

When Bats Fly During the Day

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Introduction

Bats are normally nocturnal but are occasionally seen flying during the day. What causes bats to fly during the day and under what conditions ?

* Daytime: more than one hour after sunrise to more than one hour before sunset (1)

Study Sites

Saitama, Japan : *Nyctalus aviator* roost in this narrow space of the elevated railway mainly from September to May. The highest recorded number of bats roosting at one time was 177, October 14, 2012.

Ishigaki Island, Okinawa Prefecture, Japan : *Pteropus dasymallus yayeyamae* resident, relatively common.

Rota Island, CNMI : *Pteropus mariannus* resident. Estimated number as of January, 2011 is 2200 bats. (2)



Fig. 2. Roost of *N. aviator* between the railroad and an access ramp

Method

N. aviator in Saitama Prefecture

Emergence and Return survey : Visual surveillance and/or video surveillance. 62 days in total. Fall 2012, Spring 2013, Fall 2013, Spring 2014, and Fall 2014.

Behavior during daytime flight : Recorded by photography and with binoculars and a bat detector.

P. dasymallus on Ishigaki Is.

Visual observation from August 25 to September 3, 2015

The category 4 Typhoon 15 (Goni) hit Ishigaki on August 23, 2015. Highest wind velocity 71.0 mps at 21:16 in Ishigaki City, the highest ever on record for the island.

P. mariannus on Rota Is.

Visual observation from January 10 to 16, 2019

The Super Typhoon, Yutu, a Category 5, hit Rota on October 25, 2018. The strongest typhoon ever recorded to impact the Mariana Islands. The most powerful tropical cyclone worldwide in 2018



Fig. 1. Location of study sites

Result *N. aviator* in Saitama Prefecture

● Daytime flight : Flight was observed from early March to early April and from late October to late November, 27 out of 62 days.

● In total, 553 bats (41 in spring, 512 in fall) emerged and 159 bats (54 in spring, 105 in fall) returned during the daytime.



Fig.3 *N. aviator* flying with the sun in the background.

Fig.4 *N. aviator* flying with a dragonfly in its mouth at 14:50 on November 8, 2012.

● The number of bats emerged for each day varied between 1 and 99 and the percentage of bats emerged from the total number of bats in the roost also varied between 0.7% and 96.8 %

● During daytime flight we recorded behavior such as echolocation calls, feeding buzzes, and the chasing of insects. A dragonfly in the mouth and remains of diurnal insects in the feces were also observed.

Result *P. dasymallus* on Ishigaki Is.

Daytime flight and feeding were seen during almost all 10 days of our stay in many places including suburban areas mainly during late afternoon. The most observed was 7 bats feeding on *Ficus superba* fruit at a crossover inside of town. *Garcinia subelliptica*, *Ficus virgata*, *Ficus*



variegata, and *Ficus microcarpa* were also eaten.

Fig.5 *P. dasymallus* flying in the middle of the day.



Fig.6 *P. dasymallus* eating figs along the road during the day

Result *P. mariannus* on Rota Is.

Daytime flight and feeding were seen during all 7 days of our stay almost everywhere on the Island.

Bats were coming one after another to feed on matured pandanus fruit in daytime.



Fig.7 *P. mariannus* flying with a pandanus fruit in its mouth



Fig.8 *P. mariannus* picking pandanus fruit

Discussion

N. aviator in Saitama Prefecture

From behavioral observation we conclude the purpose of daytime flight is to feed.

● The risk of avian predation is the main reason that insectivorous bats do not frequently feed during the daytime (1)(7)(8)(9)(10).

● Attacks on large bats were not fatal (7).

● *N. aviator* is a swift flyer and a large bat with FA57-65mm, HB79-108mm, and BW26-60g (2) which leads to low predation risk.

● Daytime flight of *N. aviator* was seen in Spring and Fall just before and after hibernation at a time when bats need a lot of energy. Bats returned to the roost less than one hour after their evening emergence, therefore nighttime foraging is not sufficient. This forces bats into daytime feeding on warm days when insects are abundant.

Flying foxes

P. dasymallus on Ishigaki Is.

The bat is relatively common but daytime flight in the town area is rare.

● Not much fruit on the island. Premature *Ficus superba* fruit leads to severe competition with conspecifics.

● Therefore is the need to extend foraging time into daytime.

● However, they need to compete not only with conspecifics but also with some birds such as *Zosterops japonicus*, *Hypsipetes amaurotis*, and *Corvus macrohynchos*.

P. mariannus on Rota Is.

We visited Rota Island six times in the 1990s. Bats were only seen from a distance.

This year we saw far more bats in seven days than the sum of individuals we had seen in the 90s. They often flew low in daytime. Colonies were dispersed due to roost damage and food scarcity. Bats were scattered across the island foraging even during the day. (CNMI Division of Fish and Wildlife Mr. Guilbert pers. comm.)

● After Typhoon Roy on January 12, 1988, large numbers of bats foraged widely around the island during daylight hours (3)

● For several weeks after Typhoon Pongsona December 8, 2002, an increase in diurnal activity of bats on Rota was seen (4)

● At this time it had been 3 months since Super Typhoon Yutu and forests were not yet fully recovered. Wild fig trees had only immature fruit and banana plants had not yet bloomed. They would take another 3 months to bloom. Only available food was pandanus fruits. Mature edible fruit attracted flying foxes night and day therefore severe competition with conspecifics might drive them into daytime feeding.

Big typhoons created food scarcity which lead to destruction of known feeding sites and severe competition with conspecifics.

Predatory risk by diurnal birds is low for large flying foxes.

Actually, some species of flying fox on isolated islands, such as *Pteropus melanotus* on Christmas Island (5) or *Pteropus plesaphon* on Minami Iwo Island (6) where there are little to no diurnal avian predators, are often diurnal or crepuscular.

These are the reasons that the bats extend foraging time into daytime.

Conclusion : Daytime flight is restricted to specific conditions.

- Bats that have a low risk of predation
 - Relatively large bat species
 - Bats inhabiting isolated islands
 - Bats that can fly quickly
- Shortage of food
 - Bad weather
 - Tough seasonal conditions
 - Tough environments.

