Moult of Flight Feathers in Darters (Anhingidae)

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Moult of flight feathers in darters (Anhingidae)

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There is little information on flight feather moult in darters (Anhingidae). I used a combination of direct observations and photographs to confirm that the normal pattern of moult is to replace all remiges synchronously, but not all rectrices. I surmise that at least some rectrices are retained year-round because they are important for controlling body angle and depth while diving in shallow water. However, a few birds do not replace all their remiges at once, retaining some inner primaries and secondaries. The retained feathers are insufficient to allow flight, and the reason why these feathers are retained is unknown.

Key words: *Anhinga*, buoyancy, flightless moult, rectrices, remiges

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Darters (Anhingidae) are a small family of water birds adapted for foraging in shallow water (Casler 1973, Mahoney 1984). They use a combination of stealth and pursuit diving to catch their prey, and thanks to their near-neutral buoyancy near the water surface (Owre 1967, Hustler 1992), they have the greatest dive efficiency of any bird (Ryan 2007). Darters also are the only Suliformes to have a flightless moult (Cramp & Simmons 1977, Marchant & Higgins 1990). Other families in the order, including their close relatives, the cormorants (Phalacrocoracidae), remain able to fly throughout a typically staggered moult (Bridge 2006). However, few if any of the rectrices are replaced at the same time as the remiges (Friedmann 1930, Middlemiss 1955, Marchant & Higgins 1990, Frederick & Siegel-Causey 2000).

The flightless moult among darters was only discovered in the early 20th century, and evidence for it is based on relatively few reports (Friedmann 1930, Chapin 1932, Middlemiss 1955, Owre 1967, White 1975). This typically has been attributed to the fact that darters are particularly cautious and vigilant while flightless (del Hoyo *et al.* 1992, Howell 2010), but the paucity of records also may be because some darters do not replace all their flight feathers at once. I observed and photographed African Darters *Anhinga rufa* at various sites in the Western Cape, South Africa, from 2005 to 2013, and was able to score moult patterns from darters spreading their wings after a foraging bout or in flight. I also examined photographs of darters obtained from colleagues or from the web. In this note I summarise moult observations of darters, provide evidence that not all individuals undergo a complete wing moult, and speculate why darters retain most of their tail feathers while moulting their remiges.

Results

Among hundreds of African Darters photographed or observed in South Africa, only seven were moulting any remiges, and these were undergoing synchronous, flightless moult. Two were photographed in Kruger National Park: one adult in June with remiges just out of pin, and one undated image with wing feathers roughly half-grown. The other five moulting darters were observed at three sites in the Western Cape: Paarl Sewage Works (n = 1), Sandvlei (1) and Rondevlei Nature Reserve (3). None was observed at two sites where darter diving ecology was studied (Ryan 2007). Of four adults, three had no visible remiges (one each in April, May and June; Figure 1), and one had remiges roughly 30% grown (April). The only immature observed in moult was later in the year; on 30

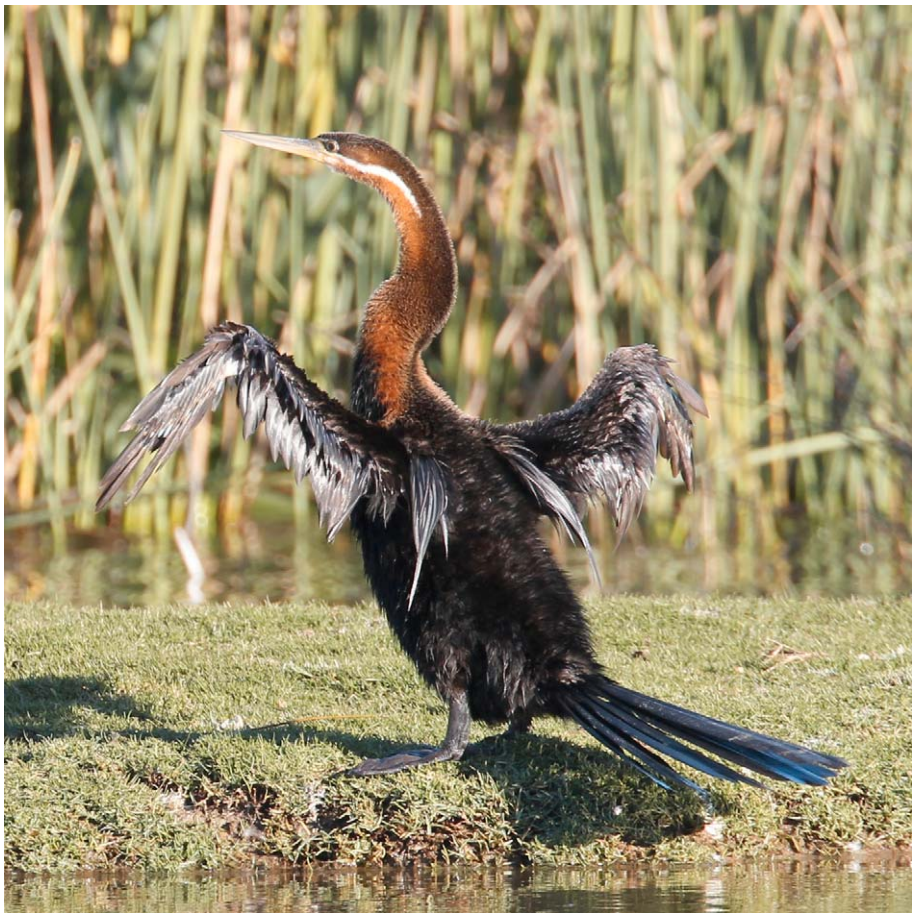

Figure 1. An adult African Darter undergoing synchronous, flightless moult of the remiges (Rondevlei Nature Reserve, 10 June 2010; photo P.G. Ryan).

November it had dropped all its remiges except for a few inner secondaries/tertials (two on one wing and one on the other).

None of the African Darters replacing their wing feathers was moulting any tail feathers, and among birds with no wing moult, 4% (n = 164) were in active tail moult. In the Western Cape, most adults in tail moult were observed in winter (June–August, n = 5), but one was just completing replacing its central tail feathers in late November and an adult photographed in northeastern South Africa was replacing its outer tail feathers in early January.

Almost all darters had wings with even-aged feathers, suggesting that synchronous moult is the norm among darters. However, one adult African Darter photographed at Rondevlei Nature Reserve had two generations of wing feathers (Figure 2), indicating that it had moulted only a subset of its wing feathers. Primary moult was roughly symmetrical, with P2–5 old and P1 and P6–10 new. Most secondaries were new, but 1–3 old secondaries remained (Figure 2). As is typically the case with sequential wing moults, primary coverts were moulted in synchrony with their respective primaries, and all greater upperwing coverts were old (Figure 2).

Discussion

The occurrence of a flightless moult in darters was only discovered in the 1920s (Friedmann 1930, Chapin 1932). The conventional wisdom for the paucity of records of darters in wing moult is that they are secretive during their flightless period (del Hoyo *et al.* 1992, Howell 2010), but not all moulting darters are secretive. There are web photos of flightless Anhingas *Anhinga anhinga* sitting in the open on chain-link fences (leesbird.com/tag/ioc-ver-2-5/, www.flickr.com/photos/trykemom/4059190685) and a flightless Anhinga is described to have followed an observer in an urban park

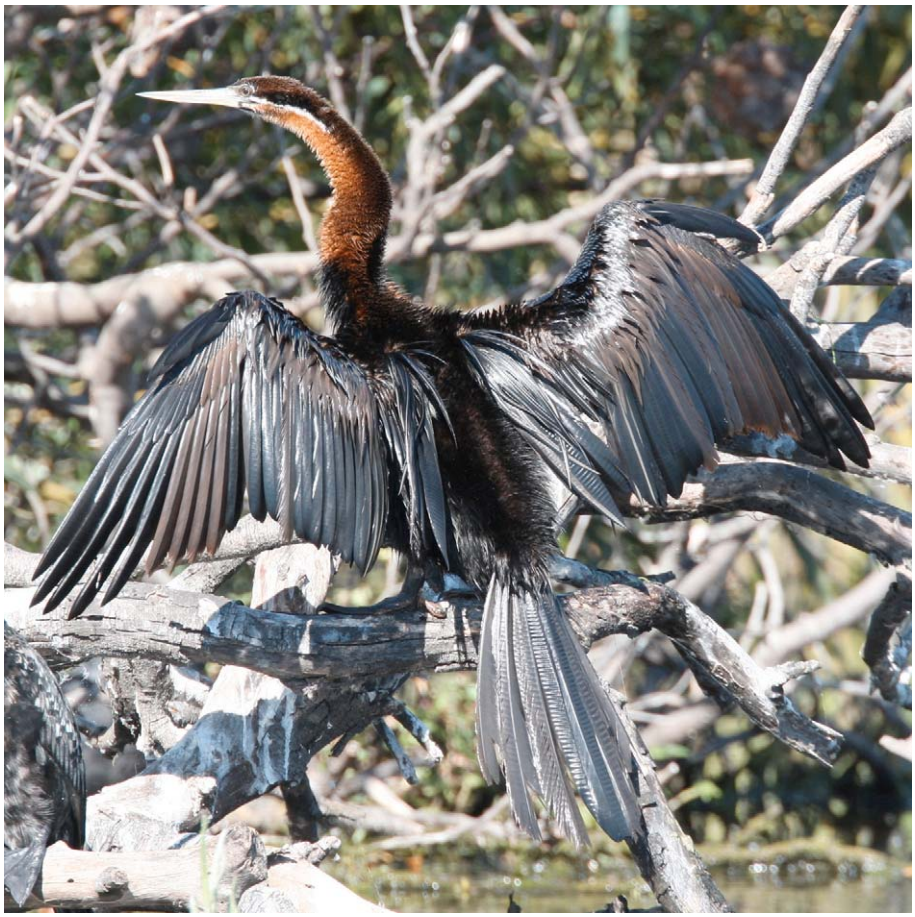

Figure 2. An adult African Darter with two generations of flight feathers (Rondevlei Nature Reserve, 30 November 2008; photo P.G. Ryan). This was the only individual to show two generations of flight feathers among >100 adult African Darters examined.

(www.flickr.com/photos/celticsong22/8123334587/). The African Darter observed at Sandvlei with all remiges still in pin was 3 m up in a large eucalypt tree over a canal in a marina development with regular small boat traffic. Flightless darters are able to clamber up and down nearly vertical trees, using their wings and chest to help grip the trunk (Freeman 2013).

My observations indicate that a complete, synchronous wing moult is the norm among darters. In the Western Cape of South Africa, most adults replaced their remiges in the austral autumn, following the early summer breeding peak (Hockey *et al.* 2005). This is earlier in the year than three previous records of moulting darters from the same region (July–August; Middlemiss 1955). However, Middlemiss (1955) only recorded the age of one of his birds (an adult, moulting on 22 July), and immature birds are likely to moult later in the year. Although some rectrices might be replaced during the wing moult, most adults seem to undertake their tail moult after completing their wing moult. I surmise that at least some rectrices are retained year-round because they are important for maintaining body angle and depth while diving in shallow water. The diving mechanics of darters have not been studied directly, but when cormorants dive in shallow water, the stiff tail is angled to create a downward force as the bird moves through the water, helping to counteract its buoyancy (Ribak *et al.* 2005). Darters diving in shallow water typically fan and slightly cock their stiff tails, presumably for a similar reason (Frederick & Siegel-Causey 2000, pers. obs.). This functionality presumably accounts for the unusual moult sequence of the rectrices, with the central feathers typically being replaced before the rest of the tail feathers are moulted (although tail moult apparently can be irregular; Marchant & Higgins 1990).

Although synchronous moult of all remiges appears to be the norm, at least some darters do not follow this

pattern. The African Darter photographed at Rondevlei (Figure 2) had not replaced all its remiges or its greater coverts, which apparently are replaced in the flightless moult (Middlemiss 1955). Although this is the only definite case, I found two other images of darters apparently undergoing an incomplete moult: an Anhinga (www.flickr.com/photos/celticsong22/8123334587/) and an Australasian Darter *A. novaehollandiae* (Brown & Brown 2013). Both had dropped most of their flight feathers, but retained 3–5 inner primaries and a few inner and outer secondaries. It is possible that the birds went on to drop all their flight feathers, but the fact that they retained similar feathers to the Rondevlei bird is intriguing. The retained feathers are unlikely to have allowed flight. Their retention may simply be aberrant, or they may also aid in diving, because darters sometimes partially spread their wings when diving (Frederick & Siegel-Causey 2000).

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Samenvatting

Er is weinig bekend over de rui van de vleugel- en staartpennen bij slangenhalsvogels (Anhingidae). Aan de hand van foto's en directe waarnemingen werd vastgesteld dat de vleugelpennen meestal tegelijk geruid worden (waarbij de vogels hun vliegvermogen tijdelijk verliezen). De staartpennen werden niet synchroon vernieuwd. Mogelijk zijn er altijd enkele staartpennen nodig om als roer te fungeren wanneer er in ondiep water wordt gedoken. Enkele vogels bleken niet alle vleugelpennen tegelijk te ruien. Ook deze onvolledig ruiende dieren waren niet in staat te vliegen. De reden van dit afwijkende ruipatroon blijft voorlopig onduidelijk. (JP)

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