



## Notes on Distribution and Behavior of the Endangered Hawaiian Hoary Bat (*Lasiurus cinereus semotus*), 1964-1983

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### ABSTRACT

Recent observations show that the Hawaiian hoary bat breeds on Hawaii and Kauai and occurs at least sporadically on Maui, Molokai, and Oahu. Two pregnant females found on Kauai and Hawaii carried twin fetuses that would have been born in June. Bats are most conspicuous from August to December, when they are seen earlier in the evening, in larger aggregations, and often over coastal waters. Foraging patterns suggest that Hawaiian hoary bats concentrate in the fall and may hibernate. They are more often associated with exotic (64%) than with native (19%) vegetation.

### INTRODUCTION

Forty years ago Baldwin (1950) reported that knowledge of the Hawaiian hoary bat (*Lasiurus cinereus semotus*) was "scant." Although information about this species has been summarized since that time (Tomich 1969, 1986; Kramer 1971), its actual status remains unclear. Kramer (1971) stated that "information about the distribution and abundance of the Hawaiian bat is sketchy and very meager." Tomich (1969) thought its population on the island of Hawaii was perhaps a few thousand, based on a number of scattered observations, yet he urged that the species be declared endangered. It was listed as an endangered species in 1970 and is presently protected by both federal and state laws (U.S. Fish and Wildlife Service 1973). We report here on 58 observations of 154 bats in the hope that this information will contribute to the understanding and conservation of the only terrestrial mammal endemic to the state of Hawaii.

### METHODS

During a 6-year survey (1976-1981) of the forest birds of Hawaii, Maui, Lanai, Molokai, and Kauai, we had an opportunity to supplement the limited knowledge of the Hawaiian hoary bat. The survey systematically covered the native forests of the state using a network of transects either 3.2 km or 1.6 km apart (Scott et al. 1981, 1986). While conducting avian and botanical surveys, trained observers spent many nights (Table 1) at randomly determined points along the transects in the forest in areas not normally reached by biologists. These observers recorded all bats seen. In addition, we kept records of all bats observed by us and our colleagues during incidental travels in the islands, primarily from 1976 to 1983.

### DISTRIBUTION

The Hawaiian hoary bat has been considered a resident of Hawaii Island and a sporadic visitor to Maui, Oahu, and Kauai: there are no published records from Molokai or Lanai (Tomich 1986, Kramer 1971). In the last several years there have been additional observations and a breeding record from Kauai (Table 2). All known records of live bats on islands other than Hawaii and Kauai are from May through December (Bryan 1955, Tomich 1969, and Table 2 of this paper). Although it is not known if breeding occurs on islands other than Hawaii and Kauai, we believe it is unlikely. Thirty-one bats were recorded during 1,800 person-days (one bat per 58 person-days) in the forests of Hawaii Island during the Hawaii Forest Bird Survey (Scott et al. 1986). In contrast, only one bat was found during 1,440 person-days surveying the other islands, where all areas covered by native forests, as well as many forest edges such as are apparently favored by bats, were visited. If bats were at least as common as on Hawaii, we would have seen 25 additional bats on other islands.

Further bat observations (1964-1983) known to us from islands other than Hawaii, exclusive of our transect sightings, have been included in Table 2 and are discussed below.

*Maui.* There are only seven dated records for Maui, with all but one of the live bats found in late summer or fall. This suggests that the Hawaiian hoary bat occurs on this island as a migrant, probably from the Big Island, although more intensive searches may yet turn up a resident population.

*Molokai.* One observation of bats has been recorded from Molokai. This was an open-water sighting, suggesting that the animals may have been moving through the area from other islands. A long-time Molokai resident, Noah Pekelo, who has looked for bats, has stated that they are seldom seen there (pers. comm.).

*Oahu.* The few scattered records from Oahu could be attributed to vagrant individuals from other islands. Bats may have been common on the island formerly, as Kotzebue recorded that the "air was filled" with bats about 6 miles west of the Pearl River on 8 December 1816 (Tomich 1986).

*Kauai.* With 15 bat records (1964-1982) occurring from May through February (Table 2), Kauai is second only to the island of Hawaii in the number of documented sightings. The 25 animals seen in May by Howarth is the second largest concentration ever reported. June records, including a female carrying two fetuses, confirm breeding for the island. There

are a number of undocumented observations of bats flying over the mouths of Kauai's northern rivers, such as the Lumahai (D. Boynton, pers. comm.).

**Hawaii.** On the island of Hawaii, bats were found from sea level to 3,050 m in many areas of the island (Fig. 1). Sightings were concentrated below 670 m on Highway 11 between Hilo and Kilauea, which was traversed two to three times a week by the second author, and at 305 m south of Kailua (Fig. 1). Though far more time was spent on roads on the windward side of the island, most bats were seen south of Kailua; thus it would seem that bats are more abundant on the drier leeward side of the island.

In summary, the statement of Kramer (1971) that the hoary bat occurs primarily on Hawaii and only irregularly on Maui, Oahu, and Kauai, with no records for Lanai and Molokai, clearly needs revision. The species is a breeding resident on Hawaii and Kauai, with scattered records during the nonbreeding season for all other populated islands except Lanai and Niihau. We have no knowledge of its status on Kahoolawe.

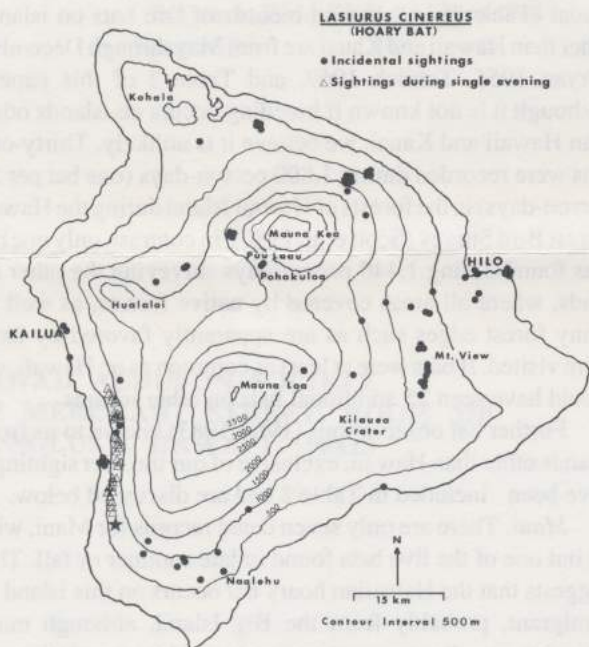


Figure 1. Distribution of Hawaiian hoary bat sightings on the island of Hawaii, 1976 to 1983. Each dot represents one bat observation; triangles indicate bats observed the evening of 11 September 1982 by J. Jeffrey and P. Pyle (see text). Star indicates the approximate location of a bat sighting by Fujioka and Gon (1988).

REPRODUCTION

Baldwin (1950) examined two female bats from the island of Hawaii, finding two fetuses in a specimen collected in May and none in a female collected in November. He concluded that the animals bred in "early summer." Two records from Kauai corroborate his interpretation. A pregnant female found on Kauai on 14 June 1982 contained two nearly full-term fetuses, and a bat found freshly impaled on a barbed wire fence on 23 June 1971 was immature. These records suggest that *L. c. semotus* females, like those of the North

American races (Findley and Jones 1964, Bogan 1972), typically produce two young in June.

TEMPORAL PATTERNS

Most timed bat sightings (incidental observations plus forest bird surveys) occurred near sunset (Fig. 2), reflecting the period of greatest overlap between observers and bats when visibility is good. Observations made only during the forest bird survey provide much less biased data. Bird observers spent about 1,200 person-days in the field on the island of Hawaii, were active each evening, and, more importantly, began recording birds at sampling stations immediately after sunrise. During the surveys, bats were recorded on transects 16 times: 12 of the sightings were near or after dusk and 4 were recorded while awaiting sunrise. Twenty-four bats were recorded at dusk and six at dawn, or 0.02 bats per person-day at dusk versus 0.005 bats per person-day at dawn. These differences are highly significant ( $X^2 = 10.8$ ,  $df = 1$ ;  $P < 0.001$ ). Our failure to record a single bat during more than 13,000 8-min count periods conducted between 0600 and 0930 h further attests to the lack of early morning bat activity during the summer months (May-August) in the forested areas of Hawaii. Fujioka and Gon (1988) recorded the time during which

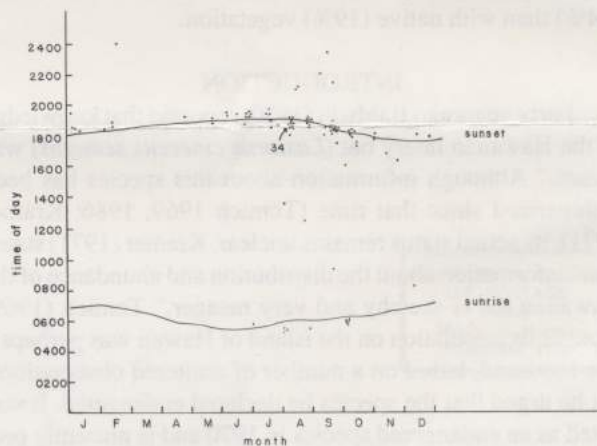


Figure 2. Frequency of Hawaiian hoary bat sightings by time of day, 1976 to 1983, island of Hawaii. Solid lines represent sunrise and sunset. Twilight in Hawaii ranges from 22 to 25 minutes before sunrise and after sunset year round. Each dot represents a single bat; 34 refers to 34 bats observed by Jeffrey and Pyle on 11 September 1982 (see text); star indicates midday record of Fujioka and Gon (1988).

a large congregation of bats (up to 108 individuals) dispersed from roosting areas south of Kailua. Bats were first seen at 1830 h (at dusk), with a rapidly increasing number peaking at about 1900 h and then decreasing rapidly until dark. Our island-wide records (Fig. 2) are consistent with these Kona sightings. We agree with Kramer (1971) that bats forage primarily in the early evening hours and that most bats have finished feeding and returned to their roosts well before morning twilight.

Fujioka and Gon (pers. comm.) recorded 108 bats flying northerly direction (353°) over a 45-min period in South Kona on 30 July 1977. For 10 days (27 July - 6 August 1977), they

studied these pre-dusk flights, which averaged  $55 \pm 27$  (range 8-108) bats per night. At 1335 h on 2 August they discovered 16 bats "entering and emerging from" a lava tube south of their previous location (Fig. 1). They speculated that the large evening flights could have resulted from roosting bats leaving this and nearby pit craters and lava tubes for their evening foraging bouts, but pointed out that little other evidence suggests that this generally solitary species ever aggregates in caves. On 11 September 1982, J. Jeffrey and P. Pyle (pers. comm.), two forest bird survey members, recorded 34 bats at dusk along 37 km of highway (0.9 bats/km) between Milolii and Kealakekua Bay, a location just northwest of the Fujioka and Gon records. These sightings suggest that hoary bats in Kona may regularly aggregate, and possibly use roosting caves, in the late summer months. If so, the population discovered by Fujioka and Gon may account for a significant fraction of leeward Hawaii's bat population, and their aggregations may be precursors to group hibernation in caves during the winter.

#### SEASONAL PATTERNS AND DISPERSION

More than 95% of the recent timed bat observations were at twilight or after dusk (Fig. 2). All bats seen flying earlier during daylight hours were found from August to December, following the early summer birthing season. Young hoary bats require about 45 days to reach independence (Maser et al. 1981), so they would begin foraging on their own at the end of July or in early August. The sudden diurnal appearance of bats at this time could indicate that juveniles, presumably less efficient at locating and capturing food, require more time to feed and thus begin to forage earlier to meet their energy needs.

Most bats have been recorded on Maui, Oahu, and Molokai from August to December. Most (82%) of the bat sightings on Hawaii also occurred at this time (Fig. 3), even though the greatest sampling effort was from May through August. Kramer (1971) suggested that hoary bats in Hawaii undergo a limited migration, continuing a pattern of movement essential in the mainland New World population from which they were derived. Although not proving the existence of migration in Hawaii, our data show that hoary bats are much more active and conspicuous in the fall months. They also form larger aggregations during that period. We recorded our largest group (8 bats) on 30 August 1977; Tomich (1969) recorded large groups on 22 September 1963 (12 bats) and 18 October 1964 (22 bats). The large aggregations of  $55 \pm 27$  bats (Fujioka and Gon 1988) and 34 bats (Jeffrey and Pyle, pers. comm.) from South Kona were in late July-early August and September, respectively. The two groups recorded by Tomich were over water and up to 0.9 km offshore. Such assemblages could give rise to interisland migrants.

Another striking feature of our records (Fig. 2, Table 2) is that only two bat observations, both on the island of Hawaii, were recorded from March and April. Although this may be a sampling error, the few sightings in winter suggest either much reduced activity or perhaps hibernation in the colder months with individual bats occasionally waking to forage, as they do in North America (Whitaker 1967). If hibernation

occurs, the conspicuous behavior of bats from August to November might relate to their need to lay down layers of fat, which they are capable of doing (Tomich 1965), prior to periods of reduced activity from January through April.

#### SOCIAL GROUPINGS AND FORAGING

Until the discovery of large numbers of Hawaiian hoary bats on the South Kona coast (Fujioka and Gon 1988), this species was considered solitary, even though loose groupings of up to 22 individuals had been recorded (Tomich 1969).

Forty-two of 56 incidental and transect bat sightings (75%) were of single individuals. The other 14 sightings consisted of 2 (six times), 3 (twice), 4 (four times), 5 (once) and 8 (once) animals, for an average of 1.59 bats per sighting. The animals within the groups were dispersed, and each bat appeared to forage independently of the others. Foraging bats typically flew strongly, swerving erratically from just above ground to 30 m or more above the forest canopy. On 17 May 1977, we found a hoary bat impaled on a barbed wire fence bordering native forest at the edge of a road on the island of Hawaii. It was only 1 m above the ground and presumably became entangled while foraging.

That 16 bats were seen flying about the entrance of a cave in Kona (Fujioka and Gon 1988) challenges our belief that the species is solitary. If such aggregations at caves are normal, then it is surprising that other bat caves have not been discovered. The species may be seasonally gregarious, aggregating following the breeding season when juveniles of the year become independent (and larger groups are seen). If the bats hibernate together during winter, this could explain the dearth of records for that period (Fig. 3). The discovery of the South Kona cave is important in that it provides an exceptional opportunity to study the species and fill in some of the many gaps in our knowledge of its ecology and behavior.

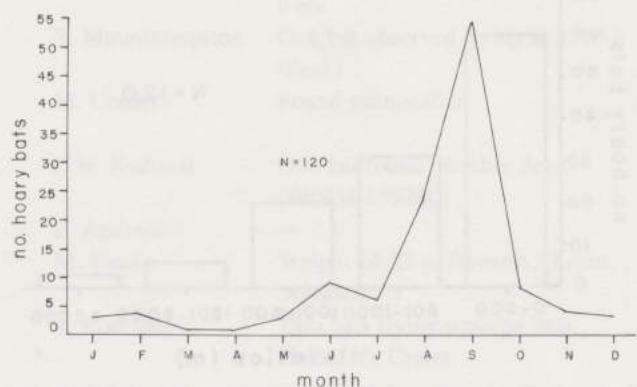


Figure 3. Monthly occurrence of Hawaiian hoary bat sightings, island of Hawaii, 1976 to 1983.

#### HABITAT CORRELATES

*Habitat.* Our bat sightings on Hawaii were placed into 5 habitat categories (Table 3). Hawaiian hoary bats were most frequently associated with exotic vegetation (64.2% of sightings). There were relatively few in native vegetation (18.7%). Of the bats recorded as occurring in native vegetation 38% were in disturbed areas. All 10 sightings made along the road

from Hilo to Volcano were in areas with tall eucalyptus or other exotic trees; no bats were seen in sugar cane fields. Most authors have remarked on bats flying offshore over bays; two of our sightings were at Hilo Bay.

No bats were seen in closed-canopy forest, native or exotic, nor any in the very open dying ohia forest on the windward slopes that we surveyed extensively in 1977. The systematic observations made during the forest bird survey suggest that bats occur most frequently on the edges of mesic forests and occur less often in the forests themselves. This conclusion, consistent with the distribution and habitat associations noted by observers on other islands, may be biased by the greater visibility of bats on forest edges.

**Elevation.** Bats were found from sea level to 3,048 m., but they were not uniformly distributed across this elevational range. Indeed, 76.7% of the bats we found were below 1000 m (Fig. 4), as were the 108 bats discussed by Fujioka and Gon (1988). This contrasts markedly with Perkins' observation (1903) that "...bats seldom visited the lowlands," but does corroborate Baldwin's statement (1950) that bats were to be found most frequently from sea level to 1,200 m.

**Rainfall.** On the island of Hawaii, bats were found in areas with up to 7,620 mm of precipitation per year. Sixty-two percent of the bats were found in areas with less than 2,540 mm of rain, and only 4.3% in areas with 5,080 mm or more of rain a year. Baldwin (1950) found bats only in those areas with 20 to 90 inches (508 to 2,286 mm) of annual rainfall. Although we found bats in areas with less (6.0%) or more (at least 37.1%) rainfall, our observations suggest that fewer bats occur in the wetter areas. This may be a result of fewer flying insects as well as reduced opportunities to forage in areas of higher rainfall. Indeed, nowhere on the windward (rainy) side of Hawaii Island have we found the relatively large numbers of bats reported from the drier leeward side of the island.

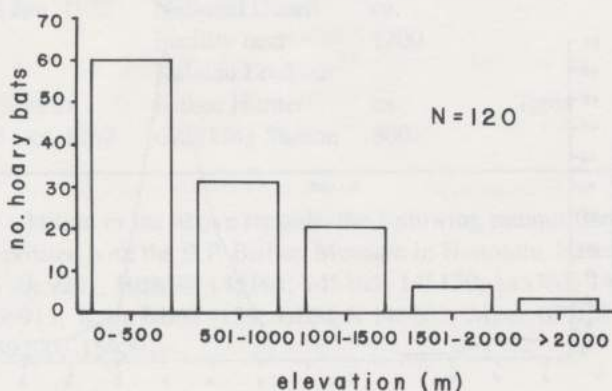


Figure 4. Frequency of Hawaiian hoary bat sightings by elevation, island of Hawaii, 1976 to 1983. Figure does not include the 108 bats seen at ca. 790 m by Fujioka and Gon (1988).

#### DISCUSSION

The biology of the Hawaiian hoary bat is scarcely better known today than when it was summarized by Baldwin (1950). No quantitative information on roosting behavior, breeding biology, home range, foraging patterns, or food supply is available. That the species may still migrate (be-

tween islands) in small numbers, and possibly hibernate, is intriguing in view of its recent evolutionary history in a relatively small, very isolated island archipelago.

The Hawaiian hoary bat is undoubtedly rare in the forests of Hawaii Island given that only one individual per 58 person-days was recorded there. But is it endangered? Possibly not. We suggest that its frequency near forest edges, exotic trees, and in orchards, its island-wide distribution on Hawaii, and its breeding population on Kauai are indications that it is more common and more adaptable than previously thought. Whether the hoary bat has declined because of introduced predators, as has been suggested (Degener 1970), agricultural practices, deforestation, or other human induced stresses is completely unknown. However, its apparent former abundance on Oahu (Tomich 1986) relative to its rarity there today suggests that at least some populations have declined. A great deal more must be learned to understand the true status of Hawaii's only endemic land mammal.

#### ACKNOWLEDGMENTS

We gratefully acknowledge the observations of many of our survey crew members over the years and the persistent encouragement of P.Q. Tomich. We owe many of our records to Eddie Andrade, Tom Telfer, P.Q. Tomich, Miles Ueoka, and Ron Walker, and we thank them very much for providing information. We also thank Alan C. Ziegler for preparing a listing of specimen label data from bats in the collection of the B.P. Bishop Museum and for extensive comments on the manuscript. We thank Wayne Lantz and Bonnie J. Fancher for typing the drafts of the paper, and Sheila Doyle, Tom Telfer, P. Quentin Tomich, and Julia Williams for further comments on drafts of this paper.

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Table 1 Kilometers of transects and approximate number of person-nights during the Hawaii Forest Bird Survey, 1976 to 1981.

Island	Kilometers of transects	Person-nights in forest
Hawaii	983	1800
Maui	174	800
Molokai	76	350
Lanai	10	90
Kauai	63	200
Total	1306	3240

Oahu was not surveyed.

Table 2 Incidental records of Hawaiian hoary bats from the islands of Maui, Molokai, Oahu, and Kauai, 1964 to 1983.

Date	Location	Elevation (m)	Habitat	Observer	Comments
<b>MAUI</b>					
28 Aug. 1975	Waiakoa Homesteads	133	Open stand of trees	D. Woodside	Four bats observed foraging at dusk by Woodside and five other biologists
Jul. 1976	Kaupo Gap	915	--	M. Levine, P. Higashino	One bat, flying, east edge of Kaupo Gap
14 Oct. 1979	Kula	880	Exotic vegetation	C.B. Kepler	One bat observed at 1815 h for 3 min. feeding around persimmon trees
21 May 1980	Puu Mamane, Haleakala Crater	2,225	Open Mamane forest	S. Mountainspring	One bat observed flying at 1915 h (dusk)
10 June 1981	Kahului	10	State baseyard lumberpile	M. Ueoka	Found mummified
11 Aug. 1982	1 mile above Kula Sanitorium	854	Exotic vegetation	C.H. Kishinai	One bat found "freshly dead" (BPBM 159280)
Various	Kula	850	Various	E. Andrade	--
10 Aug. 1983	Kula Sanitorium	950	Kitchen	M. Ueoka	Weight 14.25 g, forearm 57 mm, released
Oct. 1983	Ainahou Tr., Haleakala N.P.	ca. 2040	Alpine shrubland	T. Rodrigues	Two bats flying upslope into Haleakala Crater
<b>MOLOKAI</b>					
December	South coast of Molokai	Sea level	Ocean	A. Cooper	Several bats observed foraging over the water
<b>OAHU</b>					
27 Jul. 1974	University of Hawaii, Manoa Valley	25	Urban landscape	A.J. Berger	--
Oct.-Dec. 1980	Aiea Gulch	150	Exotic vegetation: ( <i>Leucaena glauca</i> )	Q.D. Stephen-Hassard	Three separate observations, 1 bat each time

## KAUAI

1 Jul. 1964	Kokee National Guard Radar Station	ca. 1200	Building lights	S. Au	Found "half dead," died 2 days later
3 Feb. 1970	Pohakea Ridge	1097-1250	Ohia forest	J. Sincock	One flying from 0845-1010 h, in valley below campsite
22 Jun. 1971	Wailua	Sea level	--	T. Telfer	Collected alive (BBM-X 146222)
23 Jun. 1971	Princeville	ca. 100	Exotic vegetation	W. Dias	Live immature bat found impaled on barbed-wire fence (specimen lost)
2 Nov. 1975	Puu Opae, Koikee	ca. 1200	--	D.S. Boynton	Collected (BBM-X 148202)
28 Jan. 1975	Kalalau Lookout	1325	--	W.J. Schrenk	One individual observed at dusk
17 Nov. 1976	Kalaheo	--	Exotic vegetation	A. Martin	One bat hanging on fence collected, identification confirmed by T. C. Telfer (specimen not saved)
24 Nov. 1976	Anahola Bay	Sea level	--	W.J. Schrenk, W. Bennert	One individual observed at dusk
15 Oct. 1977	Koikee Hunter Checking Station	ca. 800	Highway corridor	--	One bat was observed at dusk feeding along the highway corridor
May 1978	Koikee	ca. 1125	Building lights, Missile Tracking station	F.G. Howarth	Up to 25 bats circling the powerful lights
25 Sept. 1978	Koikee	--	--	G. Anderson, F.O. Hay	Picked up, released in good condition on 26 Sept. 1978
Oct. 1978	Nomilu Fish Pond, S. Coast	Sea level	Open ocean, 30 m. from shore	T.C. Telfer	--
Oct. 1978	--	--	Exotic vegetation, trees	T.C. Telfer	--
Oct. 1980	1/4 mile below Koikee Hunter Checking Station	ca. 800	Exotic vegetation, trees	T.C. Telfer	Observed up to four bats every Saturday
Oct. 1981		ca. 800	Exotic vegetation, trees	T.C. Telfer	Observed up to four bats every Saturday
14 Jun. 1982	National Guard Facility near Kalalau Lookout	ca. 1200	--	K. Fujii; verified by T.C. Telfer	Found in mechanics shed; pregnant female, two near-term fetuses
5 Sept. to 30 Oct. 1982	Koikee Hunter Checking Station	ca. 800	Trees	T.C. Telfer	Three to five bats reportedly seen along highway corridor

In addition to the above records, the following mummified remains, skeletons, or carcasses of Hawaiian hoary bats have been deposited with the B.P. Bishop Museum in Honolulu, Hawaii. The specimen numbers for each island are: Hawaii, BBM 9009; 9130; 9201; BBM-X 145164; 145165; 145170; 145763; 147035; 147123; 147124; 147125; 147126; 155005; 156911; 156912; 156913; Kauai, BBM 9129; BBM-X 148202; Maui, BPBM 159266; 159268; 159280; Oahu, BPBM 159287; 159288; 159289; 159290; 159291.

Table 3 Summary of bat sightings in five general vegetation types.

	Native vegetation	Pasture lands	Exotic vegetation	Urban areas	Water
Number of Bats	23	10	79	6	5
Percentage of bats observed	18.7	8.1	64.2	4.9	4.1

**BIRD WITH US IN MICRONESIA**

The Hawaii Audubon Society is sponsoring a visit to Micronesia from 15 February to 3 March 1991. The focus is on birds.

Koror, Yap, Truk, Saipan, and Pohnpei are among the thousands of coral atolls and volcanic islands scattered across nearly 12,000 square miles of the Pacific Ocean and known as Micronesia.

The Pohnpei Flycatcher, Fantail, Lory, Cicadabird, Long-billed White-eye, Oceanic Flycatcher, Blue-faced Parrotfinch, Great Truk White-eye, Palau Fruit-Dove, Micronesian Pigeon, Palau Ground-Dove, Nicobar Pigeon, Nightingale Reed-Warbler, Golden White-eye, Rufous Fantail, Mariana Fruit-Dove, Mariana Crow and Black Drongo are among the birds the group can hope to see.

Dr. H. Douglas Pratt, an authority on the natural history and bird life of Hawaii and the Pacific, will lead the HAS group. Pratt, a talented artist as well as a zoologist, illustrated the *Field Guide to the Birds of Hawaii and the Tropical Pacific*. His work is on display at the Bishop Museum.

The tour will cost \$3,895 a person, including round-trip air fare from Honolulu. If there are fewer than 13 participants, the cost will be \$3,995 each. Hawaii Audubon will receive \$150 per participant.

For more information and a detailed itinerary, contact Hawaii Audubon Society, 212 Merchant Street, Suite 320, Honolulu, HI 96813.

**OVERSEAS SUBSCRIBERS:  
POSTAGE IS GOING UP**

The cost of mailing the 'Elepaio to non-U.S. addresses has increased. Effective 1 January 1991, the subscription rate will be \$6 a year, plus the actual postage required. Exact figures will be included with the renewal notices scheduled to be mailed in November.

**JULY PROGRAM:  
WILD BIRDS OF JAPAN**

Films of the Red-crowned Crane, Swans, and Sea Eagles of Japan and civic action groups concerned about wild bird conservation in Japan will be shown at the Hawaii Audubon Society General Meeting on Monday, 16 July. The meeting, in the Boardroom of the Bishop Museum (please note this is a change from our normal location), begins at 7:30 P.M. All are welcome and refreshments will be served. The films have been made available by the Consulate General of Japan in Hawaii.

**CONSERVATION NEWS**

'O'opu hi'u kole Listing Petition: Hawaii Audubon Society received good news from the U.S. Fish and Wildlife Service. The HAS petition to list the endemic Hawaiian fresh water fish, 'o'opu hi'u kole (*Lentipes concolor*), as a threatened and/or endangered species with critical habitat designation (see 'Elepaio January 1990 Vol. 50(1):5-6). On 17 May 1990, the USFWS published in the Federal Register an initial 90-day finding that the petition presents substantial scientific or commercial information indicating that the petitioned action may be warranted. The Service now has one year (from 4 October 1989, the date of the USFWS receipt of the petition) to publish a proposed rule or finding on the petitioned action. Petitioners along with their legal counsel (Sierra Club Legal Defense Fund) will collect additional information on the species. Comments from the public are due by 17 July 1990.

**Lecture on Oil Spill Preparedness and Bird Clean-Up:** Jay Holcum is tentatively scheduled to speak on oil spills and bird clean-up in Honolulu on 18 July. The public is welcome to attend this talk, which is sponsored by Chevron. For more information, call Dana Kokubun, National Audubon Society Hawai'i Office. 522-5566.

**State Functional Plans:** The Office of State Planning is coordinating revisions to the State Functional Plans, seven of which deal with physical resources. Areas of interest to HAS members include water, State conservation lands, tourism, and energy. The Functional Plans are used by the State to establish priorities for addressing major issues within the specific areas addressed by the plans. Consequently, it is important that the public contribute to the revisions. The revised plans are expected to be available for public comment in July, when public informational meetings will be held. For more information, call OSP at 548-3064 (O'ahu).

**JULY FIELD ACTIVITY:  
'IHI'IHILAUAKEA NATURE  
CONSERVANCY PRESERVE**

Hawaii Audubon Society members and friends will hike to 'Ihi'ihilauakea, Koko Head, O'ahu, on Sunday, 15 July. Dr. Samuel Gon III will lead the hike, which features the rare Hawaiian *Marsilea villosa*, a vernal pool (if there has been enough rain), primitive tadpole shrimp (if flooded), possibly seabirds, marine mammals, and sea turtles. Hiking shoes, hat, sunscreen, binoculars, camera, and water are recommended. Meet at the Hanauma Bay parking lot at 8 A.M. Call Dr. Gon, 537-4508 (days) for information.

**HAWAII AUDUBON SOCIETY**  
212 Merchant Street, Room 320  
Honolulu, Hawai'i 96813  
(808) 528-1432

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## CALENDAR OF EVENTS

- July 9 (Mon.) HAS Conservation Committee Meeting at the HAS office at 6 P.M. Call Marjorie Ziegler for details, 528-1432.
- July 9 (Mon.) HAS Board Meeting at the HAS office at 7 P.M. Call M. Casey Jarman for details, 263-6396 (hm), 956-7489 (wk).
- July 15 (Sun.) Hike to `Ihi`ihilauakea Nature Conservancy Preserve. See page 65.
- July 16 (Mon.) HAS General Meeting at the Bishop Museum Boardroom, 7:30 P.M. Program: Wild Birds of Japan. See page 65.

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