

To: Ray Tulafono, Director
From: Sandra Banack
Subject: Quarterly Report, September-December 1993

Summary of Activities

I have been working with the Wildlife Section of the Department of Marine and Wildlife Resources in a coordinated effort to understand fruit bat ecology. I have focused on two areas of study (1) radiotracking and (2) fruit bat feeding ecology. This report will outline my activities on fruit bat foraging.

Introduction

The primary question which I am gathering information to answer is How Do The Foraging Patterns of Flying Foxes Change in Relation to Seasonal Variation in Available Resources? I am interested in studying what the fruit bats eat and how this use changes throughout the year. To accomplish this task, I have used ejecta pellets as an indicator of use. As flying foxes feed they compress the fruit to the top of their mouth with their tongue. This action effectively squeezes out the juices, which are swallowed, and creates a pellet of dry fruit pulp which is spit out. These ejecta pellets are approximately the same size irrespective of the plant species, thus they provide an excellent measure of use within and between species.

The preliminary data presented here will be used to determine which fruits the bats prefer to eat. The results will be useful in determining the most important resources for the fruit bats. In addition, this work will identify times of year when fruit bats are resource limited (have the least amount of food available). This research will contribute to the long term conservation of flying foxes on American Samoa.

Materials and Methods

Study site: This work was conducted on the island of Tutuila, American Samoa located 170W longitude and 14S latitude in the Pacific Ocean. I limited my study site to the area between the villages of Afono and Vatia on the NorthEast side of Tutuila. This area was least damaged by the recent hurricanes and contains the highest density of P. samoensis on the island. In addition, there is a nearby colony of P. tonganus which regularly feeds within this area.

Tree species were chosen for investigation based upon direct weekly observations of flying fox foraging behavior, indirect

observations of pellets found under trees on regular forest transects, and previous information gathered on resource use. Sample size for each species varies according to availability and accessibility of fruiting trees during each month.

Fruit traps made from plastic or aluminum window screening or cloth or nylon mosquito netting were suspended under fruiting trees one meter off the ground and tied to adjacent foliage. One tarp measuring six square meters or two three square meter tarps were placed under each selected tree in the primary forest. One three square meter tarp was placed under trees with small canopies located in the agroforest or secondary forest and two three square meter tarps were placed under trees with large canopies. Each tarp was placed subjectively in an area with fruit above and/or in an area with fresh ejecta pellets on the ground below. This was done in an attempt to place the tarp in an area that would be most likely to receive fallen ejecta pellets if the tree were visited by a bat. Tarps were placed only under trees containing fruit.

Tarps were tied or cleaned from debris and rechecked 72 hours (+/- 3hrs) later. For each 72 hour sample the percentage of canopy fruit overhanging the tarp was estimated by determining the number of equal size tarps that it would take to cover all of the fruit in the tree. An estimate of the total number of fruits per tree was also made for each 72 hour sample period and the percentage of those fruits which hung over the tarp was recorded. The total number of ejecta pellets, the number of uneaten fruits, and the number of chewed fruits along with percent of fruit consumed from each chewed fruit and whether or not the seed was damaged was recorded. An attempt was made to gather two 72 hour samples per month (a minimum of 10 days apart) for each tree included in the sample. The same trees were sampled for consecutive months until all fruit was removed from the tree and the tarps produced zero pellets. New trees were added as they began fruiting and were located.

Broad phenology patterns within my study area for each tree species included in my sample were recorded monthly using binoculars on regular transects through the forest and using a spotting scope for phenology assessments for individual trees on steep slopes. The density of trees species within the area will be determined for the final data analysis.

Results

Fruit bats in Amalau are eating mostly asi fruit, Syzygium inophylloides in July and August (Fig. 1 & 2). In September and October when the asi fruit is no longer available, the animals begin to eat more agricultural crops, particularly breadfruit and papaya (Fig. 3). In November and December, the flying foxes are eating small amounts of many different kinds of fruit presumably as they ripen and become available. Palauquium stehlinii, is being eaten heavily in October and less so in November and December as

the fruit crop diminishes. Talie, Terminalia catappa, had fruit available in November but it did ripen until December. Ifi, Incarpus fagifer, is available at low levels from October through December in Amalau and is sought out and eaten as it ripens.

Discussion

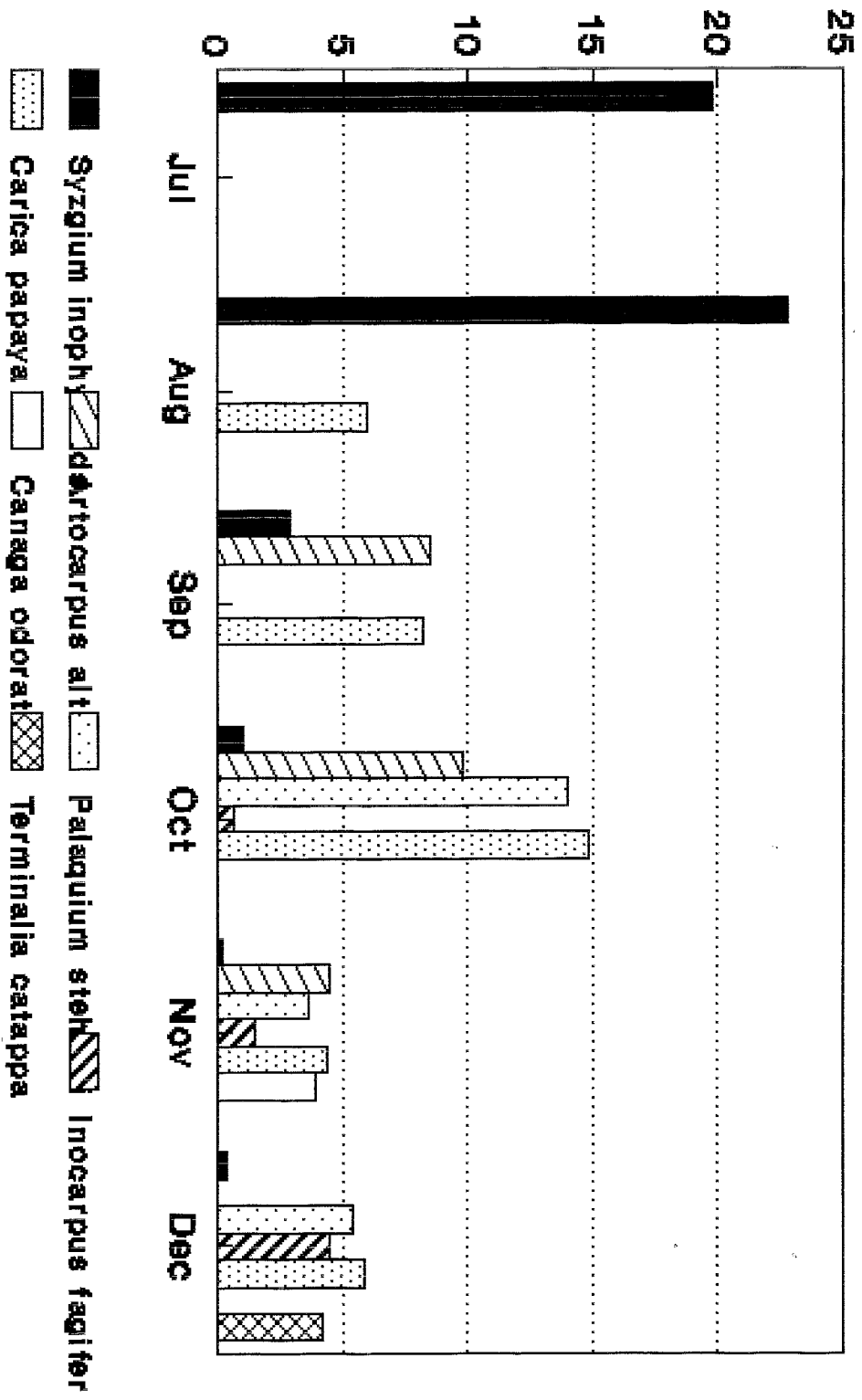
Although the data are preliminary, results indicate flying foxes may be a specialist (eating very few kinds of fruit) when a preferred fruit is abundant but be a generalist (eating many different kinds of fruit) when resources drop below a certain level (See Fig.1 & 2). The amount of ripe fruit per tree and the density of fruiting trees may determine whether or not a fruit bat can specialize on an individual resource. For example, the resources available during November and December such as ifi, talie, and Palaquium all have few ripe fruits per tree and are at relatively low densities in Amalau. The flying foxes respond by eating all of these fruit types in small quantities.

It is possible that there is a niche difference between the two species of fruit bats which affects where they are likely to forage. If this is true, then Pteropus samoensis, pe'a vao, which feeds predominantly in the primary forest (Fig. 2) undergoes a more radical food crisis than Pteropus tonganus, which regularly feeds in agroforested areas (Fig. 3). During regular field observations, I found P. samoensis in agroforested areas, feeding on breadfruit and coconut flowers, only during September and October.

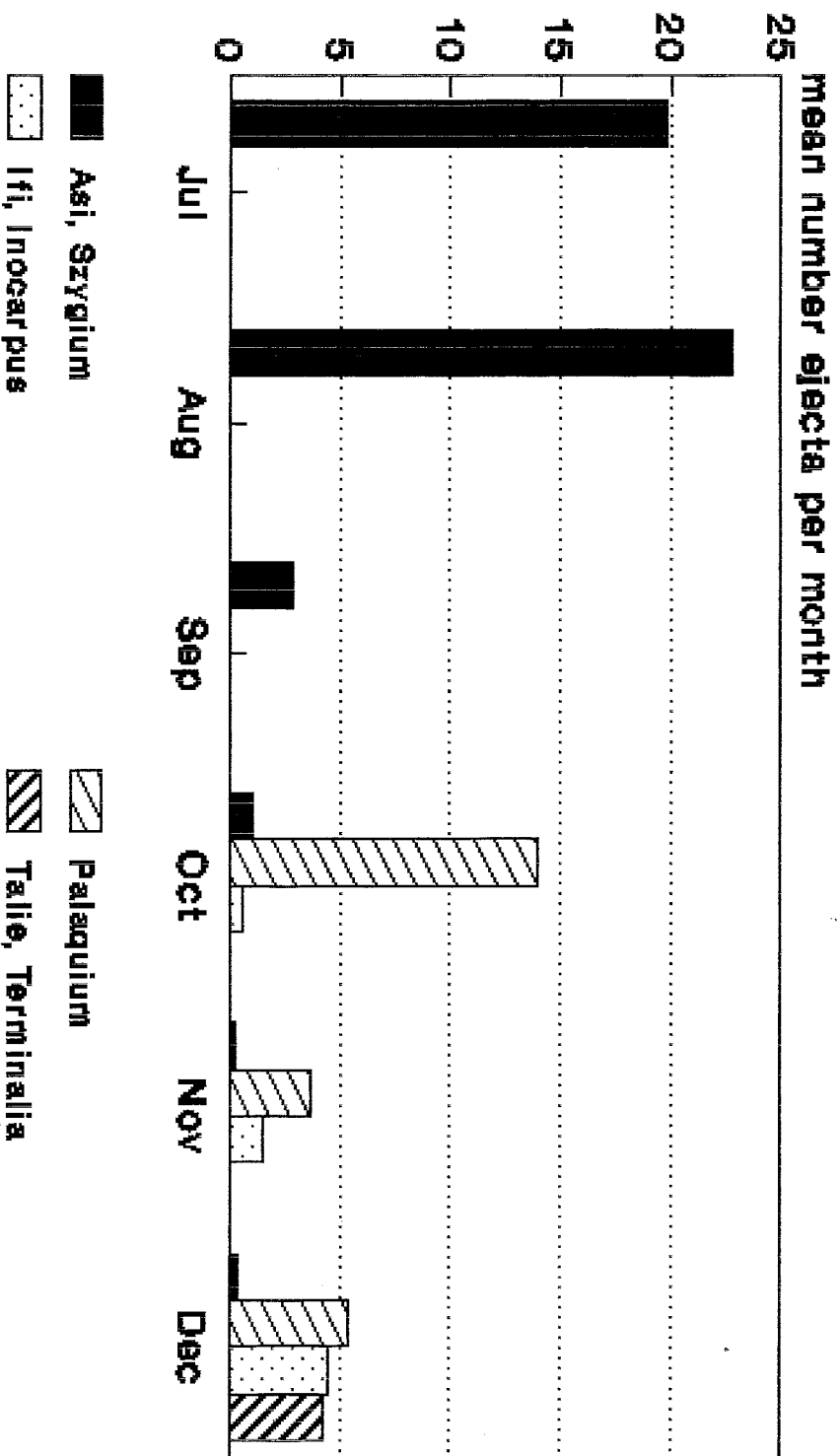
These results do not include flower resources which are also utilized by flying foxes. Starting in December and now in January as the asi flowers open, I expect to find continued low usage of fruit resources as the flying foxes specialize on the abundant flower resource.

Over the next few months, I intend to continue my study on foraging ecology. These results will be reanalyzed and examined in terms of a preference index (a number to compare the usage of these different species taking into account the fruit crop size and plant densities) to determine if the bats are seeking out certain resources and ignoring others. I greatly appreciate the support of the Department of Marine and Wildlife Resources, particularly Gilbert Grant, Pepper Trail, Peter Craig, and Ray Tulafono. This work is also being supported by the National Park of American Samoa, Bat Conservation International, Sigma Xi, and the Museum of Vertebrate Zoology, Univ. of Calif., Berkeley.

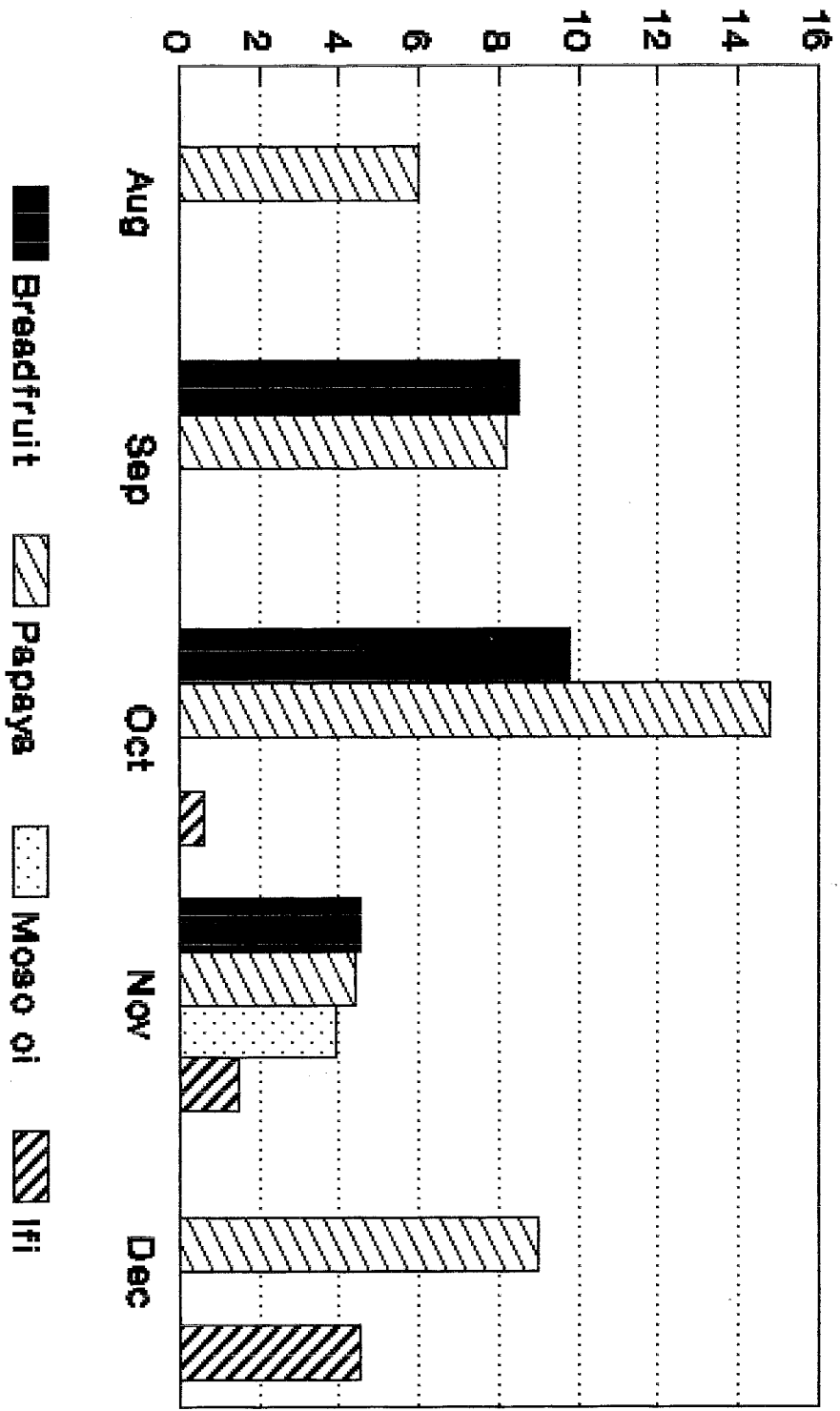
Ejecta Pellets



Primary Forest ejecta pellets



Agroforest ejecta pellets



Appendix I: Diet

	Flowers	Fruits	Leaves
July	2	3	
Aug	0	8	
Sep	2	7	1
Oct	7	13	
Nov	4	13	
Dec	2	7	
Jan	2	7	1

July -

Erythrina variegata (Fabaceae), flowers;
Ceiba pentandra (Bombacaceae) flowers;

Syzygium inophylloides (Myrtaceae), fruits;
Planchonella torricellensis (Sapotaceae), fruits;
Planchonella garberi (Sapotaceae), fruits.

August -

Syzygium inophylloides, fruits;
Ficus tinctoria (Moraceae), fruits;
Planchonella torricellensis, fruits;
Planchonella grayeana (Sapotaceae), fruits;
Planchonella garberi (Sapotaceae), fruits,
Ficus prolixa (Moraceae) fruits,
Ficus obliqua (Moraceae), fruits,
Carica papaya (Caricaceae), fruits.

September -

Eria robusta (Orchidaceae), flowers, leaves.

Syzygium inophylloides, flowers, fruits;
Ficus prolixa, fruits;
Carica papaya, fruits;
Artocarpus altilis (Moraceae), fruits;
Palaquium stehlinii (Sapotaceae), fruits;
Inocarpus fagifer (Fabaceae), fruits;

October -

Planchonella torricellensis, flowers;
Freycinetia reineckei (Pandanaeae), flowers
Cocos nucifera (Arecaceae), flowers;
Elaeocarpus tonganus (Elaeocarpaceae), flowers,
Albizia saman (Mimosaceae), flowers.
? Fragrae berteriana (Loaganiaceae), flowers;

Syzygium inophylloides, fruits;
Ficus prolixa, fruits;
Carica papaya, fruits;
Artocarpus altilus, fruits;
Palaquium stehlinii, fruits;
Inocarpus fagifer, fruits,
Ficus obliqua, fruits;
Freycinetia reineckei (Pandanaeae), fruits,
Planchonella garberi, fruits,
Pometia pinnata (Sapindaceae), fruits;
Musa sp. (Musaceae) flowers, fruits,
Piper graeffei (Piperaceae), fruits;
Magifera indica (Anacardiaceae), fruits,
Calophyllum inophyllum (Clusiaceae), fruits;

November-

Syzygium inophylloides, flowers, fruits;
Planchonella torricellensis, flowers;
Freycinetia reineckei, flowers
Musa sp. (Musaceae) flowers

Ficus prolixa, fruits;
Ficus unculata (Moraceae), fruits;
Carica papaya, fruits;
Artocarpus altilus, fruits;
Palaquium stehlinii, fruits;
Inocarpus fagifer, fruits,
Ficus obliqua, fruits;
Freycinetia reineckei, fruits;
Piper graeffei, fruits;
Magifera indica, fruits;
Terminalia catappa (Combretaceae), fruits,
Calophyllum inophyllum, fruits.
Canaga odorata, fruits

December-

? *Eria robusta*, leaves

Syzygium inophylloides, flowers

Musa sp., flowers

Syzygium inophylloides, fruits

Inocarpus fagifer, fruits

Terminalia catappa, fruits

Palaquium stehlinii, fruits

Carica papaya, fruits

Piper graeffei, fruits

Planchoella grayeana, fruits

January-

? *Hoya*, leaves

Syzygium inophylloides, flowers

Musa sp., flowers

Syzygium inophylloides, fruits

Inocarpus fagifer, fruits

Terminalia catappa, fruits

Palaquium stehlinii, fruits

Carica papaya, fruits

Piper graeffei, fruits

Planchoella grayeana, fruits