CPSU/UH Avian History Report 5B
HISTORY OF ENDEMIC HAWAIIAN BIRDS

Part I. POPULATION HISTORIES--SPECIES ACCOUNTS
Sea Birds: Hawaiian Dark-rumped Petrel ('Ua'u)

Winston E. Banko

Research Associate
Hawaii Field Research Center
Hawaii Volcanoes National Park
Hawaii 96718

May 1980
ABSTRACT

Pterodroma phaeopygia sandwichensis is a stout, medium-sized petrel with light underparts and, except for a white forehead, dark upperparts. It was first described in 1884. Exhaustive search uncovered some 192 observations, collection records, reports and related statements on relative abundance and geographical distribution from 1862 to 1978. All data are arranged in geographical and chronological order and systematically analyzed. Distribution at-sea and outside expected range (extraliminal) are given. Numbers of island records are shown by U. S. Geological Survey quadrangle. References and names of observers are cited. Completeness of data, erroneous and doubtful records are addressed. Findings are summarized. Substantial colonies once known on Kaua'i, Moloka'i, Lāna'i, and Hawai'i were found to have disappeared. It is concluded that the long-term natural survival of P. p. sandwichensis depends essentially upon maintaining the vitality of the largest remaining subpopulation, that within Haleakala National Park (on Maui).
# TABLE OF CONTENTS

ABSTRACT ................................................................. i

LIST OF TABLES .......................................................... iii

LIST OF FIGURES ......................................................... iii

2. *Pterodroma phaeopygia sandwichensis* .......................... 1

   OBSERVATIONS, REPORTS, AND SPECIMEN RECORDS ............... 1

   Early Records (1875-ca.1917) ..................................... 1

      Kaua'i ............................................................. 2
      Moloka'i ........................................................... 2
      Lana'i ............................................................. 2
      Maui ............................................................... 2
      Hawai'i ........................................................... 3

   Later Records (ca.1917-1978) ..................................... 3

      Kaua'i ............................................................. 3
      Lana'i ............................................................. 4
      Maui ............................................................... 4
      Hawai'i ........................................................... 5
      Distribution at Sea ............................................... 7
      Extra-limital ...................................................... 7

COMPLETENESS OF DATA, ERRONEOUS AND DOUBTFUL RECORDS ....... 8

CHRONOLOGICAL DISTRIBUTION OF RECORDS ........................... 8

GEOGRAPHICAL DISTRIBUTION OF RECORDS ............................. 9

SUMMARY ................................................................. 9

CONCLUSIONS .......................................................... 13

OBSERVERS ............................................................. 13

REFERENCES CITED ..................................................... 14

UNPUBLISHED SOURCES CITED .......................................... 16

APPENDIX I ............................................................. 18
LIST OF TABLES

Table
1. Distribution of 192 'Ua'u records by decade . . . . . 9

LIST OF FIGURES

Figure
1. Distribution of observations, reports, and museum records of Pterodroma phaeopygia sandwichensis, per quadrangle, on islands of Kaua'i, Moloka'i, Lana'i, and Maui, 1894-1978 . . . . 10
2. Distribution of observations, reports, and museum records of Pterodroma phaeopygia sandwichensis, per quadrangle, on Island of Hawai'i, 1894-1978. . . . . . . . . . . . . . . . . . . 11
2. *Pterodroma phaeopygia sandwichensis*

'Ua'U or Hawaiian Dark-rumped Petrel

(a subspecies of Dark-rumped Petrel)

The 'Ua'U or Hawaiian Dark-rumped Petrel (*Pterodroma phaeopygia sandwichensis*) is one of two subspecies; the other, *P. p. pygmaea*, breeds exclusively in the Galapagos Islands. King (1967) and Berger (1972) give general descriptive accounts of the 'Ua'U, describing it as a large, 16-inch long, stout gadfly petrel with dark grey upperparts, including nape and rump, white underparts, and short wedge-shaped tail. The 'Ua'U may be distinguished most easily from the 'A'o (*Puffinus puffinus newelli*)--the only other similar inland breeding species--by its white, rather than black forehead. Like the 'A'o, the 'Ua'U flies over land only at night, nesting from May to October in burrows in the mountains, sometimes many miles from the sea. Kjargaard (1978) provides a detailed historical summary of the 'Ua'U within Haleakala National Park on Maui, the largest population now extant. An account of the breeding biology of *P. p. phaeopygia* in the Galapagos is given by Harris (1970). A comprehensive biological investigation of the 'Ua'U has yet to be conducted. Most of a total of 72 specimens located in a recent world-wide survey of museums were found in the Los Angeles County Museum (25), Bernice P. Bishop Museum (24), and American Museum of Natural History (8) (Banko 1978 ms.).

OBSERVATIONS, REPORTS, AND SPECIMEN RECORDS

Drawing conclusions from a large volume of historical information on relative abundance and distribution of 'Ua'U required that data be geographically arranged and chronologically ordered in a systematic fashion, as outlined in the Introduction to Part I (CPSU/UH Avian History Report 4). Records presented in Appendix I satisfy criteria necessary for basic documentation and comparative analysis.

In the following descriptive account, sources of published information are cited by author and year in the usual style. One, two, or three digit numbers in parentheses refer to specific records in Appendix I. Sources of published and unpublished information listed in Appendix I may be traced to complete references in the bibliography.

**Early Records (1875-ca.1917):**

Perkins (1903) seems to have been the only observer to comment on the relative abundance and distribution of 'Ua'U in the early days. He called this bird "common in many parts of the
islands, nesting in the high mountains, where it forms large colonies," also noting that "the young were formerly killed in great numbers by the natives" for food (1).

Kaua'i

The 'Ua'u was described by R. Ridgway (in Baird et al. 1884) from one of two specimens collected by V. Knudsen on Kaua'i (4). Knudsen obtained another specimen from an unspecified locality, presumably on Kaua'i, about 1886 (Banko 1978 ms.) (5). Munro (1941) tells of F. Gay and W. Deverill finding eggs on Kaua'i in April and May (6, 8), and of himself taking specimens and observing 'Ua'u flying up over the ridges towards the mountains near Kakapua, in 1895 (13).

Moloka'i

Except for information which may yet be retained in memories of old residents, virtually all we know today of 'Ua'u on Moloka'i was noted by Bryan (1908, 1914) during a series of visits there in 1907 and 1914. During one or the other of these trips, Bryan recorded specimens collected, colonies present, or individuals heard at Pelekunu (16, 18-22), Oloku'i (17, 25-28), Wailau (23, 24, 29), Moanui (32), and Hālawa (31). In a 1974 letter to me, N. Pekelo confirmed the former existence of 'Ua'u at Hālawa and added Makukooniki (islet) to the localities reported to be frequented by 'Ua'u in early days (30).

Lāna'i

The sole information on 'Ua'u breeding colonies on Lāna'i in early times was passed along by Munro (1941, ca. 1960 ms.) who told of specimens collected and birds known by Henry Gibson, presumably before 1911 when Munro began residing there, in the following localities: north end of the mountain and in the dry forest at the northwest end of the island (34); Kānepu'u forest, on ridges at the head of Maunalei, and above Waiapaa (35).

Maui

Knowledge of breeding localities of 'Ua'u before 1901 on Maui are limited to an account by Finsch (1880) of finding a few old holes and an old dried up white egg on the way from Olinda to the summit of Haleakalā in 1879 (44), and information passed along by C. Thompson and Harry Gibson (probably same person as Henry Gibson) to J. S. Medeiros of recollections of 'Ua'u being taken from burrows (for food) in the Polipoli area in 1900 and along the rim of Haleakala Crater from 1905 to 1910 (45, 46).
The earliest mention of 'Ua'u on the island of Hawai'i seems to be that of Lyons (1875) who, 100 years ago, stated that the sole privilege of capturing 'Ua'u belonged to landowners, in Hāmākua in this case (154). Richardson and Woodside (1954), N. Santos, Shallenberger (1977), McCoy and Gould (1977) found bones of 'Ua'u in lava caves on middens of ancient Hawaiians at widely spaced locations on Mauna Loa, Mauna Kea, and Hualālai, many miles from breeding grounds known today, providing evidence of the extensive populations which may once have existed during the historic period (106, 159, 159a, 172, 173).

Early day records and reports of 'Ua'u on Hawai'i are more numerous than from any other island. Wilson and Evans (1894) obtained downy young of the 'Ua'u from a native Hawaiian at Kīlauea in 1887 and was told that a considerable number nested in holes in the vicinity, particularly on the slopes of Mauna Loa (130). Munro (1941) passed the carcass of an 'Ua'u lying on the trail at ca. 4500 feet elevation in the land of Hōnaunau, Kona, on 16 November 1891 (107). Henshaw (1902) secured an 'Ua'u specimen from M. Newell which had been found washed up on the beach at Hilo on 20 November 1890 (175). Henshaw was told by native Hawaiians in the 1894 to 1902 period that 'Ua'u formerly nested in great numbers in the lava between Mauna Loa and Mauna Kea (174) and that they were common on a fishing ground some 5 to 10 miles off windward Hawai'i (179). Though H. C. Shipman, a resident of the Hilo area since 1892, had never seen 'Ua'u himself, he recalled as a lad his mother telling him of native Hawaiians claiming different caves or nesting areas, presumably in the mountains, for capturing young for food (177). W. H. Meinecke accurately imitated the call of an 'Ua'u which he said represented a bird he heard occasionally at night as a boy near his home in Wai'ōhinu before the turn of the century, the species that older residents reported to him as nesting in numbers at nearby Pali Puaao before destruction of the area in the great earthquake of 1868 (123).

Later Records (ca.1917-1978):

Munro (1941, 1944), well aware of the history of 'Ua'u disappearance in the islands, stated nearly 40 years ago that this bird was in danger of extinction.

Kaua'i

There seems to be only one positive record of 'Ua'u on the island of Kaua'i since those of the 1890's, a specimen picked up by T. C. Telfer on 8 December 1968 at the beach near Kapa'a and confirmed by J. L. Sincock (12).
Lāna'i

On Lāna'i, G. C. Munro found remains of 'Ua'u at Kahiholena Gulch and Ha'alelepa'akai in 1926 (36-38). S. L. Montgomery and R. J. Shallenberger recovered an 'Ua'u which landed near their lantern on the night of 26 October 1973 above Kahiholena (Shallenberger 1974) (39), and Hirai (1978) heard night-calling birds at Kumoa Gulch and between Pu'u Kilea and Ha'alelepa'akai Puhielelelu Ridge during June and July 1976 (40-42).

Maui

Reports of 'Ua'u on Maui, all originating from Haleakala National Park, began in the 1930's. Crater-wide surveys initiated in the late 1960's suggest that this population has been the largest known to the present time. Kjargaard (1978) reported that T. Rodrigues, Jr., and CCC personnel heard petrels in Haleakala Crater in the 1930's which hindsight now indicates were probably those of 'Ua'u (47), and that calls continued to be noted by C. McCall, Jr., and other NPS Rangers in the late 1940's (48). Bonsey (1951) reported many night-calling petrels, no doubt 'Ua'u, at Kapalaoa and Hōlua from 7 July to 11 September 1951 (49). Richardson and Woodside (1954) recorded numerous 'Ua'u from above Hōlua Cabin, in the central crater area, above Kapalaoa Cabin, and a live juvenile (no doubt a crashed Haleakalā youngster) obtained by J. S. Medeiros near Kahului (50-55). Scattered specimens were salvaged and night-calling birds heard in Haleakalā from 1957 to 1964 by Carpenter (1959a, 1959b), L. N. Huber, W. V. Ward, W. B. King; and by Park biologists G. C. Ruhle, Dunmire (1961), and other NPS personnel (56-72).

Systematic searching for 'Ua'u nest burrows was begun in 1965 to 1966 by J. W. Larson who located 15 holes and estimated 100 pairs of 'Ua'u nesting in the Kapalaoa area and 300 pairs at Leleiwi and Kalahaku (cliffs) (74, 75). Night-listening and daytime burrow searches since 1967 by J. Kunioki, W. B. King, K. Buxbaum (1973), and J. I. Kjargaard gradually increased estimates of 'Ua'u breeding in Haleakala Crater. The estimate of 1600±500, including juveniles, by Kjargaard (1978) is the last and highest (76-91).

The first disabled 'Ua'u on Maui was reported by Richardson and Woodside (1954), as previously noted (50). In 1976 two crashed adults in the Lāhainā area and six fallen juveniles in Wailuku and Kahului were found (93-100). Inquiry would no doubt reveal that other 'Ua'u have been salvaged on Maui in recent years.
Hawai'i

No information was found in the literature or field notes indicating that 'Ua'u existed on the flanks of Kohala, Hualalai, or North Kona slopes of Mauna Loa during the historical period, 1778 to 1978 (101-104, 108, 109). The remains of a single bird reported by Munro (1944) lying on a trail at 4500 feet elevation in Hōnaunau in 1891 remains the sole evidence of 'Ua'u presence along Mauna Loa's lower South Kona slopes, as previously noted (107).

On the Ka'ū flank of Mauna Loa small numbers of 'Ua'u have been found at widely scattered locations. I began systematic searching of the Southwest Rift of Mauna Loa in 1968 and turned up persistent night-calling in three locations: on a 5536 feet elevation unnamed volcanic complex 0.75 mile southeast of Pu'u Ohohia (108); on Pu'u Keokeo at 6875 feet elevation 2.75 miles uprift (119); and on a volcanic complex about 1.5 miles down the Southwest Rift from Pu'u Keokeo (120). However, nest burrow(s) were discovered at only two sites characterized by persistent night-calling (108, 119). Listening at other locations along the Southwest Rift of Mauna Loa at night resulted in hearing little or no calling (113-118, 121-122).

The possibility that 'Ua'u once nested at Pali Puuao near Wai'ōhinu, Ka'ū, developed during an interview I had with W. H. Meinecke. Although residents of Wai'ōhinu who are now deceased had traditionally credited Pali Puuao (cliff of the 'A'o) with being a breeding ground of 'A'o (Puffinus puffinus newelli), Meinecke accurately imitated the night-calling of 'Ua'u when describing the sound he heard near his childhood home in Wai'ōhinu in the 1890's. Meinecke was unfamiliar with the physical appearance of either the 'A'o or 'Ua'u. It is therefore possible that it was the 'Ua'u that nested at Pali Puuao, or that both species nested there. The historical record is thus confused (123).

Records of 'Ua'u on the windward slopes of Mauna Loa are confined to Hawaii Volcanoes National Park and vicinity. 'Ua'u were not detected by P. C. and/or W. E. Banko at the summit crater of Mauna Loa, nor at Pu'u'ula'ula along the summit trail on the Northeast Rift at 10,000 feet elevation; however, feathers and bones have recently been found and presence revealed along the Mauna Loa summit trail at ca. 8000 feet elevation by C. Corn (S. Conant, pers. comm.); M. Fontes, and K. Nishimoto; and P. Conant, and S. Nagata (S. Conant, pers. comm.) (125-129). Although native Hawaiians supplied S. B. Wilson with downy young at Kīlauea in 1887, and indicated that 'Ua'u nested in considerable numbers in the vicinity, and more particularly on the slopes of Mauna Loa (130), reconnaissance in the Kīlauea area by W. B. King, Morrison (1967) (Hatch 1967), and me, turned up mostly negative results (135-137, 139, 146). While I heard a few calls on 7 September 1972 at Makaopuhi Crater, and P. H. Baldwin...
(Banko, pers. comm.) thought it possible a relict population there may have been previously overlooked, no calls were heard under poor listening conditions on 6 August 1978 (147, 148, 150). The possibility of 'Ua'u breeding at Makaopuhi therefore presently lacks confirmation.

There is ample evidence that 'Ua'u frequent the Kīlauea area, mostly in November, although one record each exists for May, October, and December. During the 31 year period 1948 to 1978, some 10 disabled birds, many recently fledged, have been reported or recovered (J. H. Hansen; D. Forbes; van Riper III [1978 ms.]; Baldwin & Hubbard [1949]; D. W. Peterson; S. Linderer; J. P. Lockwood) mostly as a result of crashes around the well-lighted Volcano House and Kīlauea Military Camp (131, 132, 140, 142-145), but also at the USGS Volcano Observatory (141), near erupting Mauna Ulu (149), and along the Belt Highway near the 47 milepost about 7 miles southwest of the Park boundary (138). Reports of birds calling at night in the Kīlauea area have never been positively identified as those of 'Ua'u by persons familiar with the vocalizations of this species, and at least some reporting error has been acknowledged (133-137). There is a possibility that some calling reported to be that of 'Ua'u may have been that of the White-tailed Tropicbird (Phaethon lepturus dorotheae) which I have heard vocalize in flocks on stormy nights from March to May in the Kīlauea area, at least before the 5 November 1967 to 13 July 1968 eruption of Halema'uma'u when the population which lived on the crater walls was much greater.

On the northeast flank of Mauna Loa, outside Hawaii Volcanoes National Park, one disabled 'Ua'u found near the Kulani Project, 5500 feet elevation, was salvaged as a specimen by an unknown party on 28 November 1954 (Banko 1978 ms.) (112). J. P. Lockwood heard persistent night-calling at an unnamed 7996 feet elevation volcanic cone on 28 July 1976 (110).

In addition to previously mentioned archaeological evidence of 'Ua'u populations once-resident on Mauna Kea, reported by Richardson and Woodside (1954) (159), and McCoy and Gould (1977) (159a), there are a number of observations indicating that remnant groups have persisted until recently. Richardson and Woodside also reported a dead carcass found near Kanakaleonui on the east slope of Mauna Kea; five fresh burrows located at 8800 feet elevation near Pu'u Kole on the southeast slope; remains of three 'Ua'u picked up by H. Fergerstrom at over 9000 feet elevation (above Pu'u Kole); and discovery of feathers and part of a beak at ca. 10,000 feet elevation on the south flank (155, 158). Walker (1962) heard one calling near Kaluamakani Cabin (151). A few years later, in 1968, I picked up an old 'Ua'u wing at the State Division of Forestry cabin below Kanakaleonui, and in 1969 identified a dried-up carcass brought to me by N. Santos as that of an 'Ua'u (167). In 1969 I queried construction foreman N. Crapo relative to possible night-calling heard or carcasses
encountered in Crapo's daily commuting from Hale Pōhaku to the telescope construction site on the summit of Mauna Kea during 1968 and 1969, but he knew nothing of such a bird (163, 164). During the 1968 and 1970 breeding seasons I carried out several wide-ranging night listening surveys along jeep trails on the upper east, northeast, north, northwest, and west slopes of Mauna Kea, including particularly the Pu'u Kole and Kanakaleonui areas (161, 162, 165, 166, 170, 171). A single rush of wings and a few calls heard at 1935, 1942, 1950, and 2015 hours on 2 June 1970 near Kanakaleonui were the only positive results obtained during five nights of work (168, 169).

Distribution At Sea

Other than the Henshaw (1902) report that native Hawaiians in the 1890's observed 'Ua'u to be common on a fishing ground some 5 to 10 miles offshore windward Hawai'i (179), little of substance was recorded of the pelagic distribution of the 'Ua'u until the Smithsonian Institution conducted the Pacific Ocean Biological Survey Program in the middle and late 1960's. Trained biologists in this program recorded distribution and relative abundance of all species of sea birds during 3561 hours of observation on 15 cruises along a predetermined replicated sampling track of 34,384 miles in the general vicinity of the Hawaiian Islands. From information collected on these cruises, King (1970), who reported results of the work, concluded that 'Ua'u were widespread over the 500,000 square mile study area and doubtlessly ranged beyond survey parameters in all directions. Individuals were identified as far north as 42°N and as far south as 5°N latitude; as far east as 148°W and as far west as 158°W longitude (181-184). One density center was found in the northwest corner of the study area, near latitude 25°N, longitude 157°W (180). 'Ua'u were also seen by R. S. Crossin in early morning hours in company with 'A'o (Puffinus puffinus newelli) near the island of Kaua'i (King, pers. comm.), and there were many instances recorded of 'Ua'u flying directly toward or away from Kaua'i (185, 186).

S. Tokumine, skipper of the fishing boat Kaimamala out of Hilo, reported to me that 'Ua'u were present in Hawaiian waters (from South Point, island of Hawai'i to French Frigate Shoals, Northwestern Hawaiian Islands) from May to October, and were absent from about November to April (187).

Extra-limital

There seems to be only one 'Ua'u of record that has been collected on an island outside the Hawaiian Islands. A specimen from the Molucca Islands in the Southwest Pacific suggested to King (1967) the possibility of a migration to the Western Pacific during the non-breeding season (188).
COMPLETENESS OF DATA, ERRONEOUS AND DOUBTFUL RECORDS

The foregoing records on relative abundance and geographical distribution of 'Ua'u are believed essentially complete for the sources examined, from 1884 until the contemporary period.

Attention is drawn to several erroneous or doubtful records. Henshaw (1902), lacking specimens, felt "reasonably sure" that night-calling birds which invaded Hilo on stormy nights during the fall and winter months were 'Ua'u (176). Baldwin (1946, 1952) expressed a more recent similar belief (178), and passed along a report of Mr. Nakamura that he saw a small flock near Malamakī (Puna District) (178, 124). Passage of time and lack of corroborating reports or other evidence tend to cast doubt on the validity of these records.

Morrison (1967) corrected his mistaken impression of hearing 'Ua'u in the vicinity of the Volcano House (136, 137). There seems sufficient negative evidence from other surveys (135, 139), and lack of a single positively identified 'Ua'u heard at Kīlauea over the years by me or others to discount the validity of Dunmire's (1960) and Eisenmann's (1961) reports also.

Munro (1941) reported that he found five pairs of 'Ua'u wings on Lāna'i on 11 September 1896, but gave the year as 1926 in an unpublished manuscript (33, 20). The wings, clearly labeled 11 September 1926, are in the Bernice Pauahi Bishop Museum, Honolulu, establishing 1926 rather than 1896 as the actual year of collection.

The report of Warner (1968), of sea birds grounded along the windward beaches of Kaua'i during the summers of 1960 and 1961, confused the identity of 'A'o (Puffinus puffinus newelli) with that of 'Ua'u (R. E. Warner, pers. comm.). Circumstantial evidence and lack of further similar incidents involving 'Ua'u on Kaua'i supports Warner's subsequent belief that the birds seen both years were 'A'o, not 'Ua'u as stated.

CHRONOLOGICAL DISTRIBUTION OF RECORDS

Of the 192 existing 'Ua'u records, 187 were classified according to decade of origin and compiled in Table 1. The numbers in the table exhibit the initial observations following description of the species in the 1880's, the comparative absence of reports from early 1900's through the 1930's, and steady buildup of information from 1940's through the 1960's and 1970's.
TABLE 1. Distribution of 192 'Ua'u records by decade.

<table>
<thead>
<tr>
<th>Decade</th>
<th>1840's</th>
<th>1910's</th>
</tr>
</thead>
<tbody>
<tr>
<td>1770's</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>1780's</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>1790's</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>1800's</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>1810's</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>1820's</td>
<td>13</td>
<td>73</td>
</tr>
<tr>
<td>1830's</td>
<td>16</td>
<td>50</td>
</tr>
</tbody>
</table>

GEOGRAPHICAL DISTRIBUTION OF RECORDS

Distribution of all positive observations, reports, and specimen records—except at-sea and extra-limital records—are shown for each quadrangle for the islands of Kaua'i, Moloka'i, Lāna'i, and Hawai'i in Figures 1 and 2. There seem to be no records of 'A'o occurrence on Ni'ihau, O'ahu, and Kaho'olawe, the small offshore islets of the five major islands (except for Maku'ooniki off Moloka'i), or on the Northwestern Hawaiian Islands.

SUMMARY

The 'Ua'u or Hawaiian Dark-rumped Petrel (Pterodroma phaeopygia sandwichensis) is one of two subspecies characterized by comparatively large size, dark-grey upperparts, white underparts, and short wedge-shaped tail. It nests from May to October in the Hawaiian Islands, flying over land only at night to nest in burrows sometimes many miles from the sea.

The history of 'Ua'u on the island of Kaua'i is comparatively short. Specimens were collected in the 1880's in undescribed localities and the species was noted in the 1890's breeding in the mountains. Except for the recovery of one grounded 'Ua'u, presumably a straggler, picked up near the beach at Kapa'a in 1968, none have been reported on Kaua'i since 1895 when the last breeding residents were recorded.

Nothing seems to be known of the occurrence of the 'Ua'u on the island of Moloka'i before 1907 or after 1914. W. A. Bryan found colonies and/or collected specimens at Pelekunu, Oloku'i, Wailau, Moanui, and Hālawa. N. Pekelo also reported 'Ua'u to be
FIGURE 1. Distribution of observations, reports, and museum records of Pterodroma phaeopygia sandwichensis, per quadrangle, on islands of Kaua'i, Moloka'i, Lāna'i, and Maui, 1894-1978.
FIGURE 2. Distribution of observations, reports, and museum records of *Pterodroma phaeopygia sandwichensis*, per quadrangle, on Island of Hawai'i, 1894-1978.
formerly present on Makukooniki (islet), according to old residents of the area he talked with.

G. C. Munro noted that 'Ua'u were found on Lāna'i in the early days at the north end of the mountain, in the dry forest at the northeast end of the island, Kānepu'u forest, on ridges at the head of Maunalei, and above Waiapaa. Remains of a few birds were found in 1926 at Kaiholena and Ha'alelepa'akai. Night-calling birds heard in 1976 by L. T. Hirai at Kumoa Gulch and between Pu'u Kīlea and Ha'alelepa'akai Puhielelu Ridge appear to represent the last remnant stocks extant.

The history of 'Ua'u on Maui is confined to Haleakalā where there is one early record of a breeding group on the outside flank of the volcano, in 1879. All other observations of 'Ua'u at Haleakalā are confined to the crater where an estimated 1600±500 currently nest along the rim and steep interior cliffs. Individuals from this population, the largest extant, have recently been known to occasionally crash at night near bright lights in the Wailuku, Kahului, and Lāhainā areas.

Records and reports of 'Ua'u on the island of Hawai'i are more numerous than from any other island. Breeding colonies on Mauna Kea, Mauna Loa, Kīlauea, and in the lava fields between Mauna Kea and Mauna Loa were patronized by native Hawaiians in the late 1880's who captured 'Ua'u for food. There is growing archaeological evidence that 'Ua'u had a much greater earlier distribution on the island of Hawai'i than historical records indicate. Small breeding colonies have persisted until recent times high on the eastern slopes of Mauna Kea, near Pu'u Kole and Kanakaleonui. The only known breeding group extant on the island of Hawai'i is a small scattered group which nests on the Southwest Rift of Mauna Loa. Another small scattered population may exist in or near Hawaii Volcanoes National Park and/or along the flanks of the northeast Rift where recent indications have been found. A few individuals, presumably from this windward Mauna Loa group, have been crashing at night in the Kīlauea area for over 30 years.

'Ua'u are not known from O'ahu, Ni'ihau, Kaho'olawe, or the Northwestern Hawaiian Islands.

The 'Ua'u may be found at sea from May to October in offshore waters up to hundreds of miles distant from the main Hawaiian Islands. It is largely absent in the Hawaiian Island environment during the winter months and its wintering grounds are not yet known. A single 'Ua'u specimen recovered in the Molucca Islands in the Southwest Pacific furnishes a possible clue as to direction and duration of migration during the non-breeding season.
CONCLUSIONS

The 'Ua'u was a breeding resident of Kaua'i but disappeared sometime after 1895 before the size and location of colonies were described. On Moloka'i, breeding colonies were known at five locations but these vanished sometime after 1914. Five 'Ua'u colonies were reported to have existed on Lāna'i in the late 1800's and/or early 1900's, but only a few individuals have been heard calling at two locations in recent years. On the island of Hawai'i, extensive breeding colonies of 'Ua'u existed in the late 1800's on Mauna Kea, Mauna Loa, lava fields between these two volcanoes, and Kīlauea. All except one small scattered group on the Southwest Rift of Mauna Loa and possibly a similar population on or near the Northeast Rift appear to have disappeared. The largest and most intact breeding group of 'Ua'u now extant is the 1600±500 which nest on the steep crater walls of Haleakalā. It is unlikely that future surveys will turn up the existence of another group even 10% of the size of the Haleakalā population. The lack of many crashed individuals in other than already known or suspected breeding localities does not encourage hope that substantial populations remain to be discovered. Given the history of disappearance of breeding 'Ua'u in the Hawaiian Islands, it is clear that long-term natural survival of the 'Ua'u is essentially dependent upon the vitality of the population in Haleakalā National Park.

OBSERVERS

REFERENCES CITED


UNPUBLISHED SOURCES CITED

19. Hawaii Division of Fish and Game. 1 May 1969 ms. Checklist of the native Hawaiian birds showing range and status (prepared by Gerald Swedberg).


Warner, R. E. 1968. The role of introduced diseases in the extinction of the endemic Hawaiian avifauna. Condor 70: 101-120.


APPENDIX I

1. Observations, reports, and specimen records are organized by island group, island, district, and/or quadrangle map. Order of listing, names and locations of district, and quadrangle boundaries are explained and illustrated in CPSU/UH Avian History Report 4: Introduction to Part I, Population Histories--Species Accounts.

2. Acronyms composed of the first three letters of the author's (or senior author's) last name, the initial letter of the first name, and last two digits of the year of publication represent sources found in the bibliography under References Cited. For example, BRYWO1 = Bryan, W. A., and Alvin Seale. 1901. Notes on the birds of Kauai. Bishop Museum Occ. Papers, 1(3): 129-137. In cases where it is necessary to distinguish between two or more articles published by an author in any given year, letters are added to the acronym in alphabetical sequence, e.g., BRYWO1a = Bryan, W. A. 1901. A key to the birds of the Hawaiian group. Bishop Museum Press. 76 pp.

Parenthetical numbers such as (5), represent references listed under Unpublished Sources Cited in the bibliography.

3. Place-names are cited in original form.

4. Parenthetical information is qualified.
### Relative Abundance/Locality

<table>
<thead>
<tr>
<th>Source</th>
<th>Elev. (ft.)</th>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southeastern Hawaiian Islands</td>
<td></td>
<td></td>
<td><strong>ISLANDS-WIDE INERENCE</strong></td>
</tr>
<tr>
<td>1</td>
<td>....</td>
<td>(1892-1896)</td>
<td>common...forming large colonies; young formerly killed in great numbers (by the natives for food) / in many parts of the islands, nesting in the high mountains</td>
</tr>
<tr>
<td>2</td>
<td>....</td>
<td>(1944)</td>
<td>in danger of extinction / nested in the mountains of Hawaii, Maui, Molokai, Oahu, Kauai, Lanai</td>
</tr>
</tbody>
</table>

#### Island of Kaua'i

**ISLAND-WIDE INERENCE**

<table>
<thead>
<tr>
<th>Source</th>
<th>Elev. (ft.)</th>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>....</td>
<td>(27 Oct. 1966)</td>
<td>Swedberg: King never heard ('Ua'u) call / (night island-wide surveys for 'A'o)</td>
</tr>
</tbody>
</table>

**UNDESIGNATED LOCALITY**

<table>
<thead>
<tr>
<th>Source</th>
<th>Elev. (ft.)</th>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>....</td>
<td>1884</td>
<td>Banko: species described from two specimens</td>
</tr>
<tr>
<td>5</td>
<td>....</td>
<td>(1886)</td>
<td>Knudsen: collected specimen</td>
</tr>
<tr>
<td>6</td>
<td>....</td>
<td>1891</td>
<td>Gay: lays eggs in April, May</td>
</tr>
<tr>
<td>7</td>
<td>....</td>
<td>1891</td>
<td>specimens in Gay and Robinson collection at Kekapua, Makaweli</td>
</tr>
<tr>
<td>8</td>
<td>....</td>
<td>1891</td>
<td>Deverill: nests in mountains</td>
</tr>
<tr>
<td>9</td>
<td>....</td>
<td>2 Feb. 1895</td>
<td>Banko: specimen obtained (Munro)</td>
</tr>
</tbody>
</table>
**MULTIQUADRANGLE**

10 Hadley: large numbers observed and reported / grounded along the windward beaches ... Summer of 1960 WARR68

11 large numbers observed and reported / grounded along the windward beaches ... Summer of 1961 WARR68

**KAPAA**

12 Sincock: Telfer picked up one alive (have no other observations...nor heard anything resembling its call) / at the beach near Kapaa ... 8 Dec. 1968 (23)

**HANAPEPE**

13 could be seen...flying up over ridges towards the mountain...shot specimen 2 July 1895 / Kekapua, near residence (Kekupua) ... (1891) MUNG41

Island of O'ahu

**ISLAND-WIDE INFERENCE**

14 know of no record ... (1941) MUNG41

Island of Moloka'i

**ISLAND-WIDE INFERENCE**

15 HSFG: thought to be extinct or extirpated ... (1969) (19)
<table>
<thead>
<tr>
<th>No.</th>
<th>Text</th>
<th>Location/Collection</th>
<th>Date/Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>specimen collected...in the long grass / not far back of village</td>
<td>Kamalo</td>
<td>(1903/1904)</td>
</tr>
<tr>
<td></td>
<td>(Pelekunu)</td>
<td></td>
<td>BRYW08</td>
</tr>
<tr>
<td>17</td>
<td>hunters secured 63 birds / (on the almost vertical cliffs of Olokui)</td>
<td></td>
<td>3500-4000 (1907)</td>
</tr>
<tr>
<td>18</td>
<td>heard one calling / near Pelekunu Village</td>
<td></td>
<td>27 April (1907)</td>
</tr>
<tr>
<td>19</td>
<td>heard in sufficient numbers...secured specimens / Kaunuohua trail</td>
<td></td>
<td>9 May (1907)</td>
</tr>
<tr>
<td></td>
<td>on pali into Pelekunu Valley</td>
<td></td>
<td>BRYW08</td>
</tr>
<tr>
<td>20</td>
<td>found bill, wings, feet and some loose feathers / Kaunuohua trail</td>
<td></td>
<td>3500 9 May (1907)</td>
</tr>
<tr>
<td></td>
<td>on pali into Pelekunu Valley</td>
<td></td>
<td>BRYW08</td>
</tr>
<tr>
<td>21</td>
<td>colonies present / seldom less than 1500 ft. above the sea</td>
<td></td>
<td>(1907)</td>
</tr>
<tr>
<td></td>
<td>(Pelekunu)</td>
<td></td>
<td>BRYW08</td>
</tr>
<tr>
<td>22</td>
<td>occasionally...found in same colony...on rare occasions in the same</td>
<td></td>
<td>(1907)</td>
</tr>
<tr>
<td></td>
<td>hole (as 'A'o) / (Pelekunu)</td>
<td></td>
<td>BRYW08</td>
</tr>
<tr>
<td>23</td>
<td>Banko: Bryan collected 16 specimens /</td>
<td></td>
<td>6-14 June 1907</td>
</tr>
<tr>
<td></td>
<td>Wailau</td>
<td></td>
<td>(7)</td>
</tr>
<tr>
<td>24</td>
<td>found half-eaten carcass / on the way over the Pali from Mapulehu</td>
<td></td>
<td>14 June (1907)</td>
</tr>
<tr>
<td></td>
<td>to Wailau</td>
<td></td>
<td>BRYW14</td>
</tr>
<tr>
<td>25</td>
<td>21 specimens taken in six hour hunt with dogs (63 in 1906 under</td>
<td></td>
<td>3500-4000 14 June (1907)</td>
</tr>
<tr>
<td></td>
<td>similar circumstances) / on the almost vertical cliffs of</td>
<td></td>
<td>BRYW14</td>
</tr>
<tr>
<td></td>
<td>Olokui</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>found remains of 3 birds / ascending trail up Olokui</td>
<td></td>
<td>June (1907)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BRYW14</td>
</tr>
</tbody>
</table>
27 Banko: 26 collected by Bryan / Olokui (valley) .... 20 July 1914 (7)

28 Banko: Bryan collected five specimens / Olokui .... 20 July 1914 (7)

29 Banko: Bryan collected two specimens / Wailau .... 14 June 1917 (?1907)

**HALAWA**

30 Pekelo: formerly taken by residents of Halawa / cliffs above Halawa and on Makukooniki (islet) .... undated (18)

31 none seen or heard while camped / at Halawa .... (10-15 May, 1907) BRYW08

32 numbers seen, 3 specimens taken / Moanui... flying over the headlands close down beside the sea .... 5-6 June (1907) BRYW14

**Island of Lana'i**

33 found the remains of five pairs of wings evidently of adult birds of this species / along an unused trail in the bottom of Kaiholena valley .... 11 Sept. 1896 MUNG41

34 Henry Gibson: frequented ridges...nested ...when a boy / at the north end of the mountain and also in the dry forest on the northwest end of the island .... (1941) MUNG41

35 Munro: used to nest according to Henry Gibson / in the Kanepuu forest, on ridges at the head of Maunalei and above Waiapaa .... (1960) (20)

36 Munro: found...5 pairs of wings / on a little used trail in the Kaiholena Gulch .... 1926 (20)
Island of Lana'i--(Continued)

<table>
<thead>
<tr>
<th>No.</th>
<th>Event</th>
<th>Date</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td>Banko: wing specimens from five salvaged by Munro / Kaiholena (gulch)</td>
<td>11 Sept. 1926</td>
<td>(7)</td>
</tr>
<tr>
<td>38</td>
<td>Munro: found...remains of one / at Haalelepaakai</td>
<td>1926</td>
<td>(20)</td>
</tr>
<tr>
<td>39</td>
<td>Montgomery &amp; Shallenberger: one landed below lantern...heard no calling / along Munro jeep trail above Kaiholena (gulch)</td>
<td>2700</td>
<td>SHAR74</td>
</tr>
<tr>
<td>40</td>
<td>night calling heard suggests probable population of 50 / along 0.25 mile stretch of Munro Trail (jeep road), Kumoa Gulch</td>
<td>2800</td>
<td>HIRL78</td>
</tr>
<tr>
<td>41</td>
<td>negative results from listening surveys / Kanepuu</td>
<td>June, July 1976</td>
<td>HIRL78</td>
</tr>
<tr>
<td>42</td>
<td>listened for calls with only sporadic or negative results / 5 locations along Munro Trail between Puu Kilea and Haalelepaakai Polipoli area</td>
<td>June 1976</td>
<td>HIRL78</td>
</tr>
</tbody>
</table>

Island of Maui

UNDESIGNATED LOCALITY

<table>
<thead>
<tr>
<th>No.</th>
<th>Event</th>
<th>Date</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>43</td>
<td>Banko: Medeiros picked one up</td>
<td>15 Oct. 1955</td>
<td>(7)</td>
</tr>
</tbody>
</table>

Haleakala National Park

<table>
<thead>
<tr>
<th>No.</th>
<th>Event</th>
<th>Date</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>44</td>
<td>reported to breed; found a few old holes under the ferns, and an old dried-up white egg / outer slopes of Haleakala (on way from Olinda to summit)</td>
<td>(July 1879)</td>
<td>FINO80</td>
</tr>
<tr>
<td>45</td>
<td>Medeiros: Thompson recalled retrieving young from burrows / Polipoli area</td>
<td>1900</td>
<td>(8)</td>
</tr>
<tr>
<td></td>
<td>Event Description</td>
<td>Date</td>
<td>Reference</td>
</tr>
<tr>
<td>---</td>
<td>----------------------------------------------------------------------------------</td>
<td>------------</td>
<td>-----------</td>
</tr>
<tr>
<td>46</td>
<td>Medeiros: Harry Gibson recalled his mother being in parties from Kaupo which collected young birds / along rim of Haleakala Crater</td>
<td>1905-1910</td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>Rodriques and other CCC personnel: heard / Haleakala</td>
<td>1930's</td>
<td>KJAJ78</td>
</tr>
<tr>
<td>48</td>
<td>McCall and other Park Rangers: saw and heard / Haleakala</td>
<td>late 1940's</td>
<td>KJAJ78</td>
</tr>
<tr>
<td>49</td>
<td>(unidentified petrels) numerous / Kapalaoa and Holua at night; over the sea (?Hana)</td>
<td>7 July-11 Sept. (1951)</td>
<td>BONH51</td>
</tr>
<tr>
<td>50</td>
<td>live specimen in juvenile plumage picked up by Medeiros / reservoir near Kahului (Pukalani?)</td>
<td>22 Oct. 1953</td>
<td>RICF54</td>
</tr>
<tr>
<td>51</td>
<td>several seen in flight...one obtained from two burrows / quarter mile S of the Holua Cabin</td>
<td>8 June (1954)</td>
<td>RICF54</td>
</tr>
<tr>
<td>52</td>
<td>partial skeleton found / in central crater (Haleakala)</td>
<td>(5-9 June 1954)</td>
<td>RICF54</td>
</tr>
<tr>
<td>53</td>
<td>found tracks...apparently exploring for burrows / next to lava flows in the floor of the crater (Haleakala)</td>
<td>(5-9 June 1954)</td>
<td>RICF54</td>
</tr>
<tr>
<td>54</td>
<td>numerous bird calls and other notes heard from first night on / above the Holua Cabin region near the W floor of the crater</td>
<td>(5-9 June 1954)</td>
<td>RICF54</td>
</tr>
<tr>
<td>55</td>
<td>numerous bird calls and other notes heard from first night on / above the Kapalaoa Cabin which is below the S rim of the crater</td>
<td>(5-9 June 1954)</td>
<td>RICF54</td>
</tr>
<tr>
<td>56</td>
<td>NPS: carcass found / near the summit of Haleakala</td>
<td>May 1957</td>
<td>(2)</td>
</tr>
<tr>
<td>57</td>
<td>heard after dark / Holua cabin</td>
<td>7 Mar. 1959</td>
<td>CARR59a</td>
</tr>
<tr>
<td>Date</td>
<td>Event Description</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 April 1959</td>
<td>NPS: Ruhle saw one / Haleakala Crater Overlook</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27 Oct. 1959</td>
<td>one seen / Along trail to Kapalaoa Cabin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oct. 1959</td>
<td>NPS: one seen / Near the base of Puu Nole Cinder cone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19 April 1960</td>
<td>NPS: evidence found / Along the cliffs above Holua Cabin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1961)</td>
<td>many nest in the walls of the crater / behind Kapalaoa and Holua Cabins...best places to hear them at night</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 June 1962</td>
<td>Ward: recordings made / Above Kapalaoa Cabin 800 ft.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12, 13, 15 May 1964</td>
<td>Huber: population...estimated at between 150 and 300 birds / (Haleakala Crater)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12-16 May 1964</td>
<td>King: unlikely that the population...exceeds 1,000 pairs / (Haleakala Crater)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>May 1964</td>
<td>Huber: estimated 150 / (Haleakala Crater)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-7 Aug. 1964</td>
<td>Gill &amp; Huber: population...desperately low, doubtfully exceeding 75 individuals / (Haleakala Crater)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1964</td>
<td>Banko: four specimens salvaged (one by Huber) / (Haleakala Crater)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 May 1964</td>
<td>King: heard a few...not as plentiful as at Holua Cabin / Vicinity Kapalaoa cabin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sept. 7 1964</td>
<td>Huber: estimated 25-50 / unspecified locality, Haleakala Crater</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Source</td>
<td>Estimate</td>
<td>Locality</td>
</tr>
<tr>
<td>-----</td>
<td>--------</td>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>71</td>
<td>Huber</td>
<td>estimated 150</td>
<td>unspecified locality, Haleakala Crater</td>
</tr>
<tr>
<td>72</td>
<td>Banko</td>
<td>four specimens obtained</td>
<td>(Haleakala Crater)</td>
</tr>
<tr>
<td>73</td>
<td>15 total known burrows, 47 percent active</td>
<td>(Haleakala Crater)</td>
<td>1966</td>
</tr>
<tr>
<td>74</td>
<td>Larson</td>
<td>at least a hundred pairs</td>
<td>Kapalaoa Pali</td>
</tr>
<tr>
<td>75</td>
<td>Larson</td>
<td>at least 300 breeding pairs</td>
<td>Leleiwi and Kalahaku Palis</td>
</tr>
<tr>
<td>76</td>
<td>15 total known burrows</td>
<td>(Haleakala Crater)</td>
<td>1967</td>
</tr>
<tr>
<td>77</td>
<td>15 total known burrows, 60 percent active</td>
<td>(Haleakala Crater)</td>
<td>1968</td>
</tr>
<tr>
<td>78</td>
<td>36 total known burrows, 39 percent active, 3 dead adults recovered</td>
<td>(Haleakala Crater)</td>
<td>1969</td>
</tr>
<tr>
<td>79</td>
<td>King</td>
<td>from nocturnal vigils to determine the location and frequency of calls, and diurnal searches for burrows...estimate yields 355 burrows which are probably being used by breeding pairs...total of 710 paired breeders and a slightly greater number of nonbreeders yields a total of about 1500...in the population / Haleakala Crater...22 sq. miles...searches for burrows could only be carried out effectively when it was determined beforehand that an area had birds calling over it at night</td>
<td>10 June-2 Sept. 1970</td>
</tr>
<tr>
<td>80</td>
<td>226 total known burrows, 95 percent active, 1 dead adult recovered</td>
<td>(Haleakala Crater)</td>
<td>1970</td>
</tr>
<tr>
<td>81</td>
<td>113 burrows checked, 71 percent active, 1 dead adult, 2 dead juveniles recovered</td>
<td>(Haleakala Crater)</td>
<td>1971</td>
</tr>
</tbody>
</table>
Island of Maui--(Continued)
Hale Nat'l. Park (con't.)

| 82 | Kunioki: total of 132 petrel burrow sites were relocated and checked...not possible to locate 50 petrel nests that were found and numbered by King in 1970...in addition 41 new burrows were found...total of 173 burrows observed, 90% appeared to have been active and 10% inactive or abandoned / survey along the West (Haleakala) Crater Rim from White Hill to Kilohana...observations were devoted primarily to traversing the cliff and slopes of the West Rim to check the burrow sites, note activity status of each nest site and record the locations onto maps...most effort was in trying to relocate the petrel burrow sites from the previous year and to pin-point the exact locations to record...on topo maps...all observations were conducted during the day with no night postings or observations | ..... | 15 May-27 Aug. 1971 | (16) |
| 83 | population numbers about 1800...calculated from surveys...an apparent increase since 1970 / (Haleakala Crater) | ..... | 14 June-13 Aug. 1972 | BUXK73 |
| 84 | 344 total known burrows, 82 percent active, 1 dead adult, 3 dead juveniles recovered / (Haleakala Crater) | ..... | 1972 | KJAJ78 |
| 85 | 344 total known burrows, 76 percent active, 3 dead adults, 1 dead juvenile recovered / (Haleakala Crater) | ..... | 1973 | KJAJ78 |
| 86 | 344 total known burrows, 62 percent active, 3 dead adults, zero dead juveniles recovered / (Haleakala Crater) | ..... | 1974 | KJAJ78 |
| 87 | 362 total known burrows, 65 percent active, 2 dead adults, zero dead juveniles recovered | ..... | 1975 | KJAJ78 |
88 428 total known burrows, 67 percent active, 6 dead adults, zero dead juveniles recovered / (Haleakala Crater) .... 1976 KJAJ78
89 437 total known burrows, 71 percent active, 2 dead adults, zero dead juveniles recovered / (Haleakala Crater) .... 1977 KJAJ78
90 primary nesting areas / Kilohana Pali and White Hill .... (1966-1977) KJAJ78
91 total population including juveniles estimated at 1600'500 / (Haleakala Crater) .... (1977) KJAJ78
92 99% of all known active burrows (Haleakala Crater) in KILOHANA QUAD. .... (1978) (24)

LAHAINA

93 disabled adult picked up / Lahaina Highway .... 27 Oct. 1976 (17)
94 disabled adult picked up / Lahaina .... 29 Oct. 1976 (17)

WAILUKU

95 Kunioki: disabled immature picked up / Wailuku Dairy Queen .... 23 Oct. 1976 (17)
96 Kunioki: disabled immature picked up / backyard of residence, Kahului .... 23 Oct. 1976 (17)
97 Kunioki: disabled immature picked up / Papa Street, Kahului .... 24 Oct. 1976 (17)
Island of Maui--(Continued)

WAILUKU (con't.)

98 Kunioki: disabled immature picked up / Kahului football stadium .... 24 Oct. 1976 (17)

99 Kunioki: disabled immature picked up / Wailuku .... 24 Oct. 1976 (17)

100 Kunioki: disabled immature picked up / Kaahumanu Shopping Center, Kahului .... 25 Oct. 1976 (17)

Island of Hawai‘i

Kohala

KAWAIHAE

101 Banko: long-term residents Richards and Wall reported hearing or seeing nothing resembling 'Ualu / Kahua Ranch .... 1955-1968 (1)

102 Banko: listened for an hour or two after dark...very windy...none heard / camp S of Puu Pili; Kahua Ranch .... 20 May 1968 (1)

103 Banko: listened for an hour or two after dark...none heard / camp near Puu Laalaau, head of W branch Honokane Nui, N Kohala Mtns. 3840 21 May 1968 (1)

KAMUELA

104 Banko: none heard 1930-2040 hours / Forestry Road overlooking Waipio Valley 4 miles N of Kamuela .... 11 Aug. 1967 (1)
Kona

HUALALAI

105 Banko: listened for calling of 'Ua'u without success 2000-2200 hours / Hualalai crater complex (Nawahine) 7400, 7600 26 June 1967 (1)

106 Banko: Santos collected bones of this species (presumably middens of early Hawaiians) / lava cave near Ahua Umi Heiau, Hualalai - Mauna Loa saddle area .... (1970) (6)

KAUNENE

107 passed the skin of a petrel lying on trail ... native guide said it was a 'Ua'u / Honaunau, Mauna Loa ca. 4500 16 Nov. 1891 MUNG41

PAPA

108 Banko: persistent night calling heard on initial and all subsequent visits; entire volcanic complex searched in 1967, finding only one active burrow (which was subsequently occupied in 1968 and 1972; unchecked in 1969, 1970, and 1971) / unnamed red cinder cone, and crater complex, 0.75 mile SE of Puu Ohohia, SW Rift, Mauna Loa 5536 18 May, 29 June 1967; 8-9 July 1968; 21 July, 1 Sept. 1972 (1)

Ka'u

PUU O UO

109 Banko: negative daytime search for burrows / Puu O Uo volcanic cone and crater complex NW slope Mauna Loa 8846 13 June 1967 (1)
Island of Hawai'i—(Continued)

PUU ULAULA

110  Lockwood: heard night calling of birds an
    hour or so after dark (?'Ua'u) / volcanic
    cone on NE Rift Mauna Loa

111

KULANI

112  Banko: one specimen salvaged / Kulani
    (Project)

ALIKA CONE

113  Banko: only one night-time call heard
    locally; sporadic calling heard distantly
    up-Rift of Puu O Keokeo / 1 mile NW of Puu
    O Keokeo

114  Banko: heard none listening 2000-2030 hours
    / Kipuka Nene 2-3 miles SE of SW Rift cracks
    and cones, Mauna Loa

115  Banko: only one night-time call heard on
    each visit / volcanic cone and crater complex
    2.5 miles N of Puu O Keokeo, SW Rift, Mauna
    Loa

116  Banko: no calls heard all evening to
    2113 hours / volcanic cone and crater complex
    adjacent to Great Crack, SW Rift, Mauna Loa
117 Banko: no calls heard from dusk to 2218 hours / volcanic cone and crater complex adjacent to Great Crack, SW Rift, Mauna Loa

118 Banko: none heard in three 1-mile apart night-time listening stations / starting 4 miles S of unnamed red cinder cone and crater complex (0.75 mile SE of Puu Ohohia) to within 1 mile of base of cone

8000 26 Aug. 1973 (1)

5536 8 July 1968 (1)

PUU KEOKEO

119 Banko: persistent night calling heard...one burrow near summit active in 1968, 1972; one burrow near base (maikai) of cone active in 1968 / Puu O Keokeo volcanic cone and crater complex, SW Rift, Mauna Loa


120 Banko: persistent night calling heard 1945-2107 hours...no burrow found / volcanic cone and crater complex ca. 1.5 miles down SW Rift from Puu Keokeo, Mauna Loa

.... 14 Aug. 1967 (1)

121 Banko: only a few calls heard from 2006-2230 hours / volcanic cone 1.5 miles NE of Puu Keokeo

.... 25 June 1968 (1)

122 Banko: no calls heard all evening to 2040 hours / volcanic cone about 4 miles NE Puu Keokeo

.... 26 June 1968 (1)
Island of Hawai'i--(Continued)

NAALEHU

123 Banko: Meinecke (born about 1886 in Waiohinu): night calling of petrels formerly heard from birds presumably nesting at nearby Pali Puuao (KAHUUKU RANCH QUAD.)...when a lad of only 6 or 8 years (about 1894) old timers told Meinecke of the 'A'o nesting in numbers at Pali Puuao before it collapsed in great earthquake of 1868...however Meinecke accurately imitated calling of 'Ua'u in my presence and was not familiar with appearance of either species. The historical record is therefor confused - possibly 'Ua'u nested at Pali Puuao or in conjunction with 'A'o / Waiohinu (NAALEHU QUAD.)

Kilauea

KAPOHO

124 Nakamura: saw small flock / near Malama-Ki .... Nov. (1951) BALH52

Hawaii Volcanoes National Park

PUU ULAULA

125 Banko: none heard in night survey 2005-2020 hours / Puu Ulaula (Red Hill) 10,092 5 June 1967 (6)

126 Conant: Corn picked up three partial specimens / about 0.25 mile NE Mauna Loa Trail 7700 late June 1975 (25)
127 Banko: NPS trail crew members Fontes and Nishimoto: found feathers and bill (identified as those of 'Ua'u by Banko) along Mauna Loa trail, above Strip Road

128 presence revealed (? heard) / Mauna Loa summit trail

MAUNA LOA

129 W. & P. Banko: none heard in night survey / Mokuweoweo Crater, W and E summit rims, Mauna Loa

KILAUEA CRATER

130 downy young obtained from a native, told that a considerable number had their nests in holes in the ground in the vicinity / Kilauea...and more particularly on the slopes of Mauna Loa

131 one caught alive / N rim of Kilauea caldera

132 NPS: young bird picked up alive / Kilauea Military Camp

133 believed heard at night / Volcano House

134 repeatedly heard...probably this species / Volcano House

135 King: unsuccessful night survey / Kilauea Iki, Halemaumau, Chain of Craters
<table>
<thead>
<tr>
<th>ID</th>
<th>Author</th>
<th>Description</th>
<th>Location</th>
<th>Date</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>136</td>
<td>Morrison</td>
<td>heard...surprised at the sound - to my ear more of a nervous chattering than the wailing sound I have heard described / (Kilauea Crater)</td>
<td>Kilauea Crater</td>
<td>28-29 April 1967</td>
<td>HATG67</td>
</tr>
<tr>
<td>137</td>
<td>Morrison</td>
<td>believe April 1967 records in error / (Kilauea Crater)</td>
<td>Kilauea Crater</td>
<td>(27 Sept. 1967)</td>
<td>MORG67</td>
</tr>
<tr>
<td>138</td>
<td>Banko</td>
<td>Hansen brought in specimen found dead on Belt Highway / 47 mile post (about 7 miles SW of Park boundary)</td>
<td>Kilauea Crater</td>
<td>22 Oct. 1967</td>
<td>(1)</td>
</tr>
<tr>
<td>139</td>
<td>Banko</td>
<td>none heard in night survey / Kilauea Crater</td>
<td>Kilauea Crater</td>
<td>25 May 1968</td>
<td>(1)</td>
</tr>
<tr>
<td>140</td>
<td>Banko</td>
<td>Forbes picked up one immature bird / Kilauea Military Camp</td>
<td>Kilauea Military Camp</td>
<td>18 Nov. 1968</td>
<td>(1)</td>
</tr>
<tr>
<td>141</td>
<td>Banko</td>
<td>specimen captured 2000 hours / flew into USGS Volcano Observatory window...night calm, ground fog</td>
<td>Kilauea Military Camp</td>
<td>13 May 1969</td>
<td>(1)</td>
</tr>
<tr>
<td>142</td>
<td>Banko</td>
<td>one immature picked up on ground; heavy overcast weather / Kilauea Military Camp</td>
<td>Kilauea Military Camp</td>
<td>28 Nov. 1972</td>
<td>(1)</td>
</tr>
<tr>
<td>143</td>
<td>Banko</td>
<td>Lockwood picked up immature live specimen / found on ground near the Volcano House</td>
<td>Kilauea Military Camp</td>
<td>19 Nov. 1974</td>
<td>(1)</td>
</tr>
<tr>
<td>144</td>
<td>Banko</td>
<td>Linderer picked up immature live specimen / Volcano House</td>
<td>Kilauea Military Camp</td>
<td>11 Nov. 1976</td>
<td>(1)</td>
</tr>
<tr>
<td>145</td>
<td>van Riper</td>
<td>one adult picked up / struck Volcano House during night</td>
<td>Volcano House</td>
<td>12 Nov. 1977</td>
<td>(4)</td>
</tr>
</tbody>
</table>
### KAU DESERT

<table>
<thead>
<tr>
<th>No.</th>
<th>Observations</th>
<th>Time</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>146</td>
<td>Banko: negative daytime search for burrows / Mauna Iki, Puu Koae cone, pit craters and basalt cliffs E and S of Puu Koae</td>
<td>3250</td>
<td>25 May 1967</td>
</tr>
</tbody>
</table>

### MAKAOPUHI CRATER

<table>
<thead>
<tr>
<th>No.</th>
<th>Observations</th>
<th>Time</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>147</td>
<td>Banko: several calls heard 1920-2100 hours / N mezzanine Makaopuhi Crater</td>
<td>3000</td>
<td>7 Sept. 1972</td>
</tr>
<tr>
<td>148</td>
<td>Baldwin: may have been present...seems very reasonable to me that population found in 1972 may be a relict group</td>
<td>3000</td>
<td>(1940's)</td>
</tr>
<tr>
<td>149</td>
<td>Banko: obtained carcass found dead by USGS field party...specimen had broken wing and burned feathers / within 3 ft. of edge of erupting crater, Mauna Ulu</td>
<td>....</td>
<td>1 Dec. 1972</td>
</tr>
<tr>
<td>150</td>
<td>Banko: none heard in listening survey from dark to 2030 hours...windy, drizzling rain / SE rim Makaopuhi Crater</td>
<td>3000</td>
<td>6 Aug. 1978</td>
</tr>
</tbody>
</table>

**Mauna Kea**

### UMIKOA

<table>
<thead>
<tr>
<th>No.</th>
<th>Observations</th>
<th>Time</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>151</td>
<td>heard uttering its peculiar call from a nearby hill after dark / (Kalumakani cabin)</td>
<td>7000</td>
<td>July 1962</td>
</tr>
<tr>
<td>152</td>
<td>Banko: none heard during 26 5-minute listening periods, 0.5 mile interval stop survey...2000-2400 hours / along State jeep trail on N and W slopes of Mauna Kea, from Puu Kanakaleonui to near Kemole (MAKAHALAU QUAD.)</td>
<td>(ca. 9000)</td>
<td>3 May 1968</td>
</tr>
</tbody>
</table>
Island of Hawai'i--(Continued)

AHUMOA

153 Banko: none heard during 11 5-minute listening periods, 0.5 mile interval stops, 2015-2115 hours / starting at 10,100 ft. el. at end of State jeep trail on W slope of Mauna Kea down to Puu Laau 7900 ft. el. .... 3 July 1968 (1)

MAUNA KEA

154 to owners belong sole privilege of capturing 'ua'u / land of Hamakua (Mauna Kea) .... (1875) LYOC75

155 complete dead specimen found / near Kanakaleonui...on the E slope of Mauna Kea 9400 29 April 1954 RICF54

156 five fresh burrows found / near Puu Kole... SE slope of Mauna Kea 8800 12 June 1954 RICF54

157 Fergerstrom obtained remains of three / above 9000 ft. on the E slopes of Mauna Kea (Puu Kole area) 8800 Spring of 1954 RICF54

158 feathers and part of beak found / on S slope of Mauna Kea ca. Spring of 1954 RICF54

159 many bones found with Hawaiian artifacts / Hopukane Shelter Cave, S side of Mauna Kea ca. (1954) RICF54

159a one of featured foods found in middens of early Hawaiians dated tentatively A.D. 1264 to 1657 / adze quarry sites, S slopes Mauna Kea 11,000-12,400 (1975/1976) MCCP77

160 Banko: picked up old wing; confirmed as 'Ua'u later by Banks and Laybourne, USNM / State Forestry cabin below Puu Kanakaleonui 9400 29 May 1968 (5)
161 Banko: none heard during 20 5-minute listening periods, 2015-2300 hours, half-mile interval stops / along State Fish & Game jeep road on E slope Mauna Kea, from near Puu Kole 10 miles to camp at Puu Kanakaleonui 8800-9400 29 May 1968 (1)

162 Banko: none heard during 17 5-minute listening periods, 2015-2155 hours, 300 ft. el. interval stops / starting at 12,000 ft. el. on summit road down to Hale Pohaku construction camp 9200 ft. el. .... 2 July 1968 (1)

163 Banko: Crapo (construction foreman for first Mauna Kea telescope): heard and saw no birds resembling 'Ua'u / Hale Pohaku construction camp and along access road to summit of Mauna Kea 9200-13,500 April-June 1968 (1)

164 Banko: Crapo saw and heard nothing of 'Ua'u since interview of 2 July 1968 / Hale Pohaku 9200-13,500 22 Aug. 1969 (1)

165 Banko: negative results for four 10-minute listening stations, 1945-2044 hours / along jeep trail E flank Mauna Kea beginning at 8800 and ending 9400 ft. el. switchback area above Puu Kole .... 15 June 1969 (6)

166 Banko: negative results during three 5-minute night listening periods / site of 'Ua'u burrows located by Fergusstrom in 1954, and along State Fish & Game jeep road 0.5 on either side (above Puu Kole) (ca. 8800) 22 Aug. 1969 (1)

167 Banko: Santos brought in old dried-up carcass picked up / black sand flats 0.25 mile S of Kanakaleonui 9400 28 Oct. 1969 (1)
Island of Hawai'i--(Continued)

**MAUNA KEA (con't.)**

| 168 | Banko: heard rush of wings and one call of 'Ua'u at 1935; two calls at 1942, several more weak calls at 1950 hours toward Kanakaleonui cone / 500 yards S Kanakaleonui | 9400 | 2 June 1970 | 1 |
| 169 | Banko: listened 2003 to 2015 hours hearing one clear 'Ua'u call / 1.25 miles S of Kanakaleonui | 9000 | 2 June 1970 | 1 |
| 170 | Banko: heard none in four 10-minute listening periods at 1 mile interval stops, from 2022 to 2130 hours / 2.25, 3.25, 4.24, 5.25 miles S of Kanakaleonui | 8900, 8700, 8800, 9100 | 2 June 1970 | 1 |
| 171 | Banko: none heard in four 10-minute listening periods at 0.5 mile interval stops, 1945-2044 hours / N along State Fish & Game jeep road starting W of unnamed volcanic cone N of Pu'u Kole | 8800, 9000, 9300, 9400 | 15 June 1970 | 1 |

**NAOHUELEELUA**

| 172 | remains of five found...fragile...skeletons nearly complete...not recent / on floor of lava tube edge of 1859 lava flow, Grid 18-73, Impact Area, Pohakuloa Training Area (U. S. Army) | .... | (1976-1977) | SHAR77 |
| 173 | leg and sterna bone middens in lava tube apparently used as sleeping cave by early Hawaiians / Grid 16, 17-81, 82, Area 7, P. T. A. (U. S. Army) | .... | (1976-1977) | SHAR77 |
174 natives report formerly...nested in great numbers / in the lave between Mauna Kea and Mauna Loa.

175 specimen obtained / Hilo beach

176 feel reasonably sure ('Ua'u) is mysterious visitor which has periodically invaded town of Hilo upon dark and stormy nights...harsh snarling cries...heard intermittently all night long...over the zone of light...usually during the fall and winter months...white underparts convince...beyond much doubt that this bird is none other than one of the petrels...some natives declare it is 'ua'u...others...'ao...koae...never seen by human eye...attempts to secure specimen futile / Hilo

177 Banko: Shipman (resident of Hilo area since 1892) never saw an 'Ua'u but as a lad recalled mother telling of natives claiming different caves or nesting areas for capturing young for food / undesignated localities

178 heard many...I think this species...more than ever before / (Hilo)
At Sea

179 natives reported common / on a fishing ground some five to ten miles off...windward Hawaii

180 distribution map (compiled from 3,561 hours observation on 15 cruise surveys along 34,384 mile replicate sampling track 1964-1965 indicates a density center in the NW corner of the area / near lat. 25°N, long. 157°W (in 500,000 sq. mile study area, between about 10°-27°N lat., and 148°-158°W long.)

181 observed on surveys / N to 42°N lat. .... (1964-1965) KINW67

182 observed on surveys / S to 5°N lat. .... (1964-1965) KINW67

183 individuals seen on surveys / as far S as lat. 11° N, as far E as long. 148°W, and as far N as lat. 25°N .... (1964-1965) KINW70

184 determined from surveys that species doubtless ranges / beyond the edges of the (10°-27°N lat. and 148°-158°W long.) study area in all directions .... (1964-1965) KINW70

185 King: Crossin saw in company with 'A'o / close to southern shore of Kauai...Pacific Biological Survey Program, Smithsonian Institution .... early morning (1965-1966)

186 King: numerous pelagic records / flying directly toward or away from Kauai a few miles offshore .... (1965-1966) (21)

187 Banko: Tokumine (Skipper of fishing vessel Kaimamala out of Hilo) identified 'Ua'u from specimen showed him, gave it the Japanese .... (15 July 1968) (1)
name "mitaru", and said it was present in offshore Hawaiian waters from May to October...
gone the rest of year / commercial fishing grounds from South Point, Hawaii, to French Frigate Shoals

Extra-Limital

188 a specimen / from the Molucca (Islands)
indicates a migration to the Western Pacific during the contranuptial season

.... (no date given) KINW67