

Aerial Predation of Japanese Pipistrelle *Pipistrellus abramus* by Diurnal Predatory Bird Species in a Suburban Riverine Habitat in Japan

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Introduction

Diurnal predatory bird species sometimes prey on nocturnal bats.

Birds adapted to urban environments, such as the Common Kestrel *Falco tinnunculus*, also adapted their hunting methods to newly available prey, such as bats.

The Japanese pipistrelle *Pipistrellus abramus* inhabits cities and suburbs and can be a food source for diurnal predatory species of birds in urban areas.

Methods

The Study Site: The river banks span an area of 400 m around 35°55' 30"N, 139°25'30"E along the river including the site visible from the observation point approximately 100 m on both sides of the river.

From April 1, 2012, to May 31, 2022, we often monitored the behavior of Japanese pipistrelles between approximately 1h before sunset and approximately 1 or 2h after sunset, mainly during spring to autumn. We spent a total of 710 days, with 318 days spent during the years 2012-2019, 163 days in the year 2020, 148 days in 2021, and 81 days in 2022 from January to May.



Results

Table 1. Predation of *Pipistrellus abramus* by diurnal birds
Blank cells at the time of predation indicate that time remained unrecorded.

Date	Time of predation	Predator	No. of bats captured	Time of first bat appearance	Sunset Time
Jun.28.2012		Peregrine Falcon	1	19:06	19:03
Jul.2.2012	19:31	Common Kestrel	1	19:15	19:03
Oct.9.2013		Peregrine Falcon	1	17:33	17:15
May 13.2014		Common Kestrel	0	18:39	18:39
May 28.2015	19:00	Common Kestrel	1	18:58	18:50
Jun.10.2015	19:16	Common Kestrel	1	18:59	18:58
Jun.12.2015		Common Kestrel	2	19:02	18:59
Oct.30.2015		Peregrine Falcon	3	16:52	16:50
Nov.3.2015		Peregrine Falcon	2	17:03	16:46
Apr.7.2017	18:11	Common Kestrel	1	17:51	18:09
May 24.2017	18:53	Common Kestrel	1	18:33	18:48
Mar.4.2018	17:43,17:46,17:51	Common Kestrel	3	17:39	17:40
Mar.19. 2018	17:50,18:00	Peregrine Falcon	2	17:50	17:53
Mar.23.2018	17:50,17:53,17:57, 18:12	Peregrine Falcon	4	17:50	17:56
Mar.30.2018	17:55,18:13	Peregrine Falcon	2	17:55	18:02
Apr.2.2018	18:14	Peregrine Falcon	1	17:52	18:05
Apr.5.2018		Common Kestrel	1	18:07	18:07
May 5.2018		Japanese Sparrowhawk	0	18:33	18:32
May 10.2018		Peregrine Falcon	0	18:42	18:37
May 15.2018		Common Kestrel	2	18:38	18:41
Dec. 3.2019		Falco spp.	0	16:48	16:28
Apr.23.2020	18:05,18:25	Japanese Sparrowhawk	2	17:59	18:23
Apr.25.2020	17:50,18:00,18:15	Japanese Sparrowhawk	3	17:50	18:24
Apr.26.2020	17:35	Corvus spp.	0	16:38	18:25
Apr.26.2020	17:40	Japanese Sparrowhawk	1	16:38	18:25
Apr.28.2020	17:27,17:52,17:40,17:53	Japanese Sparrowhawk	4	17:27	18:27
Apr.29.2020	17:50	Japanese Sparrowhawk	1	17:26	18:28
Apr.30.2020	17:32	Carrion Crow	1	16:39	18:29
Apr.30.2020	17:13	Japanese Sparrowhawk	0	16:39	18:29
May 1.2020	18:03,18:09	Japanese Sparrowhawk	2	17:35	18:29
May 3.2020	17:45	Japanese Sparrowhawk	0	17:45	18:31
May 4.2020	17:54, 18:06, 18:23, 18:33	Japanese Sparrowhawk	4	17:54	18:32
May 7.2020	18:24	Japanese Sparrowhawk	1	18:04	18:35
May 22.2020	17:55	Common Kestrel	0	17:55	18:47
Jun. 15.2020		Common Kestrel	0	19:15	19:01
Aug.1.2020	18:48	Peregrine Falcon	0	18:48	18:47
Apr.20.2021	18:28	Japanese Sparrowhawk	1	17:46	18:20
Apr.21.2021	18:35	Japanese Sparrowhawk	1	18:13	18:21
Apr.24.2021	18:22,18:25,18:29	Japanese Sparrowhawk	3	17:04	18:23
Apr. 25.2021	18:22	Japanese Sparrowhawk	0	18:18	18:24
May 17.2021	18:36	Common Kestrel	0	18:36	18:43
Mar.1.2022	17:53	Bull-headed Shrike	1	17:43	17:37
Apr.6.2022	17:45-17:50	Carrion Crow	0	17:45	18:08
Apr.30.2022	18:25	Japanese Sparrowhawk or Common Ke	1	18:18	18:28
May 2.2022	17:48	Japanese Sparrowhawk	1	17:47	18:30
May 3.2022	18:43,18:46	Japanese Sparrowhawk	2	18:35	18:31
May 26.2022	18:50	Japanese Sparrowhawk	0	18:28	18:49

Japanese Sparrowhawk *Accipiter gularis*

The smallest raptor in Japan and breeds in urban environments.

From April-May 2020, a pair nested in an urban park adjacent to the study site. The male delivered prey to its mate. Torn-off and discarded bat wings were found. In April 2021 and 2022, a pair also nested.



Common Kestrel *Falco tinnunculus*

Breeding in urban areas in southern Kanto since 1966. Not observed often at the study site. Quite skilled bat hunters.



Peregrine Falcon *Falco peregrinus*

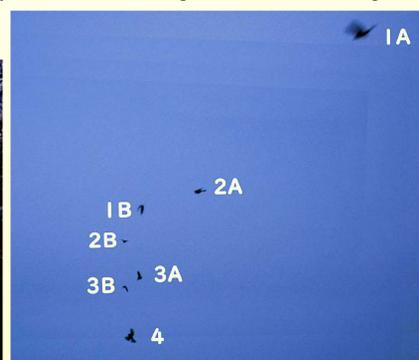
Has expanded into urban areas recently. Did not visit the study site frequently.



Bull-headed Shrike *Lanius bucephalus*

According to previous reports in Japan, an impaled Japanese pipistrelle was found in February and March and predation by shrikes was observed twice in March. We recorded predation by the Bull-headed Shrike only once, on March 1, 2022. All cases are when Japanese pipistrelles wake up from hibernation and fly occasionally on warm days.

A and B represent the Bull-headed Shrike and the Japanese pipistrelle, respectively. The numbers represent the time sequence of the images. No. 4 is the point when the shrike captured the bat.



Crow (*Corvus spp.*)

Carrion and Jungle Crows inhabited the study site throughout the year. We observed only three cases of hunting of the Japanese pipistrelle by crow species. The Carrion Crow *Corvus corone* captured the bat after several failed attempts, suggesting that they were not skilled bat hunters.



Discussion

In our observations, 32 of the 47 attacks (68%) occurred in April and May (Table 1). Among these predation events, 26 events, i.e., 81% of the 32 attacks, were by the Japanese Sparrowhawks and Common Kestrels, probably because the Japanese Sparrowhawks nested near the study site and the Common Kestrels also bred in the same city. Another reason could be a seasonal change in the daily activity of bats. In April and May of 2020 and 2021, the bats often appeared before sunset and were frequently attacked by diurnal predators. On April 24, 2021, the bats appeared in daylight, an hour and nineteen minutes earlier than sunset, and a Japanese Sparrowhawk hunted three bats (Table 1). **Diurnal predators can take advantage of the Japanese pipistrelle in bright daylight.** Considering a short feeding opportunity before and after sunset for these diurnal avian predators, we suspect that **the bats were their potential prey when the daytime food supply of the predators was insufficient.**

The Japanese pipistrelle is small, weighs 5-11 g, flies slowly, and is an easy target for small predatory birds, including the Japanese Sparrowhawks, Common Kestrels and Bull-headed Shrikes. These bats are prospective prey for predatory birds in urban areas.