by Paul Hess

Flashy Foraging by Redstarts

Painted Redstarts have long delighted observers by flashing prominent white patches on their outspread wings and tail. O. W. Howard remarked in 1899 that the birds "seem to take pride in showing off their colors" (*Bulletin of the Cooper Ornithological Club* 1:63–65). He noted in passing that "now and then they will fly up to catch some insect, much after the manner of the flycatcher", but he did not relate the flashing to the flycatching. Joe T. Marshall Jr. called the display "typical feeding" in 1957 (*Pacific Coast Avifauna* No. 32), but neither did he comment on the flashes' function. Only rarely did anyone mention the display as a tactic to flush up prey, as did Jon L. Dunn and Kimball L. Garrett in *A Field Guide to Warblers of North America* in 1997.

Not until 1999 was the function explained in depth, when Piotr G. Jablonski demonstrated that the plumage pattern and the flashing behavior are closely linked to foraging success (*Behavioral Ecology* 10:7–14). The flashing patches scare hidden insects into escape-flight, during which the birds can easily see and capture them. Jablonski also found that the redstarts use the display efficiently, not randomly. When flashing, they typically scan branches above and in front of them where the white patches would be most visible to prey; in fact, 89 percent of insects were flushed from that direction in 52 chases Jablonski observed. When he dyed redstarts' patches black to match the rest of the wings and tail, the birds were significantly less efficient in flushing prey than when they had normal plumage.

The sprightly **Painted Redstart** is known for flashing the white patches on its wings and tail. Piotr G. Jablonski and colleagues have shown that this behavior is an effective foraging technique and is innate, not learned. *Cochise County, Arizona; May 2004. © Brian E. Small.*

Jablonski, Sang Don Lee, and Leszek Jerzak added an evolutionary dimension in 2006, reporting that the foraging technique is innate rather than learned by experience or by imitating parents or other birds (*Behavioral Ecology* 17:925–932). In an aviary designed to represent Painted Redstarts' natural environment, the authors tested hand-raised young birds that were never exposed to adult birds and that had no experience with escaping insects. Fledglings only 18–25 days old spread their tail in typical displays, even though the display was unrewarded because at that age the tail is not fully developed. The naïve youngsters behaved in exactly the same manner as did experienced, wild-caught adults tested separately.

Whereas Jablonski worked in Arizona, Ronald L. Mumme conducted research in Costa Rica using the closely related Slate-throated Redstart. In 2002 Mumme reported a link between tail flashing and foraging success in this species as well (*Auk* 119:1024–1035). With white outer rectrices artificially blackened, birds became significantly less efficient in flushing prey. In studies described in 2006 and 2007, Jablonski, Mumme, and several colleagues analyzed geographic variation in the amount of tail-white among different Slate-throated Redstart populations in Central and South America (*Evolution* 60:1086–1097; *Evolution* 2007 in press). Hypothesizing that the variation might be adaptive, the authors altered redstarts' tails in one geographic region to match those of other regions. They also studied responses of insect prey to models representing redstarts from various populations. The results suggest that the amount of white is indeed selected for optimal foraging in a particular region's prey and habitat characteristics. A Slate-throated Redstart's tail pattern evidently reflects exquisite evolutionary precision.

Migrants' Sleeping Behavior

Nocturnally migrating Swainson's Thrushes and White-crowned Sparrows can function satisfactorily for weeks at a time with only one third the sleep they receive during most of the year. Recent experimental studies show that these species are adapted to seasonally sudden and severe loss of sleep in a manner that humans can only envy.

In pioneering laboratory research published in 2004, Niels C. Rattenborg and six colleagues found that White-crowned Sparrows averaged 63 percent less sleep when in periods of migratory behavior than in nonmigratory periods (*PLoS Biology* 2:924–936). Infrared video, electrodes placed on the surface of the brain, and electrophysiological records of muscle activity enabled comparison of the sparrows' sleep patterns in migratory and nonmigratory states of activity. While in migratory condition, the birds spent considerably more time in daytime drowsiness and very short naps, which might have helped to compensate for the overall loss of sleep, the authors said. There must be some manner of compensation because sleep-deprived sparrows performed as well as they performed during the nonmigratory period in cognitive tests of their memory of previously learned tasks. Whatever the neurophysiological basis, White-crowned Sparrows are remarkably able to adjust to loss of sleep during migration.

Nocturnal migrants such as Swainson's Thrush and **White-crowned Sparrow** must adapt to substantial loss of sleep during migration. Experiments with both species indicate that brief naps during periods of daytime drowsiness may provide sufficient compensation. *Hidalgo County, Texas; November 2004. © Joe Fuhrman.*

Thomas Fuchs and four coauthors used infrared motion detectors and video recordings in a year-long study of Swainson's Thrush sleeping patterns in observation cages. The team reported in 2006 that the thrushes averaged 67 percent less sleep during migratory periods than during nonmigratory periods (*Animal Behaviour* 72:951–958). The birds adjusted their daytime behavior accordingly. When nocturnally sleepless, they spent 41 percent of the day in a drowsy state with eyes partially closed; contrastingly, in seasons when they slept at night, they were drowsy during only 14 percent of the day. Drowsy periods contained many brief episodes of sleep averaging 9.2 seconds with both eyes closed and averaging 8 seconds with one eye closed and one eye open. The latter behavior is a sign that one brain hemisphere is asleep and the other is awake—a condition termed unihemispheric sleep, which is possibly an adaptation enabling simultaneous sleep and alertness for predators. The authors suggested, as had Rattenborg's group, that a combination of drowsiness, brief naps, and unihemispheric sleep might compensate for the loss of nighttime sleep.

Could nocturnal migrants rest more than we realize by sleeping in flight? Speculation has arisen about such diverse long-distance migrants as albatrosses, frigatebirds, shorebirds, Sooty Tern, Common Swift, and Blackpoll Warbler, but the truth is unknown. Reviewing the subject in 2006, Rattenborg said no direct evidence exists; it is all circumstantial because of the difficulty of measuring sleep in a flying bird (*Naturwissenschaften* 93:413–425). Advanced technology may soon provide an answer. New devices small enough for birds to carry are successfully recording brain activity in wakeful free-flying pigeons in the daytime. Rattenborg believes that sleep-related neuronal activity recorded by such devices, combined with behavioral signs of sleep, would provide the most conclusive evidence that nocturnal migrants sleep in flight.

Gull-billed Tern Conservation

The Gull-billed Tern is beginning to attract the U. S. government's attention as a species that needs stronger protection. The need is clear when two ironic contrasts in its present classification are considered:

- The Roseate Tern, estimated at 3,500 breeding pairs in the eastern U. S., is listed as endangered. Yet the Gull-billed Tern, whose eastern subspecies *aranea* is similarly scarce at 3,600–4,400 pairs, is merely a "bird of conservation concern".
- The California Least Tern (subspecies *browni*), estimated at 7,000 pairs, is listed as endangered although recently proposed for downlisting to threatened. Yet the Gull-billed Tern's California and western Mexico subspecies (*vanrossemi*), estimated at only 250 pairs in the U. S., receives no special federal protection.

Kathy C. Molina and R. Michael Erwin noted those

The **Gull-billed Tern** has declined severely in most of its North American range, threatened by myriad ecological problems. A new status review urges more-effective protection by the U. S. government. *Cape May, New Jersey; July 2004. © Richard Crossley / VIREO.*

discrepancies in 2006 in the first comprehensive report on Gull-billed Tern status and distribution in North America in more than 20 years (*Waterbirds* 29:271–295). They focused on both North American subspecies: *aranea*, which is widespread but local along the Atlantic and Gulf coasts from Long Island to Texas; and the slightly larger-bodied and longer-billed *vanrossemi*, which occurs at only two small California breeding colonies at the Salton Sea and San Diego Bay. Including eight colonies in coastal western Mexico, the world's entire breeding population of *vanrossemi* is estimated at fewer than 800 pairs.

After analyzing an immense array of past and present population data, Molina and Erwin described the current *aranea* and *vanrossemi* numbers as "alarmingly small". Apparent declines in the largest Atlantic Coast populations of *aranea* since the 1970s are especially alarming: down 60 percent in Virginia, 58 percent in North Carolina, and 70 percent in Florida. Only in Texas and Louisiana are relatively large populations apparently stable or perhaps growing slightly.

The Gull-billed Tern was virtually annihilated in much of its range for the nineteenth-century feather trade, and it has not shared in the triumph of avian conservation that brought back the egrets. Now it faces increasingly worrisome problems that threaten many coastal species: habitat destruction by barrier-beach development; disturbance by beach-goers; predation by foxes, raccoons, and gulls; erosion and vegetation succession on dredge-material islands; and toxic chemicals. These factors may be forcing the terns to nest in suboptimal low-lying sites that are flooded by high tides and storm overwash.

What is needed? Molina and Erwin emphasize research into influences on reproductive success, systematic range-wide population monitoring, and adequate protection of colony sites from human disturbance and predators. Some hope for future management came in 2005 when the U. S. Fish & Wildlife Service stated in its Pacific Region Seabird Conservation Plan that "not enough is being done to fully conserve" the species. The USF&WS is also reviewing a status-and-distribution report it commissioned from Molina and Erwin—the first step in assessing conservation status of a species.

J. R. Pemberton, who discovered California's first Gull-billed Tern breeding colony at the Salton Sea, concluded his joyful report in 1927 with a plea (*Condor* 29:253–258): "[T]hey are unique birds and will well reward anyone paying them a visit—but be sure and treat them as honored guests." Eighty years later, the honor of effective protection remains elusive.

Eastern Harlequin Duck

After declining for at least a century, Canada's little-known eastern population of Harlequin Ducks may have approached total collapse in the 1980s. How perilously close is uncertain because winter counts represent undetermined proportions of the population and because most breeding pairs are scattered sparsely across vast roadless regions of northern Québec and Labrador. Reasonably reliable estimates do not exist.

Based on surveys at a limited number of wintering sites, the Canadian Wildlife Service estimated in 1990 that fewer than 1,000 Harlequin Ducks remained—a level perhaps below the minimum viable size to sustain the population. The Canadian government declared the population endangered and banned hunting. Soon an upward trend was detected, and the status was upgraded in 2001 to "special concern". Recent winter counts in Atlantic Canada and Maine indicate further increases, but a management plan proposed in 2006 by Canada's conservation ministry warns that numbers may still be under 3,000 <www.env.gov.nl.ca/env/wildlife/wildlife_at_risk.htm>.

Two findings in Greenland complicate estimations. David Boertmann and Anders Mosbech speculated in 2002 that Canadian breeders "probably account for an appreciable proportion" of 5,000–10,000 males that molt in western

Greenland (*Waterbirds* 25:326–332). Meanwhile, fifteen males that bred in Québec and Labrador were tracked by satellite telemetry to Greenland, where they molted and likely wintered. Serge Brodeur and eight coauthors speculated in 2002 that this small sample could represent a Canadian breeding population not counted in Atlantic coastal surveys (*Journal of Avian Biology* 33:127–137).

Interpreting breeding surveys is difficult because Harlequin Duck pairs are distributed very unevenly within typical habitat along fast-flowing waterways. Joel P. Heath, Gregory J. Robertson, and William A. Montevecchi reported this variable pattern in 2006 after analyzing surveys between 1992 and 2000 in eleven river canyons in northern Labrador (*Canadian Journal of Zoology* 84:855–864). At two extremes, the ducks' density in pairs per kilometer averaged nine times higher along one river than along another. Relatively dense populations were also more stable from year to year; those least dense were near local extinction in some years.

Why the variation? Habitat availability did not appear to be involved. The study compared prey abundance and biophysical features relevant to Harlequin Ducks at two rivers where the ducks' density differed greatly (thus, where causal habitat differences might be most evident). No factor differed detectably between the two waterways; habitat for the ducks was essentially the same on both rivers.

But another condition did differ. Among all eleven rivers, the authors found that the ducks' density was inversely correlated with the density of avian predators—Golden Eagles,

Eastern Canada's **Harlequin Duck** population is difficult to census because breeding pairs are very irregularly distributed, even in preferred habitat. Their abundance at various rivers, according to a recent study, is inversely related to the abundance of nearby raptors. *Barnegat Light, New Jersey; February 2006. © Jim Zipp.*

Gyrfalcons, Peregrine Falcons, and Great Horned Owls. The abundance of these raptors, all known to prey on Harlequin Ducks, depends on the availability of suitable cliffside nesting sites in the river canyons. Where sites are few, the ducks can thrive. Where sites are many, the predators can exclude ducks from suitable habitat.

Heath and his colleagues discussed the ducks' irregular distribution from viewpoints of demographics, population dynamics, and conservation management. One of their conclusions is a caution: Understanding Harlequin Duck populations' local variability is an essential step toward determining the eastern population's regional viability.