Short Note

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A treetop diner: camera trapping reveals novel arboreal foraging by fishing cats on colonial nesting birds in Bangladesh

https://doi.org/10.1515/mammalia-2023-0074
Received June 21, 2023; accepted December 21, 2023; published online January 15, 2024

Abstract: Based on camera trap images, we document active foraging attempts on nests of colonial waterbirds by a fishing cat *Prionailurus viverrinus*. The nests were built in the canopy of an 8-m-tall Indian Oak tree *Barringtonia acutangula* in the Haor Basin region, northeast Bangladesh. In 2022, two events of fishing cats reaching nests with fledglings were documented. In one event, the cat killed four fledglings. The species primarily follows a piscivorous diet and is evolutionarily adapted for semi-aquatic hunting niches. These records provide the first known evidence of the arboreal hunting behaviour observed in the fishing cat.

Keywords: arboreal camera trapping; Felidae; *Prionailurus viverrinus*; predatory-prey relationship; wetland ecosystems

The fishing cat *Prionailurus viverrinus* (Bennett, 1833) is a globally vulnerable ‘Evolutionarily Distinct and Globally Endangered’ (EDGE) small felid found in South and Southeast Asia (Mukherjee et al. 2016). The species has a disjunct distribution pattern that shadows the extent of freshwater landscapes and coastal wetlands – ecosystems that are today largely human-dominated (Mishra et al. 2022; Rana et al. 2022). Despite fishing cats’ extensive proximity to anthropised habitats, their ecology, population structure, etc. are yet to be completely understood (Petersen et al. 2022; Tensen 2018). This is particularly true for Bangladesh. Although studies on human-fishing conflict in the country have gained momentum (Akash et al. 2022; Chowdhury et al. 2015; Eva et al. 2022; Sultana et al. 2022), research on the species’ ecology has not been undertaken so far. This is in sharp contrast to the fishing cat studies in the Terai Arc in Nepal (Mishra et al. 2022), the Coromandel Coast and the Ganges-Godavari floodplains in India (Chakraborty et al. 2020; Malla et al. 2018; Mukherjee et al. 2012), and in the urban wetlands in Sri Lanka (Ratnayaka et al. 2022) that employed novel technologies such as camera trapping and satellite telemetry.

The fishing cat has primarily a piscivorous diet (MacDonald and Loveridge 2010). Scat analyses show that fish can comprise up to three-fourths of its diet (Cutter 2015; Haque and Vijayan 1993). However, its dentition, except for the large premolars to grip any slippery prey, is of a generalized felid structure (Castelló 2020). Feeding of fishing cats on shellfish, herpetofauna, birds, small rodents, and, in rare cases, on calves, chital *Axis axis* fawns, carcasses and kills of large sympatric carnivores are, thus, also reported (MacDonald and Loveridge 2010; Sunquist and Sunquist 2017). This nocturnal species is known to take birds roosting in trees close to the water surface as reported in mangroves of Cambodia (V. Herr, personal communication) and birds roosting on floating platforms in wetlands (Malla et al. 2018), but active arboreal foraging has not been previously recorded (Hunter and Barrett 2018; Macdonald and Loveridge 2010; Sunquist and Sunquist 2017).

The hunting strategy of fishing cats is well-documented, both in *in-situ* and *ex-situ* conditions (Ganguly and Adhya 2022; Iwaniuk et al. 2001). Depending on the water depths of the hunting grounds, fishing cats can be mobile or stationary while in pursuit of prey (Ganguly and Adhya 2022). Both studies showed that the species actively uses its semi-webbed forepaws to search and grasp prey items.

When compared to arboreal specialist felids such as the margay *Leopardus wiedii*, marble cat *Pardofelis marmorata* and clouded leopards *Neofelis* spp., the evolutionary adaptations of the fishing cats are entirely different (MacDonald and Loveridge 2010; Sunquist and Sunquist 2017).

The fishing cat is comparatively short-legged with a relatively short, stubby, muscular tail. It has water-resistant two-layered fur, semi-retractile claws and partially webbed forepaws i.e., no more webbed than that of the bobcat *Lynx rufus*. Along with the flat-headed cat *P. planiceps*, it is one of

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the only two extant Felidae that has evolved for semi-aquatic hunting niches (Ganguly and Adhya 2022; Hunter and Barrett 2018; MacDonald and Loveridge 2010).

Since the 1990s, the advent of camera trapping has revolutionized non-invasive studies in rare, threatened, elusive terrestrial wildlife across the world. This comparatively budget-friendly and low-effort method enables access to invaluable ecological and behavioural data, ranging from biodiversity inventorying to assessing community synergy to estimating species abundance (Oliver et al. 2023). Recently, the application of camera trapping to understand arboreal wildlife has gained increasing popularity (Gregory et al. 2014). Arboreal camera-trapping can enhance the detection rate of species that are explicitly canopy-dwellers (Debruille et al. 2020; Séguigne et al. 2022). Arboreal camera traps are now being used to understand tree-living communities (Agostini et al. 2022) as well as to monitor nesting success in colonial waterbirds (Brandis et al. 2014).

Between 12 June, 2022 and 31 October, 2022, a systematic camera trapping survey was carried out in Bangladesh to monitor avian breeding and roosting colonies. These are often multi-species colonies comprising little cormorants Microcarbo niger, cattle egrets Bubulcus ibis, and openbill storks Anastomus oscitans. Upon identifying a tree occupied by a colony, two Scoutguard passive infrared camera traps were deployed per colony, mounted in the top canopy, and placed ensuring a clear view of the targeted nests (Figure 1B). No baits were used. Camera traps were set in the field-scan

**Figure 1:** Location of the bird colony where the arboreal predatory behaviour of the fishing cat was captured on camera traps in northeast Bangladesh. (A) Fishing cat range in Bangladesh. (B) Northeast Bangladesh. (C) The Indian Oak/Hijal tree. Red circles denote the placement of the camera traps. The range map in Bangladesh is adapted from Mukherjee et al. (2016).
mode and kept operational 24 h a day. Each camera trap was programmed to capture two images upon trigger after every 4-min interval. Every 21–30 days of the sampling period, camera traps were checked for data collection and battery replacement.

One such colony on an Indian Oak tree (Hijal in Bangla) [Barringtonia acutangula (L.) Gaertn. 1791] in a village in Barlekhia subdistrict, Moulovibazar district, northeast Bangladesh was recorded. The site (N 24°41’30.32033 E 92°06’13.4”) is adjacent to the Hakaluki Haor. The wetland is part of the Haor Basin region, northeast Bangladesh, a known fishing cat habitat (Sultana et al. 2022) and conflict hotspot (Akash et al. 2022) (Figure 1A and B). The tree is about 8 m tall with no canopy connection within a 30 m radius (Figure 1C). The village is surrounded by floodplains that are subject to agrarian practice throughout the year except for the monsoon.

From a survey effort of 282 camera trap days carried out on this colony, while compiling data, we observed predatory attempts of a fishing cat on two separate occasions, of which one was successful. A summary of the sequence of all 19 photos obtained on these two occasions is given in Table 1 and selected 12 images in Figure 2.

At 2054 h on 03 August, 2022, a camera trap recorded a fishing cat approaching a little cormorant nest that had four fledglings (Figure 2A–F). The parents were seen actively taking care of the fledglings (Figure 2A). During the predation event, only the chicks were recorded on camera. The last trigger with the parents and the chicks together was at 2030 h (Figure 2B). The cat was photographed biting the neck of one chick (Figure 2C). At 2102 h, the camera recorded the dead chick in the nest but no cat (Figure 2D; Table 1). The whole event took place in 8 min; four photos were captured. Based on the photo sequence, it is evident that the cat killed all four chicks and took away three. At 2145 h, one of the parents was recorded on the camera (Figure 2E). At 1046 h on 04 August, 2022, the parent was recorded still attending to the dead chick (Figure 2F). The dead chick was not recorded on the night of 04 August, 2022.

On 02 October, 2022, the other camera trap also recorded a similar event. The camera was aimed at one cattle egret nest with one little cormorant nest at the bottom of the frame (Figure 2G–L). At 2105 h, the camera recorded two cattle egrets and one little cormorant (all adults) that seemed to be startled, showing flight response (Figure 2H). At 2248 h, the fishing cat was captured on the camera. The cat was in the lower middle left of the image (Figure 2I). One egret and one cormorant were seen perched warily at a distance in the background. From this timeline, the birds were not recorded for the rest of the event. Until 2316 h, the cat was recorded on the camera. It gradually approached and searched both nests. The nests remained empty until the cormorant returned at 0521 h on 03 October, 2022 (Figure 2L). Between 2248 and 2316 h, the camera recorded three images in 28 min; the cat was seen on each of these images. Although the predation event was unsuccessful, the fishing cat continued searching the nest for 1.5 h, if the time of the trigger when the startled behaviour of the birds was first captured is taken into account.

These two occasions suggest that fishing cats, despite being adapted specifically for hunting fish and wetland ecosystems, can climb trees and forage in canopies if

<table>
<thead>
<tr>
<th>Image ID</th>
<th>Time</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>7393</td>
<td>17:47:10</td>
<td>Four fledglings and one parent are seen together for the last time</td>
</tr>
<tr>
<td>7343</td>
<td>20:38:15</td>
<td>Four fledglings are visible on the camera-trap. No parent is there</td>
</tr>
<tr>
<td>7344</td>
<td>20:54:41</td>
<td>The fishing cat appears at the bottom of the frame</td>
</tr>
<tr>
<td>7345</td>
<td>20:54:41</td>
<td>The fishing cat appears at the bottom of the frame</td>
</tr>
<tr>
<td>7436</td>
<td>20:58:43</td>
<td>The fishing cat approaches the nest, biting one of the fledglings</td>
</tr>
<tr>
<td>7437</td>
<td>20:58:43</td>
<td>The fishing cat continues biting one of the fledglings</td>
</tr>
<tr>
<td>7438</td>
<td>21:02:03</td>
<td>The fishing cat has left. One dead fledgling is visible in the image</td>
</tr>
<tr>
<td>7441</td>
<td>21:45:01</td>
<td>A parent is visible at the top right corner of the frame</td>
</tr>
<tr>
<td>7442</td>
<td>04:52:59</td>
<td>The parent is sitting at the nest</td>
</tr>
<tr>
<td>7445</td>
<td>04:56:12</td>
<td>The parent is sitting at the nest</td>
</tr>
<tr>
<td>7502</td>
<td>10:33:10</td>
<td>The parent is sitting at the nest and still attending the dead fledgling</td>
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<thead>
<tr>
<th>Image ID</th>
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<th>Observations</th>
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<tbody>
<tr>
<td>5681</td>
<td>17:34:38</td>
<td>Two adult cattle egrets and one little cormorant are seen in the image. No sign of juvenile birds</td>
</tr>
<tr>
<td>5886</td>
<td>20:09:52</td>
<td>The egrets and the cormorant are in the frame, grooming</td>
</tr>
<tr>
<td>5897</td>
<td>21:05:05</td>
<td>The egrets are startled noticing something. The cormorant is in flight</td>
</tr>
<tr>
<td>5914</td>
<td>22:48:15</td>
<td>The fishing cat appears at middle-left of the frame. One egret is not present in the frame. One egret and one cormorant are sitting on the background, alert</td>
</tr>
<tr>
<td>5916</td>
<td>23:11:16</td>
<td>The cat approaches the egrets’ nest. No bird is in the image</td>
</tr>
<tr>
<td>5917</td>
<td>23:16:10</td>
<td>The cat continues searching</td>
</tr>
<tr>
<td>5918</td>
<td>00:33:15</td>
<td>No animal is in the frame</td>
</tr>
<tr>
<td>5920</td>
<td>05:21:51</td>
<td>The cormorant returns to the nest</td>
</tr>
</tbody>
</table>
Figure 2: Photo sequence of the arboreal predatory behaviour of the fishing cat captured on camera traps in northeast Bangladesh arranged in a clockwise sequence. (A–F) The first event on 03 August, 2022. (G–L) The second event on 02 October, 2022 (for descriptions see Table 1).
necessary. Documentation of this behaviour is of particular significance. Firstly, the Haor Basin in northeast Bangladesh, a region dotted with saucer-shaped depressions that seasonally turn into lakes during torrential downpours and monsoon floods, is a fishing cat habitat of global importance (Sultana et al. 2022). Researchers have long been perplexed about fishing cats’ adaptations when using a landscape that stays completely submerged in the monsoon. Secondly, there are numerous similar breeding colonies of waterbirds spread all over Bangladesh that very likely serve as potential food sources for fishing cats.

Fishing cats are often accused – although not scientifically verified – as surplus killers of poultry, as found in recent surveys and media reports (Akash et al. 2022; Sultana et al. 2022). When looking into the potential trigger of anthropogenic retaliatory response against the species, both studies found that fear and kill-on-sight action as the major reasons. On the other hand, breeding colonies of water-associated birds are located close to human vicinity, in anthropised habitats such as mosaics of wetlands, homestead forests, and agricultural landscapes. For example, Naheer (2014) documented several such little cormorant colonies from several regions in Bangladesh. Kabir et al. (2019) studied colonies of white egrets Ardea alba and black-crowned night herons Nycticorax nycticorax. These breeding colonies were all located in peri-urban or rural scapes – many more are spread all across the country. These three species are also often predated upon by the fishing cats (Malla et al. 2018; Mukherjee et al. 2016). The arboreal behaviour, thus, poses a query whether the cats might only be venturing into these colonies. The general mass, overall, has a positive attitude toward this conservation approach. Although this perception has not been studied properly, Chowdhury and Hossain (2012) documented similar mindsets when studying a lesser adjutant Leptoptilos javanicus colony discovered in a village in northwestern Bangladesh. Furthermore, the conservation of these colonial waterbirds in Bangladesh is actively endorsed by the Forest Department, Bangladesh, and promoted in the media (Aziz 2023). Lastly, this observation also posits that the conservation of waterbird colonies can act as a food source for fishing cats and create a new avenue to curb the ever-intensifying human-fishing cat conflict incidents in Bangladesh. The monitoring of media reports on human-fishing cat conflicts suggests that a fresh conflict is happening in the country every two weeks (Akash et al. 2022). Conservation efforts targeting fishing cats should thus be prioritised and all options for effective mitigation be scientifically assessed.

Acknowledgments: We express our gratitude to the Bangladesh Forest Department for the permission to conduct the project ‘The Status, distribution and conservation of colonial waterbirds in Bangladesh’. We are thankful to the locals for their active participation in locating the bird colonies and setting up camera traps.

Research ethics: The camera trap survey was carried out as per the guidelines stated and approved in the Innovation Grant Agreement set out by the Sustainable Forests and Livelihoods project Small Innovation Grant Committee of the Forest Department, Bangladesh.

Author contributions: ASS led the project and conducted the fieldwork. MA conceptualized and wrote the manuscript. The authors have made a conscious effort to ensure that this manuscript has not been previously published and is the result of original research with equal contributions.

Competing interests: The authors declare no competing interests.

Research funding: The study was funded under the Small Innovation Grant scheme of the Sustainable Forests and Livelihoods (SUFAL) Project. We express our gratitude to The World Bank for the financial support.

Data availability: Not applicable.

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Chakraborty, S., Barik, S., Saha, R., Dey, A., Deuti, K., Venkatraman, C., Mazumdar, S., and Saha, G.K. (2020). Camera trap records of fishing cat (Prionailurus viverrinus) from East Medinipur (West Bengal, India), and notes on threats to this population. Écoscience 27: 149–156.


