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### MOLTS BY AGE IN THE BRISTLE-THIGHED CURLEW AND OTHER SHOREBIRDS

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Prior to the 1970s, molt and its effect on age determination in birds, especially in the field, was not a thoroughly worked topic in ornithology. This changed somewhat in 1977, when A. J. Prater, J. H. Marchant, and J. Vuorinen published their *Guide to the Identification and Ageing of Holarctic Waders*. Field ornithologists began to pay more attention to the age of their subjects as it relates to accurate species identification within certain shorebird genera (e.g., *Calidris*; Veit and Jonsson 1984), and an entirely new era in field ornithology arose. The accurate determination of age in the field, in turn, depends on a critical understanding of the timing, location, and variation in the extent of molt in these species.

Although the determination of molt-related age characters in the field began with the shorebirds, progress within this group has been modest at best (at least for North American species), and many questions remain. In numerous shorebird species, juveniles that winter south of the equator replace a variable number of outer primaries during a protracted first prebasic molt, while juveniles of the same species wintering north of the equator retain all of their juvenal primaries during a curtailed version of this molt. The details of this variation, at least in North American species such as the Wandering Tattler (*Heteroscelus incanus*), Least Sandpiper (*Calidris minutilla*), and potentially many others for which no data exist at all, have yet to be worked out. For example, does the number of dropped primaries in these species vary clinally with latitude or do distinct populations exist in which first-year birds either do or do not drop primaries? The latter situation has been used as support for ranking the golden plovers as species (Johnson 1985), but more data are needed from other genera to reveal the extent to which genetic versus environmental factors control this molt.

Oddly enough, one of the best-studied North American shorebirds in terms of molt is one of the rarest: the Bristle-thighed Curlew (*Numenius tahitiensis*). Jeffrey S. Marks (1993) studied molt in banded birds of known age for a cumulative 13 months over four years (1988–1991) on Laysan in the northwestern Hawaiian Islands, where wintering curlews typically perform all of their molting. Marks observed many interesting and previously unreported aspects of shorebird molt; some of these may reflect unique life-history traits of the Bristle-thighed Curlew, while others may be common to other large shorebirds but remain undocumented.

Marks found that immature Bristle-thighed Curlews do not replace their juvenal primaries until March through September of their second calendar year. The bird shown on the back cover, photographed on Midway Atoll on 5 June 1998, is undergoing this molt, having replaced the innermost four primaries, with the fifth incompletely grown. This molt often includes all of the primaries, but sometimes (perhaps in years of poor food supply only) the outermost primaries can be retained. Remarkably, from July through November or later, these second-year birds undergo a second wave of primary replacement, in many cases commencing before completion of the first wave, thus involving primaries that are no more than a few months old. This summer/fall molt appears to be incomplete in a large proportion of second-year birds but complete in third-year and older birds, which lack the earlier spring/summer replacement. Thus, many birds in their second basic plumage (between their second and third years) can be reliably distinguished by having two or three generations of primaries. For many (but not all) adults, the complete prebasic molt of remiges occurs

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in blocks, rendering the birds flightless for up to two weeks or more. Finally, adult curlews also undergo a partial prealternate molt (body feathers) in the winter and spring; the extent of this molt in second-year and third-year birds remains unknown.

Because molt is such an energy-consuming process, why would second-year curlews replace their inner primaries twice during summer and fall? Part of the answer undoubtedly relates to Bristle-thighed Curlews' remaining on the winter grounds for their first two to four years of life (Marks and Redmond 1996). Upon their arrival in late summer and fall the inexperienced juvenile curlews must learn to forage for the relatively limited but consistent food resources of tropical atolls. This likely takes up much of their energy reserves, and since they will not be migrating the following year, molt of primaries is delayed until the next spring and summer, when adults are on the breeding grounds and competition for food is reduced. By this time intense insolation has likely taken its toll on the primaries, necessitating gradual replacement (see photo) in order for the birds to fly and forage in late summer and fall. The second wave represents a partial conversion toward the typical adult pattern, in which primaries are completely replaced each fall upon return to the wintering grounds. Presumably, second-year birds can afford this extra replacement because of reduced competition for food while older birds are breeding, increased foraging experience, the lack of exhausting migrations and breeding, and their remaining capable of flight during late summer when many adults become flightless. On the other hand, if sufficient resources are not available (as often seems the case), primary replacement in second-year birds is arrested before it is complete.

The interesting patterns of primary molt in immature Bristle-thighed Curlews thus result from the life-history traits of the species, as dictated by many circumstances (steady but limited food resources, intense solar radiation, lack of predators) that other shorebirds may not encounter. This and the intraspecific variation in primary molt by latitude noted above might suggest that environmental rather than genetic factors are more responsible for these patterns of molt, but comparison with related species is needed to test this hypothesis. Some evidence (Prater et al. 1977, Cramp 1983) suggests that the feather-replacement strategy of immature Whimbrels (*Numenius phaeopus*) may be similar, but despite the Whimbrel's being widespread and abundant, studies such as that on the Bristle-thighed Curlew (Marks 1993) have not been undertaken.

Two other aspects of molt, illustrated in the featured photo and not covered by Marks (1993), are worth mentioning. First, note that the greater primary coverts are being replaced along with their corresponding primaries. This pattern is normal in many birds with first prebasic primary molts that follow the typical sequence (proceeding distally from the innermost primary) but not in species with eccentric patterns, in which flight-feather molt proceeds distally from a primary other than the innermost (Pyle 1997). It would be interesting to know whether those shorebird species with eccentric first prebasic molts south of the equator concurrently replace the greater primary coverts. Replacement patterns of the greater primary coverts are rarely documented in studies on molt (e.g., Prater et al. 1977, Cramp 1983) despite the importance of this feather tract to accurate age determination (Pyle 1997). Second, note that the first prebasic molt commenced with the scapulars, inner lesser coverts, and median coverts, with the outer lesser coverts, most or all greater coverts (dropped or hidden below the median coverts), and secondaries yet to be renewed. This sequence (commencing with the median coverts) is common in the Charadriiformes (shorebirds, gulls, terns, alcid) and is easily viewed in the field.

Slowly but surely, our knowledge of molts in North American birds is improving. For passerines and other landbirds, this knowledge has been gained largely through banding data and examination of museum specimens. Because of the larger size, fewer captures, and fewer specimens of many waterbirds, however, a complete knowledge of the timing, extent, and location of their molts by age will be more

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difficult to obtain. The next step with these species is detailed studies of molt in the field, as have been initiated among the pelicans (Schreiber et al. 1989), ducks (Cooke et al. 1997), and gulls (Howell et al. in press). I suggest that the next challenge for astute field ornithologists is determining molt patterns and their relationship with age in common shorebirds (e.g., the Whimbrel) and other large waterbirds. The answers may require only a little background knowledge, a cooperative flock of birds, patience, and a good telescope.

Comments by Jeffrey S. Marks, Steve N. G. Howell, and Robert A. Hamilton improved the manuscript. This is contribution 748 of the Point Reyes Bird Observatory.

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## CORRIGENDUM

The legend for Figure 2 in “First Record of a *Cuculus* Cuckoo on Midway Atoll and the Hawaiian Islands” by Pyle and Nestler (*W. Birds* 29:124–127, 1998) was confused. The correct legend should be as follows: Specimens of *Cuculus canorus canorus* (left two birds), *C. c. telephonus* (center two birds), and *C. saturatus* (right two birds). In each case the specimen (of those at MVZ; see text) with the boldest barring is on the left, and the specimen with the sparsest barring is on the right. Descriptions of the bird from Midway matched the paler specimen of *telephonus* (third specimen from the right). From left to right, MVZ 101637 (collected 12 May), 109077 (2 July), 143575 (17 September), 130838 (23 May), 134619 (19 May), and 140272 (16 May).



Sketch by Cin-Ty Lee

Hooded Merganser