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An albino Greater Shearwater: feather abrasion and flight energetics.—Barrowclough and Sibley (1980) speculated on the survival potential of a partially albinistic Yellow-rumped Warbler (*Dendroica coronata*) whose white flight feathers were severely abraded. As they pointed out, the actual significance of increased abrasion to albinistic flight feathers remains uncertain for two reasons: (1) the relationship of fitness to flight energetics is unknown and (2) the importance of other factors (e.g., camouflage and countershading) needs to be evaluated.

Previous authors (e.g., Averill 1923) observed that black shows less wear than white on primary feathers, and Voitkevich (1966) suggested that the presence of melanin was associated with increased thickness of keratin in these same feathers. The importance of melanin was confirmed by experimental abrasion of differently colored and pigmented warbler feathers (Burtt 1979). Barrowclough and Sibley (1980), however, argue the significance of abrasion-resistant coloration among wild birds.

On 28 August 1980, 40 miles SE of Oregon Inlet, Dare County, North Carolina (30°30′N 74°38′W) DSL observed and collected an albinistic Greater Shearwater (*Puffinus gravis*) from a mixed feeding flock of 30–40 Greater and Cory's Shearwaters (*Calonectris diomedea*).

At a range of 30 m, the bird appeared to lack the maneuverability, speed, and grace of the shearwaters with which it was associated. Although other shearwaters nearby soared on very light winds, the albino flapped and generally remained 3–5 m above conspecifics. Unlike the other individuals it never landed on the water to feed and its wing beat appeared faster and deeper.

The bird, a female (NCSM 7741; ovary 3.5 × 8.0 mm) weighed 424.3 g. The iris was dark brown. The bill was flesh colored, lighter than that of a normal Greater Shearwater, and the tarsi and feet were light pink with the outer toe of each foot gray-brown. All plumage was essentially unpigmented, except for faintly dark coloration in feathers of the "cap," tail, and spotting on the tips of the primary wing coverts and on feathers on the leading, ventral surface of the wings. All feathers were old and very worn. The tail and flight feathers were abraded to the extent that the wings were abnormally shortened and on the remaining distal 5 cm of most primary feathers the barbs were lacking. Microscopic examination revealed that most distal barbs, when present, lacked barbules. We assume this resulted from abrasion.

Most of the collected Greater Shearwaters found lingering off the North Carolina coast during the summer months (10-year study, see Lee and Booth 1979) are young birds. Timing of molt suggests the albino Greater Shearwater was almost certainly immature and probably a yearling. That this individual showed no sign of feather replacement even by late August when most immature birds have advanced molt may indicate its poor general condition. As prefledgling Greater Shearwaters spend about 3 months in nest burrows, feather abrasion may have begun before the bird could fly.

Compared to 18 normally pigmented Greater Shearwaters collected in the same area (666.0 ± 98.2 g [SD]) the 424.3 g weight of the albino specimen was low. When we compared various measurements that relate to flight, the albino was well below similar measurements for birds with normal abrasion. Measurable percent of difference was recorded for wing span (−8.2), wing chord (−3.6), and tail length (−6.4). The total wing area of the albino (as calculated by tracing the outline of the outstretched wings on paper) was 10.8% smaller than the average area of normally pigmented specimens.

The emaciated condition of the albino bird resulted in a lower wing-loading ratio (0.53 g/cm^2) than for normally pigmented birds with typical feather abrasion (0.75 g/cm^2, assuming an average weight of 666.0 g). A bird of normal weight with a wing surface area of the albino specimen, however, would have a wing-loading ratio of 0.84 g/cm^2 (12% higher loading). If the distal 5 cm of the primaries are not included in the wing area a truer picture of the labored flight energetics can be obtained. These figures reveal a total effective wing area of 738 cm^2 (17.1% less than that of a normally pigmented bird) and a wing-loading ratio of 0.58 g/cm^2 and one of 0.90 g/cm^2 for a bird of average weight.

Like most Procellariidae, Greater Shearwaters forage over pelagic regions where prey is distributed in discontinuous and sporadically available patches. Sustained economical flight is therefore critical to survival. The feather abrasion on this bird clearly placed it at a disadvantage. In fact, the 5 Greater Shearwaters we salvaged in June 1984, after a small die off, were in starved condition and weighed 372 (range = 337–432) g. These weights closely agree with that of the albino.

This represents only the second record known to us (see Alexander 1898) of a shearwater in which the degree of albinism was extensive, and one of only a few reports of extensive albinism in Procellariiformes. Our report demonstrates how increased abrasion may affect fitness and provides support for the long held belief that pigment in flight feathers contributes both to the lack of deterioration of feathers and ultimately to the potential for survival of the bird. Other factors related to feather pigment, such as loss of camouflage and countershading (Barrowclough and Sibley 1980), would not seem critical to survival in large shearwaters.

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