

A White-tailed Eagle (*Haliaeetus albicilla*) at Derby Hill, New York

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Abstract

This paper considers a sea-eagle (*Haliaeetus* sp.) seen at Derby Hill Bird Observatory, near Mexico, Oswego County, New York 24 April 1993. The bird has been identified and noted in various publications as a White-tailed Eagle (*H. albicilla*) in its fourth plumage cycle, but critical field notes on its plumage and structure have not been previously published. This paper also provides historical context on the remarkable developments in raptor identification since the



The Derby Hill *Haliaeetus* was photographed on Fujichrome slide film, using a Canon EOS camera fitted with a 400mm lens, as the bird had its wings drawn in, in glide to the east-northeast of the Observatory. Although the image is poor, the large wing area, distinct “fingers” (outer primaries, on the right wing), and spade-shaped tail are visible. The massive outer portion of the wing (right wing), not seen in Bald Eagle or Steller’s Sea-Eagle, led observers to call the wings “big barn doors.” Not visible in the image, but clearly visible in the field, the bird had a sizeable, all-yellow bill and uniformly rich brown plumage in body and wings (no traces of white), with only the centers of some rectrices showing white. Multiple observers counted seven distinct primaries when the wings were fully outstretched. The wing shape when wings were fully extended was very square, reminiscent of some Old World vultures. The tail was held mostly closed, making it difficult to study the rectrices, but the tail coverts were dark brown and the visible rectrices edged with dark brown, a pattern unknown in Steller’s Sea-Eagle of any morph.

This image has had a tortuous path to reach print. From the original slide transparency, an inter-negative was made, and then a color photographic print was made from that. From the print, color photocopies were made, and one of those was scanned to make a jpg file, which was used for this article. The quality of the original slide was much better than the image seen here; and the photographer sent the much better original slides of the bird to a Derby Hill associate in May 1993, but those slides were apparently also lost.

Photograph by Jean Litzenberger.

early 1990s, in particular, our understanding of, and our access to information on, the variable plumages and molts of sea-eagles.

Field Encounter

At 10:40 EDT on 24 April 1993, a sea-eagle (*Haliaeetus* sp.) passed the hawkwatch area at Derby Hill Bird Observatory, near Mexico, Oswego County, New York, seen by over 150 observers and photographed by Jean Litzenberger (frontispiece).

The bird’s plumage and structure immediately indicated to the numerous experienced observers present that the bird was clearly a species of *Haliaeetus* but certainly not a Bald Eagle (*H. leucocephalus*).

At the time of the observation, which lasted for about three minutes at ranges varying from about 50 m to 225 m, no one was able to identify the bird. Many observers immediately committed details of the bird’s plumage and structure to field notebooks, and some made sketches, admittedly rather rough ones (Figures 1-3).

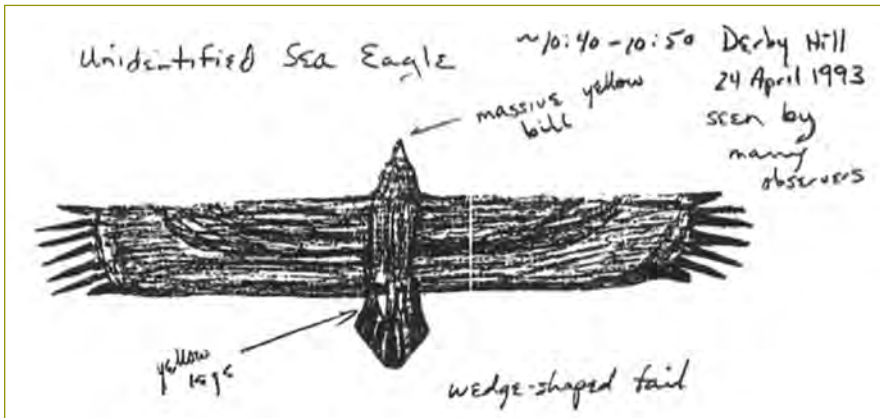
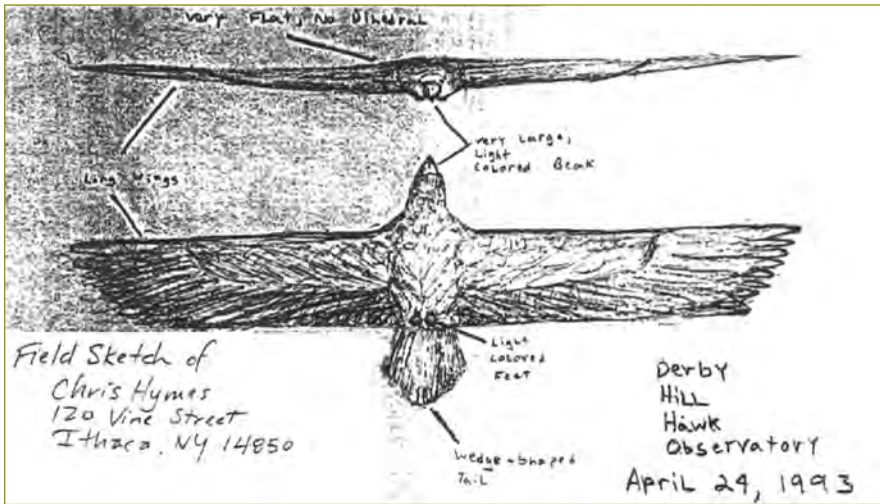
The observers’ unanimous impression was of a very large eagle, almost uniformly brown in wings and body plumage, with a large yellow bill, yellow feet, and spade-shaped tail (Figures 1-3, frontispiece). Brinkley, using a Kowa TSN-2 spotting scope with 30x-wide eyepiece, was able to see eye color (“brandy brown”) well and some detail in the visible rectrices, some of which had whitish interior portions but were otherwise edged dark brown. Another observer, farther from the bird and using a Celestron C90 scope, also detected white in the tail. No one reported seeing molt limits or heavy wear in the plumage, and the overall impression was of a bird in relatively fresh, even plumage. The bird appeared very large in its dimensions and also very stable in flight, more so than Bald Eagle.

Within seconds of the bird’s appearance to the west-northwest of the Observatory, Gerry Smith, the hawkwatch director and counter, and Brinkley had alerted all observers within shouting distance that this bird was neither a Bald nor a Golden Eagle and that it should be observed and documented carefully. After circling and gaining altitude in soar, in company with a Red-tailed Hawk (*Buteo jamaicensis*) and several Broad-winged Hawks (*B. platypterus*),

the eagle “broke” the soar and glided eastward, passing to the east of the Observatory grounds. Jean Litzenberger then photographed the bird, as other observers began to compose field notes, recording the following aspects of plumage and structure:

- 1) A very wide-winged eagle, rich brown in color overall, with no white feathers visible in the head, body, or wings, either above or below;
- 2) Width of wing uniform throughout the length of the wing, that is, leading and trailing edge of wings parallel, reminding some observers of an Old World vulture (*Gyps*) (cf. Figures 5-9, 13a, 13b);
- 3) White in the plumage limited to the spade- or wedge-shaped tail, which was not fanned during the bird’s passage but which appeared to have white restricted to the central portions (possibly inner webs) of some rectrices; basal portions of rectrices apparently covered by dark undertail coverts, making rectrix patterns difficult to see;
- 4) Very broad outer portion of the wing (“hand”) with strikingly long, distinct “fingers,” that is, distinctly segregated outer primaries; seven distinct outer primaries were counted; these long primaries, along with the “barn door,” square-handed wings and wedge-shaped tail, made for an appearance utterly unlike Bald Eagle, again recalling instead an Old World vulture (Clark and Wheeler [1987] emphasize that Bald Eagle has only six emarginate or distinct primaries, White-tailed seven; multiple observers present were aware of this and thus counted); and
- 5) A very large yellow bill, with no hint of dusky tones in the maxilla.

The bird flew eastward, just north of the lake-shore, above eye level by some 10 m or more, such that observers were readily able to study the underparts, with the upperparts being briefly visible during several downstrokes of the wing. The manner of flight was direct, with several long glides on fully extended wings broken by a few slow, deep, powerful flaps. As the bird angled to the east-northeast, east of Derby



Figures 1, 2. Field sketches of Derby Hill sea-eagle in soar by Chris Tessaigia-Hymes (above) and Adam M. Byrne, showing approximate tail and wing morphology and overall proportions, especially the caudal and cephalic projections and relative bill/head size, well.

Hill, its wings were drawn in, in medium glide (frontispiece). The distance from the bird was judged by most people to be about 50 m at the closest, but some judged that when the bird passed closest to the observers, it was less than 50 m. For the first part of the observation, the bird was to the west of the observation area, in optimal morning light (3.5 hours after sunrise). Using a scope, Brinkley felt that the upperwing coverts may have had a warmer tone, but the bright morning sun on the bird, which illuminated the yellow bill well, could have been responsible for this impression. The bird wore no jesses, but it was not possible to see if it was banded. It did not vocalize.

Following the observation, there was much discussion about the possible identification of the bird among observers, and the appearance of the bird was not in question. Despite the presence of dozens of very experienced hawkwatchers, no one present was able to identify the bird to species, though it was ob-

vious to all that Bald Eagle was ruled out by the bird's plumage and proportions, including tail, wings, and bill. There was no match for the plumage in the books at the Observatory or in the many hawkwatchers' cars. The bird's rich brown wings and body plumage, lacking any white, and its yellow bill color, apparently lacking dusky areas, pointed away from a younger immature of any species, just as its tail and eye color indicated that it was not yet an adult in definitive plumage. Observers were thus only able to say that we had seen a subadult sea-eagle, likely an older subadult. Because such plumages are in the small minority of plumages observed, especially in long-lived birds such as sea-eagles, they are not illustrated in bird field guides, as we learned that morning.

Research, 1990s

In 1993, there were no English-language publications treating plumages and molts of sea-eagles in great detail, including those of Bald



Figure 3. Field sketch of Edward S. Brinkley, showing approximate distribution of white in rectrices and overall proportions of the eagle in glide. In hindsight, the wings should have been drawn a bit wider, the tail probably a bit shorter (as in Figures 1, 2); some white was observed in the centers of some rectrices, but dark undertail coverts apparently concealed much of the rectrices.



Figure 4. A silhouetted adult White-tailed Eagle in soar, showing seven distinct outer primaries and square hand in the left wing. This image, from the book *Havsörnens Ekologi på Åland* (Kulves 1973), was one we found early in our research—remarkably, it was one of few such “distant” flight shots that was available in 1993 and thus helpful in beginning to understand the differences in wing morphology between White-tailed Eagle and Steller’s Sea-Eagle. Twenty years later, we have the ability to do an image search that instantly pulls up thousands of shots, including many useful images of distant birds! Photograph by Göran Harberg.



Figure 5. Images of nonadult White-tailed Eagles taken in April are scarce, even in the twenty-first century. This soaring bird is in its second plumage cycle, as it has clearly begun molt of inner primaries and outer secondaries; the plumage aspect overall is very similar to first cycle. The rectrices of younger birds are longer than those of older birds, especially older adults; the appearance of a “wedge-shaped” tail varies considerably, depending on state of molt, age, and how the tail is held (closed or fanned), but there is also individual variation in shape. The length of the innermost secondaries also influences the apparent length of tail: birds that have dropped these feathers appear to have longer tails—or, more precisely, longer caudal projection, that is, the length of the body/tail beyond the trailing edge of the wing. Younger White-tailed Eagles, even those in molt, show a rather boxy wing shape when wings are extended in full soar. By contrast, the outer portion of the wing in Steller’s looks narrow, even somewhat pointed in soaring birds. This bird was photographed 26 April 2007 on Isle of Harris, Outer Hebrides, United Kingdom. Photograph by Carl Chapman.

Eagle, and North America had then, as now, few authorities on Old World sea-eagles. Observers assumed that the candidates for consideration were Steller’s Sea-Eagle (*H. pelagicus*), recorded multiple times in Alaska, and White-tailed Eagle (*H. albicilla*), recorded in Alaska as well as in Canada and Massachusetts, but not in eastern North America away from Greenland since 1945. At that time, both Steller’s and White-tailed were considered polytypic, with two subspecies each. No one present at the hawkwatch had extensive comparative experience with these taxa, much less with their non-adult plumages. At that stage in North American hawkwatching, most advanced observers were fluent in distinguishing the plumages of Bald Eagle and Golden Eagle (*Aquila chrysaetos*) at various ages (treated well in Clark and Wheeler [1983]), and some were well versed in the molts of Golden Eagle—beautifully illustrated by Lars Jonsson in his newly published *Birds of Europe* (1993)—but no field guide then illustrated sea-eagle plumages exhaustively (which is still true in 2013).

In late April 1993, we began to conduct research on *Haliaeetus* plumages through North American and European libraries. The European and Asian field guides we consulted were generally not helpful, most depicting mostly the first plumage (then often termed “juvenal”) and definitive plumage (“adult”), which some



Figure 6



Figure 7



Figure 8



Figure 9

Figures 6–9. Flight profiles of White-tailed Eagles of different ages. In glide—that is, with wings drawn in more than when the bird is soaring with wings fully outstretched—White-tailed Eagles may show a more rounded (Figure 9) than boxy (Figure 7) wing shape, but the outer portion of the wing is still enormous, especially when the wings are “set” in glide (Figures 6, 8). In no flight posture does the wing shape of White-tailed Eagle resemble the unique paddle shape of Steller’s Sea-Eagle. In some instances, it is difficult to perceive more than six distinct primaries in a flying White-tailed, but the wing shape, particularly the great breadth of the outer portion of the wing is distinctive. Although the tail is often perceived as short in older adults (Figures 8, 9), younger birds (Figure 6) have rather long tails, molting in progressively shorter rectrices as they age. Depending on how the tail is held, the shape may resemble a spade, keystone, or wedge; birds in active molt of the rectrices (spring through fall) show a variety of tail shapes, but tail shape also varies quite a bit among individuals of the same age.

These photographs were taken at Kværkeby Mose, Denmark 8 March 2012 (Figure 6), at Bisserup Havn, Denmark 28 September 2012 (Figure 7), at the nature reserve Smør- og Fedtmosen, Denmark 13 March 2010 (Figure 8), and on the Isle of Mull, Scotland, United Kingdom in June 2005 (Figure 9). Photographs by Leif Knudsen (Figure 6), Yvonne Engmann (Figure 7), Frank Desting (Figure 8), and Paul Gale (Figure 9).

sources indicated was not acquired until the eighth year or sometimes even twelfth year. We turned to more detailed specialty guides and to handbooks (Dement’ev et al. 1966, Brown and Amadon 1968, Glutz von Blotzheim and Bauer 1979, Cramp and Simmons 1980, Porter et al. 1981, Boyer and Burton 1983, Palmer 1988), then to scientific literature in German, Swedish, Danish, and Hebrew (Kulves 1973, Helander 1975, Christensen 1979, Forsman 1981, Brüll 1986, Shirihai 1986, Helander et al. 1989) in an effort to assemble, piecemeal,

some understanding of the highly variable plumages of White-tailed Eagle. We consulted several popular books as well, mostly for their photographs (e.g., Parry and Putnam 1979, Love 1984, Hamaguchi et al. 1985). Librarians at Cornell University’s Olin Library, Mann Library, and the Lab of Ornithology were very helpful in obtaining photocopied articles via Inter-Library Loan, and linguists specializing in Scandinavian languages helped us with translation. Published material on the endemic Greenland subspecies of White-tailed Eagle (*H.*



Figure 10. Evaluation of the primaries of sea-eagles is most feasible when they are in full soar or are commencing a downward wing stroke or sharp turn. The seven distinct outer primaries of this White-tailed Eagle are much more apparent on the right wing than on the left wing. This bird's primaries are from three distinct plumage cycles, based on their relative freshness. For precise ageing, it can be useful to consider the "sets" (continuous groups of feathers between molt waves) in well-photographed birds such as this one (see Pyle 2006). The sets in this bird (left wing) would be: p1-p2, p3-p8, and p9-p10. Here, p1-p2 are fresh and new—shorter, glossier, and darker; and the very worn p9-10 appear to be quite worn and old, almost certainly from the bird's first cycle (juvenile feathers). Within the p3-p8 set, one sees a difference between p3-p4 and p5-p8, with the latter group being darker and less worn, almost certainly an indication that they were replaced at the same time as p1-p2. In this image, the fresh p5-p8 (and especially p5-p7) show distinct emargination, with clearly visible "notches," in the outer webs (both wings); p4, though older, also shows a distinct notch. Note in the right wing how the seven emarginated primaries separate out into long "fingers" at the commencement of downstroke and in other maneuvers (this can be studied in slow/stop-motion online at <<http://vimeo.com/37608597>>).

This pattern in the primaries—together with the white feathers in underparts and axillaries, the dusky maxilla, the amber eye, and the tail pattern—point to a bird in its third plumage cycle. The outermost primaries are replaced last of all the primaries (Edelstam 1984, Pyle 2006) and so often appear very worn and somewhat paler than other primaries in third-cycle birds. Some birds at this age have darker (and longer) tails, and others have tails with less dark brown than this individual (cf. Figure 11). Of tails in this plumage, Forsman (1999) writes: "Tail still mostly dark, often even darker than in previous plumages, but the individual variation is considerable." Note that the undertail coverts are quite long and are mottled but mostly dark brown. This bird would be about 14 months younger than the Derby Hill eagle. This image was taken at Rausu, Japan 29 February 2012. Photograph by Arthur Morris/BirdsAsArt.

albicilla groenlandicus) was then, and continues to be now, very limited, and material on Steller's Sea-Eagle was difficult to obtain and required consulting people with command of Russian or Japanese; however, no reference that we considered comprehensive on plumages of Steller's was located through 1996, with Dement'ev et al. (1966) the most thorough and useful. Mindful that we might well have seen an escapee or falconer's bird rather than a wild bird, we also looked into other, more remote possibilities, such as Sandford's Sea-Eagle (*H. sanfordi*) of the Solomon Islands; all such species were easily ruled out, despite the limitations of the literature.

The results of our research were unsatisfying, as there was very little published on *Haliaeetus* plumage progression in known-age birds, and so our findings remained fragmentary, as we

were working with often very poor photocopies of black-and-white images, mostly of perched birds. Although all indications were still that the Derby Hill eagle's plumage and structure were consistent with an older subadult White-tailed Eagle (for instance, likely close to birds depicted in Plates 22, 25, and 26 of Helander et al. 1989), we were unable then to find an image of a flying bird that would provide a close match for the Derby Hill eagle, and indeed we found very few photographs of flying subadults—and only a handful of those taken in spring. On the other hand, we could find nothing at all in the limited literature or available photographs to suggest that any plumage of Steller's Sea-Eagle corresponded to the bird observed at Derby Hill, and so the bird was thus widely considered a White-tailed Eagle and published as such (Boyle et al. 1993, Huggins 1993, Spahn

1993).

In May 1993, William S. Clark contacted us about the observation. His extensive field experience with all northern-hemisphere *Haliaeetus* species, his large personal slide collection, and his library of books on birds of prey provided much-needed reliable information on both structure and plumages in the genus. Clark was also in regular contact with European experts on White-tailed Eagle and sent around both the photograph of the eagle taken by Litzenberger and several sets of field notes and sketches; at that time, Clark had more direct field experience with northern-hemisphere taxa of *Haliaeetus* than virtually anyone else, and so he reviewed the Derby Hill material critically as well. This correspondence, in the days before email, took three years, wrapping up in summer 1996, just after



Figure 11. Another White-tailed Eagle in third plumage cycle, this bird shows the typical amber eye, dull yellow bill, white axillaries (and bases of some primary coverts), plus some mottled whitish areas in remiges, especially p1-2 (and s1 on the left wing), all fairly typical of a bird in third cycle. As one sees in this photograph, the overall shape of the wing (and thus the flight profile) is a product of the relative ages of the remiges. The trailing edge of the wing recalls the bowed shape of Steller's a bit, though the hand is still clearly a White-tailed's broad, nearly square hand. The full-winged look of this bird results from having short innermost secondaries (s13-s16) and rather long s3-s4. As the last of the first-cycle secondaries are replaced with shorter feathers in the next molt cycle, the trailing edge of the wing will appear more even and straight (cf. Figures 7-9, 12, 14, 16, 18), but young birds that have completed molt may also show a straight trailing edge (Figure 6). In this photograph, it is possible to count individual rectrices: this bird has twelve, correct for White-tailed; Steller's is unique among sea-eagle species in typically having fourteen rectrices. The extent of white in the tail at this age is quite variable; this bird shows more white than many at this age (cf. Figure 10). This photograph was taken at Tancho no-Sato, Kushiro, Japan 23 February 2006. Photograph by Jemi and John Holmes.

publication of *A Photographic Guide to North American Raptors* (Clark and Wheeler 1995), which included photographs of White-tailed and Steller's; we were unaware at that time of the paper by Stenlund (1995). Because the first few comments from European reviewers were not unanimously supportive of identification as White-tailed Eagle (as reported in Brinkley et al. [1994]), we decided to conduct further research on the range of plumage variation in Steller's Sea-Eagle; the only reference we had then was Dement'ev et al. (1966). We were at that time still receiving communication from raptor biologists around the world, but their

statements about Steller's plumages were difficult to reconcile with one another, a source of real confusion for us. After several more rounds of discussion, however, William S. Clark, Klaus Malling Olsen, Kjeld Hansen, Frank Wille, and other reviewers believed the Derby Hill eagle was a good fit for a White-tailed in its fourth plumage cycle (that is, fifth calendar year), and the record was thenceforth referenced as such in print (e.g., Clark and Wheeler 2001). As Klaus Malling Olsen wrote, "I can see from your photos that the wing shape of Steller's does not fit the *Haliaeetus* from Derby Hill" (in litt. to William S. Clark, 22 August 1994).

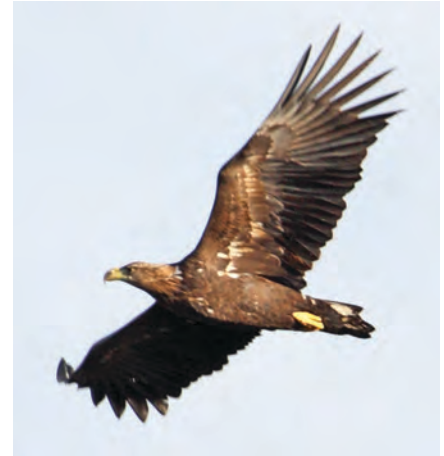


Figure 12. This apparent fourth-cycle White-tailed Eagle still has dusky tones in the maxilla, a few white feathers in nape and breast, and a little white in axillaries and coverts. This bird's plumage is a uniform rich brown; note how the long, dark brown undertail coverts conceal much of the tail on this bird, leaving only a hint of what is probably more white in several rectrices. This bird has replaced all primaries, including p10, which appears to be new and growing, and shows a mostly straight trailing edge to the wing. The caudal projection appears relatively short in this bird; compare Figure 13a, which shows a bird with shorter innermost secondaries, which enhances the appearance of longer caudal projection. This individual seems rather compact and small-billed, perhaps indications that it is male. This bird was photographed at Tystrup-Bavelse Søerne, Denmark 13 October 2009 and so would probably be a little more than six months older than the Derby Hill eagle. Photograph by Bente Holm-Peterson.

Research, 2000s

At the turn of the century, reliable and complete references on *Haliaeetus* plumages were becoming available, some of them in English. In 1999, Forsman published *The Raptors of Europe and The Middle East: A Handbook of Field Identification*, the first English-language text to treat plumages of White-tailed Eagle in detail, and the watershed field guide *Birds of Europe* (Mullarney et al. 1999) also came out that year. In February of the same year, the Japan Wild Bird Society hosted the First Symposium on Steller's and White-tailed Sea Eagles in East Asia, and the symposium proceedings (Ueta and McGrady 2000) included detailed data on molt in Steller's based on specimens and photographs (Morioka 2000). Subsequently, Clark (2001) published on plumage progression in known-age Bald Eagles in detail, and Ferguson-Lees and Christie completed *Raptors of the World* (2001).

By this time, too, students of raptor identification in North America were becoming much more focused on particularities of plumages and molts, rather than more generally on shape or jizz, and more specialty guides were de-



Figures 13a, 13b. This White-tailed Eagle, a migrant photographed at Ulaanbaatar, Mongolia in October 2010, shows a strong square-handed appearance, with seven very distinct outer primaries (p4 especially long and distinct), yellow bill and feet, dark underparts with only a small amount of white in the axillaries, and very long, wedge-shaped tail with white limited to the interior of the rectrices. The broad, squared hand is typical of White-tailed and very unlike the narrow, almost pointed hand of Steller's. The wings are held flat in soar, with the primaries flared up a bit. The caudal projection appears long in this individual, whose rectrices still show typical immature pattern, but probably also because innermost secondaries look short compared to the rest of the secondaries. The appearance of a bowed trailing edge of the wing, along with the long, immature tail, might suggest a bird in third cycle, but these are apparently within the range of variation for fourth-cycle White-tailed Eagles. This bird appears to be in its fourth plumage cycle and would then be about six months younger than the Derby Hill eagle; aside from the bit of white in the axillaries, the bird is a dead-ringer for the Derby Hill eagle in terms of structure and plumage. Figure 13b is especially useful for conveying the distinctiveness and the unfamiliarity of such a bird in the context of the eastern Great Lakes—this image perfectly captures the first impression of the Derby Hill eagle when the bird was west of the Observatory. Photographs by Amarkhuu Gungaa.

voted to the finer details (e.g., Wheeler 2003a, 2003b). Raptor watchers increasingly used the mountain of data gathered by raptor banders—on plumage variations, differences in feather shapes, even hybrids—as aids in field identification. Digital cameras appeared on the scene in the early part of the century, and their use greatly accelerated the process of learning not just to identify raptors in flight but also to age them, including Bald Eagles. Specialized online discussion groups also accelerated the learning process and made what had been very arcane material widely available.

In 2003, the New York State Avian Records Committee reviewed the documentation of the bird and associated correspondence and, noting “no indication of any white visible on the underwings, including the axillaries,” did not accept the documentation as pertaining with certainty to a White-tailed Eagle (NYSARC 2006). At that time, this evaluation seemed a reasonable, conservative interpretation of Forsman's text, and indeed Forsman's Plate 84 shows a “fourth plumage” White-tailed from Finland that appears similar to the Derby Hill eagle except that the bird has a trace of white in several axillary feathers.

In the subsequent ten years, much more high-quality material has been published on plumages of sea-eagles, and numerous astute observers have taken birding trips to the Russian Far East and to northern Japan to observe White-tailed Eagles and Steller's Sea-Eagles in close proximity, in all four seasons. In north-

ern Europe, hundreds of photographers and birders have spent time at winter eagle-feeding stations, and tours are regularly offered to such locations, which began as efforts to study and sustain populations of White-tailed Eagle. Observation blinds near nest sites have also become popular in some parts of Europe and the United Kingdom. Populations of the species are rebounding in most European countries, affording observers many more opportunities to see and photograph the eagles, and photographers have also begun to focus more on plumage variation and different age classes, rather than nesting or hunting birds. In addition to thousands of images of nonadult sea-eagles from Europe, India, and Asia posted on the web, several more excellent handbooks have been published recently (e.g., Mebs and Schmidt 2006); research revealing regional variation in molts and plumages of White-tailed Eagles has been published in northern and central Europe (Struwe-Juhl and Schmidt 2003, Olsen 2008, Probst and Struwe-Juhl 2009); at least one apparent hybrid sea-eagle has been documented in British Columbia (Clark 2008); and the 120-year-old riddle of the so-called “Korean subspecies” of Steller's Sea-Eagle (*H. p. niger*) has just recently been solved (Kaiser 2010, Kaiser 2011). Relatively little, however, has been published from Greenland in the current century, with the exception of genetic studies (Hailer et al. 2007).

Supplementing the abundance of photographs and the excellent new publications, there are now many videos and films that in-

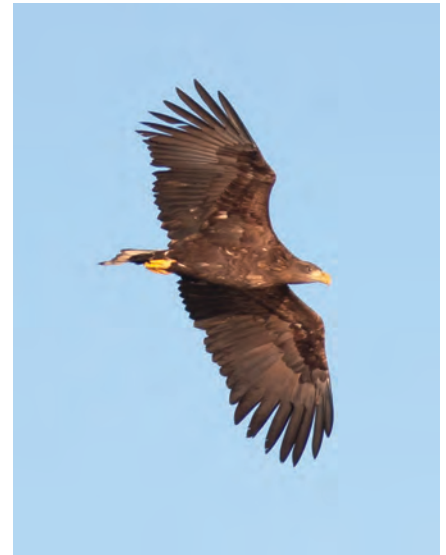


Figure 14. This White-tailed Eagle can be aged as being in its fourth plumage cycle by the fresh outer primaries and the wear lines in the primaries, showing sets at p1-p3 and p4-p10 (right wing) or p1-p4 and p5-p10 (left wing). The tail is becoming adult-like, but the plumage is still mostly solid brown. The eye is medium/dark brown in this individual; most birds in this plumage, and with bright yellow bills, show a paler, amber eye. This photograph was taken 15 December 2010 at Østkov, Fredrikssund, Denmark, making this bird potentially four months younger than the Derby Hill eagle (assuming it is indeed a fourth-cycle bird). A similarly plumaged but more heavy-set subadult, more like the Derby Hill eagle in proportions, was photographed by Kim Hyun-tae at Sosan, South Korea 11 December 2003 and is illustrated online at: <http://orientalbirdimages.org/birdimages.php?p=46&action=birdspecies&Bird_ID=854&Bird_Family_ID=96&pagesize=1>. Photograph by Steen Højmark-Jensen.

clude sea-eagles, including *Realms of the Russian Bear* (1992), *The Blue Planet* (2001), *Eagles of Mull* (2009), and *The Eagles Return* (2010), as well as short videos of sea-eagles distributed via Vimeo, YouTube, and other video-sharing websites. Conservation groups in Europe have also mounted numerous “eagle cams” that show White-tailed Eagles around the clock via the web. Naturally, most images available online are of adults and juveniles, but advanced subadult plumages are also represented, far more frequently than in years past.

As the results of more research, photographic safaris, and birding trips have become available, we have continued to compile new information, some of which has shed clearer light on the Derby Hill eagle. In the interim, Brinkley has become more familiar with the remarkably variable plumages of White-tailed Eagle, having conducted a dozen tours of Iceland, 1986-2007, with up to twelve eagles observed per tour, including various subadult plumages, several individuals appearing very similar to the Derby Hill



Figure 15. This photograph taken at Kronprins Frederiks Bridge, Frederikssund, Denmark shows a White-tailed Eagle in fourth plumage cycle above two White-tailed Eagles that appear to be in first cycle. The fourth-cycle bird may still have some dusky tone in the maxilla, but the general impression at a distance is of a dark brown bird with yellow bill and feet and remarkably broad wings, both in the hand and the arm. There is a slight “bump-out” in the arm in this bird in this flight attitude (cf. frontispiece), probably because some of the central secondaries are still a bit longer than the surrounding secondaries, but the effect may be exaggerated by the posture of the wing. The photograph was taken 20 January 2013, so this bird would be in theory about three months younger than the Derby Hill eagle and resembles it strongly. Photograph by Niels Hejnfelt.

eagle. In the section that follows, we summarize what we have learned about molt and ageing of subadult White-tailed Eagles and Steller’s Sea-Eagles as it relates to the Derby Hill eagle.

Identification of subadult sea-eagles

To refer to plumages of sea-eagles, we use the modified Humphrey-Parkes system (see Howell



Figure 16. In the fourth plumage cycle, many White-tailed Eagles take on proportions close to those of an adult, with remiges appearing more uniform in condition and length (compare Figures 10, 11). This bird has replaced p10 from the first cycle (juvenile plumage) and shows sets at p1-p3 and p4-p10. The tail is normally still immature, both darker and longer than in older adults, the eye is amber (rarely medium or dark brown), the bill yellow (or mostly so), and the plumage is mostly dark brown, including the axillaries in some individuals. Some individuals, such as this bird, still have flecks of white in the wing and tail coverts, and some retain white in the axillaries, while others (such as this one) do not. Even with wings drawn, seven distinct primaries can be counted in both wings; in full soar, p4 would be a bit more distinct from p1-3 in this bird. In White-tailed Eagle, the outer portion of the wing (beyond the carpal joint) is more substantial in breadth and overall area than in Steller’s. In addition to the different wing shape, Steller’s in superficially similar plumage shows a more striking diamond shape to the tail, dark brown edging in rectrices limited to the outer web of r7, blackish rather than rich brown plumage, and typically white in upperwing coverts (compare Figure 27). This photograph was taken at Akan, Japan 16 February 2011, making this bird potentially nine weeks younger than the Derby Hill eagle. Photograph by Dorit Bar-Zakay.

et al. 2003, 2004, Howell 2010). This system resolves the so-called “first basic problem”—that is, the inconsistency with which various authors name the first plumage cycle—by synonymizing the complete prejuvenal molt with the first prebasic molt. To name the successive plumage cycles of sea-eagles, we often shorten “first plumage cycle” to “first cycle,” etc., thus: first cycle, second cycle, third cycle, fourth cycle, fifth cycle, and finally definitive cycles, whereby definitive plumage is maintained. These correspond to juvenile (or juvenile) plumage, Basic I plumage, Basic II plumage, Basic III plumage, Basic IV plumage, and adult plumage of other authors. In many parts of the world, sea-eagles in the first plumage cycle are called “juveniles,” those in the second and third plumage cycles “immatures,” and those in the fourth and fifth plumage cycles “subadults,” and those terms are useful when the plumage

cycle/age is unclear; however, because plumages vary so much in *Haliaeetus* both regionally and individually, we have elected to attempt to name plumages with as much precision as possible, aware that our assessments could well be “off” by a plumage cycle (~year) or even more (see Pyle 2008).

The concept of a plumage cycle is particularly useful for northern sea-eagles, whose plumage aspects change appreciably over the course of the year; in other words, there is not a static, unchanging plumage aspect that can be labeled “third plumage” or “fourth plumage,” both because of the great variability in plumages and because of the changes that occur as birds molt body feathers and flight feathers over the course of the cycle. In sea-eagles that nest in boreal and temperate environments, most molt of flight feathers occurs during the warmer months (spring through fall) and proceeds by stepwise



Figure 17. This White-tailed Eagle is probably in its fourth plumage cycle (fifth calendar year), as it is mostly dark brown overall (with only a few flecks of white below) and has very few secondaries remaining from first cycle (the ones that protrude). The tail still shows immature pattern (and the caudal projection is relatively substantial, accentuated perhaps by short innermost secondaries), and the bill is mostly or all yellow. The bird closely resembles the Derby Hill eagle in most respects. Much of this bird's underparts are in shadow, making the bird (including the tail) look quite dark, which was also the case when the Derby Hill eagle passed east of the Observatory. This bird would be three weeks younger than the Derby Hill eagle, if both are correctly aged as fifth-calendar-year birds. This photograph was taken 1 April 2013 at Tårup Lund, Denmark. *Photograph by Hjalte Kjærby.*

molt, also called serial molt or *Staffelmauser*, wherein molt of remiges proceeds in sequence but is incomplete each year, beginning where arrested the previous year and also commencing again at original nodes, resulting in two or more waves of molt proceeding simultaneously (Edelstam 1984, Clark 2004, Pyle 2005, Pyle 2006). In sea-eagles, most or all rectrices are replaced annually, but fewer than half, sometimes only a

fourth, of the remiges are replaced per season, and they are replaced in relatively predictable sequence, though many factors, including nutrition, appear to influence the extent of molt in a given cycle. Thus, by the third molt season, remiges of three different generations (that is, from three different cycles) normally coexist (Figures 10, 11), and precise ageing can be accomplished by studying the configuration of retained first-cycle (that is, juvenal) and renewed basic feather sets (Clark 2004, Pyle 2006, Pyle 2008). Large birds that undergo serial molt, such as large eagles, typical require three or four molt cycles to replace all remiges.

Birds in active molt of the remiges have a disheveled appearance, with the trailing edge

of the wing appearing ragged and uneven. By winter, most of the new remiges are fully grown in, and the plumage looks cleaner and more uniform from winter through early spring; thus many authors on sea-eagles make reference to "first-winter" plumage, "second winter," and so forth. Ageing of sea-eagles that have not been uniquely marked as nestlings involves some degree of speculation, though the speculation may be well grounded in studies of known-age birds. Such studies have been conducted with Bald Eagles and European White-tailed Eagles but not with Steller's Sea-Eagles or with Greenland White-tailed Eagles; however, basic principles apply to all large birds undergoing serial molt (Pyle 2006).

Figure 18. Fourth- or fifth-cycle White-tailed Eagle. The rectrices have not yet lost their thick dark edges, and the plumage is uniformly dark brown otherwise, with yellow bill, yellow legs, and brownish-amber eye. Seven primaries are distinct, the wing shape is boxy, and the hand is square. Unlike in many Steller's Sea-Eagles, p6-p8 do not appear markedly shorter than p9. Current literature fails to depict how richly colored and uniformly dark brown these older subadults can be. Juveniles and younger immatures (first through third plumage cycles) are normally the only nonadult plumages illustrated, with their extensive white mottling and speckling. Older adults, the most widely illustrated plumages, appear so bleached in head, breast, and mantle that the species was once called Gray Sea Eagle. This photograph was taken at Haderslev Fjord, Denmark 9 September 2011. We speculate that this bird is five months older than the Derby Hill eagle, but it is possible that it is seven months younger. *Photograph by Torben Andersen.*





Figure 19. This White-tailed Eagle was aged by local hawkwatchers as a fourth- or fifth-cycle bird. Note that although its body plumage suggests an older adult, the long tail, showing dark-edged rectrices, is still that of an immature (see Probst and Struwe-Juhl 2009). Most birders who have observed the species in Alaska have seen old birds, in which the tail is quite short by comparison. This photograph was taken at Tystrup-Bavelse Søerne, Denmark 4 December 2011. Photograph by Bente Holm-Petersen.

The comparative wealth of resources and technological advances in 2013 versus 1993 have permitted us to look back with critical distance on our notes, and the evaluation of those notes by others, and we have been surprised to find that some past claims about sea-eagle plumages require revision, in light of new information and the abundance of photographs from across Eurasia. With the recent publication of authoritative information on known-age White-tailed Eagles, especially from northern and central Europe, we are more able to confirm our earlier, piecemeal identification and make an unequivocal identification of the Derby Hill eagle as a White-tailed. In particular, an article on individual and geographic variation in the plumages of White-tailed Eagle by Probst and Struwe-Juhl (2009) is very useful in resolving the points of confusion about the Derby Hill eagle, most of which have to do with the combination of dark plumage (lacking white below), yellow bill, and nonadult tail pattern (see NYSARC 2006). Probst and Struwe-Juhl use “first plumage” in referring to juvenal plumage, so their terminology corresponds, numerically, to the modified Humphrey-Parkes system discussed above, though they do not use the term “cycle.”

Probst and Struwe-Juhl (2009) note that in White-tailed Eagle “[t]he tail pattern in fourth plumage is extremely variable. There are dark-tailed variants such as seen in all previous plumage stages. One sees apparent ‘adults’ with immature tails. [Cf. Figure 19.] We are aware of no fourth-plumage White-tailed Eagle with a pure

white tail, lacking at least brownish-black tips.” Forsman (1999) is in agreement: “Tail variable and can be either largely dark or largely white.” Indeed if one spends just a few hours looking at images of White-tailed Eagles on the web, the variability of tail patterns vis-à-vis other aspects of plumage and soft part development



Figures 21, 22. In all plumages, the wing shape of Steller's Sea-Eagle is distinctive. The first-cycle bird (left; 12 February 1996 over Lake Funen, Japan) already shows a very pale bill and mostly white tail; the distribution of white in underwings is typical for the age, but some are much darker, with white limited mostly to coverts. The apparent second-cycle bird (right) has a huge yellow bill and mostly white tail that shows the distinctive diamond shape; its tail coverts have begun turn white as well (3 December 2009 over the Namgang River near Jinju, South Korea). Tail shape varies among individuals, and molt also influences tail shape in this species. Compare Figures 25–28. Photographs by Jon Hornbuckle (left) and Mike Friel.

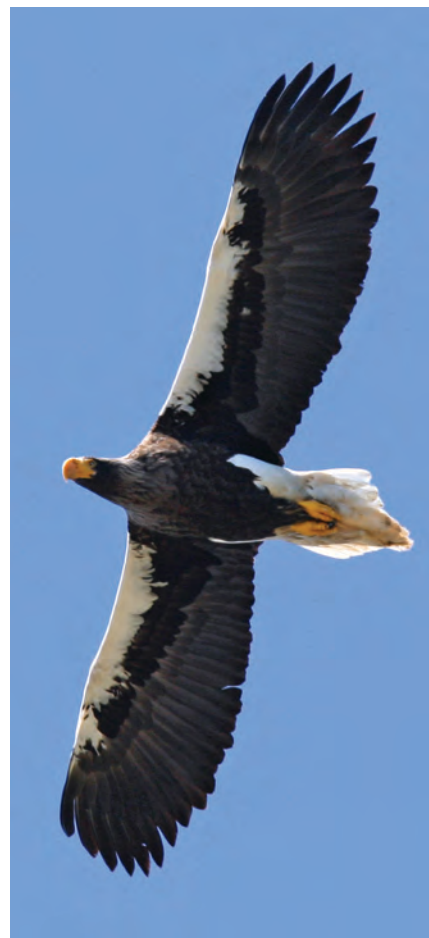


Figure 20. This photograph illustrates well the classic shape of adult Steller's Sea-Eagle in relaxed soar, showing paddle-shaped wings—very full through the central and outer secondaries, narrower in the hand, and appearing pinched at the base. This bird was photographed near Talan, Russia 24 June 2008. Photographs by Lars Petersson/www.larsfoto.se.



Figures 23, 24. Both in powered flight and in glide, Steller's Sea-Eagles show narrower hands than White-tailed, with gradual shortening from p7 to p5 noticeable in many cases. The appearance of narrow hands, however, probably results more from the comparatively long inner primaries and outer secondaries, which make the hand appear less broad than White-tailed, even appearing somewhat pointed in many individuals. Steller's typically shows six distinct outer primaries, one fewer than White-tailed. On occasion, p4 almost appears distinct, like a seventh "finger" in Steller's, especially when birds are making a rapid downward wing stroke or course change, with wingtips flared. But in virtually every photograph we have examined, six distinct primaries are discernable, while the next inner primary (p4) forms part of the group of inner primaries (p1-p3). Unique among sea-eagles, Steller's normally has fourteen rectrices, two more than White-tailed and other *Haliaeetus*. These are often more easily counted in Steller's that have dark-tipped rectrices. Note that adult and subadult Steller's Sea-Eagles, of both morphs, have white or mostly white tail coverts, whereas adult and older subadult White-tailed Eagles have brown tail coverts. From above, the white of the coverts extends to the lower rump area (Figure 24, right). These birds were photographed at Kurile Lake, Southern Kamchatka Wildlife Refuge, Russia 3 February 2007 and near Talan, Russia 24-25 June 2008. Photographs Sergey Gorshkov/Minden Pictures (Figure 23) and by Lars Petersson/www.larsfoto.se (Figure 24).



is high and apparently greater than the similar variability seen in Bald Eagle. In agreement with earlier publications on White-tailed Eagle and congeners, Probst and Struwe-Juhl (2009) note that the tail length gradually decreases from first plumage (rectrices longest and typically mostly dark, but rarely mostly white) to definitive adult plumage (rectrices shortest and all white); the transition may take up to 12 years in European birds. And so the shape and pattern of the Derby Hill eagle's tail is consistent with a subadult White-tailed Eagle having mostly brown plumage, yellow bill, and a tail that retains brown, as seen in Plate 1 of Probst and Struwe-Juhl (2009) (see also Figures 12-18).

As do earlier authors, Probst and Struwe-Juhl (2009) note that wing shape gradually changes with age, as the longer first-cycle (juvenile) secondaries are replaced by shorter ones, giving the older birds that are not in heavy or obvious molt a neater, more even-looking trailing edge in the wing. The Derby Hill eagle showed broad wings with straight (rather than bowed or ragged) trailing edge, the shape expected in an older subadult in spring that had replaced most or all of its first-cycle secondaries. The photograph of the bird in glide shows a slight bulge in the inner-central secondaries, but we believe this appearance is caused by the wings being drawn in rather than a set of longer secondaries there.



Figures 25, 26. These Steller's Sea-Eagles are beginning second plumage cycle, aged by the two generations of remiges, the distinctive patterning of white in the base of the primaries and their coverts, the extensively white tail (dark brown limited to the tips), mostly dark tail coverts, and the mostly yellow, even orangish bill (Morioka 2000). In Steller's, the tail becomes mostly white very early in the bird's life compared to most White-tailed Eagles, and birds in the first plumage cycle often have mostly white tails. When the tail is fully fanned, the shape recalls may recall that of a parrot (Figure 26). Counting of rectrices is often possible with a good photograph (here 14 rectrices, two more than White-tailed). In all plumages, the distinctive wing shape is discernable, even in molting individuals. While younger White-tailed Eagles have rectrices that are often edged all the way around in dark brown, with white interiors, younger Steller's Sea-Eagles have rectrices that are mostly white with dark tips. Figure 26 shows the slight dihedral of a Steller's in direct flight with wings fully outstretched. These birds were photographed near Talan, Russia 24-25 June 2008. Photographs by Lars Petersson/www.larsfoto.se.

Probst and Struwe-Juhl (2009) summarize the fourth plumage as follows. "White-tailed Eagles in the fourth plumage already have many adult characters. From a distance, one often sees just a *uniformly brown, yellow-billed bird*, recalling the plumage of the adult. With closer views, the following differences are usually readily apparent: 1) *The body plumage is so uniformly colored that even the head is not set off as paler than the rest of the body*, as normally is the case in adults. 2) It is possible that in the coverts of the flight feathers, and in the underparts, there can still be a few stray paler feathers. 3) In flight, fourth-plumage birds still show pale axillaries and a few pale feathers in the underwing coverts; in specimens, for instance, one finds traces of immature plumage. 4) At this age, the bill and eye are pale yellow. *The tip of the maxilla almost always shows a dark patch, but the bird will look yellow-billed when seen in the distance*" (italics ours).

On the matter of assigning an age to an eagle based on its plumage aspect, Probst and Struwe-Juhl (2009) are emphatic: "In the fourth plumage, the molt is so variable that we are not able to describe any single characteristic by which this plumage may be identified in

the field. This is regrettable, as birds in their third plumage sometimes cannot be safely distinguished from those in their fourth plumage. Observers of apparent fourth-plumage birds have no alternative but to label them as birds 'showing characters of fourth plumage,' knowing well that some such individuals could be a year younger. Indeed, the distinctions between birds in fourth plumage and older birds (fifth plumage and older) are not always clearly definable. White-tailed Eagles in the fourth plumage should be simply called 'subadult'" [English 'subadult' in the original; all translations ours].

There is little discussion of plumages after fourth cycle, other than to acknowledge that some birds in their fifth plumage cycle birds look very similar to fourth-cycle birds (cf. Figures 18, 19), while others already appear to have acquired definitive plumage. Of course, a similar pattern of variable plumage maturation occurs in Bald Eagles (Clark 2001, Pyle 2008). William S. Clark points out, based on his field studies, that in fact many White-tailed Eagles in their fourth plumage cycle frequently "show variable or dark brown axillaries, not white axillaries," as we have confirmed in investigating photographs of known-age birds and of birds that can be aged

by molt (e.g., Figures 14, 16, 17).

As studies of known-age birds confirm, aspects of plumage (in tail, body, wing, head) and of soft parts (eye and bill color in particular) may differ markedly between White-tailed Eagles of the same age—and it is clear that these aspects do not co-develop in a uniform or consistent manner. One often sees images of individuals that appear to combine aspects of multiple plumage-types, including very young birds with bright yellow bills, though these appear to be less common than very young Steller's with bright yellow or orange bills, at least based on our review of available images.

Given what we now know about variation in subadult White-tailed Eagles and Steller's Sea-Eagles, it is possible to identify the Derby Hill eagle as a White-tailed Eagle in its fourth plumage cycle, that is, a bird in its fifth calendar year (hatched in 1989). Although the bird's caudal projection perhaps points toward a younger individual, the straight trailing edge to the wing would seem very unlikely in a third-cycle bird, which would, probably even in spring, show some unevenness in the trailing edge of the wing, producing a more bowed or uneven shape overall (cf. Figures 10, 11). White-tailed

Eagles in their fourth plumage cycle, and possibly even some late in their third, can show uniformly brown plumage in body and wings, contrary to past assumptions. William S. Clark (in litt.) also points out that, “in any case, small amounts of white in a dark plumage cannot be seen at a distance” (cf. Figure 17).

In 1993, as now, we ruled out Steller's Sea-Eagle for the following reasons:

- 1) In all plumages, Steller's have wings that are very distinctively shaped along: pinched at the base, bulbous through the center, and rounding or narrowing at the outer primaries (Figures 20-28); the Derby Hill Eagle did not show such a wing shape, and even with wings partly drawn in, in glide, the large outer portion of the wing was evident (frontispiece); with wings fully outstretched, three observers sketched the bird as having broad, boxy wings of even width along their length (Figures 1-3);
- 2) Multiple observers counted seven distinctly separate outer primaries on the Derby Hill eagle; although some Steller's do seem to

have a semi-distinct “seventh” primary (p4), similar to some White-taileds, almost all that we have studied in photographs do not (Figures 20-28);

- 3) Plumages and soft parts of Steller's, like those of White-tailed, vary considerably, with almost all elements of plumage and soft parts having the potential to be somewhat advanced or retarded compared to most individuals in the same age class; however, Steller's show white in the underwing coverts, upperwing coverts, and tail through virtually every plumage, with even very dark birds showing some white (Figures 27, 29), and most birds showing extensive white in the tail very early (by the second plumage cycle);
- 4) A large sea-eagle showing a fully yellow bill, no white in body plumage or wing coverts, and no trace of molt or unevenness in remiges (straight trailing edge of the wing) is an older subadult; older subadult Steller's show mostly white tail coverts and tails, unlike the Derby Hill eagle, which showed uniformly

dark brown tail coverts and dark-edged rectrices, a pattern unknown in Steller's.

- 5) All observers agreed that the bird glided on perfectly flat wings, lacking any dihedral; Steller's typically shows moderate to strong dihedral in soaring or gliding flight (Figure 26; Wheeler and Clark 1995).

The presence of emarginations in the outer primaries of large soaring birds is most easily discerned by examining good photographs of birds in flight. Emarginations are obvious narrowings of the distal portion of the primary, usually along the outer web in large raptors, and contribute to the appearance of distinct “fingers,” as the separate outer primaries are sometimes called by hawkwatchers. The location on the remex where the web emarginates abruptly is sometimes called a notch (Campbell and Lack 1985) (see Figure 10). Typically, however, hawkwatchers studying sea-eagles are not looking for notches or emargination specifically but rather the appearance of segregated or distinct primaries when the bird is in full soar. The



Figures 27, 28. These photographs of Steller's Sea-Eagles provide an instructive contrast between a darker immature and a lighter immature. The lighter individual (Figure 28) appears to be in its third plumage cycle (and was aged in the field as such), while the darker bird appears to be in its second plumage cycle, based on the more restricted progression of molt, to p4 only. The younger, dark bird still has dark tail coverts (cf. Figure 29), whereas the older bird's coverts have extensive white (cf. Figure 22). Edelman (1984) notes that White-tailed Eagles have four distinct “molt units” in the secondaries. According to Morioka (2000), two of the molt units in the secondaries of Steller's are located very near the base of the wing, with molt occurring outward from s15 and inward from s16. Thus the appearance of a wing that seems “pinched” at the base is exaggerated still more during molt in these units (Figures 27, 28). As in adults, the even curves of the trailing edges of the wings are graceful and gradual, ending in a rather narrow, almost pointed hand. This wing shape, compared by some observers to “two swags of bunting,” is seen only in Steller's. These photographs were taken near Talan, Russia 24-25 June 2008. Photographs by Lars Petersson/www.larsfoto.se.

Derby Hill eagle showed seven distinct outer primaries, typical of White-tailed, not typical of Steller's (in which p4 rarely appears set off from or different in shape from p1-3), and not observed in Bald Eagle. Had the Derby Hill eagle displayed a distinctive "paddle-winged" flight silhouette, its identification as Steller's would almost certainly have been immediate, as that shape was very well depicted in field guides of the day. Seen well, a Steller's should be relatively straightforward to identify in almost any plumage, though a study of plumage is just as critical as an evaluation of structure.

Authoritative sources on molts and plumages in Steller's were few in the twentieth century, with Dement'ev et al. (1966) providing the most detail. That source, like others of its time, incorporates molt data from captive individuals, but the information accords generally with data on molt in free-flying Bald and White-tailed Eagles. Dement'ev et al. (1966) describes "first (juvenile)," "second-year," "third-year," and "fourth-year (definitive)" plumages in Steller's, with most molt of flight feathers occurring between spring and fall. Of the second plumage, they note: "tail and large wing feathers contain more white mottling; side rectrices with brown occupying tip of feather and small areas at base, as well as edge of external vane; iris and beak as in nest plumage." In third plumage, they indicate: "general coloration of wings, body and neck dark brown with bronze cast, forehead occasionally white mottled; rectrices white, irregularly black-speckled at margins of feathers; tail coverts white with brown mottling; some lesser and median wing coverts white; iris dark brown; beak yellow, with small dark patch at end of upper mandible." The plumage that follows this is the fourth, identified as definitive; thus, at no point after first (juvenile) plumage cycle is the tail mostly dark—rather, it is mostly white—nor are the underparts solidly dark.

Later authors on Steller's Sea-Eagle (Wheeler and Clark 1995, Morioka et al. 1995) mention a fifth plumage cycle prior to definitive plumage, and Morioka (2000) provides much greater detail about the appearance and molts of remiges, but general descriptions of plumage progression are consonant with those of Dement'ev et al. (1966). Importantly, Morioka (2000) illustrates the distribution of white in the bases of the primaries and their underwing coverts in the first three plumage cycles; the white is replaced by dark brown in the fourth winter, by which time the hallmarks of definitive adult plumage are present: white rectrices and coverts, and white upperwing and underwing coverts (marginal, lesser, and some median), and white thigh and flank feathers. Thus, nothing published on Steller's Sea-Eagle, and no photograph that we



Figure 29. Dark-morph female Steller's Sea-Eagle at Tierpark Berlin-Friedrichsfelde, winter 2001-2002. This bird exhibited typical Steller's pre-definitive plumages until late in 2008, when it became clear as she completed molt into definitive plumage that she was of the dark morph. Because both parents were typical (light) Steller's, and because her offspring have thus far also been typical, it is clear that dark Steller's—previously considered either a full species or subspecies—constitutes instead a morph. Like the other immature Steller's presented in this article, this bird showed white in upperwing and underwing coverts and in the tail from first plumage through all subsequent immature and subadult plumage cycles, according to Martin Kaiser, the Curator of Birds, with quite extensive white in the tail and tail coverts by the second plumage. A photograph of this bird in third plumage cycle appears in Kaiser (2010), and there are now many photographs of the bird in definitive plumage posted on the web. Photograph by Martin Kaiser.

are able to locate, suggests that Steller's could have a plumage like that of the Derby Hill eagle. Even the darker nonadult Steller's Sea-Eagles show some white in the underwing and/or in the body plumage (e.g., Figures 27, 29) and typically white in the tail, with only dark tips rather than dark edges of remiges.

For years, however, the question of the dark subspecies, or type, of Steller's has lingered, and one observer at Derby Hill thought the bird could have been such; that assessment was reviewed and not accepted (NYSARC 1995). In 1993, we were aware of the original description of dark Steller's as *Haliaeetus niger* by Heude (1887) and of its subsequent treatment as a subspecies of *H. pelagicus* (e.g., Austin 1948), although authors as early as Vaurie (1965) suggested that it was instead simply a dark morph. In 1993, we were also aware that this dark type had not been reported anywhere since the early or mid-twentieth century, with a few possible sight records from the Korean Peninsula in 1968 (Gore and Won 1971) but none anywhere since that time and still no reports through early 2013 of which we or people

regularly working with the species are aware. Ferguson-Lees and Christie (2001) suggested that *niger* was extinct. In 1993, we found little in the literature on dark Steller's, in which adults lack white in the upperwing and underwing coverts, flank and thigh feathers, and forecrown. The specimen record, so far as we could determine, contained only adults labeled as "*niger*"; it appeared then that no specimens of pre-adult plumages, if they existed, were labeled as such. We deduced in 1993 that a dark Steller's advanced enough to have an even trailing edge to the wing and no dusky aspect to the maxilla should certainly have much more white in the tail than the Derby Hill eagle (with brownish areas, if any, confined to the tips of the rectrices) and should in any case show typical Steller's wing shape and bill shape.

Remarkably, the set of mysteries surrounding dark Steller's Sea-Eagle has been solved just recently, with the discovery in 2009 that a female Steller's held at Tierpark Berlin since 2001 (Figure 29) was in fact a dark bird—a fact established only after the bird attained definitive adult plumage in her eighth year (Kai-

ser 2010). The parents of the dark female were both typical Steller's. The dark female, paired with a typically plumaged Steller's that attained definitive adult plumage in his fourth year, has been producing young each year since 2009, and those offspring that have attained definitive adult plumage have so far been typical (that is, light-morph) Steller's in all respects. This confirms that "niger" refers to a dark morph rather than a species or subspecies (Kaiser 2011).

According to Martin Kaiser, Curator of Birds at Tierpark Berlin (in litt.), the staff was very surprised that the female Steller's turned out to be a dark morph because the bird's pre-adult plumages were like those of light-morph Steller's, from its hatching 22 April 2001 through all pre-adult plumages. By June 2003, the bird, then in second plumage cycle, had attained mostly white rectrices, but it continued to show white in nape, breast, tertials, axillaries, subhumeral coverts, upperwing coverts, and underwing coverts (compare Steller's in third plumage cycle depicted in Clark [2008]). These white markings were lost only with attainment of definitive adult plumage in winter 2008-2009 (M. Kaiser, in litt.). Based on the study of this bird, then, it would seem very unlikely that an older subadult dark-morph Steller's Sea-Eagle would exhibit uniformly dark tail coverts, as the Derby Hill eagle did, much less dark-edged rectrices, a pattern not documented in Steller's.

Plumage variations of nonadult dark-morph Steller's are not known, but there is no informa-

tion now to suggest that they differ from light-morph Steller's of comparable ages. Eugene Potapov, who has spent the past 25 years studying the species in the field, has never observed any Steller's at any age that is darker than regularly illustrated; moreover, the photographs of the darkest young Steller's that he and his colleagues have observed in Russia (<<http://www.potapov-nature.com/sse/original/Talan2.jpg>>) thus far show extensive white flecking above and almost pure white tails in their first plumage cycle; many such birds are rather blackish overall. Birds in similar plumage have also been held in European zoos, and photographs of several such individuals are posted on websites. We have spent a great deal of time trying to locate a photograph of a Steller's Sea-Eagle that approaches the appearance of the Derby Hill eagle, but we have had no success. A hybrid of Steller's with Bald Eagle (Clark 2008) should be considered as well, but such a bird as an older subadult would be most unlikely to be uniformly dark brown in wings and body—in other words, would surely show some white in the underparts and underwing, as in the parent species.

Discussion

Resources and tools that birders now take for granted—digital cameras, cellular telephones, Internet (providing access to information and contact with observers around the world)—were all in development but essentially unavailable in 1993. As one observer commented: "In

the twenty-first century, the Derby Hill eagle would have been seen by thousands around the world and would have been identified by sunset, though there would have been the usual abundance of misinformed comments, too." Birding, and the distribution of information and images, have changed massively since the early 1990s, but the art and science of raptor identification were both well underway then, and adherents had already developed a relatively sophisticated vernacular to describe plumage and structure (Dunne et al. 1988), even if terminology for molt and understanding of plumage progression had yet to be more fully explored, especially in larger species like sea-eagles, whose molts, and the plumages that result from them, are both complex and variable.

Initially, when reading field notes and photographs, several European reviewers stumbled over language they found to be at odds with their experience of White-tailed Eagle, especially the description of the large bird with a large yellow bill, which suggested Steller's to them rather than their familiar White-tailed. We were concerned, on receiving the first few responses, that perhaps the language in our notes had tended too much toward stressing the differences from Bald Eagle; we were composing fresh impressions, using the hawkwatching lingo of the day and of course using Bald Eagle as the chief point of comparison. Bald Eagle is, of course, not part of the Eurasian hawkwatching repertoire, and our field notes were partly intended to make clear that Bald Eagle was not

Figure 30. White-tailed Eagles in northerly climes average larger than those that breed farther south, and females in northern populations often have strikingly large bills, as this subadult with mostly brown plumage, pure white tail, and brandy-colored eye at Flatanger, Norway 8 March 2011. Heavy-billed eagles are also seen in the British Isles, though many of these birds have been re-introduced from populations in Norway or are the progeny of such re-introduced birds. Photograph by Ole Jørgen Liødden.



a candidate for consideration. We also considered the possibility that the bird's dark plumage made it appear somewhat larger than it actually was (see, e.g., Kaufman 2011, p. 35).

But it is certainly possible that our impressions of the Derby Hill eagle's large size and large bill—impressions shared by everyone who observed the bird—were not overstated. Rather, the bird may indeed have been extremely large in comparison to Bald Eagle, as White-tailed Eagles from northerly populations, particularly females, certainly are (Figure 30). Greenland birds in fact overlap in some measurements with Steller's (Salomonsen 1950, 1979). The record for greatest wingspan in White-tailed Eagle, some 253 cm, was recently documented, a very large-billed bird near Nuuk, Greenland in 2011 (Andersen 2012; cf. Figure 31). The maxi-

mum wingspan for Steller's Sea-Eagle is generally given as 240–245 cm (e.g., Wheeler and Clark 1995, Ferguson-Lees and Christie 2001), though exceptional wingspans of 280 cm (Meyburg 1994) and 287 cm (Pacific Institute of Geography 2006) are reported. Eugene Potapov (in litt.), however, notes that measurements of Steller's Sea-Eagles are not routinely taken in Russia because of the challenges in getting clean, consistent measurements in the field on these large birds. Greenland White-tailed Eagles have bills that are likewise sometimes strikingly large, recalling Steller's and perhaps nearly as massive in some cases, if not as strongly arched in the maxilla. Edelstam (1984) indicates that *groenlandicus* White-tailed Eagle molts more slowly than Scandinavian birds of the nominate subspecies, but plumages and molts of Green-

land birds have not yet been studied in detail as European birds' have been through color-banding (Helander 1990, Struwe-Juhl and Grünkorn 2007). According to Frank Wille (in litt.), who has studied White-tailed Eagles in Greenland for 50 years, the birds there are still very unapproachable there because of intense persecution by humans. There may well be differences in plumage aspects between *groenlandicus* and the nominate subspecies, especially if maturation and molts progress more slowly, and perhaps more variably, in the larger *groenlandicus*. European White-tailed Eagles may take twelve years to attain the paler head, breast, and upperparts associated with definitive plumage, so it stands to reason that some Greenland birds could take longer still.

In the Nearctic region, White-tailed Eagle is

Figures 31. White-tailed Eagles in Greenland are substantially larger than those in the rest of the species' large Eurasian range and have traditionally been recognized as subspecies *groenlandicus*, and although genetic studies have not shown clear support for this status, a recent study indicates a very close relationship between populations in Iceland, Greenland, and Norway (Hailer et al. 2007). This older female White-tailed Eagle in active molt of outer primaries is one that researcher Frank Wille has studied since 1985 in the Nuuk District of Greenland, here photographed 12 July 2008. Almost as impressive as the large proportions of Greenland birds is their copious body plumage, including tail coverts and thigh feathers, typical of large birds that live year-round in high-latitude locations. Photograph by Frank Wille.



a regular resident in Greenland, where populations have increased since the middle of the twentieth century (Hansen 1979, Kampp and Wille 1990). In Alaska, one pair has nested occasionally on Attu, in the westernmost Aleutian Islands, from at least the late 1970s through at least 1996; the state has records totaling not fewer than 19 individuals of the species (Tobish and Balch 1987; T. Tobish, pers. comm.). Farther south, a specimen of a male White-tailed Eagle in its first plumage cycle was collected on Vancouver Island, British Columbia 18 March 1898 (Bishop 1905). That specimen has been considered lost (Campbell et al. 1990), but much of Bishop's collection went to the Field Museum of Natural History in Chicago (Howard 1951), and that institution holds at least one specimen (FMNH 130651) that matches date and location of Bishop's White-tailed, a specimen labeled a Bald Eagle of subspecies *washingtoniensis*.

Eastern North America has fewer records of White-tailed Eagle. In northeastern Canada, Samuel Weiz reported the species breeding at Okak, Labrador during his seventeen-year mission there, which began in June 1850 (Weiz and Packard 1866). Farther north, in what is now known as Nunavut, ornithologist Ludwig Kumlien (1879) observed a White-tailed Eagle along the Cumberland Sound of Baffin Island in October 1877 and recorded a nesting pair there in spring 1878; Kumlien was familiar with the species from Greenland. Very nearby, at Pangnirtung (Panniqtuuq), Baffin Island, a local constable described to Arctic explorer J. Dewey Soper a White-tailed Eagle seen in 1928 (Soper and Wilson 1928). Godfrey (1979) considers some of the Canadian records "convincing, [but] unfortunately none is completely satisfactory." There is a remarkable report of a White-tailed Eagle seen from a ship far out in the North Atlantic Ocean about 1200 km east of Battle Harbor, Labrador 16 August 1933 (Hausman 1966). Massachusetts has three records of single White-tailed Eagles, from 14 November 1914 (captured offshore), 10 February 1935, and 15-30 January 1945 (Veit and Petersen 1993). These eastern North American records are from sites variously 550-2600 km from southern Greenland. At its closest point, Greenland is 2674 km from Derby Hill, about 75 km closer to Derby Hill than Derby Hill is to Brownsville, Texas.

Likewise quite far from continental landmasses, a White-tailed Eagle in definitive plumage frequented the Hawaiian Islands from 30 December 2006 through about 7 July 2007 (Pyle and Donaldson 2007, Pyle and Pyle 2009, Zaun 2009). The Alaska and Hawaii records surely refer to the smaller nominate subspecies, whereas the Massachusetts, Canadian,

and Atlantic Ocean records most likely refer to the larger *groenlandicus*. Records of White-tailed Eagle from offshore sites closer to Europe (e.g., Ireland, Faeroe Islands, Canary Islands, Balearic Islands, Malta, Cyprus, Svalbard, Jan Mayen) are certainly of the nominate subspecies, which is known to wander widely, particularly the younger birds, which have reached the Middle East (Saudi Arabia, Lebanon, Israel, Palestinian Territory), northern Africa (Tunisia, Egypt, Algeria, Morocco), and southern Asia (Bangladesh, Thailand, Myanmar, Taiwan, Okinawa Islands) (Azzopardi 1978, Tetsuo 1979, Bergier and Thévenot 2010, BirdLife International 2012a). Satellite tracking of White-tailed Eagles across the species' enormous range confirms the strong tendency to wander in younger birds; similar satellite tracking of Steller's Sea-Eagles shows mostly predictable movements between summer and winter range, though one study tracked an immature into the interior of China (McGrady et al. 2003), and vagrant Steller's have been recorded from Taiwan (BirdLife International 2012b), the northwestern Hawaiian Islands (Balazs and Ralph 1979), and Alaska (records totaling seven individuals; T. Tobish, pers. comm.). The world population of White-tailed Eagle is estimated at upwards of 39,600 birds and despite many obstacles is increasing; the population of Steller's is estimated at no more than 5100 individuals and is decreasing because of overfishing of prey species, lead poisoning (from ingestion of lead shot in carrion), industrial development, and industrial pollutants, problems that also affect White-tailed Eagles in some parts of their range (BirdLife International 2012a, 2012b).

In 2013, the information environment is far richer than it was in 1993, and communication with ornithologists and birders around the globe is far less arduous, thanks to technological advances. Our understanding of plumage variation in sea-eagles has thus increased considerably in the past ten years, but there is surely still more to learn. While we have been immersed in the minutiae of molts of sea-eagles, the hawkwatching pendulum in North America has swung decisively back toward identification by shape and flight and behavior (e.g., Liguori 2005, Liguori 2011, Dunne et al. 2012, Crossley et al. 2013), with the express purpose of simplifying field identification and involving more people in the appreciation and conservation of birds of prey. We think that the structure alone of the Derby Hill sea-eagle indicated White-tailed Eagle, but that identification would have remained conjectural without careful documentation of the bird's plumage and soft parts, which indicated White-tailed Eagle, very probably a bird in its fifth calendar year.

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