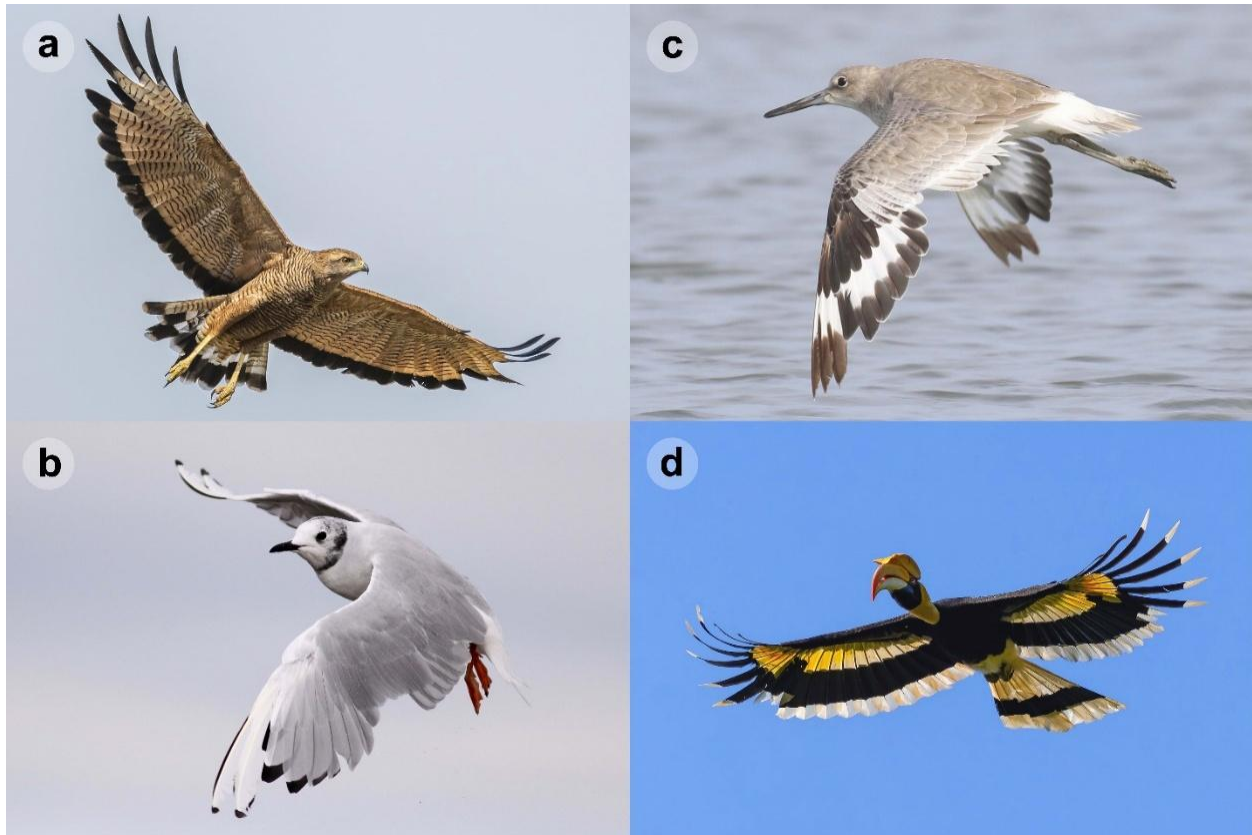


Supplementary Information

Wing Morphology of *Anchiornis huxleyi* and the Evolution of Molt Strategies in Paravian Dinosaurs

Kiat *et al.* 2025

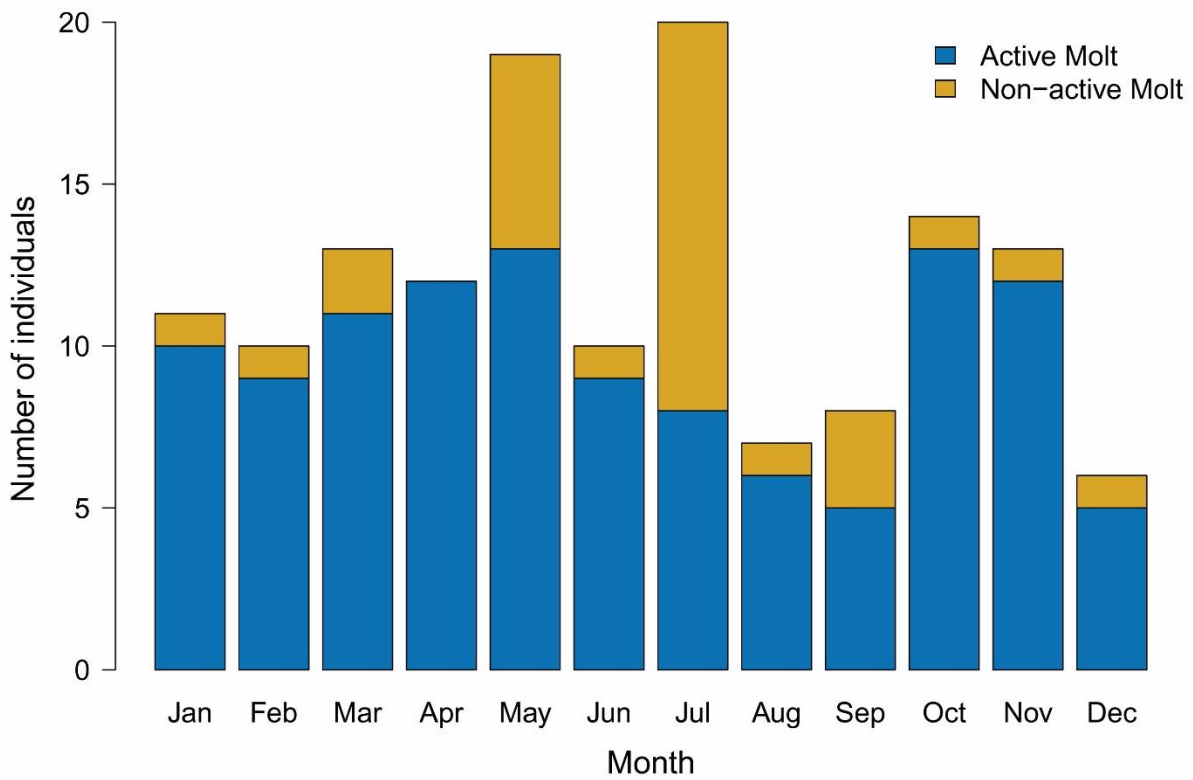
Communications Biology



Supplementary Figure 1. Examples demonstrating how remex and rectrix coloration patterns may help in identifying temporary changes in wing morphology due to feather molting: (a) Savanna Hawk *Buteogallus meridionalis* (photo by A. Hernández, ML551890791), (b) Bonaparte's Gull *Chroicocephalus philadelphia* (photo by S. Zhang, ML484737051), (c) Willet *Tringa semipalmata* (photo by M. Balitbit, ML621494709), and (d) Great Hornbill *Buceros bicornis* (photo by K. Jeerawarangul, ML557169981).



Supplementary Figure 2. *Anchiornis huxleyi* STM0-143. This fossil exhibits preservation of wing feathers and their coloration, allowing for an identification of the wing molt. The feathers attached to the manus (marked in a white frame) are arranged parallel to each other, which does not suggest disorganization of the feathers due to poor preservation. However, the black feather tips in this specimen do not form uniform wing bars as in STM0-214 (Figure 2), indicating a mix of feathers of different lengths (similar to the wing pattern shown in Figure 4d for the African Sacred Ibis). Shorter feathers may be immature, resulting from irregular molt in this taxon, similar to flightless species of modern birds. The scale bar (bottom left) equals 10 cm.



Supplementary Figure 3. The frequency of active remex and rectrix molt as documented in 143 Flightless Cormorants (*Nannopterum harrisi*) using photos from the Macaulay Library (Cornell Lab of Ornithology). This finding shows a higher frequency of active molt compared to previous findings in modern birds and may suggest a slow and prolonged molt occurring over most of the annual cycle.

Supplementary Table 1. Primary covert proportions relative to the length of primary feathers among 32 species of modern birds and the *Anchiornis*.

Order	Species	1st series	2nd series	3rd series	4th series	5th series
Anseriformes	<i>Branta ruficollis</i>	0.42	0.54			
Galliformes	<i>Lagopus lagopus</i>	0.29	0.49			
Phoenicopteriformes	<i>Phoenicopus roseus</i>	0.39	0.62			
Podicipediformes	<i>Podiceps cristatus</i>	0.41	0.61			
Columbiformes	<i>Streptopelia turtur</i>	0.27	0.44			
Pterocliiformes	<i>Pterocles senegallus</i>	0.29	0.47			
Otidiformes	<i>Chlamydotis macqueenii</i>	0.31	0.48			
Musophagiformes	<i>Crinifer piscator</i>	0.22	0.44			
Cuculiformes	<i>Clamator glandarius</i>	0.17	0.42			
Caprimulgiformes	<i>Apus affinis</i>	0.27	0.47			
Gruiformes	<i>Porzana carolina</i>	0.25	0.48			
Charadriiformes	<i>Charadrius hiaticula</i>	0.27	0.48			
Eurypygiiformes	<i>Eurypyga helias</i>	0.32	0.46			
Phaethontiformes	<i>Phaethon aethereus</i>	0.32	0.50			
Gaviiformes	<i>Gavia arctica</i>	0.40	0.59			
Procellariiformes	<i>Hydrobates leucorhous</i>	0.31	0.44			
Ciconiiformes	<i>Ciconia ciconia</i>	0.38	0.52			
Suliformes	<i>Anhinga anhinga</i>	0.31	0.47			
Pelecaniformes	<i>Ardea cinerea</i>	0.31	0.54			
Cathartiformes	<i>Cathartes aura</i>	0.26	0.42			
Accipitriformes	<i>Accipiter nisus</i>	0.25	0.47			
Strigiformes	<i>Bubo scandiacus</i>	0.35	0.53			
Coliiformes	<i>Urocolius macrourus</i>	0.30	0.42			
Trogoniformes	<i>Trogon viridis</i>	0.23	0.38			
Bucerotiformes	<i>Upupa epops</i>	0.24	0.41			
Coraciiformes	<i>Halcyon smyrnensis</i>	0.27	0.49			
Galbuliformes	<i>Galbula ruficauda</i>	0.26	0.41			
Piciformes	<i>Jynx torquilla</i>	0.25	0.47			
Falconiformes	<i>Falco peregrinus</i>	0.31	0.50			
Psittaciformes	<i>Psittacula krameri</i>	0.31	0.50			
Passeriformes	<i>Phylloscopus trochilus</i>	0.18	0.39			
Sphenisciformes	<i>Aptenodytes forsteri</i>	0.86	0.88	0.89	0.92	0.97
	<i>Anchiornis huxleyi</i>	0.52	0.66	0.83		