

Immature Plumages of the Eastern Imperial Eagle *Aquila heliaca*

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ABSTRACT

The Eastern Imperial Eagles, *Aquila heliaca*, like other large eagles, attain adult plumage after four (sometimes five) annual moults, resulting in four immature (sometimes a fifth, almost adult) plumages. Herein I will describe these immature plumages, beginning with juvenile and ending with adult plumage, both of which are well known and well described and depicted. However, the plumages of the older immatures have not been well understood or described accurately. Moults are not completed during any annual moult cycle in this species; nor are all of the body and covert feathers or the flight feathers replaced annually. Moults of the primaries (wave moult) and secondaries and the characters of new feathers are crucial in determining the sequence of plumages. I used museum specimens and photographs of eagles in hand and in flight to determine each plumage.

INTRODUCTION

Knowledge of the ages of immature eagles is important to eagle researchers and ringers as an aid in determining their overall population structure and to know the actual age of breeding immatures. This knowledge will also permit keen birdwatchers to accurately age immature eagles in the field. Herein I will describe the age classes of the Eastern Imperial Eagle *Aquila heliaca*. Like other large eagles, (e.g., Bald Eagles *Haliaeetus leucophelus* (McCullough 1989; Clark 2001; Gerard & Bortolotti 1988), White-tailed Eagles *H. albicilla* (Helander *et al.* 1989), African Fish Eagles *H. vociferus* (Prout-Jones & Milstein 1986), Steppe Eagles *Aquila nipalensis* (Clark 1996), and Golden Eagles *A. chrysaetos* (Bloom & Clark 2001; Jollie 1947), this species reaches adult plumage after four or five annual moults. As a result, Imperial Eagles have four immature plumages (and sometimes a fifth, almost adult, plumage). Their adult and juvenile plumages are well understood and depicted in many guides and handbooks (Cramp & Simmons 1980; Porter *et al.* 1981; Jonsson 1992; Mullarney *et al.* 1999; Ferguson-Lees & Christy 2001); Forsman (1999) and

Clark (1999) describe and depict the second plumage as well. However, none of these references correctly describes nor depicts the third and fourth plumages.

Second plumage eagles appear very much like juveniles, as the replacement feathers are nearly the same. New body and covert feathers of third plumage eagles are dark, adult-like, resulting in an overall mottled appearance that is variable, depending on the number of dark replacement feathers. Fourth plumage eagles also appear overall mottled but have replaced more feathers and are most often somewhat darker. They differ from third plumage eagles by having all secondaries (both new and old) with dark tips, and most tail feathers adult-like. Fifth plumage eagles are essentially adult, however, many individuals show a variable number of retained immature feathers, particularly on the underwing coverts.

METHODS

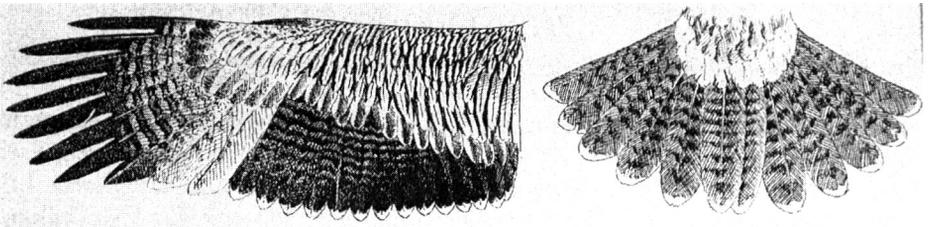
I have looked at numerous museum specimens of immature Imperial Eagles in many museums and have studied and taken photographs of immature eagles in hand and in flight. I aged them by their flight feather moult using the methods described in Clark (this proceedings) and Bloom and Clark (2001). New primaries and secondaries are easily distinguished from older ones.

RESULTS

Juvenile

Juveniles are quite different from adults and are shown and described well in bird guides and handbooks. They differ from older immatures by showing little or no moult on the body, coverts, and flight and tail feathers (Fig. 1). The inner primaries are pale in the first two plumages. The uniformly wide white band on the trailing edge of the wings and tail is a distinctive character of this plumage (Fig. 1).

Figure 1. Juvenile E. Imperial Eagle. (0-1 years old) Juveniles show little or no moult on the body, coverts and flight and tail feathers. Inner primaries are pale and unbarred. A distinctive character of this plumage is the uniformly wide white band on the trailing edge of the wings and tail.

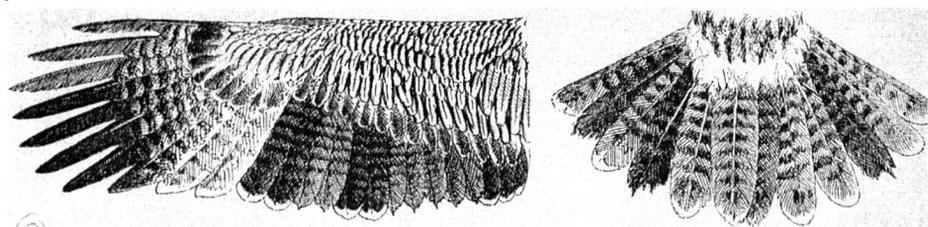


Second plumage

Eagles in their second plumage appear similar to juveniles but have replaced many feathers in the first annual moult. They show one wave of replacement primaries beginning with P1 and proceeding outward to P7 or P8 (Fig. 2); replacement inner primaries are pale like the ones replaced. They have also replaced many juvenile secondaries with similar feathers beginning with moult centres at S1 and S5 (Miller 1941) and proceeding towards the body, and beginning at S14 and proceeding away from the body. They show a mix of new

and juvenile secondaries, usually S1-2 new, S3-4 juvenile, S5-6 new, S7-11 juvenile, and S12-14 new (Fig. 2). The new body, tail and covert feathers are similar to those of juveniles, so their overall appearance is similar, except that they appear more ragged and blotchy because of the mix of old and new feathers.

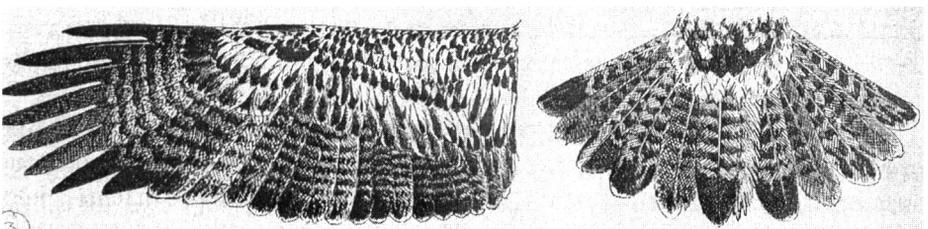
Figure 2. Second plumage E. Imperial Eagle. (1-2 years old). Eagles in their second plumage appear similar to juveniles but have replaced many body, covert, and tail and flight feathers. New replacement primaries from P1 and to P7 or P8; new inner primaries are pale with faint barring. New secondaries are S1-2, S5-6 and S12-14. Wings and tail appear ragged because of the mix of old juvenile and new feathers.



Third plumage

Eagles in their third plumage have a variable number of new dark body and coverts feathers. They exhibit a second wave of primary moult beginning anew at P1 and proceeding out to P3 or P4; new inner primaries are somewhat pale with irregular dark tips. The previous wave has resumed where it left off and proceeded to P9 or P10 (Fig. 3). Most of the secondaries have been replaced, but one or two juvenile ones per wing are occasionally retained. New secondaries are dark with narrow pale bands and a broad dark band on their tips (Fig. 3). Similarly, three or four new tail feathers also have a broad dark band on their tips (Fig. 3). Eagles in this plumage have straw-coloured crown, cheeks and nape that contrast with dark or mostly dark throat. They appear overall mottled and usually show more pale than dark feathers on the body and coverts. In particular, the back is mostly pale and mottled, usually lacking white scapulars, the uppertail coverts are mostly whitish, and the rump shows a variable mix of pale and dark feathers.

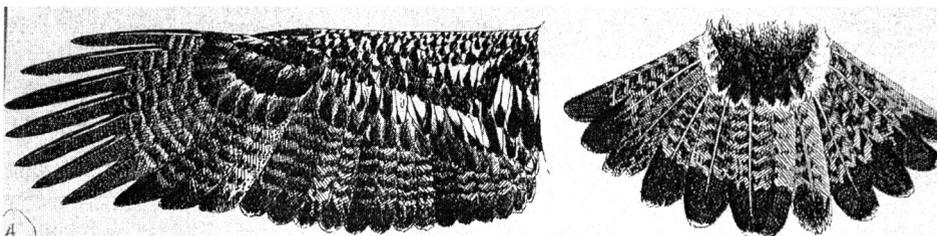
Figure 3. Third plumage E. Imperial Eagle. (2-3 years old) Eagles in their third plumage show some new dark body and covert feathers. A second primary wave moult extends from P1 to P3 or P4, with new inner primaries somewhat pale, but with irregular dark bands on the tips. First wave now progressed to P9 or P10. New secondaries are dark with narrow pale bands and a dark band on their tips. Similarly, three or four new tail feathers also have an irregular dark band on their tips. Uppertail coverts are mostly whitish, and the rump shows pale and dark blotches.



Fourth plumage

Immatures in this plumage are similar to but usually much darker than third plumage eagles, as more new dark body and covert feathers have grown in. A new wave of primary moult has progressed from P1 to P3 and the previous one from where it left off during the last moult cycle to around P7 to P8 (Fig. 4). All secondaries have broad dark tips, wider on new ones, narrower on old ones (Fig.4), and eight or more tail feathers have adult-like wide dark tips (Fig.4). Their backs and uppertail coverts are mostly dark. Some individuals can show white scapulars.

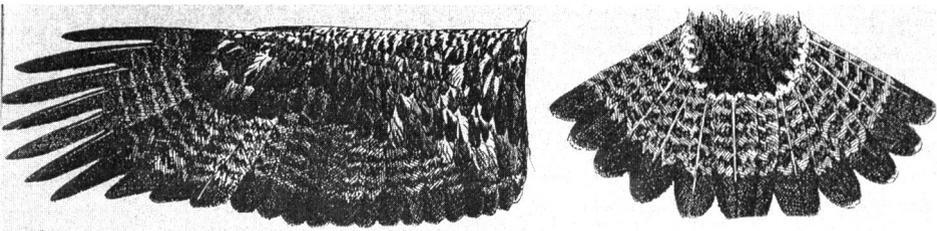
Figure 4. Fourth plumage E. Imperial Eagle. (3-4 years old) Fourth plumage eagles are usually much darker than third plumage eagles. Third wave of primary moult now to P3, and the second to around P7 to P8. All secondaries have dark tips, and eight or more tail feathers have adult-like wide dark tips. Uppertail coverts are mostly dark.



Fifth plumage

Fifth plumage eagles appear almost or completely adult. Some will have retained some immature feathers on the body or coverts, often on the underwing coverts. The undersides of the flight feathers of young adults show a variable amount of pale barring, whereas those of older adults are uniformly dark.

Figure 5. Fifth plumage E. Imperial Eagle (4-5 years old). Some eagles at this age are completely adult, but others show retained immature feathers, often on the underwing coverts. Young adults show narrow pale barring on the undersides of the flight feathers.



DISCUSSION

Determining the age classes of this species was not difficult, once the sequence of moult of the flight feathers was understood. Looking at numerous specimens in a museum collection, one can readily identify those that are adults and those that appear like juveniles. The latter can be separated easily into

juveniles and second plumage eagles by whether or not flight feathers had been replaced. All of the remaining specimens were of eagles in transition that showed a mix of dark and pale feathers on the body and coverts. Differences in the moult of the primaries and secondaries of those eagles separated them into two categories, third and fourth plumage eagles. The key is that the flight feather moult of each age class is different. (See Clark (this proc.) for a more complete discussion of primary wave moult). It was not easy to determine fifth plumage eagles from museum specimens, as one cannot see the underwing coverts.

The age of acquiring adult plumage is important because it determines the number of immature plumages. Some, for example Forsman (1999), believes that the large eagles take six years to attain adult plumage. As discussed earlier, I believe, based on the results of Bloom & Clark (2001), Clark (1996), Clark (2001), Gerard & Bortolotti (1988), Helander *et al.* (1989), Jollie (1947), McCullough (1989), and Prout-Jones & Milstein (1986), that all large eagles attain adult plumage after four moults, resulting in four immature plumages. Those who believe that there are six plumages must then 'stretch out' the immature plumages into one or two extra age classes.

The descriptions of third and fourth plumage eagles in Clark (1999) are terse and do not describe the differences between these age classes. Only the third plumage eagle is depicted in this guide, and the descriptions of third and fourth plumage eagles does not mention the range of variation nor enumerate the field marks to distinguish them.

Forsman (1999) has a more detailed description of the immature plumages of this species. However, because of his theory that adult plumage is attained in six years, his age classes are not correct. If one were to remove his third plumage category and change his fourth and fifth plumages to third and fourth plumages, respectively, then we would be almost in agreement. His sixth plumage corresponds well also with my fifth plumage. I believe that plates 476-477 are really second, not third, plumage eagles, plates 478-479 are third, not fourth, plumage, plate 480 is a third, not fifth, plumage, and plate 481 is a fifth, not sixth, plumage eagle. Plate 482 is an older adult; note the lack of pale barring on the undersides of the flight feathers.

I agree with Clark (1999), del Hoyo *et al.* (1994), Forsman (1999), Mullarney *et al.* (1999) and others that the Spanish Imperial Eagle is a separate species, *Aquila adalberti*; however, Ferguson-Lees and Christy (2001) consider it to be one species with *A. heliaca*. Regardless of the taxonomic classification, this technique for ageing immatures should apply to both species.

Eastern Imperial Eagles reach adult plumage in four or five years, thus have four immature plumages, and often an adult-like fifth one. The characters to distinguish each of the four immature plumages are described.

ACKNOWLEDGEMENTS

I thank Gerold Dobler for stimulating me to look closer at the age categories of the Eastern Imperial Eagle, resulting from our discussions regarding a third or fourth plumage Imperial Eagle we observed together at Bharaptur, India. I

thank Stefan Danko for showing me nesting Imperial Eagles in Slovakia and Andras Kovacs and Martin Horvath for showing me Imperial Eagles in Hungary and for inviting me to present my ageing criteria at the Imperial Eagle workshop. John Schmitt prepared the excellent illustrations.

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