

รายงานฉบับสมบูรณ์
เมธีวิจัยรุ่นที่ 2 : RSA/5/2538
สนับสนุนโดย
สำนักงานกองทุนสนับสนุนการวิจัย (สกว)
(1 กันยายน 2538 - 30 สิงหาคม 2541)

การติดตามการเปลี่ยนแปลงขนาดและการกระจาย
ของประชากรของกระทิงและวัวแดงในประเทศไทย

สมโภชน์ ศรีโกสามาตร

ภาควิชาชีววิทยา คณะวิทยาศาสตร์ มหาวิทยาลัยมหิดล

กิตติกรรมประกาศ

สำนักงานกองทุนสนับสนุนการวิจัย (สกว) มีส่วนสนับสนุนเป็นอย่างมากทำให้งานวิจัยต่อไปนี้เป็นไปด้วยความสำเร็จ นอกจากนี้ยังมีหน่วยงานอื่น ๆ และบุคคลหลายคนที่ทำให้งานดำเนินได้เป็นอย่างดี ดังมีรายละเอียดสอดแทรกในกิตติกรรมประกาศของแต่ละบทความ

บทคัดย่อ

มีกระทิงประมาณ 900 ตัวและวัวแดง 400 ตัวในเขตอนุรักษ์ในประเทศไทย ประชากรของกระทิงที่เขตรักษาพันธุ์สัตว์ป่าห้วยขาแข้ง อุทยานแห่งชาติเขาใหญ่ และอุทยานแห่งชาติปางสีดา มีประชากรเพิ่มขึ้นเนื่องจากการจัดการที่ดีคือมีการปราบปรามการค้าสัตว์อย่างเคร่งครัดที่ห้วยขาแข้ง และมีการทำให้ประชาชนมีส่วนร่วมที่อุทยานแห่งชาติเขาใหญ่ การสะสมเขาสัตว์เป็นปัจจัยที่สำคัญทำให้ประชากรของกระทิงและวัวแดงลดลงและเป็นวัฒนธรรมต่อเนื่องของการใช้ทรัพยากรสัตว์ป่าที่มีมาตั้งแต่สมัยอยุธยาจากการค้าขายหนังกวางในคริสต์ศตวรรษที่ 17 จนมีการติดต่อกับประเทศจีนและคนจีนอพยพรวมทั้งการติดต่การค้าขายและเปิดประเทศกับประเทศตะวันตกตั้งแต่กลางคริสต์ศตวรรษที่ 19 จนในที่สุดการค้าสัตว์และสะสมเขาสัตว์มีมากขึ้นตั้งแต่มีการแพร่หลายของอาวุธปืนเพิ่มขึ้นหลังสงครามโลกครั้งที่ 2

It is confirmed that there are about 900 gaur and 400 banteng in protected areas in Thailand. Due to strong law enforcement and local people involvement in conservation in Huai Kha Khaeng Wildlife Sanctuary and Khao Yai National Park, some populations of gaur and banteng are increasing. Trophy collection in Thai houses is still a major factor causing population decline of gaur and banteng in Thailand. Trophy collection is a tradition following the long tradition on the use of wildlife resources for commercial trade since 17th century. It started from deer skin trade and then the other use of wildlife resources followed and continued on.

รายละเอียดของผลงาน

ผลงานที่ตีพิมพ์ในช่วงของการรับทุนทั้งในวารสารวิชาการและในบทความทั่วไปมีดังต่อไปนี้คือ

SRIKOSAMATARA, S. AND V. SUTEETHORN (1995). Populations of gaur and banteng and their management in Thailand. *Natural History Bulletin of the Siam Society* 43(1): 55-83.

HEINEN, J.T. AND S. SRIKOSAMATARA (1996). Status and protection of Asian wild cattle and buffalo. *Conservation Biology* 10: 931-934

สมโภชน์ ศรีโกสามาตร 2540 สัตว์ป่าใกล้สูญพันธุ์: วัวแดง. วารสารสารคดี 12(143): 4-5. มกราคม 2540.

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ส่วนบทความที่อยู่ในรูปของ manuscript คือ

SOMPOAD SRIKOSAMATARA, & Varavudh Suteethorn. Factors reversing population decline of gaur and banteng in Thailand

SOMPOAD SRIKOSAMATARA. Relative density and distribution of large herbivores in a formerly "compression area" of a dry tropical forest, western Thailand

SRIKOSAMATARA, S. AND G. SCHROERING. Commercial use of wildlife: an important factor for the extinction of deer in Thailand.

เอกสารทั้งหมดได้แนบมาในรายงานครั้งสุดท้าย

สัญญาเลขที่ RSA/5/2538
รายงานการเงินในรอบ 36 เดือน

ชื่อโครงการ การติดตามการเปลี่ยนแปลงขนาดและการกระจายของประชากรของกระทิงและวัวแดงในประเทศไทย โดยเฉพาะในเขตรักษาพันธุ์สัตว์ป่าห้วยขาแข้ง
ชื่อหัวหน้าโครงการ รศ. ดร. สมโภชน์ ศรีโกสามาตร
รายงานในช่วงวันที่ 1 มีนาคม 2541 ถึงวันที่ 30 สิงหาคม 2541

รายจ่ายประจำงวดปัจจุบัน

หมวด (ตามเอกสาร โครงการ)	รายจ่ายจากรายงาน ครั้งก่อน	รายจ่าย คราวนี้	รวมสะสม
1. ค่าจ้าง	13,500	34,000	47,500
2. ค่าตอบแทนเมธีวิจัย	90,000	90,000	180,000
3. ค่าใช้สอย	10,000	10,150	20,150
4. ค่าวัสดุ *	23,470	1,965	25,435
5. ค่าครุภัณฑ์	20,350	0	20,350
6. ค่า Reprints	0	0	0
7. ค่าหนังสือและวารสาร	10,000	10,000	20,000
8. ค่าลงทะเบียนสัมมนา	0	0	0
9. ค่าเดินทาง ค่าเบี้ยเลี้ยง และที่พัก	22,000	50,000	72,000
รวม	189,320	196,115	38,5435

จำนวนเงินที่ได้รับและเงินคงเหลือ

งวดที่ 1	ได้รับจาก สกว.	360,000	บาท
	ได้รับจากมหาวิทยาลัย *	120,000	บาท
	อื่น ๆ (เช่นคอกเบี้ย)	4,387	บาท
	รวม	484,387	บาท
	รายจ่าย	164,425	บาท
	เหลือ	319,962	บาท
งวดที่ 2	ได้รับจาก สกว.	0	บาท
	ได้รับจากมหาวิทยาลัย *	113,475	บาท
	อื่น ๆ (เช่น ขกมาจากงวดก่อนหรือคอกเบี้ย)	209,450	บาท
	รวม	322,925	บาท
	รายจ่าย	226,755	บาท
	เหลือ *	96,170	บาท
งวดที่ 3	ได้รับจาก สกว.	360,000	บาท
	ได้รับจากมหาวิทยาลัย (จากงวดที่แล้ว) *	96,170	บาท
	ได้รับจากมหาวิทยาลัย (เพิ่มเติม) *	120,000	บาท
	อื่น ๆ (เช่นขกมาจากงวดก่อนหรือคอกเบี้ย)	1,984	บาท
	รวม	578,154	บาท
	รายจ่าย	147,330	บาท
	เหลือ *	430,824	บาท
งวดที่ 4	ได้รับจาก สกว.	0	บาท
	ได้รับจากมหาวิทยาลัย *	216,170	บาท
	อื่น ๆ (เช่นขกมาจากงวดก่อนหรือคอกเบี้ย)	219,160	บาท
	รวม	435,330	บาท
	รายจ่าย	231,000	บาท
	เหลือ *	204,330	บาท
งวดที่ 5	ได้รับจาก สกว.	270,000	บาท
	ได้รับจากมหาวิทยาลัย *	204,330	บาท

	อื่น ๆ (เช่น ขยกมาจากจวคก่อนหรือคอกเบี้ย)	3,453	บาท
	รวม	477,783	บาท
	รายจ่าย	189,320	บาท
	เหลือ *	288,463	บาท
จวคที่ 6	ได้รับจาก สกว.	194,150	บาท**
	ได้รับจากมหาวิทยาลัย *	204,330	บาท
	อื่น ๆ (เช่น ขยกมาจากจวคก่อนหรือคอกเบี้ย)	1,965	บาท
	รวม	400,445	บาท
	รายจ่าย	196,115	บาท
	เหลือ *	204,330	บาท

เงินคณะ (เบิก ได้แก่ ค่าวัสดุ ค่าเบี้ยเลี้ยง ค่าที่พัก และค่าเดินทางบางส่วน และมีกฎระเบียบที่ยุ่งยากซับซ้อน) และใช้ได้น้อยมาก ส่วนที่เหลือในที่สุดแล้วคณะจะเรียกคืน

** รวมเงิน 90,000 บาทที่คาดว่าจะได้รับจาก สกว

เงื่อนไขการส่งจ่าย2ใน3ท่าน

1. นายสมโภชน์ ศรีโกสามาตร

2. น.ส.กรรณิการ์

3. น.ส.กรรณิการ์

08/08/95 09:11 0851M*2350 026-278725

3. นางกรรณิการ์ NEW 000007238048

บัญชีรายการฝากเงินประจำเดือนระยะเวลา			
ธนาคารพาณิชย์ในเครือธนาคารไทยพาณิชย์			
บัญชีเงินฝากประจำ	วันที่ฝากเงิน	จำนวนเงินฝาก	ดอกเบี้ย
08/08/95	09:11	0851M*2350	026-278725
500.00	50.00	50.00	100.00

248

78725-2

ชื่อบัญชี 78725-2 เมธีวิชัย สก.-สมโภชน์ ศรีโกสามาตร
NAME

ธนาคารไทยพาณิชย์ จำกัด (มหาชน)
THE SIAM COMMERCIAL BANK PUBLIC COMPANY LIMITED

สาขารามาริบัติ -

บัญชีเงินฝากออมทรัพย์
SAVINGS ACCOUNT

เลขที่บัญชี 026-2 78725-2
ACCOUNT NO

Signature

150000

8/09/95CDB	*****100.00*****100.00	0851H
26/09/95BDN	****360,000.00****360,100.00	0324K
3/10/95CWD	*****15,000.00	****345,100.00 0253C
1/11/95XWD	*****15,100.00	****330,000.00 0254D
4/12/95XWD	*****15,000.00	****315,000.00 0253C
15/12/95CWD	*****2,070.00	****312,930.00 0249C
25/12/95CWD	*****4,370.00	****208,560.00 0258C
25/12/95CWD	*****15,000.00	****293,560.00 0258C
28/12/95CWD	*****10,000.00	****283,560.00 0254C
31/12/95T/I	*****0.00*****4,387.59	****287,947.59 0000A
25/01/96CWD	*****5,000.00	****282,947.59 0256C
30/01/96XND	*****15,000.00	****267,947.59 0252C

30/01/96CWD	*****53,500.00	****214,447.59 0252C
13/02/96CWD	*****40,000.00	****174,447.59 0257C
15/02/96CWD	*****40,000.00	****134,447.59 0248C
28/03/96CWD	*****45,000.00	****89,447.59 0253C
16/04/96CWD	*****20,000.00	****69,447.59 0253C
25/04/96CWD	*****30,000.00	****39,447.59 0248C
24/05/96CWD	*****15,000.00	****24,447.59 0254C
24/06/96CWD	*****12,000.00	****12,447.59 0251C
30/06/96T/I	*****0.00*****2,963.87	****15,411.46 0000A
22/08/96CWD	*****12,000.00	****3,411.46 0255C

720000

7200000

22/08/96CWD	*****3,300.00	*****111.46 0251C	✓
18/11/96QDN		****360,000.00****360,111.46 0259C	
19/11/96CWD	*****40,000.00	****320,111.46 0251L	✓
17/12/96CWD	*****30,000.00	****290,111.46 0253C	✓
31/12/96T/I	*****0.00*****1,984.36	****292,095.82 0000A	✓
16/01/97CWD	*****45,000.00	****247,095.82 0250C	✓
20/02/97CWD	*****25,000.00	****222,095.82 0249C	✓
24/02/97CWD	*****9,425.00	****212,670.82 0256C	✓
17/03/97CWD	*****11,000.00	****201,670.82 0255C	✓
28/03/97CWD	*****40,000.00	****161,670.82 0251C	✓
28/03/97CWD	*****15,000.00	****146,670.82 0258C	✓
22/05/97CWD	*****30,000.00	****116,670.82 0254C	✓

20/06/97 CWD	*****40,000.00	*****76,670.82 0248C	✓
INT	*****4,506.31		
30/06/97 TAX	*****0.00	*****81,177.13 0000A	
29/07/97 CWD	*****25,000.00	*****56,177.13 0258C	✓
08/08/97 CWD	*****25,000.00	*****31,177.13 0254C	✓
01/09/97 CWD	*****30,000.00	*****1,177.13 0252C	✓
29/09/97 QDP	****270,000.00	****271,177.13 0249C	✓
03/10/97 CWD	*****15,000.00	*****256,177.13 0254C	✓
10/10/97 CWD	*****17,500.00	*****238,677.13 0251C	✓
02/12/97 CWD	*****15,000.00	*****223,677.13 0255C	✓

7200000

XXXXXXXXXX

09/12/97

09/12/97 CWD	*****15,000.00	****208,677.13 0252C	W
22/12/97 CWD	*****30,000.00	****178,677.13 0251C	
INT	*****3,453.24		
31/12/97 TAX	*****0.00	****182,130.37 0000A	
07/01/98 CWD	*****15,000.00	****167,130.37 0257D	W
22/01/98 CWD	*****50,000.00	****117,130.37 0251C	W
23/01/98 CWD	*****50,000.00	*****67,130.37 0259C	W
29/06/98 CWD	*****20,000.00	*****47,130.37 0255C	W
INT	*****1,965.80		
30/06/98 TAX	*****0.00	*****49,096.17 0000A	
08/10/98 CWD	*****15,000.00	*****34,096.17 0254C	W

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POPULATIONS OF GAUR AND BANTENG AND THEIR MANAGEMENT IN THAILAND

Sompod Srikosamatara and Varavudh Suteethorn***

ABSTRACT

The populations of gaur and banteng in Thailand are estimated using data from the authors' research in Thung Yai and Huai Kha Khaeng Wildlife Sanctuaries, from research in Khao Yai National Park, and from brief surveys and available publications during the last 4-5 years. It is estimated that there are about 915 gaur and 470 banteng in the protected areas of Thailand. There are no gaur and banteng outside protected areas. The most important area for gaur and banteng conservation is Huai Kha Khaeng Wildlife Sanctuary with total populations of about 290 gaur and 290 banteng. There has been at least a 60% reduction in the population of gaur and 80% reduction in the population of banteng in Thailand during the last 20 years. Banteng in Thailand are more prone to extirpation than gaur and both are more threatened than elephant. The practice of keeping gaur and banteng trophies encourages poaching within protected areas. The trophies in Bangkok registered at the Royal Thai Forest Department in 1994 were equivalent to 967 gaur and 1840 banteng. A public campaign against the tradition of keeping gaur and banteng horns for trophies should be initiated by the government and conservation NGOs, combined with a good system for registering already acquired horns. More active management should involve regular patrolling in protected areas, strong law enforcement, and a strong program for regulating the number of guns owned by local people.

INTRODUCTION

Both gaur and banteng are classified as internationally threatened by GROOMBRIDGE (1993). They are shy forest animals and difficult to count. A method for surveying gaur and banteng using line transect and dung has been developed by SRIKOSAMATARA (1993). To apply this method to a larger area requires systematic survey, which we did in Thung Yai and Huai Kha Khaeng Wildlife Sanctuaries and the detailed results will be reported elsewhere (SRIKOSAMATARA & SUTEETHORN, in manuscript).

This study is an attempt to estimate the populations of gaur and banteng in different protected areas in Thailand based on the authors' research in Thung Yai and Huai Kha Khaeng Wildlife Sanctuaries (SRIKOSAMATARA & SUTEETHORN, in manuscript), studies in Khao Yai National Park by DOBIAS (1985, 1986) and CLIMO (1990), short visits to many protected areas and information obtained from both published and unpublished reports. The data can contribute to regional action plans for management of these species (HEDGES, in prep.).

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STUDY SITES AND METHODS

In addition to the authors' research in Thung Yai and Huai Kha Khaeng Wildlife Sanctuaries (WS), short surveys were made in many protected areas and information about populations of gaur and banteng was collected from various secondary sources, particularly management plans. Data on gaur in Khao Yai National Park (NP) was obtained from DOBIAS (1985, 1986, pers. comm.) and CLIMO (1990). The survey route in each protected area was based on information from maps, existing reports and interviews with protected area personnel. More effort was put into surveying areas where densities of gaur and banteng were expected to be the greatest. From maps of various types and scales we obtained information on access, general topography, existing forest area, forest types, geology and the distribution of tribal villages. Whenever possible, mineral licks were investigated for tracks or other signs of gaur and banteng. Estimates of numbers were based on comparing the relative abundance of gaur and banteng tracks and dung with data from Thung Yai and Huai Kha Khaeng Wildlife Sanctuaries.

RESULTS

Populations of Gaur and Banteng in Protected Areas in Thailand

It is estimated that there are about seven subpopulations of 50 or more gaur with the total population of 915, and two subpopulations of 50 or more banteng with a total population of 470 in protected areas in Thailand. The most important area for gaur and banteng conservation is Huai Kha Khaeng WS with the total population of 290 gaur and 290 banteng. Other important areas for gaur and banteng conservation are summarized in Table 1 and Fig. 1. Detailed information for different protected areas is given in the following section and Appendix I.

Northern Area

All information about gaur and banteng in the North was obtained from secondary sources. Om Koi WS and Mae Tuen WS, with the combined area of 2397 km², are located in this area. Mae Ping NP is separated from both sanctuaries by a reservoir. These areas have experienced high poaching pressure (BHUMPAKPHAN & KUTINTARA, 1993). It is estimated that there are 50 gaur and 50 banteng in this area and most of them are in Om Koi WS. There are about 15 gaur and 5 banteng in Sri Satchanalai NP.

In Mae Tuen WS, both gaur and banteng have been reported (FRI, 1993a). Mixed Deciduous and Dry Dipterocarp Forest cover about 50% and 37% of the sanctuary, respectively. Since the main underlying rock is granite, numerous mineral licks are expected to be located in this area. About 30 villages (Karen, Thai and Hmong) are reported in the sanctuary and most villages are located near streams where mineral licks are likely to be found. Much of the area is easily accessible by boat. Due to the likelihood of high poaching pressure, the populations of gaur and banteng are expected to be very low.

In Om Koi WS, both gaur and banteng have been reported (FRI, 1993c). Mixed Deciduous and Dry Dipterocarp Forest dominate the area. Several villages (Karen, Lahu

and Lisu) of 720 households and 2,702 people are situated in the sanctuary. The high poaching pressure and long history of human occupation in the area since 1967 possibly caused rapid declines in the populations of gaur and banteng.

In Mae Ping NP, KU (1989b) reported the presence of banteng. The area is dominated by Dry Dipterocarp (42%) and Mixed Deciduous (35%) Forest (KU, 1989b). There are 28 villages of 3477 households with 16,449 people (mainly Thai but some Karen) within or on the boundary of the national park. Most villages have been set up for at least 30 years and some are about 100 years old.

Petchabun Range

Nam Nao NP and Phu Khieo WS, with a combined area of 2388 km², are located in this area. These areas have experienced heavy poaching pressure since 1960 (RFD, 1961; RUHLE, 1964; SUKAVANICH, 1988; PALIPHOD, 1989). It is roughly estimated that there are 30 gaur and 20 banteng in Nam Nao NP and Phu Khieo WS. Thirty gaur each are roughly estimated for Phu Luang WS and Thung Salaeng Luang NP.

In Nam Nao NP, gaur and banteng have been reported (DOBIAS, 1982). A visit by the authors in 1992 indicated that both gaur and banteng can often be found near Phrom Song Guard station which connects with Phu Khieo WS. In Feb. 1992, 6–7 gaur were reported from this area.

Both gaur and banteng have also been reported in Phu Khieo WS (KU, 1989a). Gaur were reported in the central part of the sanctuary around Thung Kamang (an area of several shallow lakes of about 8 km²), Bung Paen (a rich swampy grassland of about 64 ha) and Phu Khing (SUKAVANICH, 1988). Three gaur were sighted in 1987 (SUKAVANICH, 1988). Tracks of gaur and banteng were found at two of the 13 mineral licks surveyed near Thung Kamang by SUPMEE (1986) during 1984–1985 but no local officials reported the presence of banteng in the sanctuary recently (Kitti Kreetiyutanont, pers. comm.). At least 13 gaur were known to be shot by villagers in the past (PALIPHOD, 1989) and a gaur was reported to be poached during our visit. About 60% of villagers near this area have guns (PALIPHOD, 1989).

In Phu Luang WS, both gaur and banteng were reported by RFD (1993d). During our visit in 1993, a forest guard at the Tat Loei station at the southern boundary of the sanctuary reported gaur tracks in the upper watershed area of the Loei river.

In Thung Salaeng Luang NP, RFD (1961) reported the presence of gaur, but hunting pressure for gaur was high during 1960 (RUHLE, 1964). Subsequent reports of sighting of gaur have appeared in newspapers which should be considered cautiously; for example, 50–60 gaur were reported near Poi Rab, Tambon Wang Nok Aen, Wang Thong District, Phitsanulok Province by Assistant Chief of the park Mr. Dhira Temwongra (*Matichon Daily Newspaper*, 14 Feb. 1994). Mr. Nat Ratana estimated 30 gaur left in the park and poaching is still being reported (*Matichon Daily Newspaper*, 22 Mar. 1994).

Dong Paya Yen and Sun Kampaeng Range

Khao Yai NP, with an area of 2168 km² and Tap Lan NP and Pang Sida NP, with a combined area of 2201 km², are located in this area. Lowland forests still remain in Pang Sida NP. It is roughly estimated that there are 100 gaur in Khao Yai NP and 50 gaur and 10 banteng in Tap Lan and Pang Sida NPs.

Table 1. Important protected areas for gaur and banteng conservation in Thailand. The numbers with G and B in brackets are the estimated numbers of gaur (G) and banteng (B) in different areas. SN = small number.

-
1. NORTHERN AREA (65G, 55B)
 - 1.1 Om Koi WS and Mae Tuen WS, 2397 km² (50G, 50B)
 - 1.2 Sri Satchanalai NP, 213 km² (15G, 5B)
 2. PETCHABUN RANGE (90G, 20B)
 - 2.1 Nam Nao NP and Phu Khieo WS, 2388 km² (30G, 20B)
 - 2.2 Phu Luang WS, 848 km² (30G, 0B)
 - 2.3 Thung Salaeng Luang NP, 1262 km² (30G, 0B)
 3. DONG PAYA YEN AND SUN KAMPAENG RANGE (150G, 10B)
 - 3.1 Khao Yai NP, 2169 km² (100G, 0B)
 - 3.2 Tap Lan NP and Pang Sida NP, 2201 km² (50G, 10B)
 4. PHU PHAN RANGE (0G, 0B)
 5. PHANOM DONGRAK RANGE (20G, 20B)
 6. SOUTH-EASTERN AREA (30G, 20B)
 - 6.1 Khao Soi Dao WS, Khao Kitchakut NP and Khao Ang Ru Nai WS, 1834 km² (30G, 20B)
 - 6.2 Khao Chamao-Khao Wong NP, 84 km² (SN)
 7. TENASSERIM (510G, 315B)
 - 7.1 Huai Kha Khaeng WS, 2575 km² (290G, 290B), Thung Yai WS, 3200 km² (170G, 0B), Umphang WS (SN), Mae Wong NP (SN), Khlong Lan NP (SN), Khao Laem and Sri Nakharin NP (SN), 12429 km² (460G, 290B)
 - 7.2 Kaeng Krachan NP and Mae Nam Phachi WS, 3438 km² (50G, 25B)
 8. PENINSULAR SOUTH (50G, 30B)
 - 8.1 Khlong Nakha WS, Khlong Saeng WS, Khlong Yan WS, Khao Sok NP, Sri Phangnga NP and Kaeng Krung NP, 3515 km² (50G, 30B)

Total (915G, 470B)

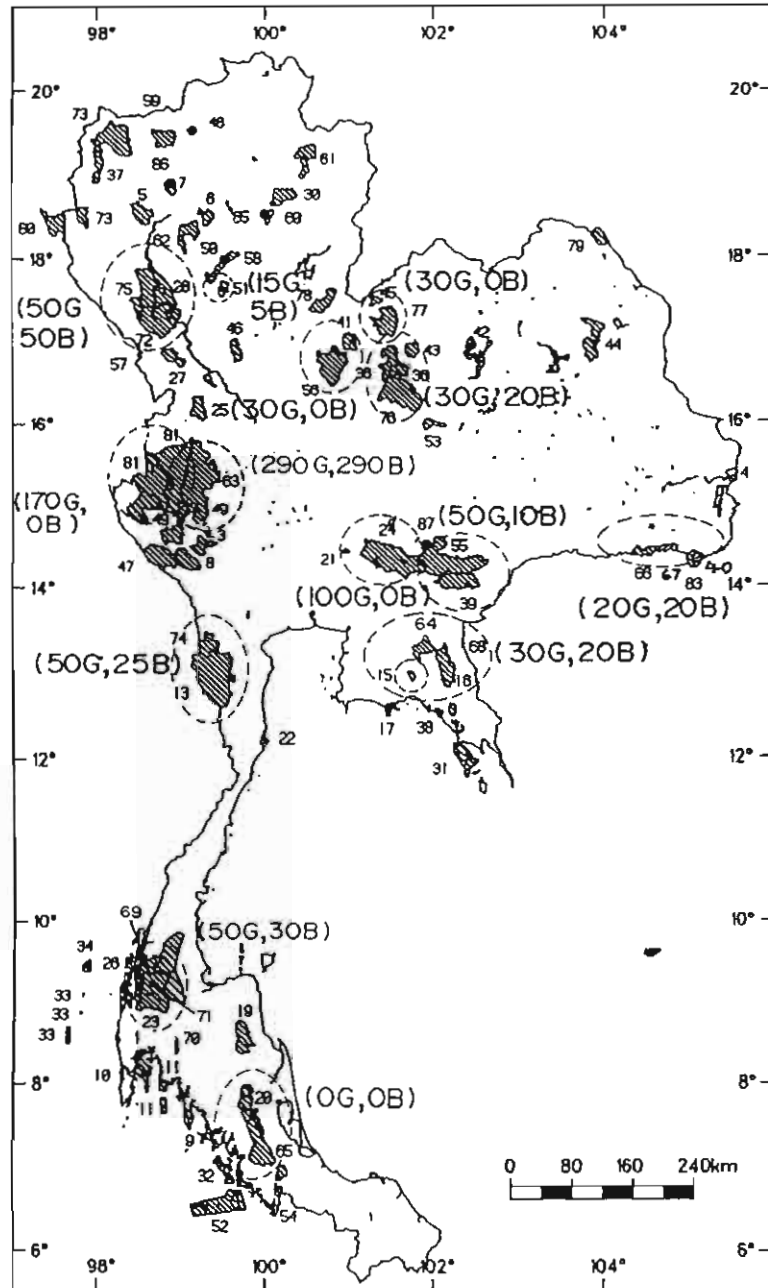


Figure 1. Distribution of important areas for gaur and banteng conservation in Thailand. The map and numbers representing different protected areas are modified from IUCN (1992). The total number of protected areas in this map is about 91 but the number increased to more than 108 in 1992. The numbers in front of G and B in brackets represent estimated numbers of gaur and banteng in different areas.

In Khao Yai NP only gaur have been reported (SAYER, 1981; KUTINTARA & PONGUMPHAI, 1982; DOBIAS, 1985, 1986; NPD, 1987). In 1932 sympatric gaur and banteng were described at a lowland of Thung Kha, north of Pak Chong district and westward between Klong Yai Railway Station to Heo Ta Bua (LEKAGUL, 1952).

There are two subpopulations of gaur in Khao Yai. One in the west near Khao Fa Pha-Khao Inthani area, and another in the east around perhaps east of Khao Laem and Khao Rom. DOBIAS (1986) estimated the density of gaur around Khao Fa Pha-Khao Inthani (82 km²) as 0.5 with the range of 0.3–0.6 km⁻². When we drew up lines to all locations where signs of gaur were found in this area, we obtained a minimum polygon of about 100 km², so that a population estimated in this area is about 50 with a range between 30 to 60.

For the population in the eastern side of the park, DOBIAS (1986, pers. comm.) did not report any gaur dung in line transects around the headquarters area (82 km²) but reported 3 gaur dung along 24.6 km transect in the Sai Yai area (82 km²) which yields a density of gaur dung of 17 (0–71) km⁻². During Jan. to Mar. 1990, CLIMO (1990) walked 20 km of line transect in 40 km² of Samopun Valley and observed gaur tracks only once but they encountered gaur tracks six times and one dung pile as they were cutting the transects. This indicates a low population density of gaur in this area. It has also been reported that gaur are also numerous on Khao Rom. Brockelman (pers. comm.) has reported numerous tracks on the sides of Khao Laem. On Apr. 1995, high density of gaur dung were reported between Khao Khieo and Khao Rom Noi at an elevation of 1200m asl (W.Y. Brockelman, pers. comm.). In 1985, two gaur sightings were reported near Khao Kamphaeng in the northeast area of the park (DOBIAS, 1985). A herd of 30 gaur was reported from Wang Sai Village, Tambon Wang Mi, Pak Thong Chai District on Nov. 1991 (*Matichon Daily Newspaper*, 9 Nov. 1991) but this information should be considered cautiously. It is roughly estimated that there are at least 50 gaur in the eastern side of the park.

Gaur may have been affected by tourist activities or poaching near the headquarters area. This is supported by comparing numbers of gaur sighted in 1985 and 1973–1974. During 1985 two gaur sightings were reported between this area and headquarters (DOBIAS, 1985). One gaur sighting was made at a mineral lick, 5 km from the headquarters while the other was made in an area 6 km from the headquarters. This can be compared with a report from 1973–1974 (SUCHART ET AL., 1976), during which, at least 8 sightings of gaur in herds of up to 17 individuals were reported from the wildlife tower at Nong Phak Chi, 5 km northwest of headquarters. The last sighting of gaur at Nong Phak Chi was documented by a photograph of 6 gaur taken by Mr. Surachit Jamonman on Sept. 1981 (Fig. 2).

DOBIAS (1985) reported that poaching was widespread and intense within the park, and it became a more serious problem in the headquarters area in 1985, when market hunting for gaur meat and trophies occurred. The Khao Fa Pha and Sai Yai areas might be under the heaviest poaching pressure (DOBIAS, 1985, 1986). Gaur poaching was also reported 6 km from headquarters on 7 Jun. 1986 and in the northeast of the park on Nov. 1991. Five gaur were reported to be poached in early 1992 (*Bangkok Post Daily Newspaper*, 21 Sept. 1992) and poachers from Ban Mu Sri, Amphoe Pak Chong were reported to poach two gaur in May 1993 (*Matichon Daily Newspaper*, 21 May 1993).

In 1992, restaurants in Nakhon Nayok (near the south edge) and Pak Chong (north of

the park) were still reported to offer recipes with wildlife meat (*Bangkok Post Daily Newspaper*, 21 Sept. 1992). Poachers still sold gaur meat to restaurants at resorts surrounding Khao Yai NP in May 1993 (*Matichon Daily Newspaper*, 21 May 1993).

The road extending from Nakhon Nayok into the south part of the park in 1982-1983 and connecting with the existing road built from Pak Chong in 1960, cut the park into two big pieces. The heavy traffic reported by GRANDSTATFF (1988) possibly acts as a barrier for gaur dispersal. CONRY (1989) reported gaur trails following or crossing logging roads, but gaur evidently do not cross asphalt roads with heavy traffic like that in Khao Yai.

In Pang Sida NP, RFD (1993a) reported both gaur and banteng. On Nov. 1994, 83 dung piles of wild cattle (most of them possibly belonging to gaur) were seen along the dirt road of 77 km from the park headquarters to Klong Nam Mun Guard Station of Tap Lan NP (Fig. 3). These dung piles were possibly accumulated during the last rainy season. The distribution of the dung piles was clumped near the headwaters of Huai Nam Yen and Huai Samong at an elevation of about 300-500m asl. The density of wild cattle (mostly gaur) found along the road is possibly about the same as SRIKOSAMATARA (1993) found in Khao Nang Rum, about 1.8 km⁻². Banteng were reported by national park workers but their population must be very small. In Jan. 1995, a mineral lick was visited in the middle of the grassland named "Bu Ta Poad" (Fig. 3). Old tracks of gaur from the last rainy season were found in the lick and nearby area. Gaur were also reported in the eastern part of the park near Laloeng Phai. It is estimated that there are about 50 gaur and about 10 banteng in this national park.

As there is still very little traffic within Pang Sida NP, the road still has little effect on the area's use by gaur and banteng. Gaur were also found feeding on shrubs along the road. It is expected that when the road is improved and there is more traffic within the park, gaur and banteng will avoid using the road. The high density of wild cattle found in this national park is probably due to the prime lowland forest habitat which still remains. Also, poachers do not hunt gaur much as their meat sells for less and spoils faster than that of sambar deer and barking deer. For trophy hunting, poachers aim more to elephant hunting than wild cattle.

In Tap Lan NP, gaur and banteng have both been reported (RFD, 1993f). No dung was seen on the road connecting Pang Sida NP and Klong Nam Mun Guard Station in Tap Lan on Nov. 1994. This area is quite degraded (RFD, 1993f) and if the gaur and banteng exist, their population must be very small.

Phu Phan Range

All gaur and banteng are extirpated from this area (Appendix I).

Phanom Dongrak Range

This is an important site for a possible trans-boundary park between Thailand and Cambodia. It is roughly estimated that there are 20 gaur and 20 banteng in this area.

South-eastern Area

The deforestation rate in south-east Thailand has been high (CHUNKAO, 1987). Khao Soi Dao WS, Khao Kitchakut NP and Khao Ang Ru Nai WS, with a total area of 1834 km², contain nearly all the forest that remains. There are perhaps 30 gaur and 20 banteng

in these three protected areas and a small population of gaur and banteng in Khao Chamao-Khao Wong NP.

In Khao Soi Dao WS, RFD (1993e) reported only gaur. MIDAS (1993) mentioned that gaur and banteng occur mainly the northwest part of the sanctuary, in an area proposed for an extension. During the survey of pileated gibbons by W.Y. Brockelman and S. Srikosamatara in 1977, some banteng-like tracks were seen but not confirmed, while one set of gaur tracks was seen on the pass NW of Khao Soi Dao Tai, at an elevation of about 920m asl. Evidence of wildlife poaching in Khao Soi Dao has been widespread (BROCKELMAN ET AL., 1977). During a study on ecology and behavior of the pileated gibbons, S. Srikosamatara reported 59 gunshots during 234 days of his stay in 1978–1979.

In the contiguous Khao Kitchakut NP, banteng and gaur were reported by DOBIAS (1982). In Khao Ang Ru Nai WS, both gaur and banteng have been reported (RFD, 1991) while KU (1986) reported only gaur. Seven gaur were seen near Bo Thong Guard Station on Jan. 1992.

In Khao Chamao-Khao Wong NP, a single herd of 20–30 banteng was reported by DOBIAS, (1982). Poaching camps were encountered during the 1978 survey by W.Y. Brockelman and S. Srikosamatara. A population of gaur and banteng still survived in the park during our visit on Nov. 1994.

Tenasserim

Gaur and banteng were once common in this region (LEKAGUL, 1952). Huai Kha Khaeng WS, Thung Yai WS, Umphang WS, Mae Wong NP, Khlong Lan NP, Khao Laem NP, and Sri Nakharin NP, with a total area of 12,429 km², and Kaeng Krachan NP and Mae Nam Phachi WS to the south, with a total area of 3438 km², are situated in this area. Within the first large conservation area, there are reasonable numbers of gaur and banteng only in Huai Kha Khaeng WS and Thung Yai WS.

In Huai Kha Khaeng WS, both gaur and banteng were reported and mixed group were found at mineral licks (Fig. 4). The population density of gaur and banteng combined appears to be only about 20–50% of what the area could support based on comparison with similar habitat in India (SRIKOSAMATARA, 1993). The population of gaur and banteng combined is estimated to be about 580 with a range of 410–735 and there are possibly more banteng than gaur (SRIKOSAMATARA & SUTEETHORN, in manuscript). In this paper it is assumed that the ratio of gaur and banteng is 1:1 in Huai Kha Khaeng so that there are about 290 gaur and 290 banteng.

In Thung Yai WS gaur are more commonly reported than banteng. A large herd of 53 gaur was found in Thung Yai grassland in April 1985 (Fig. 5). Banteng were reported 10–15 km north of Thi Nuai Guard Station in May 1993, which is near Hom Mineral Lick, south of the sanctuary and next to Huai Kha Khaeng WS. The population of gaur is estimated to be about 170 with the range of 125–220 (SRIKOSAMATARA & SUTEETHORN, in manuscript).

In Kaeng Krachan NP, gaur were reported in 1912 in the Huai Ma Reo area (GAIRDNER, 1915) but this area is in the lowland and now situated outside the eastern boundary of the park, where forest encroachment has been very high. Both gaur and banteng have also been reported within the park recently (TISTR, 1992b). DOBIAS (1982) mentioned that both gaur and banteng were common around the summit of Phaoen Thung Mountain.

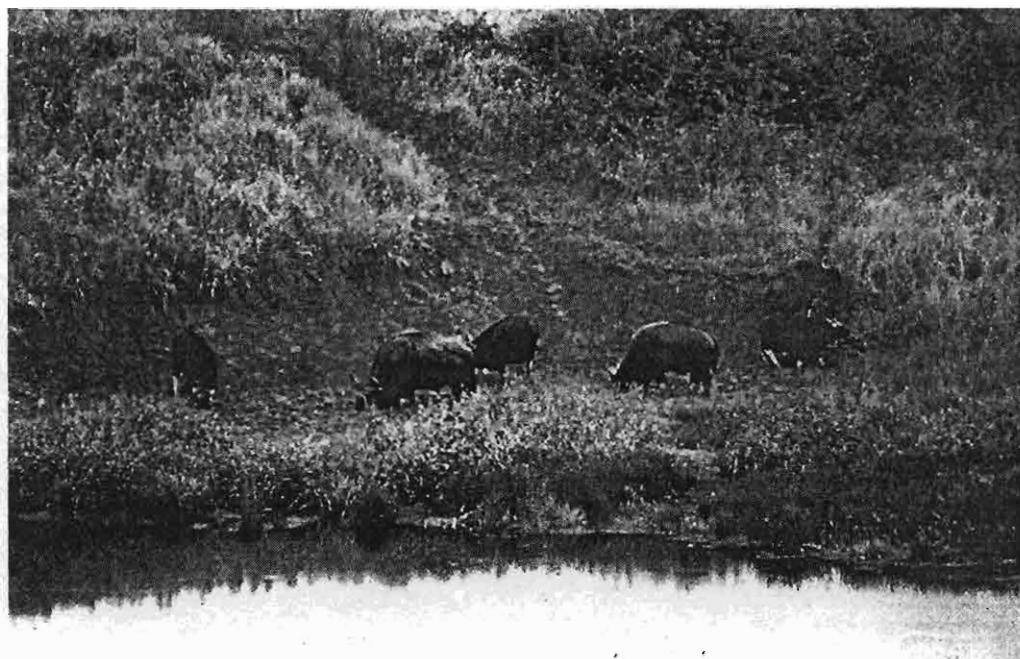


Figure 2. A herd of six gaur at a mineral lick in Khao Yai NP (Photo by Mr. Surachit Jamonman)

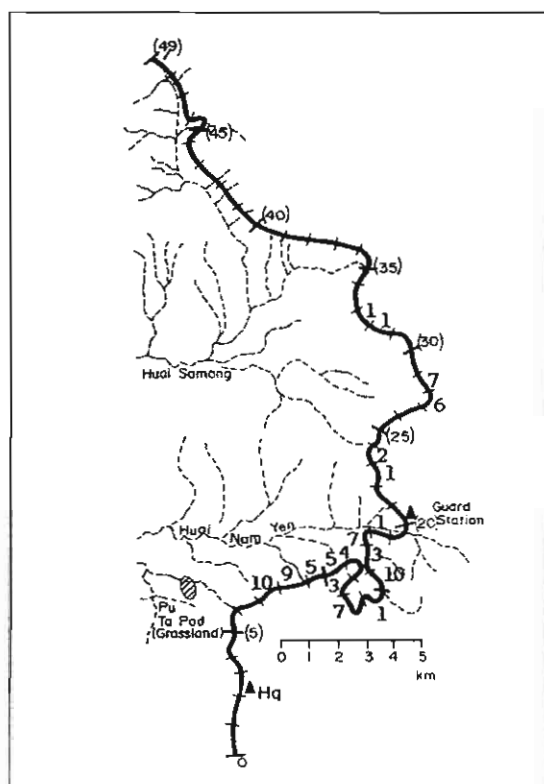


Figure 3. Dung of gaur and/or banteng found along the dirt road in Pang Sida NP on 12 Nov. 1994. The numbers in brackets are reference points in km. The numbers between the km reference line are number of dung found.

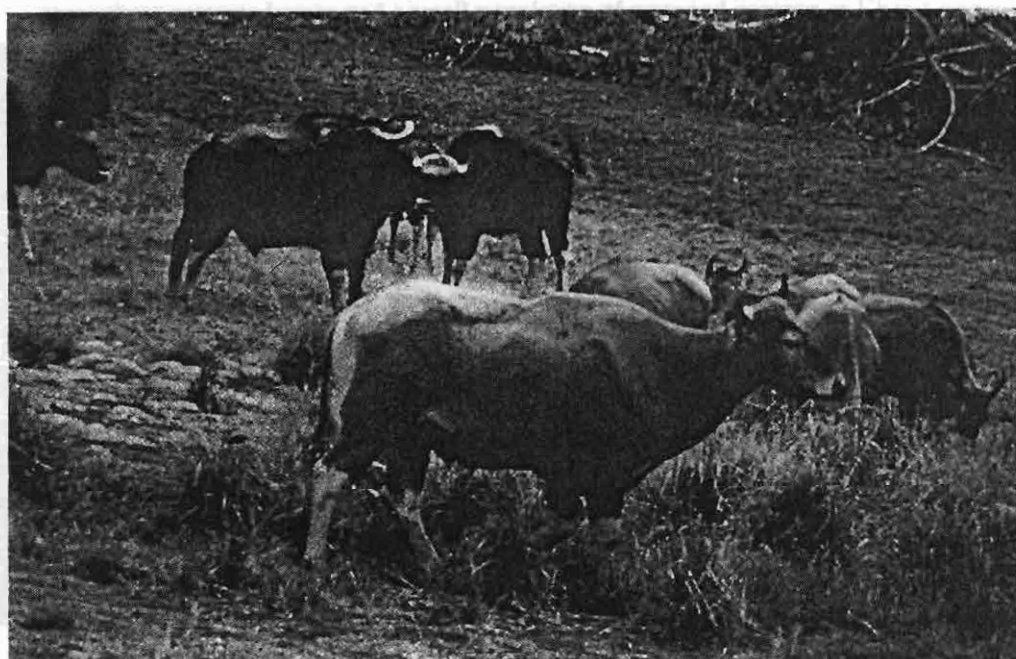


Figure 4. A mixed herd of gaur and banteng at Ya Mineral Lick in Huai Kha Khaeng WS (Photo by Ms. Busabong Kanchanasaka).



Figure 5. A herd of 53 gaur in Thung Yai WS (Photo by Mr. Jira Jintanugool)

TISTR (1992b) reported a sighting of 4 banteng near Komkris Stream in 1978. Gaur tracks were common around Pan Stream while only one sighting of gaur was reported near Tortip Waterfall. We visited the area on Aug. 1993, and Apr. and May 1994. Four mineral licks were checked where there were signs of elephant but no sign of either gaur or banteng. Two other mineral licks located near Tortip Waterfall and Phanoen Thung Mountain were also reported having neither gaur nor banteng tracks. Very old tracks of a gaur were seen along the road along Mae Nam Pan River near Khao Prakarang. As almost all the area in the park is tropical rain forest, and grassland areas in the middle of tropical rainforest have been shown to attract herds of gaur in Malaysia. A major population of gaur is expected to be distributed around a grassland of about 30 ha on Phanoen Thung Mountain.

In Mae Nam Pachi WS, both gaur and banteng were reported by MIDAS (1993). We visited the southeast and northwest side of the sanctuary during May 1994. Tropical deciduous forest dominates the sanctuary. Granite rock covers most of the area in the sanctuary. From the pattern of mineral lick formation in Huai Kha Khaeng WS where granite rock also underlies the area, mineral licks should be found along lowland streams, but most of the area in the lowlands has been settled by people. However, quite a few villages still maintain the names of former mineral licks e.g. Ban Pong Krathing, Ban Pong Phrom, Ban Pong Chang Thaeng and Ban Pong Yo (Pong in Thai means mineral lick). Old tracks of gaur were seen near Pu Nam Ron Guard Station. Two gaur were reported to be poached near this area, one in 1991 and the other in 1993; a small population of gaur still exists.

Peninsular South

Banteng have been reported as far south as northern Perlis of West Malaysia ($6^{\circ} 30'N$) (WILD LIFE COMMISSION OF MALAYA, 1932) although LEKAGUL (1959) and LEKAGUL & MCNEELY (1977) cited no report of banteng south of $8^{\circ} N$. The only block of forest that still harbors gaur and banteng in the South consists of Khlong Nakha WS, Khlong Saeng WS, Khlong Yan WS, Khao Sok NP, Sri Phangnga NP and Kaeng Krung NP, with a total area of 3515 km². The prime lowland habitat for gaur and banteng in these protected areas has been flooded by the Chiew Larn or Ratchaprapra Dam since 1980 (NAKHASATHIEN, 1989). The dam has also made the area more accessible by boat. Wildlife poaching was reported in the protected areas during 1987–1988 (BOONRATANA, 1988). It is estimated that there are 50 gaur and 30 banteng in the above areas.

In Khlong Nakha WS, only gaur were reported in the sanctuary during a visit on May 1994.

In Khlong Saeng WS, gaur and banteng have been reported (EGAT, 1980; NAKHASATHIEN, 1989). The prime low elevation habitat for gaur and banteng has been flooded by the Chiew Larn Dam. Mr. Ronglarp Sukmasuang, a researcher at Khlong Saeng Wildlife Research Station, walked 6 transects with a total length of 8 km and found a few dung of gaur. His survey area was near Khlong Khuan, a tributary of Khlong Saeng. Two herds of three and five gaur were seen during 1994 near this area. Another area where gaur were reported was near Khlong Mon near Khao Na Nok Huk. There is no recent report of banteng.

In Khlong Yan WS, a short visit was made on May 1994. No information about gaur

and banteng could be obtained.

In Khao Sok NP, both gaur and banteng were reported (EGAT 1989; NAKHASATHIEN, 1989). In 1982, gaur and banteng were common around Kai Han Field in the northeast part of the park. Tracks of gaur and banteng were reported in Jan. 1988 (BOONRATANA, 1988) and a small herd of gaur was reported near upper Khlong Yi in 1988. A short visit was made on May 1994. It was found that Kai Han Field is in fact a sinkhole where water floods the area and some grassland grows. The proximity of this area to a large village means that the gaur and banteng in this area may have already been hunted out.

Sri Phangnga NP is a long and narrow national park where tropical rain forest dominates. A visit was made on May 1994 indicate that gaur and banteng could occur around the border with Khao Sok NP and Khlong Saeng WS.

In Kaeng Krung NP, tracks of gaur were reported in Jan. 1987 (P.D. Round, pers. comm.) and in 1990. During a visit in May 1994, a park worker reported banteng near the park headquarters which is near the proposed Kaeng Krung Dam site. TCE (1983) reported that wildlife populations in this area are more abundant than in Chiew Larn area.

Threats to Gaur and Banteng in Thailand

Gaur and banteng have been extirpated from many protected areas in Thailand e.g. Salak Pra WS. The densities of gaur and banteng in the best protected areas such as Huai Kha Khaeng WS, are very low, less than 50% of the carrying capacity of the area. This is largely due to the demand for trophies which encourages poaching in protected areas. The total number of trophies in Bangkok registered at the Royal Thai Forest Department in 1994 were equivalent to about 967 gaur and 1840 banteng. Data on numbers of trophies outside Bangkok are not available. Trophies are still sent to shops in areas such as Nakhon Ratchasima Province, and Cha-Am, Ban Lat and Muang Districts of Phetchaburi Province, where faked animal heads can be added to the trophies for decoration (Fig. 8).

DISCUSSION

Status of Gaur and Banteng in Thailand

When we combine the population estimates of gaur in this paper (approx. 1,000) with the number of gaur trophies in Bangkok registered at the Royal Forest Department in 1994 (N=967), it is likely that there were at least 2,000–2,500 gaur in Thailand in 1970. This is similar to the estimate of LENG-EE (1978) of 2,500–3,000, though much greater than the 500 gaur estimated by LEKAGUL & MCNEELY (1977). This would indicate at least a 50–60% reduction within the last 20 years.

We can also add the population of banteng estimated in this study (approx. 500) to the number of trophies in Bangkok registered at the Royal Forest Department in 1994 (N=1840). It is highly probable that there were at least 2,300–2,500 banteng in Thailand in 1970. The population of banteng estimated by LEKAGUL & MCNEELY (1977) as 500 and by LENG-EE (1978) as 500–1000 are probably underestimates. This would indicate a population reduction of at least 80% within the last 20 years.



Figure 6. A herd of 23 banteng at Phai Lom Stream near Noi Mineral Lick within Huai Kha Khaeng Wildlife Sanctuary taken on 25 May 1992 (Photo by Mr. Theerapat Prayurasiddhi). The herd was led by a mature cow. One mature bull was black.



Figure 7. A gaur was shot dead near Kor Stream in Huai Kha Khaeng Wildlife Sanctuary on April 1988 (Photo by Sompoad Srikosamatara).

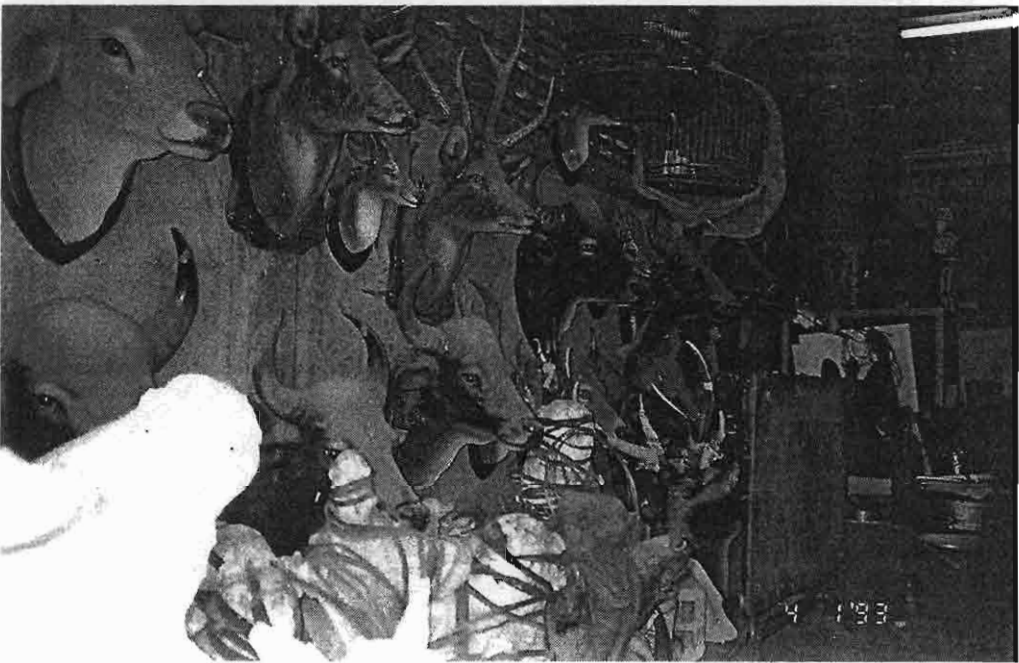


Figure 8. Trophies at a shop at Nakhon Ratchasima Province where faked animal heads were added (Photo by S. Srikosamatara). Trophy collection encourages poaching in protected areas.

The population size of banteng in Thailand has been declining faster than that of gaur. This is probably due to the fact that the dry lowland habitat which is preferred by banteng, has been destroyed and encroached upon more rapidly than upland habitat types. Almost all of the best hunting grounds for gaur and banteng before World War II were lowlands which have been colonized by people or flooded by dams. These include, for example, Heo Ta Bua near Khao Yai NP, Thung Kang Yang near Sai Yok and Erawan NPs, Thung Phlai Ngam and the area near Cha-Am District which is south of Kaeng Krachan NP and Mae Wong area near Mae Wong NP. Banteng are also easier to hunt than gaur, as they are less aggressive and tend to stay closer to human habitations than gaur.

The factors contributing to population declines of gaur and banteng at present are different from those observed in the past. LEKAGUL (1959) mentioned that wildlife became over-hunted in Thailand as more vehicles became available and areas became accessible after World War II. Even after protected areas were set up in Thailand, LEKAGUL & MCNEELY (1977) and LENG-EE (1978) stated that overhunting and destruction of wildlife habitats were still the primary problems of wildlife conservation during 1970–1980. During 1980–1990, as the rate of deforestation increased in Thailand (CHUNKAO, 1987) more attention was shifted to habitat destruction as the major factor in the depletion of wildlife populations (NOOTONG, 1980; SAIVICHEN, 1985; JINTANUGOL, 1985; WONGPAKDEE, 1991). Trophy collection may have grown in the earlier days when hunting was non-selective. It was the custom of rural people in Thailand to give trophies to high ranking officials as souvenirs. Trophy collections still exist today, and are even admired by many people.

Status of Subspecies of Gaur

Gaur in Thailand (except Peninsular South which belong to *B. gaurus hubbacki*) and Indochina belong to the subspecies *B. gaurus readei* Lydekker 1903, which is the most threatened. According to YIN (1993), gaur in Myanmar are heavily poached and their populations are probably becoming reduced. YIN (1993) reported gaur in Pidung WS (727 km²), Shwe-u-daung WS (327 km²), Shwe-settaw WS (555 km²), Kahilu WS (161 km²), Tamanthi WS (2158 km²), proposed Kyaukpandaung WS (133 km²), proposed Lemro WS (45 km²), proposed Yegauk WS (193 km²) and Alaungdaw Kathapa NP (1612 km²). RABINOWITZ ET AL., (1995) roughly estimated 100–200 gaur in Tamanthi WS (2151 km²). Viable populations of gaur may also be found in Alaungdaw Kathapa NP (1612 km²) and Pegu Yoma NP (1461 km²) (BLOWER, 1982). The high level of trophy trade along the Thai-Myanmar border at Mae Sai-Tachilek (SRIKOSAMATARA ET AL., 1992; SRIKOSAMATARA & SUTEETHORN, 1994) and Mae Sot (Ardith Eudey, pers. comm.) indicates a serious poaching problem in Myanmar.

In Lao PDR, gaur can still be found in the southern and central part of the country (SALTER, 1993; SALTER ET AL., 1990; DUCKWORTH ET AL., 1994). TAMMINS & EVANS (1994) estimated 200 gaur in Nam Theun National Biodiversity Conservation Area (3445 km²). A protected area system in Lao PDR just now being established. There has been a high level of trophy trade along Thai-Lao border (SRIKOSAMATARA ET AL., 1992; SRIKOSAMATARA & SUTEETHORN, 1994) and high hunting pressure (CHAZEE, 1990; TAMMINS & EVANS, 1994; SCHALLER & RABINOWITZ, 1995) so that the populations of wild cattle in Lao PDR are expected to be declining. In 1991 and 1993, the total number

of wild cattle trophies for sale along Thai-Lao border were 100 and 36, respectively (SRIKOSAMATARA ET AL., 1992; SRIKOSAMATARA & SUTEETHORN, 1994). These trophies did not include ones that were not shown openly. Some trophies may come from Cambodia.

In Cambodia, THOULESS (1987) reported that perhaps large mammals are not as threatened as most people thought but the large scale of trophy trade along Thai-Cambodia border reported in Thai newspapers during 1989-1991, inside Phnom Penh (BAIRD, 1993) and in Lomphat of eastern Cambodia (OLIVIER & WOODFORD, 1994) suggest the opposite. OLIVIER & WOODFORD (1994) did aerial surveys from a single-engined aircraft (Cessna 206) in Mondolkiri area (4754 km²) of eastern Cambodia and found only three gaur.

In Vietnam, the density of ungulates in one of the best protected areas for wild cattle, Yok Don Nature Reserve, was about half of that found in Huai Kha Khaeng WS and the current hunting pressure within the reserve was very high (MACKINNON ET AL., 1989). Gaur were less common than banteng in Yok Don NR (LAURIE ET AL., 1989). Gaur were also reported in Nam Cat Tien NP (HOE & QUY, 1991), Green Forest in Dac Lac Province and Nui Bi Doup (710 km²) of Lam Dong Province in South Vietnam (CANH, 1995).

In China, XIANG & SANTIAPILLAI (1993) reported indiscriminate hunting which had led to the extirpation of gaur in Xishuangbanna. Gaur were extirpated from most areas of Gaoligongshan region of Yunnan Province and only remnant populations cross back and forth along the Chinese-Myanmar border (MA ET AL., 1994).

It is hard to tell whether populations of gaur (*B. gaurus hubbacki* Lydekker 1907) in Malaysia are increasing according to numbers estimated by KHAN (1973), KHAN ET AL., (1982) and ABIDIN ET AL., (1991): 400 in 1973, 472 in 1981, 600 in 1991. This is because it is not clear how population sizes were estimated.

It is possible that the population of gaur in Thailand is a lot lower than the populations in India and Nepal which belong to the subspecies *B. gaurus gaurus*. Table 2 shows population estimates of gaur in different protected areas in India. It can be seen that there is higher populations of gaur in smaller areas in India than in Thailand. This may be partly due to the Hindu culture in which cattle are considered sacred. Wild cattle trophies are rarely seen in Indian or Nepalese houses (Tirtha Maskey, David Smith, and Ullas Karanth, pers. comm.). SCHALLER (1967) stated that the villagers did not appear to poach gaur very often at Kanha, although a few young may have been taken in snares. According to local forest officers, poachers found it difficult to handle and dispose of an adult quickly and efficiently, and the Hindu population in the town adjoined gaur for the most part because of the animal's resemblance to the sacred cow (SCHALLER, 1967).

In conclusion, the subspecies of gaur *B. g. readi* Lydekker in Thailand and Indochina is the most threatened subspecies and its population size is declining. The subspecies in India (*B. g. gaurus*) and Malaysia (*B. g. hubbacki*) appear to be increasing or remaining stable.

Table 2. Population estimates of gaur in some protected areas in India. NP and S stand for national park and sanctuary, respectively.

Name of Protected area	Area (km ²)	Population estimates	Reference
Kanha NP	318	200	SCHALLER (1967)
		550-600	COE (1980)
Mudumalai S	321	300-400	SCHALLER (1967)
Parambikulam S	235	157	EASA & BALAKRISHNAN (1990)
Dajipur S	218	200-300	SAMANT (1990)
Nagarahole NP & Bhadra S	1064	1000+	KARANTH (1986)
Bandipur NP	690	464	BASAPPANAVAR (1985)
Melghat S	1597	1581	RODGERS (1991)
		(1018-2144)	
Manas S	391	1200-1500	DEBROY (1991)

Status of Subspecies of Banteng

Banteng in Thailand all belong to the subspecies, *B. javanicus birmanicus* Lydekker 1898, as do those in Indochina. This is the most threatened subspecies due to the large-scale trophy trade, the Vietnam war and the slow development and management of protected area systems in Indochina. According to YIN (1993), banteng in Myanmar are reported in Pidaung WS (727 km²), Shwe-u-daung WS (327 km²). Viable populations of banteng may be found in Alaungdaw Kathapa NP (1606 km²) and Pegu Yoma NP (1461 km²) (BLOWER, 1982).

Banteng can still be found in the southern and central part of Lao PDR (SALTER ET AL., 1990; DUCKWORTH ET AL., 1994). There was no recent report of banteng in 3445 km² of Nam Thuen National Biodiversity Conservation Area (TIMMINS & EVANS, 1994). There has been a high level of trophy trade along Thai-Lao border as mentioned above. In eastern Cambodia, OLIVIER & WOODFORD (1994) found 97 banteng in Mondolkiri area (4754 km²) during their aerial survey. Large-scale trophy trade was also found in Lomphat of eastern Cambodia (OLIVIER & WOODFORD, 1994). In Vietnam, one of the best protected area for banteng is Yok Don Nature Reserve as mentioned above. Banteng were also reported in Nam Cat Tien NP, Green Forest in Dac Lac province and Nui Bi Doup (710 km²) of Lam Dong province (CANH, 1995) in southern Vietnam.

The number of banteng in Thailand is less than in Java. Javan banteng belong to another subspecies *B. javanicus javanicus* d'Alton. In 1988, ASHBY & SANTIAPILLAI (1988) estimated that about 700-1000 banteng remained in Java of which half were estimated to be in Ujung Kulon (783 km²) and Baluran reserves (250 km²). The Ujung Kulon population of banteng has been stable over a period of 50 years and has been no clear evidence of a recent decline (ASHBY & SANTIAPILLAI, 1988). HOOGERWERF (1970) stated that during the entire period of his investigations in Ujung Kulon, poaching did not have

a great adverse effect on the banteng population. Poachers found the risk too great to hunt anything other than the valuable rhino in the period from 1937 to 1942 and again from 1950 to 1957, due to the ever improving management of Ujung Kulon.

Banteng in Borneo, belonging to *B. javanicus lowi* Lydekker, are possibly more threatened than the subspecies in Thailand and Java. There is no estimate of population size of banteng in Borneo but they have gone extinct from Brunei and Sarawak and their population is expected to be small due to the nature of the habitat (tropical rainforest), low density of mineral licks (PAYNE, 1992), high level of poaching by the natives of Borneo (AKEN & KAVANAGH, 1982; CALDECOTT, 1988) and the transmigration of farmers from Java. In Sarawak, banteng may persist in remote parts of the north and east of the country (AKEN & KAVANAGH, 1982). CALDECOTT (1988) reported 7 banteng trophies from 1,113 trophies and pets in longhouses and bazaars in Sarawak and this may reflect a low density of banteng in Sarawak. In Sabah, banteng occur in scattered concentrations throughout much of the eastern part (in Kulamba and Tabin Wildlife Reserve, and Kretam Virgin Jungle Reserve) but have been almost exterminated in the western half of the country (DAVIES & PAYNE, 1982; PAYNE, 1982; PAYNE & ANDAU, 1991). However, the areas surrounding mineral licks where a large population of banteng occurs in Kretam Virgin Jungle Reserve in Sabah are scheduled for conversion to permanent agriculture (AMBU, 1990). COCKBURN & SUMARDJA (1978) reported no banteng in Tanjung Puting National Park in Central Kalimantan along the coast of southwest Borneo while ASHBY & SANTIAPILLAI (1988) mentioned that banteng have disappeared from this park. YASUMA (1994) reported very few banteng in East Kalimantan. WIRAWAN (1985) and DOI (1988) reported sighting and tracks of banteng in Kutai National Park in East Kalimantan. Skulls of banteng were seen hung in longhouses at Longnawan village and Bahau River and tracks were seen at Iwan River in the interior of Kalimantan in March 1991 (Tim O' Brian, pers. comm.).

It can be concluded that the subspecies of banteng in Thailand and neighboring countries, *B.j. birmanicus*, is less threatened than the subspecies in Borneo, *B.j. lowi*, and that the populations of both subspecies are declining. The Javan subspecies, *B.j. javanicus*, is the least threatened and its populations are quite stable.

Management of Gaur and Banteng in Thailand

The demand for gaur and banteng horns as trophies has been identified as a current threat to gaur and banteng, not only in protected areas in Thailand but also in her neighboring countries. Proper management of these species requires a multifaced approach.

A popular option which has been adopted for managing Thai protected areas, e.g. Khao Yai NP, is to attempt to improve the standard of living of people surrounding these areas (WELLS ET AL., 1992). But this measure will not be successful without regular patrolling in protected areas and strong law enforcement. An effective system to register gaur and banteng trophies should be instigated. A public campaign against a practice of trophy collection should be initiated by the government and conservation NGOs.

Given the current low population densities of gaur and banteng even in good protected areas, which are far below 50% of the carrying capacity, poaching should be eliminated from protected areas. At very low population density, any wildlife harvesting at all will

be below a level of sustainable yield (ROBINSON & REDFORD, 1994). The population should be allowed to grow back to at least at 50–60% of the carrying capacity.

This consideration should be at least applied to Thung Yai and Huai Kha Khaeng WS which maintain the largest population of gaur and banteng in Thailand. As we do not know yet how long it will take for the populations to grow to a satisfactory level. A monitoring programme to track changes in population density should be set up. In Huai Kha Khaeng WS, the population density should increase from the current 1.8 km⁻² to 2.3–5.0 km⁻². At the same time the current protective measures (PITDAMKAM, 1992) of very strong law enforcement should be supported. A strong programme for regulating the number of guns owned by local people around protected areas should be initiated. Emphasis on protection should also be given to the lowland forest near Sap Fa Pha Guard Station, as it currently contains a high density of gaur and banteng, and it is also rather close to human habituations. The same protective measures and gun control should also be applied to other protected areas where substantial populations of gaur and banteng still exist. Pang Sida NP should receive more attention as it is the only other protected area in addition to Huai Kha Khaeng WS where lowland forests are still left. The effect of a road through this park on wildlife could be considerable, and thus management action should control how the road can be used by the general public.

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Notes added in proof:

1. Morphometric data suggest that the Thailand and Indochinese (*Bos gaurus readei* Lydekker 1903) and Malaysian (*B. gaurus hubbacki* Lydekker 1907) gaur are the same and may be called *Bos gaurus laosiensis* Heude 1901 (Colin Groves, pers. comm.). The mainland (*Bos javanicus birmanicus* Lydekker 1898) and Javan (*B. j. javanicus* d'Alton 1823) banteng are also the same and both may be called *B. javanicus javanicus* (Groves, pers. comm.). Adopted scientific name is based on earliest available name. This may not be applied to gaur as the first scientific name was given to mithan (*Bos frontalis* Lambert 1804) which is domestic gaur. Domestic gaur are not species and subspecies in the same sense as wild gaur. More research (e.g. skull measurement and genetic data) is still required to confirm the above conclusion.

2. The densities of dung of gaur and banteng surveyed in 1988 and 1992 around Khao Nang Rum Wildlife Research Station in Huai Kha Khaeng WS were not different (SRIKOSAMATARA & SUTEETHORN, in manuscript). This is due to a successful law enforcement since 1991 and there have been few reports of wildlife poaching in this area. However, in 1995 poaching of banteng and gaur was reported in the southern part of the sanctuary (Theerapat Prayurasiddhi, pers. comm.). In 1995, a cattle disease, Foot Rot, was a cause of death of a wild banteng in this area (Prayurasiddhi, pers. comm.). This disease was possibly transmitted from domestic cattle. There have been about 326,00 domestic cattle in the buffer zone since 1992. A number of cattle diseases can be transmitted from domestic to wild cattle and there are also examples of these diseases causing a large-scale reduction of wild cattle population in India, Myanmar and Thailand. An appropriate action should be made to stop such disease transmission. This can be done by not allowing domestic cattle to be raised in the buffer zone. If this action cannot be made, limited number of domestic cattle should be allowed to be raised. This should be combined with an effective programme of vaccination of all domestic cattle in the buffer zone.

3. The total number of trophies of gaur and banteng in Thailand is a lot higher than is reported in this paper. This is because there are few data available outside Bangkok. In 1992 the total number of trophies in Uthai Thani Province, next to Huai Kha Khaeng WS, registered at the Provincial Forest Unit, in addition to those reported before in Bangkok as 967 gaur and 1840 banteng, were equivalent to 685-1370 gaur and 174-347 banteng.

4. Some trophies in Thailand possibly came from neighboring countries such as Lao PDR, Myanmar and Cambodia. A large scale trade of trophies between Thailand and Lao PDR possibly started after 1990. Significant trophy trade between Thailand and Myanmar took place at Mae Sot, Tak Province at least during 1982-85. There was no trophy trade

at Mae Sot during our visit in May 1990. Trophy trade between Thailand and Cambodia has been reported at Poi Pet opposite Aranyaprathet, Prachinburi Province since 1991 (*Bangkok Post Daily Newspaper*, 15 Apr. 1991.)

Appendix 1. Detailed information on gaur and banteng in different protected areas in Thailand.

Northern Area

Doi Chiang Dao WS, 521 km² (gaz. 24 Aug. 1978; Fig. 1, No. 59): Gaur and banteng which once occurred in the sanctuary have been hunted out (MIDAS, 1993).

Doi Khuntan NP, 255 km² (gaz. 5 Mar. 1975; Fig. 1, No. 6): A few banteng may occur in the park (DOBIAS, 1982).

Doi Inthanon NP, 482 km² (gaz. 2 Oct. 1972; Fig. 1, No. 5): Hill Evergreen Forest occupies about 42% of the park (KU, 1989c). There are 67 villages of 2,212 households of 12,650 people within and nearby the park. Villagers are Karen, Hmong and Thai. Gaur were possibly present in 1959 (RUHLE, 1964) but probably extirpated (DOBIAS, 1982; MIDAS, 1993). The last banteng was possibly shot in 1975 near Siriphum Waterfall (KU, 1989c).

Doi Pha Muang WS, 576 km² (gaz. 16 Jul. 1980; Fig. 1, No. 62): Neither gaur nor banteng are reported.

Doi Phu Kha NP, 1680 km² (gaz. 1993): Gaur were not reported in the area during our survey on Apr. 1993 (SRIKOSAMATARA & SUTEETHORN, 1994).

Doi Suthep-Pui NP, 262 km² (gaz. 14 Apr. 1981; Fig. 1, No. 7): Intensive human use of the area has eliminated large mammals including gaur or/and banteng (DOBIAS, 1982; KU, 1989d). ELLIOTT & BEAVER (1992) stated that hunting had caused the disappearance of all large mammal species (except barking deer) 20 years ago.

Khao Ja Son NP, 592 km² (gaz. 28 Jul. 1988; Fig. 1, No. 2): Neither gaur nor banteng were reported. Hunting and poaching in the national park is very high and the large mammals which are still left are wild boar and barking deer (Lisa Evans, pers. comm.).

Lansang NP, 104 km² (gaz. 14 May 1979; Fig. 1, No. 27): No gaur and/or banteng are reported (DOBIAS, 1982).

Lum Nam Pai WS, 1194 km² (gaz. 13 Dec. 1972): No information.

Mae Ping NP, 1005 km² (gaz. 13 Jul. 1981; Fig. 1, No. 28): Details in the article.

Mae Tuen WS, 1173 km² (gaz. 10 Aug. 1978; Fig. 1 No. 72): Details in the article.

Mae Yom NP, 454 km² (gaz. 1 Mar. 1986; Fig. 1, No. 30): TCE (1982) reported the presence of gaur. During the survey in 1991, CCB (1992) reported no sign of wild cattle in the inundation area of the proposed Kaeng Sua Ten Dam or upland areas. Local hunters and tribal occupants state that there are no longer any wild cattle in the park (CCB, 1992).

Mae Yuam WS, 292 km² (gaz. 1 Mar. 1986): No information.

Namtok Mae Surin NP, 397 km² (gaz. 29 Oct. 1981; Fig. 1, No. 37): Gaur and/or banteng have not been reported.

Om Koi WS, 1224 km² (gaz. 19 Aug. 1983; Fig. 1, No. 75): Details in the article.

Phu Nang NP, 512 km² (not gaz. in 1992): No information.

Ramkhamhaeng NP, 341 km² (gaz. 27 Oct. 1980; Fig. 1 No. 46): Banteng and gaur were reported (DOBIAS, 1982).

Salawin WS, 875 km² (gaz. 24 Aug. 1978; Fig. 1, No. 84): Gaur and banteng were reported (SAYER, 1981; FRI, 1991b). BHUMPAKPHAN & KUTINTARA (1993) reported the presence of gaur but banteng may have been extirpated. Sightings of gaur were recorded in 1986 and 1988. FRI (1991b) reported high poaching pressure within the sanctuary by Karen and Thai Yai minorities, and by minority army along the Thai-Myanmar border. Poaching of gaur was reported in the nearby area from Mae La Luang near Mae Yuam WS (FRI, 1991b).

Sri Satchanalai NP, 213 km² (gaz. 8 May 1981; Fig. 1, No. 51). About 15 gaur and 5 banteng were estimated in the national park in 1994 (Martin van de Bult, pers. comm.).

Taksin Maharaj NP, 149 km² (gaz. 23 Dec. 1981): No information.

Petchabun Range

Nam Nao NP, 962 km² (gaz. 4 May 1972; Fig. 1, No. 36): Details in the article.

Namtok Chatakan NP, 543 km² (gaz. on 2 Nov. 1987; Fig. 1, No. 4): A visit was made on Dec. 1992. Both gaur and banteng were possibly extirpated from the area 20 years ago.

Phu Hin Rong Kla NP, 307 km² (gaz. 26 Jul. 1984; Fig. 1, No. 41): A visit was made on Dec. 1992. No recent report of gaur and banteng in the park and they were possibly extirpated from the area long time ago.

Phu Kao-Phu Phan Kham NP, 322 km² (gaz. 20 Sept. 1985; Fig. 1, No. 42): A visit was made on Jun. 1991. There has been no report of gaur and banteng in this area.

Phu Khieo WS, 1560 km² (gaz. 26 May 1972; Fig. 1, No. 76): Details in the article.

Phu Luang WS, 848 km² (gaz. 18 Dec. 1974; Fig. 1, No. 77): Details in the article.

Phu Kradeung NP, 348 km² (gaz. 23 Nov. 1962; Fig. 1, No. 43): No wild cattle were reported (RUHLE, 1964; DOBIAS, 1982). FRI (1991a) reported the extirpation of gaur from the area and there has been no sighting of gaur during at least the past 10 years.

Phu Miang-Phu Thong WS, 545 km² (gaz. 31 Dec. 1977; Fig. 1, No. 80): A brief visit was made on Dec. 1992. No gaur and banteng have been reported. Both gaur and banteng have possibly been extirpated.

Phu Rua NP, 120 km² (gaz. 26 Jul. 1979; Fig. 1, No. 45): There has been no report of any gaur or banteng in the area (TRISURAT, 1989).

Phu Wiang NP, 325 km² (gaz. 8 Dec. 1991): Visits were made on Sept. 1989 and Jun. 1991. There have been no report of gaur or banteng.

Tat Ton NP, 217 km² (gaz. 31 Dec. 1980; Fig. 1, No. 53): A visit was made on Jul. 1991. Gaur and banteng have been extirpated from the area.

Thung Salaeng Luang NP, 1262 km² (gaz. 13 Dec. 1972; Fig. 1, No. 56): Details in the article.

Sap Lanka WS, 155 km² (gaz. 31 Dec. 1986; Fig. 1, No. 85): Banteng were reported near Ban Pang Hu Sua near Heo Ta Bua, in the headwaters of Lam Phaya Klang River, Chai Badan District in 1923 (WANARAKS, 1941). Neither gaur nor banteng were reported recently in the area.

Dong Paya Yen and Sun Kampaeng Range

Khao Yai NP, 2169 km² (gaz. 18 Sept. 1962; Fig. 1, No. 24): Details in the article.

Pang Sida NP, 844 km² (gaz. 27 May 1982; Fig. 1, No. 39): Details in the article.

Sakaerat Environment Research Station, 72 km² (gaz. 1976): Gaur are probably extirpated from the area (TONGYAI, 1980).

Sam Lan NP, 44 km² (gaz. 2 Jun. 1981; Fig. 1, No. 21): Neither gaur nor banteng have been reported (DOBIAS, 1982).

Tap Lan NP, 2236 km² (gaz. 23 Dec. 1981; Fig. 1, No. 55, Fig. 4): Details in the article.

Phu Phan Range

Huai Huat NP, 828 km² (gaz. 24 Jul. 1988): On Mar. 1991, a one day hike was made through part of the best forest in the national park from Ban Kok Tum toward southwest direction to Ban Kham Phak Kut. One track of Indian muntjac and wild pig droppings were found. Our guide, Mr. Not Chaokonkhaeng, who classified himself as Phuthai and was 39 years old from Ban Kok Tum told us that last gaur was possibly shot in 1975.

Kaeng Tana NP, 80 km² (gaz. 13 Jul. 1981; Fig. 1, No. 4): MIDAS (1993) did not report the presence of gaur or banteng. A brief visit was made on Apr., 1991, 1993 and Jan. 1994. There was no report of gaur or banteng from any informant.

Mukdahan NP, 49 km² (gaz. 28 Dec. 1988): A visit was made on Mar. 1991. There is no report of gaur or banteng in this national park.

Pha Taem NP, 340 km² (gaz. 31 Dec. 1991): There was no report of gaur or banteng during our survey of Apr. 1993 (SRIKOSAMATARA & SUTEETHORN, 1994).

Phu Langka NP, 50 km² (not gaz. in 1992): A short visit was made on Apr. 1991. No report of gaur or banteng in this area.

Phuphan NP, 665 km² (gaz. 6 Jun. 1973; Fig. 1, No. 44): A visit was made on Mar. 1991. Gaur and banteng were extirpated from the area. SAYER (1981) reported banteng while SRIKOSAMATARA & DOUNGHAE (1982) mentioned the possibility of gaur and banteng presence. TISTR (1992a) did not mention the presence of banteng and reported that a gaur was poached on Jun. 1979 in a forest near Ban Mai Pattana village. Only one gaur is expected to be left in the park near Ban Phupan Thong Village or at the back of Srikae Cave Temple, Kut Bak District (TISTR, 1992a). Hunting was also reported in 1959 (LEKAGUL, 1959). Poaching pressure inside the national park is expected to be very high judging from the news about elephant poaching in the national park in Jun. 1993 (*Matichon Daily Newspaper*, Jun. 1993).

Phu Si Than WS, 250 Km² (gaz. 3 Jun. 1990): Visits were made on Mar. and Jul. 1991. Both gaur and banteng were extirpated from the area.

Phu Wua WS, 187 km² (gaz. 2 May 1975; Fig. 1, No. 79): A visit was made on Apr. 1991. No gaur or banteng was reported in the area.

Phanom Dongrak Range

Huai Sala WS, 380 km² (gaz. 28 Dec. 1990; Fig. 1, No. 66): A brief visit was made on Apr. 1992. Due to land mine problems, no field survey was made. There was a report of 3 banteng in Jul. 1981 but the follow-up survey on Aug. 1981 was aborted due to a mine explosion.

Phanom Dongrak WS, 316 km² (gaz. 15 Dec. 1978; Fig. 1, No. 67): A brief visit was made on Apr. 1992. Due to land mines, no survey can be made. A soldier told us that from his station at Khao Phra Wihan where he can see Cambodian lowland he saw five banteng grazing on young grass along the Thai-Cambodia border on Nov. 1990 and Apr. 1991. A report about an expedition during Apr. and Aug. 1976 (ANON., 1976a, b) documented a gaur shot in Jun. 1976. Tracks of banteng and gaur were found during April survey but they were not fresh and were believed to be from the previous monsoon season. No tracks of any wild cattle were found during the August survey. ANON. (1976a,b) considered this area to be hopeless for large herbivores in general.

Phu Chong Nayoi NP, 686 km² (gaz. 1 Jun. 1987; Fig. 1, No. 40): A brief visit was made on Apr. 1991. On Nov. 1990, there was a report of three banteng near Phu Man Kao in the northern part of the park.

Yot Dom WS, 203 km² (gaz. 11 Oct. 1977; Fig. 1, No. 83): A brief visit was made on Apr. 1991. Our informant, Mr. Mai Nantana (48 years old at the time of our survey), who was born and grew up in that area told us that there were still gaur in the area. On Apr. and Nov. 1991, there was a report of three herds of banteng with 4-7 individuals each and there were three kouprey mixed with the herds at the border area between Yot Dom WS and Phu Chong Nayoi NP (*Thai Rath Daily Newspaper*, Nov. 18, 1991; *Manager Daily Newspaper*, 20-26 Jan. 1992).

Eastern Area

Khao Ang Ru Nai WS, 1030 km² (gaz. 10 Oct. 1977; Fig. 1, No. 64): Details in the article.

Khao Chamao-Khao Wong NP, 84 km² (gaz. 31 Dec. 1975; Fig. 1, No. 15): Details in the article.

Khao Khiao-Khao Chomphu WS, 145 km² (gaz. 2 Jul. 1974): Neither gaur nor banteng was reported (STORER, 1979; DOBIAS, 1982).

Khao Kitchakut NP, 59 km² (gaz. 4 May 1977; Fig. 1, No. 16): Details in the article.

Khao Sabap NP, 134 km² (gaz. 2 May 1975; Fig. 1, No. 38): No recent survey was made. Srikosamatara visited the area during Apr. 1978. During 20 km hiking, deer and wild pigs were the only signs of large mammals encountered.

Khao Soi Dao WS, 745 km² (gaz. 4 Sept. 1972; Fig. 1, No. 16): Details in the article.

Tenasserim

Chaloem Rattanakosin NP, 59 km² (gaz. 12 Feb. 1980; Fig. 1, No. 3): Gaur and banteng were reported in the park (DOBIAS, 1982). Wildlife tended to concentrate in the west from where it could roam to the adjacent Srinagarin NP and Erawan NP. Poaching was believed to be heavy (STORER, 1981).

Erawan NP, 550 km² (Khao Salob, RÜHLE 1964; gaz. 19 Jun. 1975; Fig. 1, No. 8): Gaur and banteng were reported (DOBIAS, 1982; FRI, 1993b).

Huai Kha Khaeng WS, 2575 km² (gaz. 1972; Fig. 1, No. 63): Details in the article.

Kaeng Krachan NP, 2915 km² (gaz. 12 Jun. 1981; Fig. 1, No. 13): Details in the article.

Khao Laem NP, 1497 km² (gaz. 8 Nov. 1990): A short visit was made on Dec. 1991 and Jan. 1992. All the lowland (388 km²) which is the best habitat for gaur and banteng has been flooded due to Khao Laem Dam since 1984. Most areas are accessible either by road or by boat. If there are gaur in the national park (TISTR, 1994b), very few are expected.

Khlong Lan NP, 300 km² (gaz. 25 Dec. 1982; Fig. 1, No. 25): RFD (1993b) reported both gaur and banteng on the western side of the park.

Khlong Wang Chao NP, 748 km² (gaz. 29 Aug. 1990): No gaur and banteng was reported.

Mae Nam Pachi WS, 489 km² (gaz. 1 Aug. 1987; Fig. 1, No. 74): Details in the article.

Mae Wong NP, 894 km² (gaz. 14 Sept. 1987; Fig. 1, No. 29): A short visit was made on May 1990. There has been no recent report of gaur and banteng in this area. Banteng used to be common in this area (WANARAKS, 1941; LEKAGUL, 1954) and this area was once a popular area for big game hunting (LEKAGUL, 1954; LEKAGUL & MCNEELY, 1977). A picture of a large male banteng shot in 1907 can be seen in GAIRDNER (1917). The area has been easily accessible and heavily disturbed since 1959.

Sai Yok NP, 500 km² (gaz. 27 Oct. 1980; Fig. 1, No. 47): Gaur and banteng have been reported (DOBIAS, 1982; FRI, 1992b). FRI (1992b) reported both gaur and banteng along Maenam Lo Stream and Bong Ti Stream to the Thai-Myanmar border. Banteng probably occur in the southern part of the national park (FRI, 1992b). FRI (1992b) expected that both species would be prone to extirpation from the national park.

Salak Phra WS, 859 km² (gaz. 31 Dec. 1965): Banteng are relatively more abundant than gaur (WILES, 1980). STORER (1981) reported that during his 6-day trip in 1979, he found shooting platforms at all salt licks. At one platform there was a fresh gaur's skin. In the Thung Na Mon area, he came across a poachers' camp of approximately ten hunters who had poached wildlife including one gaur. These poachers were armed with guns ranging from muzzle loaders to M16 automatic rifles. At other places in the sanctuary he found empty cartridges of high velocity sporting loads such as 30.06 cal. The evidence indicated that Salak Phra was used by more wealthy sport hunters as well as poorer villages at least during 1979. Poaching is highest during the dry season when animals congregate near water. Gaur and banteng are extirpated from this area due to the road that cut across the sanctuary and the building of Sri Nakharin dam.

Sri Nakharin NP, 1532 km² (gaz. 23 Dec. 1981; Fig. 1, No. 49): Both gaur and banteng have been reported in the park (DOBIAS, 1982) while later FRI (1992a) reported only gaur. Short visits were made on Mar. 1989, Dec. 1991 and Jan. 1992. Most of the lowland has been flooded due to Sri Nakharin Dam since 1981. The area is easily accessible both by road or by boat. If gaur are left in the area, the population size must be very small.

Thung Yai WS, 3200 km² (gaz. 24 Apr. 1989; Fig. 1, No. 81): Details in the article.

Umphang WS, 2515 km² (gaz. 17 Apr. 1989): A short visit was made on May 1990. Both gaur and banteng have probably been extirpated.

Peninsular south

Chalerm Pha Kiet Somdej Prathep Rattana Rachasuda WS, 200 km² (gaz. 12 Sept. 1990): No information.

Kaeng Krung NP, 541 km² (gaz. 8 Dec. 1991): Details in the article.

Khao Banthad WS, 1267 km² (gaz. 4 Sept. 1975; Fig. 1, No. 65): TISTR (1994a) mentioned nothing about either gaur or banteng. Gaur and banteng as large mammals were probably extirpated due to poaching (MIDAS, 1993).

Khao Luang NP, 570 km² (gaz. 18 Dec. 1974; Fig. 1, No. 19): Banteng is possibly present while gaur was reported by National Park workers (BOONRATANA, 1988). Neither gaur nor banteng was reported by MIDAS (1993) and RFD (1993C).

Khao Phanom Bencha NP, 50 km² (gaz. 9 Jul. 1981): BOONRATANA (1988) reported neither gaur nor banteng.

Khao Pra Bang Khram WS, 156 km² (gaz. 1993): Both gaur and banteng were reported in the area until early 1970 (Vichian Thongthao and P.D. Round, pers. comm.).

Khao Pu Khao Ya NP, 694 km² (gaz. 27 May 1982; Fig. 1, No. 20): No information.

Khao Sam Roi Yot NP, 98 km² (gaz. 28 Jun. 1966; Fig. 1, No. 22): Neither gaur nor banteng has been

reported in the park (DOBIAS, 1982).

Khao Sok NP, 645 km² (gaz. 22 Dec. 1980; Fig. 1, No. 23): Details in the article.

Khlong Nakha WS, 480 km² (gaz. 26 May 1972; Fig. 1, No. 69): Details in the article.

Khlong Phraya WS, 95 km² (gaz. 12 Nov. 1980; Fig. 1, No. 72): MIDAS (1993) reported both gaur and banteng. The area is too small to support any viable population of either species.

Khlong Saeng WS, 1156 km² (gaz. 18 Dec. 1974; Fig. 1, No. 71): Details in the article.

Khlong Yan WS, 491 km² (gaz. 1993): Details in the article.

Sri Phangnga NP, 246 km² (gaz. 16 Apr. 1988): Details in the article.

Thaleban NP, 102 km² (gaz. 27 Oct. 1980; Fig. 1, No. 54): Neither gaur nor banteng were reported (DOBIAS, 1982). The largest mammals found are Indian muntjac and wild pigs (Mr. Colin McQuistan, pers. comm.).

Ton Nga Chang WS, 182 km² (gaz. 14 Jul. 1978; Fig. 1, No. 87): Neither gaur nor banteng was reported (DOBIAS, 1982).

Uttayan Sadet Nai Krom Luang Chumphon WS, 454 km² (gaz. 23 Mar. 1988): A short visit was made on May 1994. Very little forest is left due to Typhoon "Gay" which moved through the area on Nov. 1989. Neither gaur nor banteng was expected.

ASIAN WILD CATTLE CONSERVATION ASSESSMENT AND MANAGEMENT PLAN WORKSHOP

Chonburi, Thailand
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A COLLABORATIVE WORKSHOP OF
The Zoological Parks Organization of Thailand
The Royal Forest Department of Thailand
IUCN/SSC Asian Wild Cattle Specialist Group
IUCN/SSC Conservation Breeding Specialist Group



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SPECIES SURVIVAL COMMISSION



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Census, Survey and Monitoring Techniques

The Asian Wild Cattle Specialist Group has to deal with eight species in many different areas throughout south and southeast Asia. At the present time we know very little about how many animals actually remain and many of the counts which have been conducted have been brief and rather crude. Counts using robust and reliable techniques which can be carried out relatively quickly in the field are urgently needed.

Before starting an animal count the goals of the project must be well defined (i.e. what is the information needed for?). A major consideration is whether absolute numbers are ever required. In almost all cases indices of relative abundance combined with information on population trend is adequate for wildlife managers and conservation planners. Careful thought must be given to the level of confidence required, and the time, resources and number of interested and dedicated people available.

For the purpose of this report we will use the following definitions:

SURVEY: Attempt to produce an index of relative abundance.

CENSUS: Attempt to estimate the absolute number of animals in an area.

MONITORING: Attempt to assess population trends over time through repeated surveys or censuses.

Below is a list of potential techniques which can be used for censusing, surveying and monitoring wild bovid populations.

FAECAL TECHNIQUES

Advantages: relatively cheap (time and money required are low); good for estimating relative abundance. Better than sightings for low density populations. Major problems: confusion will arise if >1 species produce similar faeces, needs good quality data on decay rate, cannot be used for censuses unless information is available on defecation rate (very limited data are usually available), provides no information on population structure, and many animals defecate in a non-random fashion thus requiring a large sample size. Rainy season rapid decay rates in the tropics frequently make this technique unsuitable except in areas of high population density. There are two major ways of recording faecal abundance: line transects and plots.

1) Line transects. This includes any technique in which a known line is patrolled, and the distance from the line to the faecal piles are recorded. Advantages: can provide good quality data with confidence limits, a widely used technique; it is frequently more efficient than plot-based techniques, as more time is spent collecting data; allows for quantitative compensation for samples of unknown origin (i.e. dung from unknown species can be ignored during