*New Idea***A millennium of stasis in avian ornamentation? Implications for sexual selection theory****Rebecca E. Koch and Geoffrey E. Hill***Rebecca E. Koch, (rek0005@auburn.edu), Department of Biological Sciences, Auburn University, Auburn, AL, USA**Geoffrey E. Hill, (ghill@auburn.edu), Department of Biological Sciences, Auburn University, Auburn, AL, USA***Abstract**

Sexual selection is widely accepted as an explanation for the evolution of ornamental traits in animals. Theory predicts that ornament evolution via sexual selection is triggered when a population is moved from an equilibrium state by changes in environmental conditions or population parameters and that once initiated, the rate of change can be rapid in comparison to change induced by natural selection. To assess these ideas, we considered whether there are examples of substantive changes to ornamental traits in any species of bird over recent human history. We proposed and tested a new means to assess contemporary evolution in the ornamental traits in birds, covering a period of more than a thousand years before present. We predicted that cases of rapid change in avian ornaments would be captured in the pictorial record across the centuries for which bird plumage has been documented. We found no substantial change in the ornamental traits of any species of bird, and we found few instances of even small changes in the ornamentation of bird species as depicted in the historical record. Our study is the first to systematically evaluate changes in ornamental traits within extant species on a time scale of centuries, and our findings have important implications for the mechanisms that generate the diversity of ornaments in birds.

Key Words: sexual selection, speed of evolution, plumage coloration, museum specimen, art.

Introduction

Sexual selection is widely accepted as a major selective agent that shapes ornamental traits in animals (Andersson 1994, Pizzari et al. 2006, Hill 2013). Females potentially assess three fundamental aspects of prospective mates when they assess ornamentation: species identity, condition, and sexiness (Hill 2015a, 2015b). Signals of species identity and condition are expected to function most effectively when they are simple and unelaborated (Maynard-Smith 1991, Dale et al. 2006). The elaboration of traits is best explained by arbitrary female choice for aesthetic beauty, which can lead to a runaway process and rapid changes in the trait (Fisher 1958, Schluter and Price 1993, Arak and Enquist 1995, Prum 2010).

Extensive diversification and elaboration of ornamentation have occurred in the past in a wide range of animals, from flies to birds. For instance, the complex and diverse display traits in closely related Neotropical manakins (Pipridae) are striking evidence that large differences in ornamentation can evolve even between the most recently diverged sister taxa (Prum 1997). Despite the theoretical and phylogenetic support for rapid elaboration and diversification of ornamentation, however, examples of sexual selection creating changes in ornamentation in a contemporary time frame are rare (Svensson and Gosden 2007).

The absence of evidence for recent evolution in ornamental traits is especially interesting because

disruptions to the environment or population structure are implicated as potential triggers for change in ornaments via sexual selection (Arnold 1983, Schluter and Price 1993). We therefore might expect rapid evolution in sexually selected displays following perturbations to populations, such as when there is a hybridization event that introduces new genetic combinations, in circumstances in which predation pressure is substantially increased or decreased, when a population experiences a substantial reduction or increase in size, or when a population is impacted by a novel pathogen. Over recent centuries, numerous bird species have been subjected to such changes in population size, genetic structure, and natural selection pressures as human activities have altered environments and changed bird populations (Marzluff 2001, Møller et al. 2010). However, only small changes in the ornamental traits of just a few species have been reported in response to changing environmental conditions. For example, the extent of white in the tails of dark-eyed juncos (*Junco hyemalis*) decreased by 17 to 20% in the 20 years after the establishment of a new population outside of the usual mountain range of the species (Yeh 2004), and the mean tail length of barn swallows in Europe increased by about 11 mm in less than 20 years as a result of climate change (Møller and Szep 2005). In addition, one recent study has shown that wild Trinidadian guppies (*Poecilia reticulata*) experimentally subjected to increased predation pressure for one year increased the relative size of their sexually selected orange spots from an average of about 6% to 8% of the lateral fish body area (Gordon et al. 2015).

In contrast, human-induced environmental changes have resulted in numerous examples of measureable changes in non-sexually selected traits of animals on the time scale of decades (Hendry et al. 2007, Svensson and Gosden 2007, Møller et al. 2010). Male guppies evolved a larger body size at maturity over four years in response to decreased predation pressure (Reznick et al. 1997); medium ground finches (*Geospiza fortis*) evolved larger bills in response to an introduced competitor in 22 years (Grant and Grant 2006); and, both fruit flies (*Drosophila subobscura*) and house sparrows (*Passer domesticus*) evolved morphological differences along a latitudinal gradient upon introduction to North America: fruit flies adjusted wing size along a geographic cline over 20 years after introduction, and house sparrows adjusted body size in less than 100 years (Johnston and Selander 1964, Huey et al. 2000). If natural selection can shape morphological traits within a time scale observable to researchers, we might reasonably expect that sexual selection should, perhaps to an even greater extent, generate changes in ornamental traits over the same time scale (Svensson and Gosden 2007). The scarcity of examples of any change in animal ornamentation and particularly the

total lack of large-scale change in ornamentation is unexpected and deserves further study.

In this study, we surveyed for changes in the ornamentation of hundreds of species of birds over multiple centuries by comparing the ornamentation of birds as depicted in historical art to the ornamentation of the same species in contemporary populations. This time period that we assessed is shorter than that detectable in fossilized remains or with phylogenetic analyses, which rarely allow for detailed examination of ornament evolution, but longer than is possible with a study of a focal population.

Illustrations, when used to depict natural history rather than impressionistic designs, accurately portray features of birds such as coloration, color patterns, and elongated plumes that have been documented to function as criteria in female mate choice (Andersson 1994, Hill 2006). If sexual selection leads to the rapid evolution of ornamental traits under changing ecological conditions, then we would expect to find examples in the historical record of species having gained, lost, or conspicuously modified an elaborate trait. We also examined change in the plumage traits of museum study skins across time as a second means to search for evidence of rapid evolution in ornamentation. By documenting change in ornamental traits in historical illustrations and museum specimens, we assessed whether major evolutionary change has occurred in the ornaments of birds across centuries.

Methods

Illustrations

We examined digital and printed images of lifelike illustrations of avian species created before 1900 (Table S1, S2). We located sources of illustrations using keyword searches in online databases of archived historical texts. We included an artist's work in our analysis only if the entirety of his collection included lifelike depictions of birds that appeared to have biologically accurate morphological characteristics, rather than impressionistic or stylized paintings; by excluding entire artists rather than individual images, we reduced the possibility that we would inadvertently exclude just those illustrations of large phenotypic change for which we were looking.

Using plates in the *Handbook of the Birds of the World* (del Hoyo et al. 2010) and knowledge of the geographic location from which the focal bird was painted, we identified the species or subspecies depicted in each historical image and compared the appearance of the illustrated bird to the modern phenotype of its species. Often, illustrations painted in more recent centuries were already labeled with species names that corroborated our identification. Given that we included

Figure 1. Examples of the historical and contemporary bird images that were compared in our study of change in ornamental traits of birds. Pictures are the white-throated rock thrush (*Monticola gularis*) in 2100 B.P. (A), and in the twenty-first century (B); the northern rosella (*Platycercus venustus*) from 1848 (C), and in contemporary illustrations (D). Images courtesy of the National Palace Museum, Lynx Edicions (del Hoyo et al. 2010), and the National Library of Australia (Table S1).

only lifelike depictions in our analysis, all but ten out of 449 historic illustrations of birds could be matched to a modern species conclusively; the ten images that we could not, with certainty, link to one contemporary species were either depicted in a position that obscured diagnostic traits or had overall nondescript plumage that overlapped too extensively within closely related species (e.g. an *Empidonax* flycatcher). There was no significant ornamentation in this latter group, so excluding them from the analysis had no effect on our conclusions. The critical point is that every species depicted in historic art with even the most subtle diagnostic plumage characteristic could be matched to contemporary species; there were no images of “mystery” birds that might have transformed through sexual selection into something so different it would be unrecognizable among contemporary taxa.

For each illustration, we recorded any difference between a trait in the historical image and its counterpart in the modern bird that could not be easily attributed to a change in bird positioning or a noticeable yellowing or fading of paint. We excluded the colors of bills, feet, and eyes in our measurements because some artists are known to have drawn birds from dead specimens, and these body parts are most likely to change in color after death. For comparison with the historical depiction, we used the plates of the *Handbook of the Birds of the World* (del Hoyo et al. 2010) for the archetypal description and image of each species’ modern phenotype, and we also performed Google Image searches to reference the modern bird’s appearance in multiple positions and under different lighting regimes. We assessed every “hue” (the shade of a discretely colored patch of plumage), “pattern” (spots, stripes, bars), and “structure” (crests, wattles, elongated rectrices) trait visible on each bird species, resulting in a complete analysis of all visible discrete traits on each bird. For this qualitative analysis, we prioritized analyzing a wide range of traits on a large number of images, so we used visual assessment rather than spectral quantification to assess changes in ornamentation. Given the small random variation created by the position of the bird and the challenges of accurately depicting complex plumage colors (such as iridescence) with paint, the human ability to interpret similarity or difference between images allowed for both feasible and biologically relevant analysis of trait change. For example, subtle barring in the breast of the rock thrush in a historical depiction (Figure 1A) was not counted as a true phenotypic difference from the modern bird (Figure 1B) because this artist consistently used this pattern to depict the texture of feathers. Similarly, the smaller size and paler color of the blue wing patch on the illustrated rock thrush was not counted as a difference because image searches revealed that the size of that colored patch varied greatly among individuals and different bird positions.

Museum specimens

In November and December of 2012, R.E. Koch traveled to the ornithology collections of four museums (Museum of Natural Science, Louisiana State University; American Museum of Natural History, New York; Museum of Comparative Zoology, Harvard University; and Museum of Vertebrate Zoology, University of California, Berkeley) to perform a trait analysis on study specimens (Table S3). We chose to focus on two families of lekking birds that are characterized by elaborate ornamentation and that are well-represented in museum collections: manakins (*Pipridae*) and cotingas (*Cotingidae*). We targeted these

taxa because the extraordinary divergence in appearance among closely related species in the manakins and cotingas (Prum 1997, Berv and Prum 2014) suggests that many episodes of elaboration have occurred in the recent past, and because both taxa feature conspicuous color patches easily visible on prepared skins. We compared paired groups of specimens that were identical in species (or subspecies, when available) and in geographic location, but that differed in collection time by more than 30 years; we chose this minimum time difference based on the ages of study skins in the visited museums. For each species or subspecies measured, we inspected 1–6 adult male specimens in breeding plumage in each of two relative age classes (“older” or “newer”). We compared the visible plumage traits of the two age classes side-by-side and recorded any phenotypic differences in color or pattern that could not be attributed to variation in feather positioning or to a minor fading in color that we observed in some of the older specimens. We used the plates of the *Handbook of the Birds of the World* (del Hoyo et al. 2010) to validate species and subspecies identity and to assess whether changes observed could be attributed to known geographical polymorphisms rather than change over time.

Results

Illustrations

We analyzed 433 species (about 5% of extant bird species) in a total of 449 historical illustrations from artists worldwide; some species were present in more than one illustration. Illustrations were created on dates ranging from approximately 4500 before present (BP; Egyptian tomb art) to 1890 (paintings from natural historians). We recorded no substantial changes in the colors or shapes of feathers in any species of bird. This qualitative survey did not yield information about the magnitude of these changes, but all recorded changes were small and subtle, such as a lack of pale white tips to the tail or an underemphasis of a patch of color at the base of the bill. Of the 2963 individual traits that we compared between historical and contemporary illustrations, 139 (4.7%) showed such small changes. These changes were distributed among 113 species (26% of all examined) that had at least one recorded difference between artistic depiction and modern phenotype (Table S2). The most substantial change we observed was the lack of a blue border on the edge of a white cheek patch in a historical depiction of the northern rosella (*Platycercus venustus*, painted in 1840–1848; Figure 1C), a trait that appears in all contemporary illustrations of the species (Figure 1D).

Museum collections

We compared groups of “older” and “newer” specimens in 57 species and subspecies in *Cotingidae* and *Pipridae*. The age difference between the collection times of older and newer groups ranged from 31 years to 122 years, with a mean of 72 years. We found a single small change in a plumage trait—the extent of a color patch—in each of 3 taxa (5% of total taxa examined; Table S3): an increased width of black collar in older *Chiroxiphia caudata* specimens, a more conspicuous demarcation between brown collar and red breast color patches in modern *Phoenicircus carnifex* specimens, and a larger purple color patch on the belly of older *Cotinga amabilis* specimens. These changes were noticeable only upon close inspection. All other pairs of older and newer groups were judged indistinguishable.

Discussion

There is nearly universal consensus that sexual selection resulting from female mate choice is the major selective agent leading to ornament evolution (Andersson 1994, Hill 2013), though the particular evolutionary processes that give rise to the fantastic array of colors, patterns, and forms of ornamental traits in animals remain obscure. To better understand the frequency and magnitude of changes in ornamentation, we assessed the colors, patterns, and feather shapes of birds in illustrations created centuries before the present and compared these images to the contemporary appearances of the same bird species. We also compared ornamentation of older and newer study skins in museum collections. We found zero instances of what we categorized as significant changes in ornamentation—exaggerated changes on the scale we might expect to have produced the diversity of elaborate ornaments that we observe in modern bird species—over the time period we examined.

Our method of evaluating changes in ornamentation is not without difficulties; even the most lifelike paintings are subject to artistic interpretation, and we were limited to about 400 comparisons among the nearly 10,000 extant species of birds. Nevertheless, we would not have missed significant and conspicuous changes in traits, and the eye-catching species targeted by historical naturalists are exactly those most likely to possess prominent ornaments. Moreover, a rapid change in the appearance of a bird species is likely to have captured the attention of observers and be documented in the written record, but we know of no such account of change in appearance for any wild bird anywhere in the world. Finally, the collective wisdom of ornithologists

gives us confidence that we did not miss important examples of change. When we requested permission to examine specimens at major museum collections and explained our purpose, curators with a lifetime of experience looking at birds in the wild and examining extensive series of study skins were unanimous in responding that they knew of no significant changes in ornamentation in any species of wild bird during recorded history (Dr. James Remsen, Jeremiah Trimble, Dr. Carla Cicero, and Paul Sweet, personal communication).

This pattern of apparent near-stasis in ornamentation over recent history has occurred against a backdrop of environmental upheaval. The past two centuries have been an era of tumultuous change for many avian populations. Human activities have reduced bird populations to the brink of extinction, allowed small founder populations of species to expand to fill continents, eliminated predators, introduced new and devastating predators, shuffled species distributions resulting in more and novel hybrid pairings, and greatly changed the microclimates, nest site availability, food, and parasites of numerous bird species (Marzluff 2001, Primack 2006, Møller et al. 2010). These types of perturbations may alter the relative costs of sexual displays or change the strength of female preference for ornaments and thus initiate evolution by sexual selection (Arnold 1983, Schluter and Price 1993). Yet, we observed no evolutionary responses by ornamental traits on the scale that we would expect due to the extreme environmental changes created by human activities.

The immense diversity of colors, patterns, and shapes across avian species, often between closely related sister taxa (Prum 1997, Berv and Prum 2014), is testament to the large-scale changes in ornamentation that have occurred many thousands of times in the past several hundreds of thousands to millions of years of avian speciation. Given the limitations of the fossil record, it is impossible to know how ornamentation may have changed in the time since the estimated genetic divergence of species, and whether the differences in display traits we currently observe among sister taxa developed rapidly in concert with speciation or accumulated incrementally in the millennia since speciation. Our observations indicate that despite enormous and diverse perturbations to populations, ornamental traits have remained largely unchanged across recent centuries. This indicates either that modern ecological disruptions have not been sufficient to trigger ornamental evolution or that secondary sexual characters change form so gradually that we would indeed require multiple millennia to detect them. On the other hand, verbal (Fisher 1958) and population genetic (Lande 1981, Kirkpatrick 1982) models largely predict rapid change in ornamentation (but see Roff and Fairbairn 2014). In our opinion, reconciling the empirical

observation of near-stasis in ornamentation across centuries with the predictions of sexual selection theory is a significant unresolved challenge in evolutionary biology.

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Table S1: Sources of images used in illustration analysis.

Artist	Image source	Original publication	URL
Audubon, John James	University of Pittsburgh	<i>Birds of America</i> . London: 1827-1838	http://digital.library.pitt.edu/a/audubon
Bai, Cui, Lu Ji, and Huang Quan	China Online Museum	Assorted sources, ~900-1300	http://www.chinaonlinemuseum.com/painting-birds.php
Gould, John	National Library of Australia	<i>Birds of Australia</i> , vol. 1-7. London: 1840-1848	http://catalogue.nla.gov.au/Record/365487 (Broz et al.: RARE RBN ef F4773)
Gould, John	Biodiversity Heritage Library	<i>Birds of Britain</i> , vol. 1-5. London: 1861-1873.	http://www.biodiversitylibrary.org/page/37485930#page/28/mode/1up
Unknown	Auburn University Library	Photographs of Egyptian tomb art from ~1800-2500 B.P.	No URL. Printed in: Houlihan P.F., Goodman S.M. 1986. <i>The Birds of Ancient Egypt</i> , Aris & Phillips.
Jardine, Sir William and John Selby	Biodiversity Heritage Library	<i>Illustrations of Ornithology</i> . Edinburgh: 1834	http://www.biodiversitylibrary.org/item/122925#page/6/mode/2up
Lear, Edward	University of Wisconsin Digital Collections	<i>Illustrations of the family Psittacidae, or Parrots</i> . London: 1832	http://digioll.library.wisc.edu/cgi-bin/DLDecArts/DLDecArts-idx?id=DLDecArts.LearParrots
Lord Lilford	Biodiversity Heritage Library	<i>Coloured Figures of the Birds of the British Isles</i> . London: 1885-1897	http://www.biodiversitylibrary.org/ia/colouredfigureso01lilf#page/11/mode/1up
MacGillivray, William	The British Natural History Museum	Assorted sources, 1831-1841	http://www.nhm.ac.uk/nature-online/art-nature-imaging/collections/macgillivray/index.dsml
Nuttall, Thomas	Biodiversity Heritage Library	<i>A Popular Handbook of the Ornithology of Eastern North America</i> . Boston: 1896.	http://www.biodiversitylibrary.org/item/32640#page/6/mode/2up
Wenjin, Bian	National Palace Museum	“Three Friends and a Hundred Birds,” 1413	http://www.npm.gov.tw/exh99/bian_wenjin/en_01.html
Wilson, Alexander	Biodiversity Heritage Library	<i>American Ornithology</i> , vol. 1-3. New York: 1808-1814	http://www.biodiversitylibrary.org/item/67724#page/5/mode/1up

Table S2: Historical image qualitative analysis results. Sources for images are listed in Table S1. The “Total # Traits Observed” encompasses characteristics of color (shade of a color patch), pattern (distribution of discrete patches of color), and structure (ornamentally elongated feathers or colored patches of skin). When more than one entry exists for a single species, values in this column are labeled “N/A”; the total traits for each species were only counted once.

Scientific Name	Year	Artist	# Small Changes	# Large Changes	Total # Traits Observed
<i>Acanthiza chrysorrhoa</i>	1848	Gould	0	0	9
<i>Acanthiza nana</i>	1848	Gould	0	0	6
<i>Acanthorhynchus superciliosus</i>	1848	Gould	0	0	11
<i>Accipiter gentilis</i>	1834	Jardine and Selby	0	0	1
<i>Accipiter nisus</i>	1840	MacGillivray	0	0	3
<i>Acridotheres cristatellus</i>	~1480	Lu Ji	0	0	3
<i>Acridotheres cristatellus</i>	1413	Bian Wenjin	0	0	N/A
<i>Acrocephalus australis</i>	1848	Gould	0	0	4
<i>Actitis hypoleucos</i>	1840	MacGillivray	1	0	4
<i>Aegotheles cristatus</i>	1848	Gould	0	0	5
<i>Aethopyga gouldiae</i>	900	Huang Quon	1	0	6
<i>Agapornis taranta</i>	1832	Lear	0	0	6
<i>Ailuroedus crassirostris</i>	1848	Gould	0	0	10
<i>Alauda gulgula</i>	1413	Bian Wenjin	1	0	7
<i>Alcedo azurea</i>	1848	Gould	1	0	7
<i>Alcedo azurea</i>	1834	Jardine and Selby	0	0	N/A
<i>Alisterus scapularis</i>	1848	Gould	0	0	8
<i>Alpochen aegyptiacus</i>	1840	MacGillivray	0	0	5
<i>Alpochen aegyptiacus</i>	~3350 BP	Unknown	0	0	9
<i>Amytornis textilis</i>	1848	Gould	0	0	5
<i>Anas acuta</i>	~4150 BP	Unknown	1	0	7
<i>Anas acuta</i>	~1890	Lilford	0	0	10
<i>Anas americana</i>	~1890	Lilford	0	0	8
<i>Anas clypeata</i>	~1890	Lilford	0	0	13
<i>Anas crecca</i>	~1890	Lilford	1	0	13
<i>Anas discors</i>	~1890	Lilford	0	0	11
<i>Anas platyrhynchos</i>	~1890	Lilford	0	0	10
<i>Anas querquedula</i>	~1890	Lilford	1	0	9
<i>Anas rhynchotis</i>	1848	Gould	0	0	12
<i>Anas strepera</i>	~1890	Lilford	1	0	11
<i>Anhinga melanogaster</i>	1848	Gould	0	0	7
<i>Anodorhynchus hyacinthinus</i>	1832	Lear	0	0	5
<i>Anous stolidus</i>	1848	Gould	0	0	2
<i>Anser albifrons</i>	~4500 BP	Unknown	0	0	N/A
<i>Anser albifrons</i>	~1890	Lilford	0	0	9
<i>Anser anser</i>	~1890	Lilford	0	0	6
<i>Anser anser</i>	1840	MacGillivray	0	0	3
<i>Anser brachyrhynchus</i>	~1890	Lilford	1	0	6
<i>Anser caerulescens</i>	~1890	Lilford	0	0	2

<i>Anser fabalis</i>	~1890	Lilford	1	0	7
<i>Anser fabalis</i>	1840	MacGillivray	2	0	7
<i>Anseranas semipalmata</i>	1848	Gould	0	0	5
<i>Anthochaera phrygia</i>	1848	Gould	0	0	10
<i>Anthrochaera paradoxa</i>	1848	Gould	0	0	11
<i>Anthus petrosus</i>	1840	MacGillivray	0	0	3
<i>Anthus pratensis</i>	1840	MacGillivray	0	0	2
<i>Anthus spinoletta</i>	~1890	Lilford	0	0	9
<i>Aplonis metallica</i>	1848	Gould	0	0	7
<i>Aprosmictus erythropterus</i>	1832	Lear	0	0	7
<i>Apteryx australis</i>	1848	Gould	0	0	2
<i>Apteryx owenii</i>	1848	Gould	0	0	2
<i>Aquila chrysaetos</i>	1840	MacGillivray	1	0	3
<i>Ara ararauna</i>	1832	Lear	0	0	5
<i>Ara macao</i>	1832	Lear	0	0	8
<i>Ardea cinerea</i>	~1890	Lilford	1	0	12
<i>Ardea cinerea</i>	1840	MacGillivray	1	0	7
<i>Ardea purpurea</i>	~1890	Lilford	0	0	13
<i>Ardeola ralloides</i>	~1890	Lilford	0	0	7
<i>Ardeotis australis</i>	1848	Gould	0	0	8
<i>Arenaria interpres</i>	~1890	Lilford	0	0	13
<i>Artamus personatus</i>	1848	Gould	0	0	8
<i>Artamus leucorhynchus</i>	1848	Gould	0	0	5
<i>Asio otus</i>	1840	MacGillivray	0	0	4
<i>Atrichornis clamosus</i>	1848	Gould	0	0	7
<i>Aviceda subcristata</i>	1848	Gould	1	0	9
<i>Aythya ferina</i>	1840	MacGillivray	0	0	6
<i>Aythya ferina</i>	~1890	Lilford	0	0	5
<i>Aythya fuligula</i>	~1890	Lilford	0	0	6
<i>Aythya marila</i>	~1890	Lilford	0	0	6
<i>Aythya nyroca</i>	~1890	Lilford	0	0	8
<i>Barnardius barnardi</i>	1832	Lear	1	0	15
<i>Barnardius zonarius</i>	1848	Gould	0	0	12
<i>Barnardius zonarius</i>	1832	Lear	0	0	12
<i>Biziura lobata</i>	1848	Gould	0	0	3
<i>Bolbopsittacus lunulatus</i>	1832	Lear	1	0	5
<i>Bombycilla japonica</i>	1413	Bian Wenjin	1	0	15
<i>Botaurus lentiginosus</i>	~1890	Lilford	0	0	7
<i>Botaurus stellaris</i>	~1890	Lilford	0	0	5
<i>Branta bernicla</i>	~1890	Lilford	0	0	7
<i>Branta leucopsis</i>	~1890	Lilford	0	0	7
<i>Branta ruficollis</i>	~1890	Lilford	0	0	11
<i>Bubo bubo</i>	1840	MacGillivray	0	0	3
<i>Bubulcus ibis</i>	~1890	Lilford	0	0	6

<i>Bucephala albeola</i>	~1890	Lilford	0	0	5
<i>Bucephala clangula</i>	~1890	Lilford	1	0	8
<i>Bucephala clangula</i>	1840	MacGillivray	0	0	6
<i>Bulweria bulwerii</i>	~1890	Lilford	0	0	1
<i>Burhinus oedicephalus</i>	~1890	Lilford	0	0	9
<i>Buteo rufinus</i>	~3400 BP	Unknown	0	0	4
<i>Butorides striatus</i>	1848	Gould	2	0	6
<i>Butorides striatus</i>	~1890	Lilford	0	0	N/A
<i>Cacatua galerita</i>	1832	Lear	0	0	4
<i>Cacatua leadbeateri</i>	1848	Gould	0	0	8
<i>Cacatua leadbeateri</i>	1832	Lear	0	0	8
<i>Cacatua sulphurea</i>	1832	Lear	0	0	5
<i>Cacatua tenuirostris</i>	1848	Gould	2	0	7
<i>Calidris canutus</i>	1840	MacGillivray	2	0	2
<i>Callocephalon fimbriatum</i>	1848	Gould	0	0	4
<i>Calyptorhynchus banksii</i>	1848	Gould	0	0	3
<i>Calyptorhynchus baudinii</i>	1848	Gould	0	0	4
<i>Calyptorhynchus baudinii</i>	1832	Lear	0	0	4
<i>Carduelis cannabina</i>	1840	MacGillivray	2	0	6
<i>Carduelis carduelis</i>	1840	MacGillivray	0	0	6
<i>Carduelis chloris</i>	1840	MacGillivray	3	0	4
<i>Cassidix melanicterus</i>	1834	Jardine and Selby	0	0	6
<i>Casuarus bennetti</i>	1848	Gould	0	0	4
<i>Casuarus unappendiculatus</i>	1848	Gould	0	0	4
<i>Cephalopyrus flammiceps</i>	1413	Bian Wenjin	2	0	7
<i>Cereopsis novaehollandiae</i>	1848	Gould	2	0	6
<i>Certhis familiaris</i>	1840	MacGillivray	1	0	1
<i>Ceyx erithaca</i>	1834	Jardine and Selby	2	0	6
<i>Chamaeza ruficauda</i>	1834	Jardine and Selby	1	0	7
<i>Charadrius alexandrinus</i>	~1890	Lilford	0	0	10
<i>Charadrius asiaticus</i>	~1890	Lilford	1	0	8
<i>Charadrius bicinctus</i>	1834	Jardine and Selby	1	0	11
<i>Charadrius dubius</i>	~1890	Lilford	1	0	8
<i>Charadrius fuscifrons</i>	~1890	Lilford	0	0	16
<i>Charadrius hiaticula</i>	~1890	Lilford	0	0	8
<i>Charadrius morinellus</i>	~1890	Lilford	0	0	10
<i>Charadrius ruficapillus</i>	1848	Gould	0	0	9
<i>Chenonetta jubata</i>	1848	Gould	0	0	6
<i>Chlamydera nuchalis</i>	1848	Gould	1	0	8
<i>Chlamydotis undulata</i>	~1890	Lilford	0	0	10
<i>Chloropsis aurifrons</i>	1834	Jardine and Selby	0	0	8
<i>Chloropsis hardwickii</i>	1413	Bian Wenjin	0	0	7
<i>Chrysococcyx lucidus</i>	1848	Gould	0	0	5
<i>Ciconia ciconia</i>	~1890	Lilford	0	0	3

<i>Ciconia nigra</i>	~1890	Lilford	0	0	7
<i>Cinnyris jugularis</i>	1848	Gould	0	0	7
<i>Circus assimilis</i>	1848	Gould	0	0	5
<i>Circus assimilis</i>	1834	Jardine and Selby	0	0	6
<i>Circus cyaneus</i>	1840	MacGillivray	2	0	3
<i>Cissomela pectoralis</i>	1848	Gould	0	0	6
<i>Cisticola exilis</i>	1848	Gould	0	0	8
<i>Cladorhynchus leucocephalus</i>	1848	Gould	1	0	3
<i>Clangula hyemalis</i>	~1890	Lilford	0	0	14
<i>Coccothraustes coccothraustes</i>	1840	MacGillivray	0	0	5
<i>Collicuricincla harmonica</i>	1848	Gould	0	0	6
<i>Columba leucomela</i>	1848	Gould	0	0	5
<i>Columba livia</i>	1840	MacGillivray	0	0	3
<i>Copsychus saularis</i>	1413	Bian Wenjin	0	0	7
<i>Corcorax melanoramphos</i>	1848	Gould	0	0	2
<i>Corvus corax</i>	1840	MacGillivray	0	0	1
<i>Corvus cornix</i>	1840	MacGillivray	0	0	2
<i>Corvus monedula</i>	1840	MacGillivray	0	0	3
<i>Cracticus tibicen</i>	1848	Gould	0	0	7
<i>Cracticus torquatus</i>	1848	Gould	1	0	7
<i>Crinifer piscator</i>	1834	Jardine and Selby	0	0	8
<i>Cuculus canorus</i>	1840	MacGillivray	4	0	6
<i>Cuculus saturatus</i>	1848	Gould	1	0	6
<i>Cursorius cursor</i>	~1890	Lilford	0	0	11
<i>Cyanistes caeruleus</i>	1840	MacGillivray	2	0	8
<i>Cyanoliseus patagonus</i>	1832	Lear	0	0	6
<i>Cyanopica cyanus</i>	~1050	Cui Bai	2	0	7
<i>Cyanopica cyanus</i>	1413	Bian Wenjin	1	0	N/A
<i>Cyanoramphus novaezelandiae</i>	1832	Lear	0	0	5
<i>Cyclopsitta diophthalma</i>	1848	Gould	0	0	7
<i>Cygnus atratus</i>	1848	Gould	0	0	4
<i>Cygnus columbianus</i>	~1890	Lilford	0	0	2
<i>Cygnus cygnus</i>	~1890	Lilford	0	0	2
<i>Cygnus olor</i>	~1890	Lilford	0	0	3
<i>Dacelo leachii</i>	1848	Gould	0	0	13
<i>Dacelo novaeguineae</i>	1848	Gould	0	0	12
<i>Daphoenositta chrysoptera</i>	1848	Gould	1	0	12
<i>Dendrocopos major</i>	1840	MacGillivray	0	0	5
<i>Dendroica caerulescens</i>	1840	Audubon	0	0	9
<i>Dendrortyx macroura</i>	1834	Jardine and Selby	0	0	9
<i>Dicaeum hirundinaceum</i>	1848	Gould	0	0	7
<i>Dicrurus bracteatus</i>	1848	Gould	0	0	4
<i>Diomedea melanophris</i>	1848	Gould	0	0	4
<i>Dromais novaehollandiae</i>	1848	Gould	1	0	4

<i>Drymodes superciliaris</i>	1848	Gould	0	0	11
<i>Dryocopus martinus</i>	1840	MacGillivray	0	0	4
<i>Dryonastes chinensis</i>	1413	Bian Wenjin	0	0	8
<i>Egretta alba</i>	~1890	Lilford	0	0	2
<i>Egretta picata</i>	1848	Gould	1	0	5
<i>Egretta rufescens</i>	~1890	Lilford	0	0	4
<i>Elanus scriptus</i>	1848	Gould	0	0	8
<i>Emberiza calandra</i>	1840	MacGillivray	2	0	2
<i>Emberiza schoeniclus</i>	1840	MacGillivray	0	0	3
<i>Enicognathus leptorhynchus</i>	1832	Lear	0	0	9
<i>Entomyzon cyanotis</i>	1848	Gould	0	0	12
<i>Eolophus roseicapillus</i>	1848	Gould	1	0	7
<i>Eophona migratoria</i>	900	Huang Quon	1	0	6
<i>Eophona migratoria</i>	1413	Bian Wenjin	1	0	N/A
<i>Eopsaltria australis</i>	1848	Gould	1	0	10
<i>Ephthianura tricolor</i>	1848	Gould	0	0	8
<i>Erithacus rubecula</i>	1840	MacGillivray	0	0	4
<i>Erythroriorchis radiatus</i>	1848	Gould	0	0	6
<i>Erythrura gouldiae</i>	1848	Gould	2	0	9
<i>Esacus magnirostris</i>	1848	Gould	1	0	12
<i>Eudyptes chrysocome</i>	1848	Gould	0	0	5
<i>Eurystomus orientalis</i>	1848	Gould	0	0	8
<i>Falco columbarius (spp. pallidus)</i>	1840	MacGillivray	0	0	3
<i>Falco peregrinus</i>	1848	Gould	0	0	5
<i>Falco peregrinus</i>	1840	MacGillivray	0	0	3
<i>Falco tinnunculus</i>	1840	MacGillivray	0	0	5
<i>Ficedula zanthopygia</i>	1413	Bian Wenjin	0	0	9
<i>Francolinus pictus</i>	1834	Jardine and Selby	1	0	8
<i>Fregata ariel</i>	1848	Gould	0	0	7
<i>Fringilla coelebs</i>	1840	MacGillivray	0	0	4
<i>Fringilla montifringilla</i>	1840	MacGillivray	0	0	5
<i>Fulmarus glacialis</i>	~1890	Lilford	0	0	5
<i>Gallinula ventralis</i>	1848	Gould	0	0	5
<i>Garrodia nereis</i>	1848	Gould	0	0	3
<i>Garrulax perspicillatus</i>	1413	Bian Wenjin	0	0	6
<i>Garrulus glandarius</i>	1840	MacGillivray	1	0	7
<i>Gavia adamsii</i>	~1890	Lilford	0	0	8
<i>Gavia arctica</i>	~1890	Lilford	0	0	12
<i>Gavia immer</i>	~1890	Lilford	0	0	8
<i>Gavia stellata</i>	~1890	Lilford	0	0	6
<i>Geophaps plumifera</i>	1848	Gould	0	0	13
<i>Glareola pratincola</i>	~1890	Lilford	0	0	10
<i>Glossopsitta concinna</i>	1834	Jardine and Selby	0	0	10
<i>Grus japonensis</i>	~1100	Zhao Ji	0	0	6

<i>Grus rubicunda</i>	1848	Gould	1	0	7
<i>Haematopus longirostris</i>	1848	Gould	0	0	4
<i>Haematopus ostralegus</i>	1840	MacGillivray	0	0	3
<i>Haematopus palliatus</i>	~1890	Lilford	0	0	5
<i>Hamirostra melanosterna</i>	1848	Gould	0	0	6
<i>Himantopus himantopus</i>	~1890	Lilford	0	0	2
<i>Hirundo rustica</i>	1840	MacGillivray	2	0	6
<i>Histrionicus histrionicus</i>	~1890	Lilford	0	0	13
<i>Hydrobates pelagicus</i>	~1890	Lilford	0	0	3
<i>Hydrobates pelagicus</i>	1840	MacGillivray	0	0	3
<i>Hypsipetes leucocephalus</i>	1413	Bian Wenjin	0	0	2
<i>Irediparra gallinacea</i>	1848	Gould	0	0	9
<i>Ixobrychus minutus</i>	~1890	Lilford	0	0	7
<i>Jacamaralcyon tridactyla</i>	1834	Jardine and Selby	1	0	7
<i>Lanius collaris</i>	1834	Jardine and Selby	0	0	7
<i>Lanius collurio</i>	~3800 BP	Unknown	0	0	6
<i>Lanius excubitor</i>	1840	MacGillivray	0	0	5
<i>Lanius nubicus</i>	~3800 BP	Unknown	0	0	9
<i>Larus canus</i>	1840	MacGillivray	0	0	3
<i>Larus fuscus</i>	1840	MacGillivray	0	0	3
<i>Leiothrix lutea</i>	1413	Bian Wenjin	1	0	10
<i>Leipoa ocellata</i>	1848	Gould	0	0	9
<i>Lichenostomus leucotis</i>	1834	Jardine and Selby	0	0	8
<i>Limosa lapponica</i>	1840	MacGillivray	0	0	7
<i>Lonchura striata</i>	1413	Bian Wenjin	0	0	6
<i>Lopholaimus antarcticus</i>	1848	Gould	0	0	10
<i>Lorius domicella</i>	1832	Lear	1	0	8
<i>Loxia curvirostra</i>	1840	MacGillivray	1	0	4
<i>Mackenziaena leachii</i>	1834	Jardine and Selby	0	0	5
<i>Mackenziaena severa</i>	1834	Jardine and Selby	1	0	3
<i>Malachorhynchus membranaceus</i>	1848	Gould	0	0	10
<i>Malurus coronatus</i>	1848	Gould	0	0	11
<i>Malurus cyaneus</i>	1848	Gould	0	0	11
<i>Malurus pulcherrimus</i>	1848	Gould	0	0	10
<i>Malurus splendens</i>	1848	Gould	0	0	14
<i>Manorina melanophrys</i>	1848	Gould	0	0	7
<i>Manucodia keraudrenii</i>	1848	Gould	0	0	5
<i>Megapodius reinwardt</i>	1848	Gould	0	0	5
<i>Melanitta fusca</i>	~1890	Lilford	0	0	4
<i>Melanitta nigra</i>	~1890	Lilford	0	0	2
<i>Melanitta perspicillata</i>	~1890	Lilford	0	0	4
<i>Melithreptus lunatus</i>	1848	Gould	0	0	7
<i>Menura alberti</i>	1848	Gould	0	0	11
<i>Menura novaehollandiae</i>	1848	Gould	0	0	11

<i>Mercops apiaster</i>	1840	MacGillivray	3	0	5
<i>Mergus albellus</i>	~1890	Lilford	0	0	18
<i>Mergus cucullatus</i>	~1890	Lilford	0	0	12
<i>Mergus merganser</i>	~1890	Lilford	0	0	7
<i>Mergus serrator</i>	~1890	Lilford	0	0	11
<i>Mergus serrator</i>	1840	MacGillivray	0	0	6
<i>Merops ornatus</i>	1848	Gould	0	0	14
<i>Milvago chimachima</i>	1834	Jardine and Selby	0	0	7
<i>Milvus milvus</i>	1840	MacGillivray	1	0	3
<i>Momotus mexicanus</i>	1834	Jardine and Selby	2	0	9
<i>Monarcha melanopsis</i>	1848	Gould	0	0	5
<i>Monticola gularis</i>	1413	Bian Wenjin	0	0	10
<i>Motacilla alba</i>	900	Huang Quon	0	0	6
<i>Motacilla alba</i>	1840	MacGillivray	0	0	4
<i>Motacilla cinerea</i>	1840	MacGillivray	1	0	5
<i>Muscipipra vetula</i>	1834	Jardine and Selby	0	0	4
<i>Myiagra cyanoleuca</i>	1848	Gould	0	0	4
<i>Neochmia temporalis</i>	1834	Jardine and Selby	1	0	6
<i>Neophema splendida</i>	1848	Gould	0	0	10
<i>Neophron percnopterus</i>	~4500 BP	Unknown	1	0	6
<i>Nestor notabilis</i>	1848	Gould	0	0	6
<i>Netta rufina</i>	~1890	Lilford	0	0	8
<i>Nettapus coromandelianus</i>	1848	Gould	0	0	7
<i>Ninox boobook</i>	1848	Gould	0	0	4
<i>Ninox connivens</i>	1848	Gould	0	0	6
<i>Ninox novaeseelandiae</i>	1848	Gould	0	0	4
<i>Ninox strenua</i>	1848	Gould	1	0	4
<i>Numenius arquata</i>	1840	MacGillivray	0	0	4
<i>Nycticorax nycticorax</i>	~1890	Lilford	0	0	7
<i>Oceanites oceanicus</i>	~1890	Lilford	0	0	3
<i>Oceanodroma castro</i>	~1890	Lilford	0	0	3
<i>Oceanodroma leucorhoa</i>	~1890	Lilford	0	0	4
<i>Ocyphaps lophotes</i>	1848	Gould	0	0	12
<i>Odontophorus capueira</i>	1834	Jardine and Selby	2	0	9
<i>Oenanthe oenanthe</i>	1840	MacGillivray	3	0	4
<i>Origma solitaria</i>	1848	Gould	0	0	3
<i>Oriolus xanthornus</i>	1840	MacGillivray	0	0	5
<i>Orthonyx temminckii</i>	1848	Gould	0	0	9
<i>Pachycephala rufogularis</i>	1848	Gould	1	0	6
<i>Pachyramphus castaneus</i>	1834	Jardine and Selby	1	0	7
<i>Pachyramphus validus</i>	1834	Jardine and Selby	0	0	7
<i>Pachyramphus viridis</i>	1834	Jardine and Selby	1	0	7
<i>Pandion haliaetus</i>	1848	Gould	0	0	5
<i>Pandion haliaetus</i>	1840	MacGillivray	0	0	3

<i>Paradoxornis webbianus</i>	1413	Bian Wenjin	0	0	6
<i>Pardalotus punctatus</i>	1848	Gould	0	0	14
<i>Paroaria coronata</i>	1840	MacGillivray	0	0	4
<i>Parus major</i>	900	Huang Quon	1	0	7
<i>Parus major</i>	1413	Bian Wenjin	0	0	N/A
<i>Parus major</i>	1840	MacGillivray	0	0	5
<i>Passer domesticus</i>	1840	MacGillivray	0	0	5
<i>Passer montanus</i>	900	Huang Quon	0	0	5
<i>Passer montanus</i>	~1050	Cui Bai	0	0	N/A
<i>Passer montanus</i>	1413	Bian Wenjin	0	0	N/A
<i>Pedionomus torquatus</i>	1848	Gould	0	0	6
<i>Pelagodroma marina</i>	~1890	Lilford	0	0	8
<i>Pelicanus conspicillatus</i>	1848	Gould	0	0	6
<i>Pericrocotus flammeus</i>	1413	Bian Wenjin	1	0	8
<i>Pernis apivorus</i>	1840	MacGillivray	1	0	3
<i>Petrochelidon ariel</i>	1848	Gould	0	0	11
<i>Petroica goodenovii</i>	1834	Jardine and Selby	1	0	8
<i>Petroica phoenicea</i>	1848	Gould	0	0	9
<i>Petroica rodinogaster</i>	1834	Jardine and Selby	0	0	4
<i>Phaethon rubricauda</i>	1848	Gould	0	0	7
<i>Phalacrocorax aristotelis</i>	~1890	Lilford	0	0	3
<i>Phalacrocorax carbo</i>	~1890	Lilford	0	0	5
<i>Phalacrocorax varius</i>	1848	Gould	0	0	5
<i>Phalaropus fulicaria</i>	~1890	Lilford	0	0	5
<i>Philemon corniculatus</i>	1848	Gould	0	0	11
<i>Philomachus pugnax</i>	~1890	Lilford	0	0	7
<i>Phoenicopterus ruber</i>	~1890	Lilford	1	0	3
<i>Phoenicurus aureus</i>	900	Huang Quon	1	0	6
<i>Phoenicurus aureus</i>	1413	Bian Wenjin	0	0	N/A
<i>Phoenicurus phoenicurus</i>	~3800 BP	Unknown	2	0	6
<i>Phoenicurus phoenicurus</i>	1840	MacGillivray	1	0	5
<i>Phylloscopus borealis</i>	1413	Bian Wenjin	1	0	9
<i>Phytotoma rutila</i>	1834	Jardine and Selby	1	0	7
<i>Pica hudsonia</i>	1840	MacGillivray	1	0	5
<i>Picnonotus sinensis</i>	1413	Bian Wenjin	0	0	5
<i>Pinguinus impennis</i>	1840	MacGillivray	0	0	4
<i>Pipilo maculatus</i>	1834	Jardine and Selby	0	0	8
<i>Pitta erythrogaster</i>	1848	Gould	0	0	9
<i>Platalea leucorodia</i>	~1890	Lilford	0	0	3
<i>Platycercus adscitus</i>	1832	Lear	0	0	9
<i>Platycercus caledonicus</i>	1848	Gould	1	0	10
<i>Platycercus elegans</i>	1848	Gould	1	0	7
<i>Platycercus eximius</i>	1848	Gould	0	0	11
<i>Platycercus flaveolus</i>	1848	Gould	0	0	10

<i>Platycercus venustus</i>	1832	Lear	0	0	11
<i>Platysteira cyanea</i>	1834	Jardine and Selby	0	0	9
<i>Playrcercus venustus</i>	1848	Gould	1	0	13
<i>Plegadis falcinellus</i>	~1890	Lilford	0	0	7
<i>Pluvialis apricaria</i>	~1890	Lilford	0	0	4
<i>Pluvialis squatarola</i>	~1890	Lilford	0	0	7
<i>Podargus ocellatus</i>	1848	Gould	0	0	5
<i>Podiceps auritus</i>	~1890	Lilford	0	0	7
<i>Podiceps cristatus</i>	~1890	Lilford	0	0	11
<i>Podiceps grisegena</i>	~1890	Lilford	0	0	7
<i>Podiceps nigricollis</i>	~1890	Lilford	0	0	6
<i>Poecile palustris</i>	1840	MacGillivray	0	0	4
<i>Poliopsar cineraceus</i>	900	Huang Quon	0	0	9
<i>Poliopsar sericeus</i>	900	Huang Quon	1	0	6
<i>Polysticta stelleri</i>	~1890	Lilford	0	0	15
<i>Polytelis alexandraw</i>	1848	Gould	0	0	9
<i>Pomatostomus temporalis</i>	1848	Gould	0	0	9
<i>Porphyrio porphyrio</i>	1848	Gould	0	0	5
<i>Porzana albicollis</i>	1834	Jardine and Selby	0	0	8
<i>Porzana pusilla</i>	1834	Jardine and Selby	1	0	5
<i>Probosciger aterrimus</i>	1848	Gould	0	0	3
<i>Prunella collaris</i>	~1890	Lilford	0	0	10
<i>Psephotus chrysopterygius</i>	1848	Gould	1	0	14
<i>Psophodes cristatus</i>	1848	Gould	0	0	7
<i>Psophodes olivaceus</i>	1848	Gould	0	0	8
<i>Pterodroma hasitata</i>	~1890	Lilford	0	0	5
<i>Pterodroma leucoptera</i>	~1890	Lilford	0	0	4
<i>Pteropodocys maxima</i>	1848	Gould	0	0	9
<i>Ptilinopus regina</i>	1848	Gould	0	0	9
<i>Ptiloris magnificus</i>	1848	Gould	0	0	16
<i>Ptiloris victoriae</i>	1848	Gould	0	0	13
<i>Ptilorus paradiseus</i>	1848	Gould	0	0	13
<i>Ptilorus paradiseus</i>	1834	Jardine and Selby	0	0	N/A
<i>Puffinus puffinus</i>	~1890	Lilford	0	0	2
<i>Purpureicephalus spurius</i>	1832	Lear	0	0	10
<i>Pycnonotus sinensis</i>	900	Huang Quon	0	0	4
<i>Pyrrhcorax pyrrhcorax</i>	1840	MacGillivray	0	0	2
<i>Rallinus tricolor</i>	1848	Gould	0	0	5
<i>Recurvirostra avosetta</i>	~1890	Lilford	0	0	6
<i>Rhipidura albiscapa</i>	1848	Gould	1	0	11
<i>Rhipidura rufifrons</i>	1848	Gould	0	0	12
<i>Rhodostethia rosea</i>	1834	Jardine and Selby	1	0	7
<i>Saltator fuliginosus</i>	1834	Jardine and Selby	0	0	1
<i>Scythrops novaehollandiae</i>	1848	Gould	0	0	9

<i>Selenidera maculirostris</i>	1834	Jardine and Selby	0	0	9
<i>Semioptera wallacii</i>	1848	Gould	0	0	12
<i>Sericornis frontalis</i>	1848	Gould	1	0	10
<i>Sericulus chrysocephalus</i>	1848	Gould	0	0	8
<i>Sericulus chrysocephalus</i>	1834	Jardine and Selby	0	0	N/A
<i>Smutsornis africanus</i>	1834	Jardine and Selby	1	0	9
<i>Somateria mollissima</i>	~1890	Lilford	0	0	9
<i>Somateria spectabilis</i>	~1890	Lilford	1	0	14
<i>Sterna hirundo</i>	1840	MacGillivray	1	0	4
<i>Sterna hirundo</i>	1840	MacGillivray	0	0	4
<i>Stiltia isabella</i>	1848	Gould	0	0	8
<i>Stipiturus malachurus</i>	1848	Gould	0	0	7
<i>Strepera graculina</i>	1848	Gould	0	0	3
<i>Streptopelia chinensis</i>	1413	Bian Wenjin	1	0	8
<i>Streptopelia tranquebarica</i>	1413	Bian Wenjin	2	0	7
<i>Streptopelia turtur</i>	~3800 BP	Unknown	0	0	7
<i>Strigops habroptilus</i>	1848	Gould	0	0	6
<i>Struthidea cinerea</i>	1848	Gould	0	0	3
<i>Sturnus vulgaris</i>	1840	MacGillivray	0	0	4
<i>Sula bassana</i>	~1890	Lilford	0	0	4
<i>Sula bassana</i>	1840	MacGillivray	1	0	5
<i>Sula Capensis</i>	1840	MacGillivray	0	0	5
<i>Sylvia atricapilla</i>	1840	MacGillivray	1	0	5
<i>Sylvia communis</i>	1840	MacGillivray	0	0	3
<i>Sypheotides indica</i>	1834	Jardine and Selby	1	0	8
<i>Tachybaptus ruficollis</i>	~1890	Lilford	1	0	5
<i>Tachyphonus coronatus</i>	1834	Jardine and Selby	0	0	3
<i>Tachyphonus cristatus</i>	1834	Jardine and Selby	0	0	6
<i>Tadorna ferruginea</i>	~1890	Lilford	0	0	7
<i>Tadorna radjah</i>	1848	Gould	0	0	9
<i>Tadorna tadorna</i>	~1890	Lilford	0	0	14
<i>Tanysiptera sylvia</i>	1848	Gould	0	0	10
<i>Tetrao tetrix</i>	1840	MacGillivray	0	0	5
<i>Thalasseus bergii</i>	1848	Gould	0	0	4
<i>Threskiornis aethiopicus</i>	~3800 BP	Unknown	1	0	4
<i>Threskiornis spinicollis</i>	1848	Gould	0	0	7
<i>Titrya semifasciata</i>	1834	Jardine and Selby	1	0	8
<i>Todiramphus macleayii</i>	1848	Gould	0	0	9
<i>Todiramphus sanctus</i>	1848	Gould	0	0	9
<i>Trichoglossus chlorolepidotus</i>	1832	Lear	1	0	7
<i>Trichoglossus haematodus</i>	1848	Gould	1	0	8
<i>Turdus iliacus</i>	1840	MacGillivray	0	0	3
<i>Turdus merula</i>	1413	Bian Wenjin	0	0	3
<i>Turdus merula</i>	1840	MacGillivray	0	0	3

<i>Turdus pilaris</i>	1840	MacGillivray	0	0	4
<i>Turdus viscivorus</i>	1840	MacGillivray	1	0	2
<i>Turnix melanogaster</i>	1848	Gould	0	0	4
<i>Upupa epops</i>	~3800 BP	Unknown	0	0	7
<i>Upupa epops</i>	~1280	Zhao Mengfu	3	0	N/A
<i>Urocissa erythroryncha</i>	~1480	Lu Ji	2	0	9
<i>Vanellus armatus</i>	1834	Jardine and Selby	1	0	10
<i>Vanellus gregarius</i>	~1890	Lilford	1	0	12
<i>Vanellus miles</i>	1848	Gould	0	0	7
<i>Vanellus vanellus</i>	~1890	Lilford	1	0	8
<i>Vini kuhlii</i>	1832	Lear	0	0	10
<i>Zoothera citrina</i>	1834	Jardine and Selby	1	0	12
<i>Zosterops japonicus</i>	1413	Bian Wenjin	0	0	4
<i>Zosterops lateralis</i>	1848	Gould	0	0	9

Table S3: Museum specimen analysis results. For each listed species or subspecies, we compared groups “older” and “newer” specimens that were collected in the same geographic region. The “Age Difference” is the difference in collection times between the older and newer specimens of one species.

Scientific Name	Age Difference (years)	# Small Changes	# Large Changes
<i>Ampelion rubrocristatus</i>	104	0	0
<i>Antiophia galeata</i>	104	0	0
<i>Capornis cucullatus</i>	64	0	0
<i>Cephalopterus glabricollis</i>	31	0	0
<i>Chiroxiphia caudata</i>	60	1	0
<i>Chiroxiphia lanceolata</i>	107	0	0
<i>Chiroxiphia linearis</i>	91	0	0
<i>Chiroxiphia pareola boliviana</i>	111	0	0
<i>Chiroxiphia pareola napensis</i>	39	0	0
<i>Corapipo leucorrhoea</i>	92	0	0
<i>Cotinga amabilis</i>	59	1	0
<i>Cotinga cayana</i>	97	0	0
<i>Cotinga cotinga</i>	90	0	0
<i>Cotinga maynana</i>	84	0	0
<i>Cotinga nattererii</i>	98	0	0
<i>Cotinga ridgwayi</i>	69	0	0
<i>Lepidothrix serena</i>	38	0	0
<i>Machaeraptorus regulus antioquiaae</i>	72	0	0
<i>Machaeraptorus regulus aureopectus</i>	33	0	0
<i>Machaeropterus pyrocephalus</i>	51	0	0
<i>Manacus aurantiacus</i>	67	0	0
<i>Manacus candei</i>	105	0	0
<i>Manacus manacus flaveolus</i>	57	0	0
<i>Manacus manacus manacus</i>	99	0	0
<i>Manacus manacus viridiventris</i>	54	0	0
<i>Manacus vitellinus vitellinus</i>	37	0	0
<i>Masius chrysopterus peruvianus</i>	83	0	0
<i>Phoenicircus carnifex</i>	56	1	0
<i>Pipra aureola aureola</i>	48	0	0
<i>Pipra caerulocapilla caerulocapilla</i>	64	0	0
<i>Pipra chloromeros</i>	83	0	0
<i>Pipra cornuta</i>	122	0	0
<i>Pipra erythrocephala berlepschi</i>	52	0	0
<i>Pipra erythrocephala erythrocephala</i>	84	0	0
<i>Pipra fasciicauda fasciicauda</i>	67	0	0
<i>Pipra fasciicauda scarlatina</i>	54	0	0
<i>Pipra filicauda</i>	79	0	0
<i>Pipra mentalis ignifera</i>	63	0	0
<i>Pipra mentalis mentalis</i>	105	0	0
<i>Pipra pipra coracina</i>	51	0	0
<i>Pipra pipra discolor</i>	75	0	0
<i>Pipra pipra pipra</i>	98	0	0
<i>Pipreola arcuata arcuata</i>	99	0	0
<i>Pipreola chlorolepidota</i>	74	0	0

<i>Pipreola frontalis frontalis</i>	43	0	0
<i>Pipreola intermedia intermedia</i>	46	0	0
<i>Pipreola intermedia signata</i>	68	0	0
<i>Pipreola riefferi occidentalis</i>	59	0	0
<i>Pipreola riefferi confusa</i>	83	0	0
<i>Porphyrolaema porphyrolaema</i>	75	0	0
<i>Pyroderus scutatus masoni</i>	99	0	0
<i>Querula purpurata</i>	79	0	0
<i>Rupicola peruviana sanguinolenta</i>	47	0	0
<i>Rupicola saturata</i>	85	0	0
<i>Xipholena lamellipennis</i>	58	0	0
<i>Xipholena punicea</i>	63	0	0