In Praise of the Rectrix

Feather birding with a point-and-shoot

Birds have feathers, something we all knew before any one of us ever self-identified as a birder. If we stuck with it for a while, if we advanced as birders, we learned that discrete tracts of feathers, indeed individual feathers, might be useful, even indispensable, in bird ID. An emarginate primary here, a fringed tertial there; retained juvenile secondaries on *this* bird, replaced formative greater coverts on *that* one—those feathers and others like them could make all the difference, with apologies to Ogden Nash, in distinguishing between the common chickadee and the migrant alouette from Picardy.

It's not true. I don't mean feathers aren't important. I mean we didn't *really* identify birds that way. Okay, sure, field guide authors and bird illustrators did it that way. But the vast majority of us aren't bird book authors and bird illustrators. Julie Zickefoose, who happens to write books and paint birds, was once asked, "How do you paint a feather"? Her answer: "Unless you're talking about the plume sticking out of a California Quail's forehead, I don't usually paint *a* feather. I try to paint masses of them, in convincing blocks." She elaborated: "With all due respect to Basil Ede, who gave loving treatment to each individual feather, I see birds as smooth conglomerates of feathers, and I think less is more where painting them is concerned." Julie's very best paintings were, she let on, the ones that are not selfconscious, that go fast, that don't have many feathers in them."

Julie offered that assessment in a March 2010 interview in this magazine, and I think she was speaking for so many of us, although in more formal language, who were birding at the time. Sure, some of us had access to individual feathers way back then: We visited museums, we volunteered at banding stations, we sometimes picked up dead birds along roadsides and beneath windows. I know Julie had access to those resources. (And to be clear, Julie absolutely knows feathers. I recently heard her give a talk that went into astonishing detail, not only feather by feather, but actually feather part by feather part!) And I know Peter Pyle, who graciously read a draft of this essay, has always had access to feathers. But most of us, realistically speaking, did not.

Until now.

I've said it before. I'll keep saying it. The proliferation of point-and-shoot digital cameras has revolutionized birding and nature study. Can I let you in on a dirty little secret?—I haven't hoisted a scope-and-tripod rig in over a year. But I photograph birds every single day. And when I review the photos, another daily activity of mine, I look at feathers. And that gets me to thinking about taking photos of birds specifically for the sake of feathers. Call it a vicious circle of enlightenment. Call it a mixed metaphor. But recognize this for what it is: a substantially revised approach to the engagement and appreciation of birds and nature.

Jonathan Alderfer, like Julie and Peter a gifted creator of influential content for birders, wrote in the Aug. 2004 *Birding* that field guide illustrations "exert a strong influence over our perception of birds in the field." No question about it. But Jonathan penned those words at the dawn of the digital photography revolution. I can't begin to tell you how many times in the past year I've seen field ID go like this: cool bird spotted → digital photo obtained → in-field upload to iNat → ID determined on the spot. Later: discussion, admiration, and learning on social media. Does the preceding seem "good" to you? "Bad" to you? That's not my point. My point is, It's really happening, more and more, and I can't see ID-by-screen slowing down or reversing.

Besides, it powerfully affirms Jonathan's thesis—namely, that we see birds in the field according to how they are depicted in our resources for learning. I used to look at "smooth conglomerates of feathers," "masses of them, in convincing blocks," at birds "that don't have many feathers in them." But I use a point-and-shoot digital camera now, and I find myself, in a certain sense, looking at feathers for the first time in my many decades as a birder.

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Focus on the Rectrix

I totally get that most of us, myself very much included, are inclined to look at birds' exquisitely feathered heads or complexly structured wing feathers. But doing so is a little bit like endeavoring to learn calculus before algebra. So I have a gentle exhortation. Next time you're out with your point-and-shoot, see if you can get photos of a bird's *tail*, simply built, readily seen, easily analyzed. I'm talking about an *individual* bird's tail, photo'd ideally both from above (dorsal aspect) and below (ventral aspect). The avian tail is, on the whole, a remarkably consistent or "conserved" trait.

The tails of most birds consist of only 12 feathers. Like, that's the entire tail! Compare that with a dog or a cat. I haven't Googled it, but dogs' and cats' tails have bones and muscles and other tissues and, well, a lot more than 12 hairs. By the way, the bird with arguably the most excellent tail of all, the Marvelous Spatuletail, *Loddigesia mirabilis*, of Peru, has the fewest number of tail feathers of any bird on Earth: only four! I'm still trying to wrap my mind around that…

Anyhow, you really can see individual tail

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Featured Photo–Canada Jay. Boulder County, Colorado; May 29, 2020.
Photos by © Ted Floyd.

All North American passerines, including Canada Jays, have 12 rectrices, and if there are any passerines in the world that have another number (aside from the anomalous individual with 13 rectrices), I'd like to know about it! As Ted mentions, those studying molt assign numbers to each rectrix "distally" on either side of the tail—or, if you prefer to reference the entire tail, "bilaterally." Thus, in the image of the tail's upper surface, the two rectrices on top are the left and right R1s, respectively, and the shortest lateral rectrices on the underside are the right and left R6s, respectively. Note the switch in chirality: We number rectrices from the bird's perspective, similar to how we refer to our own hands and feet.

When I look at a bird's tail, I immediately ask three questions: (1) Are the rectrices in molt? (2) If not, are they all there? And (3) can we use their shape and degree of wear to determine their feather "generation(s)," and hence the bird's age? The timing of molt in Canada Jays is surprisingly early for a bird of northern climes. In our Boreal MAPS project, we see the inner primaries of adults starting to molt as early as late May, and the rectrices, beginning with the R1s and proceeding bilaterally, as early as mid-June. On Ted's jay, the gap between the longest secondaries and innermost visible primaries in the dorsal image looks suspiciously like active molt of inner primaries, but the presence of both R1s indicates that the rectrices are not in molt yet, as expected on the early date of May 29. Because birds frequently lose and often grow back their rectrices within a molt cycle, I like to count them all up to make sure I'm interpreting everything correctly, especially in the case of rectrix numbering. On the ventral image I can account for all of the rectrices on the bird's left side (right side from our perspective), but I only see five on its right side. It looks to me like there is a gap where the right R5 (penultimate) rectrix should be, indicating recent loss of this feather. There's an old term, "adventitious molt," for this phenomenon, but I don't like either word, the first being unnecessarily unfamiliar (pompous) and the second indicating a process that has nothing to do with it. Instead, I'll say something along the lines of "accidental feather loss."

Now to the most edifying question: What age is this bird? As with most North American corvids, no rectrices are replaced during the preformative molt (in the bird's first fall), and there are no prealternate molts (in spring). This leaves us with two choices: They are all juvenile, indicating a recent fledgling (hatch-year, "HY") or a one-year-old bird (second-calendar-year, "SY"), or they are all definitive basic, indicating an older adult (after-second-year, "ASY"). We can rule out an HY because, in May, such a bird would still have juvenile body feathers, blackish in this species, and the rectrices would look fresher than this, among other clues. To determine between SY and ASY, we look at rectrix shape and wear.

In most passerines, the shape of basic rectrices is broader and more truncate (less tapered) at the tip in adults than in juveniles. This is a result of a nestling's need to fledge as soon as possible, so the juvenile rectrices are grown quickly at the sacrifice of higher barb density. Adults molt during the leisurely period following breeding, usually in July–August, after the young of most species have departed but when there is still plenty of insect food around. Adults therefore grow higher-quality feathers, including broader rectrices. This intrinsic difference is usually most evident in the outer two rectrices (R5 and R6). Because of their lower quality, juvenile rectrices also wear at a much faster rate than basic rectrices; by their second summer (when they are about one year old), their feathers are often extremely abraded—and hence even narrower than when fresh. This difference is again most evident in the outer rectrices, which get the most exposure during the course of a plumage cycle.

We are not quite finished yet, however, as these two factors—shape and wear—always have to be analyzed in the context of the all-important *date* of the image. I get a surprising number of requests to evaluate images with no indication as to date—a non-starter for me in many instances. May 29 is close to the end of the plumage cycle for the Canada Jay. Thus, in any age class, the rectrices are more worn than in fall (following molt), especially for females, which do most of the incubation; repeatedly leaving and entering the nest adds to feather wear and tear. Based on both the broader shape to the outer rectrices (and also that of the unmolted outer primaries, but I'm not supposed to look at those) and only a moderate amount of wear to these feathers for late May, I'm completely confident that this is an adult (ASY).

—PP

Supplemental Photos–Western Kingbird. Laramie County, Wyoming; May 23, 2020.
Photos by © Ted Floyd.

Lots of birds show white in their outer rectrices. Within some species, such as *Setophaga* warblers, this varies by the age and sex of the bird, suggesting that it is a trait related to sexual selection. But in many other groups, including doves, sandpipers, woodpeckers, pipits, thrashers, longspurs, and sparrows, the amount of white in the tail does not vary much by age and sex, suggesting another reason for it. One hypothesis is that white in the tail is a defense mechanism to thwart predators. When a Sharp-shinned Hawk chases a Vesper Sparrow, for example, the former focuses on those white flashes in the outer tail of the latter; the sparrow then quickly and purposefully closes its tail when diving for cover, losing both the white flashes and the pursuing hawk in the process. The same adaptation presumably applies to cottontails, deer, and other mammals with white under-tails. Note that, in birds, this white can be at the tips or along the edges (the "outer web of the outer rectrix"), but it does not usually include the entire outer rectrix.

For some reason, the Western Kingbird, but not the other North American kingbirds, shows white edges to the outer rectrices, as is well noted in field guides and by lecturing field trip leaders. Is this more likely due to sexual selection or to predator avoidance? In considering this question, we ask another: Does the extent of white in this species vary by age and sex? The Western Kingbird shows complex molting strategies, including suspensions for migration and molting at special stopover locations. First-cycle birds undergo what we molt eccentrics call an "eccentric" preformative molt, whereby the outer primaries and inner secondaries are replaced while an inner block of these feathers (together referred to as the remiges) comprises retained juvenile feathers. On the bird here, careful evaluation of the right upper-wing secondaries and (the bird's) left under-wing primaries reveals what appear to be "eccentric molt limits," indicating an approximately one-year-old bird (an SY) on May 23. By the way, the fresher inner tertials, S8 and S9, are alternate feathers, which can be shown by both SY and ASY birds.

I've totally disobeyed Ted's injunction against mentioning wings, so I'll wrap up with this punch line: In this case, age doesn't matter! Most birds that undergo an eccentric preformative molt replace all rectrices during this molt. That is the case here, with both formative and definitive basic rectrices being equally fresh, broad, truncate, and patterned. Examining a large series of specimens, I have found no differences in the extent of white among juvenile, formative, and definitive basic outer rectrices of Western Kingbirds, or between males and females of any rectrix generation. So the answer may be related to predator avoidance. Why Western, but not other kingbirds? A question in need of future field experimentation.

—PP

feathers—and there just aren't many of them—on birds in your digital photos. The flight feathers of the tail are called *rectrices*, plural; any particular one is called a *rectrix*, singular. And with just a little bit of discipline, you can number them (from the inside out, R1, R2, etc.) and even say how old they are! What I'm going to do now is turn the proceedings to Father Feather himself, Peter Pyle. I've selected photos of three birds I encountered earlier in 2020, each bird showing the tail from below and from above. It will kill him, but I'm asking Peter to comment *only* on the birds' rectrices, their tail feathers. Age and wear, molt of course, R1–R6 (R1–R10, I guess, in the case of the merganser?)—anything.

Some of the content may be new to you. Speaking for myself, I learn something about feathers virtually every time I get an email from Peter. But don't obsess about the new knowledge. Instead, drink deep the big lesson that this stuff is learnable in the first place. You really can go out, take a picture—okay, a lot of pictures—of a picnic table jay or roadside kingbird or duck pond merganser, and see actual, individual, real-life feathers.

Peter, over to you…

Supplemental Photos–Hooded Merganser. Boulder County, Colorado; Apr. 10, 2020. *Photos by © Ted Floyd.*

When we look at ducks, we usually don't think much about their tails, although for those of us who age and sex them, there is a lot here to consider! And by "a lot," I also include the number of rectrices—usually 14–18, but up to 20 in mergansers, including, by my count, our subject bird (10 on each side). About 15 years ago, I had the distinct pleasure of flipping molt terminology in ducks on its head, much to the consternation of—and, in some instances, stubborn repudiation by—waterfowl biologists. By tracing the evolution of molts in geese and ducks, it becomes clear that the colorful winter and spring plumages of adult male ducks are the definitive basic plumage, while the dreary and brown summer ("eclipse") feathering represents the definitive alternate plumage.

Unlike the situation with puddle ducks and diving ducks, the rectrices are not replaced during the prealternate molt in mergansers, making analysis relatively straightforward. In our bird, all of the rectrices are of the same generation, without contrast in wear, which, if present, would indicate molt limits; this is especially evident in the ventral view of this bird's tail. Looking at the tail from the upperside, one might first wonder whether a central rectrix, appearing darker and fresher, has been replaced. But veteran rectrix scrutinizers know that first impressions often need confirmation. A closer look reveals that the darker stripe represents shadowing on the edges of two or more rectrices; otherwise, the feathers are of the same quality.

This merganser's rectrices are broad and truncate, especially the outer ones, as viewed from the underside. In waterfowl, juvenile rectrices have a distinct notch at the tip because duckling down clings to them, causing the tip of the shaft to break off after fledging. Does the lack of notched juvenile rectrices indicate an adult? Not so fast. Replacement of rectrices during the preformative molt in ducks is notoriously variable, ranging from two rectrices to all rectrices among individuals of most species. Could this be a first-spring bird (an SY) with replaced formative rectrices? To properly age this bird, we must, as always, consider all feather tracts. So, getting back to Ted's exhortation to "comment *only* on [these] birds' rectrices," I can never do this when aging a bird. I must, like Basil Ede, consider every single feather. This Hooded Merganser is an adult (ASY), not only because of the broad rectrices, but also because of the uniformly basic body plumage, the pattern to the basic tertials, and its general magnificence.

—PP