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### **IDENTIFICATION AND TRACKING OF A VAGRANT AMERICAN FLAMINGO (*Phoenicopterus ruber*) ACROSS THE UNITED STATES USING DISTINCTIVE PLUMAGE AND SOFT-PART MORPHOLOGICAL FEATURES**

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#### **ABSTRACT**

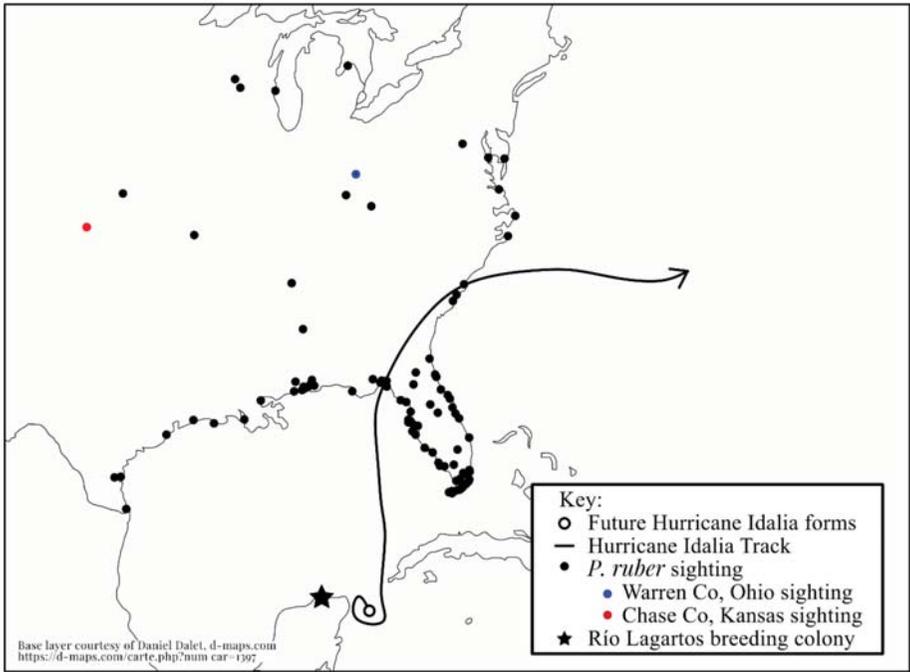
Unique plumage and soft-part features allowed the tracking of an individual American Flamingo (*Phoenicopterus ruber*) across the United States following a historic hurricane-induced vagrant event without the use of traditional markers such as banding, tagging, or GPS devices. Through photographic analysis of these distinctive markings, it was determined that one of two flamingos first seen in Warren County, Ohio, on 1 September 2023, was later seen in Chase County, Kansas, on 27 September 2023.

#### **INTRODUCTION**

The North American bird-watching community was delighted by the appearance of many American Flamingos (*Phoenicopterus ruber*) across the eastern United States in the fall of 2023. This unprecedented occurrence was a once-in-a-lifetime opportunity to see, in the wild, one of the largest and most colorful birds in the Western Hemisphere without traveling to the tropics. As the birds spread across the country, the author attempted to track the individual birds by carefully examining publicly available high-quality photographs. Through a comparison of plumage and morphological features, the author was able to identify a flamingo photographed in southwestern Ohio, and a flamingo documented several weeks later in eastern Kansas, that appear to be the same individual.

Hurricane Idalia made landfall in the Big Bend Region of northwestern Florida as a Category 3 storm in the early morning of 30 August 2023 (National Hurricane Center 2023). In the previous days, Hurricane Idalia passed over the western Caribbean Sea, including the tip of the Yucatan Peninsula and western Cuba.

Hurricane Idalia reemerged in the Atlantic Ocean on 31 August 2023 and continued east out to the Atlantic Ocean (National Hurricane Center 2023, Figure 1).



**Figure 1: The track of Hurricane Idalia overlaid with approximate locations of all flamingo sightings following the hurricane (eBird 2023; National Hurricane Center 2023, base map courtesy Dalet 2024).**

The morning of 30 August 2023 saw dozens of flamingos appearing in scattered small groups, or single individuals, across the western coast of Florida. Throughout the next few days small flocks and lone birds were found across the eastern United States in a hurricane-assisted excursion of the species (eBird 2023).

On 1 September 2023, two days after Hurricane Idalia’s landfall, an adult and juvenile were found at Caesar Creek Beach in Warren County, Ohio (eBird data, Keller 2023). They disappeared the following day, but others continued to be discovered in Pennsylvania, Kentucky, Tennessee, and much later Wisconsin, Missouri, Kansas, and Michigan (eBird 2023). Many of these birds remained in their post-hurricane location for a significant period of time, some for as long as four weeks.

American Flamingos are widespread in the Caribbean, thus, it was initially unknown where these hurricane disbursed birds originated from. However, several banded birds were documented in Florida and North Carolina and were determined to be from the Río Lagartos colony in Yucatán, Mexico (Davis 2023). Since Hurricane Idalia formed just east of the Yucatán Peninsula (National Hurricane Center 2023),

many of these vagrants likely originated from this colony, although it is possible that some may have strayed from large breeding colonies in Cuba (del Hoyo, et al 2024).

While the incidence of new sightings across the Midwest had dramatically slowed by late September, a flock of five were discovered along Lake Michigan on 22 September 2023. These same five birds were relocated the next day ca. 160 km to the west, and again a week later at a different lake nearby. On 26 September, a single bird was photographed in Clay County, Missouri, in the far northwestern part of the state. It was not seen again after the initial sighting. The next day, 27 September, a bird was found at Chase State Fishing Lake, in the Flint Hills physiographic province (Schoewe 1949), Chase County, Kansas, ca. 210 km to the southwest of the Missouri bird.

Following the initial reports, Kansas birders quickly arrived at the location and thoroughly documented this cooperative bird (Figure 2). The bird remained at Chase State Lake until 9 October, allowing many excellent photos to be taken by photographers and enabling a detailed examination of its plumage and morphology.



**Figure 2: American Flamingo (*Phoenicopterus ruber*) at Chase State Fishing Lake, Kansas, 27 September 2023. Photo courtesy Franklin Miller.**

## **ANALYSIS AND RESULTS**

### **Photographic Analysis**

Following the sighting of the bird in Chase County, Kansas, the author began a comparison of the many digital images of both, the Kansas bird and other flamingos throughout the Midwest in an attempt to ascertain if this individual bird had been

previously photographed. Since such an effort requires both distinctive features and photos of sufficient resolution to make a comparison, many images were unusable. However, despite the limited sample size, a matching bird was quickly found. The distinctive features chosen to identify the Kansas bird were as follows: a heavily worn eighth primary on both wings, a dark spot or “mole” on the soft gular skin on the right-hand side of the bill (Figure 3), and a dark scar on the medial side of the right tibiotarsus (Figure 4). These features were found to match most similarly with the adult flamingo found at Caesar Creek Beach, Warren County, Ohio, on 1 September 2023 (Figures 3 and 4). While the molt is not well-understood, studies of other *Phoenicopterus* species have shown that both synchronous and sequential molt patterns are possible (Howell et al. 2010). Though molt patterns are likely to be similar between birds of the same breeding colony, it is uncommon for any two birds to be found in the same stage of molt (Sileo et al. 1977). In addition, the gular skin mark and leg scar match between these birds and corroborate the hypothesis that these two birds may be the same individual (Figure 3).

### Statistical Analysis

While biological statistics are complex and it is probably not possible to state with certainty the probability of two such identical birds occurring (Zar 2010), it is possible to estimate the likelihood of any bird with the same unique markings. I took the three unique characteristics listed above (the eighth primaries, gular spot, and leg scar), and assigned them each a generous probability of 0.01 (1 in 100 hundred birds will have an identical mark in that location), I used that information to predict the likelihood that any two birds share all three of those characteristics. The simultaneous occurrence of multiple independent events can be found by multiplying each of the individual probabilities together, that is:  $P_{sum} = P_1 P_2 P_3 \dots$ . In this case, since I assigned a 1/100 probability for each distinct characteristic, the probability of all three characteristics being present is found by  $P_{sum} = 0.01 \times 0.01 \times 0.01 = 0.000001$ , or 1 in a million likelihood that a given bird has that specific combination of features. Taking the upper estimate of the global American Flamingo population as 330,000 according to Torres-Cristiani et al. (2020) and performing  $P_{sum} (0.000001) \times 330,000 = 0.33$ , there is a 33% likelihood of such a bird existing at any given time. The probability for two such birds existing at the same time can be found by multiplying  $P_1 \times P_2$  again, here  $0.33 \times 0.33 = 0.11$  (11%). However, I was not concerned with the entire population, only those that strayed to the United States following Hurricane Idalia. Roughly 150 individuals were sighted in the United States following the hurricane (Davis 2023), which is only 0.045% of the population. It follows that the likelihood of two birds having three identical markings and being a part of the group that strayed following the hurricane can be found by  $P_{sum} = 0.11 \times 0.00045 = 0.000050$ , or roughly 1/20,000 odds

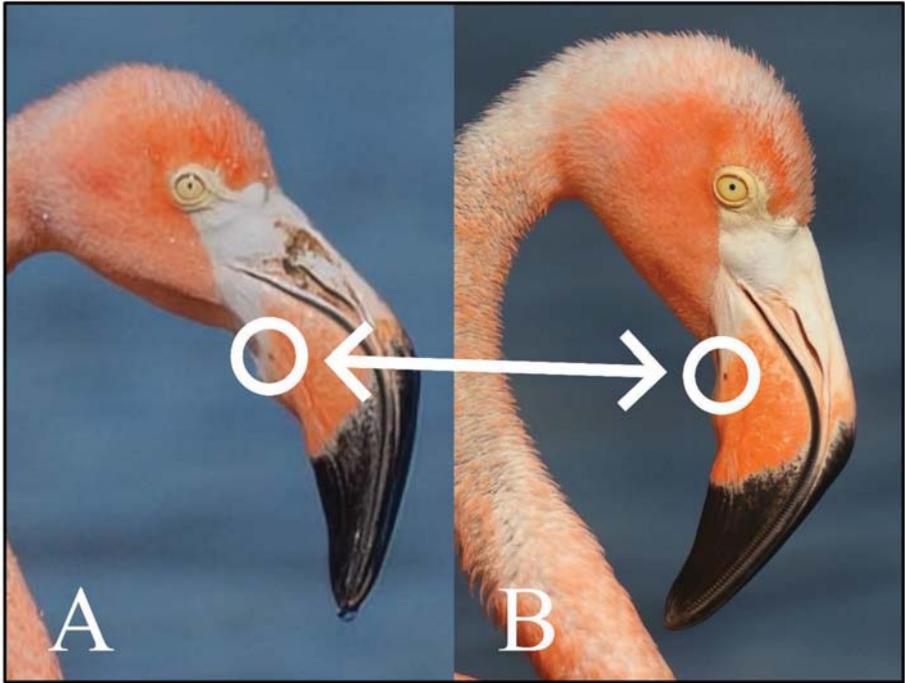


Figure 3: Comparison of the soft-part markings between two photographs of what appears to be the same American Flamingo (*Phoenicopterus ruber*). (A) Gular area spot on bird photographed in Warren County, Ohio, 1 September 2023. (B) Gular area spot on bird photographed in Chase County, Kansas, 27 September 2023. Photos courtesy of Macaulay Library.

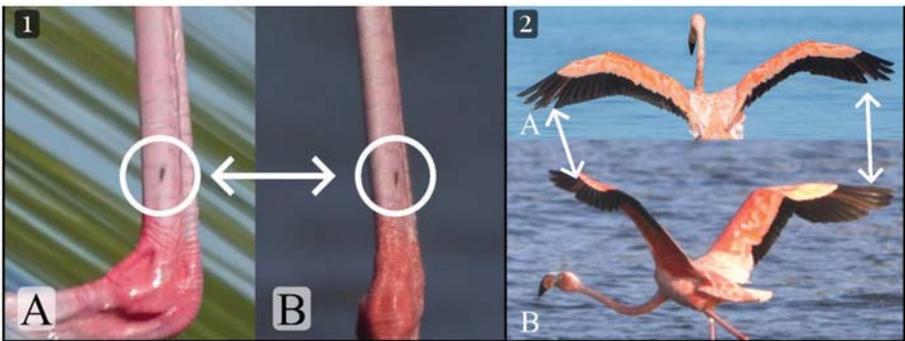


Figure 4: Comparison of the medial side of the right tibiotarsus, showing a matching scar between the Ohio bird (1A) and the Kansas bird (1B). Box 2 compares the molt progression between the Ohio bird (2A) and the Kansas bird (2B). Note the retained, non-molted eighth primary in both individuals. All photos courtesy of the Macaulay Library.

While all these numbers are merely estimates, the likelihood of this occurrence must be lower in reality, since this analysis has ignored age, color, and the lack of other

distinctive characteristics that would likely distinguish such similar birds. It is therefore scientifically useful to accept that these two birds are the same individual. Regrettably, the photo and video that exist of the Missouri bird are not of sufficient resolution to determine, with certainty, if it was the same bird and are not useful for analysis in this report. However, the media available does show the eighth primaries in non-molt, like the bird in Ohio and Kansas. Thus, it is plausible given the location and date as the birds moved westward, the Missouri bird is the same individual.

## DISCUSSION

Traditional long-distance bird recoveries have required the use of markers such as metal or plastic bands, wing tags, or telemetry devices. However, this is not the first time photographic analysis of bird plumage has been used to identify individuals far from their original range. In Schmoker and Liguori (2010), the authors discuss the recovery of a Harlan's Hawk (*Buteo jamaicensis harlani*) in Colorado based on comparison with photos taken in Alaska three months prior. In 2018, the ABA area's first vagrant Great Black Hawk (*Buteogallus urubitinga*) was rediscovered in Maine, four months after it was first sighted in south Texas; the relationship confirmed through detailed photographic analysis of the primary coverts (Johnson 2018). In 2002, a juvenile Brown Pelican (*Pelecanus occidentalis*) was traced across multiple US states and Canadian provinces, identified by an abnormality in its foot (Wormington 2002).

Given the exhaustive nature of such photographic comparisons, it has not yet been broadly adopted as practical for birds that are not otherwise notable vagrants. However, this method of individual identification has the potential to significantly broaden our understanding of the movements of extralimital individuals in cases where the capture and application of traditional physical markers is not practical.

Analysis of unique soft-part and plumage morphology strongly suggests that one of the two American Flamingos first seen in Warren County, Ohio, on 1 September 2023, was later seen in Chase County, Kansas, on 27 September 2023, and is possibly the same bird seen in Clay County, Missouri, on 26 September 2023. Several questions remain unanswered, including the fate of the immature bird originally seen in company with the bird seen later in Kansas. The author has been unable to match that bird with any other immature birds reported. However, a lone immature bird was found in Shannon County, Missouri, on 6 October 2023, but photos were not of sufficient quality to compare with the Ohio bird. Finally, there were no further known sightings of an adult flamingo in surrounding states after the adult bird was last seen in Kansas on 9 October 2023. Did this bird survive the journey back to the Yucatán, or did it succumb to unfamiliar predators, or weather along the way? It is impossible to answer these questions without more data, but this case study can set a precedent for the close examination of vagrant birds with the aim of using unique plumage and morphology to study their movements across state and country boundaries.

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