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Fruit Bats in American Samoa: Their Status and Future

by

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Introduction

Two species of fruit bats (flying foxes) appear in American Samoa. *Pteropus samoensis* is solitary and diurnal. *Pteropus tonganus*, the more abundant of the two species, is colonial and crepuscular-nocturnal. These bats have played a role in Samoan culture (Sinavaiana 1992) and are currently hunted for recreation and subsistence. This paper reviews the status of fruit bats in American Samoa, including relevant conservation legislation, population trends, hunting pressure, and other management issues.

Study Area

American Samoa, located 4,200 km southwest of Hawaii, consists of five small volcanic islands and two atolls. The largest island, Tutuila, is 142 km² and supports nearly 90% of the rapidly expanding human population in the Territory (Fig. 1). The estimated population in 1990 was 46,600 people, increasing at about 3.7% per year.

As elsewhere in the South Pacific, bats are the only indigenous mammals in American Samoa. Fruit bats are found on the five larger islands, which are mountainous and largely covered by rain forest, secondary growth, and agricultural plantations. These islands have steep slopes with limited areas suitable for human settlement and agriculture.

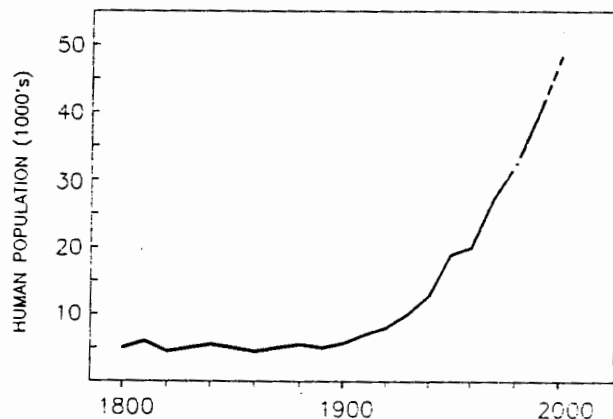


Fig. 1. Human population growth in American Samoa. Source: 1900-2000 (EDPO 1988); pre-1900 was based on scant records.

Legislative Protection

Since 1986, it has been illegal to export or commercially hunt fruit bats in American Samoa. Before 1986, annual exports from American Samoa to Guam increased from about 200 bats in the early 1980's to almost 2,000 bats in 1984 (Wiles and Payne 1986).

Legal restrictions by the Samoan government also apply to private or subsistence hunting (although enforcement is lacking): (1) there is a 3-month hunting season, (2) the bag limit is 7 bats per day, (3) shooting at roosts is prohibited,

(4) daytime hunting is prohibited (in order to protect *P. samoensis*), and (5) bats cannot be sold or bartered.

In 1989, Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES) listed both *P. samoensis* and *P. tonganus* as species in which international trade is prohibited.

Methods

Methods for determining the relative abundance and hunter harvests of fruit bats are summarized below. Further details are described by Knowles (1989) and Department of Marine and Wildlife Resources (1990).

An index of relative abundance was derived by the use of daytime surveys (Wilson and Engbring 1992). In 1989, 43 bat counts were made at 19 habitat stations at varying times of day and on different days. These stations ranged in size from 0.1 to 2.5 km² (average 0.9 km²) and covered a total of 17 km², equaling 12% of the land area of Tutuila Island. Survey locations differed slightly during the 3 years of study (1987-89). At each station, the observer was stationary and viewed a large area of terrain for 20 min during either of two periods (0500-1115 h or 1500-1930 h), because bat activity decreases somewhat during midday, particularly for *P. tonganus*.

Observed bats were classified as either using the study area or merely flying over it. Bats that flew over the ridges or well above the canopy and did not stop in the study area were assumed to be only flying over and were not included in the estimate of relative abundance. Bats observed eating, resting, or flying within or just above the forest canopy in the area were assumed to be using it. Given that it was possible to record the same bat on more than one occasion, the observer provided a final best estimate of the number of individual bats using the study area during the observation period. The relative abundance index was then calculated as the total number of individual bats using all study sites during all surveys divided by the total number of surveys conducted. Wilson and Engbring (1992) discussed a number of possible biases inherent in this method of estimating relative abundance.

A preliminary estimate of the hunter harvest was obtained by interviewing a subsample of subsistence hunters on Tutuila Island. In 20 of the possible 60 villages, 60-90 hunters were interviewed every 3 months from April 1990 to March 1991. The islandwide harvest was estimated from

the sample interviews for all hunters on the island. The latter was calculated by assuming that the ratio of hunters to people in the sampled villages was similar to the ratio of all hunters to all people on the island. Numbers of the two species of fruit bats killed were combined because many hunters do not differentiate between the two species. Because of potential sources of bias in the interview process, such as recall inaccuracy or the purposefully inaccurate reporting for fear of legal consequences, we believe the interviews yielded only a general picture of annual harvest levels.

Results

Population Trends

The abundance of the Samoan fruit bat (*P. samoensis*) on Tutuila Island has varied since systematic surveys began in 1987 (Fig. 2). The largest change between survey periods occurred during a single month (December 1987-January 1988) when the index fell by one half. It seems unlikely that this large change in the index accurately reflects a population change; the index change more likely reflects the impreciseness of the index to track population levels. If this is so, the increase in the index during the last observation period (April-May 1989) does not necessarily represent an increase in bat numbers.

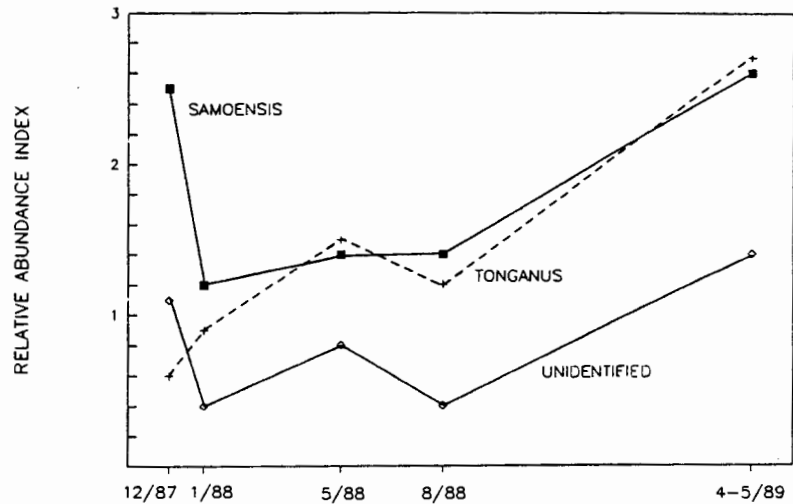
For the Tongan fruit bat (*P. tonganus*), a population increase may be occurring on Tutuila Island (Fig. 2). The abundance index shows a persistent increase since 1987.

Subsistence Hunting

At present, approximately 1% of the American Samoa population hunts. Fruit bats are hunted year-round for two reasons—the hunters are unaware of existing regulations that limit legal hunting to 3 months, and the regulations are not enforced.

An estimate of the number of fruit bats killed annually by hunters is complicated by a special event that occurred during the study period—Hurricane Ofa (February 1990)—which dramatically increased the bat harvest. After the hurricane, bats were exceptionally vulnerable to human harvest (see Discussion); thus the estimated harvest (2,800 bats) during the months following the hurricane (Table) is probably not indicative of typical hunting pressures.

Fig. 2. Relative abundance index for daytime-active fruit bats in combined habitat stations on Tutuila Island, 1987-89.



The high numbers of bats taken during the next 3½-month-period (July-October 15) may also have been influenced by the hurricane's effects or may realistically reflect an increased hunting pressure before a major holiday in American Samoa (White Sunday in early October), when hunting, especially for birds, is a well-known event.

Consequently, we have estimated the total harvest in two ways. The lower estimate assumes that only the last two quarters sampled reflect typical year-round hunting pressures; the high estimate assumes the same except for the one quarter which had increased hunting pressure because, presumably, of the White Sunday holiday. In this manner, we estimate that 700-2,300 fruit bats are probably killed annually by hunters on Tutuila Island.

Table. Estimate hunter harvest of fruit bats on Tutuila Island, American Samoa, following Hurricane Ofa in February 1990.

Quarter	Estimated total harvest fruit bats ^a
1. April-June 1990	2,800
2. July-15 October 1990	1,800
3. 15 October-December 1990	130
4. January-March 1991	230
Total	4,960
Modified annual harvest estimate	700-2,300 ^b

^a Includes both *P. samoensis* and *P. tonganus*.

^b See text for explanation.

Discussion

If our data accurately reflect bat abundance, then population levels of fruit bats have been relatively stable during the past few years, a finding similar to that of Wilson and Engbring (1992). We caution, however, that there are potential pitfalls in the use of daytime counts of fruit bats to monitor their relative abundance. While the method is convenient, daily activity patterns and other factors (e.g., hunger) can affect the numbers of bats active during the daytime, thereby complicating the interpretation of changes in the index. Further field studies are needed to test the reliability of this method.

We do not know how current population levels of bats on Tutuila compare to levels in the past, but anecdotal accounts suggest that former levels were higher. Hunting and habitat degradation because of farming and other human activities may have caused population reductions, and such pressures will presumably increase as the human population grows (Fig. 1).

We speculate that the recent Hurricane Ofa, which hit American Samoa in February 1990, caused significant mortality to fruit bats in two ways. First, the devastation caused by the storm probably killed some bats either directly or by blowing them far out to sea. Second, the surviving bats had difficulty finding food because the storm stripped virtually all fruit off the trees. It is likely that some bats starved in the weeks following the hurricane. An additional indirect effect was that the bats were more vulnerable than usual to hunting as they flew into villages in an apparent search for food.

Such severe weather events are, however, a characteristic feature of the South Pacific region. During the period 1840–1966, six hurricanes (sustained winds over 75 mph) and 42 tropical storms (sustained winds 40–75 mph) hit somewhere in the Samoan islands, for an average of one major storm event every 3 years (U.S. Army Corps of Engineers 1980). Fruit bats are thus almost certain to encounter one or more such storms during their lives because of their potentially long lifespan (up to 17 years—Koopman and Cockrum 1967). Because of this high probability of encounter, the bats may have evolved adaptations to such disturbances. For example, bats may have developed behavioral patterns to improve their short-term survival during such storms, such as roosting in protected areas or near the ground.

Life history traits of a population also provide a strategy to cope with ecological problems commonly encountered by a population (Stearns 1976). For many species, these traits tend to be associated in two general patterns that have been called r-selection and K-selection. Colonizing species are good examples of r-selected populations. They face a high rate of adult mortality each year; to survive over the long run, there must be a high rate of annual recruitment to the population. Individuals in these populations exhibit rapid growth, a short lifespan, and a high annual reproductive effort. In contrast, K-selected species (e.g., redwood trees) have relatively high survival rates of adults but low annual recruitment of young into their population. Adults are thus long-lived and reproduce enough times so that, despite the low recruitment of young, the population survives.

Fruit bats appear to have K-selected traits. Scattered data for several fruit bat species (Falanruw 1988) indicate that females generally have lengthy gestation (4–6 months) and weaning (2.5–6.8 months) periods, and produce one young per year. There is also a prolonged period before the young reach sexual maturity (1.5–2 years). The resulting recruitment rate of fruit bats is extremely low compared with other mammals of similar size. To offset this low recruitment, life expectancy may be long—one captive bat lived 17 years.

While a long life span buffers fruit bat populations against short-term adversity and a low recruitment rate, it also makes them vulnerable to any activity, such as hunting, that targets the adult segment of the population. A significant loss of breeding members, coupled with a low recruitment rate of young, would cause population numbers to

be reduced and retard the recovery of the population to former levels.

Summary

Five small islands in American Samoa support populations of the fruit bats *P. samoensis* and *P. tonganus*. Abundance indices indicate that both populations have been relatively stable in recent years (1987–89) despite substantial mortalities from hunting. But continuing habitat alteration because of agriculture, and potentially greater hunting pressure from a rapidly growing human population, pose problems that the bats may be poorly adapted to meet. The slow reproductive rate and longevity of adults, though a seemingly successful strategy for meeting recurring natural disasters such as hurricanes, may be less successful in accommodating increases in hunting pressure and other human-caused effects.

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