

**POPULATION STATUS, DISTRIBUTION AND
GENERAL BEHAVIOUR OF
SPOTTED DEER [*Axis axis*, Erxleben, 1777]
IN BARDIA NATIONAL PARK, BARDIA; NEPAL.**

A Dissertation

**Submitted to Central Department of Zoology, Tribhuvan University
for the Partial Fulfillment of the Requirement for the
Master's Degree in Zoology [Ecology]**

By

DHAN PRASAD PARAJULI

Roll No: 523

**INSTITUTE OF SCIENCE AND TECHNOLOGY
TRIBHUVAN UNIVERSITY
KIRTIPUR, KATHMANDU
NEPAL**

March, 2007

Date:

RECOMMENDATION

It is recommended that **Dhan Prasad Parajuli** has completed his dissertation work entitled “**POPULATION STATUS, DISTRIBUTION AND GENERAL BEHAVIOUR OF SPOTTED DEER [*Axis axis*, Erxleben, 1777] IN BARDIA NATIONAL PARK, BARDIA; NEPAL**” under my supervision. This is the candidate’s original work, which brings out useful findings in the concerned field of conservation biology. To the best of my knowledge, this dissertation has not been submitted for any other degree in any institution. Hence, I recommend this dissertation to be accepted for the partial fulfillment of requirement for the degree of Master’s of Science in Zoology (Ecology).

Dr. Mukesh Kumar Chalise
Associate Professor
Central Department of Zoology
Tribhuvan University
Kirtipur, Kathmandu.

Date:

APPROVAL

On the recommendation of Supervisor Dr. Mukesh Kumar Chalise, Associate Professor, Central Department of Zoology, Tribhuvan University, the dissertation work entitled **“POPULATION STATUS, DISTRIBUTION AND GENERAL BEHAVIOUR OF SPOTTED DEER [*Axis axis*, Erxleben, 1777] IN BARDIA NATIONAL PARK, BARDIA; NEPAL”** submitted by **Dhan Prasad Parajuli** has been approved for the examination.

Prof. Dr. Vasanta Kumar Thapa
Department Head
Central Department of Zoology
Tribhuvan University
Kirtipur, Kathmandu.

Date:

ACCEPTANCE

The dissertation work entitled “**POPULATION STATUS, DISTRIBUTION AND GENERAL BEHAVIOUR OF SPOTTED DEER [*Axis axis*, Erxleben, 1777] IN BARDIA NATIONAL PARK, BARDIA; NEPAL**”, submitted by **Dhan Prasad Parajuli** has been accepted as the partial fulfillment of the requirement for Master’s Degree of Science in Zoology with “Ecology” as special paper.

EXPERT COMMITTEE

Dr. Mukesh Kumar Chalise
Associate Professor
Central Department of Zoology
Tribhuvan University
Kirtipur, Kathmandu

Prof. Dr. Vasanta Kumar Thapa
Department Head
Central Department of Zoology
Tribhuvan University
Kirtipur, Kathmandu

()

External Examiner

ACKNOWLEDGEMENT

I express my sincere honour and special thanks to my academic supervisor, Associate Professor Dr. Mukesh Kumar Chalise for his guidance, encouragement and brilliant insight throughout this research work.

I am highly obliged to Professor Dr. Vasanta Kumar Thapa, Department Head, Central Department of Zoology; TU. for his kind support, suggestions and encouragement. I express my sincere thanks to my respected teachers of Central Department of Zoology; Tribhuvan University.

I would like to thank Department of National Park and Wildlife Conservation (DNPWC) and Bardia National Park (BNP) for granting me permission to carry out this research work at BNP. I express my thanks to the Chief Warden Mr. Puran Bhakta Shrestha of Bardia National Park, Ranger Mr. Ramesh Thapa and Game-scouts who assisted in my field work. I am thankful to Mr. Khadga Bahadur Khadka, Senior Game Scout Mr. Jeet Bahadur Khadka, Senior Nature Guide Mr. Sitaram Chaudhary, Mr. Kumar Khadka and Mr. Santa Chaudhary who provided me valuable information, support and suggestions in my field work. I am heartily indebted to the whole family of Bardia Jungle Cottage, Thakurdwara who provided family environment and lodging support during my field visits. I am thankful to Mr. Naresh Subedi of NTNC, Bardia for providing library support.

I appreciate the encouragement and enthusiastic support with suggestions that I got from my friend Mr. Laxman Khanal throughout the course of study. Friends, Mr. Phanindra Khatri, Mr. Bikash Shrestha and Mr. Jayanta Upadhhaya are equally thankful for their interest and support.

I am thankful to my brothers and sisters for their interest and continuous support in my work. I express my honour to my respected brother-in-law, Kedar Prasad Dahal for his abiding interest and inspirations in my study. My loving wife Durga Pokharel (Parajuli) deserves the credit of completion of this work for her keen interest and company in every moments of my study. I am grateful to my parents for encouragement and support throughout the course of study and I would like to dedicate this dissertation to my loving parents.

Dhan Prasad Parajuli
Exam Roll No: 523
TU Regd. No. 38548-93
Enrolled Year 2060/061

ABSTRACT

The current population status, distribution and general behaviour of the spotted deer (*Axis axis*) in five major Phantas and the adjoining areas of Bardia National Park (BNP) were studied by direct ocular observation, field observation and questionnaire survey method. The field work was conducted during April- July 2006 to explore the population situation, distribution pattern, general behaviour with diurnal activities of the spotted deer in the northern-west lowland corner of the park.

The total population of the spotted deer was counted as 832 from the 16 different study blocks of the park. Among them 351 individuals were recorded from the five major phantas. The average sex ratio was computed as 48.99 bucks per 100 does. The crude density of spotted deer was found to be 27.73 deer/ km² among total study area of BNP. The average herd size was of 16.67 individuals.

The distribution pattern of spotted deer was found to be clumped type within about 30 km² total study area while there was regular type of distribution in small area (0.36 km²) of Lower Khauraha Phanta. They were mainly distributed along the Phantas and adjoining areas.

The social organization of the spotted deer was a loose aggregation with frequent fusion and fission. The most common herds were mixed herds followed by female-fawn herd and breeding herds. The male herds, isolated male/female herds were occasionally seen. Spotted deer are true grazers and seasonal browser. They preferred *Imperata cylindrica*, *Cyanodon dactylon*, *Sachharum spontaneum*, *Tamarindus indica* and *Trifolium* sp. on feeding. Preference of wide and open land for long range of vision, high capacity of escape and greater sensitivity and alertness towards danger were major defense measures from their predators. The adult and dominant male showed dominancy towards both territorial and sexual behaviour.

The grazing percentage was peaked up in the early morning and evening, they took rest under trees-shade during the mid-day of April. Feeding was the most common diurnal activity followed by walking, resting, alert and other activities like chasing, sparring, mounting, suckling etc.

The major threats of spotted deer in the BNP were illegal hunting, trapping, poaching, entry of domestic cattle and dogs, scarcity of food and water in dry season. Therefore provision of artificial water holes, grassland management, seed dispersal, ban on entry of domestic animals, effective implementation of government rules to control hunting, poaching and trapping in joint effort of local people are the main recommendation of this study for the flourishing of the spotted deer in BNP.

CONTENTS

<u>S. N.</u>	<u>Content</u>	<u>Page No.</u>
	Recommendation	I
	Approval	II
	Acceptance	III
	Acknowledgement	IV
	Abstract	V
	Contents	VI
	List of Tables and Photo Plates	IX
	List of Figures	IX
	List of Abbreviations and Acronyms	X
1.	INTRODUCTION	1
	1.1 Background	1
	1.2 Spotted Deer	2
	1.2.1 Evolution of Spotted deer	2
	1.2.2 Systematic Position	2
	1.2.3 Physical Description	3
	1.2.4 Habitat and Food Habit	6
	1.2.5 Social Structure	7
	1.2.6 Reproduction and Lifespan	8
	1.3 Distribution and Status of Spotted deer	9
	1.4 Distribution of Spotted deer in Nepal	10
	1.5 Value of Spotted deer	10
	1.6 Rationale of the Study	10
	1.7 Research Objectives	11
	1.8 Limitations of the Study	11
2.	STUDY AREA	12
	2.1 Physical Description	12
	2.1.1 Location, Boundary and History of BNP	12
	2.1.2 Topography and Geology	12
	2.1.3 Drainage and Hydrology	14
	2.1.4 Climate	14
	2.2 Biological Description	17

2.2.1	Flora	17
2.2.2	Fauna	19
2.2.3	Ethnic Communities and Land Use	20
2.3	The Core Research Area, the Phantas	22
3.	METHODOLOGY	25
3.1	Preliminary Field Survey	25
3.2	Field Survey	25
3.3	Population Status	25
3.3.1	Population Census	25
3.3.2	Population Density	26
3.3.3	Age and Sex composition	26
3.3.4	Herd Composition and Size	27
3.4	Distribution	28
3.5	Diurnal Activity and General Behaviour	28
3.6	Vegetation Analysis	29
3.7	Questionnaire Survey	30
3.8	Interviews and Discussions	30
4.	RESULT	31
4.1	Population Status of Spotted Deer in Five Major Phantas of BNP	31
4.1.1	Population Estimation	31
4.1.2	Population Density	33
4.1.3	Age and Sex Composition	33
4.1.4	Herd Size and Composition	37
4.2	Distribution Pattern of Spotted Deer in Five Major Phantas of BNP	37
4.3	Distribution Pattern of Spotted Deer in Intensive Study Area	39
4.4	General Behaviour and Diurnal Activity Pattern	41
4.4.1	General Behaviour	41
4.4.1.1	Social Behaviour	41
4.4.1.2	Territorial Behaviour	42
4.4.1.3	Feeding Behaviour	43
4.4.1.4	Sexual Behaviour	45
4.4.1.5	Anti-predatory Behaviour	45

4.4.1.5.1	Alert Posture	46
4.4.1.5.2	Alarm Call and Foot Stamping	46
4.4.1.5.3	Alert Flight	46
4.4.2	Diurnal Activity pattern	47
4.4.2.1	Early Morning Activities of Mixed Herds	47
4.4.2.2	Late Morning Activities of Mixed Herds	48
4.4.2.3	Afternoon Activities of Mixed Herds	48
4.4.2.4	Evening Activities of Mixed Herds	49
4.4.2.5	Diurnal Activities Spotted Deer in BNP	49
5.	DISCUSSION	52
5.1	Population Status of Spotted Deer	52
5.2	Distribution of Spotted deer in BNP	53
5.3	General Behaviour and Diurnal Activity Pattern	54
6.	CONCLUSION	58
7.	RECOMMENDATIONS	60
8.	REFERENCES	61
9.	APPENDIXES	67
I	Floristic Composition of BNP	67
II	Questionnaire Survey with Nature Guides of BNP	69
III	Monthly Maximum Temperature of Rani Jaruwa Nursery, Bardia	71
	Monthly Minimum Temperature of Rani Jaruwa Nursery, Bardia	71

LIST OF TABLES

<u>S. N.</u>	<u>Page No</u>
Table 1: Population status of spotted deer in five major phantas of BNP in 2006	31
Table 2: Range of population of spotted deer in five major phantas of BNP	32
Table 3: Range of crude density of spotted deer at five major phantas of BNP	33
Table 4: Population of spotted deer in 16 different locations of BNP	38
Table 5: Population of spotted deer at different study blocks of Lower Khauraha	39
Table 6: Study blocks and habitat types in intensive study area	43
Table 7: Number of herds of spotted deer observed at different study blocks	43

LIST OF FIGURES

S.N	Page No
Figure 1: Annual Rainfall at Rani Jaruwa Nursery, Bardia.	15
Figure 2: Average Monthly Rainfall at Rani Jaruwa Nursery, Bardia.	16
Figure 3: Annual Mean Max. /Min. Temperature in Rani Jaruwa Nursery, Bardia.	16
Figure 4: Monthly Variation of Max. /Min. Temperature in Rani Jaruwa Nursery, Bardia,	17
Figure 5: Annual Relative Humidity in Rani Jaruwa Nursery, Bardia (2000 – 2004).	17
Figure 6: Cast wise Demographic Presentation of Bardia District	22
Figure 7: Percentage of Population of Spotted Deer in Different Phantas of BNP	33
Figure 8: Age and Sex Composition of spotted Deer at Lower Khauraha Phanta	34
Figure 9: Age and Sex Composition of spotted Deer at Upper Khauraha Phanta	34
Figure 10: Age and Sex Composition of spotted Deer at Lower Baghaura Phanta.	35
Figure 11: Age and Sex Composition of spotted Deer at Upper Baghaura	36
Figure 12: Age and Sex Composition of spotted Deer at Lamkauli Phanta	36
Figure 13: Percentage of Grazing Population of spotted deer in BNP	44
Figure 14: Early Morning Activities of Mixed Herds of Spotted deer in BNP	47
Figure 15: Late Morning Activities of Mixed Herds of Spotted deer in BNP	48
Figure 16: Afternoon Activities of Mixed Herds of Spotted deer in BNP	48
Figure 17: Evening Activities of Mixed Herds of Spotted deer in BNP	49
Figure 18: Diurnal Activities of Mixed Herds of Spotted deer in BNP	49
Figure 19: Percentage of Diurnal Activities of Spotted deer in BNP	50

LIST OF PHOTO PLATES

- Photo Plates 1-8. Different Age and Sex Groups and Herd Types of spotted deer
40
- Photo Plates 9-16 Behavioural Study and Different Behaviour of spotted deer
50

ABBREVIATIONS/ACRONYMS

⁰ C	Degrees Celsius
BC	Before Christ
BCP	Bardia Conservation Project
BNP	Bardia National Park
CBS	Central Bureau of Statistics
CITES	Convention on International Trade in Endangered Species of Wild Flora and Fauna
DNPWC	Department of National Parks and Wildlife Conservation
GM	Gulariya Municipality
HMGN	the then His Majesty's Government of Nepal
INGO	International Non-Governmental Organization
IOF	Institute of Forestry
IUCN	World Conservation Union
Km	Kilometer
Km ²	Square Kilometer
m.	Meter
mm.	Millimeter
NG	Nepal Government
NGO	Non-Governmental Organization
No.	Number
NTNC	National Trust for Nature Conservation
RBNP	the then Royal Bardia National Park
RCNP	the then Royal Chitwan National Park
TAL	Terai Arc Landscape Programme
TU	Tribhuvan University
USA	United States of America
USSR	United States of Soviet Russia
VDC	Village Development Committee
WWF	World Wildlife Fund