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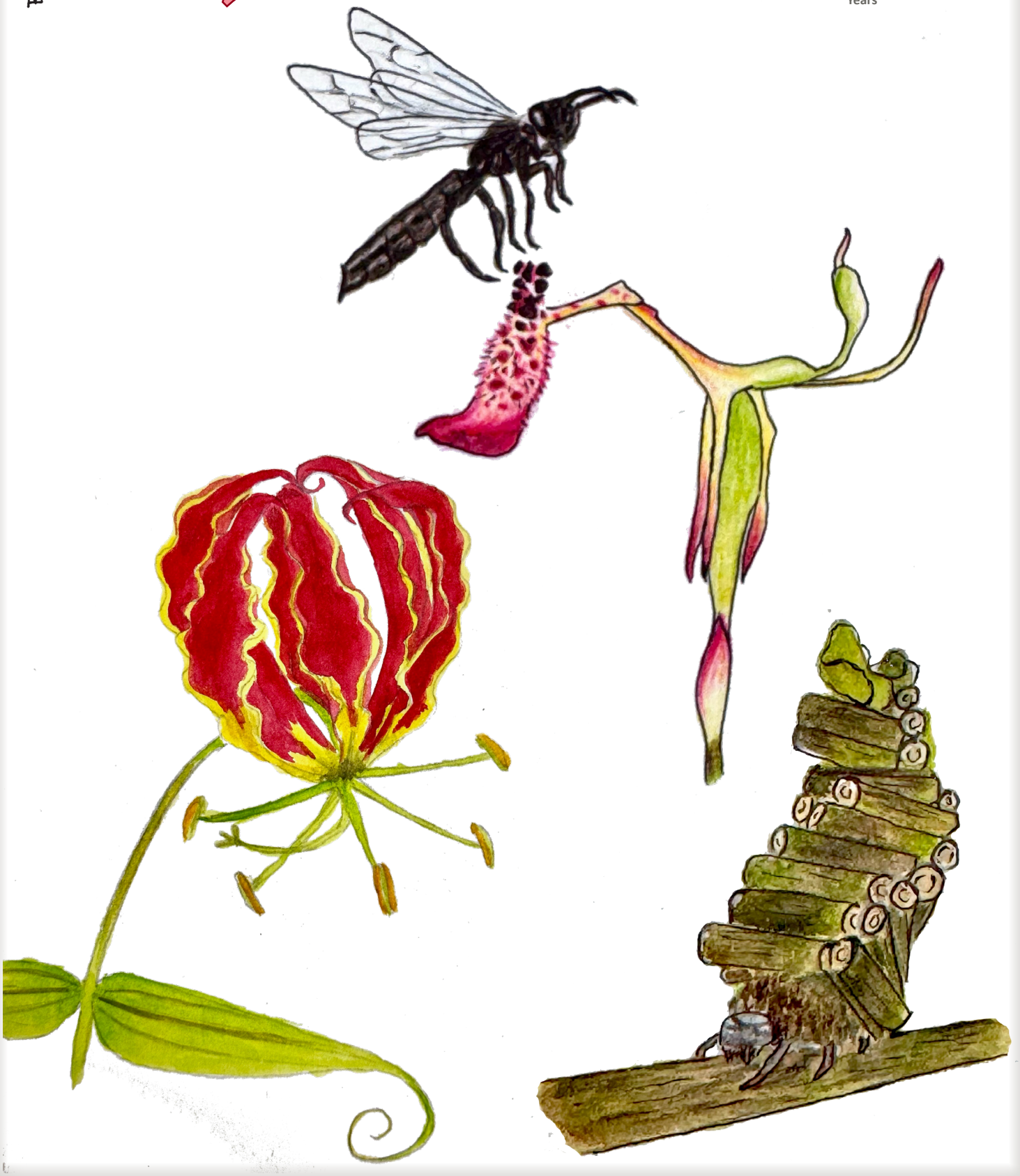

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Cover: A Warty Hammer Orchid *Drakaea livida* gets pollinated by a male thynnine wasp through 'sexual deception' — a colour pencil reproduction of photos by ron_n_beths (flickr.com) and Rod Peakall; Water colour reproduction of Flame Lily *Gloriosa superba* -- photo by Passakoran_14; and a bag worm and its architectural genius (source unknown). Art work by Pannagasri G.

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ARTICLE

Preliminary notes on a coastal population of Striped Hyena *Hyaena hyaena* (Linnaeus, 1758) from Chilika lagoon, India

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Abstract: The Striped Hyena *Hyaena hyaena* (Linnaeus, 1758), India's only hyaena species, is a solitary scavenging carnivore. It typically thrives in arid and semi-arid regions. Limited documentation exists on its occurrence along the Indian eastern coast – the easternmost limit of the Striped Hyena's global distribution range. Information on the Striped Hyena's presence along Chilika's sandy coastline was received during Fishing Cat *Prionailurus viverrinus* (Bennett, 1833) focused interview surveys which encouraged this study. We used camera-traps, night surveys on foot (for direct sightings), and day-time surveys to examine animal remains near hyena denning sites in locations with reported hyena sightings. We documented a group of three individuals (plausibly a mother and cubs) during consecutive nights. We also collected data on its natural history and ecology, for example, behaviour, diet, co-scavengers, and sympatric species. Golden Jackal *Canis aureus* (Linnaeus, 1758), feral dogs, and Wild Boars *Sus scrofa* (Linnaeus, 1758) were found to be co-scavengers. Camera-trap videos and direct sightings revealed that the hyena took refuge inside *Pandanus* sp. foliage (a mangrove associate) in the Chilika landscape. We found den sites with animal remains, including bones that were tentatively identified as Bovidae and Suidae families. Triangulated by observations from the field and videos from camera traps, these could belong to feral cows, and wild boars. A turtle carapace piece was also detected. Furthermore, local fishermen reported that hyena scavenge on fish remains in fishing nets, Olive Ridley carcasses, and lifts newborn cattle. Residents reportedly killed hyenas misperceiving them as 'child-lifters'. We recommend detailed investigation of the ecology of this coastal population of the Striped Hyena, especially its diet, and urgent adoption of conservation programs.

Keywords: Behaviour, camera traps, coasts, diet, ecology, interview surveys, mangrove associate, natural history, scavenge, solitary.

Odia: ସାରାଂଶ: ହେଟାବାଘ ବା Striped Hyena Hyaena hyaena (Linnaeus, 1758) ଭାରତର ଏକମାତ୍ର Hyaena ପ୍ରଜାତି | ଏହା ଏକାକୀ ସ୍ୱଭାବର ଏବଂ ମେହେନ୍ତୁର-ଶ୍ରେଣୀୟ ବା ପରିଷ୍କାରକ-ମାଂସାହାରୀ। ଏହା ସାଧାରଣତଃ ଶୁଷ୍କ ଏବଂ ଅର୍ଦ୍ଧ-ଶୁଷ୍କ ଅଞ୍ଚଳରେ ବଢ଼ିଥାଏ। ଭାରତୀୟ ପୂର୍ବ ଉପକୂଳରେ ପୂର୍ବତମ ସୀମା ହେଉଛି ଏହି ହେଟାବାଘର ବିଶ୍ୱବ୍ୟାପୀ ବଣ୍ଟନ ପରିସର | ଏହି ହେଟାବାଘର ସ୍ଥିତି ବିଷୟରେ ସୀମିତ ମାତ୍ର ସମ୍ମିଳିତ ତଥ୍ୟ ରହିଛି । ଅତୀତରେ ଚିଲିକାର ବାଲିଆ ଉପକୂଳରେ ହେଟାବାଘର ଉପସ୍ଥିତି ବିଷୟରେ ସୂଚନା ମିଳିଥିଲା | ମାଛ-ରଙ୍କା ବିଲେଇ (*Prionailurus viverrinus*) ପାଇଁ ସାକ୍ଷାତକାର ସର୍ଭେ ସମୟରେ ଆମେ ହେଟାବାଘ ଉପସ୍ଥିତି ସମ୍ପର୍କିତ ସୂଚନା ପାଇଥିଲୁ | ତାହା ଏହି ଅଧ୍ୟୟନକୁ ଉତ୍ସାହିତ କରିଥିଲା। ଆମେ କ୍ୟାମେରା-ଟ୍ରାପ୍ ବ୍ୟବହାର କରିଥିଲୁ | ପ୍ରତ୍ୟକ୍ଷ ଦର୍ଶନ ପାଇଁ ପାଦରେ ରାତି ସର୍ବେକ୍ଷଣ, ଏବଂ ହେଟାବାଘ ରହୁଥିବା ଗାଡ଼ ନିକଟରେ ପ୍ରାଣୀ ଅବଶେଷ ପରୀକ୍ଷା କରିବା ପାଇଁ ଦିବସକାଳୀନ ସର୍ବେକ୍ଷଣ କରିଥିଲୁ | ଏହି ସ୍ଥାନ ଗୁଡ଼ିକରେ ହେଟାବାଘକୁ ପ୍ରତ୍ୟକ୍ଷ ଦେଖାଯିବାର ରିପୋର୍ଟ କରାଯାଇଥିଲା। ରାତ୍ରୀ କାଳୀନ ଅଧ୍ୟୟନରେ ଆମେ ଲଗାତାର ତିନୋଟି ହେଟାବାଘଙ୍କୁ ଲିପିବଦ୍ଧ କରିଲୁ | ସମ୍ଭବତଃ ସେମାନେ ମା ଏବଂ ଶାବକଙ୍କର ଏକ ଗୋଷ୍ଠୀ । ଆମ ଅଧ୍ୟୟନରୁ ଆମେ ଏହା ମଧ୍ୟ ଜାଣିଲୁ ଯେ ହେଟାବାଘର ସହ ପରିଷ୍କାରକ-ମାଂସାହାରୀ ପ୍ରଜାତି ରୂପେ ସୁନେଲି ବିଲୁଆ (*Canis aureus*), ବୁଲା କୁକୁର ଏବଂ ଜଙ୍ଗଲୀ ବାରହା (*Sus scrofa*) ଅନ୍ତର୍ଭୁକ୍ତ | କ୍ୟାମେରା-ଟ୍ରାପ୍ ଭିଡିଓରୁ ଜଣାପଡ଼ିଲା ଯେ ହେଟାବାଘ ଚିଲିକା ଭୂଦୃଶ୍ୟରେ *Pandanus* ପ୍ରଜାତି ଜଙ୍ଗଲ ଭିତରେ ଆଶ୍ରୟ ନେଇଥିଲା। ଏହି ଗଛ ଗୁଡିକ ହେନ୍ତାଳ ବଣ ସହଯୋଗୀ ଅଟନ୍ତି | ହେଟାବାଘ ଗୁମ୍ଫା ସ୍ଥାନଗୁଡ଼ିକ ନିକଟରେ ଆମେ ପାଇଥିବା ପଶୁପକ୍ଷୀଙ୍କ ଅବଶେଷରେ ଯେଉଁ ହାଡ଼ ସାମିଲ ଥିଲା ସେଗୁଡିକ Bovidae ଏବଂ Suidae ପରିବାର ଭାବରେ ଚିହ୍ନଟ କରାଯାଇଥିଲା। ଏଗୁଡ଼ିକ ଜଙ୍ଗଲୀ ଗାଈ ଏବଂ ଜଙ୍ଗଲୀ ଘୁଷୁରିର ହୋଇପାରେ। ଛାଡି ଯାଇଥିବା ଖାଦ୍ୟ ଓ ହାଡ ଅଂଶରୁ ଗୋଟିଏ ସମୁଦ୍ର କଇଁଛର ପିଠି ଖୋଳପା ମଧ୍ୟ ଥିଲା | ସ୍ଥାନୀୟ ମତ୍ସ୍ୟଜୀବୀମାନେ ରିପୋର୍ଟ କରିଛନ୍ତି ଯେ, ମାଛ ଧରିବା ଜାଲରେ ଲାଗିଥିବା ଅଲିଭ୍ ରିଡଲେ ସମୁଦ୍ର କଇଁଛର ଶବକୁ ହେଟାବାଘ ଖାଇଥାଏ ଓ ସେମାନେ ନବଜାତ ଗୋରୁଙ୍କୁ ମଧ୍ୟ ଉଠାଇ ନିଅନ୍ତି | ମଣିଷ ଶିଶୁଙ୍କ ହତ୍ୟାକାରୀ ଭାବି ସ୍ଥାନୀୟ ବାସିନ୍ଦା ମାନେ ହେଟାବାଘଙ୍କୁ ଆକ୍ରମଣ କରି ହତ୍ୟା କରିଥାନ୍ତି | ଉପକୂଳବର୍ତ୍ତୀ ଅଂଚଳର ଏହି ହେଟାବାଘଙ୍କ ସଠିକ ସଂଖ୍ୟା, ସେମାନଙ୍କ ପରିବେଶ, ବିଶେଷକରି ଏହାର ଖାଦ୍ୟ, ଏବଂ ସଂରକ୍ଷଣ ଇତ୍ୟାଦିର ଅଧିକ ସର୍ଭେକ୍ଷଣ ଆବଶ୍ୟକ |

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Author details: See end of this article.

Author contributions: P. Dey—field work, research conceptualization, supervision. T. Adhya—research conceptualization, supervision, writing, review of manuscript G.H. Varma—field work, writing. S. Nandy—identification of sample, review of manuscript.

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INTRODUCTION

The Hyaenidae family encompasses four extant species: the Aardwolf *Proteles cristata* (Sparrman, 1783), the Brown Hyena *Parahyaena brunnea* (Thunberg, 1820), the Spotted Hyena *Crocuta Crocuta* (Erxleben, 1777), and Striped Hyena *Hyaena hyaena* (Linnaeus, 1758). The only hyena species present in India is the Striped Hyena (Prater 1980) which is a solitary and nocturnal scavenger (Reiger 1979). Although the Striped Hyena holds a widespread presence across Africa, the Middle East, central Asia, and the Indian subcontinent (Kruuk 1976; Hofer & Mills 1998; Kasparek et al. 2004), it is globally 'Near Threatened' in the IUCN Red List of Threatened Species and the Mediterranean population is Vulnerable (AbiSaid & Dloniak 2015). Key threats include poisoning and reduced natural & domestic carrion due to declines in other large carnivore populations (Hofer 1998). Striped Hyenas display scavenging habits across a broad spectrum of food items such as mammals, birds, reptiles, fish, insects, and fruits (Singh et al. 2010). They are opportunistic hunters, targeting small mammals, and livestock (Kruuk 1976). Denning preferences vary widely, from caves in rocks to dens dug underneath bushes, and tall grasses, utilization of holes along riverbanks, and even existing porcupine burrows (Prater 1971; Alam 2011).

India represents the easternmost boundary for the Striped Hyena in their global distribution and has primarily been recorded from arid & semi-arid regions (Reiger 1979). The species is absent in the northeastern region (Prater 1971). Reports of their existence in the east coast come solely from Odisha, India (Karnad 2017). The Zoological Survey of India listed two species of mammals in Chilka (Chilika) lake in Annandale (1921) and updated it in the list by Saha (1995), with 18 species, and separately mentioned about hyena from a particular field trip. Although the presence of 18 mammalian species in Chilika is mentioned elsewhere, a specific mention about hyena was overlooked (Mohanty et al. 2004; SWO 2007). But Mishra et al. (1996) mentioned about its occurrence all over Odisha including the mangrove swamps and coastal areas.

We were informed of their presence in Chilika during a Fishing Cat-focused interview survey. Here, locals refer to the Striped Hyena as 'hentabagha' or 'dhenkia', and people coming from other parts of Odisha also call it 'heta', 'hetabagha', 'lenkda', and 'hundala'. Based on this, we conducted camera-trap surveys in the coastal sandy banks of Chilika, along the Bay of Bengal, as suggested by the residents. Additionally, we conducted night patrolling on foot for possible direct sightings. During the day, we studied the animal remains near known hyena den sites. Lastly, we collated observations & perceptions of residents on the Striped Hyena, based on informal interviews, and discussions.

MATERIALS AND METHODS

Study site

Chilika (19.467°–19.900° N, 85.100°–85.583° E) is Asia's largest brackish-water lagoon. It was declared a Ramsar site under the Ramsar Convention on Wetlands in 1981, covering a total area of 1,165 km^2 during the monsoon, decreasing in expanse to 906 km^2 in the summer months. The lagoon is composed of three environments—freshwater, brackish, and marine—shaped by the inflow of freshwater from Mahanadi River's tributaries and streams of western catchment, and the inflow of saline water from the Bay of Bengal from sea mouth, and Palur channel. Our study site (6 km) is part of a 60-km long sand bar between Chilika Lagoon and the Bay of Bengal. This area is mainly covered by casuarina forests with intermittent patches of *Pandanus* (Odia, Kiya, Kia in Saxena & Brahmam 1996), a mangrove-associated species, interspersed with cashew plantations.

Methodology

To validate the presence of the species, we deployed five camera traps (BROWNING HD XD PRO) along the coastal islands of Chilika, covering a range of 6 km (19.467°–19.900° N, 85.100°–85.583° E) (Image 1). This opportunistic deployment of camera traps spanned a period of three months from May–August 2022. Cameras were deployed in the video mode and data was periodically retrieved from the SD cards, and saved. Out of these, videos with clarity, and in which the entire body of the target species could be seen were segregated. We then attempted to analyse the videos for individual identification of the hyenas, based on their stripe patterns on the flank. All videos where the hyenas were too close or too far from the traps were excluded because of lack of clarity. During our direct observations in the field, we identified several burrows in the sand near the *Pandanus*, with piles of bones nearby indicating their use by the hyenas. Fifteen pictures of bone piles as well as individual bones were taken opportunistically with mobile phones. These were later assigned tentative taxonomic identification by one of the authors (SN). We also recorded relevant information on Striped Hyena ecology emanating from discussions with local fishermen as well as their perceptions towards the species.

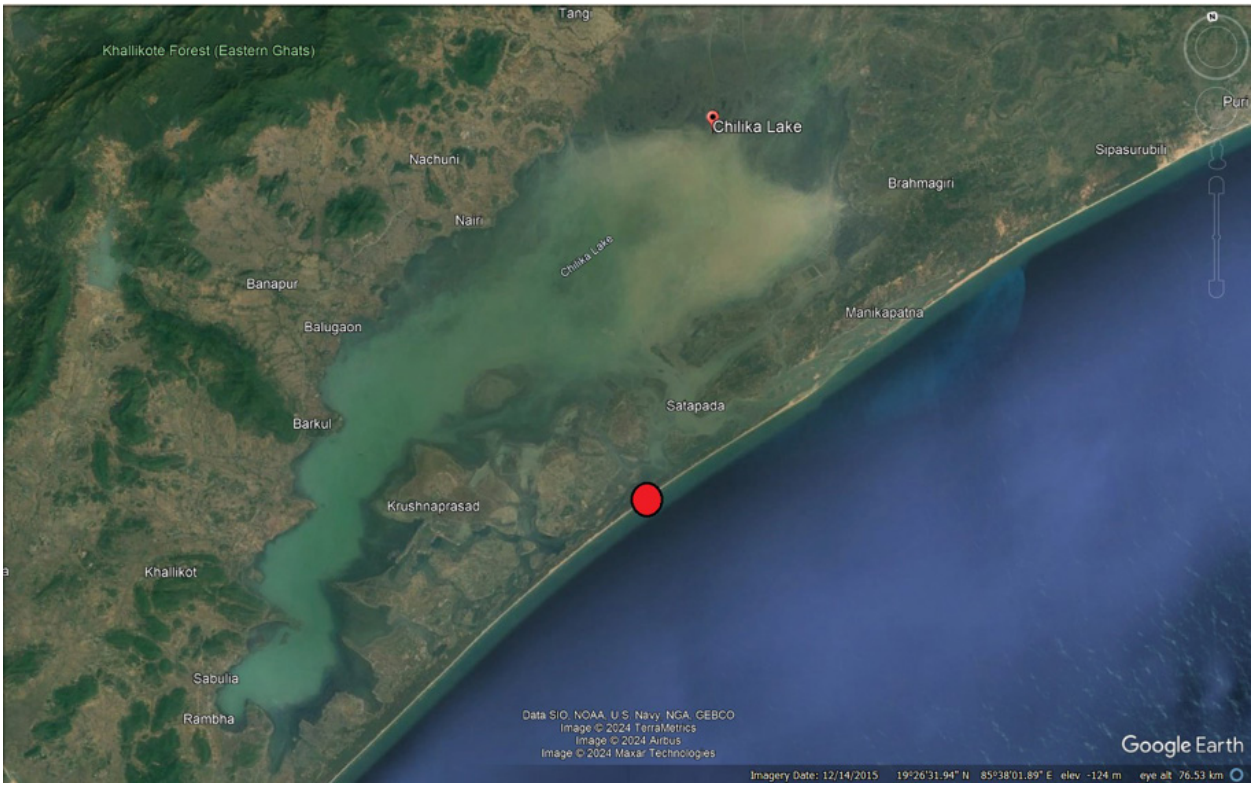


Image 1. Location of study site of Striped Hyaena in Chilika, Odisha: a sandy coastline with casuarina forest plantation, *Pandanus* patches and cashew plantations.

RESULTS

Camera Trap Results

a. Individual identification through camera trap: From the 71 video recordings captured through camera traps, 47 were selected for individual identification (based on clarity of the videos and clear pictures of the entire body of the study species). Fourteen videos were excluded because the hyenas were either too close or too far from the camera. Pictures of unique left and right flanks were segregated; since there were more unique right flanks than left, the right flank was chosen for the individual identification. With the available data, four individuals were successfully identified (Image 3–6). One of them was solitary, while the other three formed a group, presumably a mother, and two well-grown cubs (slightly smaller body size).

b. Behavioural Observations: From the camera trap videos, we observed the Striped Hyena engaged in various activities such as moving, resting, checking the camera traps with curiosity, and scratching them. In seven recordings, two hyaenas were observed together, engaging in activities such as playing, sniffing, playing with dried branches, and digging up the sand. Additionally, three hyenas were recorded together in six videos, where they were observed playing, resting, grooming, and engaging in allogrooming.

Detailed observation of the camera trap recordings showed the hyenas resting outside or going inside the *Pandanus*. The stilt roots of *Pandanus* could potentially serve as their daytime refuge.

c. Sympatric species and co-scavengers: Apart from the hyenas, the camera traps captured footage of various other animals in the area, including feral cows, Wild Boars *Sus scrofa* 'Barha' in Odia, Golden Jackals *Canis aureus* 'Bilua' in Odia, feral dogs, Indian Crested Porcupines *Hystrix indica* 'Jhinka' in Odia, and a Spotted Deer *Axis axis* 'Mruga' in Odia. Through a series of camera trap results from two consecutive days, we observed that the carcass of an adult feral cow was scavenged by Golden Jackals, feral dogs, and Wild Boars.

d. Denning and diet of Striped Hyena: In this landscape, the Striped Hyenas were found to make burrows in the sand beneath dense *Pandanus* vegetation (mangrove associates) (Image 9).

About 39 bone fragments seen from 10 field photographs could be identified as specimens—that belonged to the family Bovidae, and two to the family

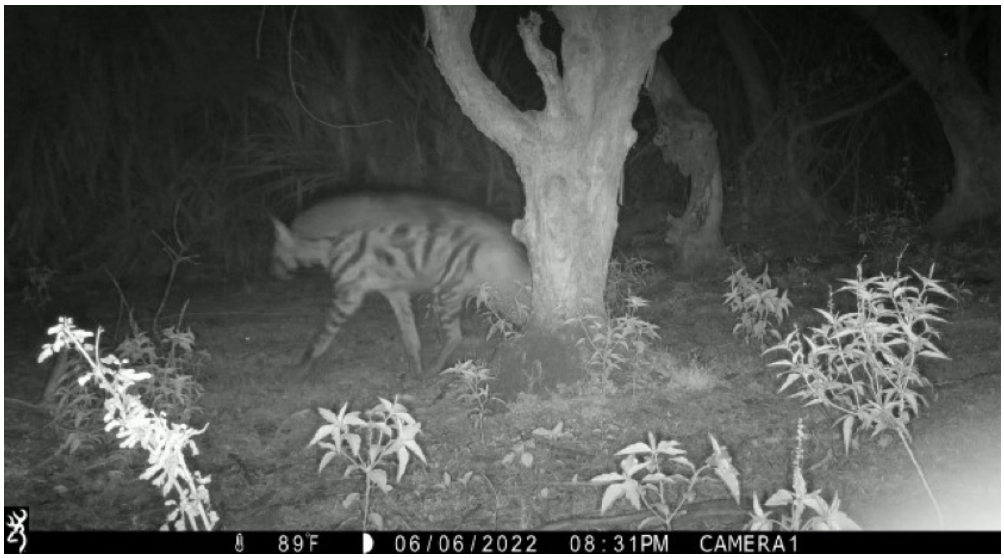


Image 2. Camera trap image of the left flank of Striped Hyaena. Each flank has a unique stripe pattern which can be used for individual identification. © The Fishing Cat Project.

Suidae (Image 7). An eroded fragment of turtle carapace and a broken horn sheath were also found (Image 8). One specimen could not be identified. Since we observed feral cows and wild boars in the field, and recorded the same in camera traps, it can be inferred that the bone remains found near the hyena dens were primarily from feral cows, followed by Wild Boars. Chilika Buffalo, an indigenous buffalo breed, is a common livestock in the region and the broken horn sheath could tentatively belong to the same.

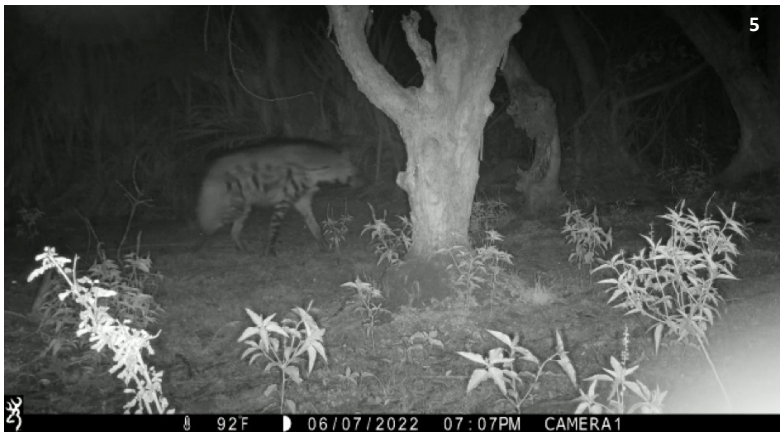
People's observations and perceptions of Striped Hyenas

During our interactions, residents reported hyenas scavenging on the carcasses of feral cows, fish bycatch from fishing nets, and Olive Ridley Turtles during mass nesting periods. They also reported instances of hyena depredation on newborn calves. Our conversations with the local fishermen revealed a prevalent perception of fear towards hyenas among community members due to the belief that hyenas lift human children. This perception has resulted in retaliatory killings, with two hyenas reportedly being killed in the last three years.

DISCUSSION

Shah (1995) mentions that "Tiger, Leopard, and Sloth Bear do occur in the vicinity of the (Chilika) Lake area". Other historical records from Chilika lagoon do not indicate the presence of large predators capable of providing carrion to the striped hyenas in the region. We documented a feral cow population that could be potential food for hyenas in our study area. Nevertheless, it remains uncertain whether this cow population extends throughout the Chilika coastline.

Carlton & Hodder (2003) classify Striped Hyenas as maritime carnivores, alongside 20 other terrestrial carnivores, highlighting their dependence on intertidal zones for sustenance and citing instances of crab consumption by Striped Hyenas along Kenya's coastline. Additionally, Karnad (2017) documented hyenas feeding on Olive Ridley Turtle eggs in Rushikulya, Odisha (45 km away from our study site). Notably, Odisha's coastline has the eastern-most hyena population, and this overlaps with one of the largest Olive Ridley mass nesting sites. Despite its importance as a key hyena habitat, there exists a dearth of knowledge regarding the ecology of coastal hyena populations. The Chilika coastline is sparsely populated by humans, although incidents of hyena killings have been reported. This remains a threat to hyaena populations across their global range (Hofer 1998). There is an urgent need for comprehensive studies on ecology of the coastal hyena population in Chilika, alongside conservation programs to promote tolerance of the Striped Hyena within local communities, and appreciation of its important ecological role.



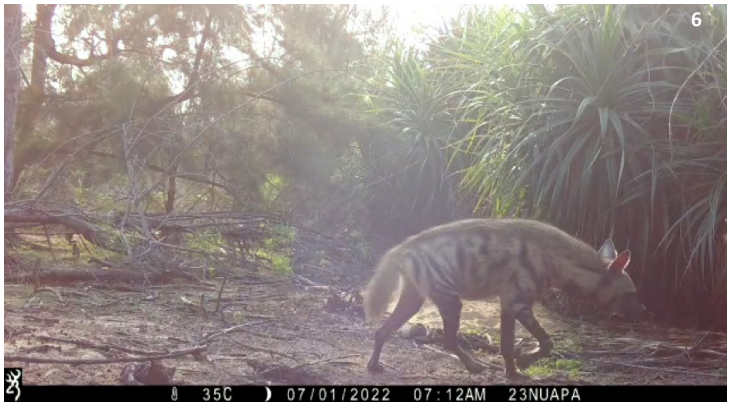


Image 3–6. Camera trap images of the four right flanked Striped Hyaenas. Each flank has a unique stripe pattern which can be used for individual identification. © The Fishing Cat Project.

Table 1. List of tentatively identified bone specimens from Chilika, Odisha.

Image No.	Number of fragment in image	Elements identified	Tentative taxonomic identity*
Chilika bones 01	1	Broken mandible with third premolar and first to third molars	Class Mammalia Order Artiodactyla Family Bovidae *Bos indicus* Linn
	2	Tibia	
	3	Broken scapulae	
	4	Calcaneum bone	
	5	Broken scapulae	
	6	Humerus with broken proximal end	
	7	Metacarpal bone	
	8	First phalanx	
	9	Broken femur without distal end	
	10	Atlas vertebra	
	11	Broken rib	
	12	Broken rib	
	13	Broken lumber vertebra	
	14	Broken thoracic vertebra	
	15	Cervical vertebra	
	16	Cervical vertebra	
	17	Cervical vertebra	
	18	Broken lumber vertebra	
	19	Cervical vertebra	
	20	Astragalus	
	21	Fragment of thoracic vertebra	
	22	Fragment of thoracic vertebra	
	23	Fragment of thoracic vertebra	
	24	First phalanx	
	25	Fragment of thoracic vertebra (?)	
	26	Fragment of thoracic vertebra (?)	
	27	Broken vertebra	
	28	Fragment of horn core(?)/rib (?)	?
	29	Broken rib (?)	?
Chilika bones 02	-	Broken vertebra	Class Mammalia Order Artiodactyla Family Bovidae *Bos indicus* Linn
Chilika bones 03	-	Broken pelvic girdle	
Chilika bones 04	-	Fragment of Humerus without proximal end	
Chilika bones 05	-	Fragment of Ulna	
Chilika bones 06	-	Broken humerus without proximal portion	
Chilika bones 07	-	Broken shaft of tibia without epiphysis	
Chilika bones 08	-	Broken femur without distal end	
Chilika bones 09	-	Mandible with fragments of incisors, canines, premolars and molar teeth	
Chilika bones 10	-	Broken mandible	
Chilika bones 11	-	Broken pelvic girdle	
Chilika bones 12	1	Broken radius and ulna without distal end	
	2	Fragment of proximal portion of metacarpal	
Chilika bones 13	-	May be fragment of turtle carapace (very eroded)	Not identifiable
Chilika bones 14	-	May be fragment of horn sheath	Not identifiable
Chilika bones 16	-	Bone very fragmentary in nature	Not identifiable

*Identification is tentative, as material was not physically examined.

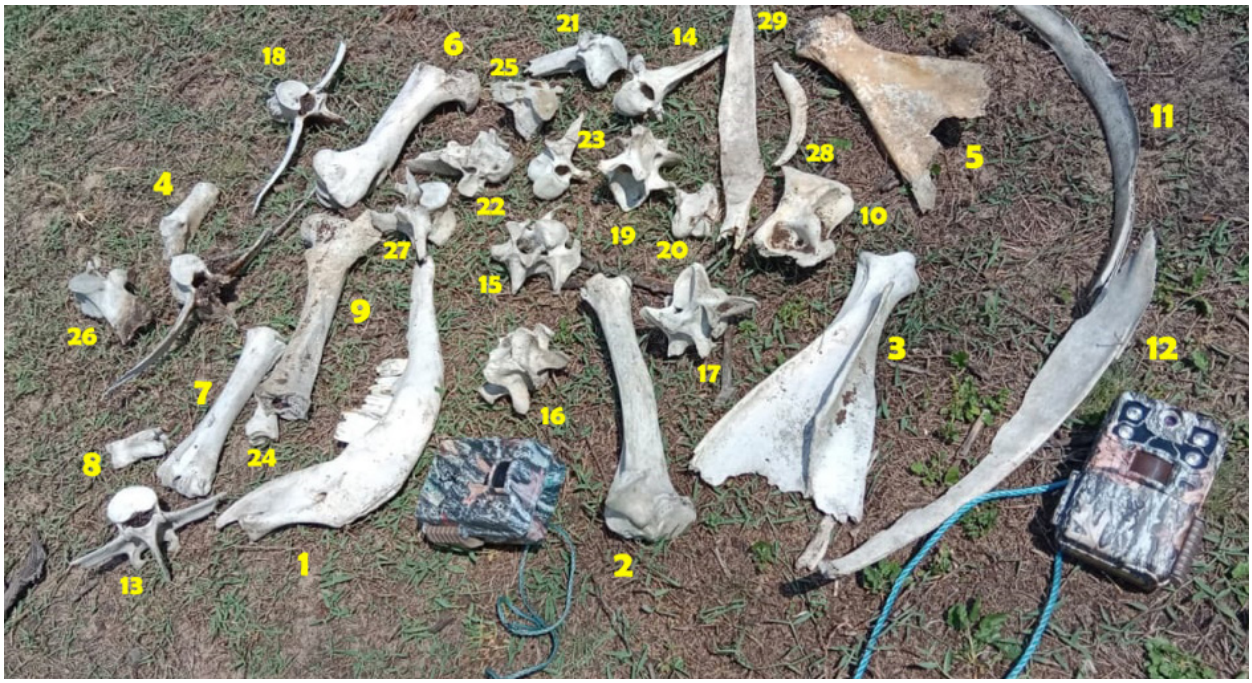


Image 7. The image displays a collection of bones identified as belonging to the Bovidae family, arranged in ascending order of numbering: 1— Broken mandible | 2—Tibia | 3—Broken scapulae | 4—Calcaneum | 5—Broken scapulae | 6—Humerus with broken proximal end | 7—Metacarpal | 8—First phalanx | 9—Broken femur without distal end | 10—Atlas vertebra | 11—Broken ribs | 12—Broken ribs | 13—Broken lumbar vertebra | 14—Broken thoracic vertebra | 15—Cervical vertebra | 16—Cervical vertebra | 17—Cervical vertebra | 18—Broken lumbar vertebra | 19—Cervical vertebra | 20—Astragalus | 21—Fragment of thoracic vertebra | 22—Fragment of thoracic vertebra | 23—Fragment of thoracic vertebra | 24—First phalanx | 25—Probably fragments of thoracic vertebra | 26—Probably fragments of thoracic vertebra | 27—Probably broken vertebra | 28—Probably fragment of horn core/rib | 29—Probably a broken rib. The Browning HD XD Pro camera trap, with dimensions of 13 cm in length and 8 cm in width, is included for scaling purposes. These bones were collected near hyaena dens. © Partha Dey.

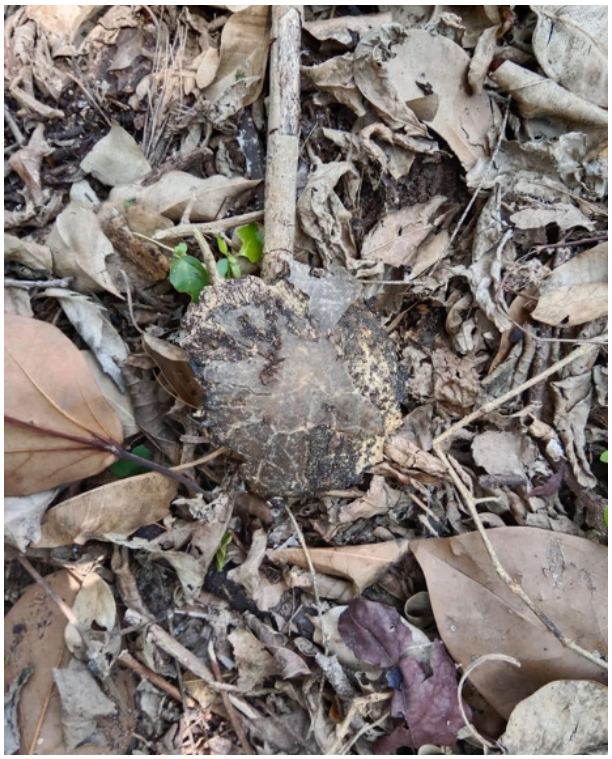


Image 8. Fragment of turtle carapace. © Partha Dey.

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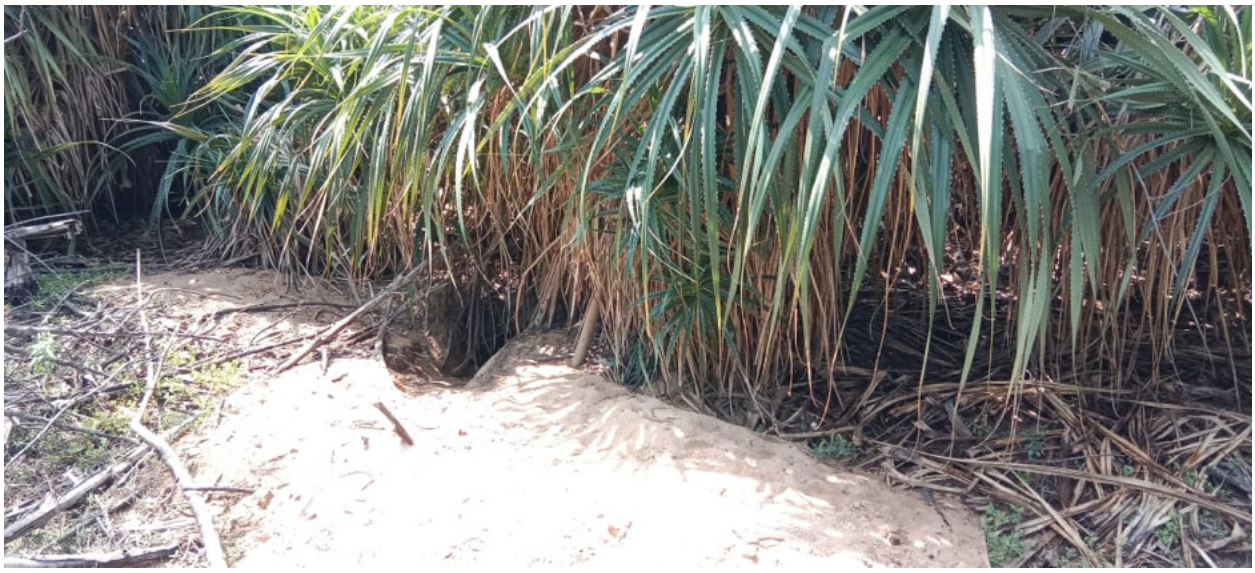

Image 9. Den site of Striped Hyaena consisting of burrows in the sand and thick vegetation of *Pandanus* which is a mangrove associate. © Partha Dey.

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WhatsApp Video 2023-09-22 at 12.48.

Video 1. Camera trap video recording of an adult and two cubs of Striped Hyena.

WhatsApp Video 2023-09-22 at 12.52.

Video 2. Camera trap video recording of Porcupine.

WhatsApp Video 2023-09-22 at 12.51.

Video 3. Camera trap recording of Striped Hyaena going inside the *Pandanus*.

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