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THE STATUS OF THE MARIANAS FRUIT BAT ON SAIPAN, TINIAN, AND ROTA

by Michael E. Wheeler

Early accounts of fruit bats in Micronesia (Tate 1934, Bryan 1939) report little ecological information. Surveys between 1963 and 1968 on Guam indicated serious population declines of the Marianas Fruit Bat (*Pteropus mariannus*) (Perez 1972, 1973). Fruit bat populations on Guam have continued to decline and are now at a critically low level (Wheeler and Aguon 1978), leading to a proposal to the Federal Government that the Guam population of this bat be listed as an endangered species (USDI 1979). Factors contributing to the decline are: over-hunting, permanent habitat loss due to increased urbanization, and severe typhoons that temporarily damage habitat and decrease food resources and bat numbers (Perez 1973, Wheeler 1979).

Fruit bats are highly prized as food by the people of the Marianas, and the demand on Guam for this delicacy is filled partially by importing frozen Marianas Fruit Bats from other islands (Ralph and Sakai 1979). Concern for all populations of *P. mariannus* led to a project to survey fruit bat populations on Saipan, Tinian, and Rota. This paper reports on the initial surveys of these islands, the number of fruit bats currently being imported from the Northern Marianas and other islands to Guam, and gives recommendations concerning the status of the Marianas Fruit Bat.

METHODS

Survey times were as follows: Saipan - 22.2 man-hours between January 15-20, 1979 by a team of two biologists; Tinian - 21.2 man-hours between January 17-20, 1979 by a team of two biologists; and Rota - 16.9 man-hours between April 4-6, 1979 by a team of three biologists. Observation stations were established to allow a view of at least 5 hectares of forest vegetation. The following number of stations were used: Saipan 15; Tinian 12; and Rota 13. Survey locations were selected because of their similarity to the preferred habitats of fruit bats on Guam. One-half to one and one-half hours were spent observing with binoculars or a spotting scope at each station. The number of bats sighted, their activity, and behavior were recorded. With the aid of topographic maps (scale of 1:25,000) and a dot grid, the area that could be accurately surveyed was estimated, and the observed densities of fruit bats were estimated. These surveys were conducted primarily during the daylight hours of each morning (0630-1130), although two to three late afternoon station counts were conducted

Marianas Fruit Bat at rest.

on each island. Counts were not conducted during rain or heavy winds.

An additional survey method consisted of roadside counts in which the observer drove about 8-20 kph in a vehicle and recorded all bats observed flying in the area under observation.

To obtain island-wide population estimates, each island was divided into four regions and the populations in each region were estimated. A regional method was used to better account for variations in habitat, exposure, geology, and other factors that could affect bat density. Regions were determined by dividing each island into quarters using north-south, east-west lines emanating from the following points: Saipan - CS 670800 on U.S. Army map sheet 3367 I SW, Tinian - CS 530600 on U.S. Army map sheet 3367 II SW, and Rota - CR 050650 on U.S. Army map sheet 3264 IV SE. If a survey area was crossed by a regional boundary line, the survey area was considered to be located in that region which contained a greater amount of the area surveyed. The maximum and mean densities of fruit bats observed in the survey areas located in each region were determined, based on the estimates of area made using topographic maps and a dot grid. The maximum density of a region was simply the highest density in any survey area within that region. Estimates of the area of unsurveyed woodland or brushland habitat in each region were made with the same technique used for estimating area surveyed. Recent (1976) aerial photographs of Rota were used to spot check the vegetation mapping shown on the Army maps of that island, and habitats were determined to be realistically represented on the maps.

Estimates of the maximum and mean numbers of fruit bats in the unsurveyed areas of each region were made by calculating the product of the amount of area not surveyed in the region and either the maximum or mean density of fruit bats observed in the surveyed areas of that region. An island-wide estimate was obtained by summing the estimates for the numbers of bats in the unsurveyed habitat of each region and the total number of bats sighted in the surveyed areas.

Individuals desiring to import frozen fruit bats into Guam are required to obtain an import permit from Guam's Department of Agriculture before the bats can be cleared through Customs. Data on fruit bat imports were collected from the files of issued and returned import permits at Guam's Department of Agriculture. Permits issued were used to calculate the number of fruit bats requested for import, and permits returned were used to calculate the number of fruit bats actually imported.

Table 1. Survey effort, number of Marianas Fruit Bats sighted, and population projections for Saipan, Tinian, and Rota.

	Saipan	Tinian	Rota
STATION COUNTS			
Man-hours	12.5	18.0	13.1
Ha surveyed	282.4	272.2	501.0
Number seen	0	2	36
ROADSIDE COUNTS			
Man-hours	9.7	3.2	3.8
Km traveled	199.4	34.6	63.7
Number seen	0	0	3
TOTAL NO. SIGHTED	0	2	39
TOTAL NO. IN UNSURVEYED HABITAT			
Based on mean density	0	24	152
Based on maximum density	0	107	376
TOTAL NO. ON ISLANDS			
Based on mean density	0	26	191
Based on maximum density	0	109	415

RESULTS

Saipan

In spite of an extensive survey effort, no bats were sighted on Saipan. By contrast, an equivalent effort in similar habitat along the northern cliffline of Guam yielded from 4 to 17 bat sightings, depending on location and time of day (Wheeler and Aguon 1978). Thus, Saipan's fruit bat population may be more severely depleted than Guam's. Possibly the Marianas Fruit Bat is now completely extirpated on Saipan, although one was seen there in 1976 (Bruner and Pratt 1979). Even if a few isolated bats remain, the lack of hunting restrictions and the easy accessibility of bat habitat are conducive to the extermination of the remnant population.

Tinian

On Tinian, only two bats were sighted. Both sightings were along the cliffs on the southern coast. The population projection suggests that there are not more than about 100 fruit bats on Tinian and about 25 is probably a more realistic figure (Table 1). There is a possibility that some bats travel the 9 km between Tinian and Aguijan, as one resident reported that a group of 20 bats annually makes this trip toward the end of the dry season (January to June). Nonetheless,

the population of resident bats on Tinian is extremely low and may soon be extirpated if hunting restrictions and export limitations are not initiated.

Rota

Rota was reputed to have had thousands of fruit bats three to four years ago (Eddie Dela Cruz, pers. commun.), but Drahos and Strong (unpublished notes) saw only 150 in 1977. In my surveys only 39 bats were sighted (Table 1). The projected population on Rota is approximately 200 to 400 fruit bats. Rota has an October to January season for hunting fruit bats, but there is no bag limit and enforcement has been minimal.

Fruit Bat Imports to Guam

Fruit bat imports to Guam from Saipan, Tinian, and Rota have increased dramatically over the past few years, and the demand is very much in excess of the capabilities of these islands to produce bats. Ralph and Sakai (1979: Table 1) list imports from 1974 to 1976. From October 1977 to June 1978 a total of 9,229 fruit bats were requested for import to Guam from the Northern Marianas Commonwealth (Table 2). The numbers of fruit bats actually imported during this same nine month period (Table 2) were much less than requested. More recently, for fiscal year 1979 (July to June), though similarly high numbers of bats were requested for import, the annual rate of bats shipped from Tinian and Rota to Guam was lower, while bat imports from Saipan increased.

Table 2. Data on fruit bat imports to Guam for fiscal years 1978 and 1979.

	FISCAL YEAR 1978				FISCAL YEAR 1979	
ISLAND OF ORIGIN	Requested Oct-June	Requested Annual Rate[a]	Imported Oct-June	Imported Annual Rate[a]	Requested July-June	Imported July-June
Saipan	4316	5755	788	1051	5283	1822
Tinian	1099	1465	325	433	699	343
Rota	3799	5065	919	1225	2017	732
Pagan	15	20	0	0	0	0
Palau	17922	23896	9283	12377	49658	18606
Yap	7250	9367	3387	4516	14674	2896
Truk	50	67	50	67	325	0
Am. Samoa	1000	1333	0	0	140	0
Ponape	30	40	0	0	395	221
Majuro	12	16	0	0	0	0
Tonga	100	133	0	0	0	0
Kosrae	20	27	0	0	0	0
Solomons	0	0	0	0	3000	1

[a] Annual rates were estimated by multiplying the figures obtained for October to June by twelve-ninths.

The total number of bats imported from the Northern Marianas Commonwealth to Guam has increased by about 7% since fiscal year 1978. Some of the bats imported to Guam from Saipan are Palauan bats (*P. pelewensis*), Yap bats (*P. yapensis*), or individuals of the protected subspecies *P. m. paganensis* being transshiped from islands north of Saipan (Pedro Dela Cruz, pers. commun.). In addition, some of the bats imported from Tinian are being illegally harvested on Aguijan (Pedro Dela Cruz, pers. commun.). It is obvious from my data that there are not sufficient numbers of resident bats on Saipan, Tinian, or Rota to support any harvest. In addition, the volume of bats being imported from Palau and Yap probably places excessive strain on the bat resources of these islands as well.

DISCUSSION

Extrapolation to unsurveyed area in the manner presented would be most valid if fruit bats were evenly distributed over the resource area. Like its congeners (Ratcliffe 1932, Nelson 1965), the Marianas Fruit Bat sometimes diverges from this pattern of distribution. Whereas individuals or small groups of bats may have roughly an even distribution over occupied habitat, this species also has a tendency to form "clumps" in the form of colonies of up to a few hundred bats (Perez 1973). On Guam, recent research data suggest that the formation of such colonies is an infrequent phenomenon and that hunting contributes to a decrease in this type of behavior (Wheeler and Aguon 1978, Wheeler 1979). The dynamics of fruit bat distribution in the Marianas is not adequately known, and it is possible the island-wide estimates of fruit bat numbers may not include a few colonies that might have been overlooked in a short duration study. On the other hand, some seemingly suitable bat habitat on Rota and Tinian is most likely not occupied, as is the case on Guam (Wheeler and Aguon 1978). Such a situation would give a positive bias to the population estimates.

Fruit bat imports to Guam began in the early 1970's after the local population became severely depleted and fruit bat hunting was made illegal on Guam. Individual consumers and entrepreneurs began investigating other islands with direct air traffic to Guam as sources of this local delicacy. The Northern Mariana islands of Saipan, Tinian, and Rota became popular sources for individual consumers, while wholesalers also sought out sources on these islands as well as on Palau and Yap. A pattern has emerged over the five-year period 1974-1979 during which bat imports have been monitored. Imports from Tinian and Rota have peaked and are now declining because fruit bat populations on these islands are now depleted. Bat imports from Saipan peaked in 1976, but now show a renewed increase, probably as a consequence of transshipment of bats originating in Palau and Yap, as well as Pagan and other islands north of Saipan. As nearby sources diminish, some entrepreneurs are investigating more distant sources without direct air traffic to Guam, such as the Solomon Islands or American Samoa, but as yet such sources have not substantially contributed to the total number of fruit bats imported.

In 1977 and 1978 the Division of Aquatic and Wildlife Resources of Guam made recommendations concerning the conservation of fruit bats to the Trust Territory administration and the government of the Northern Marianas. The Northern Marianas Commonwealth has established Aguijan as a wildlife sanctuary, and has declared a temporary moratorium on the taking of fruit bats on islands north of Saipan. However, it has not established any restrictions on bat imports and has not adequately enforced regulations concerning the taking of fruit bats. The Trust Territory administration has taken no action on these recommendations, presumably for reasons explained elsewhere (Owen 1969). We have also recommended to the Government of Guam the prohibition of importation or possession of Marianas Fruit Bats, and limitations on the importation of other species; however, cultural political and economic considerations were considered by the Governor's office to be more important than conservation, and the recommendations were not acted upon.

It appears that importation restrictions, if they are to be initiated at all, must come from legislation at the Federal level. The Federal Government, in its review of the Marianas Fruit Bat for endangered status (USDI 1979), has been advised to consider *P. mariannus* endangered on Guam, Rota, Aguijan, Tinian and Saipan.

The results presented here represent merely an initial attempt to determine actual population numbers, and additional surveys of Saipan, Tinian, and Rota are planned. There is an additional need to assess the population status of other species of fruit bats in Micronesia, particularly those of Palau and Yap. Quantitative data are necessary to support efforts for conservation, and future investigations of wildlife in Micronesia should address this need as it relates to fruit bats.

ACKNOWLEDGMENTS

Funding was provided by Federal Pittman-Roberson Aid to Fish and Wildlife Restoration on Guam. I wish to thank Mr. Pedro Dela Cruz of the Department of Natural Resources of the Northern Marianas, Mr. Eddie Dela Cruz, and the staff of the Division of Agriculture of the Northern Marianas for their advice and assistance in this project. Robert D. Anderson, J. Mark Jenkins, and Celestino F. Aguon assisted in data collection.

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OBSERVATIONS ON MONGOOSES CLIMBING TREES

by Nicholas G. Zimmer

The Small Indian mongoose *(Herpestes auropunctatus)* is known to be a predator of ground nesting and primarily ground-feeding birds (Baldwin, Schwartz and Schwartz, 1952; King and Gould 1967; Kramer 1971; Munro 1947; Schwartz and Schwartz 1950a, 1950b, 1951; Tomich 1969), but its ability to climb trees to possibly prey on eggs or adults has been doubted. I record here two observations of mongooses climbing trees with ease.

The first observation was on November 28, 1977, on the Island of Hawaii in Hawaii Volcanoes National Park near the maintenance area at 1200 m elevation. A mongoose was seen by S. Kaawaloa and A. Waipa at 2 p.m. on a clear, sunny day, approximately 10 m up in a large vertical (120 cm dbh) 'ohi'a-lehua *(Metrosideros collina)* tree. The observers saw it descending head first to the ground. The same mongoose was seen to go into a live-trap by the kennel and after capture was determined to be a female.

The second observation was 200 m west of Ainahou Nursery in the park at 914 m elevation on May 3, 1979, again at 2 p.m. on a clear day. I observed a single mongoose climb approximately 8 m up a 10 m tall (60 cm dbh) 'ohi'a-lehua. It went up and down the tree twice in the span of five minutes. Birds in the tree canopy flew away during the initial ascent of the mongoose. The animal seemed quite adept at climbing, as

Casa de Manana
La Jolla, CA 92037
December 4, 1978

To the Hawaii Audubon Society
P.O. Box 22832
Honolulu, HI

Dear Friends:

I am much touched by your kindness in sending me the beautiful placque. It has been installed where I will have the maximum pleasure in gazing upon it.

I, too, wish I could have been with you for the 40th anniversary. We all have occasion to be proud of the accomplishments of our society, and we are well aware of the struggles we have had.

Our little Society was my chief interest, and greatest joy for many years, and richly repaid any efforts I put forth.

Thanking you again, most deeply--

With mahalo and aloha,

Grenville Hatch

it took only about 5 seconds to ascend the tree.

This agility in climbing vertical trees, as shown by these observations, suggests that the mongoose may have played a part in the decline of Hawaii's native forest birds.

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DONATION REMINDER

Your donations are needed! Many of you received letters asking for help in maintaining the 'Elepaio. We enclose a return envelope in this issue for your donation in case you have misplaced yours. Please mail it in today! Mahalo!

ALOHA TO NEW MEMBERS

The Society welcomes the following new members and hopes that they will join in our activities to further the protection of Hawaii's native wildlife:

Joint with National: J.A. Broussard & Pomeroy, Paauilo; Mrs. James W. Drew, Kalaupapa; Katherine Herkes, Kailua-Kona; Janet Hirota, Kaneohe; B.J. Johnsen, Kailua; Richard Kimura, Honolulu; Mrs. Arthur R. King, Honolulu; K. Lani, Honolulu; Victoria E. Lee, Honolulu; James B. Levine, Kaneohe; Thom Moore, Kailua; A. Morgan, Jr., FPO San Francisco; Jess Norris, FPO San Francisco; R.B. Phillips, Honolulu; A. Roberts, Honolulu; Eric Roby, Pearl Harbor; Harold Sanders, Hilo; Jeff Stewart, Kaneohe; George W. Trendlev, Honolulu; Catherine Vernon, Kealakekua; Alvin T. Wakayama, Kamuela; Russell Wong, Mariana Islands, GU.

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ETHNOBOTANY FEATURED IN FEBRUARY

The February meeting will be *The Ethnobotany of some Hawaiian Fiber Plants* by Mrs. Evangeline Funk, a graduate student in the Department of Botany at the Univerity of Hawaii. She has recently completed her M.S. thesis on the anatomy of two cordage plants, olonā *(Touchardia)* and opuhe *(Urera)*, and three tapa plants, including 'oloa *(Neraudia)* and two types of mamake *(Pipturus)*.

Mrs. Funk was interested in determining if the historically recorded uses of these plants were actually compatible with their anatomical characteristics. In addition, she analyzed parts of artifacts to explore the possibilities of making plant identifications from the preserved materials. At present Mrs. Funk is continuing her graduate work and expanding her ethnobotanical studies. She is also the President of the Hawaiian Botanical Society.

The meeting will be held at the McCully-Moilili Library, 2211 S. King Street, at 7:30 pm.

WILDLIFE REFUGES FIELD TRIP

On February 10 we will visit the U.S. Fish and Wildlife Service Refuges on Oahu. This will take us to the James Campbell NWR (Kii and Punamano Units) at Kahuku, then on to Pearl Harbor NWR (Honouliuli and Waiawa Units). Endangered waterbirds and many wintering ducks and shorebirds will be present. Meet at the Hawaii State library on Punchbowl St. at 7 a.m., at 7:30 a.m. at Kahekili Highway and Haiku Rd., Kaneohe, or at 8 a.m. at the parking lot at Kahuku Sugar Mill. For more information, call Rob Shallenberger (261-3741).

TALKS SCHEDULED ON HAWAIIAN ECOLOGY

In connection with the Waikiki Aquarium, the University of Hawaii Sea Grant College announces a Spring 1980 natural history lecture series whose theme is "Hawaii: Ecology of the Islands". Speakers for the next month are:

Jan. 30. *Hawaii: a Laboratory for Island Evolution.* Dr. Sheila Conant, Univeristy of Hawaii.

Feb. 13. *Hawaii's Ocean: Waves, Currents and Climate.* Dr. E. Dixon Stroup, Oceanography Department at the University of Hawaii.

Feb. 27. *Hawaii's Amazing Plants and what we (Pre- and Post-Cook) have done to them.* Lorin Gill, Moanalua Gardens Foundation, and Sierra Club, Hawaii.

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SCHOLARSHIPS OFFERED

The Rose Shuster Taylor scholarships are again being offered for a one-year undergraduate tuition scholarship to the University of Hawaii for majors in some aspect of natural history. For information, write: Dr. Sheila Conant, Department of General Science, University of Hawaii, 2450 Campus Road, Honolulu 96822. Deadline is April 1; 1980.

GALAPAGOS ISLANDS TRIP

A few places are left in the trip to the Galapagos Islands May 23 - June 4. For details, contact Rob Shallenberger (261-3741).

HAWAII AUDUBON SCHEDULE OF EVENTS

February 10 (Sunday) Field trip to U.S. Fish & Wildlife refuges on the north shore of Oahu. For details see inside back cover.

February 11 (Monday) Board meeting at Susan Schenck's (98-1038 Moanalua Road - 488-4974), 7 pm. All members welcomed.

February 18 (Monday) Regular meeting on Ethnobotany of some Hawaiian fiber plants 7:30 pm at McCully-Moilili Library, 2211 S. King Street.

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