Assessing the conservation status of tigers

In West Sumatra

Final report to Conservation Leadership Program, November 2008

Project ID : 110808

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Summary

The main aim of this project is to assess tiger populations in the 3000 km^2 Batang Hari Protection Forest (BHPF), West Sumatra, Indonesia. Project activities included training all team members, forestry staff and students in camera trapping techniques and then conducting a camera trap campaign. To date, the project trained 6 personnel, 2 from the Conservation and Natural Resources Bureau-BKSDA, Dept. Forestry, and 4 Fauna & Flora International (FFI) – Durrell Institute of Conservation and Ecology (DICE) Batang Hari project staff. The training focussed on how to use field equipment (GPS, compass and camera traps) as well as field survey methods. During the first field trip, the team coordinator trained 1 local student and 8 local community members to set camera traps and to make transects. 36 camera traps (a combination of Highlander Photoscout and Stealthcam camera units) were set up at 20 points covering 383 km^2 effective samplinga area within hill and submontane forest (Figure 1). From 1633 trap-nights, all presumed tiger prey were photographed, as well as 23 tiger photographs of four adult individuals, that yielded a mean density estimate of 1.3 adult tigers/100 km2 (1.31-2.87, 95% C.I.s).

Between 13 and 16 June, the team coordinator and FFI-DICE Batang Hari project coordinator facilitated a discussion with a local forestry official of Solok Selatan district and the head of BKSDA West Sumatra Province regarding the importance of developing of a conservation management plan. From 11-13 August, a reporter and cameraman from a local TV company “Padang TV” ,joined the team during a field trip. This provided an opportunity to show them first-hand project activities as well as to introduce them to the vast array of biodiversity in BHPF. This three day field trip also exposed them to some of the challenges involved with conserving this important area. This helped BHPF to increase the management level of this area. In addition, the team coordinator was invited by FFI-AFEP Technical Manager Dr. Matthew Linkie to give a presentation to 9 staff members in FFI-AFEP’s Banda Aceh office in Sumatra. The presentation focuse on the BHPF CLP project and tiger and prey monitoring techniques.

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Introduction

In order to better protect tigers across their range, conservation managers need to determine their distribution and abundance. This is especially important for the Critically Endangered Sumatran tiger that is threatened by habitat loss and poaching of prey. These threats led to the extripation of the Balinese and Javanese tiger subspecies from Indoneisa. Similiarily, Sumatra currently has some of the highest levels of deforestation in the tropics and tiger forest habitat is becomingg increasingly fragmented and isolated, thereby increasing tiger vulnerability to extinction (Linkie et al. 2007; Dinerstein et al. 2007). The best prospect for the long-term survival of tigers is within large protected areas.

At 3000 km sq, BHPF, West Sumatra, forms part of a level 1 Tiger Conservation Landscape (TCL), which is the highest priority for wild tiger conservation, and has the potential to contain a large Sumatran tiger population. Although incidents of human-tiger conflict at the BHPF border confirm tiger presence, scientific data for this protected area are lacking and urgently needed. Thus, the overall aim of this BP-funded project was to produce the first tiger management plan for BHPF to increase the long-term conservation prospects for tigers. This was achieved through the following objectives and activities;

Objective 1. Assessing the conservation status of tigers, their prey and their forest habitat

Activity 1.1. Train Forestry Department staff and Indonesian students in tiger and prey monitoring techniques

Activity 1.2. Camera trap surveys

Objective 2. Use the Sumatran tiger as an umbrella species for improved habitat management in the BHPF

Activity 2.1. Discuss the development of a conservation management plan

Objective 3. Increase awareness about the importance of BHPF for biodiversity and local livelihoods

Activity 3.1. Media and journalist field trip

Objective 4. Evaluate project results

Activity 4.1. End of term project review

Activities

Activity 1.1 Training Department forestry staff and Indonesian students in tiger and prey monitoring techniques

The project ran a two week training session for 6 personil, 2 the BKSDA (Conservation and Natural Resources Agency, Dept. Forestry) staff, 4 FFI-DICE tiger project team member and 1 Bogor Agriculture Institute (IPB) student. The training focussed on how to use field equipment, including GPS units, compasses and camera traps, as well as how to apply the most recent field survey methods. During the first field trip, the team coordinator trained all team members, 1 students (IPB) and 4 team members of the local community to set up the camera traps and make transects.

Figure 1. Project team members, student and local community members being trained to set up camera traps.

Activity 1.2 Camera trap survey

Field mehtods

Camera trapping was conducted from 01 June-24 August 2008, a combination of Highlander Photoscout (n=22 , Highlander Sports Inc.) and MC2-GV Stealthcam (n=13, Stealth Cam, LLC) camera units that contained a heat and motion sensor, activated by a warm-blooded animal moving past, were used. Cameras were set to record medium-large bodied mammals and were placed approximately 0.5 m off the ground and 2.0-3.0 m from the focal area of interest. A total of 20 camera trap placements were made, with 15 of these using paired cameras. Placements were set along ridge trails and terrestrial animal trails, as identified through the presence of tiger and prey sign, that were located hill forest to montane forest (663–2045 m asl). The spacing of camera placements was 1.5–7.0 km apart and formed an approximate circular boundary around the trapping area that left no apparent gaps, based on the topographic data, through which an adult tiger could pass undetected. Cameras operated continuously in the field and every two weeks their maintenance was checked, film was changed and, where necessary, batteries replaced.

GIS and statistical methods

For each photograph the animal, where possible, was identified to the species level. The number of trap nights for each placement was calculated as the maximum number of days for a single camera at the placement. The number of independent records for each species (defined as no same individual species being photographed more than once within 60 minutes at the same camera placement) at each placement was then calculated as the number of photographs per 100 trap nights. From this, the overall mean species encounter rate, with 95% standard deviations, was calculated.

For tigers only, absolute density was estimated using the standard capture-mark-recapture technique modified for tigers by Karanth and Nichols (1998). An X-matrix was constructed with sampling occasions of 10 days. For each occasion, individual tigers, as identified from their unique stripe patterns, were recorded as being captured (1) or not captured (0). These tiger capture

history data were then imported into CAPTURE software (Rexstad & Burnham, 1991).

Next, a closure test was performed to determine whether the closed population assumption was violated, or not (i.e. there were no births, deaths, immigrations or emigrations during the duration of the survey). In CAPTURE, the model selection procedure was used to identify the most appropriate population estimator. From seven available models, Model M_h is considered to be the most robust for tigers because it incorporates heterogeneous capture probabilities that produce more realistic estimates than the six other available models (Karanth and Nichols, 2002). So, if Model M_h is ranked as a close second to the top model, then it is often used, instead, to estimate tiger capture probability ($\hat{p}$) and then abundance ($\hat{N}$) (O'Brien *et al*. 2003; Karanth *et al*. 2004).

To convert the absolute tiger abundance into a density estimate ($\hat{D}$), the following equation was used,

$$\hat{D} = \hat{N} / \hat{A}(\hat{W}) \qquad \text{eq.1}$$

Within ArcView v3.2 Geographic Information System (GIS) software (ESRI Inc., Redlands, CA), a polygon was constructed around the outer most cameras ($\hat{A}$). A strip-width buffer ($\hat{W}$) was then added to this polygon to create the effective sampling area. The buffer width was determined by estimating half the home range length, averaged for tigers in the sampled area. This width was estimated as the ½mean maximum distance moved (MMDM) for each individual tiger between camera placements (Wilson and Anderson, 1985; Karanth and Nichols, 2002).

Tiger and prey abundance

A total of 35 camera traps were set at 20 locations covering a 383 km^2 effective sampling area patch of hill and submontane forest (Figure 3). Cameras were active from 1 June to 11 September 2008 and yielded 1633 trap nights and 334 (indpendent photo) wildlife photographs, there were 19 species of mammal (n = 258 photographs), two species birds (n = 50 photographs), local people (n =

8 photographs) and 1 photographs unidentified animal, that included ten species that were either 'Vulnerable', 'Endangered' or 'Critically Endangered' (n = 281 photographs) and one 'Data Deficient' species (n = 44, IUCN 2008). From the principal ungulate tiger prey, the highest encounter rates were recorded for pig-tailed macaque (2.02 ± 2.46) and common porcupine (1.79 ± 4.18) (Table 1).

Table 1: Number of captures and encounters rates (ER, number of photographs/100 trap nights) from Batang Hari Landscape.

Species	**Scientific name**	**Red List status**	**# independent photos**	**ER (± SD)**
Sumatran tiger	*Pathera tigris sumatrae*	CR	23	1.38 (1.32)
Tiger prey				
Bearded Pig	*Sus barbatus*	LR	28	1.55 (4.70)
Common Porcupine	*Hystrix brachyuran*	VU	32	1.79 (4.18)
Greater Mouse Deer	*Tragulus napu*	LR/lc	1	0.06 (0.28)
Malayan Tapir	*Tapirus indicus*	VU	2	0.19 (0.84)
Red Muntjac	*Muntiacus muntjac*	LR	15	0.93 (1.43)
Sambar Deer	*Cervus unicolor*	LR/lc	1	0.05 (0.24)
Serow	*Capricornis sumatraensis*	VU	1	0.05 (0.23)
Pig-tailed Macaque	*Macaca nemestrina*	VU	33	2.02 (2.46)
Other species				
Asiatic Golden Cat	*Catopuma teminckii*	VU	28	1.86 (2.07)
Asiatic Wild Dog	*Cuon alpinus*	EN	2	0.14 (0.45)
Callosciurus sp	*Callosciurus sp*		1	0.06 (0.28)
Clouded Leopard	*Neofelis diardi*	VU	32	1.97 (1,79)
Great argus Pheasant	*Argusianus argus*	NT	62	3.37 (11.78)
Malayan Pangolin	*Manis javanicus*	LR/lc	1	0.05 (0.24)
Malayan Sun Bear	*Helarctos malayanus*	DD	44	2.69 (4.61)
Marbled Cat	*Pardofelis marmorata*	VU	5	0.19 (0.61)
Masked-palm Civet	*Lophura inornata*	LR/lc	7	0.44 (1.41)
Salvadori's Pheasant	*Lophura inornata*	VU	5	0.28 (0.72)

Three-striped Ground Squirrel	*Lariscus insignis*	LR/lc	1	0.05 (0.22)
Yellow-throated Marten	*Martes flavigula*	LR/lc	1	0.05 (0.24)
Local people			8	0.52 (1.51)
Unidentified			1	
Total			**334**	

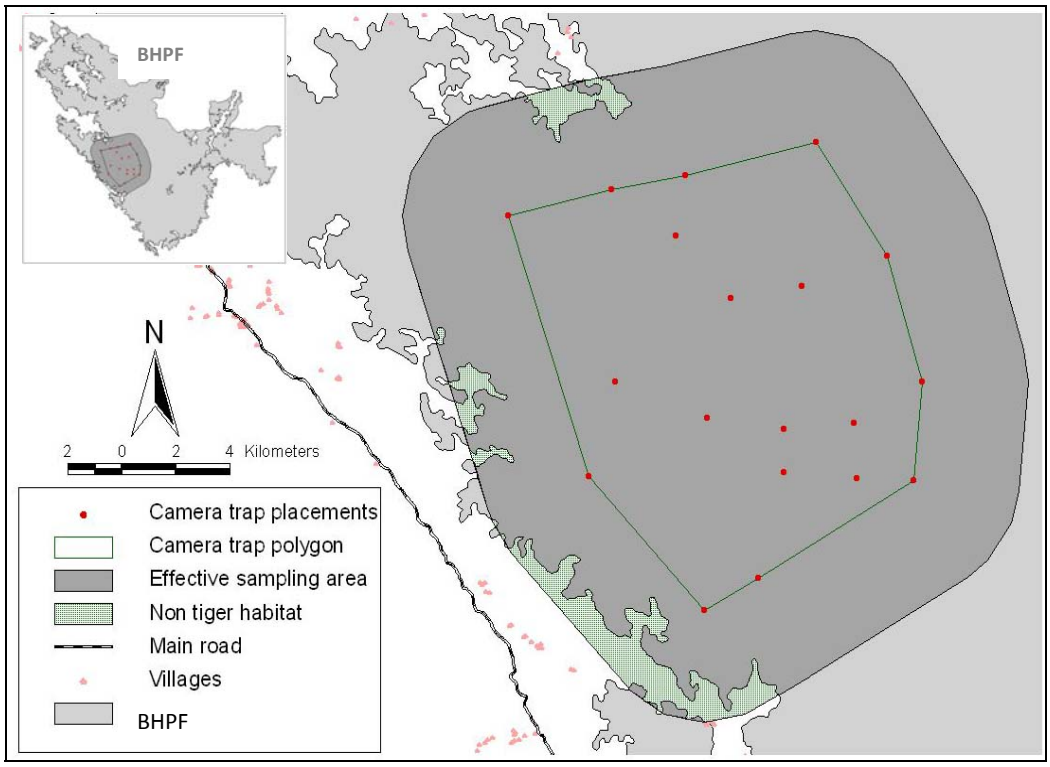

Figure 4. Camera traps location in BHPF

A tiger encounter rate of 1.38 ± 1.32 was recorded, and from 23 photographs, four individual tigers (M_{t+1}) were identified. Based on eight sampling occasions each of five days, the population closure test supported the assumption that the population was closed during the study (z = -0.652, P = 0.257). The abundance estimation model selection procedure found little difference between the top two ranked models of the null, M_o, and heterogeneity, M_h, models (i.e. M_o = 1.00 and M_h = 0.99). Model M_h was therefore selected because it is the most realistic with respect to tiger movements and tiger home range boundaries (Karanth and Nichols, 1998). This model generated a tiger

capture probability ($\hat{p}$) of 0.350 and an absolute abundance ($\hat{N}$ ± S.E.($\hat{N}$)) of 5 adult individuals ± 1.375, with 95% confidence intervals (C.I.s) of 5-11. The overall probability of capturing a tiger within the sampling area ($M_{t+1}/\hat{N}$) was 80%, highlighting the need for a model that incorporated a function of detection probability. Following the strip width boundary method, the outer most cameras formed a 164.2 km^2 polygon. Using a buffer width of 4.16 km, based on half the average distance moved by individual tigers between cameras, produced an effective sampling area of 383.0 km^2 (Figure 6), which produced an estimated tiger density $\hat{D}\left(SE\left[\hat{D}\right]\right)$ of 1.31±0.36 adult tigers/100 km^2 (1.31-2.87, 95% C.I.s).

Animal density is a function of habitat productivity, metabolic needs of the species and size of the area (Kawanishi and Sunquist, 2004). From 1388 trap-nights and 10-day sampling occasions a small sample size (M_{t+1}) was an inevitable consequence as most other studies on low density tiger populations have found (Table 2). For example, a camera trap study by Lynam et al. (2007) in six separate sites across Malaysia recorded only 1-3 individuals per study area, which was too few to perform a capture-mark-recapture analysis. The tiger capture data from BHPF was sufficient to estimate a tiger density. The 1.3 tigers/100 km^2 recorded in this study was comparable with other studies from Sumatra and Malaysia (Table 2) and indicates a reasonably healthy tiger population, especially with the photographic records of two cubs and a tigress.

Table 2. Capture-mark recapture analyses of low density tiger populations (adapted from Linkie *et al*. 2008).

Study	Location	Forest type	M_{t+1}	$\hat{N}$± S.E.($\hat{N}$)	Adults/100km^2 (95% C.I.s)
Kawanishi and Sunquist (2004)	Malaysia	Lowland-Hill	5	7 ± 1.92	2.0 (1.7–4.0)
	Malaysia	Lowland-Hill	5	5 ± 2.35	1.1 (1.1–4.4)
	Malaysia	Lowland-Hill	6	6 ± 2.44	1.9 (1.9–6.6)
Rayan & Mohamad (2008)	Malaysia	Lowland-Hill	6	8 ± 1.89	2.6 (2.3-4.9)

Simcharoen *et al*. (2007)	Thailand	Hill	15	19 ± 3.87	4.0 (3.4–7.1)
O'Brien *et al.* (2003)	Sumatra	Lowland	9	13 ± 3.66	1.6 (1.2–3.2)
Linkie *et al.* (2006)	Sumatra	Lowland-Hill	6	7 ± 2.65	3.3 (3.3–9.9)
	Sumatra	Hill	5	6 ± 1.28	2.0 (2.0–4.1)
	Sumatra	Submontane	5	6 ± 1.87	1.5 (1.5–4.0)
Linkie *et al.* (2008)	Sumatra	Lowland-Submontane	10	13 ± 2.48	3.0 (2.5–5.0)
	Sumatra	Lowland-Submontane	15	19 ± 4.21	1.6 (1.3–2.9)
This study	Sumatra	Hill-submontane	4	5 ± 1.38	1.3 (1.3-2.9)
Wibisono et al. (2008)	Sumatra	Hill-submontane	6	6 ± 2.40	1.8 (1.8-6.4)

Prey relative abundance

A positive and significant correlation has been shown for the densities of tiger and that of their prey (Karanth et al. 2004; Miquelle et al. 2005). Hence, prey base depletion is critically important in maintaining healthy tiger populations (Karanth and Stith 1999). From 120 Sumatran tiger feaces collected in Way Kambas NP in southern Sumatra, the majority of prey consumed were pig-tailed and long-tailed macaque (58.0%), followed by wild pig (11.8%), muntjac (11.6%), sambar (4.7%) and other species (13.8%; Franklin 2002). From BBSNP, a positive relationship was found between tiger and sambar, which was significant, and with wild pigs, which was highly significant (O'Brien et al. 2003).

The camera trap data from BHPF recorded all of the presumed Sumatran tiger prey species, with the highest encounter rates for great Argus pheasant, pig-tailed macaque, common porcupine and then bearded pig (Table 3). Compare to former studies in KSNP, BHPF prey encounter rate is lower. Although between KSNP and BHPF have similar habitat, both area has different intervention in term of habitat management.

Table 3. Comparison of tiger prey encounter rates (ER, independent photographs/100 traps nights) for four former camera trapping study areas inside

Kerinci Seblat National Park (KSNP) and Batang Hari Protection Forest (BHPF), with main prey shaded.

Common name	KSNP				BHPF
	Lowland-submontane	Lowland-submontane	Hill-submontane	Submontane	Hill-submontane
Wild boar	0.71	0.29	0.42	0.00	0.00
Bearded Pig	4.12	1.26	11.55	0.04	1.55
Serow	0.03	0.05	0.08	0.13	0.05
Red muntjac	1.01	3.10	4.45	0.13	0.93
Sambar deer	0.15	0.63	0.34	0.04	0.05
Greater Mouse deer	0.40	0.78	0.92	0.09	0.06
Asian tapir	3.66	3.20	2.94	0.87	0.19
Common porcupine	3.01	2.76	4.92	0.17	1.79
Pangolin	0.00	0.10	0.00	0.00	0.05

Activity 2.1 Facilitating discussions on the development of a conservation management plan

13-16 June 2008 a meeting was held to discuss the development a conservation management plan for BHPF was conducted jointly by a representative of the local forestry official, BKSDA and field manager FFI-DICE Batang Hari Project. At the end of the meeting, all participants agreed to increase conservation management for BHPF. This comitment will followed up by a stakeholders meeting to discuss a conservation management plan for BHPF.

Activity 3.1 Organising a field trip for journalist and members of the media

11- 13 August 2008 a Local TV company “Padang TV” (1 reporter and 1 cameramen) was join the team on a camera trapping field trip. The head of KSDA Sumatra Barat Province Mr. Indra Arinal and 3 staff kindly joined the field trip. This three days field trip showed them the project activities first-hand as well as to expose them to the vast array of biodiversity within BHPF. This trip also highlighted some of the threat within this area such as encroachment and illegal

logging. According the aim of project, this activity we proposed can contribute to increase the management level of this area.

Activity 4.1 End of term project review

The preparation of a final report with reccomendations for future work was conducted meeting with Head of BKSDA West Sumatra, Mr. Indra Arinal and staff, and Andalas Wildlife Study Club (AWSC), also KALAWEIT Sumatra Program was invited to attended the meeting. The meeting was held in 17 October 2008 at BKSDA office in Padang. The meeting presented the project result and recomendation for future work. The head of BKSDA appreciate and fully support the project was given good input to BKSDA as Forestry Department representative for West Sumatra Province. Mr. Indra also fully support to project continuing the activity in BHPF and surroundings area, also requsted to conduct monitoring human tiger conflict activity in West Sumatra because human tiger conflict in Sumatra was increase in previous year and no data about tiger population in patch forest surroundings Kerinci Seblat NP and BHPF.

Recommendation

The BHL project was started by DICE/FFI in partnership with the Natural Resources Conservation Office (BKSDA, Department of Forestry) for West Sumatra, who had requested support for conserving tigers in the BHPF. The baseline data have now been collected with BSKDA, who recieved field training in the process. From this study, the key tiger habitat areas have now been identified across the BHL using reliable survey and data analysis techniques which enables the following recommendation to be made with confidence:

- Mitigating deforestation - This area has undergone extensive deforestation and has the highest rates of forest loss and degradation across the Batang Hari landscape. To tackle deforestation will require a range of action from increasing law enforcement to addressing local land right claims. However, a

accurate land use plan is urgently required to determine where legal forest clearance for plantations can and cannot take place.

- Spatial management plan – In order to effectively protect BHPF, an up-to-date and accurate protected area border is needed, which has been ground-truthed in the field and accepted by the Government of Indonesia. Without this border, land use planning will be difficult and will probably suffer from overlapping boundaries, especially with the PT AMT logging concession to the south of BHPF. A recommendation for DICE/FFI and BKSDA is to identify the different land-use types, their legality and explore the possibility for enlarging BHPF, such as through the incorporation of the logging concession into BHPF once the license expires. Whilst it might be desirable from a tiger conservation perspective to expand the protected area, it might be difficult to justify this at the expense of West Sumatra's economic development. It is, therefore, worth recalling that 'Protection Forest' areas were primarily created to maintain and protect vegetation cover, soil stability on steep slopes and watershed areas. Protection Forest areas are not available for commercial logging or conversion for other commercial activities, although this is known to happen. The BHPF protects one of Sumatra's most important watersheds, which provides benefits to 100,000s of people living around the protected area and downstream of the River BH. So, there is every reason to support and ensure the protection of this area and involve the neighbouring communities to become involved through local watershed forest management schemes, which could establish customary (*adat*) forest.
- Mitigating poaching - These areas are further from the threats posed by deforestation and are also remote, thereby making them less accessible to poachers. Whilst neither tiger and prey poaching was not recorded as a major threat during this study, but from camera trap photos found evidences human ilegal activity inside the area included bird hunting, swift nest ilegal harvesting and ilegal miner. Also in Sumatra, there is usually a spike in tiger prey poaching in the weeks leading up to the religious holiday of Idul Fitri. It is therefore recommended that law enforcement patrols are conducted to

ascertain the level of poaching in the BHPF. Given the limited resources of BSKDA for forest patrols, it would seem sensible to focus effort in the more accessible, i.e. lowland, areas to achieve greatest success (Leader-Williams & Albon 1988). Previous studies have shown that increased detection rates are a greater deterrent to poachers than increased fines (Rowcliffe et al. 2004; Leader-Williams and Milner-Gulland 1993), so a strategy that involved monthly patrols in edge areas and less frequent, e.g. once every three months, patrols in the remoter areas would seem logical. However, special attention should be given to the forest edge camera trap sites that recorded the two tiger cubs, i.e. a section of the breeding population.

- Coridor propose - From this study, the BHPF has been shown to represent an important tiger area. Also, the BHPF area is important patch forest coridor to reconected KSNP area and other forest block in central Sumatra (Riau Province and Jambi Province) like Rimbang Baling Wildlife Sanctuary (RBWS) and Bukit Tigapuluh NP (BTNP). From WWF study in RBWS and BTNP, both area contain important tiger population (RBWS= 0.92-4.03 tigers/100km2). To support this coridor propose needed a intensive monitoring for tiger population and their prey within BHPF and surroundings area.

Additional activities

- FFI-AFEP presentation

The Project coordinator was invited by FFI-AFEP Technical Manager Dr. Matthew Linkie to give a 1 hour presentation to in the FFI-AFEP office in Banda Aceh. The presentation focused on the BHPF CLP project and tiger and prey monitoring techniques. 11 people attended the presentation and this was valuable because it provided an opportunity to share camera trapping techniques, lessons learned, links for future collaboration and/or training

Selection of project photos

Plate 1. Tigress and two cubs

Plate 2. Tigresses walking along a forest trail during the daytime

Plate 3. Male tiger passing along a ridge

Plate 4. One of male tiger in BHPF

Plate 5. Asian wild dog, a rarely photographed Sumatran forest carnivore

Plate 6. Great argus pheasant displaying in front of camera

Plate 7. Serow, wild forest goat

Plate 8. Bird poachers recorded inside the protected area