan Sugar Corporation for such conservation purposes. It would be named the Pheasant-tailed Jacana Rehabilitation Area and is currently known as the Pheasant-tailed Jacana Conservation Park.

Although there were some positive results initially, between 2009 and 2010, over a hundred Pheasant-tailed Jacanas died from poisoning, severely impacting conservation efforts. In the following year, under the guidance of relevant stakeholders, some farmers began shifting toward organic farming methods and adopting more eco-friendly practices.

After years of hard work, Pheasant-tailed Jacana numbers have risen, and during the 2022 Pheasant-tailed Jacana Winter Survey, 2,603 birds were recorded. This represented a tenfold increase compared to the 275 birds recorded in 2009. The growing number has also meant an expansion of the jacana's

breeding distribution range. There is now another stable breeding population at Kaohsiung City's Meinong Lake. Due to these factors, the population has been downlisted nationally from Vulnerable (VU) to Near Threatened (NT). Although progress has been made, further conservation efforts are still required as the species continues its recovery.

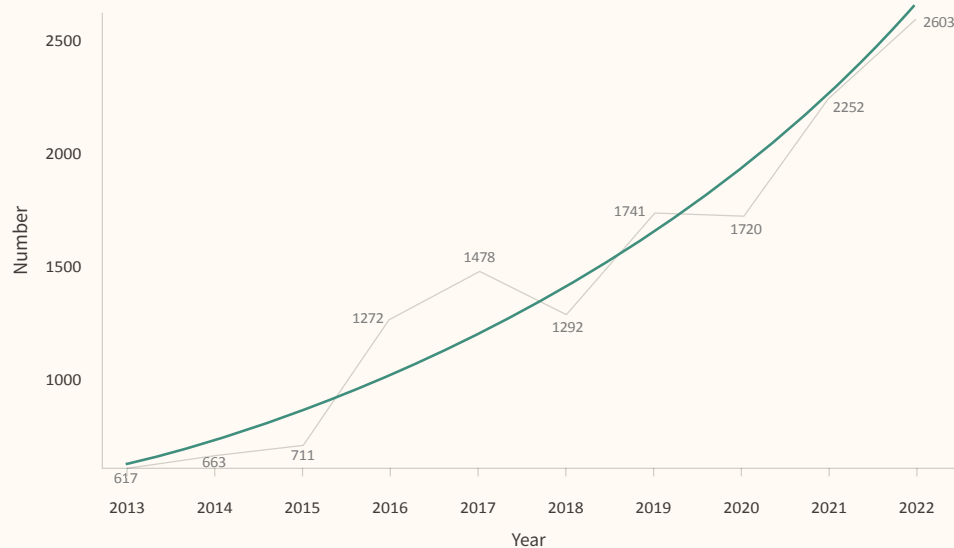


Figure 2.3.1. Pheasant-tailed Jacana population trends in Taiwan from 2013 to 2022.



4. Fairy Pitta

 Taiwan Biodiversity Research Institute,
Ministry of Agriculture



The Fairy Pitta (*Pitta nympha*) is the only species of the Pittidae family that breeds in Taiwan and is one of its few passerine summer visitors. In addition to Taiwan, this eye-catching bird also breeds in southwestern Japan, southern China, and Jeju Island in South Korea. After breeding, it is known to migrate to Borneo for wintering.

However, Fairy Pitta numbers are not stable. A noticeable decline has been observed in their primary breeding area of Huben Village in Yunlin County, as well as across Taiwan. Nationwide surveys conducted between 2009 and 2021 documented a population decrease from 334 to 251 individuals. The global population is also under threat. Currently, the species is classified as Vulnerable (VU) globally and Endangered (EN) in Taiwan. It is further designated as a Level 2 Rare and Valuable Species under Taiwan's Wildlife Conservation Act.

Results from the same 2009–2021 study

showed no significant relationship between changes in forest cover and population trends for the Fairy Pitta. This suggests that decreasing numbers may be more closely linked to environmental changes at their breeding or wintering grounds.

Therefore, although Taiwan's habitat is suitable for Fairy Pittas⁹, environmental degradation at any point along their migration route could impact the entire population. In other words, conservation efforts along all parts of the migration route are equally important.

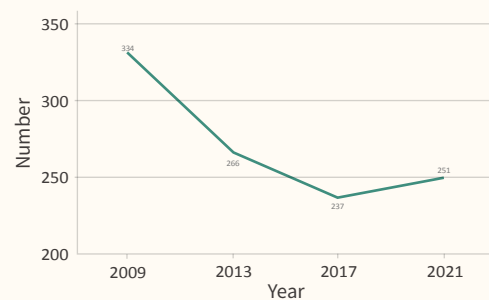


Figure 2.4.1. Nationwide Fairy Pitta Survey results from 2009 to 2018 (source: Taiwan Biodiversity Research Institute, Ministry of Agriculture).

⁹ Ko, J. C. J., Chang, A. Y., Lin, R. S., & Lee, P. F. (2023). Deforestation within breeding ranges may still drive population trends of migratory forest birds in the East Asian Flyway. *Scientific Reports*, 13(1), 14007.



5. Russet Sparrow

 Habitat Ecology Lab of National Chiayi University



The distribution of the Russet Sparrow (*Passer cinnamomeus*) spans China, Japan, the Korean Peninsula, Taiwan, northern Indochina, and the Himalayan Range. While the species is relatively common in most of these places, it is quite rare in Taiwan. Spotting one is difficult, with sightings only possible at certain locations such as the Tsengwen Reservoir in Chiayi County, Wutai Shan in Pingtung County, Hongxiang Hot Springs in Nantou County, and Nanshan Village along the Yilan Branch of the Central Cross-Island Highway. Although globally listed as Least Concern (LC) by the IUCN, in Taiwan it is classified as Endangered (EN) and is also designated as a Level 1 Endangered Species under the Wildlife Conservation Act.

In 2017 and 2020, research teams from National Chiayi University estimated the population of Russet Sparrows in Taiwan using occupancy models, yielding estimates of 1,433 and 1,756 individuals, respectively. These results suggest a slight population increase¹⁰. Additionally, data from the Taiwan Breeding Bird Survey over the period of 2011 to 2019 showed an apparent increase in the number of Russet Sparrows, although this did not reach statistical significance.

Recent studies have found that installing artificial nest boxes can help Russet Sparrows breed successfully. Therefore, in 2023, the species was officially included in the *Payments for Ecosystem Services for Endangered Species and Critical Habitat Promotion Program*, a project under the Forestry and Nature Conservation Agency, Ministry of Agriculture. Under the plan, farmers in Chiayi County's Meishan Township, Fanlu Township and Zhuqi Township are able to receive payments from the government if their tea farms use bird-friendly pesticides, plant millet from October to January, or set up nest boxes on their farmland and have Russet Sparrows breed successfully.

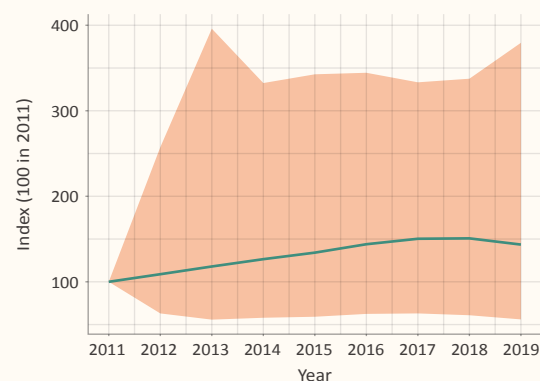


Figure 2.5.1. Population trend data for the Russet Sparrow from 2011 to 2019 revealed only a slight change in population size during this period¹¹.

¹⁰ Tsai, J.-S., Y.-W. Lin, J.-J. Lyu, and R.-S. Lin. 2022. 2022 Conservation Action Plan for the Russet Sparrow (*Passer cinnamomeus*). Forestry Bureau and Endemic Species Research Institute, Council of Agriculture, Executive Yuan, Taipei, Taiwan.

¹¹ Lin, D. L., Ko, J. C. J., Amano, T., Hsu, C. T., Fuller, R. A., Maron, M., ... & Lee, P. F. (2023). Taiwan's Breeding Bird Survey reveals very few declining species. *Ecological Indicators*, 146, 109839.

6. Northern Lapwing

 Wild Bird Society of Yunlin /
Taiwan Biodiversity Research Institute,
Ministry of Agriculture



The Northern Lapwing (*Vanellus vanellus*) is widely distributed throughout Europe and temperate Asia. During winter, they migrate to areas such as the Mediterranean Coast, North Africa, Northern India, southern China, and Taiwan. The majority of Northern Lapwings are found in Europe, where there are an estimated 3.19 to 5.17 million individuals. In contrast, the number in East Asia is not nearly as large. Currently, the Northern Lapwing is classified as Least Concern (LC) in Taiwan, but due to continuously declining numbers in Europe, the global population is categorized as Near Threatened (NT).

The species is typically found in agricultural environments and favors areas with moist soil conditions. Earthworms are an important food source for both adult and juvenile Northern Lapwings, along with other small invertebrates such as beetles, cryptids, and millipedes. Soil moisture is often related to earthworm abundance, organic matter content, and soil pH. Therefore, soil properties may further influence Northern Lapwing habitat preferences.

Each January, thousands of Northern Lapwings migrate to the farmlands surrounding Yuanchang Township in central-western Taiwan's Yunlin County to winter, especially local peanut fields. Uninterested in the peanuts, they are attracted to the earthworms and other invertebrates found in the fields. According to survey data from the Yunlin Northern Lapwing Survey, the number of Northern Lapwings in Yunlin County increased annually from 2012 to 2023. This not only indicates an increase in the number of individuals but also suggests that the population in Yunlin County is likely the largest wintering population in East Asia. Although numbers are currently stable, it is still necessary to maintain environmental quality and therefore avoid the use of harmful pesticides.

The presence of the birds not only highlights the ecological significance of Yunlin County but also provides farmers with a natural form of pest control. The case of the Northern Lapwing in Yunlin County serves as a model for biodiversity-friendly agriculture.

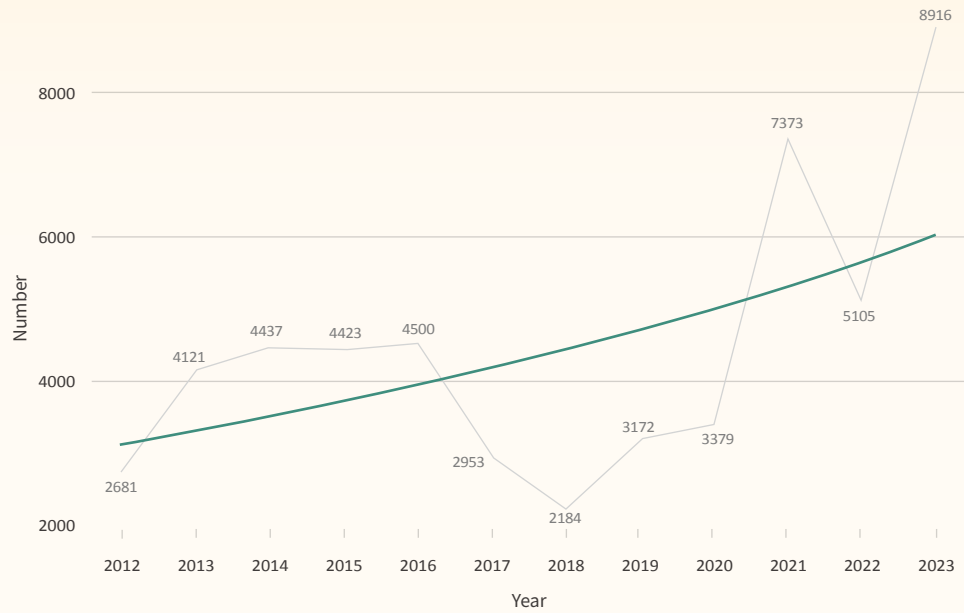


Figure 2.6.2. Survey results from the Yunlin Northern Lapwing Survey from 2012 to 2023
(source: Wild Bird Society of Yunlin; Taiwan Biodiversity Research Institute).



7. Australasian Grass-Owl



Department of Biological Resources, National Chiayi University /
Taiwan Biodiversity Research Institute, Ministry of Agriculture /
Tainan City Wildlife Conservation Association /
Institute of Wildlife Conservation, National Pingtung University of Science and
Technology / Kaohsiung Wild Bird Society

The Australasian Grass-Owl (*Tyto longimembris*) is distributed across parts of the Indian subcontinent, Indochina, southern China, Taiwan, the Philippines, Sulawesi, Papua New Guinea, and both eastern and northern Australia. Currently, five recognized subspecies exist worldwide, with *Tyto longimembris pithecopis* endemic to Taiwan. Although the subspecies breeds in Taiwan, it remains quite rare. This is likely due to its preference for grasslands and agricultural areas, which are frequently disturbed by human activity. In addition, the historical use of rodenticides in these habitats has further threatened its survival. As a result, although it is listed by the IUCN as Least Concern (LC), it is classified nationally as Endangered (EN). The Australasian Grass-Owl also holds the status of a Type 1 Endangered Species under the Wildlife Conservation Act.

Using a stratified random sampling approach and occupancy modeling framework, the breeding population in southern Taiwan was estimated at 158 pairs of Australasian Grass-Owls (95% confidence interval: 88—224 pairs). In recent years, satellite tracking has also been carried out with birds accidentally captured by bird nets near airports in

southern Taiwan. After being rehabilitated and just before being released back into the wild, certain individuals were fitted with satellite transmitters. From this study, it was discovered that some birds returned to their original capture areas to roost. Additionally, activity ranges varied greatly between individuals, with some even partially overlapping. Tagged birds used different types of land cover, however riverbank grassland areas, military bases with large grassy areas, and agricultural lands had higher frequency use.

Currently, the species is included in the *Payments for Ecosystem Services for Endangered Species and Critical Habitat Promotion Program* under the Forestry and Nature Conservation Agency, Ministry of Agriculture. Its implementation area covers 15 townships spread across Tainan City, Kaohsiung City, and Pingtung County. Under the scheme, suitable locations for erecting nesting platforms for breeding Australasian Grass-Owls will be designated. The managing team will then recruit local farmers to help build and maintain the structures, with participants receiving NTD\$3,000 as compensation.

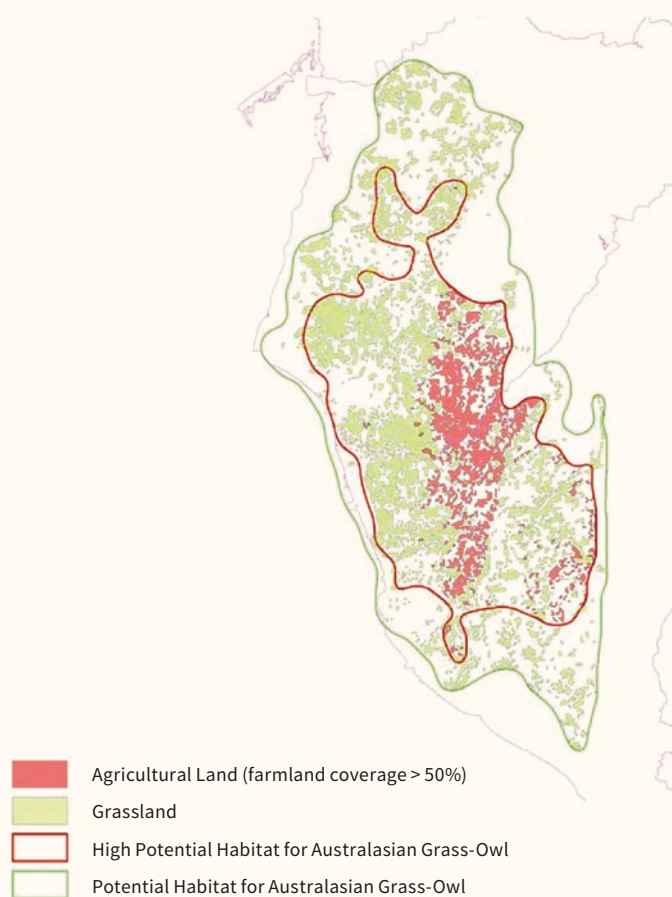


Figure 2.7.1. Predicted distribution and habitat distribution for Australasian Grass-Owls in southwestern Taiwan.

8. Critically Endangered Migratory Bird Species- The Siberian Crane Case



Taiwan Biodiversity Research Institute, Ministry of Agriculture

National conservation responsibility refers to the obligation of a country to conserve the biodiversity within its borders. Generally, the highest conservation responsibility lies with endemic species and subspecies, followed by non-migratory breeding birds. Conversely, the conservation responsibility for migratory species is relatively lower, with all countries along the migration route sharing the responsibility.

Yet in the case of critically endangered migratory bird species, the loss of any individual has a significant impact on the whole population. Therefore, when such species appear in Taiwan, extreme care and diligence are required, even though their national conservation responsibility is technically lower.

One local example involves the Siberian Crane (*Leucogeranus leucogeranus*). The species is listed by the IUCN as Critically Endangered (CR), so every individual is important. In recent years, two vagrant individuals appeared in Taiwan. These rare arrivals sparked extensive discussions among local and central government agencies, civic groups, and local communities. While there was recognition that Taiwan is not part of the species' primary migration route, and therefore has limited direct conservation responsibility,

it was also acknowledged that birds do not recognize borders. Therefore, all parties worked together to ensure proper care and protection for the birds.

The Checklist of the Birds of Taiwan lists only eight migratory bird species that occur in Taiwan and have global populations of fewer than 5,000 individuals. These species are classified as either Critically Endangered (CR) or Endangered (EN). (This excludes the Chinese Crested Tern (*Thalasseus bernsteini*), which breeds on Taiwan's outlying islands, and the Crested Ibis (*Nipponia nippon*), which has not been recorded in Taiwan for over 70 years.) The eight species are: Baer's Pochard (*Aythya baeri*), Scaly-sided Merganser (*Mergus squamatus*), Siberian Crane (*Leucogeranus leucogeranus*), Spoon-billed Sandpiper (*Calidris pygmaea*), Nordmann's Greenshank (*Tringa guttifer*), Oriental Stork (*Ciconia boyciana*), Streaked Reed Warbler (*Acrocephalus sorghophilus*), and Yellow-breasted Bunting (*Emberiza aureola*). Given their extremely low global numbers, every individual observation is invaluable for conservation and helps identify key bird habitats. When such species are recorded in Taiwan, appropriate and timely conservation actions must be taken.



Table 2.8.1. List of Endangered and Critically Endangered Migratory Bird Species occurring in Taiwan

IUCN 2023 Threat Classification	Common Name	Scientific Name	Taiwan Conservation Level	Global Population
CR	Baer's Pochard	<i>Aythya baeri</i>	II	150-700
CR	Siberian Crane	<i>Leucogeranus leucogeranus</i>	I	3,500-4,000
CR	Spoon-billed Sandpiper	<i>Calidris pygmaea</i>	II	240-620
CR	Streaked Reed Warbler	<i>Acrocephalus sorghophilus</i>		1-999
CR	Yellow-breasted Bunting	<i>Emberiza aureola</i>	II	120-600
EN	Scaly-sided Merganser	<i>Mergus squamatus</i>		2,400-4,500
EN	Nordmann's Greenshank	<i>Tringa guttifer</i>	I	600-1,300
EN	Oriental Stork	<i>Ciconia boyciana</i>	I	1,000-2,499

(source: eBird Basic dataset, 2023)

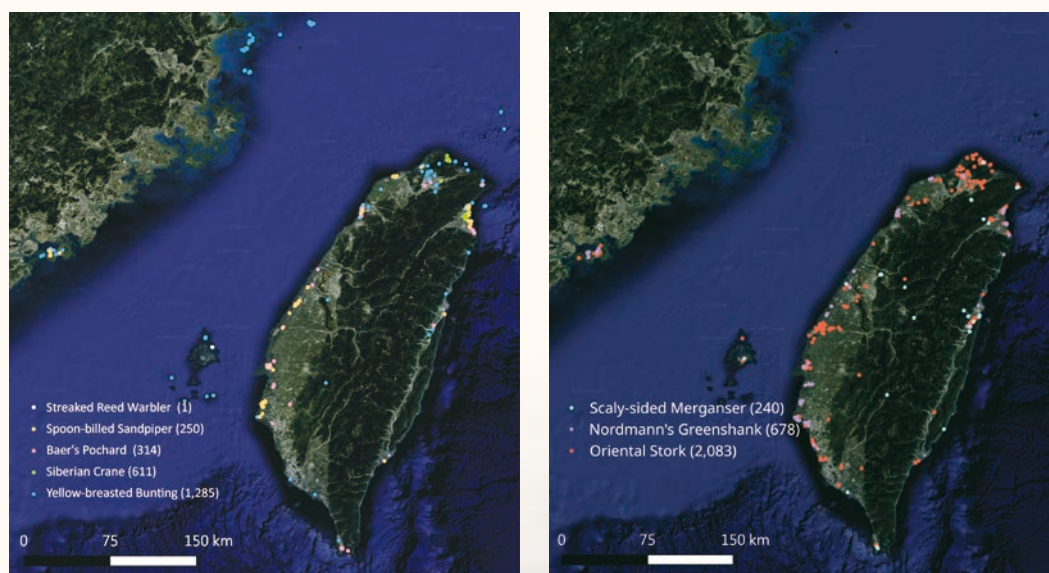


Figure 2.8.1. Locations of eBird records for critically endangered migratory bird species in Taiwan (source: eBird).



Part 3.

Important Conservation Topics

1. Roadkill

 Taiwan Biodiversity Research Institute, Ministry of Agriculture

Roadkill refers to wildlife fatalities caused by vehicle collisions on roads. Such events pose a serious threat to wildlife. To better understand the roadkill situation in Taiwan and mitigate against its impact on wildlife, the Taiwan Biodiversity Research Institute initiated the Taiwan Roadkill Observation Network (TaiRON) as a citizen science project in August 2011. Amongst project participants, it is informally known as the "Roadkill Society".

Between 2010 and 2020, the Roadkill Society accumulated 27,210 records of bird roadkill. Of these, 94.2% (25,644 entries) were identified to the species level, representing a total of 349 species. The top ten bird species in terms of roadkill incidents were the Eurasian Tree Sparrow (*Passer montanus*) [5,184], Red Collared-Dove (*Streptopelia tranquebarica*) [2,895], Light-vented Bulbul (*Pycnonotus sinensis*) [1,231], Common Moorhen (*Gallinula chloropus*) [880], Javan Myna (*Acridotheres javanicus*) [808], Spotted Dove (*Spilopelia chinensis*) [722], Rock Pigeon (*Columba livia*) [706], Collared Scops-Owl (*Otus lettia*) [628], Black-crowned Night Heron (*Nycticorax nycticorax*) [570], and Swinhoe's White-eye (*Zosterops simplex*) [510].

Since the opportunistic data mainly came from more densely populated areas, bird species that frequent urban and agricultural environments were more often recorded. Many of the top ten bird species are common to these areas and spend longer periods

on the ground, such as the Red Collared-Dove, Common Moorhen, Javan Myna, Spotted Dove, and Rock Pigeon. Additionally, records of several rare bird species, including the White-tailed Tropicbird (*Phaethon lepturus*), Band-bellied Crake (*Zapornia paykullii*), and Japanese Wood Pigeon (*Columba janthina*), were also made. These are important contributions from citizen scientists.

Currently, measures to mitigate against bird roadkill in Taiwan primarily involve the installation of warning signs to alert drivers. Additionally, wildlife-safe passages, such as overpasses and underpasses, have been constructed in Miaoli County, Taoyuan City, New Taipei City, and Kaohsiung City to provide safer routes for wildlife. These are often accompanied by several kilometers of wildlife fencing to prevent animals from entering the highway.

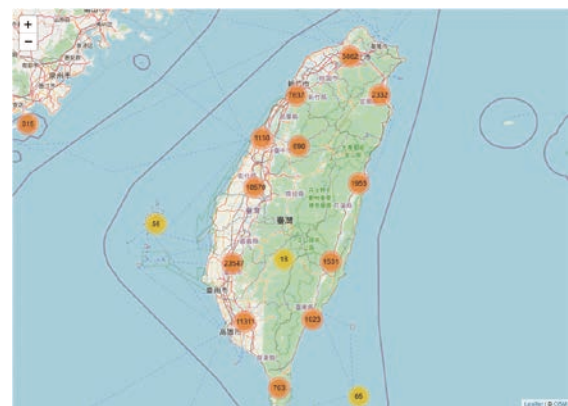


Figure 3.1.1. Distribution of bird roadkill records from 2011 to 2023.
(source: Taiwan Roadkill Observation Network).



2. Bird-Window Collisions

 Raptor Research Group of Taiwan /
Institute of Ecological and Evolutionary Biology, National Taiwan University

Birds in flight often have difficulty perceiving transparent or reflective glass, leading to collisions that can cause injury or death. This phenomenon is known as a bird-window collision. Such events have been identified as a significant threat to bird survival. In Canada, it is estimated that 25 million birds die annually due to window collisions (Loss et al., 2014). In the United States, that number is between 600 million and one billion (Machtans et al., 2013).

To address this issue, the Raptor Research Group of Taiwan established the 'Reports on Bird-Window Collision' Facebook group to collect records of such events across Taiwan. By combining the data collected in the group with records of bird-window collisions from the Taiwan Roadkill Observation Network, as of November 2022, a total of 3,484 cases involving 175 species have been documented (Table 3.2.1).

Information on mitigating bird-window collisions has been compiled on the 'Bird-Window Collision Museum' website: (<https://www.birdwindowcollision.info/>). Mitigation strategies listed include improving transparent glass, disrupting reflections on glass surfaces to avoid bird confusion, and adding high-density patterns to glass surfaces. However, the current scope of influence is limited, and long-term efforts are needed to gradually reduce the impact of window collisions on birds.

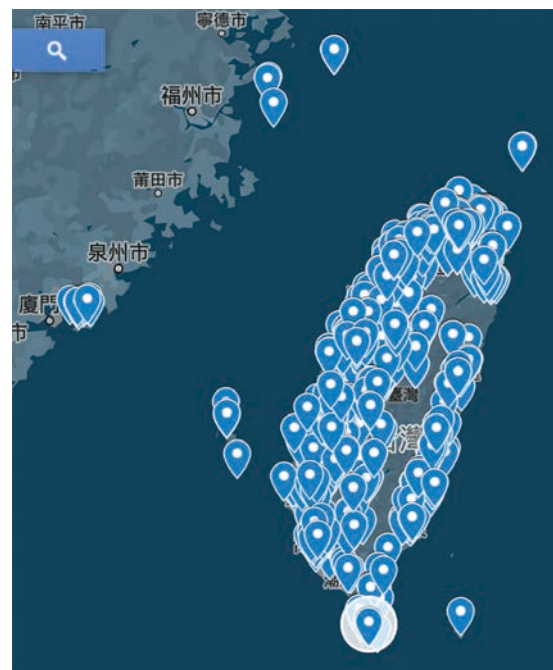


Figure 3.2.2. Distribution of bird-window collision records.
(source: Xie Ji-heng, personal communication)

Table 3.2.1. Most commonly reported bird-window collision species. (source: Xie Ji-heng, personal communication)

Common Name	Scientific Name	Total Number of Incidents	Taiwan Conservation Category
Taiwan Barbet	<i>Psilopogon nuchalis</i>	594	
Asian Emerald Dove	<i>Chalcophaps indica</i>	344	
Eurasian Tree Sparrow	<i>Passer montanus</i>	205	
Common Kingfisher	<i>Alcedo atthis</i>	187	
Crested Goshawk	<i>Accipiter trivirgatus</i>	183	
Spotted Dove	<i>Spilopelia chinensis</i>	179	
Light-vented Bulbul	<i>Pycnonotus sinensis</i>	166	
Pale Thrush	<i>Turdus pallidus</i>	138	
Swinhoe's White-eye	<i>Zosterops simplex</i>	97	II
Oriental Turtle-Dove	<i>Streptopelia orientalis</i>	90	
Red Collared-Dove	<i>Streptopelia tranquebarica</i>	62	
Ruddy Kingfisher	<i>Halcyon coromanda</i>	58	
Black Bulbul	<i>Hypsipetes leucocephalus</i>	56	
Brown-headed Thrush	<i>Turdus chrysolaus</i>	45	
Besra	<i>Accipiter virgatus</i>	43	
Asian Glossy Starling	<i>Aplonis panayensis</i>	41	
White's Thrush	<i>Zoothera aurea</i>	39	III
Rock Pigeon	<i>Columba livia</i>	34	III
Scaly-breasted Munia	<i>Lonchura punctulata</i>	31	II
White-tailed Robin	<i>Myiomela leucura</i>	30	II
Brown Shrike	<i>Lanius cristatus</i>	25	II
Northern Boobook	<i>Ninox japonica</i>	24	II
Fairy Pitta	<i>Pitta nympha</i>	24	II
Ring-necked Pheasant	<i>Phasianus colchicus</i>	20	II
Styan's Bulbul	<i>Pycnonotus taivanus</i>	19	
Collared Scops-Owl	<i>Otus lettia</i>	14	
Collared Owlet	<i>Taenioptynx brodiei</i>	11	



3. Solar Energy

 Taiwan Biodiversity Research Institute, Ministry of Agriculture /
Taiwan Wild Bird Federation

Developing renewable energy is a key strategy for many countries as they move towards sustainable development. There are several advantages to this, including mitigating air pollution, reducing greenhouse gas emissions, and enhancing energy independence. As part of Taiwan's efforts to expand the use of renewable energy, the Ministry of Economic Affairs set a policy goal of having 20% of Taiwan's energy needs met by renewable sources by 2025. However, proper location selection and design planning for photovoltaic facilities are key to balancing green energy and environmental protection.

To address this, initiatives such as "livestock-PV symbiosis", which primarily uses livestock shed roofs for the panels, and "fishery-PV symbiosis", which combines installations with aquaculture, have been introduced. Additionally, in response to concerns over controversial locations, the Ministry of Economic Affairs has implemented the *Photovoltaic Environmental and Social Impact Assessment Mechanism* to assess potential impacts of photovoltaic installations and propose corresponding mitigation strategies. Also, in the case of fishery-PV sites, prior to developing an area, extensive communication with stakeholders is conducted with the goal of reducing environmental impacts.

The National Property Administration has also issued the *Principles for Provision of National Non-Public Use Marginal Land for Adoption for Environmental Protection Purposes*. It allows non-public state-owned land to be adopted for the purposes of environmental protection. The Chiku and Jiangjun Salt Pan Wetlands in Tainan City are critical habitats for wintering migratory birds and have faced significant pressure from photovoltaic development

in recent years. To protect these important wetlands, the Chiku and Jiangjun Salt Pan Wetlands Restoration Alliance was formed, consisting of the Taiwan Wild Bird Federation, Taiwan Black-faced Spoonbill Conservation Association, the Wild Bird Society of Tainan, Wetlands Taiwan, the Taiwan Environmental & Planning Association, and the Society of Wilderness. In 2022, the alliance adopted 1,605 hectares of state-owned salt pans and is now working to maintain the area, conduct ecological restoration, and assist in monitoring efforts.

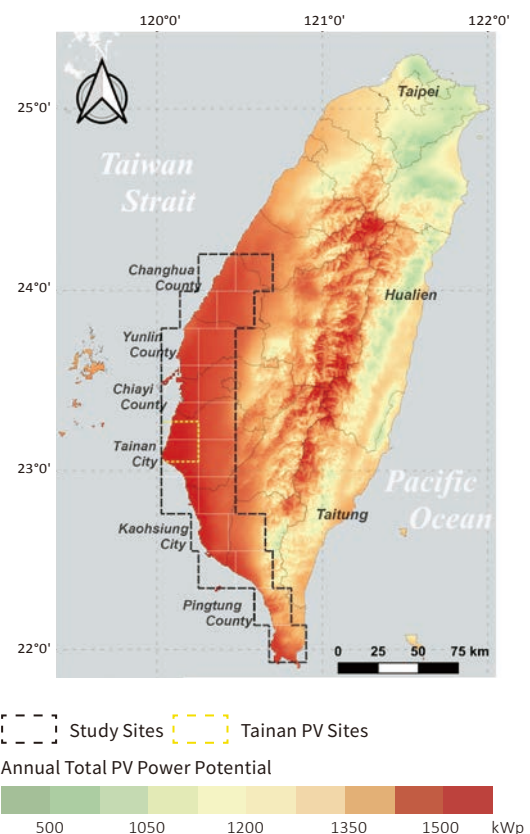


Figure 3.3.1. Potential locations for photovoltaic power installations in Taiwan and various types of photovoltaic systems (source: Taiwan Biodiversity Research Institute, Ministry of Agriculture; Fisheries Research Institute, Ministry of Agriculture).

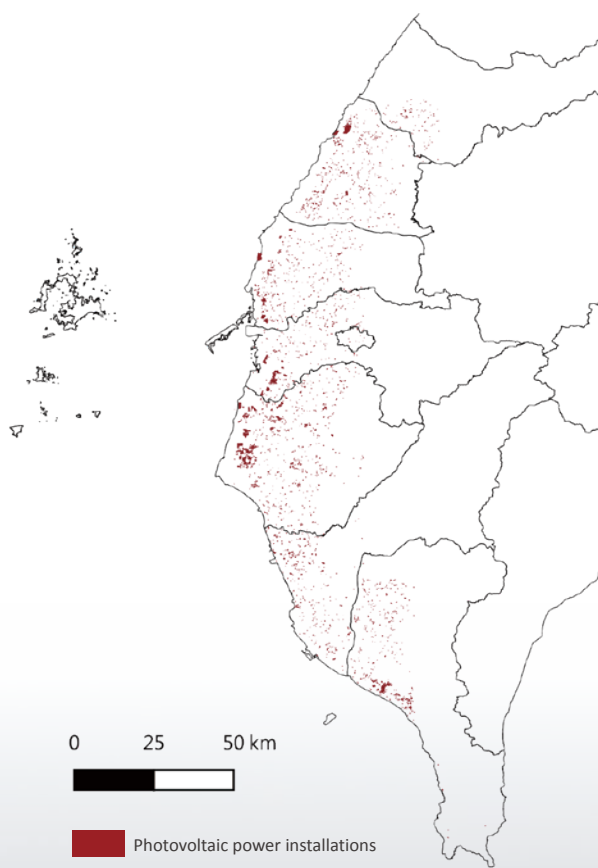


Figure 3.3.2. Distribution map of solar panels in southwestern Taiwan (credit: Taiwan Biodiversity Research Institute, Ministry of Agriculture; Fisheries Research Institute, Ministry of Agriculture).



4. Climate Change

 Taiwan Biodiversity Research Institute, Ministry of Agriculture

Climate change has widespread effects on individual organisms, populations, species, communities, and ecosystems. It not only influences bird population dynamics and distributions but also affects the timing of migration and breeding. Phenological changes, such as shifts in the onset of breeding, have already been observed.

Taiwan, with its diverse climate ranging from hot lowlands to cold mountainous regions, hosts bird species that occupy specific altitudinal ranges suited to their environmental preferences. Climate change is driving some bird species to higher elevations. A comparison of the altitudinal distribution of birds in the Yushan Mountain Range between 1992 and 2014 showed that the distribution altitude of many species increased by an average of 60 meters, especially among alpine species¹².

An analysis of data from the Taiwan Breeding Bird Survey collected in high-altitude areas between 2011 and 2021 revealed inconsistent trends for

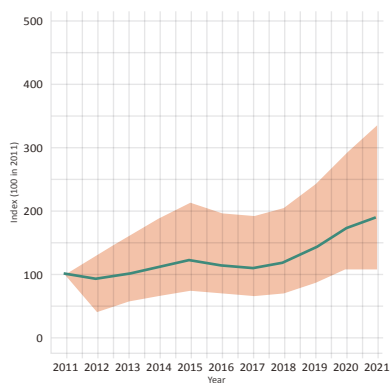
alpine breeding birds. Numbers of Coal Tit (*Periparus ater*) and Rufous-capped Babbler (*Cyanoderma ruficeps*) increased significantly while those for the White-whiskered Laughingthrush (*Trochalopteron morrisonianum*) and Taiwan Rosefinch (*Carpodacus formosanus*) decreased significantly (Figure 3.5.1; Lin, personal communication).

The *State of Taiwan's Birds 2020* report outlined the results of a climate change vulnerability and adaptation assessment for Taiwan's bird species. However, out of the 153 breeding bird species in Taiwan, only 83 were effectively evaluated, highlighting significant data gaps for many species. Observing wildlife and recording their occurrences can aid in their survival. Such data contributes to long-term monitoring efforts, and the more data collected, the greater the potential for deeper analysis. Additionally, it enables earlier detection of changes in species populations or distributions, providing researchers and conservationists with critical early warning signs.

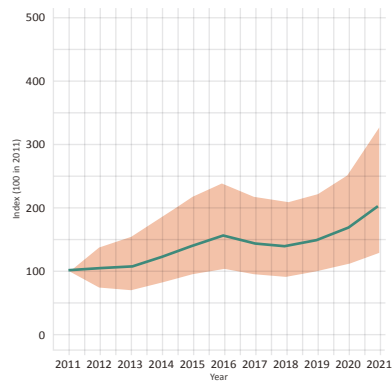
¹² Ding, Tzung-Su. 2014. Research on Indicator Species for Alpine Ecosystems Under Climate Change: Bird Indicator Species Survey and Vulnerability Analysis. Research report commissioned by the Yushan National Park Headquarters, Construction and Planning Agency, Ministry of the Interior.



Coal Tit



Rufous-capped Babbler



White-whiskered Laughingthrush



Taiwan Rosefinch

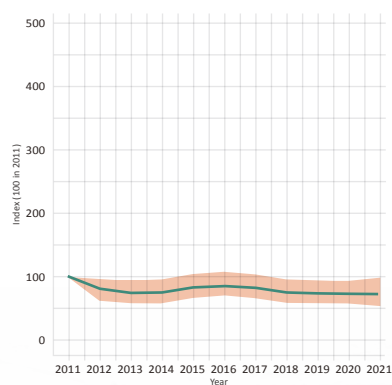


Figure 3.4.1. Population trends for four high mountain breeding bird species (credit: Da-Li Lin).



5. Invasive Species



The threat to biodiversity posed by invasive species is a widespread global issue. In Taiwan, a number of invasive species have established wild populations, primarily due to abandonment, escape, and religious release. A recent comprehensive inventory revealed that there are currently 19 invasive bird species in Taiwan.

Using data from the Taiwan Breeding Bird Survey conducted between 2011 and 2021, an analysis was performed to understand the population trends of six of Taiwan's most common invasive bird species: Javan Myna (*Acridotheres javanicus*), Common Myna (*Acridotheres tristis*), Rock Pigeon (*Columba livia*), Oriental Magpie-Robin (*Copsychus saularis*), White-browed Laughingthrush (*Pterorhinus sannio*), and Oriental Magpie (*Pica serica*). Results indicated a significant increase for all species except the White-browed Laughingthrush. The Taiwan Introduced Bird Indicator also showed substantial growth in the number of these invasive species in the country. The

expansion and population growth of invasive species present significant challenges to bird conservation efforts in Taiwan.

Nevertheless, there have also been successful cases of invasive bird species removal as well. The African Sacred Ibis (*Threskiornis aethiopicus*), was first introduced to Taiwan via private zoos in 1979. A group eventually escaped and formed a fast-growing wild population. This led to a widespread distribution across western Taiwan. The Forestry and Nature Conservation Agency later worked with local groups and hunters to implement a culling scheme, resulting in the removal of 17,467 individuals by the end of 2022. Now, its distribution range and numbers in the wild have been significantly reduced. It is conservatively estimated that the remaining population is between 500 and 1,000 birds.

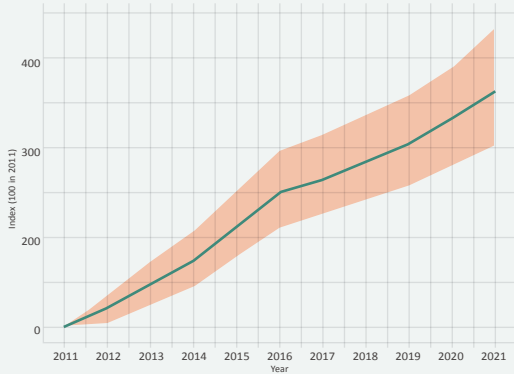


¹³ <https://www.bird.org.tw/basicpage/2788>

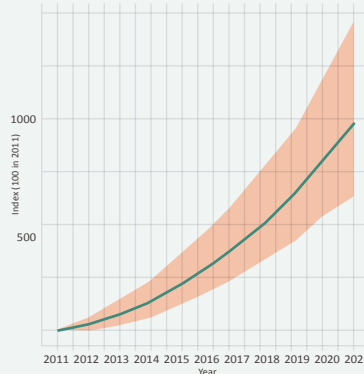
¹⁴ Lin, D. L., Ko, J. C. J., Amano, T., Hsu, C. T., Fuller, R. A., Maron, M., ... & Lee, P. F. (2023). Taiwan's Breeding Bird Survey reveals very few declining species. *Ecological Indicators*, 146, 109839.



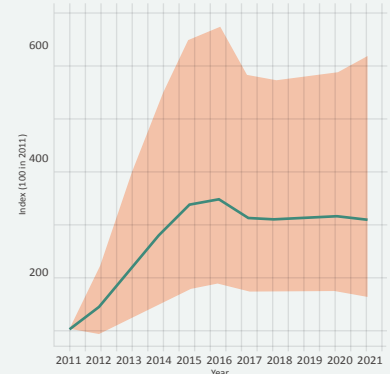
Javan Myna (G)



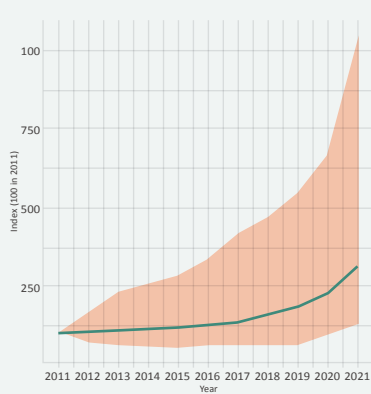
Common Myna (G)



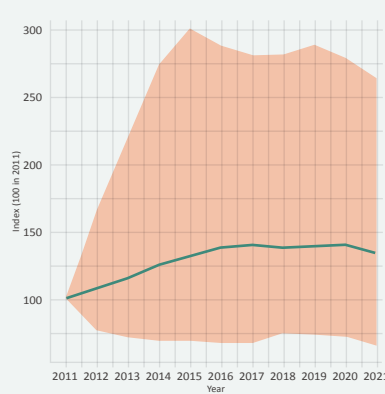
Rock Pigeon (G)



Oriental Magpie-Robin (G)



White-browed Laughingthrush (N)



Eurasian Magpie (G)

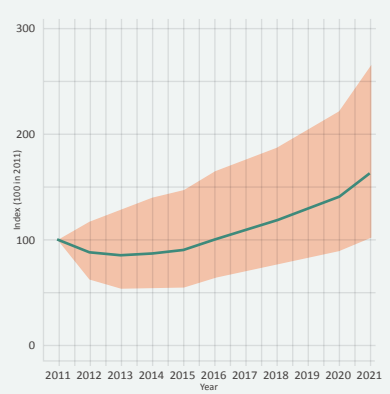
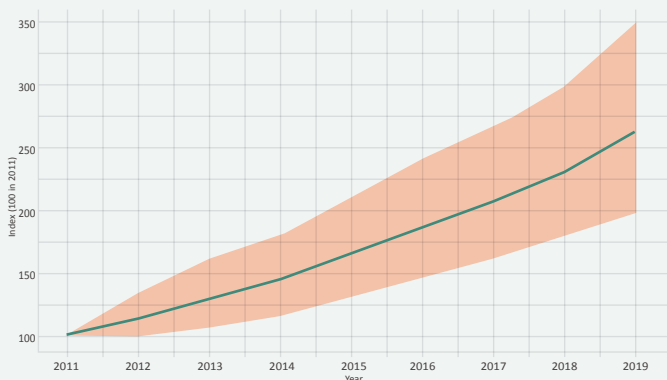


Figure 3.5.1. Population trends of six invasive bird species in Taiwan between 2011 to 2021 (G=Growth, D=Decline, N=Non-significant Change).

Figure 3.5.2. Indicator trends for invasive bird species in Taiwan from 2011 to 2019¹⁵.

¹⁵ Lin, D. L., Ko, J. C. J., Amano, T., Hsu, C. T., Fuller, R. A., Maron, M., ... & Lee, P. F. (2023). Taiwan's Breeding Bird Survey reveals very few declining species. *Ecological Indicators*, 146, 109839.

6. Tidal Flat Loss



Intertidal flats, also known as mudflats, have a substrate composed of organic matter and sediment brought by tides and rivers, making them rich in benthic organisms. They provide numerous ecological functions, including serving as habitats for various plants and animals, stabilizing shorelines, and mitigating sea level rise. They also serve as crucial foraging grounds for migratory waterbirds. However, mudflats around the world are gradually being lost due to rising sea levels caused by global warming. Coastal development and construction also plays a major role. Such activities encroach upon these habitats, affecting downstream flow quality in rivers, reducing sediment, and aggravating beach erosion. It is estimated that between 1984 and 2016, approximately 16.2% of the intertidal mudflats in East Asia, the Middle East and North America were lost. This loss of habitat poses a significant challenge for migratory waterbird conservation.

Migratory waterbirds which use the East Asian-Australasian Flyway are highly dependent on mudflats around the Yellow Sea which serve as a critical stopover site during their migratory journeys. However, over the past three decades, many of the mudflats in this area have been degraded and lost due to the construction of artificial seawalls, industrial land reclamation, and the spread of the invasive species *Spartina alterniflora*.

Taiwan, situated along the East Asian-Australasian Flyway, also faces issues related to mudflat loss. The rapid spread of *Spartina alterniflora* reduces benthic biodiversity and renders affected mudflats unsuitable for waterbirds. Extensive mangrove expansion further degrades these areas as foraging and roosting sites for waders. Research conducted in the Tamsui River Basin in 2012 revealed that the removal of mangroves in the Shezi area led to

a significant increase in species diversity and an abundance of food for shorebird species. The results also showed that although mangroves can support the nesting and breeding of terrestrial birds as well as egrets and herons, it is not the preferred habitat of waterbirds in terms of foraging or roosting. Therefore, if conservation measures for shorebirds are to be developed in protected mudflat areas, controlling mangrove coverage within these areas is crucial.

Taiwan's west coast is under constant pressure from industrial development and pollution. In particular, mudflat degradation is particularly prevalent in central-western Taiwan. Along the coastal areas of Taichung City and Changhua County, the construction of power plants, factories, landfills, and land reclamation projects has led to mudflat loss and industrial pollution. Since the 1950s, an estimated 266 square kilometers (approximately 58%) of Taiwan's coastal mudflats have been lost. This poses a significant threat to the survival of waterbird species which rely on Taiwan as a stopover or wintering site.

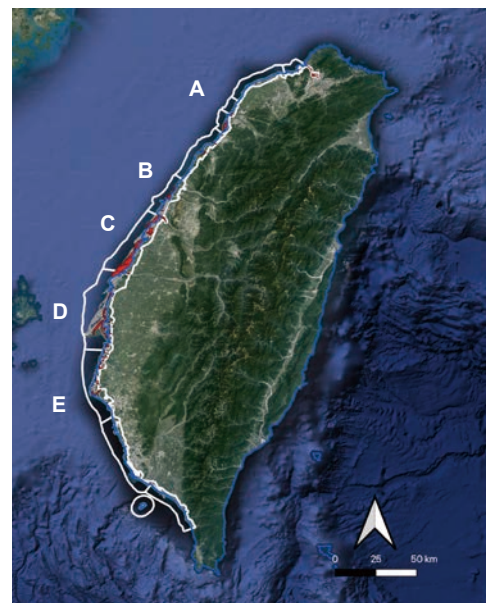
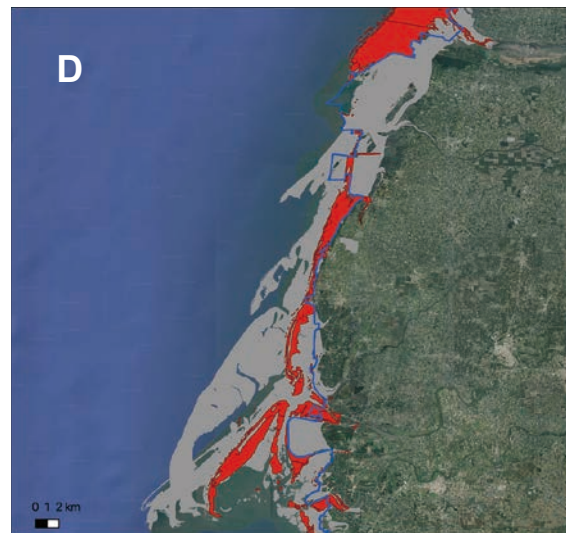
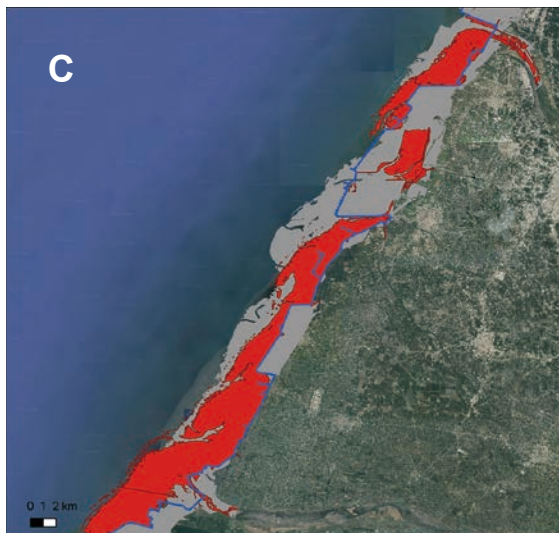
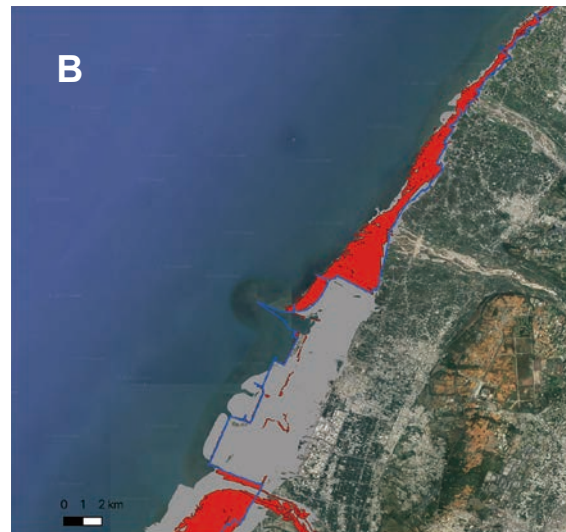
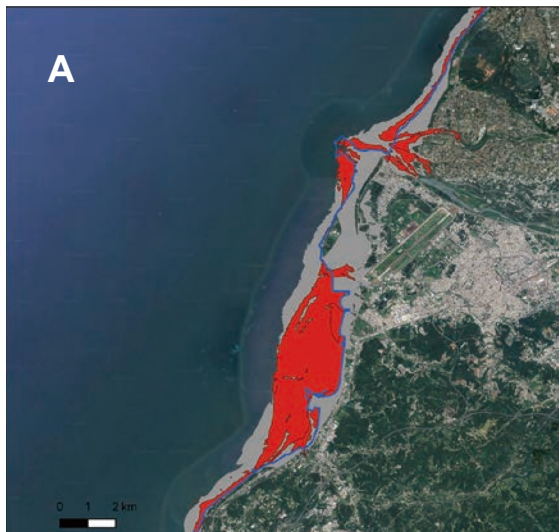


Figure 3.6.1. Distribution of lost tidal flats in Taiwan from the 1950s to the 2010s (Chen et al. 2024). Grey patches represent mudflats lost over the last 100 years. The blue line represents the coastline, and the white borders delineate the study area. Images A-E on the right are enlarged sections corresponding to the lettered sections of the map shown above.



7. Agricultural Land Loss



The greater the diversity of landscape elements and more complex the spatial configuration of an agricultural landscape, the higher the species richness of birds tends to be. A wider variety of habitats accommodates a broader range of bird species. These habitats include semi-natural landscape elements like hedgerows in fields and artificial ponds for water retention. However, environmental changes and land use policies have gradually reduced habitat availability in agricultural areas.

An examination of historical land data and satellite images in Taiwan over the period of 1904 to 2015 showed that agricultural land accounted for 23% of Taiwan's land area in 1904. This increased to 34% by 1956 due to reclamation of grasslands and forests in western Taiwan. Afterward, due to national land policies and other development actions, agricultural land was extensively converted to building land on a large scale. By 2015, agricultural land had decreased

to just 16% of Taiwan proper's total land area, posing a serious threat to wildlife dependent on agricultural landscapes.

Citizen science data on birds collected across Taiwan, coupled with qualitative and quantitative analyses, revealed that agricultural land in southern and eastern Taiwan provides the most suitable habitat for birds. In recent years, a rapid decline in the population of birds inhabiting agricultural land has been observed (see Section 1.1 Breeding Birds for details). This is possibly attributed to agricultural land loss. Additionally, the decrease in overwintering waterbirds in northeastern Taiwan's Yilan Plain has been confirmed as being the result of rice paddy field loss¹⁶. Agricultural land serves as a multifaceted ecosystem that has conservation functions for biodiversity. It contributes to sustainable agriculture while benefiting both food production and nature conservation efforts.

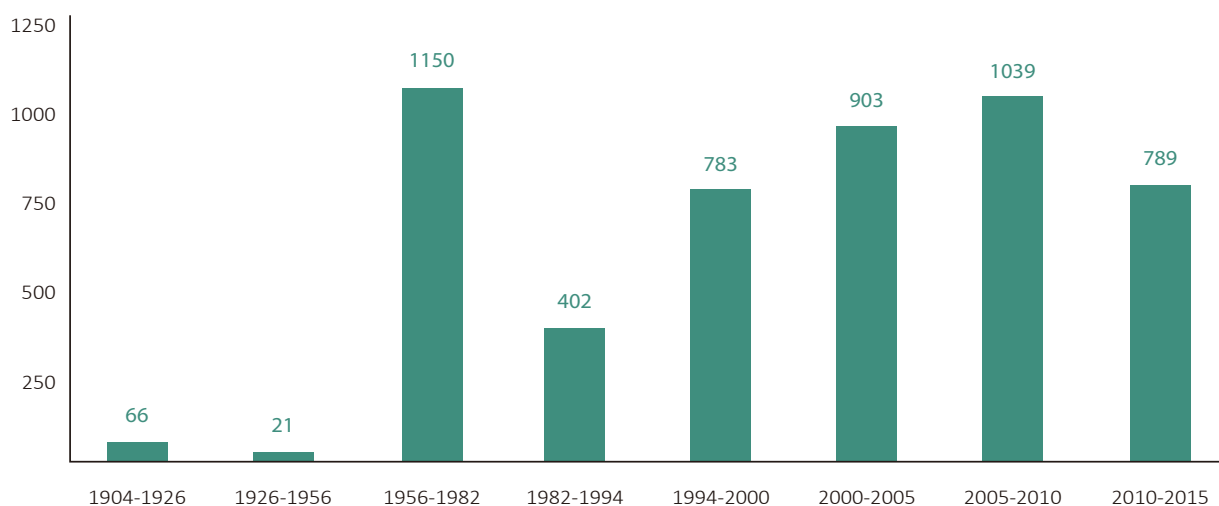


Figure 3.7.1 Land area converted from agricultural use to building land between 1904 and 2015 (credit: Redrawn from Chen et al. (2019); unit: km²).

¹⁶ Lin, D. L., Ko, J. C. J., Amano, T., Hsu, C. T., Fuller, R. A., Maron, M., ... & Lee, P. F. (2023). Taiwan's Breeding Bird Survey reveals very few declining species. *Ecological Indicators*, 146, 109839.



Part 4.

Looking Towards the Future

Taiwan's bird conservation efforts through 2030 will be guided by the Nature-Positive vision set out in the Global Biodiversity Framework. This global approach emphasizes not only halting biodiversity loss but reversing it—restoring ecosystems and achieving net gains in nature.

In line with this vision, Taiwan's conservation goals will go beyond preventing the decline of bird populations. They will focus on actively restoring habitats and improving the environmental conditions birds need to thrive.

To achieve this, Taiwan will pursue five key strategies:

◆ Ecological Restoration and Connectivity:

Efforts will be made to restore key ecosystems—such as forests, agricultural lands, and coastal mudflats—that serve as essential bird habitats. These will include creating ecological corridors and buffer zones to improve connectivity, enhancing ecosystem resilience, and supporting broader bird migration and breeding patterns.

◆ Promoting Sustainable Agriculture and Forestry:

Sustainable land use practices will be promoted to reduce habitat loss while ensuring birds have access to food sources and breeding grounds.

◆ Harnessing Data and Technology:

Advanced monitoring tools and data analytics will be used to track changes in bird populations and guide timely, science-based conservation efforts. Platforms such as eBird Taiwan and iNaturalist will play a key role in data collection and sharing.

◆ Engaging Communities Through Citizen Science:

Public engagement will be expanded through citizen science initiatives that build awareness and encourage participation in bird conservation. These programs will also help instill environmental responsibility in the next generation.

◆ Integrating Policy and International Cooperation:

Bird conservation goals will be integrated into national policies, with international partnerships helping align Taiwan's efforts with global Nature-Positive priorities.

Through these strategies, Taiwan's actions by 2030 will support the goals of the United Nations Convention on Biological Diversity, including the 2050 vision of living in harmony with nature. This includes restoring habitats, stabilizing bird populations, and improving biodiversity indicators.

Ultimately, Taiwan aims to be a model of Nature-Positive conservation, demonstrating how forward-looking, science-based action can restore and strengthen biodiversity for the benefit of both nature and people.



Part 5.

Open Data Sources in Taiwan

For more information on the birds of Taiwan, including spatiotemporal distribution information, those interested can explore the following four major databases.



eBird Taiwan

<https://ebird.org/region/TW>



iNaturalist Taiwan

<https://taiwan.inaturalist.org/>



台灣生物多樣性網絡 (TBN)

Taiwan Biodiversity Network

<https://www.tbn.org.tw/>



臺灣生物多樣性資訊聯盟

Taiwan Biodiversity Information Alliance, TBIA

<https://tbiadata.tw/zh-hant/>

1. eBird Taiwan

eBird was established in 2002 by the Cornell Lab of Ornithology and the National Audubon Society in the United States. Its purpose is to collect bird checklists from around the world, archive them, and make them freely accessible for sharing. A complete bird checklist includes clear information on time, location, and the number of bird species observed, making it an excellent resource for use in scientific research, conservation, and education. eBird also allows users to easily input, manage, view, and download their own lists and multimedia, such as photos and sound recordings. On the eBird website, users can access distribution maps based on accumulated records, receive bird alerts, and explore other features that enhance birdwatching by making it more interactive. In addition to the website, eBird offers an app for convenient on-site recording. In 2015, the traditional Chinese language portal, eBird Taiwan, was launched, designed specifically for Taiwanese users. Taiwan is currently ranked 7th globally in terms of completed checklists on eBird.

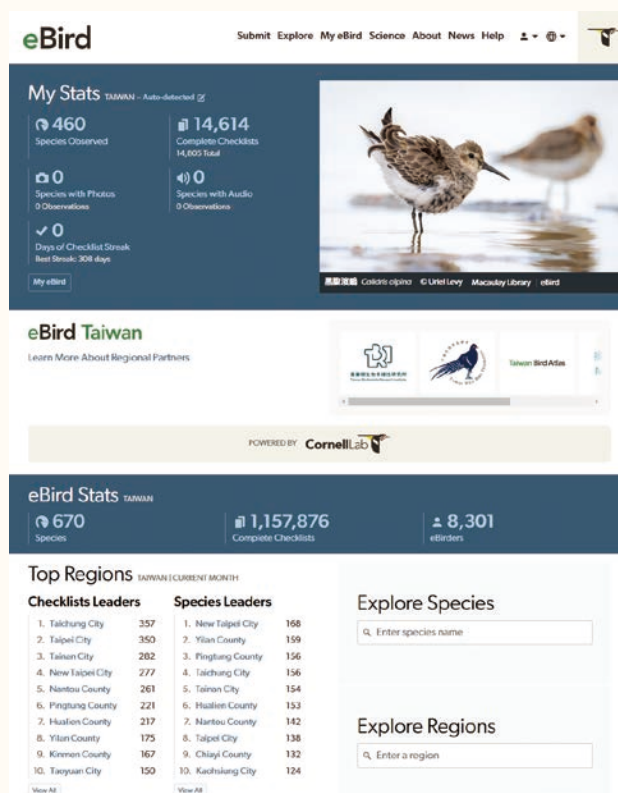


Figure 5.1.1. eBird Taiwan homepage and eBird Taiwan Stats overview (source: eBird Taiwan).



2. iNaturalist Taiwan

iNaturalist is a citizen science community jointly operated by the California Academy of Sciences and the National Geographic Society. By observing something in nature, photographing it, and uploading it to the platform, users can easily record the biodiversity around them. Since iNaturalist introduced AI photo recognition in 2017, the platform has successfully attracted many people interested in nature observation and contributing to citizen science. From 2020 to 2023, 42% of species data uploaded to the Global Biodiversity Information Facility (GBIF) came from iNaturalist, highlighting its growing influence in recent years.

Since iNaturalist launched a traditional Chinese version in 2017, the number of users in Taiwan has steadily increased. In 2022, the iNaturalist Taiwan portal was launched, jointly maintained by Associate Professor Lin Cheng-tao from the Department of Forestry and Resource Conservation at National Taiwan University and the Taiwan Forestry Research Institute, Ministry of Agriculture. As of November 2023, Taiwan's 9,074 iNaturalist users had uploaded 175,170 bird entries representing 596 species (Figure 5.2).

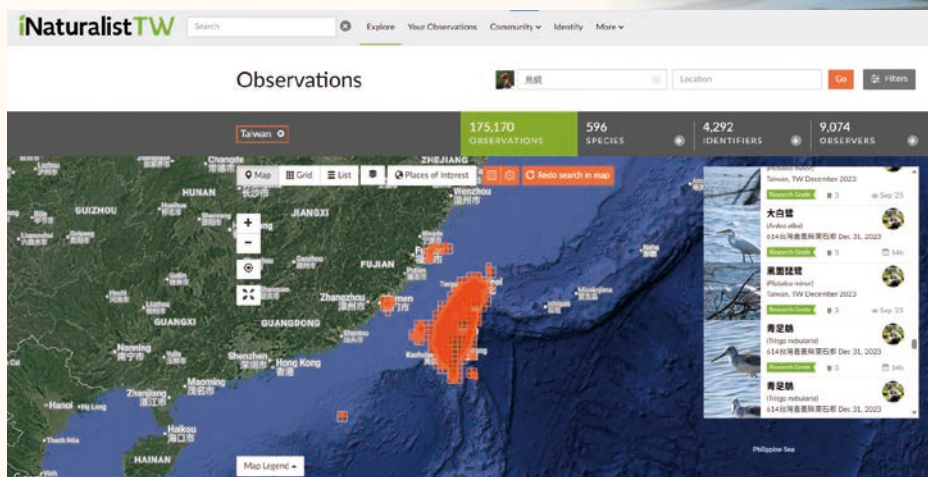


Figure 5.2.1. iNaturalist's bird observation records (source: iNaturalist).

3. Taiwan Biodiversity Network

The Taiwan Biodiversity Network (<https://www.tbn.org.tw/>) is an online platform dedicated to using open ecological survey data to provide information on wildlife distribution in Taiwan. It was established and is maintained by the Taiwan Biodiversity Research Institute, Ministry of Agriculture. The TBN works to ensure that biodiversity data conforms to the findable, accessible, interoperable, and reusable (FAIR) principles of scientific data management. This is done with the support of the National Geographic Information System (NGIS). The platform has structured Taiwan's accumulated long-term biological distribution data from various datasets and platforms for the purpose of data archiving and circulation. Since 2018, it has offered observation data download services and since May 2020, it has provided catalog download services. By 2022, the number of data downloads had exceeded 21,000 (Figure 5.3.1).

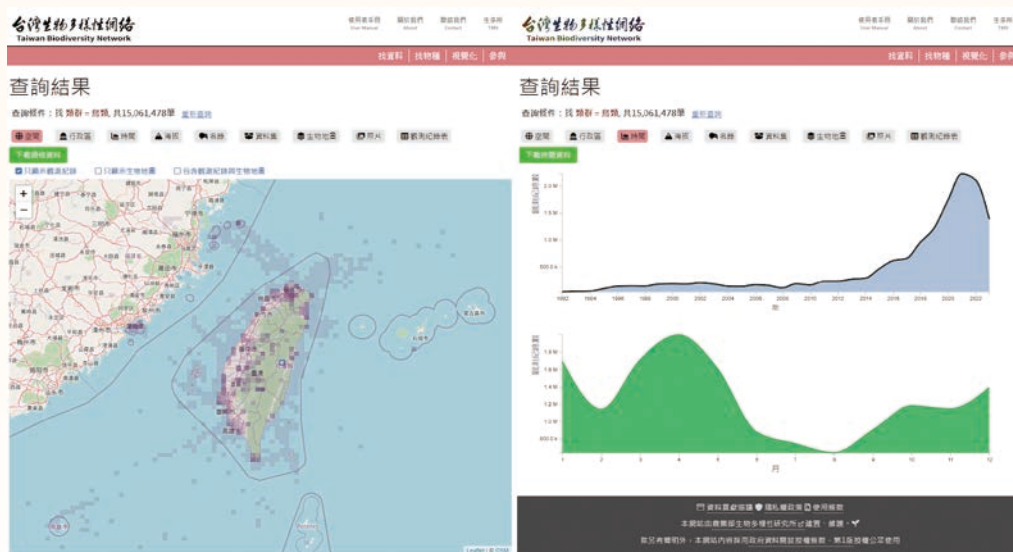


Figure 5.3.1. Temporal and spatial distribution of bird data found on the Taiwan Biodiversity Network database (source: Taiwan Biodiversity Network).





4. Taiwan Biodiversity Information Alliance

The Taiwan Biodiversity Information Alliance (TBIA) is composed of eight biodiversity-related institutions that manage biological databases: the Taiwan Biodiversity Information Facility (TaiBIF); the Taiwan Biodiversity Research Institute, Ministry of Agriculture; the Forestry and Nature Conservation Agency, Ministry of Agriculture; the Taiwan Forestry Research Institute; the National Land Management Agency, Ministry of the Interior; the Ocean Conservation Administration; the Water Resources Agency, Ministry of Economic Affairs; and the National Taiwan Museum. Its purpose is to execute the Taiwan Biodiversity Information Action Initiative, which promotes data exchange, standardization, technology sharing, and enhances the visibility of biodiversity data through collaboration among partner institutions. As of November 2023, the integrated open biodiversity data of Taiwan included occurrence records for 17,346,237 species and over 1,322,190 natural history collection records.

Users can search and download data from the TBIA, using refined field parameters to browse content and quickly access original data. It is also possible to contact data providers through the TBIA for one-time-use de-fuzzification of sensitive data (Figure 5.4.1).

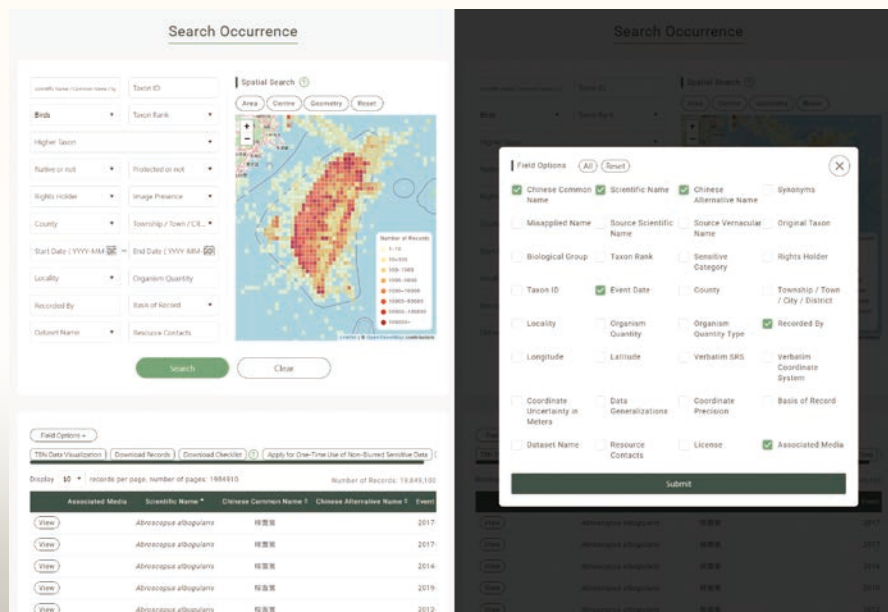


Figure 5.4.1. TBIA bird data search interface (source: Taiwan Biodiversity Information Alliance).



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The materials presented in this work and the geographical designations employed therein do not imply any opinion whatsoever on the part of the TWBF or TBRI concerning the legal status of any country, territory, or area, or concerning the delineation of borders or boundaries.

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