

by Paul Hess

Fea's or Zino's Petrel?

Official uncertainty persists. Fea's Petrel remains "hypothetical" in the American Ornithologists' Union *Check-list of North American Birds*, and "Fea's/Zino's Petrel" remains a single tick in the *ABA Checklist*. Thus, a long-standing controversy still shadows dozens of observations off our Atlantic Coast: Can Fea's Petrel and Zino's Petrel be separated at sea, even in good photographs?

The quarrel has played out colorfully in *Birding*, having been addressed both in several ABA Checklist Committee reports <aba.org/checklist/reports.html> and in various articles and letters to the editor. Here are highlights:

- The ABA decides not to accept Fea's, then known as Cape Verde Islands Petrel, because "the probability of resolving the identity of these birds beyond question appears to be low." (October 1996, pp. 399–405)
- In a two-part treatise detailing Fea's taxonomy, distribution, and identification, Michael H. Tove asserts that "Fea's is the species being seen in the ABA Area." (June 1997, pp. 206–219; August 1997, pp. 309–315)
- After seeing Tove's articles and new documentation from North Carolina, the ABA promises to reconsider adding Fea's. (December 1997, pp. 486–490)
- In a letter, seabird expert W. R. P. Bourne criticizes Tove's suggestion that Fea's and Zino's wing shapes differ—pointed in Fea's, rounded in Zino's. Tove replies that the difference appears to be meaningful and calls for its verification as a field mark. (April 1998, p. 98)
- The ABA announces "New Species Accepted: Fea's/Zino's Petrel (*Pterodroma feae/madeira*)," believing that Fea's is "overwhelmingly likely" but that distinguishing the two "remains at this stage conjectural." (December 1999, pp. 518–524)
- Letter-writers respond heatedly. Tove asks, "Why can't the ABA committee wake up to the incredibly obvious?" Harry LeGrand, former chairman of the North Carolina Bird Records Committee, declares that "there is no controversy about all the birds which have been seen and photographed well. These are Fea's." ABA member Todd Myers believes the two-species unit violates ABA listing rules. In a reply, ABA Checklist Committee Chair Jon L. Dunn points again to a "lack of pre-

cise knowledge of just how Zino's and Fea's can be separated." (April 2000, pp. 110–112)

- In an extensive assessment of gadfly petrels off North Carolina, J. Brian Patteson and Edward S. Brinkley report that "we are able to confirm at least some of these as Fea's Petrels." (December 2004, pp. 586–596)

A new analysis may not dispel doubts about identification at sea, but that is not the authors' goal. Rather, Francis Zino, Ruth Brown, and Manuel Biscoito want to reaffirm in 2008 that Zino's Petrel is a distinct species warranting continued conservation efforts to protect the endangered breeding population estimated at 65–80 pairs endemic to Madeira Island (*Ibis* 150:326–334).



Whether Fea's Petrel and Zino's Petrel can be identified at sea has long been a matter of contention. The two species differ significantly in bill size, and this individual's large bill may be evidence that it is a Fea's. *Off Hatteras, North Carolina; 20 May 2007. © George Armistead.*

The study confirms substantial genetic distinction between Zino's and a Fea's population nesting on Bugio Island 40 kilometers away. Mitochondrial DNA sequences in 15 birds from Madeira and 11 from Bugio show mutually exclusive differences suggesting that they do not interbreed.

Morphologically, the populations divide completely in a principal components analysis of nine measurements in samples of 71 adults from Madeira and 338 from Bugio. The Zino's are consistently smaller. In relative primary lengths, four of eight Zino's measured also have more rounded out-erwings, as Tove had suggested.

But Zino, Brown, and Biscoito express a caveat: "From the biometrics analyzed, the bill is by far the easiest form of differentiating the two species, but for an observer in the field this is difficult... [It] is still nearly impossible to differenti-

ate between *P. madeira* and *P. feae* in flight.”

The AOU and ABA checklist committees are virtually alone in reluctance to list Fea's. Based on photographs, this species is on the checklists of North Carolina, Virginia, Newfoundland, Nova Scotia, and Great Britain. The ABA committee is currently re-considering whether to accept Fea's based on documentation from North Carolina [see ABA Checklist Committee Report in this issue, p. 32]. No one suggests that Zino's has been definitively photographed at sea anywhere away from Madeira.

Tanager Taxonomy

Of all the puzzles that vex avian taxonomists, one of the most troublesome involves tanagers. The tanager family, Thraupidae, contains a hodgepodge of 104 genera and 413 species in the Sibley and Monroe classification (*Distribution and Taxonomy of the Birds of the World*, 1990). Among them are the genus *Piranga* of North America's breeding tanagers, as well as diverse Central American and South American taxa, including bush-tanagers, chat-tanagers, shrike-tanagers, ant-tanagers, and Neotropical honeycreepers. These groups' taxonomic relationships within the Thraupidae and with other families have long been questioned. In 1969, Robert W. Storer summarized the problem in the title of his article: "What is a tanager?" (*Living Bird* 8:127–136).

The American Ornithologists' Union Committee on Classification and Nomenclature (the "AOU Check-list Committee") addressed the situation in 2003 (*Auk* 114:542–552). Based on genetic research, the committee transferred the genera *Euphonia* and *Chlorophonia* from Thraupidae to Fringillidae—thus relating those tropical and subtropical birds more closely to crossbills, redpolls, and other finches than to tanagers.

Meanwhile, several genetic analyses have placed *Piranga*, including Hepatic, Summer, Scarlet, Western, and Flame-colored Tanagers, in a close alliance with cardinals and grosbeaks in the family Cardinalidae. New evidence supporting that view emerges from research by John Klicka, Kevin Burns, and Garth Spellman published in 2007 (*Molecular Phylogenetics and Evolution* 45:1014–1032). Using mitochondrial DNA sequences from the cytochrome-*b* and the ND2 genes, the authors assessed which genera belong in the family Cardinalidae.

The results suggest that four genera besides *Piranga* should be transferred to the Cardinalidae: *Habia* (ant-tan-



A recent genetic analysis suggests that tanagers in the genus *Tangara*, including this **Golden-hooded Tanager** (*T. larvata*), should remain classified in the family Thraupidae, whereas North America's breeding *Piranga* tanagers should not. *La Selva Biological Station, Costa Rica; January 2006.* © Glenn Bartley.

agers) and *Chlorothraupis* (several Central and South American tanagers) from the Thraupidae; *Granatellus* (tropical chats, which do not include Yellow-breasted Chat) from the Parulidae; and *Amaurospiza concolor* (Blue Seedeater) from the Emberizidae. The report also indicates that several taxa now classified in the Cardinalidae, including the genus *Saltator*, do not belong in the family, although where they should be placed is uncertain.

Two AOU check-list committees took note of the evidence in 2008. The South American committee voted to move *Piranga*, *Habia*, *Chlorothraupis*, *Granatellus*, and *Amauropiza* to the Cardinalidae. A similar proposal is pending in the North and Middle American committee, among many family-level changes being considered in the Thraupidae, Emberizidae, and Cardinalidae.

The new study by Klicka, Burns, and Spellman is the most complete taxonomic analysis to date of New World birds in the families Parulidae, Thraupidae, Emberizidae, Cardinalidae, and Icteridae. Relationships among these families remain uncertain, but the authors offer a "best estimate" that thraupids and cardinalids may be each other's closest relatives, and that parulids (wood-warblers), emberizids (sparrows), and icterids (blackbirds and allies) form a separate assemblage that is closely related to the tanager-cardinal group. Better evidence awaits analysis of additional genetic markers and complete sampling of taxa in all the families.

Red Crossbill Diversity

During two decades of investigations, Craig W. Benkman and his associates have uncovered a remarkable variety of evolutionary interactions involving Red Crossbills in North America's coniferous forests. The species' bill structure varies among different populations in relation to the types of cones they must pry open, and specialization on certain conifers has led to adaptive radiation of crossbills with diverse bill morphology.

Contributing to this diversification has been reciprocal selection leading to coevolutionary "arms races" between crossbills and conifers. For example, Julie W. Smith and Benkman demonstrated in 2007 that coevolution with lodgepole pine is promoting local adaptation and reproductive isolation—thus, ecological speciation—of a resident Red Crossbill population in the South Hills of south-central Idaho (*American Naturalist* 169:455–465).

Key to evolution of the South Hills crossbill is the absence of tree squirrels. The presence or introduction of these squirrels can alter the evolutionary outcome. The effect of introducing tree squirrels to areas where crossbills and conifers have coevolved is highlighted by Benkman, Adam M. Siepielski, and Thomas L. Parchman in 2008 (*Molecular Ecology* 17:395–404). Since red squirrels were introduced to Newfoundland in 1963, the island's endemic, large-billed Red Crossbill subspecies (named *pusilla* or *percna* by various authorities) has declined severely and may be extinct. Jon L. Dunn tells *Birding* that crossbills with rather large bills are still observed on the island but are not necessarily the endemic residents.

The point is not simply that the squirrels out-competed the crossbills; it is the evolutionary factor that enabled them to do it so thoroughly. In the squirrels' absence over the past 9,000 years, black spruce cones lost "squirrel defenses" while coevolving with the Newfoundland crossbills in an "arms race" in which cones protect their seeds, crossbills overcome the defenses with larger bills, and the pattern repeats with escalating increases in both cone defenses and bill depths of crossbills. Because the black spruce cones in Newfoundland lack squirrel defenses, squirrels have had a feast and have overwhelmingly preempted crossbills for the seeds. Benkman and his colleagues note that these squirrels are not faraway exotics but came from the nearby mainland. Local and long-distance introductions can both be harmful.

In a second paper in 2008, Parchman and Benkman focus on a more complex set of evolutionary interactions involving ponderosa pine, Red Crossbills, Abert's squirrels, and



Various **Red Crossbill** populations differ in bill size as a result of coevolution with the cones of different conifer species. Recent studies show that the presence or absence of squirrels can influence the coevolutionary process. *Lake County, Oregon; August 2006.* © Brian E. Small.

western gray squirrels (*Evolution* 62:348–360). Lodgepole pine in the South Hills has stable annual seed production, which promotes locally resident—and often evolutionarily divergent—crossbill populations. Unlike lodgepole pine, ponderosa pine seed production varies greatly from year to year, causing some Red Crossbill populations' famous nomadic behavior in years of poor cone crops. As nomads, different populations may mix and interbreed, preventing fine-scale geographic and ecological differentiation.

Meanwhile, squirrels' presence or absence adds complications by influencing crossbills' geographic distribution. In particular, natural selection exerted by gray squirrels on the relatively large-seeded ponderosa pines in the far West has resulted in cones too large for crossbills to open easily. In forests where the squirrels have exerted such selection, Red Crossbills are uncommon. Such varied patterns of coevolution and distribution are called a "geographic selection mosaic," and these examples show how complex the evolutionary effects can be.

Various papers dealing with crossbill, cone, and squirrel interactions are available as downloadable PDF files on Benkman's website <uwoyo.edu/benkman/publications.html>.

Phalarope Feeding Mechanics

The feeding behavior of phalaropes is a biomechanical marvel. Spinning rapidly on the water while pick-pick-picking small prey off the surface, these specialized foragers are a study in hyperactivity. The activity had long been interpreted only vaguely as stirring up prey, but Charles W. Michael described the effect more precisely in 1938 after watching people toss bread to ducks at San Francisco's Golden Gate Park (*Condor* 40:85). Red-necked Phalaropes joined the feast: "By spinning rapidly on the surface of the water the clever phalarope creates a whirling current that brings the water-logged bits of bread to the surface. I actually saw this magic take place while the bird was only three feet away."

The food-bearing flow is only the beginning of the story. While making a film about Red-necked Phalaropes in 1985, Bryan S. Obst noticed that the birds opened their beaks widely after tweezering a drop of water from the surface. Somehow the spreading beak moved the drop and its encapsulated prey from the bill tip up to the mouth. Seeing neither suction from the throat nor a push by the tongue, Obst and Margaret A. Rubega suspected that the drop's surface tension is the prime mover.

Rubega and Obst confirmed their hypothesis in laboratory tests using high-speed video and motion-analysis software. They announced the discovery in 1993 that "surface tension transport" (STT) indeed moves the drop (*Auk* 110:169–178). In STT, the drop's leading surface advances first and, in effect, pulls the drop's trailing surface forward. Interplaying factors involved include the size of the drop, the "wetting" properties of the bill's surface, the internal bill morphology, and the manner in which the bill is opened—all of which contribute to moving the drop upward even against the force of gravity. Rubega and Obst raised two questions for which the answers continue to be refined:

- Do other shorebird species use STT? Rubega determined in 1997 that Wilson's Phalaropes, Western Sandpipers, and Least Sandpipers do (*Ibis* 139:488–493). Sora M. Estrella, José A. Masero, and Alejandro Pérez-Hurtado reported in 2007 that Little Stint, Dun-

lin, Sanderling, Curlew Sandpiper, Common Redshank, and Black-winged Stilt also use the technique (*Auk* 124:1244–1253). Other species have not been studied.

- What aspects of bill morphology might constrain or enhance the technique's effectiveness? Rubega offered evidence in 1996 that STT performance depends largely on the size and shape of the internal bill structure (*Journal of Morphology* 228:45–60).



The long, thin bill of a **Red-necked Phalarope** has precise features that enable a remarkable feeding method. The bird can move a drop of water containing prey from its bill tip to its mouth by means of the water's surface tension. *Churchill, Manitoba; June 2006. © Robert Royse.*

Now, finally, the STT dynamics are worked out in extensive engineering detail. Manu Prakash, David Quéré, and John W. M. Bush demonstrated in 2008 exactly how the characteristics of the fluid, the "wettability" of the bill's surface, the geometry of the bill's shape, and the movement of the bill must combine for optimal efficiency (*Science* 320:931–934). Using motorized mechanical beaks, the authors quantified the complex factors at work. Interestingly, their experimental bill must repeatedly open and close to ratchet a drop up to the mouth, whereas Rubega and Obst had shown that living Red-necked Phalaropes can do the job in one bill-spreading cycle.

The Prakash team emphasizes that STT feeding is "precarious" because precise adhesion is required for food-bearing water drops to move properly up the bill. Slippery contaminants in the water can allow the drops to slide off, making STT feeding impossible. The authors warn that their study "makes clear the critical danger posed to this class of shorebirds by chemical or oil spills."