Pacific Science (1994), vol. 48, no. 4: 331 338

A Specimen of Nuku pu'u (Aves: Drepanidini: *Hemignathus lucidus*) from the Island of Hawai'i[1]

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ABSTRACT: A specimen of Nuku pu'u (*Hemignathus lucidus* Lichtenstein), collected by the U.S. Exploring Expedition in 1840 or 1841, is shown to have come from the island of Hawai'i. This is the first specimen evidence of the species for that island and the first evidence of probable sympatry of *H. lucidus* with the 'Akia pōlā'au (*H. wilsoni* Rothschild). Skull morphology provides additional evidence that these two species do not constitute a superspecies.

OF THE BIRDS THAT make up the remarkable adaptive radiation of Hawaiian finches (Carduelinae: Drepanidini), few are as distinctive as the "heterobills" of the genus *Hemignathus*. [The history of the taxa that have been included under the name *Hemignathus* involves some of the most complex nomenclatural problems in Hawaiian ornithology. Here we use *Hemignathus* in the sense of Amadon (1950), and of most previous authors, to include the "heterobills" *H. lucidus* and *H. wilsoni*, and the 'akialoas (*Hemignathus obscurus* group). We entertain reservations that even this assemblage is monophyletic, and we manifestly disagree (Olson and James 1988) with the inclusion (American Ornithologists' Union 1983) of the 'amakihis (*Loxops virens* and relatives of Amadon [1950]) in *Hemignathus*, following Pratt (1979). If that course is followed, however, the 'Akia pōlā'au must be known as *H. munroi*, rather than *H. wilsoni*, the name we use here.] In the "heterobills" the strongly curved upper portion of the bill (premaxilla) greatly exceeds the mandible in length, thus giving rise to the unique "half-billed" appearance, whence the name *Hemignathus*. Two species of these "heterobills" are now recognized, the Nuku pu'u, *Hemignathus lucidus* Lichtenstein, 1839, in which the mandible is curved in the same arc as the premaxilla, and the 'Akia pōlā'au, *H. wilsoni* Rothschild, 1893, in which the mandible is straight and more robust.

Currently, *H. lucidus* is considered to have occurred in historic times only on the islands of Kaua'i (*H. l. hanapepe*), O'ahu (*H. l. lucidus*), and Maui (*H. l. affinis*), whereas *H. wilsoni* is endemic to the island of Hawai'i (Figure 1). This apparently allopatric distribution has caused some authors to regard *H. lucidus* and *H. wilsoni* as forming a "superspecies" (e.g., Amadon 1950:169). Herein we document specimen evidence of the historical occurrence of *H. lucidus* on Hawai'i, where it would presumably have been sympatric with *H. wilsoni*.

The first description of any of the "heterobills" is that of the Nuku pu'u, *H. lucidus* (Lichtenstein 1839), based on specimens collected on O'ahu in 1837 by Ferdinand Deppe. Many years passed before the distribution and characters of the 'Akia pōlā'au were elucidated. The earliest extant specimens appear to be those taken by Théodore Ballieu in the 1870s, the distinctiveness of which was not appreciated by Oustalet, who studied the Ballieu collection (e.g., Oustalet 1877). The first person who can truly be said to have distinguished the 'Akia pōlā'au was Wilson (1889; Wilson and Evans 1892:75), who mistakenly referred to it under the name *Hemignathus olivaceus* (Lafresnaye, 1839). There was much confusion in the early literature concerning the identity of Lafresnaye's bird, which we now know to be the

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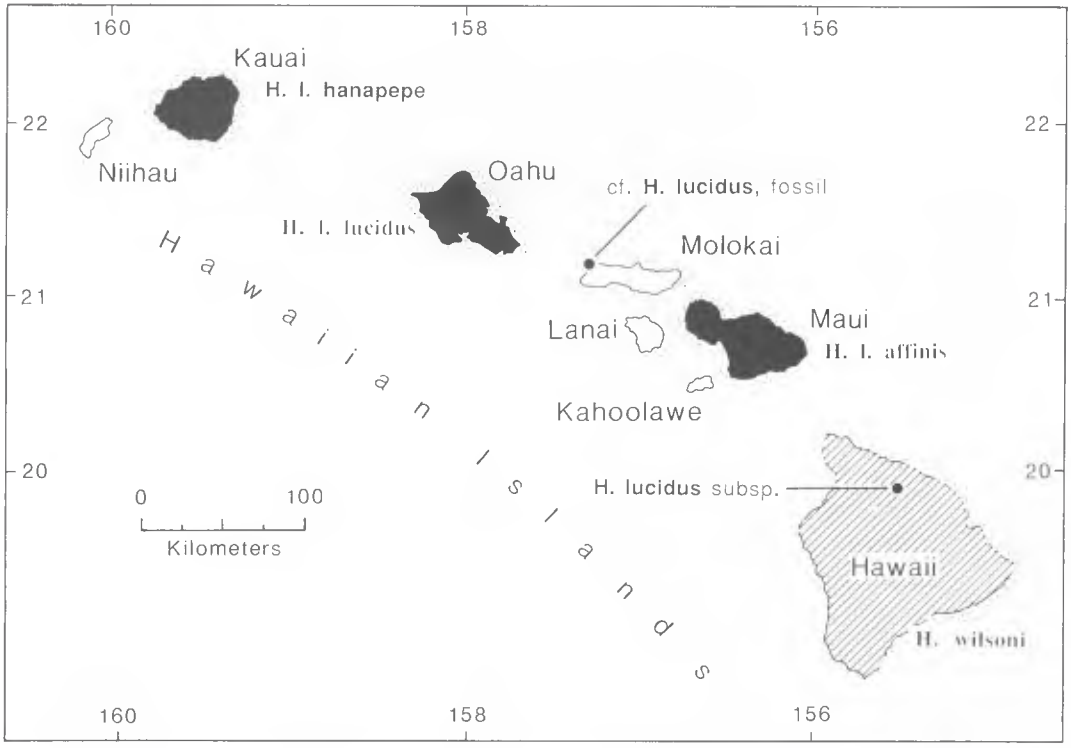

FIGURE 1. Generalized known distribution of *Hemignathus wilsoni* (hatched) and the forms of *H. lucidus* (black), including probable fossil record from Moloka'i and that from the island of Hawai'i reported here.

same as *H. lucidus lucidus* (see Bangs 1930: 363–364).

Historical Evidence

A venerable specimen of Nuku pu'u in the collections of the National Museum of Natural History (USNM 32526) was collected by the U.S. Exploring Expedition in 1840 or 1841. The original label, doubtless attached after the specimen was received in Washington, is inscribed "*Hemignathus lucidus*? Licht Hawaii U S Ex-Ex." As documented below, this is correctly identified as *Hemignathus lucidus*. That it has never received the attention of modern ornithologists may have been caused by unarticulated doubts about its island of origin. Nevertheless, the available evidence shows that it actually did come from the island of Hawai'i.

Vessels of the United States Exploring Expedition arrived in the Hawaiian Islands in September 1840; the last one left in April 1841. As reconstructed from the account of Wilkes (1845), the expedition's greatest activity was on the island of Hawai'i. Although visits were made to Kaua'i, O'ahu, and Maui, these were mainly in the nature of brief reconnaissances or provisioning forays. All of the specimens of birds listed in the official scientific reports of the expedition (Peale 1848, Cassin 1858) are either specifically attributed to the island of Hawai'i or at the least are known to occur there. No birds endemic to other islands in the archipelago are included among the Exploring Expedition specimens. Although some could have been taken, none survived the wreck of the *Peacock*, one of the expedition's two main ships, a circumstance that resulted in the loss of many specimens.

In the present connection, the observations of Titian Peale (1848), the expedition's ornithologist, are of paramount importance.

Until it was reprinted in 1978, Peale's work was one of the rarest of natural history publications because most of the original 100 copies printed were destroyed by fire (Newton 1892). This, together with the fact that Cassin (1858) rewrote the entire work a decade later (and none too successfully, at least as regards Hawaiian birds—see Newton 1892), practically ensured that Peale's original observations were seldom consulted. Because they are central to the following discussion, all of Peale's text concerning the forms of *Hemignathus* is repeated here verbatim (Peale 1848:153).

HEMIGNATHUS OBSCURUS.—(Licht.)
Certhia obscura. Latham. In Orn., i 281
Hook-billed Green Honey-eater. Latham. Gen. History of Birds, vol. iv. p. 192.
Collection Exp. Exp.

We obtained specimens of this curious bird at the Island of Hawaii only; it was found inhabiting the thick woody districts, and according to our observations, does not inhabit Oahu or the northern islands of the Hawaiian Group.

HEMIGNATHUS LUCIDIS.—(Licht.)
Collection Exp. Exp.

Found inhabiting the Island of Hawaii, with the above; it is very similar in habits; the form of the bill is admirably adapted to extracting sweets as well as insects from the flowers of the various and gigantic lobelias.

There is another species very much like this, still undescribed; it has a very slender bill, the under mandible not being larger than the upper, and little more than half its length; it differs in other respects, but the only specimen obtained by the Expedition, is too much mutilated to venture specific characters for it: the indication is made to call the attention of future ornithologists visiting that island.

In the "Catalogue of the Specimens of Mammalia and Birds, collected by the South Sea Surveying and Exploring Expedition" that appeared at the end of Peale's volume, the following Hawaiian taxa are listed under the "Cinnyridæ" (p. 324), which is a synonym of the sunbirds, Nectariniidae, but was used in Peale's day for almost any nectarivorous bird:

430. Melithreptes vestiaria (Sh.) *Apani*. Sandwich Islands.
435. Diceum sanguinea. (Latham.) *Olokela*. Hawaii.
436. Diceum virens (Latham.) *Alani*. Hawaii.
438. Hemignathus lucidus (Licht.) *Half-bill*. Hawaii
439. Hemignathus lucidus? *Half-bill*. Hawaii
440. Hemignathus obscurus (Latham.) *Half-bill*. Hawaii

Peale is thus quite explicit that there were two kinds of "heterobills" on the island of Hawai'i. It is also evident that he did not encounter any form of *Hemignathus* on any of the other islands. Furthermore, USNM 32526 agrees with Peale's characterization of his single specimen as "mutilated," because most of the ramphotheca is missing from the bill, along with the tip of the premaxilla.

We assume that the other species of "heterobill" to which Peale alludes was the 'Akia pōlā'au (*Hemignathus wilsoni*). Unfortunately, no examples of this species now exist among the material from the Exploring Expedition. If any were taken, they must have been lost with the wreck of the *Peacock*. The only other existing specimen of *Hemignathus* from the Exploring Expedition that we have traced is a single example of 'Akialoa, *H. obscurus*, in the collections of the Academy of Natural Sciences of Philadelphia (ANSP 3361).

In Cassin's (1858) rewrite of the ornithology of the Exploring Expedition, the accounts of *Hemignathus* are so confounded and contradictory to the facts as we now interpret them that we were at first perplexed to understand how his remarks could have arisen. Under the name *Hemignathus olivaceus* (Lafresnaye), Cassin (1858:179) stated that:

In the collection of the Expedition we find specimens which appear to be the bird described and figured under this name by the Baron Lafresnaye.... The specimens before us were obtained at the Sandwich Islands.

Then (p. 180), under *Hemignathus lucidus* (Lichtenstein) he added:

We have now before us, from the collection of the Expedition, and from the Museum of the Philadelphia Academy, several specimens which appear to be the present [*lucidus*] and preceding [*olivaceus*] species. They bear a strong general resemblance to each other, but the present [*lucidus*] is the larger, and has the bill much stronger. It is not surprising that these two birds have been repeatedly mistaken for each other by authors, and they are in fact to be distinguished with difficulty by descriptions only.... It is probably very nearly impossible to determine or reconcile with each other the synonyms of these two species, or the instances in which they have been mistaken for each other; but we have given them as they appear to us....

These statements are difficult to reconcile with the fact that we know of only the two specimens of *Hemignathus* (mentioned previously) that derive from the Exploring Expedition and but one other of *H. lucidus* in the Philadelphia Academy that would have been available to Cassin. What then were all the specimens he alluded to that he found so variable and impossible to determine?

It now seems probable that most of what Cassin took to be *Hemignathus* were specimens of various taxa of 'amakihis (*Loxops virens* in the sense of Amadon). Although Peale (1848) did not discuss *L. virens* in his

Figure 2. Ventral and lateral views of the Exploring Expedition specimen of *Hemignathus lucidus* (USNM 32526) from the island of Hawai'i.

text, he did list *Diceum* [*sic*] *virens* from Hawai'i in his catalogue (see above), and there are two specimens of *L. virens* from the Exploring Expedition at the Philadelphia Academy (ANSP 3376, ANSP 29983 [ex USNM 32155]). Cassin (1858), on the other hand, omitted this species from both his text *and* his catalogue, which would be the natural consequence of his considering these specimens to belong to *Hemignathus lucidus*. At that time there were a number of other specimens of 'amakihis at the Philadelphia Academy that had been received through the purchase of the Rivoli collection in 1846 and from J. K. Townsend's sojourn in the islands in the 1830s (Olson and James 1994). This series comprised three different taxa from three different islands, including the larger and much heavier-billed Kaua'i 'Amakihi, *L. stejnegeri*. Thus must Cassin's confusion have arisen. His account is therefore best ignored in favor of the more accurate first-hand observations of Peale.

The Specimen

The Exploring Expedition specimen of *Hemignathus lucidus* bears USNM catalogue number 32526, but with a query, evidently because whoever labeled it was not certain whether the specimen pertained to this number or to 32527. The first is entered in the catalogue as *Hemignathus lucidus* and the second as *H. olivaceus*. If there ever were a second specimen of heterobill from the Exploring Expedition, we have not traced it.

The specimen, somewhat the worse for wear after a century and a half (Figure 2), is considerably larger than any of the 'amakihis (wing, 74.5 mm; tail, ca. 44.5; tarsus, 22.4). The bill lacks most of the ramphotheca and the tip of the premaxilla, which latter becomes very compressed laterally immediately anterior to the nostrils, unlike the 'amakihis. The mandible is slender and curved, very unlike the heavy chisel-like mandible of *H. wilsoni*.

The plumage appears to be that of an immature molting into yellower adult garb. The entire dorsum, crown, and wings are a dull olive with a grayish cast, doubtless somewhat faded. The underparts are creamy whitish, more olivaceous on the flanks. Yellow feathers appear on the lower cheeks and on the midline of the throat and sides of the upper breast, forming a sort of inverted Y. There is also a faint yellow superciliary line. In this stage, the plumage is probably not sufficiently diagnostic for subspecific determination, although *H. l. affinis* of Maui is the closest form geographically.

DISCUSSION

Before the arrival of humans, the Nuku pu'u, *Hemignathus lucidus*, was probably distributed throughout the main Hawaiian Archipelago. The species was evidently confined to lower and middle elevations and was especially partial to koa (*Acacia koa* A. Gray) trees (Perkins 1903). The species is not known historically from Moloka'i or Lāna'i, but probably was once present on both islands. The rostrum (Figure 3) of a "heterobill" from sand dune deposits at the western end of Moloka'i (Olson and James 1982), although not certainly identifiable to species, is most likely referable to *H. lucidus* rather than to *H. wilsoni*. The O'ahu form, *H. l. lucidus*, was first collected in 1837 and never found again. The Nuku pu'u was last seen on Kaua'i in 1975 and is probably extinct there now, so the Maui population, very few in number (Scott et al. 1986), is probably the only one extant.

We have only the single Exploring Expedition specimen of 1840 or 1841 to document the species on Hawai'i, where it must have disappeared quickly, because the species was never met with on that island by such thorough and experienced collectors as Palmer, Perkins, and Henshaw (see Olson and James 1994). That it may have held on longer isolated in the Kohala range is possible, however, because on 29 June 1971 Van Riper (1982:467) observed at length on Kohala Mountain a bird that he subsequently regarded as most closely resembling the Maui subspecies of Nuku pu'u (*Hemignathus lucidus affinis*), although he had reported it previously as *H. wilsoni* (Van Riper 1973), a

Figure 3. Dorsal view of a fossil rostrum (USNM 254819) referred to *Hemignathus lucidus*, from sand dune deposits at ʻĪlio Point, Molokaʻi. The specimen lacks most of the premaxillary symphysis and part of the margin of the right nostril.

species that is not known to occur in the Kohalas (Scott et al. 1986).

The fact that *Hemignathus lucidus* and *H. wilsoni* must have been sympatric removes any possibility of regarding them as members of a single superspecies. Regardless, their underlying skull morphology and adaptations are so different (Figure 4) that no reasonable definition of a superspecies could encompass them both.

Hemignathus wilsoni is a larger, more robust bird than *H. lucidus*. It is highly specialized for hammering on branches with the chisel-like mandible and for using the elongated premaxilla as a probe. *Hemignathus lucidus* was also reported to hammer with the mandible on occasion, but less forcefully (Perkins 1903). Both species retain the imprint of their cardueline ancestry in the wide base of the upper jaw and the rounded, rather than elongate, nostrils. It appears as though only the very tip of the beak were drawn out into a probe, as one would draw out molten glass. Much of the length of the upper jaw comes from the outgrowth of the ramphotheca, which extends far beyond the bony premaxilla. In *H. wilsoni*, the upper jaw is straighter and heavier, the cranium in dorsal view is broader and less rounded, and in lateral view is less domed than in *H. lucidus* (Figure 4).

The two species are distinctive in having the posterior portion of the palatines narrow and lacking any trace of the transpalatine processes so characteristic of other drepanidines. *Hemignathus lucidus* is unique in having the pterygoids expanded and curved, whereas the straight, narrow pterygoids in *H. wilsoni* are more like those of other drepanidines.

The overall shape of the mandible in *H. wilsoni* is still quite finchlike, although the quadrate-mandibular articulation is modified for pounding. In contrast, the mandible of *H. lucidus* is much more slender and decurved.

Thus, *H. lucidus* and *H. wilsoni* share some unique similarities in the palate and upper jaw, but each has its own distinctive specializations that even without the new geographical evidence should have precluded these two taxa from being regarded as forms of a single superspecies.

We know from the fossil record (Olson and James 1982, 1991, James and Olson 1991) that many taxa of birds once regarded as occurring only on the island of Hawaiʻi were more widely distributed in the archipelago before the arrival of humans, viz.: *Branta*, *Buteo*, *Porzana*, *Corvus*, *Chaetoptila*, *Ciridops*, *Chloridops*, *Rhodacanthis*, and *Loxioides*. On the other hand, we have seen no fossils to suggest that the range of *H. wilsoni* ever extended beyond the island of Hawaiʻi. So far, it appears to be a genuine Big Island authochthon.

ACKNOWLEDGMENTS

For access to specimens used in this study we are grateful to the curators of the Acad-

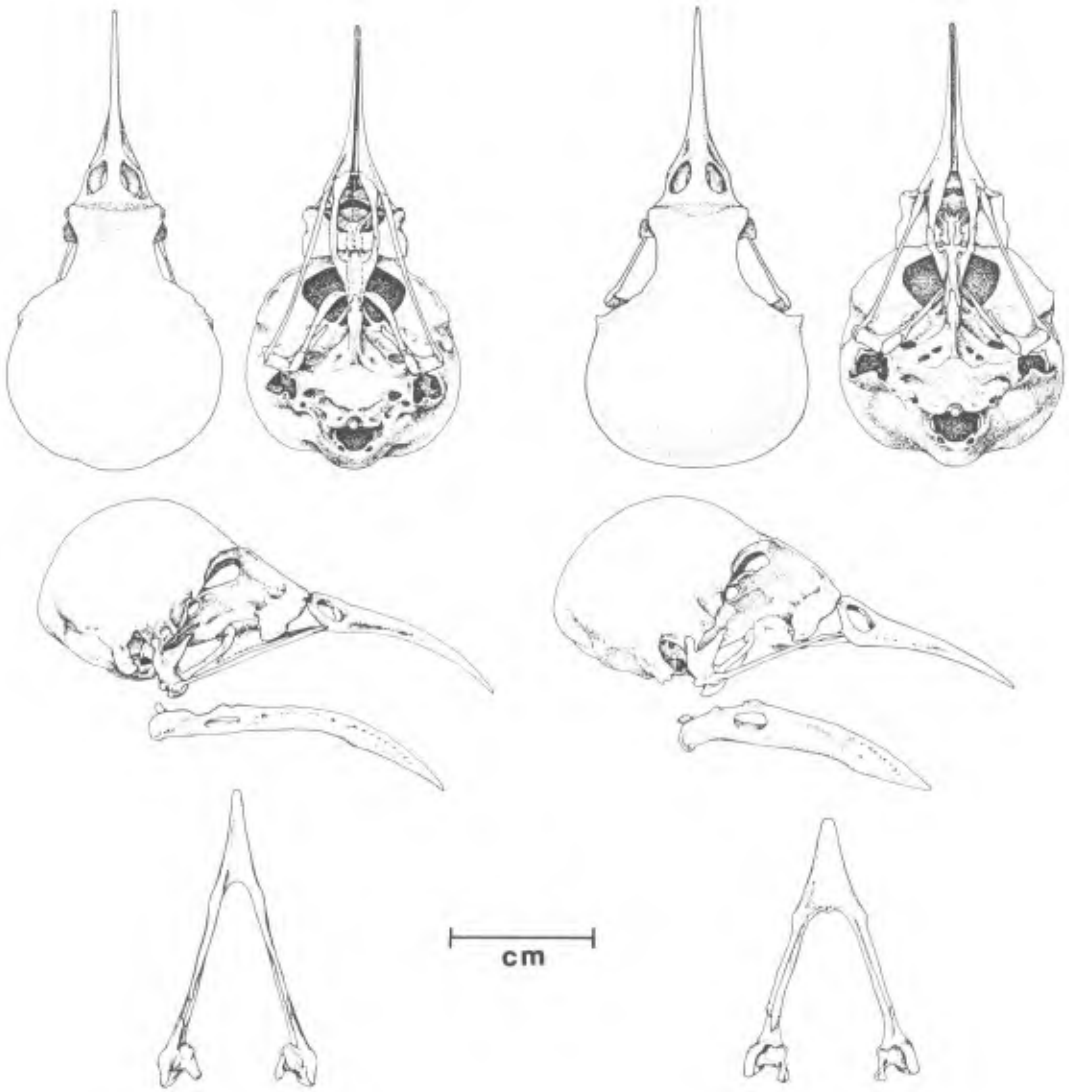

Figure 4. Dorsal, ventral, and lateral views of the skull, and lateral and dorsal views of the mandible of *Hemignathus lucidus* (BMNH S.1961.11) and *H. wilsoni* (MVZ 122610). The very different morphology of these two species indicates that it was inappropriate to regard them as members of a "superspecies."

emy of Natural Sciences of Philadelphia (ANSP); British Museum (Natural History) (BMNH); Museum of Vertebrate Zoology, University of California, Berkeley (MVZ); and the National Museum of Natural History, Smithsonian Institution (USNM). The drawings are by Jaquin B. Schulz and the photographs by Victor E. Krantz.

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