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Accounts of Nepalese mammals and analysis of the host-ectoparasite data by computer techniques

Richard Merle Mitchell
Iowa State University

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Accounts of Nepalese mammals and analysis
of the host-ectoparasite data
by computer techniques

by

Richard Merle Mitchell

A Dissertation Submitted to the
Graduate Faculty in Partial Fulfillment of
The Requirements for the Degree of
DOCTOR OF PHILOSOPHY

Department: Zoology
Major: Zoology (Parasitology)

Approved:

Signature was redacted for privacy.

In ~~Charge~~ of Major Work

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Iowa State University

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1977

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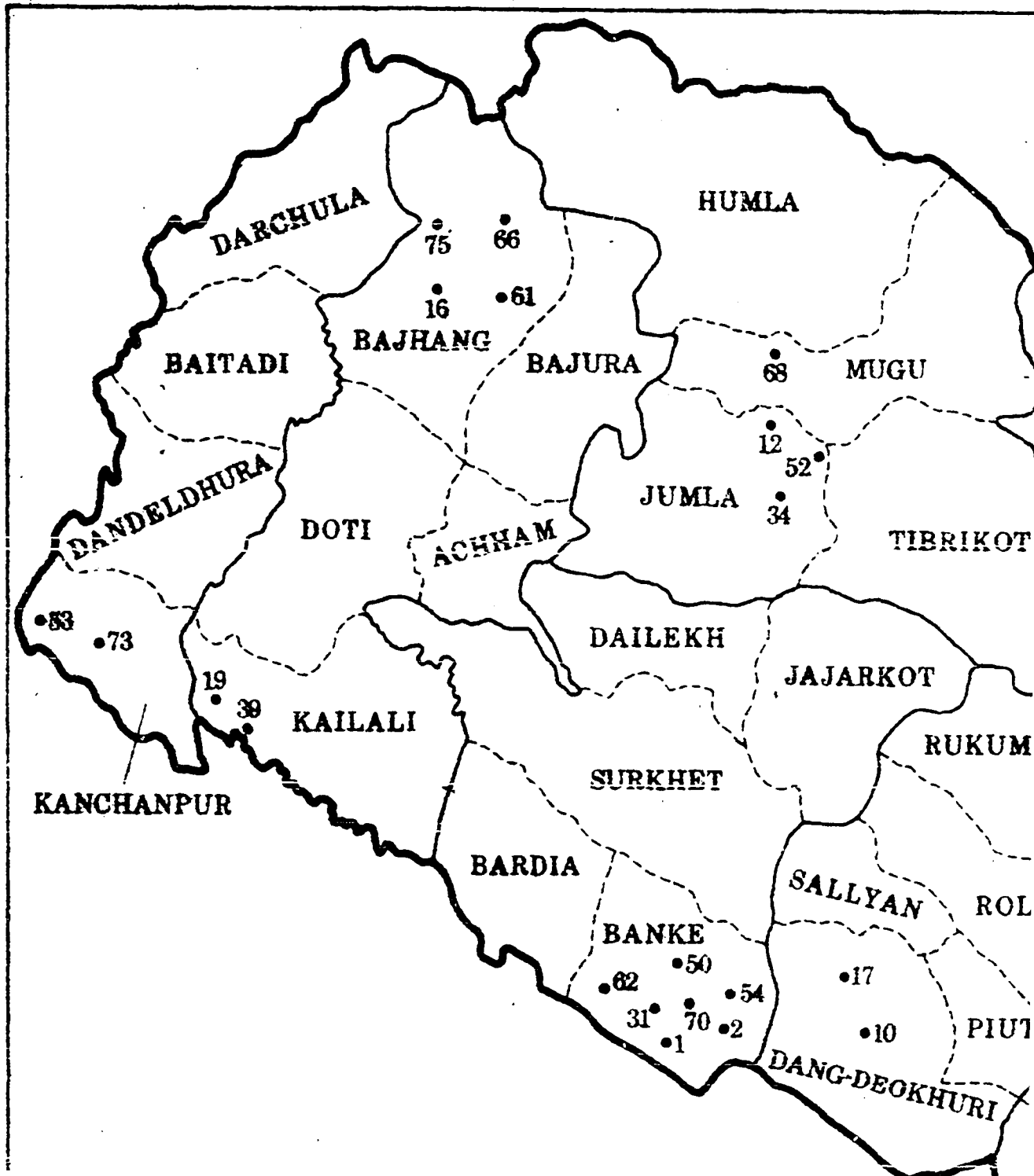
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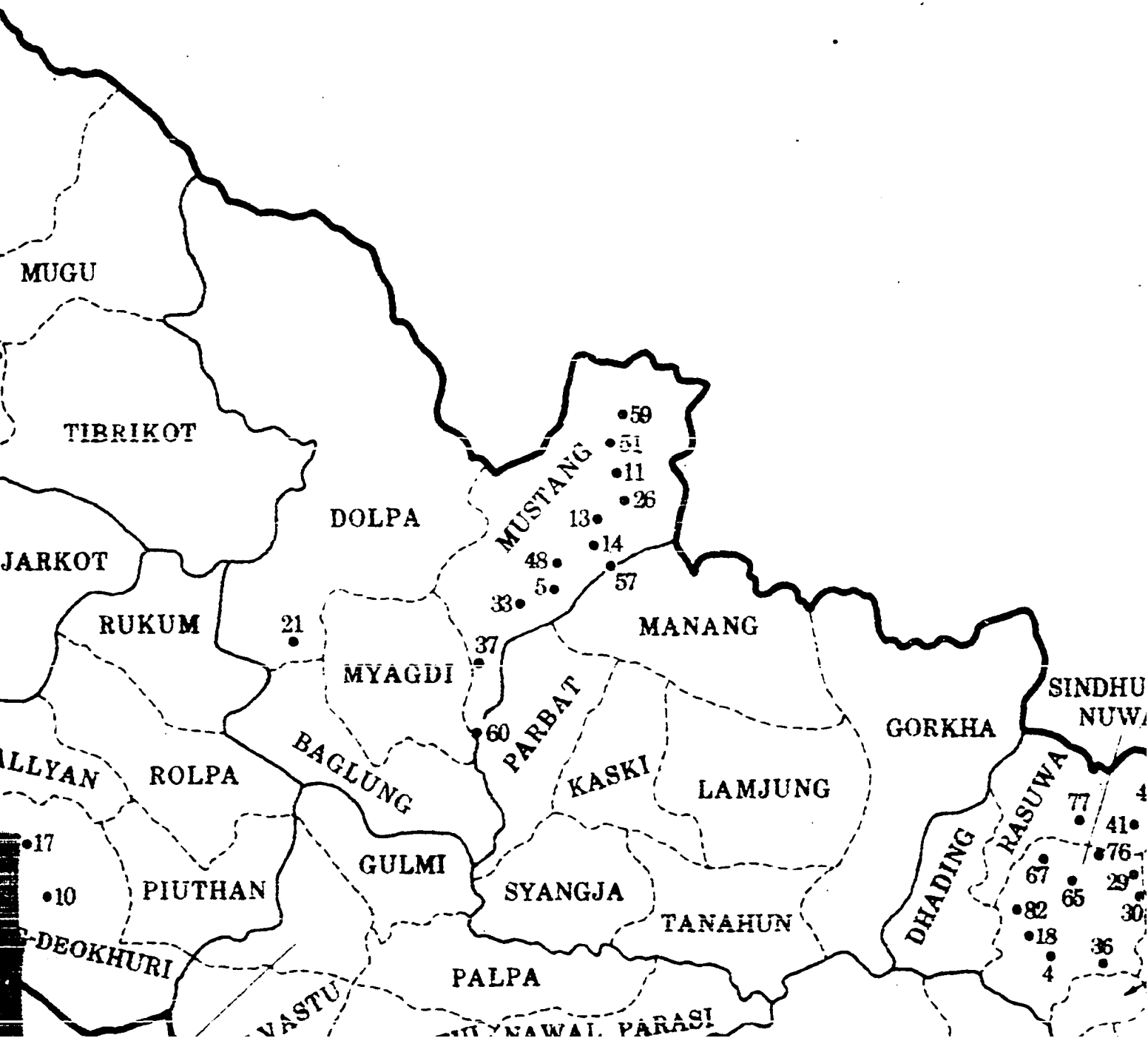
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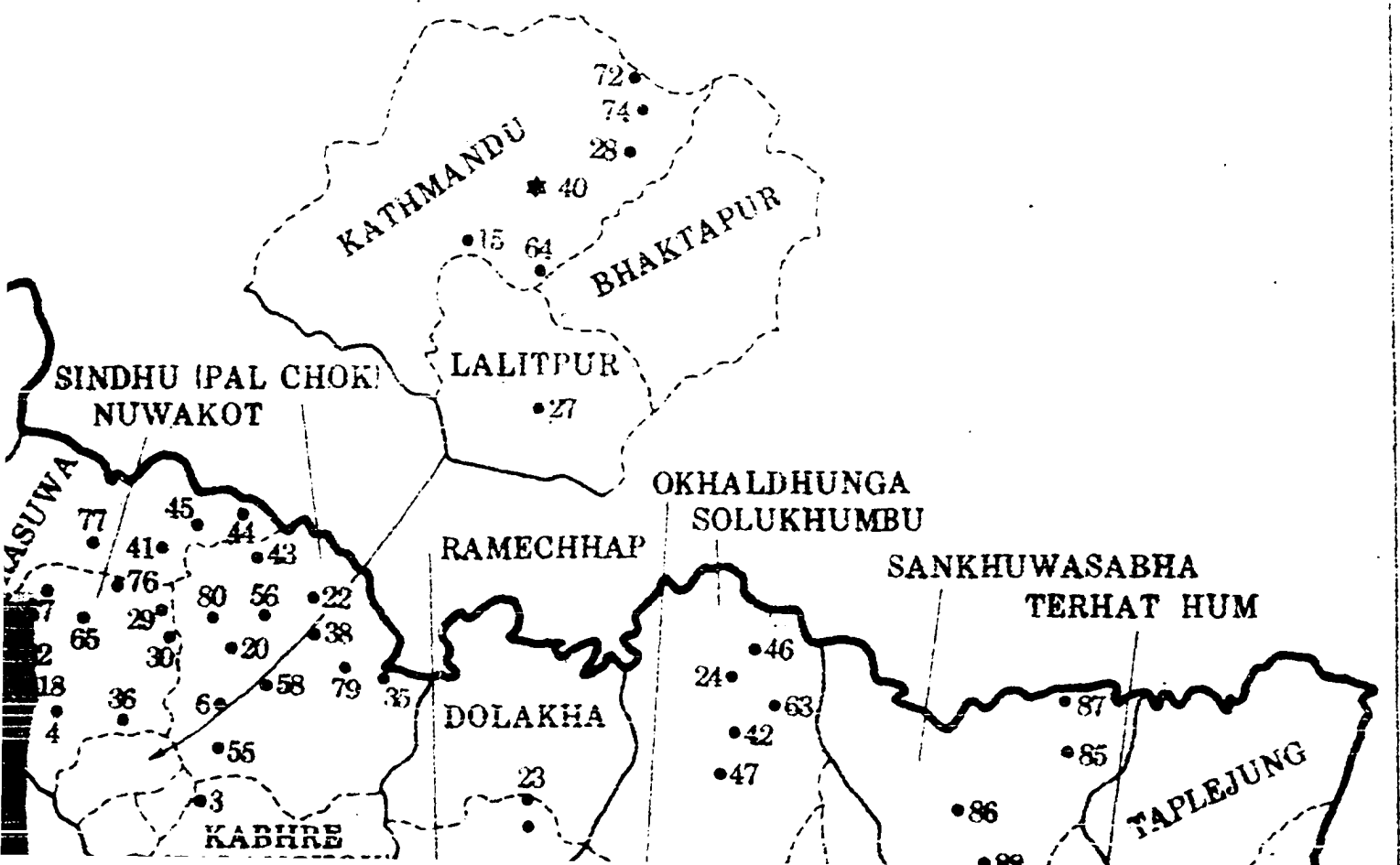
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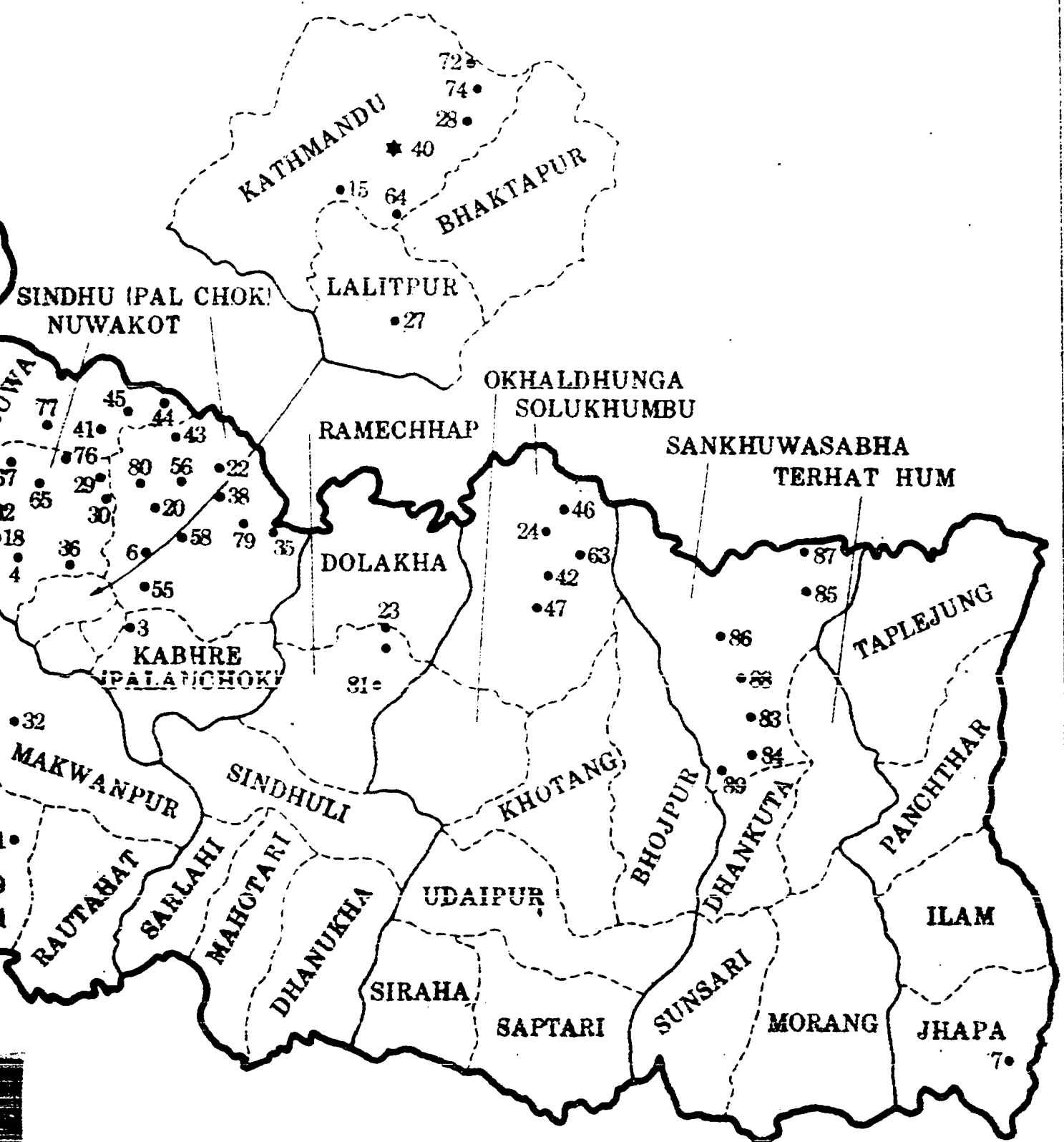


• COLLECTION SITES

★ CAPITOL

--- DISTRICTS





INTRODUCTION

From September 1966 to August 1970, the Nepal Ectoparasite Program, in conjunction with His Majesty's Government, Ministry of Health, conducted a survey of the ectoparasites and their hosts in the Kingdom of Nepal. Additional material was supplied to the project by the Arun Valley Wildlife Expedition (July 1972 - December 1973). The primary purpose of this undertaking was to collect a geographically and ecologically representative sample of ectoparasites and hosts from high altitudes in the Nepal Himalayas. The host-ectoparasite data were tabulated and numerically analyzed by means of the IBM 360/65 computer to determine host preference, host specificity and infestation rates. The technique of cluster analysis was employed to determine host affinity between geographic realms and life zones.

The objective of this work is to provide an account of the 130 species of terrestrial mammals collected or reported from Nepal, including information on their ecology, distribution, systematics and zoogeographic relationships. In addition, all body measurements of mammals are tabulated to determine mean, range, standard deviation and coefficient of variance.

A literature review and brief introductions to the zoogeography, climate and life zones of Nepal are provided. A gazetteer of 89 major localities visited during the expedition is also included.

ACKNOWLEDGEMENTS

The Nepal Ectoparasite Program was made possible by support funds from Office of Naval Research contracts N62558-5023 and N00014-68-A-0101-0001 to the Principal Investigator, Dr. Robert E. Lewis, Iowa State University, Ames, Iowa. I am grateful to Dr. Lewis for the opportunity to conduct the field phase of the program.

I am especially indebted to Dr. Harry Hoogstraal, United States Naval Medical Research Unit-Three, Cairo, Egypt, for his efforts in supplying our demands for additional equipment, and handling the shipments of hosts and ectoparasites.

Special thanks goes to His Majesty's Government, Ministry of Health, for permitting me to work directly under the expert guidance and supervision of Dr. N. K. Shah, Assistant Director of Epidemiology.

My gratitude is also extended for the cooperation of the American Ambassador, Madam Carol Laise, and her staff, notably Roy Anderson and Robert Jackson; and I am indebted to Mr. George Bell, USAID, for his friendship and support during the project.

Further, I am grateful to Christopher O. Maser, a previous collector in Nepal. Doctors H. B. Emery and J. A. McNeely of the Arun Valley Wildlife Expedition have also kindly permitted my use of their host-ectoparasite data.

The following individuals donated their time to the preparation and identification of the ectoparasites: Dr. K. C. Emerson, United States National Museum, Washington, D. C. (lice); Dr. Harry Hoogstraal, United States Naval Medical Research Unit-Three, Cairo, Egypt (ticks); Dr. Robert E. Lewis, Iowa State University, Ames, Iowa (fleas); Mr. T. C. Maa, B. P. Bishop Museum, Honolulu, Hawaii (parasitic Diptera); Dr. R. W. Strandtmann, B. P. Bishop Museum, Honolulu, Hawaii (mites) and Dr. R. L. Wenzel, Field Museum Natural History, Chicago, Illinois (bat flies).

Dr. Argawal of the Calcutta Museum and his staff made many of the facilities of that institution available to me and generously donated his time in helping to identify representative species of mammals. Doctors Robert L. Fleming, Sr. and Jr., of Kathmandu identified the birds and furnished many helpful suggestions in the collecting of specimens.

The program could not have been accomplished without the efforts of the late Captain Jai Singh, His Majesty's pilot, in providing air and helicopter transportation and liaison with our party when we were collecting in remote areas.

Mani K. Lama, my assistant, in his devotion and dedication to the project, proved to be an excellent field collector and companion. His expedition to the Mustang District turned up several new species of fleas and the first new genus of

ticks to be described in the twentieth century.

I cannot begin to describe the gratitude that I have for my wife, Marleane, who courageously accompanied me on every field trip and lent the moral support that I needed to undertake such a project. She spent many long hours photographing collecting sites, recording field data and supervising the kitchen.

LITERATURE REVIEW

Mammals

For centuries, the Kingdom of Nepal was closed to westerners, until the British government sent an envoy to the Kathmandu Valley in 1815. A few mountain climbing expeditions entered Nepal in the early 1920's from the northern approach of Mt. Everest. In 1952 for the first time, foreigners were officially permitted to enter Nepal. Even today a special permit is required to visit areas outside the Kathmandu Valley. Due to these restrictions, few scientific expeditions were undertaken until the late 1960's.

The researches of B. H. Hodgson (1822-1843) laid the foundation of mammalogy in Nepal. He published over 100 papers on the mammals of the area. Many of Hodgson's locality records are in doubt, since he was confined to the Kathmandu Valley and had to depend on traders and local hunters for many of his specimens. He collected 373 mammal specimens belonging to 70 genera and 114 species, 40 of which were subsequently described as new. A number of these were later synonymized and have since been deleted from the literature. Gray (1846, 1863b) published a checklist based on Hodgson's Nepalese mammal collection housed in the British Museum.

From the 1850's to the 1900's, mammal surveys were carried out by the British in India and the Himalayas. Compre-

hensive works on the mammals of the region were published by Jerdon (1867) and Blanford (1888-1891). Scully (1887) published an account on bats collected from the Kathmandu Valley.

In the 1920's, the first high-altitude series of mammals was collected from Nepal. Thomas and Hinton (1922) reported on a series of mammals from the Mt. Everest region which consisted of 52 specimens belonging to 10 species, of which two species and one subspecies were described as new. The majority were pikas (Ochotona) and voles (Pitymys). Ochotona wollastoni (=macrotis), O. nubrica (=pusilla) and O. roylei baltina represented the new taxa.

Hinton (1922b) listed a collection of rats from the Kathmandu Valley and nearby surroundings which included three species and four subspecies. Hinton and Fry (1923) published a checklist of the Nepalese mammals which contained 81 genera and 119 species. Thomas (1924) described a new field mouse, Apodemus gurka (=Apodemus flavicollis gurkha), from the western sector of the country. Fry (1925) listed a large collection of mammals from districts west of the Kathmandu Valley, and Lindsay (1929b) reported the discovery of a new flying squirrel, Sciuropterus gorkhali (=Petaurista elegans gorkhali).

Pocock (1939, 1941) published two volumes on the primates and carnivores of British India; for Nepal he listed four

species and subspecies of primates and 41 species and subspecies of carnivores. Ellerman (1947 a & b) published a key to the rodents of India, Ceylon and Burma, which included 21 genera and 31 species from Nepal.

Sanborn (1950) collected the bat Plecotus homochrous from Nepal. Biswas and Khajuria (1955) reported on a small collection of mammals from the Solukhumbu region of eastern Nepal and described four new mammals: Ochotona angdawai, Rattus rattus khumbuensis, Mus musculus pygmaeus, and Alticola bhatnagari. This collection included 52 specimens belonging to 21 species and subspecies (Biswas and Khajuria 1957).

Ellerman and Morrison-Scott (1966), in their account of the mammals of the Palaearctic Region and Indian subcontinent, included 71 genera and 106 species of mammals from Nepal. Frick (1968) reported 169 species and subspecies in his checklist of Nepalese mammals. Caughley (1969) listed 16 genera and 17 species from the Trisuli watershed area, and Chesemore (1970) published notes on mammals collected or sighted in southern Nepal.

In 1965, the Nepal Health Survey collected 460 specimens belonging to 18 genera and 28 species, from 15 different localities in the country. Particulars on these collections were published by Worth and Shah (1969). Weigel (1969) reported on the investigations of the Nepal Himalaya Expedition, 1968, which studied the insectivores and rodents of

eastern Nepal. Three hundred twenty-five mammals representing 10 genera and 14 species were obtained. One new species and subspecies were described and four new locality records were reported. Abe (1971) collected 231 small mammals consisting of 31 species from central Nepal. Martens and Niethammer (1972) reported Apodemus sylvaticus wardi for the first time from Nepal. Their collection included 23 specimens of A. s. wardi and 44 of A. flavicollis gorkha, taken from the Dolpa and Mustang Districts.

Birds

The Nepalese avifauna consists of over 800 species and subspecies. Only one endemic species, the spiny babbler (Turdoides nipalensis), is known; all others are shared with the Indian subcontinent (Pakistan, India, Sri Lanka, Bangladesh and Assam). Water birds and waders are poorly represented in the country since the main migratory flyways are over Kashmir and Burma. A few waterfowl funnel into the Nepal Terai via low mountain passes.

The pioneer avifaunal studies of the Himalayas were carried out mainly in India, but early workers also collected birds in Nepal. B. H. Hodgson resided for 25 years in Kathmandu (1822-1847) and his bird collections totaled well over 20,000 skins (Ali and Ripley 1969) consisting of 658 species representing several new families, over 20 new

genera and 179 new species (Gray 1846, 1863b). Scully (1879) recorded over 300 species from the Kathmandu Valley and surrounding areas.

In the twentieth century, the first bird collections from the area were associated with mountaineering ventures. Kinnear and Wollaston (1922), Hingston (1928) and Kinnear (1939) all reported on birds collected from the Mt. Everest region.

Following World War II there was an influx of ornithologists to the Indian subcontinent. In 1947, Biswas and Koelz collected birds from the central Terai along the main route to Kathmandu and within a 15 mile radius of the valley. Biswas reported on this collection, which totaled about 3500 specimens, representing about 350 species and subspecies, in an 11-part series published in the Journal of the Bombay Natural History Society (August 1960 to December 1963).

Smythies (1948, 1950) recorded birds from central Nepal and Kathmandu Valley. Ripley (1950a) reported on close to 1600 birds representing 331 species and subspecies from the eastern and western Terai and Kathmandu Valley. Ripley (1950b) also described eight new subspecies from the area. Proud (1949, 1952 a & b, 1955, 1958, 1961 a & b), over a 12 year period, collected or sighted over 350 species of birds in the Kathmandu Valley and surrounding region.

Lowndes (1955) listed birds collected from Manangbhot,

northwestern Nepal, during a mountaineering expedition; and Polunin (1955) reported on the botanical, geological and ornithological findings from Langtang Khola, central Nepal.

The foremost authorities on Nepalese birds are Drs. Robert L. Fleming, Sr. and Jr., who have resided in Kathmandu for 20 years. The Flemings have collected one of the most extensive series of birds from Nepal and the Himalayas. They have collected over 56 species and subspecies for the first time from Nepal, of which two subspecies are new to science. Rand and Fleming, Sr. (1956, 1957), Fleming, Sr. (1953, 1959, 1963, 1968) and Fleming and Traylor (1961, 1964, 1968) have reported on these extensive collections. Fleming, Jr. (1968, 1969) listed new locality records for two birds, Bombycilla garrulus and Columba rupestris. The Flemings (personal communication) reported collecting over 750 species and subspecies of birds from Nepal. Their book, which is presently in preparation, will include over 830 species and subspecies.

In the 1960's, a few collections were made from various localities throughout the country. Paynter (1961) studied Corvidae from the Pokhara Valley; and Diesselhorst (1968) collected over 1,700 specimens, representing 248 species and subspecies, from the Rapti Dun, the Kathmandu Valley, and the Solukhumbu District. Ali and Ripley (1968-72) have a nine-volume series covering 2,100 species and subspecies, of which

over 700 species and subspecies are listed for Nepal.

Ectoparasites

The bloodsucking, invertebrate parasites of Nepal that are potential or known reservoirs or vectors of infectious disease agents were unknown before 1960. Two major surveys, the Nepal Health Survey (1965-1966) and the Nepal Ectoparasite Program (1966-1970), accumulated a vast amount of field data and collections of ectoparasites; and the Arun Valley Wildlife Expedition, begun in 1972, has continued the work in eastern Nepal.

Following is a brief report on the various groups of ectoparasitic arthropods.

Fleas

Before the Nepal Health Survey (1965-1966) and the Nepal Ectoparasite Program (1966-1970), the flea fauna of Nepal was essentially unknown. In 1950, Traub described a new subspecies of fleas, Macrostylophora hastata nepali, from Dhan-kuta, eastern Nepal, and in 1968 he described a new genus and species, Evansipsylla thysanota, from Langtang Valley. He (1969) also listed 18 genera and 23 species of fleas collected by the Nepal Health Survey. Several new species await his description.

Most of the flea collections have been studied by R. E. Lewis, and three new species, attributed to new genera, have

been described. They are: Mitchella exsula Lewis, 1970, Rowleyella arborea Lewis, 1971 and Smitipsylla maseri Lewis, 1971. Additional new species described by Lewis are listed below.

Ancistropsylla nepalensis Lewis, 1968
Stenischia pagiana Lewis, 1969
Paraneopsylla ioffi nepali Lewis, 1971
Neopsylla pagea Lewis, 1971
Neopsylla mantissa Lewis, 1971
Neopsylla marleanae Lewis, 1971
Callopsylla fusca Lewis, 1971
Citellophilus mygala Lewis, 1971
Citellophilus atallahi Lewis, 1971
Chaetopsylla gracilis Lewis, 1971
Ctenophyllus triangularis Lewis, 1972
Palaeopsylla tauberi Lewis, 1973
Palaeopsylla helenae Lewis, 1973
Paradoxopsyllus acanthus Lewis, 1974
Paradoxopsyllus digitatus Lewis, 1974
Paradoxopsyllus hollandi Lewis, 1974
Paradoxopsyllus magnificus Lewis, 1974
Paradoxopsyllus mustangensis Lewis, 1974
Paradoxopsyllus oribatus Lewis, 1974
Paradoxopsyllus paraphaeopis Lewis, 1974
Paradoxopsyllus spinosus Lewis, 1974

Other undescribed taxa remain to be studied. Further reference to the siphonapteran fauna of Nepal may be found in papers by Lewis (1968, 1969, 1970, 1971 a-e, 1972b, 1973a, 1974a).

Ticks

The Himalayas harbor a rich tick fauna, especially the primitive genus Haemaphysalis, and Nepal is the ecotone for an extensive array of poorly-known, endemic Himalayan species. Earlier tick studies for the area centered on the Darjeeling District of India. There are few early reports

on the Nepalese tick fauna, most of them by H. Hoogstraal. The following papers are accounts of ticks collected from Nepal:

Hoogstraal (1962) described a new tick, Haemaphysalis nepalensis, and the male H. aponomoides from the Ramechap District of eastern Nepal. Dhanda (1964) reported on new hosts for H. nepalensis and described its nymphal stage. In 1965 the Nepal Health Survey collected a small series of ticks, consisting of four genera and four species, from various localities in the country (Worth and Shah 1969).

In 1966, Hoogstraal described Haemaphysalis himalaya, a parasite of the Himalayan tahr (Hemitragus jemlahicus), from northwestern India. Subsequently, Hoogstraal and El Kammah (1970) described the immature stages, hosts and distribution in Nepal. Nemenz (1968) described a new tick, Ixodes moschiferi, collected from the musk deer (Moschus moschiferus).

In 1970, several new species were described and new records from Nepal were published. Hoogstraal (1970b) listed six genera and 16 species of ticks infesting humans from the foothills and mountains of Nepal. Hoogstraal and Dhanda (1970) reported on Haemaphysalis darjeeling parasitizing artiodactylan mammals in the Himalayan forests of India, Burma and Thailand. Hoogstraal et al. (1970) described the adults, nymphs and larvae of Anomalohimalaya lama, the first

new tick genus to be discovered in the twentieth century. This parasite was collected from three localities in the alpine desert biotope of the Mustang District.

Kohls et al. (1970) described a new tick, Ixodes mitchelli, that parasitizes pheasants and partridge in the high Himalayas. Dhanda et al. (1970) reported a new tick, H. ramachandrai, from northern India and Nepal. Nepalese collections were taken from large carnivores (Panthera pardus and P. tigris) and cervids (Cervus unicolor). Hoogstraal (1970a) redescribed the male and female of H. (H.) birmaniae and a new species, H. (H.) goral. Numerous collections of H. (H.) birmaniae were collected from the central midlands and Gokarna, Kathmandu District.

Hoogstraal (1971a) published data on the identity, hosts and distribution of Haemaphysalis (Rhipistoma) canestrinii. H. canestrinii was collected from the Nawal Parasi District and the Kathmandu Valley. Nymphs were obtained from the palm squirrel (Funambulus pennanti) and Mus sp., while adults were taken from the fishing cat (Felis viverrina) and the leopard (Panthera pardus).

Haemaphysalis aponommoides Warburton, 1921, had previously been reported from a collection of eight adults. Hoogstraal (1962) described the adult male and Hoogstraal and Mitchell (1971) reported on the immature stages, hosts, distribution and ecology. Immature stages were collected from

pheasants, insectivores and small rodents. Adult ticks were taken from artiodactylan mammals.

Hoogstraal et al. (1971) described a new subgenus Aborphysalis of Asian Haemaphysalis ticks. In the same paper, they redescribed the tick H. aborensis Warburton, 1913, and reported on its hosts and distribution.

Hoogstraal (1971b) described the immature stages, adult structural variation, hosts and ecology of Haemaphysalis (Allophysalis) warburtoni Nuttall, 1912. He also redefined the subgenus Allophysalis and H. (A.) warburtoni, the type species of the subgenus Allophysalis. Nepal collections of 30 adults and 471 immature specimens provided data for redefining the subgenus.

Ixodes (I.) nuttallianus Schulze, 1930, prior to the Nepal Ectoparasite Program was known only from five female specimens taken from deer in China. Data on 110 adults from 25 collections taken in northcentral Nepal and nearby Tibet were presented in a paper by Clifford et al. (1971b), which included a redescription of the female and description of the male. In addition, host preference and ecological data were discussed. Goat antelopes (Capricornis sumatraensis, Naemorhedus goral) and domestic livestock were most frequently infested.

Clifford et al. (1971a) also described two new species, Ixodes hyatti and I. shahi, taken from pikas (Ochotona) in

the high Himalayas of Nepal and West Pakistan.

Hoogstraal et al. (1973) proposed a new subgenus, Partipalpiger, for I. ovatus. Hosts, ecology and distribution of this species were also reviewed. Hoogstraal and Kaiser (1973) described a new argasid tick, Argas (Argas) himalayensis, from larvae infesting the snow partridge (Lerwa lerwa). Finally, Clifford et al. (1975) reported on the Ixodes ticks of Nepal.

Mites

Nepal harbors a rich, but little known, mite fauna. Both the Nepal Health Survey and the Nepal Ectoparasite Program collected large numbers of mites. Due to the large number of specimens, the process of clearing, mounting and identification has lagged. To attest to the plentitude of the mites, over 50% of all hosts collected by both surveys were infested with mites, and over half the mites collected by the Nepal Health Survey were new species.

During the Nepal Health Survey, 57 species of mites were taken from 305 animals; 35 of these proved to be new species. Nadchatram (1969) listed the species of chiggers as well as the hosts and collection sites.

Allred (1969), in his paper on haemogamasid mites of eastern Asia and the western Pacific, listed two genera and seven species from Nepal. He also described a new species, Haemogamasus suncus, from insectivores from the central midlands.

Fourteen species of chiggers, six new, belonging to the genus and subgenus Leptotrombidium, were collected by the Nepal Health Survey (Nadchatram 1970). A new species, Myonyssus tuberosus, from small rodents, was described by Strandtmann and Garrett (1970).

Lice (Anoplura and Mallophaga)

Literature on the Mallophaga and Anoplura of the Himalayas is nearly nonexistent. The Nepal Health Survey collected a moderate number of lice, but no papers resulted from these data. The Nepal Ectoparasite Program collected over four thousand specimens and to date, one paper has been published from this material. Emerson (1971) in his paper on the Mallophaga of Nepal listed six genera and 10 species taken from mammals.

Botanical Surveys

Botanically, Nepal is of particular interest because here the floras of the eastern and western Himalayas merge. The history of plant collecting in the country is divided into two periods, 1850 to 1952 and 1952 to the present. During the first period, Nepal remained closed to foreigners, and scientific investigations were limited to the Kathmandu Valley and the Nepal-Darjeeling border.

Hooker (1854) published the first definitive work on

the flora of the eastern Himalayas. He collected botanical specimens along the Sikkim-Nepal border. Burkhill (1910) published an account of the vegetation of central Nepal and Landon (1928) cited 1672 species of Nepalese plants in his two volume work. Hay (1934) summarized the botanical investigations of these early botanists and also reported on plants found in central Nepal.

The second period of phytogeographical investigations began with the opening of the country to scientists in about 1950. Polunin (1950 a & b) surveyed the flora of Langtang Valley and Rasuwa District. Banerji (1952 a & b, 1953a, b & c, 1958) reported on six botanical collecting trips made to eastern Nepal. He summarized the collection activities in his 1965 paper.

In 1952, the British Museum, in conjunction with the Royal Horticultural Society, sent a team of botanists to collect plants from northwestern Nepal. Williams (1953) reported on the collection of over 5,000 herbarium specimens by the expedition.

In 1953 and 1954, the Fauna and Flora Research Society of Japan sent two scientific and mountaineering expeditions to central Nepal. Kihara (1955, 1956) edited the results of these expeditions and published two volumes on the botanical findings. From 1960 to 1963, the University of Tokyo collected over 60,000 plant specimens from the

eastern Himalayas. Hara (1963, 1966, 1968) reported on the accounts of these expeditions, and in 1971 he also published on the plants collected by two later expeditions (1967 and 1969) in Nepal, Sikkim and Bhutan.

Pande (1967) and Suwal (1969) reported on the results of plant surveys undertaken by His Majesty's Government, Ministry of Forests, Department of Medicinal Plants, in the Kathmandu Valley. Stainton (1972), after collecting plants between 1953 and 1968, published a book on the forest types, plant distribution and geographical divisions of Nepal.

BIOGEOGRAPHICAL CONSIDERATIONS

Physiography

Nepal is shaped like an elongated rectangle 800 km long and 160 to 240 km wide. It has a total area of about 141,000 sq km which approximates the size of the state of Arkansas. It is bounded on the north by Tibet and on the east, south and west by India. The northeast corner (Taplejung and Panchthar Districts) borders Sikkim.

The Himalayas, the highest mountains in the world, separate Nepal from the Tibetan Plateau. These mountains extend the entire length of the northern border and form an almost impenetrable barrier, breached only by a few low passes. Environments ranging from tropical to arctic occur within the political boundaries of the country.

Nepal is divided into 75 political districts (Fig. 1) and seven broad zoogeographical zones, each diagrammatically illustrated in Fig. 2. These regions, in order of diminishing altitude and from west to east are: (1) the inner Himalayas, (2) Tibetan Plateau (Highlands), (3) Midlands (west and east), (4) Mahabharat Lekh, (5) Siwaliks, (6) Duns and (7) Terai (west and east). Although the Terai and midlands are divided into west and east, they are generally treated as a single zoogeographical unit.

Zoogeography

The zoogeography of the Himalayas is of great interest since Nepal lies in the zone of intermingling between two major zoogeographic realms, the Palaearctic and the Oriental. The Himalayas serve as a faunal barrier, but in low mountain passes, Palaearctic and Oriental species are exchanged. Nepal also lies in the transition zone between three major subregions, the Manchurian of the Palaearctic and the Indian and the Indo-Chinese of the Oriental. The Oriental Region was first proposed as one of the six zoogeographical regions of the world by Sclater (1858). It includes tropical Asia and closely associated islands, such as Sri Lanka, Sumatra, Java, Borneo, Taiwan and the Philippines (Darlington 1957). It encompasses all of the Indian subcontinent, excluding West Pakistan and the higher reaches of the Himalayan Mountains, although the Oriental fauna and flora do extend up to 3500 m in Nepal. The Palaearctic Region is essentially Eurasia above the tropics (Darlington 1957).

The penetration to altitudes as high as 3500 m in the Himalayas by subtropical and tropical faunal forms is related to local microclimates and the presence at relatively high altitudes of tropical evergreen forests. The persistence of these tropical forests have provided stepping stones for incursions of Indo-Chinese faunal types into the drier regions of southern India.

The Satpura Hypothesis (Ali 1949; Hora 1950, 1953) suggested that the main route of immigration of Malayan faunal elements was along the Assam Hills and the Himalayas, and into peninsular India via the Satpura trend of mountains. It postulated that from a center of origin in the Szechuan-Yunnan area, faunal and floral elements spread over the newly upraised Himalayan trend, over the mountain ranges of Assam, westward over the eastern Himalayas, and into the Garo Hills gap. From there they spread over the Satpura trend of mountains, across the Indian peninsula to the Western Ghats and southward along that trend to Cape Comorin and Sri Lanka (Ali 1949). This would explain the strong Indo-Chinese faunal and floral affinities (over 70%) of Nepal. The high Himalayas have also served as a Palaearctic refugium, and many of the animal species found there today represent Palaearctic faunal elements.

Several authors (Biswas 1966; Chesemore 1970; Hagen 1961; Karan 1960) have divided Nepal into seven broad biogeographical life zones. Stainton (1972) listed eight geographic and vegetational divisions. Troll (1967) and Haffner (1967) discussed the climatic zones and Hara (1966) described the phytogeography of the eastern Himalayas with reference to eastern Nepal. Bhatt (1964) and Banerji (1965) listed five major vegetational and climatic zones, while Schweinfurth (1957) handled the horizontal and vertical vege-

tational zones for the country.

Climate

Reliable data on the climate are scarce. Meteorological observations were kept by Kihara (1956) from the 1952 and 1953 Japanese expeditions. Since 1962, the Swiss have maintained several meteorological stations in eastern and western Nepal. Hagen (1961) recorded precipitation and temperatures during his seven year stay. Kraus (1966) charted the climatic patterns for eastern Nepal in his meteorological researches of the Himalayas.

Nepal has a monsoon climate with heavy rainfall from mid-June through September. Nearly 80% of the total precipitation falls within this period. The characteristic mark of the monsoon climate is the preponderant summer east wind. Monsoon rains approach from the Bay of Bengal, thus reaching the eastern portion of the country first. Precipitation decreases steadily from east to west. The altitude of the great Himalaya range has a profound effect on the climate, protecting the southern portion of the country from cold winter winds generated in the Tibetan Plateau.

Climatic Divisions

Located between the tropical Gangetic Plain and the arid, alpine Tibetan Plateau, Nepal has an intermediate

climatic pattern with considerable variation due to the great altitudinal difference within such a small area. At least three major climatic zones are recognized for the country:

(1) the hot and humid tropical and subtropical region of the Terai, Siwaliks and duns, (2) the cooler (microthermal) region of the Mahabharat Lekh and midlands and (3) the subalpine and alpine region of the greater Himalayas and Tibetan Plateau (Karan 1960; Kawakita 1956).

Precipitation

Rainfall

Precipitation figures for Nepal are cited from the following: Hagen 1961, Hara 1966, Karan 1960, Kihara 1956, Kraus 1966 and Stainton 1972. Rainfall figures from different regions of the country are listed in Table 1.

A moderate climate is found only in the mountain valleys between 1500 to 2500 m. The rest of the country suffers either from extreme heat, as in the Terai and duns, or extreme cold, as in the mountainous areas to the north. The Terai is an area of tropical monsoon climate. The summer monsoons and the practically rainless winters extend into mountain valleys to an elevation of 4500 m. Some areas of the east receive up to 3000 mm of rainfall annually compared to 800 mm in the far west.

The Himalayas are a one-sided meteorological limit.

Table 1. Rainfall figures for Nepal.

Life zone	Location and altitude	Average amount of precipitation (in mm)
East Terai	Biratnagar 150 m (1949-1960)	1687
East Siwaliks	Darjeeling ^a 2100 m	3100
East Siwaliks	Dharan 300 m	2366
East midlands	Jiri 1895 m (1962-1964)	2387
Central midlands	Kathmandu 1340 m (1962) (Avg. 27 year period)	1419
West midlands	Pokhara 910 m (1957-1965)	3477
West midlands	Jumla 2300 m (1957-1964)	747
Tibetan Plateau	Jomosom 2650 m (1959-1963)	295
Greater Himalayas West	Dhorpatan 3000 m (1963)	1500
East	Namche Bazaar 3400 m	940
West Terai	Kanchanpur 150 m	762

^aDarjeeling, West Bengal, India

They receive moisture only from the south side. In the midlands and in some of the mountain valleys, there is another local differentiation--dry valleys. These dry valleys are insulated by the surrounding mountains. On the northern side of the Himalayas (Tibetan Plateau) little precipitation falls during the summer months.

The moist monsoon air approaching from the Bay of Bengal is forced to rise when it meets the mountains. In general, then, the southern slopes of the mountain ranges receive very heavy rainfall. Pokhara (west midlands), which lies close to the southern flank of the Annapurna Range, receives the heaviest rainfall of any place in Nepal at which meteorological records are kept.

Snow

Snowfall is heaviest in western parts of the country and the snowline extends lower than in the east. By mid-April the snow melts from much of the eastern alpine region, while most of the snow disappears from the western alpine region by early June.

Temperature

Except for the Kathmandu Valley, temperature records have been little kept in Nepal. A few records, for short periods of time, were recorded by me. The yearly mean temperature at Kathmandu (1340 m, 27 year period) is 18.1°C

with a mean maximum of 23.9°C and a mean minimum of 9.8°C (Kawakita, 1956).

From 24 January, 1969, to 10 February, 1969, the daily mean maximum and minimum temperatures for Dhorpatan, Dolpa District (3000m), were: mean maximum 12°C , mean minimum -18°C . Kraus (1966) listed readings for the months of January and February 1965 for Dhorpatan as mean prox. 13°C , 11°C , mean min. -21°C , -17°C .

Temperature readings from Nepalganj (western Terai) were recorded for two separate periods, 30 March, 1968 to 14 April, 1968 and 19 December 1969 to 7 January, 1970. For the first period, the mean maximum temperature recorded was 41.1°C and for the second, 19.4°C . Temperatures as high as 47.2°C were recorded from Nepalganj.

Thus, the temperature patterns are: Pre-monsoon heat from mid-March to early June raises the temperature to 39°C - 47°C in the Terai and foothills. In the midlands (2500 to 3500 m), because of the cooling monsoons, temperatures fluctuate between 6°C and 11°C . Winter temperatures reach a low of -30°C in the inner Himalayas.

Life Zones

Following is a discussion of climate and phytogeography of each of the major zoogeographical zones. The zones are treated in order of ascending altitude.

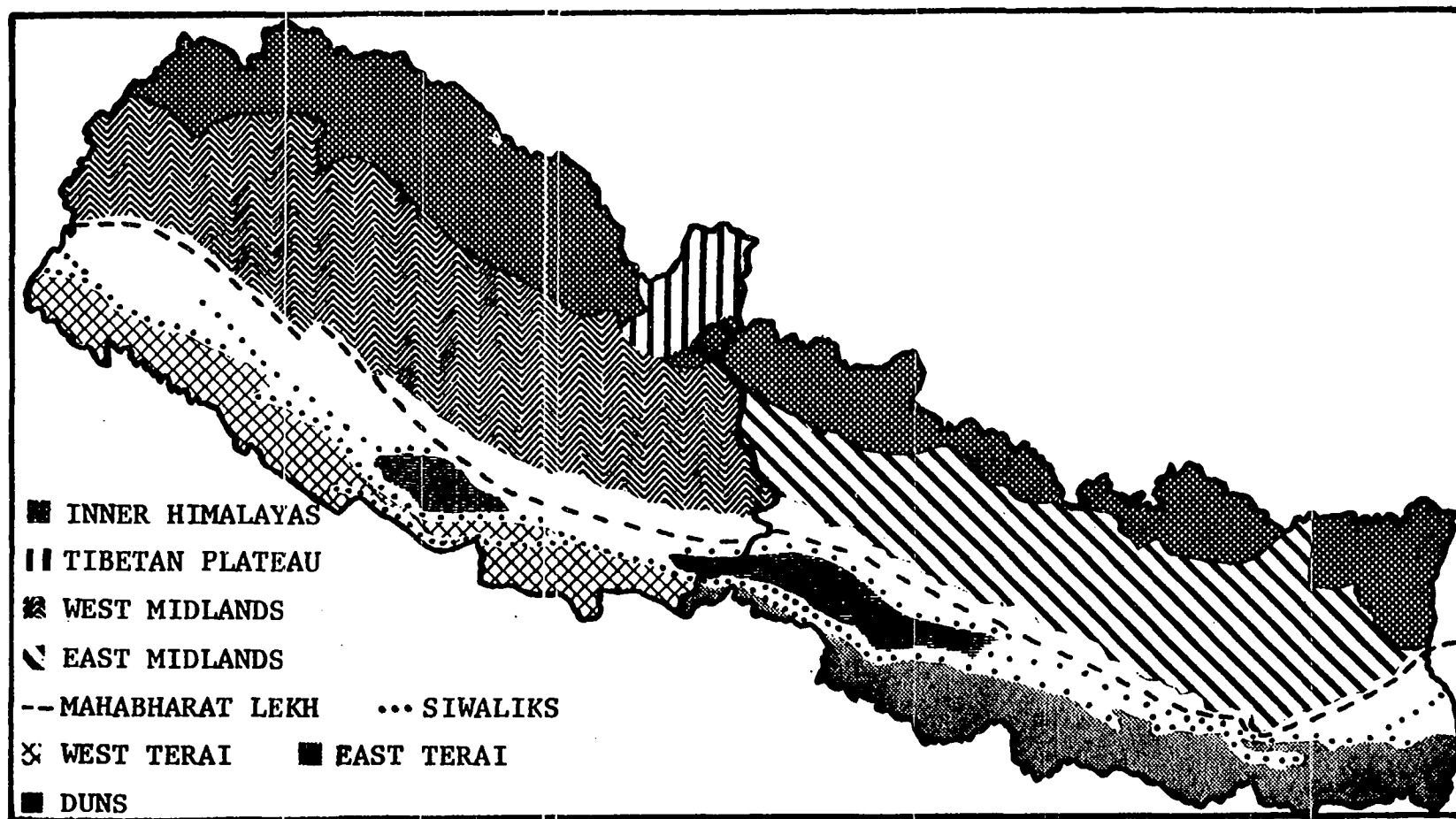


Fig. 2. The life zones of Nepal

The Terai

The Terai comprises the northern extension of the Gangetic plain and varies in width from 25 to 36 km. It extends across the entire northern border of India and ranges in elevation from 100 to 300 m. This region is a land of rivers and is arbitrarily divided into west and east along the Narayani River (Fig. 2). From mid-June through September monsoon rains fall, accounting for approximately 80% of the total precipitation. Precipitation decreases steadily from east (1700 to 2000 mm) to west (700 to 900 mm) (Karan 1960).

The tropical deciduous and semideciduous forests of the Terai are divided into three major types (Stainton 1972): (1) Homogenous sal (Shorea robusta) forests (Fig. 3) grow in fairly open stands, with little undergrowth except grasses (Saccharum, Andropogon and Setaria). These stands cover the higher regions of the Terai and the hills along the southern edge of the Siwaliks. (2) The riparian forests, found along the rivers and streams, are composed primarily of Acacia catechu and Dalbergia sissoo. These forest areas are subject to annual flooding during the monsoon period. (3) A mixed forest zone occupies the area between the riparian and sal forests. Banyan (Ficus religiosa), Jarul (Lagerstroemis), silk-cotton (Salmalia) and Semal (Bombax sp.) are prominent species of the mixed forest zone.

Large portions of the Terai have been cleared for

Fig. 3. The homogenous sal forests (Shorea robusta) of the western Terai; Sisaiya, Kanchanpur District (200 m).

Fig. 4. The elephant grass complex of the eastern Terai; Madhuban, Bara District (65 m). Dominant vegetation types: Cymbopogon sp. and Bothriochloa sp.



agriculture and are now indistinguishable from the Gangetic plain to the south. Both are treeless except for scattered mango groves and for elephant grass (Cymbopogon sp. and Bothriochloa sp.) which predominates in these disturbed areas (Fig. 4).

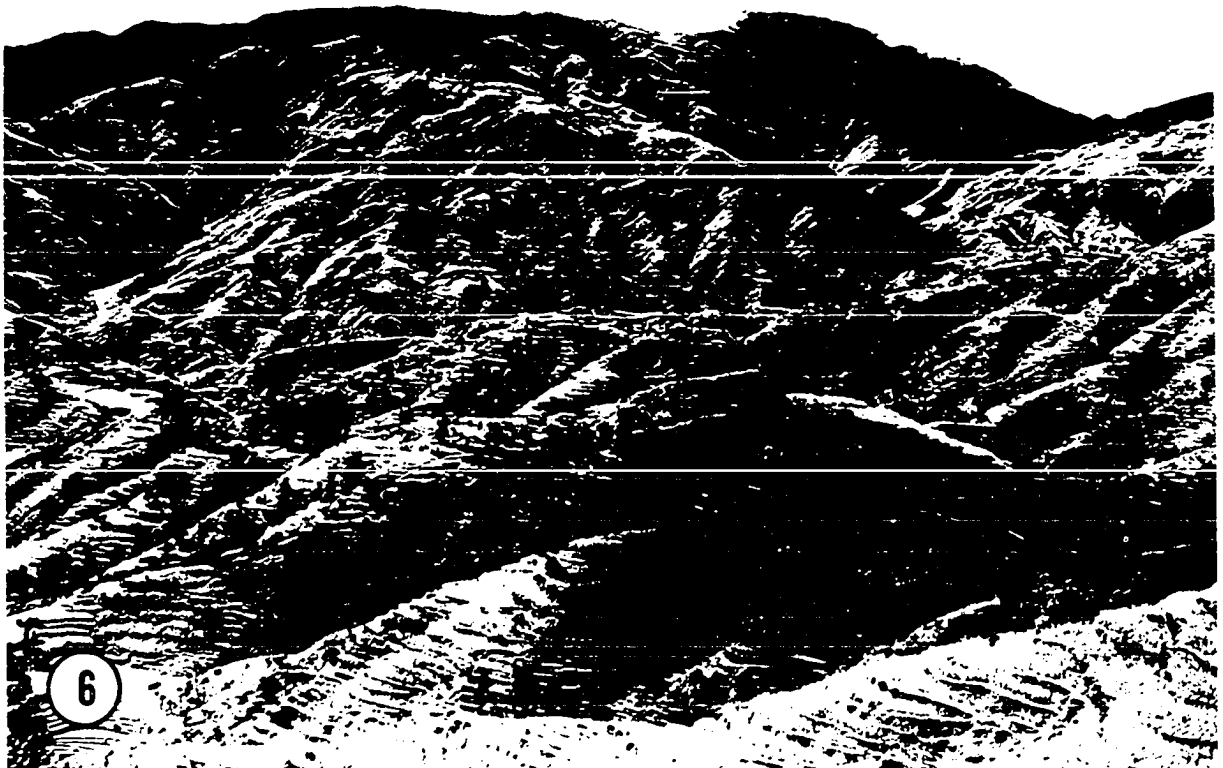
The Siwaliks

The Siwaliks (Fig. 5) comprise the southernmost foothills of the Himalayan system. These sandstone hills rise out of the Gangetic plain; and the elevation varies from 300 to 1200 m, the highest peaks reaching approximately 2000 m. It is not an independent range, for in some areas the Mahabharat chain, which lies behind and to the north, merges directly into the Siwaliks. In other areas the two ranges are separated by the dun valleys. This range of low hills extends the entire length of Nepal.

A large number of streams originate in the Siwalik Range. The dominant floral components are the subtropical moist hill pines (Pinus roxburghii, P. excelsa). Tropical deciduous vegetation occurs in the east and subtropical deciduous forests develop farther west. The eastern forests consist of sal (Shorea robusta) on the lower slopes; with Schima-Castanopsis forests growing from 700 to 2000 m. Sub-tropical evergreen forests of Eugenia tetraginia and Ostodes paniculata occur between 1000 and 1800 m. In west Nepal, the forests consist of sal at lower elevations (300 to 500 m) and

Fig. 5. The Siwalik foothills near Megauli, Chitwan District (350 m). Forests consist of Shorea robusta on lower slopes and Schima-Castanopsis on upper slopes.

Fig. 6. The heavily farmed lower slopes of the Mahabharat Lekh near Bhimpheedi, Makwanpur District (1500 m).



chir pine (Pinus roxburghii) at middle altitudes (700 to 1350 m). Quercus incana - Quercus lanuginosa forests are widespread above the pine belt (Stainton 1972).

The Mahabharat Lekh

The Mahabharat Lekh, or middle Himalayas, lying to the north of the duns, are an intricate array of high ranges (1300 to 4000 m) extending the length of Nepal. This system, lying between the inner Himalayas and Siwalik hills, averages 80 km in width. It is cut by deep ravines and, because of the rugged terrain, only the lower slopes support a dense human population (Fig. 6). The southern slopes are generally too steep to maintain a soil cap for the growth of trees. The northern slopes are less steep and support dense stands of vegetation.

The Mahabharats represent a temperate climatic region with a cool, humid climate. The forests consist of a mixture of many species, chiefly pine, larch, oak, rhododendron, poplar, walnut, alder and magnolia and fir. The dominant species in the eastern Mahabharat forests are oak, magnolia, larch and pine. Fairly extensive pine forests still exist in the western sector.

The Mahabharat forests are divided into lower, middle and upper zones. At lower altitudes (1360 to 1820 m), Pinus wallichiana, P. roxburghii, Quercus sp., Acer sp., Castanopsis indicus and Pyrus sp. are the dominant species.

At middle altitudes (1820 to 3030 m), Quercus semecarpifolia, Q. incana, Juglans regia, Alnus nepalensis, Salix sp., Magnolia sp., Cedrus deodora, Picea sp., Abies sp., Pinus excelsa, Berberis sp., Rubus sp. and Rhododendron arboreum are found. Epiphytic orchids and ferns abound in these forests. In the upper zone (3000 to 3600 m), the forests consist of fir (Abies spectabilis) mixed with birch (Betula utilis) (Bhatt 1964). Stainton (1972) listed 29 species of Rhododendron for Nepal, of which the majority occur in the Mahabharat Range.

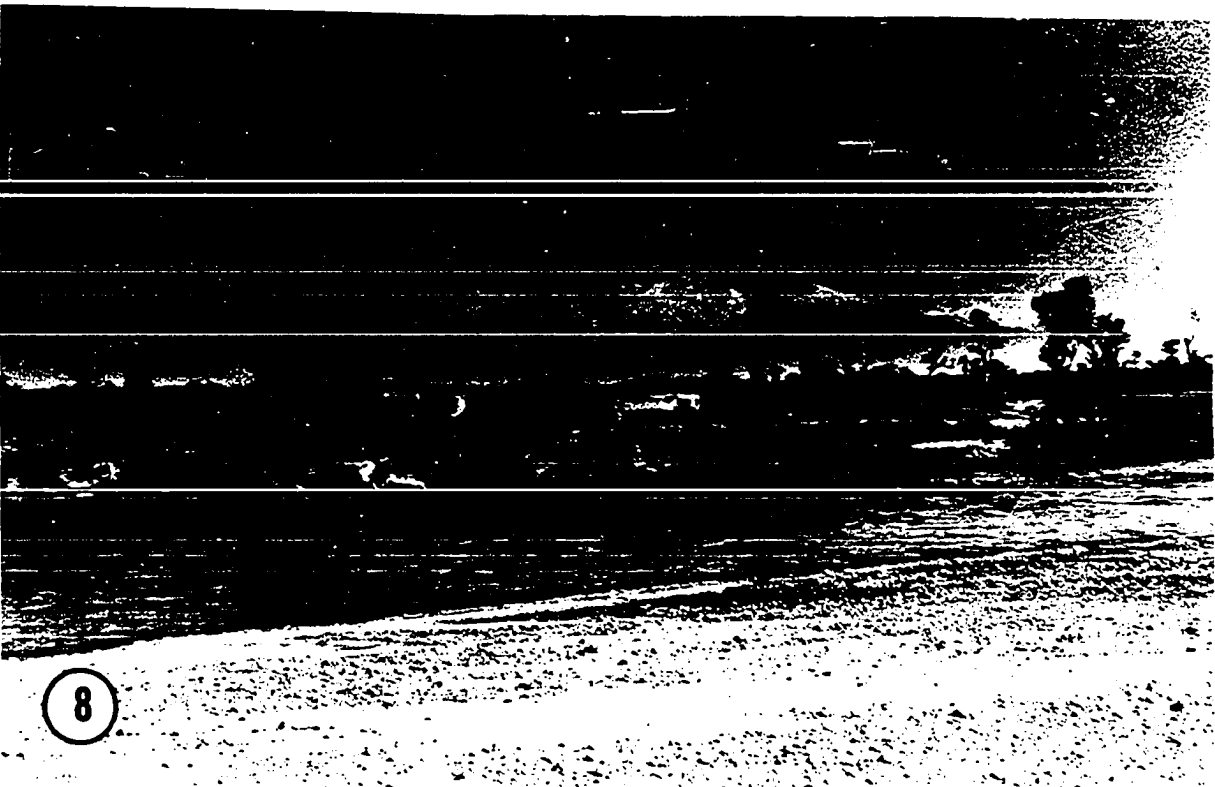
The duns

Between the Siwalik Range and the Mahabharat Lekh on the north is a series of longitudinal valleys running northwest-southeast. These valleys, called duns, are geosynclinal troughs (Wadia 1953). The largest dun valleys are the Dang in the west and the Rapti and Chitwan valleys in the central region. The Rapti and Chitwan valleys, commonly called the Rapti Dun, are joined. These wide valleys range from 300 to 1370 m. The tropical monsoon climate is similar to that of the Terai.

The nearly treeless Dang Valley (Fig. 7) has been extensively cultivated for centuries. Clumps of bamboo and mangoes are the only prevalent trees on this broad, flat plain. Sal forests still exist at the northern edge of the valley, but these areas are rapidly being cut and burned over

Fig. 7. The heavily cultivated Dang Dun; Darakhuti, Dang Deokhuri District (750 m).

Fig. 8. The forested Rapti Dun; Bhimliya, Chitwan District (175 m).



for farmland.

In the Rapti Dun (Fig. 8), the largest of these valleys, two major rivers, the Narayani and the Rapti, drain southward through the region and eventually join the Great Gandak River in India. The area is heavily clothed in deciduous forests similar to those described for the Terai: sal, mixed and riparian. Another distinct vegetation is the tall elephant grass complex (Saccharum sp., Cymbopogon sp., and Bothriochloa sp.) that grows along rivers and in disturbed areas. Heavy agriculture has denuded the area of much of its original forest.

The midlands

The midlands, the zone in which the Kathmandu Valley lies, is situated between the Mahabharat Lekh to the south and the inner Himalayas to the north. This zone, with elevations varying from 600 to 4000 m, is characterized by more gentle terrain and a temperate climate. The midlands support the heaviest human population. Most of the hillsides are denuded and are either terraced for cultivation or heavily grazed.

This region could be termed an anthropogenic zone (Hassinger 1968). By intermittent or continual grazing of domestic livestock, gathering vegetation for fuel or fodder and cultivating the hillsides, man has modified the environment. Many species of plants and animals have been eliminated

and most of the trees growing around the fields and villages have been planted. Surviving oak and rhododendron forests within reach of villages have been pruned heavily for fodder and firewood, but secondary growth has reclaimed abandoned fields. Rice, wheat, millet and corn are the principal crops of the area. Buckwheat and potatoes are grown at higher elevations (2400 to 3400 m).

The inhospitable greater Himalayas to the north and the malarious jungles of the Terai and Siwaliks to the south have concentrated the majority of the population in the midlands. The average width of the region is 60 to 100 km. Hagen (1961) separates this area into nine natural divisions based on the wide valleys of the large rivers that transverse this region. Stainton (1972) divides the area into the west, east and central midlands.

The west midlands

The west midlands lies between the Kumaon border and the Kali Gandaki River (Karan 1960). At lower elevations, both north and south facing slopes support Pinus roxburghii forests (900 to 2000 m), while Quercus incana and Q. lanuginosa forests grow between 1300 and 2400 m. Quercus semecarpifolia occurs above 2400 m and Abies spectabilis is found around 3000 m. Betula utilis is widespread above 3300 m (Stainton 1972).

Aesculus, Juglans and Acer occur along streams. Pinus

excelsa forests are widespread around Rara Tal, Mugu District (Fig. 9). Two other conifers found in the area are Cedrus deodora and Picea smithiana. Pinus excelsa, Juniperus wallichiana and Ephedra sp. are common around Dhorpatan. Tsuga dumosa forests are fairly widespread between 2100 and 3000 m. A few Rhododendron forests are found in the Jumla area. Rice is cultivated at lower elevations (900 to 1900 m) with barley and winter wheat grown at higher elevations (2100 to 3000 m). Rosa sp., Cornus sp. and Jasminum sp. grow along waterways and around cultivated lands.

The central midlands

This section of the country lies between the Kali Gandaki River on the west and the Arun-Kosi watershed to the east (Karan 1960). In most parts of the central midlands, western forest types are present on southern exposures and eastern forest types prevail on northern slopes.

The western forest type is composed of Pinus roxburghii (900 to 2000 m), Quercus incana and Q. lanuginosa (1900 to 2400 m), Q. semecarpifolia (2400 to 3000 m), with Betula utilis and Abies spectabilis growing at higher elevations (3200 m). Temperate mixed broadleaf forests of Acer, Magnolia, Osmanthus and Ilex sp. occur along streams. Wet ravines and gullies are overgrown with Alnus nepalensis.

Forest types typical of the east midlands found in the central midlands are: Schima - Castanopsis (1200 to 1800 m),

Fig. 9. The pine forests of the western midlands near Rara Lake, Mugu District (2875 m).

Fig. 10. The oak-rhododendron forests typical of the central and eastern midlands; Melumche, Sindu District (2390 m).



Michelia - Laurel - Lithocarpus (1500 to 2100 m) and Quercus - Rhododendron (2100 to 2400 m) (Fig. 10). Tsuga dumosa forests are dominant from 2100 to 3300 m, interspersed with homogenous stands of Rhododendron sp.

Sal and subtropical deciduous hill forests occur in some of the lower valleys such as Trisuli, Nuwakot District. Dalbergia sissoo and Acacia catechu also grow along the rivers in these low-lying valleys (600 to 1200 m).

The east midlands

This section is bordered on the west by the Arun-Kosi watershed and by the Sikkim-Darjeeling border to the east (Karan 1960). The east midlands are heavily populated and large tracts of the original forests have been destroyed. Schima-Castanopsis forests are widespread at low elevations and are succeeded (from 1500 to 2100 m) by temperate broad-leaved forests composed of Lithocarpus, Quercus glauca, Michelia sp. and many species of the laurel family. Quercus lamellosa is found up to 2400 m. The upper temperate mixed forests of Abies spectabilis and Tsuga dumosa grow on the higher slopes (Stainton 1972). In wet, shady places subtropical, semi-evergreen, hill forests prevail, in which tree ferns and Pandanus furcatus are prominent.

The Inner Himalayas

The inner or greater Himalayas comprise the zone of

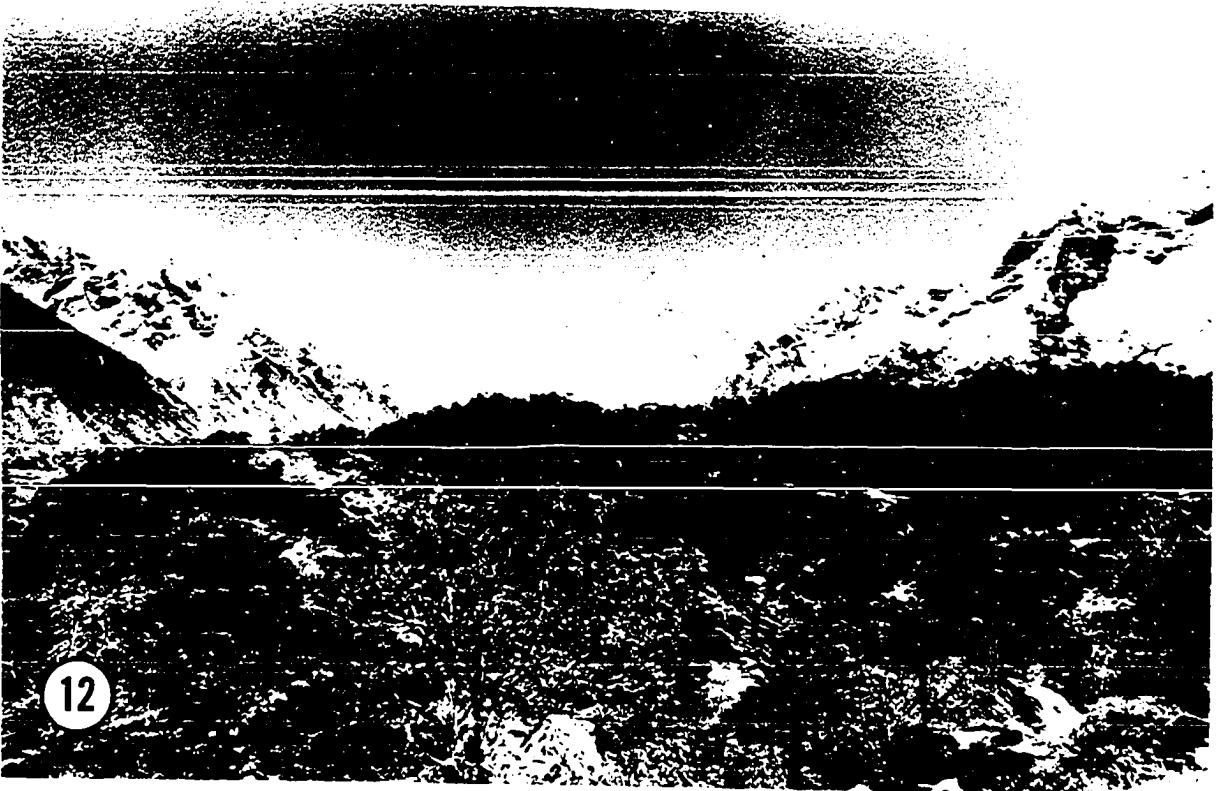
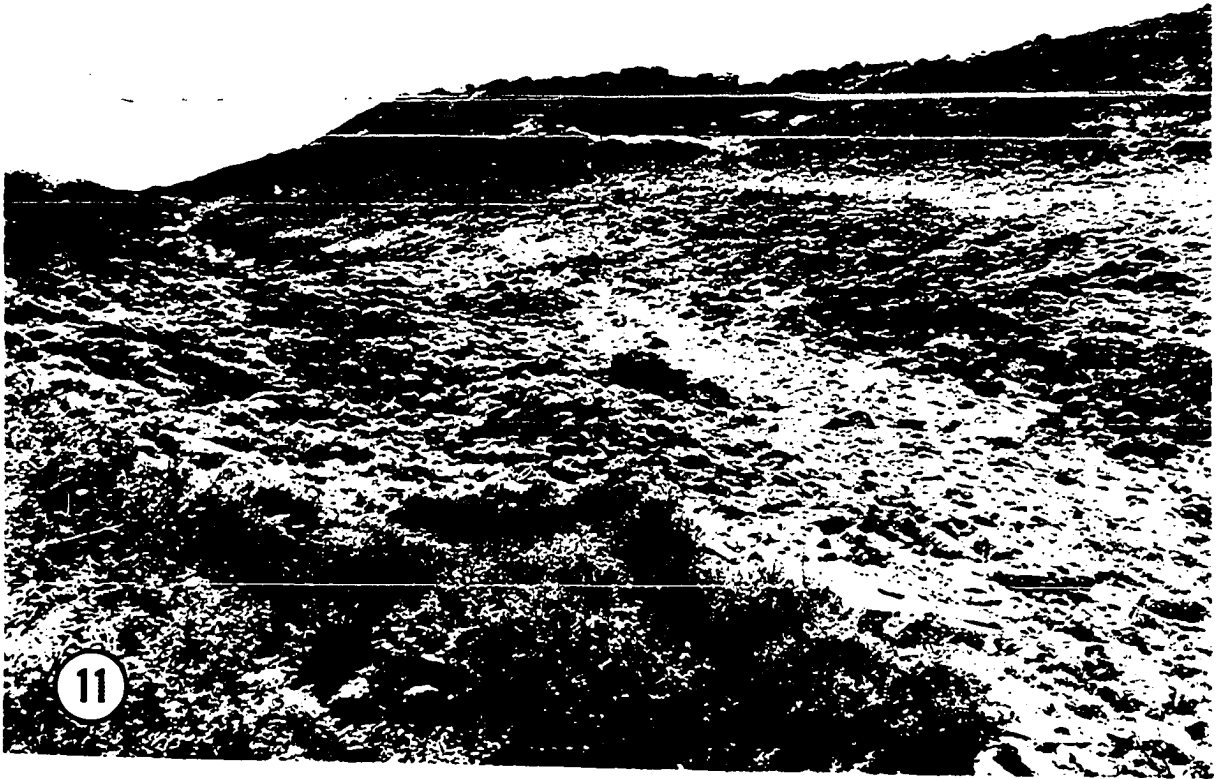
highest elevation (3600 to 8800 m) with nine peaks towering over 8000 m. In this zone, elevated plateaus and high mountain ranges are separated from one another by great depressions. The inner Himalayas rise abruptly north of the midlands, forming a steep, rugged barrier along Nepal's northern border.

Rivers have eroded wide valleys in the greater Himalayas. These valleys run east and west, parallel to the strike of the mountains. From west to east, the large valleys of the inner Himalayas are: Humla, Mugu, Langu, Thakkhola, Manang, Kutang, Kyirong, Rongshar, Khumbu and Karma (Hagen 1961). They range in elevation from 2400 m to more than 5000 m. Stainton (1972) has charted the location of these inner valleys.

Glaciers still exist in the high Himalayas, but they are a mere remnant of those which flourished in the past. The inner Himalayas have a characteristic glaciated appearance and the valleys are filled with moraines and glacial debris. Terminal moraines are now covered with alpine grasses and these areas constitute subalpine and alpine regions (Fig. 11). The tree line lies between 3600 to 3900 m and extends to 4500 m in some sections of the east. Stands of Pinus excelsa mixed with spruce (Picea morinda) and fir (Abies pindrow) occur from 2700 to 3000 m (Fig. 12). These forests give way to cypress (Cupressus torulosa) and junipers (Juniperus squamata). Birch (Betula utilis) grows near the tree line (Karan 1960).

Fig. 11. The alpine meadows of the inner Himalayas, central Nepal; Dhukphu, Sindu District (3865 m).

Fig. 12. The evergreen forests of the inner Himalayas near Namche Bazaar, Solukhumbu District (2750 m).



The upper region of the alpine zone (4200 to 4600 m) consists of stunted bushes of Rhododendron and Salix. Some herbaceous plants found in the alpine region are Potentilla, Primula, Gentiana and Saxifraga.

Potatoes and buckwheat are the principal crops grown in these high valleys, and sheep, yaks and zhumos are pastured on the high alpine meadows.

The Tibetan Plateau

The Tibetan marginal mountains mark the southern edge of the true Tibetan Plateau. They occur along the northernmost border of Nepal (Hagen 1961), reaching 6000 to 7000 m and having the arid climate typical of the Tibetan Plateau proper. The Tibetan Zone (Mustang District) lies north of the axis of the great Himalayan range. Only north of Jomosom is the edge of this region encountered. Here the mountains slope gently from south to north (Fig. 13).

The high alpine desert is largely devoid of vegetation except for a few trees and patches of xerophytic, thorny bushes (Fig. 14). Strong winds blow continuously throughout the area. Along the valley floor, the vegetation consists of Sophora, Lonicera and Caragana with a few Prunus growing around irrigated land. Stunted forests of Juniperus walli-chiana grow on the exposed southern slopes and Ephedra and Artemisia are found along the flood plain of the Kali Gandaki River. Winter wheat is the principal cultivated crop.

Fig. 13. The alpine desert biotope of the Tibetan Plateau;
Jomosom, Mustang District (2650 m).

Fig. 14. The xerophytic vegetation of the Tibetan Plateau
near Jomosom, Mustang District (2650 m).



MATERIALS AND METHODS

Personnel

The Nepal ectoparasite field team consisted of me, my wife Marleane, a Nepalese assistant, Mani K. Lama and a cook, Ang Kami Sherpa. I served as liaison between the project and His Majesty's Government, Ministry of Health, and conducted the field research. Mr. Lama acted as interpreter and assisted in the preparation of museum specimens. My wife planned and organized all supplies and photographed habitat sites and mammal specimens. The expedition engaged additional local porters, guides and camp help as needed at each major collecting locality.

Procedures

The principal goal of the Nepal Ectoparasite Program was to collect a geographically and ecologically representative sample of high altitude mammals and ectoparasites from Nepal. Representative ecosystems were sampled by establishing a series of collecting sites, each site unique in that it was in a geographically, topographically or floristically different area.

Field trips were planned to last approximately two months. Transportation to each site varied. Most localities in the Terai and duns were accessible by jeep or air. Heli-

copter and STOL aircraft were employed to reach destinations in the midlands. Human porters and yaks were used to transport gear to the inner Himalayas and the Tibetan Plateau.

Collection Methods

Mammals and birds were collected by various means to determine their kinds, distribution and interrelationships with the different life zones and ectoparasite load. Museum Special snap traps baited with peanut butter and rolled oats were used to capture small rodents and insectivores. Steel traps baited with meat were employed to take small and medium-sized carnivores. A 12-gauge shotgun and a .22 rifle were used to obtain foxes, jackals, cats, lagomorphs and game birds. Large carnivores and game animals were taken with a 30-06 rifle. Japanese mist nets were suspended over streams and clearings to snare birds and bats. A predator call was used to lure carnivores within gun-shot range. Night-hunting with the aid of a spotlight proved productive for canids, felids, viverrids and lagomorphs.

At each collection site, traps and nets were set in selected habitats. They were checked three times daily (dawn, dusk and night) for hosts. Each host was placed in a clean cotton sack and the sack was secured to prevent the loss of ectoparasites.

Ectoparasites were collected from mammals by vigorously brushing the host over a deep, white plastic pan. Each host

was then examined carefully around the eyes and ears for ticks, the flanks and belly for fleas, and the urogenital area for mites. The local livestock was also checked for ectoparasites. Crevices around bat caves and poultry roosts were checked for argasid ticks. Bat guano was examined for fleas and larval and nymphal stages of ticks. A white flannel cloth was employed to flag for ticks along game trails, shrubbery and vegetation. Bird and mammal nests were examined for fleas, mites and ticks.

From each collection site a series of representative study skins of mammals and birds was prepared for subsequent study. Small birds and bats were preserved in 70% ethyl alcohol (ETOH) or 10% formalin. For large mammals, flat skins were prepared and the skulls saved. The following external measurements (in mm) were recorded for mammals: total length, tail length, hind foot and ear. The breeding condition of each mammal was also checked. Males were examined for enlarged testes and females for embryos, uterine scars and signs of lactation. Ecological notes were recorded on the habitat and photographs were taken of collection sites and host mammals.

Analysis of Data

The host-ectoparasite data were numerically analyzed (see Sneath and Sokal 1962; Sokal and Sneath 1963) to determine: (1) host preference and specificity, (2) host specificity of

ectoparasites (70% criterion), (3) total number of ectoparasites collected and (4) mammals collected from each life zone. Cluster techniques (Sneath and Sokal 1973) were employed to determine the host affinity between geographic realms and life zones. Standard statistical methods were used to derive the mean, range, standard deviation and coefficient of variance for mammal body measurements.

SPECIAL TERMS

The following words used in the text require definition:

Duns - Synclinal depressions (valleys) within the Siwalik formation.

Khola - River

Lekh - Mountain Range

Shekari - Local Hunter

Tal - Lake

Terai - The northern extension of the Gangetic Plain, or the malarious lowland belt of Nepal. It varies in width from 25 to 36 km and in elevation from 100 to 300 m.

Zhumo - Female offspring of the cow/yak cross

Zhupiak - Male offspring of the cow/yak cross

COLLECTION SITE GAZETTEER

The exact location and spelling of Nepalese place names are often difficult because of differing ways of transliterating names from Nepali to Latin characters, as well as the application (on different maps in the literature) of various names to one locality or one name to several localities. This real or potential ambiguity is compounded by the instability of zonal and district names and boundaries. Therefore, to make the exact location of collection records more certain, each collection site is designated by a place name, a district name, map coordinates and an altitudinal range. In addition, a number is placed beside each place name which corresponds to each collection site (Fig. 1, folding map). When several place names are located close to each other, they are placed under one collection site.

This gazetteer is limited to collection sites from which the Nepal Ectoparasite Program and the Arun Valley Wildlife Expedition secured host-ectoparasite information. The place names and coordinates employed are from maps compiled by the Army Map Service (RMBM), Corps of Engineer, U.S. Army, Washington, D.C., Edition 2-AMS, 1955. India and Pakistan 1:250,000, Series U502.

Place Name	District	Map Co-ordinates	Altitude (m., approx.)
1 Bahwanipur	Banke	27°57'N, 81°47'E	153
2 Bajapur	Banke	28°02'N, 81°51'E	236
3 Banepa	Kabhre (Palanchok)	27°37'N, 85°34'E	1180
4 Batar	Nuwakot	27°53'N, 85°10'E	1622
5 Bathang	Mustang	28°45'N, 83°45'E	2950
6 Belumche	Sindu	27°56'N, 85°29'E	2270
7 Bhadrapur (Chandra Garhi)	Jhapa	26°37'N, 88°02'E	221
8 Bharatpur	Chitwan	27°35'N, 84°11'E	182
9 Bhimliya (Tiger Tops)	Chitwan	27°32'N, 84°13'E	177
10 Bijauri	Dang Deokhuri	28°07'N, 82°22'E	737
11 Charang	Mustang	29°04'N, 83°56'E	3687
12 Chautha	Jumla	29°27'N, 82°06'E	2507
13 Chelegaon	Mustang	28°55'N, 83°50'E	2950
14 Chhukgaon	Mustang	28°54'N, 83°50'E	2802
15 Chobar	Kathmandu	27°40'N, 85°17'E	1327
16 Dandigaon	Bajhang	29°33'N, 81°11'E	1770
17 Darakhuti	Dang Deokhuri	28°09'N, 82°17'E	773
18 Devighat	Nuwakot	27°56'N, 85°09'E	752
19 Dhangarhi	Kailali	28°40'N, 80°34'E	200
20 Dhobato	Sindu	27°58'N, 85°29'E	2655
21 Dhorpatan	Dolpa	28°33'N, 83°05'E	2640
22 Dhukphu	Sindu	28°06'N, 85°35'E	3864
23 Dubi Karka	Ramechap	27°44'N, 86°23'E	3602
24 Duglha	Solukhumbu	27°56'N, 86°51'E	4469
25 Dumkhauli	Nawal Parasi	27°34'N, 84°05'E	143
26 Ghilinggaon	Mustang	28°59'N, 83°51'E	3687
27 Godavri	Lalitpur	27°37'N, 85°25'E	1475
28 Gokarna (King's Forest)	Kathmandu	27°44'N, 85°24'E	1327
29 Gosainkund Lakes	Nuwakot	28°03'N, 85°25'E	4056

Place Name	District	Map Co-ordinates	Altitude (m., approx)
30 Gosainkund Pass	Nuwakot	28°04'N, 85°26'E	4285
31 Gulari	Banke	28°04'N, 81°45'E	124
32 Hitura	Makwanpur	27°27'N, 85°04'E	549
33 Jomosom	Mustang	28°46'N, 83°45'E	2652
34 Jumla	Jumla	29°17'N, 82°11'E	2301
35 Kadari (and surrounding)	Sindu	27°56'N, 85°56'E	2270-2375
36 Kakani	Nuwakot	27°49'N, 85°16'E	2248
37 Kalapani	Mustang	28°39'N, 83°37'E	2389
38 Kaldapeh	Sindu	28°03'N, 85°35'E	2478
39 Kailali	Kailali	28°44'N, 80°35'E	147
40 Kathmandu	Kathmandu	27°43'N, 85°18'E	1302-1350
41 Khangjung	Rasuwa	28°11'N, 85°22'E	2212
42 Khumjung	Solukhumbu	27°49'N, 86°44'E	3555
43 Kildonphu	Sindu	28°08'N, 85°35'E	4056
44 Kyangjin Ghyang	Rasuwa	28°12'N, 85°35'E	3614
45 Langtang (and Langtang Valley)	Rasuwa	28°13'N, 85°23-25'E	3290-3687
46 Lobuche	Solukhumbu	27°57'N, 86°51'E	4661
47 Lukla	Solukhumbu	27°41'N, 86°44'E	2699
48 Lupra	Mustang	28°48'N, 83°47'E	3540
49 Madhuban	Bara	27°04'N, 85°06'E	65
50 Mahadeva	Banke	28°13'N, 81°46'E	221
51 Maharang Pass	Mustang	29°06'N, 83°55'E	3835
52 Maharigaon	Jumla	29°21'N, 82°23'E	3060
53 Mahendranagar (#1)	Kanchanpur	28°58'N, 80°13'E	212
54 Mahendranagar (#2)	Banke	28°06'N, 81°49'E	147
55 Mani Gayru	Sindu	27°56'N, 85°30'E	2360
56 Melumche (and surrounding)	Sindu	27°56'-28°05'N, 85°32-33'E	1770-3097
57 Muktinath	Mustang	28°48'N, 83°52'E	3466
58 Mulkharka	Sindu	27°47'N, 85°26'E	1504

Place Name	District	Map Co-ordinates	Altitude (m., approx.)
59 Mustang (Lho Mantang)	Mustang	29°12'N, 83°57'E	3687
60 Nangetanti	Mustang	28°22'N, 83°44'E	2507
61 Naura	Bajhang	29°33'N, 81°17'E	1770
62 Nepalganj	Banke	28°04'N, 81°37'E	118
63 Pangboche	Solukhumb:	27°52'N, 86°47'E	3791
64 Patan	Kathmandu	27°41'N, 85°20'E	1327
65 Phulung Ghyang	Nuwakot	28°07'N, 85°22'E	2360
66 Pithlekh	Bajhang	29°35'N, 81°12'E	2139
67 Ramche	Nuwakot	28°03'N, 85°13'E	1622
68 Rara Lake (and surrounding)	Mugu	29°34'N, 82°05'E	2876
69 Serdingma	Ramechab	27°39'N, 86°23'E	2950
70 Shamsherganj	Banke	28°05'N, 81°47'E	147
71 Simri	Bara	27°07'N, 85°14'E	89
72 Singasing	Kathmandu	27°47'N, 85°26'E	1711
73 Sisaiya	Kanchanpur	28°55'N, 80°22'E	214
74 Sundarijal	Kathmandu	27°46'N, 85°28'E	1475
75 Surkemela	Bajhang	29°35'N, 81°09'E	2479
76 Syahru	Nuwakot	28°09'N, 85°23'E	2168
77 Syaburbensi	Rasuwa	28°11'N, 82°22'E	1475
78 Tamaspur	Nawal Parasi	27°34'N, 83°57'E	94
79 Tarke Ghyang	Sindu	28°02'N, 85°34'E	2354
80 Thare Pati (Uring Ghyang)	Sindu	28°01'N, 85°30'E	3385
81 Thodung	Ramechab	27°37'N, 86°22'E	2979
82 Trisuli Bazaar	Nuwakot	27°56'N, 85°08'E	546
83 Bharabise	Sankhuwasabha	27°26'N, 87°19'E	515
84 Chainpur	Sankhuwasabha	27°18'N, 87°19'E	1182
85 Chepua (and surrounding)	Sankhuwasabha	27°40-46'N, 87°21-24'E	1515-2273

<u>Place Name</u>	<u>District</u>	<u>Map Co-ordinates</u>	<u>Altitude (m., approx.)</u>
86 Kasua Khola	Sankhuwasabha	27°35-58'N 85°15-17'E	1515-4030
87 Kimathangka	Sankhuwasabha	27°50'N, 87°25'E	2667
88 Num (and surrounding)	Sankhuwasabha	27°20-40'N, 87°16-19'E	1970-3455
89 Tumlingtar	Sankhuwasabha	27°17'N, 87°13'E	455

CHECK-LIST OF THE RECENT MAMMALS

The following is a list of terrestrial mammals belonging to 10 orders, 25 families, 78 genera and 144 species and sub-species collected or reported from Nepal. Eighteen other species asserted to occur in Nepal are not included.

The arrangement of orders follows that of Simpson (1945) and family, generic and specific names those of Ellerman and Morrison-Scott (1966). An asterisk by a species denotes that it was collected or sighted for the first time from Nepal.

Order Insectivora

Family Tupaiidae

Tupaia glis lepcha Thomas, 1922

Family Talpidae

Talpa micrura micrura Hodgson, 1841

Family Soricidae

- *Sorex minutus thibetanus Kastschenko, 1905
- Sorex cylindricauda cylindricauda Milne-Edwards, 1872
- Sorex cylindricauda nepalensis Weigel, 1969
- Soriculus nigrescens nigrescens (Gray, 1842)
- Soriculus caudatus caudatus (Horsfield, 1851)
- Soriculus caudatus soluensis Weigel, 1969
- Soriculus gruberi Weigel, 1969
- Soriculus leucops (Horsfield, 1855)
- Suncus murinus caeruleus (Shaw, 1800)
- Suncus murinus soccatus (Hodgson, 1845)
- Suncus murinus tytleri (Blyth, 1859)
- *Suncus etruscus pygmaeoides (Anderson, 1877)
- *Suncus stoliczkanus stoliczkanus (Anderson, 1877)
- *Crocidura horsfieldi horsfieldi (Tomes, 1856)
- *Crocidura attenuata rubricosa Anderson, 1877
- *Crocidura sp.

Chimmarogale platycephala himalayica (Gray, 1842)
 *Nectogale elegans sikhimensis de Winton & Styan, 1899

Order Primates

Family Cercopithecidae

Macaca mulatta mulatta (Zimmermann, 1780)
Macaca assamensis pelops (Hodgson, 1840)
Presbytis entellus schistaceus (Hodgson, 1840)
Presbytis entellus achilles (Pocock, 1928)

Order Pholidota

Family Manidae

Manis pentadactyla aurita Hodgson, 1836

Order Lagomorpha

Family Leporidae

Lepus nigricollis ruficaudatus Geoffroy, 1826
Lepus oiostolus oiostolus Hodgson, 1840
Caprolagus hispidus (Pearson, 1839)

Family Ochotonidae

Ochotona roylei roylei (Ogilby, 1839)
Ochotona roylei wardi Bonhote, 1904
Ochotona macrotis wollastoni Thomas and Hinton, 1922
 *Ochotona daurica curzoniae (Hodgson, 1858)
Ochotona angdawai Biswas and Khajuria, 1955
 *Ochotona sp.

Order Rodentia

Family Sciuridae

*Belomys pearsoni pearsoni (Gray, 1842)
Petaurista elegans caniceps (Gray, 1842)
Petaurista elegans gorkhali (Lindsay, 1929)
Petaurista petaurista albiventer (Gray, 1834)
Petaurista magnificus (Hodgson, 1836)
Hylopetes alboniger alboniger (Hodgson, 1836)
Callosciurus pygerythrus lokroides (Hodgson, 1836)
Callosciurus maclellandi maclellandi (Horsfield, 1839)
Dremomys lokriah (Hodgson, 1836)
Funambulus pennanti pennanti Wroughton, 1905
Ratufa bicolor gigantea (M'Clelland, 1839)
Marmota bobak himalayana (Hodgson, 1841)

Family Hystricidae

- Hystrix hodgsoni hodgsoni (Gray, 1847)
Hystrix indica indica Kerr, 1792

Family Rhizomyidae

- Cannomys badius badius (Hodgson, 1842)

Family Muridae

- Vandeleuria oleracea dumeticola (Hodgson, 1845)
 *Vandeleuria oleracea modesta Thomas, 1914
Apodemus flavicollis gurrkha Thomas, 1924
Apodemus sylvaticus wardi (Wroughton, 1908)
Millardia meltada pallidor Ryley, 1914
Rattus rattus ssp.
Rattus rattus brunneus (Hodgson, 1845)
Rattus rattus brunneusculus (Hodgson, 1845)
Rattus nitidus nitidus (Hodgson, 1845)
Rattus turkestanicus (Satunin, 1903)
Rattus niviventer niviventer (Hodgson, 1836)
Rattus fulvescens fulvescens (Gray, 1847)
Rattus eha eha (Wroughton, 1916)
Mus musculus ssp.
Mus musculus homourus Hodgson, 1845
Mus musculus urbanus Hodgson, 1845
Mus booduga booduga (Gray, 1837)
Mus cervicolor cervicolor Hodgson, 1845
Golunda ellioti myothrix (Hodgson, 1845)
Bandicota bengalensis bengalensis (Gray & Hardwicke, 1833)
Bandicota indica nemorivaga (Hodgson, 1836)
Nesokia indica indica (Gray and Hardwicke, 1832)
 *Tatera indica indica (Hardwicke, 1807)
Alticola stoliczkanus stoliczkanus (Blanford, 1875)
Alticola stracheyi (Thomas, 1880)
 *Pitymys leucurus leucurus (Blyth, 1863)
Pitymys sikimensis (Hodgson, 1849)

Order Cetacea

Family Platanistidae

- Platanista gangetica (Lebeck, 1801)

Order Carnivora

Family Canidae

- Canis lupus chanco Gray, 1863
Canis aureus indicus Hodgson, 1833
Vulpes vulpes montana (Pearson, 1836)
Vulpes bengalensis (Shaw, 1800)

- *Vulpes ferrilata Hodgson, 1842
Cuon alpinus primaevus (Hodgson, 1833)

Family Ursidae

- Selenarctos thibetanus thibetanus (Cuvier, 1823)
Melursus ursinus ursinus (Shaw, 1791)

Family Procyonidae

- Ailurus fulgens fulgens Cuvier, 1825

Family Mustelidae

- Martes foina intermedia (Severtzov, 1873)
Martes flavigula flavigula (Boddaert, 1785)
Mustela altaica temon Hodgson, 1857
Mustela kathiah kathiah Hodgson, 1835
Mustela sibirica subhemachalana Hodgson, 1837
Mustela sibirica canigula Hodgson, 1842
Mustela strigidorsa Gray, 1853
Mellivora capensis inaurita (Hodgson, 1836)
Melogale personata nipalensis (Hodgson, 1836)
Arctonyx collaris collaris Cuvier, 1825
Lutra lutra monticola Hodgson, 1839
Lutra lutra aurobrunnea Hodgson, 1839
Lutra perspicillata perspicillata Geoffroy, 1826
Aonyx cinerea concolor (Rafinesque, 1832)

Family Viverridae

- Viverra zibetha zibetha Linnaeus, 1758
Viverricula indica wellsi Pocock, 1933
Prionodon pardicolor pardicolor Hodgson, 1842
Paradoxurus hermaphroditus bondar (Desmarest, 1820)
Paradoxurus hermaphroditus pallasii Gray, 1832
Paguma larvata grayi (Bennett, 1835)
Paguma larvata neglecta Pocock, 1934
Herpestes auropunctatus auropunctatus (Hodgson, 1836)
Herpestes edwardsi nyula (Hodgson, 1836)
Herpestes urva (Hodgson, 1836)

Family Hyaenidae

- *Hyaena hyaena hyaena (Linnaeus, 1758)

Family Felidae

- Felis chaus affinis Gray, 1830
*Felis lynx isabellina Blyth, 1847
Felis marmorata charltoni Gray, 1846
Felis temmincki temmincki Vigors and Horsfield, 1827
Felis bengalensis horsfieldi (Gray, 1842)
Felis viverrina Bennett, 1833
Neofelis nebulosa macrosceloides (Hodgson, 1853)
Panthera pardus fusca (Meyer, 1794)

Panthera tigris tigris (Linnaeus, 1758)
Panthera uncia (Schreber, 1776)

Order Proboscidea

Family Elephantidae
Elephas maximus indicus Cuvier, 1797

Order Perissodactyla

Family Rhinocerotidae
Rhinoceros unicornis Linnaeus, 1758

Order Artiodactyla

Family Suidae
Sus scrofa cristatus Wagner, 1839
Sus salvanus (Hodgson, 1847)

Family Tragulidae
*Tragulid meminna (Erxleben, 1777)

Family Cervidae
Moschus moschiferus moschiferus Linnaeus, 1758
Muntiacus muntjak vaginalis (Boddaert, 1785)
Axis axis axis (Erxleben, 1777)
Axis porcinus porcinus (Zimmermann, 1780)
Cervus unicolor niger Blainville, 1816
Cervus duvauceli duvauceli Cuvier, 1823

Family Bovidae
Tetracerus quadricornis (Blainville, 1816)
Boselaphus tragocamelus (Pallas, 1766)
Bos gaurus gaurus H. Smith, 1827
Bos grunniens grunniens Linnaeus, 1766
Bubalus bubalis bubalis (Linnaeus, 1758)
Antelope cervicapra cervicapra (Linnaeus, 1758)
Capricornis sumatraensis thar (Hodgson, 1831)
Nemorhaedus goral goral (Hardwicke, 1825)
Nemorhaedus goral hodgsoni Pocock, 1908
Hemitragus jemlahicus jemlahicus (H. Smith, 1826)
Pseudois nayaur nayaur (Hodgson, 1833)
*Ovis ammon hodgsoni Blyth, 1841

ACCOUNTS OF SPECIES

This section treats 130 species of free-living terrestrial mammals, excluding bats, which are known to occur in Nepal. Included are records of 17 mammals collected for the first time in Nepal, plus the accounts of two species previously recorded but now believed to be extinct.

Each account provides the accepted scientific name, together with a citation to the original description of the species and its type locality. Major taxonomic changes, distribution, Nepal records and the Nepal Ectoparasite Program collection records are also listed.

Major Taxonomic Changes: This section provides a citation of every major taxonomic name change for each species. Specific names recorded in earlier works and which have subsequently been relegated to synonymy are also listed.

Distribution: A very approximate geographic range is given for each species. These ranges are based on records in Ellerman and Morrison-Scott (1966), Checklist of Palaearctic and Indian Mammals, and type locality records.

Nepal Records: The records are based on collections of specimens by previous expeditions and individuals. Some mammals were sighted but not collected, and some published records are imperfectly documented. Records are arranged chronologically from the earliest collection date to the most recent.

ORDER PERISSODACTYLA

Rhinoceros unicornis Linnaeus, 1758

Great One-horned Rhinoceros, Indian Rhinoceros

1758. Rhinoceros unicornis Linnaeus. Syst. Nat. 10th ed.
Vol. 1, p. 56.

Type locality: Subhimalayan Terai of Assam (Lydekker).

1817. Rhinoceros indicus Cuvier. Regn. Anim. 1: 239.

1830. Rhinoceros asiaticus Blumenbach. Hand. Naturg. ed.
12: 107.

1867. Rhinoceros stenocephalus Gray. Proc. Zool. Soc.
London. p. 1018.

Type locality: Asia.

Distribution: The Nawal Parasi and Chitwan Districts
of Nepal, northern Bihar, Bhutan Duars, Assam.

Nepal Records: Hodgson (1834b, p. 98), Gray (1846,
p. 35), Hinton and Fry (1923, p. 427), Stracey (1957, p. 763),
Gee (1959a, p. 59; 1959b, p. 137; 1959c, p. 484; 1963, p. 67),
Willan (1965a, p. 159; 1965b, p. 159), Spillett and Tamang
(1966, p. 557), Chesemore (1970, p. 165).

NEP: 2 sightings: Mitchell - 2.

Habitat: The elephant grass complex and swampy areas
of the Reu-Rapti Valley.

Discussion: The Indian rhinoceros is a large, awkward
looking creature with a big head, short, stumpy limbs, small
eyes and wide nostrils. It has a single "horn" on the upper

surface of the nose. It is composed of agglutinated hairs and has no firm attachment to the bones of the skull. There are three toes on each foot. The skin, which is covered with large convex tubercles, has a number of loose folds, giving the animal the appearance of wearing armor. It is practically naked except for a fringe of stiff hairs around the ears and on the tip of the tail. The color varies from gray to black with a pinkish hue on the underparts and on the margins of the skin folds. There is a single pair of inguinal mammae. The length of the head and body is 2.1 to 4.2 m, the tail length 0.5 to 0.75 m, the height at the shoulders 1.3 to 2 m and the weight 2000 to 4000 kg (Walker et al. 1964b).

The skull is elongate with a prominent occipital crest. The nasal bones are large and united. The small tympanics do not form auditory bullae.

Formerly, the great one-horned rhinoceros inhabited the grasslands of the entire Terai, but at present they are restricted to an area of approximately 1000 sq km in the Rapti and Reu River Valleys of the Chitwan and Nawal Parasi Districts. Preferring swampy ground, they inhabit the uncultivated alluvial plains of the Rapti Valley. Rhinos are fond of rolling in mud and many wallows are to be seen in the Tamispur area. They are more or less solitary, but several animals may inhabit the same tract of elephant grass. Their diet consists of grasses, reeds and young shoots, and

they are known to invade rice paddies. The gestation period is approximately 19 months; a single young is born between February and April. The life span may exceed 50 years.

Habitat destruction and poaching have drastically reduced their numbers. Powdered rhino "horn" is sold as an aphrodisiac, a single horn bringing as much as \$2000 (U.S.) in Hong Kong.

Rhinos usually are not aggressive animals. They seek to escape rather than to attack. However, on occasion they have been known to charge an elephant. At Meghauli (Tiger Tops Hotel), one elephant was seriously injured by a rhino. Contrary to popular belief they use their sharply pointed lower tusks, rather than the horn, for defense.

Recent surveys have recorded the decline of the rhino in the Nepal Terai. In 1957, Stracey estimated that about 400 were left in the entire country. Gee (1959a, b & c) reported only 300 rhinos and by 1963, the number had been reduced by poaching to 160. Willan (1965b) reported an increase in the population and sighted 35 rhino calves that year. In 1966, Spillett and Tamang estimated that only 180 animals remained and in 1970, Caughley (personal communication on 18 February 1970 with Dr. Graeme Caughley, United Nations Development Program, Kathmandu, Nepal) surveying the area by helicopter, counted between 125 and 150.

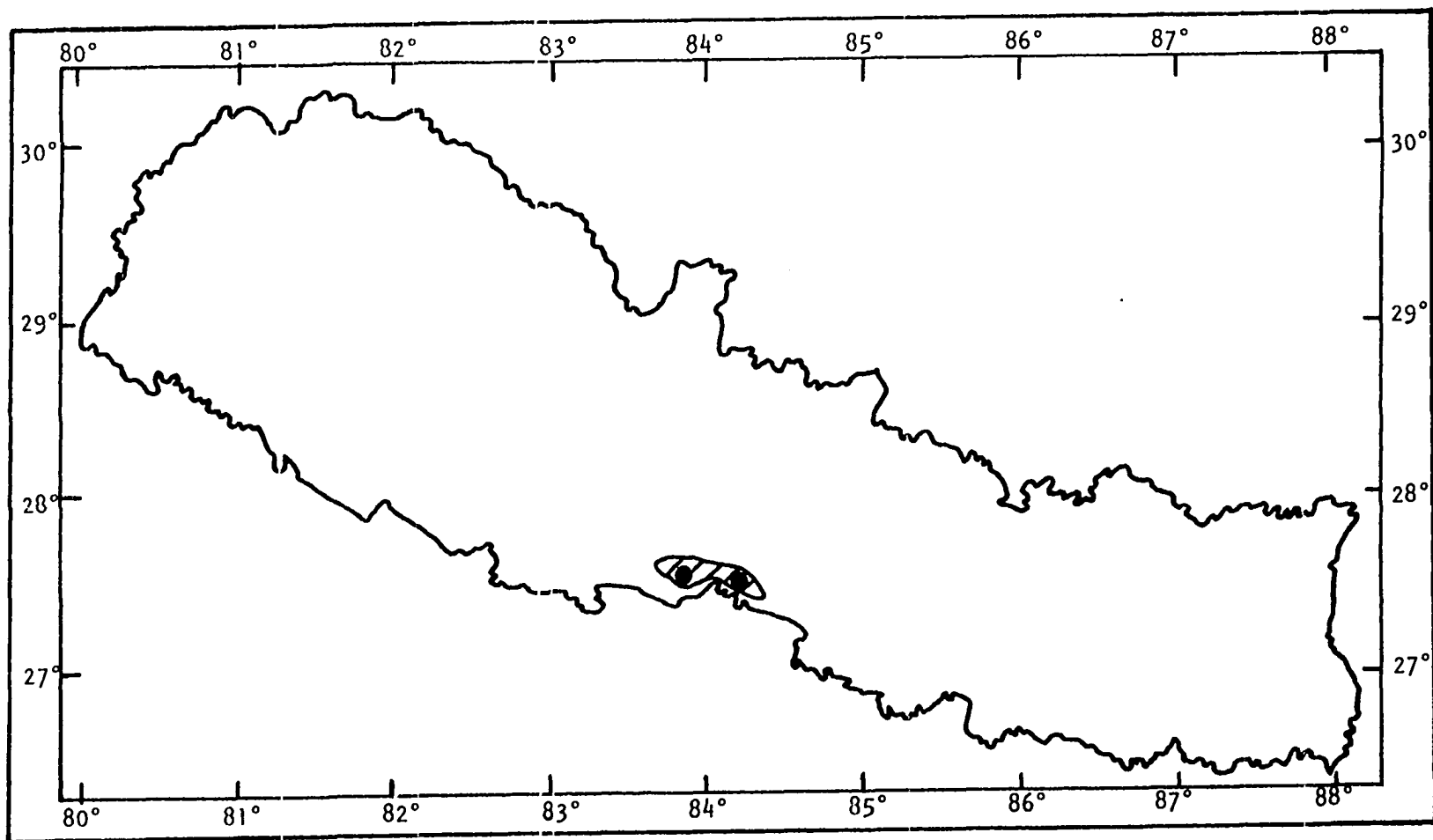


Fig. 68. Sightings and estimated distribution for Rhinoceros unicornis

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APPENDIX I.

STATISTICAL ANALYSIS FOR BODY MEASUREMENTS (in mm)

<u>Measurements</u>	<u>Mean</u>	<u>Range</u>	<u>Standard deviation</u>	<u>Coefficient variance(%)</u>
<u>Alticola stoliczkanus</u>				
Male (14)				
TL	127.03	118.5 - 133.9	5.19	5.08
T	26.82	21.1 - 29.3	2.80	10.44
HF	16.92	14.9 - 18.5	1.10	6.51
E	13.95	10.2 - 15.5	1.61	11.55
Female (2)				
TL	128.90	124.7 - 133.1	5.93	4.60
T	28.35	23.2 - 33.5	7.28	25.69
HF	18.10	17.6 - 18.6	0.70	3.90
E	12.35	9.9 - 14.8	3.46	28.05
<u>Alticola stracheyi</u>				
Male (1)				
TL	112.30	112.3 - 112.3	0.0	0.0
T	18.00	18.0 - 18.0	0.0	0.0
HF	18.50	18.5 - 18.5	0.0	0.0
E	13.00	13.0 - 13.0	0.0	0.0
Female (2)				
TL	122.75	118.6 - 126.9	5.86	4.78
T	23.90	23.5 - 24.3	0.56	2.36
HF	18.90	18.2 - 19.6	0.98	5.23
E	15.00	15.3 - 16.3	0.70	4.47
<u>Apodemus flavicollis gorkha</u>				
Male (35)				
TL	212.69	182.9 - 238.2	18.99	8.93
T	108.16	81.1 - 123.9	15.77	14.58
HF	25.20	19.8 - 27.4	1.29	5.15
E	17.88	15.6 - 19.5	1.28	7.18

<u>Measurements</u>	<u>Mean</u>	<u>Range</u>	<u>Standard deviation</u>	<u>Coefficient variance(%)</u>
<u>Apodemus flavicollis gurkha</u>				
Female (25)				
TL	201.14	173.3 - 290.3	22.94	11.40
T	102.48	81.6 - 139.1	11.07	10.80
HF	24.62	21.8 - 32.6	1.87	7.61
E	17.86	15.8 - 22.8	1.26	7.09
<u>Apodemus sylvaticus</u>				
Male (33)				
TL	187.07	161.9 - 227.3	14.20	7.59
T	91.55	71.1 - 111.9	9.45	10.32
HF	22.38	19.0 - 25.1	1.64	7.32
E	16.78	14.1 - 19.3	1.33	7.96
Female (24)				
TL	184.68	169.6 - 219.9	10.81	5.85
T	94.59	82.4 - 115.0	7.07	7.47
HF	22.9	19.7 - 24.4	1.06	4.61
E	17.09	14.1 - 19.3	1.19	6.99
<u>Canis aureus</u>				
Male (2)				
TL	882.25	852.2 - 912.3	42.49	8.81
T	235.20	218.6 - 251.8	23.47	9.98
HF	155.75	153.1 - 158.4	3.74	2.40
E	72.55	70.6 - 74.5	2.75	3.80
Female (3)				
TL	911.76	850.6 - 951.8	53.80	5.90
T	224.20	202.7 - 238.3	18.91	8.43
HF	153.00	149.1 - 157.6	4.29	2.80
E	72.83	72.0 - 73.4	0.73	1.01
<u>Cannomys badius</u>				
Female (2)				
TL	279.90	271.8 - 288.0	11.45	4.09
T	57.10	52.4 - 61.8	6.64	11.64
HF	35.60	35.0 - 36.2	0.84	2.38
E	8.05	8.0 - 8.1	0.07	0.87

<u>Measurements</u>	<u>Mean</u>	<u>Range</u>	<u>Standard deviation</u>	<u>Coefficient variance (%)</u>
<u>Crocidura horsfieldi</u>				
Male (4)				
TL	115.27	111.0 - 117.9	3.00	2.60
T	46.97	45.7 - 50.3	2.22	4.72
HF	12.70	12.3 - 13.1	0.40	3.21
E	7.80	7.4 - 8.2	0.32	4.18
Female (2)				
TL	107.55	105.4 - 109.7	3.04	2.82
T	44.35	44.1 - 44.6	0.35	0.79
HF	12.40	11.8 - 13.0	0.84	6.84
E	7.65	7.3 - 8.0	0.49	6.47
<u>Crocidura sp. 1</u>				
Male (1)				
TL	123.60	123.6 - 123.6	0.0	0.0
T	54.00	54.0 - 54.0	0.0	0.0
HF	12.80	12.8 - 12.8	0.0	0.0
E	8.10	8.1 - 8.1	0.0	0.0
<u>Dremomys Lokriah</u>				
Male (3)				
TL	304.00	281.0 - 316.5	19.94	6.56
T	164.00	138.4 - 178.5	22.23	13.55
HF	47.80	46.9 - 49.2	1.22	2.57
E	20.20	19.5 - 21.0	0.75	3.73
Female (6)				
TL	308.28	299.2 - 324.8	9.57	3.10
T	154.20	129.7 - 174.1	20.45	13.33
HF	45.81	41.3 - 49.3	2.75	6.00
E	20.01	18.2 - 22.4	1.36	6.93
<u>Felis bengalensis</u>				
Female (1)				
TL	774.40	774.4 - 774.4	0.0	0.0
T	291.00	291.0 - 291.0	0.0	0.0
HF	115.40	115.4 - 115.4	0.0	0.0
E	76.90	76.9 - 76.9	0.0	0.0

<u>Measurements</u>	<u>Mean</u>	<u>Range</u>	<u>Standard deviation</u>	<u>Coefficient variance (%)</u>
<u>Felis chaus</u>				
Male (4)				
TL	878.72	855.0 - 907.6	24.56	2.79
T	277.65	260.0 - 290.9	13.90	5.00
HF	156.57	144.0 - 168.7	10.21	6.52
E	71.45	68.5 - 74.5	2.55	3.58
Female (8)				
TL	759.95	613.5 - 841.0	78.67	10.35
T	228.80	191.2 - 270.1	27.73	12.12
HF	131.42	116.2 - 149.8	12.65	9.62
E	64.72	52.4 - 75.3	6.95	10.74
<u>Felis viverrina</u>				
Female (1)				
TL	800.20	800.2 - 800.2	0.0	0.0
T	237.00	237.0 - 237.0	0.0	0.0
HF	135.90	135.9 - 135.9	0.0	0.0
E	43.40	43.4 - 43.4	0.0	0.0
<u>Funambulus pennanti</u>				
Male (10)				
TL	279.14	255.3 - 301.3	17.17	6.15
T	135.64	111.5 - 156.8	15.46	11.39
HF	38.78	36.7 - 42.3	1.92	4.97
E	15.01	14.2 - 16.2	0.67	4.49
Female (4)				
TL	263.80	227.0 - 294.0	28.03	10.62
T	125.87	84.8 - 143.8	27.57	21.90
HF	37.97	34.9 - 39.8	2.12	5.60
E	15.27	14.8 - 16.0	0.55	3.60
<u>Golunda ellioti</u>				
Male (1)				
TL	236.00	236.0 - 236.0	0.0	0.0
T	115.10	115.1 - 115.1	0.0	0.0
HF	32.30	32.3 - 32.3	0.0	0.0
E	20.20	20.2 - 20.2	0.0	0.0

<u>Measurements</u>	<u>Mean</u>	<u>Range</u>	<u>Standard deviation</u>	<u>Coefficient variance (%)</u>
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Golunda ellioti

Female (2)

TL	186.35	181.6 - 191.1	6.71	3.60
T	84.05	83.0 - 85.1	1.48	1.76
HF	24.80	22.9 - 26.7	2.68	10.83
E	15.25	14.7 - 15.8	0.77	5.10

Herpestes edwardsi

Male (2)

TL	686.65	570.3 - 803.0	164.54	23.96
T	306.25	236.4 - 376.1	98.78	32.25
HF	80.60	78.7 - 82.5	2.68	3.33
E	23.55	22.3 - 24.8	1.76	7.50

Female (3)

TL	712.80	672.2 - 758.6	43.43	6.09
T	352.06	337.4 - 375.8	20.74	5.89
HF	71.70	70.9 - 72.4	0.75	1.05
E	19.43	18.1 - 21.0	1.46	7.53

Hylopetes alboniger

Male (1)

TL	411.00	411.0 - 411.0	0.0	0.0
T	191.60	191.6 - 191.6	0.0	0.0
HF	45.80	45.8 - 45.8	0.0	0.0
E	32.20	32.2 - 32.2	0.0	0.0

Female (2)

TL	378.10	356.1 - 400.1	31.11	8.22
T	170.10	164.0 - 176.2	8.62	5.07
HF	39.50	38.6 - 40.4	1.27	3.22
E	29.95	28.8 - 31.1	1.62	5.43

Lepus nigricollis ruficaudatus

Male (6)

TL	495.58	458.7 - 520.1	24.62	4.97
T	88.50	73.5 - 98.6	10.48	11.84
HF	107.83	101.8 - 116.1	5.33	4.94
E	93.20	85.4 - 97.3	4.75	5.10

<u>Measurements</u>	<u>Mean</u>	<u>Range</u>	<u>Standard deviation</u>	<u>Coefficient variance (%)</u>
<u>Lepus nigricollis ruficaudatus</u>				
Female (3)				
TL	560.86	540.0 - 585.0	22.67	4.04
T	98.06	80.5 - 108.0	15.25	15.55
HF	112.30	111.1 - 113.3	1.11	0.99
E	93.50	88.5 - 98.9	5.21	5.57
<u>Martes flavigula</u>				
Male (1)				
TL	909.20	909.2 - 909.2	0.0	0.0
T	394.80	394.8 - 394.8	0.0	0.0
HF	101.90	101.9 - 101.9	0.0	0.0
E	33.50	33.5 - 33.5	0.0	0.0
<u>Millardina meltada pallidor</u>				
Male (2)				
TL	213.45	164.6 - 262.3	69.08	32.36
T	94.05	71.7 - 116.4	31.60	33.60
HF	22.90	21.0 - 24.8	2.68	11.73
E	19.65	16.1 - 23.2	5.02	25.54
Female (6)				
TL	184.18	174.8 - 228.4	34.07	18.50
T	85.65	83.4 - 112.2	16.19	18.90
HF	22.65	21.6 - 23.8	0.79	3.51
E	18.20	15.9 - 20.5	1.68	9.25
<u>Mus booduga</u>				
Male (8)				
TL	116.72	100.5 - 138.5	12.08	10.34
T	55.86	47.9 - 69.8	7.04	12.60
HF	14.93	13.6 - 16.7	1.11	7.48
E	11.67	10.5 - 14.0	1.36	11.71
Female (3)				
TL	120.80	107.8 - 129.7	11.51	9.52
T	55.53	53.6 - 57.7	2.05	3.70
HF	14.96	14.7 - 15.4	0.37	2.53
E	11.03	10.9 - 11.1	0.11	1.04

<u>Measurements</u>	<u>Mean</u>	<u>Range</u>	<u>Standard deviation</u>	<u>Coefficient variance (%)</u>
<u>Mus cervicolor</u>				
Male (2)				
TL	154.95	144.5 - 165.4	14.77	9.53
T	76.05	68.6 - 83.5	10.53	13.85
HF	16.95	16.7 - 17.2	0.35	2.08
E	13.50	13.0 - 14.0	0.70	5.23
<u>Mus musculus ssp.</u>				
Male (2)				
TL	155.20	149.4 - 161.0	8.20	5.28
T	80.50	78.5 - 82.5	2.82	3.51
HF	18.55	18.5 - 18.6	0.07	0.38
E	12.95	12.2 - 13.7	1.06	8.19
<u>Mus musculus homourus</u>				
Male (162)				
TL	137.79	111.9 - 167.5	9.23	6.70
T	68.27	57.3 - 84.2	6.01	8.81
HF	17.49	12.2 - 19.7	0.99	5.70
E	12.50	10.4 - 14.1	0.77	6.17
Female (59)				
TL	136.64	112.9 - 160.9	11.35	8.31
T	68.65	54.1 - 80.1	6.61	9.63
HF	17.46	14.1 - 19.3	1.11	6.41
E	12.44	9.9 - 13.9	0.94	7.58
<u>Mus musculus urbanus</u>				
Male (150)				
TL	158.39	137.1 - 180.2	12.88	8.13
T	79.15	66.7 - 87.5	8.09	10.22
HF	18.55	16.1 - 25.5	0.96	5.21
E	13.83	11.0 - 17.4	0.94	6.79
Female (90)				
TL	160.14	114.9 - 182.3	10.92	6.82
T	80.41	56.8 - 94.0	5.99	7.45
HF	18.29	16.0 - 19.8	0.68	3.75
E	13.94	12.1 - 15.9	0.83	5.99

<u>Measurements</u>	<u>Mean</u>	<u>Range</u>	<u>Standard deviation</u>	<u>Coefficient variance (%)</u>
<u>Mus platythrix</u>				
Male (1)				
TL	181.00	181.0 - 181.0	0.0	0.0
T	79.80	79.8 - 79.8	0.0	0.0
HF	19.20	19.2 - 19.2	0.0	0.0
E	16.70	16.7 - 16.7	0.0	0.0
Female (1)				
TL	160.30	160.3 - 160.3	0.0	0.0
T	70.10	70.1 - 70.1	0.0	0.0
HF	17.80	17.8 - 17.8	0.0	0.0
E	15.50	15.5 - 15.5	0.0	0.0
<u>Mustela altaica</u>				
Male (1)				
TL	381.00	381.0 - 381.0	0.0	0.0
T	130.20	130.2 - 130.2	0.0	0.0
HF	41.20	41.2 - 41.2	0.0	0.0
E	20.50	20.5 - 20.5	0.0	0.0
<u>Mustela sibirica</u>				
Male (4)				
TL	446.57	418.5 - 506.5	40.87	9.15
T	160.75	147.1 - 174.3	13.27	8.25
HF	49.52	46.3 - 52.2	2.65	5.35
E	21.85	20.4 - 24.9	2.05	9.41
Female (2)				
TL	407.10	375.7 - 438.5	44.40	10.90
T	139.10	130.3 - 147.9	12.44	8.94
HF	46.40	42.3 - 50.5	5.79	12.49
E	20.80	19.3 - 22.3	2.12	10.19
<u>Nesokia indica</u>				
Female (3)				
TL	223.30	196.1 - 273.5	43.52	19.49
T	79.80	68.6 - 102.0	19.22	24.09
HF	30.86	29.2 - 34.2	2.88	9.35
E	15.03	12.9 - 18.7	3.18	21.21

<u>Measurements</u>	<u>Mean</u>	<u>Range</u>	<u>Standard deviation</u>	<u>Coefficient variance (%)</u>
<u>Ochotona daurica</u>				
Male (1)				
TL	196.50	196.5 - 196.5	0.0	0.0
T	6.50	6.5 - 6.5	0.0	0.0
HF	34.50	34.5 - 34.5	0.0	0.0
E	21.10	21.1 - 21.1	0.0	0.0
<u>Ochotona macrotis</u>				
Male (1)				
TL	191.10	191.1 - 191.1	0.0	0.0
T	8.40	8.4 - 8.4	0.0	0.0
HF	33.40	33.4 - 33.4	0.0	0.0
E	38.80	38.8 - 38.8	0.0	0.0
<u>Ochotona roylei</u>				
Male (21)				
TL	176.10	153.3 - 202.6	12.95	7.35
T	5.83	4.5 - 6.8	0.63	10.92
HF	33.81	33.1 - 34.8	0.37	1.11
E	23.22	18.8 - 25.2	1.56	6.73
Female (21)				
TL	177.55	159.8 - 198.5	10.94	6.16
T	6.06	5.1 - 7.3	0.57	9.45
HF	33.57	32.8 - 34.3	0.35	1.05
E	23.11	21.0 - 24.5	0.85	3.71
<u>Ochotona sp.</u>				
Male (1)				
TL	170.30	170.3 - 170.3	0.0	0.0
T	6.50	6.5 - 6.5	0.0	0.0
HF	34.80	34.8 - 34.8	0.0	0.0
E	20.00	20.0 - 20.0	0.0	0.0
Female (1)				
TL	170.20	170.2 - 170.2	0.0	0.0
T	6.50	6.5 - 6.5	0.0	0.0
HF	34.20	34.2 - 34.2	0.0	0.0
E	19.80	19.8 - 19.8	0.0	0.0

<u>Measurements</u>	<u>Mean</u>	<u>Range</u>	<u>Standard deviation</u>	<u>Coefficient variance(%)</u>
<u>Paradoxurus hermaphroditus</u>				
Female (1)				
TL	998.00	998.0 - 998.0	0.0	0.0
T	483.70	483.7 - 483.7	0.0	0.0
HF	79.20	79.2 - 79.2	0.0	0.0
E	44.60	44.6 - 44.6	0.0	0.0
<u>Petaurista elegans</u>				
Male (2)				
TL	666.50	664.5 - 668.5	2.82	0.42
T	351.80	351.6 - 352.0	0.28	0.08
HF	68.50	67.4 - 69.6	1.55	2.27
E	41.35	39.8 - 42.9	2.19	5.30
Female (3)				
TL	603.83	529.8 - 657.0	66.11	10.95
T	313.30	284.0 - 330.4	25.49	8.13
HF	66.76	61.1 - 70.7	5.02	7.53
E	41.80	40.3 - 43.3	1.50	3.58
<u>Petaurista magnificus</u>				
Male (7)				
TL	851.91	813.8 - 877.0	22.78	2.67
T	455.98	428.5 - 474.1	16.60	3.64
HF	80.87	78.2 - 84.3	2.23	2.75
E	42.35	40.5 - 45.9	1.88	4.44
Female (4)				
TL	836.57	800.0 - 862.4	28.15	3.36
T	449.50	400.0 - 474.5	33.76	7.51
HF	79.90	75.5 - 82.7	3.16	3.96
E	38.00	31.1 - 42.8	5.17	13.62
<u>Pitymys leucurus</u>				
Male (7)				
TL	132.78	120.2 - 149.0	10.42	7.85
T	24.35	20.4 - 29.4	3.38	13.90
HF	18.70	17.9 - 19.2	0.46	2.48
E	9.87	7.9 - 11.2	1.36	13.86

<u>Measurements</u>	<u>Mean</u>	<u>Range</u>	<u>Standard deviation</u>	<u>Coefficient variance (%)</u>
Female (3)				
TL	129.23	122.3 - 137.7	7.81	6.04
T	25.06	22.7 - 28.4	2.97	11.85
HF	18.16	18.0 - 18.5	0.28	1.58
E	10.13	9.8 - 10.6	0.41	4.10
<u>Pitymys sikimensis</u>				
Male (82)				
TL	141.65	121.1 - 164.0	9.88	6.97
T	36.45	30.2 - 48.0	3.62	9.93
HF	20.12	18.5 - 22.2	0.82	4.10
E	13.00	10.5 - 24.5	1.66	12.78
Female (57)				
TL	143.70	121.5 - 161.3	10.47	7.28
T	37.28	30.8 - 45.4	3.49	9.38
HF	20.02	16.8 - 25.5	1.18	5.90
E	13.10	11.2 - 15.2	0.88	6.73
<u>Rattus eha</u>				
Male (26)				
TL	271.41	239.0 - 304.6	23.40	8.62
T	161.94	140.3 - 189.4	17.59	10.86
HF	27.05	24.6 - 29.8	1.63	6.05
E	19.63	17.1 - 21.2	1.29	6.60
Female (14)				
TL	280.57	252.7 - 304.8	15.98	5.69
T	166.04	151.1 - 178.3	8.59	5.17
HF	26.68	25.5 - 28.0	0.85	3.19
E	20.16	18.2 - 21.7	0.96	4.76
<u>Rattus fulvescens</u>				
Male (11)				
TL	282.45	252.7 - 320.8	22.34	7.91
T	166.37	144.4 - 203.1	17.95	10.79
HF	27.57	24.8 - 30.7	2.02	7.36
E	19.69	16.6 - 28.8	3.24	16.46

<u>Measurements</u>	<u>Mean</u>	<u>Range</u>	<u>Standard deviation</u>	<u>Coefficient variance(%)</u>
<u>Rattus fulvescens</u>				
Female (11)				
TL	286.25	229.5 - 323.6	33.02	11.53
T	163.04	136.3 - 193.2	25.53	15.66
HF	26.81	23.2 - 29.9	2.03	7.58
E	19.09	16.4 - 20.6	1.47	7.75
<u>Rattus rattus brunneus</u>				
Male (2)				
TL	406.35	404.3 - 408.4	3.89	0.71
T	212.35	211.1 - 213.6	1.76	0.83
HF	38.75	38.3 - 39.2	0.63	1.64
E	24.75	24.0 - 25.5	1.06	4.28
Female (1)				
TL	380.10	380.1 - 380.1	0.0	0.0
T	206.90	206.9 - 206.9	0.0	0.0
HF	36.70	36.7 - 36.7	0.0	0.0
E	27.90	27.9 - 27.9	0.0	0.0
<u>Rattus rattus brunneusculus</u>				
Male (17)				
TL	363.41	258.9 - 436.3	48.35	13.30
T	196.82	139.3 - 230.3	28.50	14.48
HF	35.20	27.4 - 38.8	2.79	7.94
E	23.84	19.8 - 26.1	1.71	7.19
Female (21)				
TL	325.64	252.6 - 390.8	65.06	19.97
T	180.56	128.0 - 221.5	36.28	20.09
HF	32.83	25.6 - 36.8	3.47	10.57
E	22.91	19.0 - 26.2	2.51	10.97
<u>Rattus turkestanicus</u>				
Male (17)				
TL	327.98	305.4 - 352.4	17.08	5.20
T	168.46	149.3 - 191.6	11.38	6.76
HF	33.81	31.5 - 36.7	1.43	4.23
E	23.59	21.0 - 25.4	1.17	4.96

<u>Measurements</u>	<u>Mean</u>	<u>Range</u>	<u>Standard deviation</u>	<u>Coefficient variance (%)</u>
<u>Rattus turkestanicus</u>				
Female (19)				
TL	326.76	278.5 - 382.7	24.51	7.50
T	161.50	137.3 - 217.7	37.36	23.13
HF	33.21	30.1 - 34.8	1.37	4.14
E	23.70	21.1 - 26.4	1.26	5.31
<u>Rattus nitidus</u>				
Male (2)				
TL	261.10	247.7 - 274.5	13.95	7.25
T	138.70	128.9 - 148.5	13.85	9.99
HF	29.30	29.3 - 29.3	0.0	0.0
E	20.40	19.8 - 21.0	0.84	4.15
Female (1)				
TL	255.10	255.1 - 255.1	0.0	0.0
T	126.00	126.0 - 126.0	0.0	0.0
HF	29.10	29.1 - 29.1	0.0	0.0
E	18.10	18.1 - 18.1	0.0	0.0
<u>Rattus niviventer</u>				
Male (6)				
TL	235.95	157.9 - 274.6	41.88	17.75
T	125.85	116.5 - 147.0	20.65	16.41
HF	26.45	22.9 - 30.9	4.77	18.03
E	18.80	15.0 - 21.0	2.36	12.57
Female (9)				
TL	264.58	240.5 - 282.1	14.82	5.60
T	139.64	121.2 - 155.1	10.37	7.42
HF	28.02	24.0 - 31.8	2.34	8.38
E	20.54	17.1 - 22.6	1.63	7.94
<u>Rattus rattus ssp.</u>				
Male (4)				
TL	328.72	306.5 - 348.1	19.77	6.01
T	171.05	158.6 - 197.4	18.05	10.55
HF	34.25	32.4 - 35.1	1.25	3.65
E	22.45	20.8 - 24.7	1.67	7.44

<u>Measurements</u>	<u>Mean</u>	<u>Range</u>	<u>Standard deviation</u>	<u>Coefficient variance (%)</u>
<u>Rattus rattus ssp.</u>				
Female (7)				
TL	364.81	302.8 - 396.3	33.10	9.07
T	193.38	161.4 - 219.4	21.46	11.09
HF	34.28	31.6 - 39.9	3.54	10.33
E	23.77	19.4 - 26.1	2.21	9.32
<u>Sorex cylindricauda</u>				
Male (11)				
TL	126.41	118.6 - 138.3	5.93	4.69
T	58.02	52.8 - 63.1	3.15	5.44
HF	14.80	14.1 - 15.3	0.40	2.75
E	8.58	7.3 - 9.1	0.58	6.87
Female (6)				
TL	126.46	120.5 - 132.3	4.45	3.52
T	58.55	53.9 - 62.4	3.29	5.62
HF	14.91	14.0 - 15.3	0.47	3.21
E	8.88	8.5 - 9.1	0.23	2.60
<u>Sorex minutus</u>				
Male (2)				
TL	91.15	91.1 - 91.2	0.07	0.07
T	36.80	34.9 - 38.7	2.68	7.30
HF	12.10	11.7 - 12.5	0.56	4.67
E	4.75	4.0 - 5.5	1.06	22.33
Female (2)				
TL	98.85	91.1 - 106.6	10.96	11.08
T	37.60	32.1 - 43.1	7.7	20.68
HF	12.30	11.8 - 12.8	0.70	5.74
E	5.65	5.3 - 6.0	0.49	8.76
<u>Soriculus caudatus</u>				
Male (46)				
TL	116.94	105.3 - 129.4	5.93	5.07
T	55.13	42.7 - 63.1	4.36	7.91
HF	13.95	11.6 - 15.5	0.84	6.03
E	7.92	6.1 - 9.4	0.65	8.23

<u>Measurements</u>	<u>Mean</u>	<u>Range</u>	<u>Standard deviation</u>	<u>Coefficient variance (%)</u>
<u>Soriculus caudatus</u>				
Female (42)				
TL	118.20	109.9 - 127.9	5.06	4.28
T	55.91	48.5 - 61.5	2.77	4.96
HF	13.95	11.1 - 15.5	0.96	6.92
E	7.94	6.8 - 9.1	0.58	7.39
<u>Soriculus leucops</u>				
Male (2)				
TL	147.25	143.7 - 150.8	5.02	3.40
T	88.35	87.5 - 89.2	1.20	1.36
HF	15.40	14.8 - 16.0	0.84	5.51
E	8.90	8.6 - 9.2	0.42	4.76
<u>Soriculus nigrescens</u>				
Male (64)				
TL	130.08	116.8 - 144.2	6.39	4.91
T	44.09	36.6 - 51.8	3.72	8.45
HF	16.32	14.1 - 17.4	0.79	4.84
E	8.77	7.1 - 10.0	0.70	8.02
Female (62)				
TL	131.74	114.3 - 149.1	6.77	5.14
T	45.02	36.6 - 51.5	3.60	7.99
HF	16.16	11.9 - 17.8	1.14	7.09
E	8.65	6.6 - 9.7	0.62	7.19
<u>Suncus etruscus pygmaeoides</u>				
Male (2)				
TL	78.65	75.5 - 81.8	4.45	5.66
T	31.45	30.1 - 32.8	1.90	6.07
HF	8.80	8.1 - 9.5	0.98	11.24
E	6.00	5.8 - 6.2	0.28	4.71
Female (1)				
TL	79.50	79.5 - 79.5	0.0	0.0
T	29.20	29.2 - 29.2	0.0	0.0
HF	8.50	8.5 - 8.5	0.0	0.0
E	5.90	5.9 - 5.9	0.0	0.0

<u>Measurements</u>	<u>Mean</u>	<u>Range</u>	<u>Standard deviation</u>	<u>Coefficient variance (%)</u>
<u>Suncus murinus</u>				
Male (8)				
TL	184.07	133.1 - 206.1	23.77	12.91
T	71.82	60.5 - 81.0	7.05	9.82
HF	21.40	18.3 - 25.9	3.34	15.63
E	11.06	7.5 - 13.7	1.84	16.64
Female (17)				
TL	180.98	143.1 - 218.5	20.28	11.21
T	69.08	43.0 - 81.3	9.23	13.36
HF	20.48	18.4 - 24.0	1.61	7.86
E	11.07	8.0 - 12.7	1.26	11.42
<u>Tatera indica</u>				
Female (3)				
TL	343.16	327.0 - 357.1	15.17	4.42
T	183.93	182.5 - 186.0	1.83	0.99
HF	40.90	40.4 - 41.3	0.45	1.12
E	23.66	22.2 - 25.3	1.55	6.57
<u>Vandeleuria oleracea dumeticola</u>				
Male (2)				
TL	147.50	128.6 - 166.4	26.72	18.12
T	84.90	79.7 - 101.1	22.91	26.98
HF	16.70	16.1 - 17.3	0.84	5.08
E	12.25	11.6 - 12.9	0.91	7.50
<u>Vandeleuria oleracea modesta</u>				
Male (3)				
TL	133.56	126.0 - 138.8	6.71	5.02
T	68.53	67.3 - 70.0	1.36	1.99
HF	16.96	16.0 - 17.6	0.85	5.01
E	12.06	11.7 - 12.3	0.32	2.66
Female (5)				
TL	143.65	130.3 - 174.4	20.68	14.39
T	70.65	62.8 - 81.6	8.27	11.71
HF	17.35	15.2 - 18.9	1.57	9.08
E	12.0	10.9 - 12.9	0.88	7.39

<u>Measurements</u>	<u>Mean</u>	<u>Range</u>	<u>Standard deviation</u>	<u>Coefficient variance (%)</u>
<u>Vulpes bengalensis</u>				
Male (3)				
TL	747.40	713.2 - 771.0	30.32	4.05
T	276.70	268.0 - 291.1	12.56	4.53
HF	121.96	120.5 - 123.0	1.30	1.07
E	77.20	72.3 - 80.2	4.27	5.54
Female (2)				
TL	785.55	762.6 - 808.5	32.45	4.13
T	292.70	288.4 - 297.0	6.08	2.07
HF	114.45	111.1 - 117.8	4.73	4.13
E	76.15	76.0 - 76.3	0.21	0.27
<u>Vulpes ferrilata</u>				
Male (1)				
TL	1030.00	1030.0 - 1030.0	0.0	0.0
T	461.00	461.0 - 461.0	0.0	0.0
HF	153.00	153.0 - 153.0	0.0	0.0
E	90.00	90.0 - 90.0	0.0	0.0

APPENDIX II.

HOST SPECIFICITY OF ECTOPARASITES (70% CRITERION)

<u>Ectoparasite</u>	<u>Host (n)</u>	<u>Occurrence (%)</u>
Siphonaptera		
<u>Amphalius clarus</u>	<u>Ochotona roylei</u> (54)	091.53
<u>Amphipsylla</u> sp. 2	<u>Alticola stoliczkanus</u> (20)	086.96
<u>Ancistropsylla nepalensis</u>	<u>Axis axis</u> (8)	072.73
<u>Callopsylla kaznakovi</u>	<u>Mustela altaica</u> (1)	100.00
<u>Callopsylla gemina</u>	<u>Columba leuconota</u> (1)	100.00
<u>Ceratophyllus fringillae</u>	<u>Ochotona daurica</u> (1)	100.00
<u>Chaetopsylla lasia</u>	<u>Capra hircus</u> (goat) (1)	100.00
<u>Ctenophyllus</u> (Geusibia)	<u>Ochotona roylei</u> (60)	088.24
<u>Doraptopsylla coreana</u>	<u>Sorex cylindricauda</u> (5)	083.33
<u>Euhoplopsyllus glacialis</u>		
<u>profugus</u>	<u>Lepus oiostolus</u> (2)	100.00
<u>Frontopsylla spadix</u>	<u>Rattus eha</u> (5)	100.00
<u>Ischnopsyllus indicus</u>	<u>Pipistrellus babu</u> (1)	100.00
<u>Mitchella exsula</u>	<u>Pipistrellus babu</u> (1)	100.00
<u>Neopsylla mantissa</u>	<u>Pitymys sikimensis</u> (24)	092.31
<u>Neopsylla pagea</u>	<u>Pitymys sikimensis</u> (14)	073.68
<u>Paradoxopsyllus</u>		
<u>mustangensis</u>	<u>Rattus turkestanicus</u> (11)	084.62
<u>Paradoxopsyllus oribatus</u>	<u>Apodemus sylvaticus</u> (21)	095.45
<u>Paradoxopsyllus</u>		
<u>paraphaeopis</u>	<u>Rattus rattus</u> (1)	100.00
<u>Paraneopsylla ioffi</u>		
<u>nepali</u>	<u>Ochotona roylei</u> (12)	085.71
<u>Rowleyella arborea</u>	<u>Dremomys lokriah</u> (4)	100.00
<u>Stenischia pagiana</u>	<u>Soriculus nigrescens</u> (3)	100.00
<u>Stenoponia himalayana</u>	<u>Pitymys sikimensis</u> (30)	076.92
<u>Lentistivalius ferinis</u>	<u>Suncus murinus</u> (12)	100.00
New genus	<u>Alticola stoliczkanus</u> (6)	075.00
<u>Peromyscopsylla himalaica</u>	<u>Rat</u> (1)	100.00
<u>Malaraeus n. sp.</u>	<u>Pitymys sikimensis</u> (4)	080.00
Ixodoidea		
<u>Argas himalayensis</u>	<u>Lerwa Lerwa</u> (1)	100.00
<u>Argas</u> sp.	<u>Eptesicus</u> sp. (1)	100.00
<u>Dermacentor atrosignatus</u>	Free-living (Flagging (2) etc.)	100.00
<u>Haemaphysalis</u>		
<u>cornupunctata</u>	<u>Capra hircus</u> (1)	100.00
<u>Haemaphysalis darjeeling</u>	<u>Homo sapiens</u> (1)	100.00
<u>Hyalomma detritum</u>	<u>Cervus unicolor</u> (1)	100.00
<u>Hyalomma marginatum</u>		
<u>turanicum</u>	<u>Capra hircus</u> (3)	075.00

<u>Ectoparasite</u>	<u>Host (n)</u>	<u>Occurrence(%)</u>
<u>Ixodes kuntzi</u>	<u>Petaurista magnificus</u> (1)	100.00
<u>Ixodes berlesei</u>	<u>Carpodacus nipalensis</u> (1)	
<u>Ornithodoros coniceps</u>	<u>Free-living (flagging</u> (1) etc.)	100.00
<u>Ornithodoros</u> (<u>Reticulinasus</u>) <u>piriformis</u>	<u>Free-living (flagging</u> (13) etc.)	086.67
<u>Rhipicephalus ramachandrai</u>	<u>Tatera indica</u> (1)	100.00
<u>Rhipicephalus sanguineus</u>	<u>Canis aureus</u> (1)	100.00

Diptera

<u>Hippobosca longipennis</u>	<u>Canis familiaris</u> (5)	100.00
<u>Hippobosca sp.</u>	<u>Delichon nipalensis</u> (3)	075.00
<u>Icosta maquilingensis</u>	<u>Gallus gallus</u> (3)	100.00
<u>Lipoptena axis</u>	<u>Axis axis</u> (7)	070.00
<u>Lipoptena pauciseta</u>	<u>Muntiacus muntjak</u> (1)	100.00
<u>Lipoptena timida</u>	<u>Axis axis</u> (1)	100.00
<u>Melophagus ovinus</u>	<u>Ovis aries</u> (3)	100.00
<u>Ornithoica bistativa</u>	<u>Pavo cristatus</u> (1)	100.00
<u>Ornithomya avicularia</u>	<u>Ithaginis cruentus</u> (1)	100.00
<u>Ornithophila metallica</u>	<u>Dendrocitta vagabunda</u> (1)	100.00
<u>Pseudolynchia canariensis</u>	<u>Columba livia</u> (5)	083.33
<u>Cyclopodia sykesii</u>	<u>Pteropus giganteus</u> (16)	100.00
<u>Streblids</u>	<u>Rhinolophus lepidus</u> (1)	100.00

Mites

<u>Allodermanyssus sanguineus</u>	<u>Suncus murinus</u> (1)	100.00
<u>Androlaelaps</u> <u>macroventralis</u>	<u>Petaurista elegans</u> (2)	100.00
<u>Androlaelaps marshalli</u>	<u>Tatera indica</u> (2)	100.00
<u>Androlaelaps traubi</u>	<u>Callosciurus pygerythrus</u> (1)	100.00
<u>Androlaelaps triangularis</u>	<u>Soriculus nigrescens</u> (2)	100.00
<u>Dermanyssus sp.</u>	<u>Carpodacus erythrinus</u> (1)	100.00
<u>Gahrliopia</u> (<u>Schoengastiella</u>) sp.	<u>Suncus murinus</u> (5)	083.33
<u>Haemogamasus sp.</u>	<u>Soriculus nigrescens</u> (5)	071.43
<u>Haemogamasus dorsalis</u>	<u>Rattus rattus</u> (3)	100.00
<u>Haemogamasus horridus</u>	<u>Pitymys sikimensis</u> (1)	100.00
<u>Haemogamasus japonicus</u>	<u>Pitymys sikimensis</u> (2)	100.00
<u>Haemolaelaps fahrenheitzi</u>	<u>Pitymys sikimensis</u> (2)	100.00
<u>Hypoaspis miles</u>	<u>Tatera indica</u> (1)	100.00
<u>Laelaps agilis</u>	<u>Apodemus sylvaticus</u> (13)	100.00
<u>Laelaps buxtoni</u>	<u>Tatera indica</u> (1)	100.00
<u>Neolaelaps spinosus</u>	<u>Pteropus giganteus</u> (7)	100.00
<u>Myonyssus montanus</u>	<u>Ochotona roylei</u> (18)	090.00
<u>Ornithonyssus sylviarum</u>	<u>Oriolus xanthornus</u> (1)	100.00
<u>Pellonyssus viator</u>	<u>Hirundo daurica</u> (1)	100.00

<u>Ectoparasite</u>	<u>Host (n)</u>	<u>Occurrence(%)</u>
<u>Pterodectes leioplax</u>	<u>Kitta (Cissa)</u>	
	<u>flavirostris</u> (1)	100.00
<u>Rhyzotaelaps inaequipitis</u>	<u>Cannomys badius</u> (2)	100.00
<u>Spinturnex plecotinus</u>	<u>Barbastella leucomelas</u> (1)	100.00
<u>Falculifer rostratus</u>	<u>Streptopelia orientalis</u> (1)	100.00
<u>Pterolichus obtusus</u>	<u>Gallus gallus</u> (2)	100.00
<u>Sokoloviana sp.</u>	<u>Vanellus spinosus</u> (1)	100.00
<u>Amerosiidae</u>	<u>Apodemus flavicollis</u>	
	<u>gurkha</u> (1)	100.00
<u>Polylaelaptidae</u>	<u>Suncus murinus</u> (1)	100.00
<u>Phytoseiidae</u>	<u>Pteropus giganteus</u> (1)	100.00
<u>Listrophoridae</u>	<u>Mus musculus</u> (1)	100.00
<u>Mallophaga</u>		
<u>Amyrsidea minuta</u>	<u>Pavo cristatus</u> (4)	100.00
<u>Amyrsidea phaeostoma</u>	<u>Pavo cristatus</u> (2)	100.00
<u>Amyrsidea sp.</u>	<u>Lophophorus impejanus</u> (3)	075.00
<u>Amyrsidea elbeli</u>	<u>Arbophila rufogularis</u> (1)	100.00
<u>Bovicola limbata</u>	<u>Capra hircus</u> (7)	100.00
<u>Bovicola caprae</u>	<u>Capra hircus</u> (1)	100.00
<u>Bovicola dimorpha</u>	<u>Nemorhaedus goral</u> (2)	100.00
<u>Bovicola sp.</u>	<u>Capra hircus</u> (1)	100.00
<u>Bovicola thompsoni</u>	<u>Capricornis</u>	
	<u>sumatraensis</u> (1)	100.00
<u>Bruelia daumae</u>	<u>Zoothera dauma</u> (1)	100.00
<u>Bruelia mahasthan</u>	<u>Turdoides stratus</u>	
	<u>somervillei</u> (5)	100.00
<u>Bruelia meinertzhageni</u>	<u>Dendrocitta vagabunda</u> (1)	100.00
<u>Bruelia saliemii mollii</u>	<u>Corvus macrorhynchus</u> (1)	100.00
<u>Bruelia sehri</u>	<u>Garrulax lineatus</u> (4)	100.00
<u>Chelopistes lervicola</u>	<u>Lerwa lerwa</u> (8)	100.00
<u>Colinocola meinertzhageni</u>	<u>Lerwa lerwa</u> (7)	077.78
<u>Colpocephalum tausi</u>	<u>Pavo cristatus</u> (4)	100.00
<u>Colpocephalum turbinatum</u>	<u>Bubo (Ketupa)</u>	
	<u>zeylonensis</u> (1)	100.00
<u>Columbicola guimeraesi</u>	<u>Chalcophaps indica</u> (2)	100.00
<u>Columbicola orientalis</u>	<u>Streptopelia orientalis</u> (5)	100.00
<u>Columbicola tschulyschman</u>	<u>Columba leuconota</u> (6)	100.00
<u>Craspedorrhynchus nisi</u>	<u>Accipiter nisus</u> (1)	100.00
<u>Craspedorrhynchus</u>		
<u>spathulatus</u>	<u>Milvus migrans</u> (1)	100.00
<u>Cuculogaster theresae</u>	<u>Francolinus francolinus</u> (3)	100.00
<u>Cuculogaster obscurior</u>	<u>Alectoris graeca</u> (1)	100.00
<u>Cuculiphilus snodgrassi</u>	<u>Centropus sinensis</u> (1)	100.00
<u>Degeeriella rufarufa</u>	<u>Falco tinnunculus</u> (1)	100.00
<u>Falcolius jordani</u>	<u>Microhierax</u>	
	<u>caerulescens</u> (2)	100.00
<u>Goniocotes creber</u>	<u>Lophura leucomelana</u> (1)	100.00

<u>Ectoparasite</u>	<u>Host (n)</u>	<u>Occurrence (%)</u>
<u>Goniocotes haplogonus</u>	<u>Lophophorus impejanus</u> (18)	094.74
<u>Goniocotes rectangulatus</u>	<u>Pavo cristatus</u> (1)	100.00
<u>Goniocotes diplogonus</u>	<u>Tragopan satyra</u> (2)	100.00
<u>Goniocotes alatus</u>	<u>Alectoris graeca</u> (1)	100.00
<u>Goniocotes gallinae</u>	<u>Gallus gallus</u> (2)	100.00
<u>Gonoides dentatus</u>	<u>Lophura leucomelana</u> (2)	100.00
<u>Gonoides dispar</u>	<u>Alectoris graeca</u> (1)	100.00
<u>Gonoides dissimilis</u>	<u>Gallus gallus</u> (5)	100.00
<u>Gonoides eurygaster</u>	<u>Lophophorus impejanus</u> (23)	095.83
<u>Gonoides ithaginis</u>	<u>Ithaginis cruentus</u> (5)	083.33
<u>Goncides megaceros</u>	<u>Lophophorus impejanus</u> (2)	100.00
<u>Gonoides meinertzhageni</u>	<u>Pavo cristatus</u> (1)	100.00
<u>Gonoides pavonis</u>	<u>Pavo cristatus</u> (4)	100.00
<u>Gonoides sp.</u>	<u>Lophura leucomelana</u> (2)	100.00
<u>Gonoides spinicornis</u>	<u>Tragopan satyra</u> (3)	100.00
<u>Kurodaia deignani</u>	<u>Glaucidium cuculoides</u> (2)	100.00
<u>Laemobothrion maximum</u>	<u>Milvus migrans</u> (1)	100.00
<u>Laemobothrion tinnunculi</u>	<u>Falco tinnunculus</u> (1)	100.00
<u>Lagopoecus heterotypus</u>	<u>Lophophorus impejanus</u> (13)	100.00
<u>Lagopoecus sp.</u>	<u>Ithaginis cruentus</u> (5)	071.43
<u>Lagopoecus meinertzhageni</u>	<u>Lerwa lerwa</u> (1)	100.00
<u>Lipeurus caponis</u>	<u>Gallus gallus</u> (6)	085.71
<u>Lipeurus pavo</u>	<u>Pavo cristatus</u> (4)	100.00
<u>Lipeurus introductus</u>	<u>Lophura leucomelana</u> (1)	100.00
<u>Menacanthus stramineus</u>	<u>Gallus gallus</u> (1)	100.00
<u>Menacanthus merisui</u>	<u>Nucifraga caryocatactes</u> (1)	100.00
<u>Menopon gallinae</u>	<u>Gallus gallus</u> (9)	081.82
<u>Menopon interpositum</u>	<u>Francolinus francolinus</u> (1)	100.00
<u>Meropoecus caprai</u>	<u>Merops orientalis</u> (1)	100.00
<u>Myrsidea anaspila</u>	<u>Corvus corax</u> (1)	100.00
<u>Myrsidea shirakii</u>		
<u>himalayensis</u>	<u>Corvus macrorhynchus</u> (1)	100.00
<u>Myrsidea brunea</u>	<u>Nucifraga caryocatactes</u> (1)	100.00
<u>Oxylipeurus baileyi</u>		
<u>ithaginis</u>	<u>Ithaginis cruentus</u>	071.43
<u>Oxylipeurus himalayensis</u>		
<u>burmeisteri</u>	<u>Lophophorus impejanus</u> (23)	088.00
<u>Oxylipeurus formosanus</u>	<u>Arbophilia rufogularis</u> (1)	100.00
<u>Quadriceps bicuspis</u>	<u>Charadrius dubius</u> (1)	100.00
<u>Quadriceps dasi</u>	<u>Lobivanellus indicus</u> (1)	100.00
<u>Quadriceps hoplopteri</u>	<u>Vanellus spinosus</u> (5)	083.33
<u>Quadriceps insignis</u>	<u>Sterna aurantia</u> (1)	100.00
<u>Quadriceps sp.</u>	<u>Cannomys badius</u> (1)	100.00
<u>Strachiella mustelae</u>	<u>Mustela sibirica</u> (1)	100.00
<u>Strigiphilus bramae</u>	<u>Bubo (Ketupa)</u>	
	<u>zeylonensis</u> (1)	100.00
<u>Strigiphilus ketupae</u>	<u>Strix leptogrammica</u> (1)	100.00
<u>Turnicola angustissimus</u>	<u>Turnix suscitator</u> (3)	100.00

<u>Ectoparasite</u>	<u>Host (n)</u>	<u>Occurrence (%)</u>
<u>Alcedoecus annularis</u>	<u>Halcyon smyrnensis</u> (1)	100.00
<u>Meromenopon</u> sp.	<u>Merops orientalis</u> (1)	100.00
<u>Alcedoffula alcedinis</u>	<u>Alcedo atthis</u> (1)	100.00
<u>Cuculicola</u> sp.	<u>Taccocua leschenaultii</u> (1)	100.00
<u>Mulcticola</u> sp.	<u>Caprimulgus indicus</u> (1)	100.00
<u>Echinophilopterus</u> sp.	<u>Psittacula himalayana</u> (1)	100.00
<u>Campanulotes heteroceros</u>	<u>Columba leuconota</u> (2)	100.00
<u>Austromenopon</u> sp.	<u>Vanellus spinosus</u> (1)	100.00
<u>Anoplura</u>		
<u>Ancistroplax crocidurae</u>	<u>Soriculus caudatus</u> (2)	100.00
<u>Enderleinellus nishimauri</u>	<u>Funambulus pennanti</u> (1)	100.00
<u>Haematopinus eurysternus</u>	<u>Boselaphus tragocamelus</u> (1)	100.00
<u>Haematopinus suis</u>	<u>Sus scrofa</u> (2)	100.00
<u>Haematopinus tuberculatus</u>	<u>Bubalus babalis</u> (24)	088.89
<u>Haemodipsus ventricosus</u>	<u>Lepus nigricollis</u> <u>ruficaudatus</u> (2)	100.00
<u>Hoplopleura acanthopus</u>	<u>Pitymys sikimensis</u> (52)	088.14
<u>Hoplopleura maniculata</u>	<u>Funambulus pennanti</u> (10)	090.91
<u>Hoplopleura oenomidus</u>	<u>Rattus eha</u> (6)	075.00
<u>Hoplopleura dissicula</u>	<u>Rattus eha</u> (3)	100.00
<u>Hoplopleura affinis</u>	<u>Apodemus sylvaticus</u> (3)	100.00
<u>Hoplopleura erismata</u>	<u>Callosciurus pygerythrus</u> (2)	100.00
<u>Linognathus africanus</u>	<u>Capra hircus</u> (10)	076.92
<u>Linognathus setosus</u>	<u>Canis aureus</u> (3)	075.00
<u>Linognathus vituli</u>	<u>Bos taurus</u> (8)	072.73
<u>Linognathus</u> sp.	<u>Bos</u> sp. (Zhumo & Zhupiah)(1)	100.00
<u>Neohaematopinus echinatus</u>	<u>Funambulus pennanti</u> (8)	100.00
<u>Neohaematopinus elbeli</u>	<u>Dremomys lokriah</u> (2)	100.00
<u>Neohaematopinus petauristae</u>	<u>Petaurista magnificus</u> (5)	100.00
<u>Pediculus humanus</u>	<u>Homo sapiens</u> (19)	073.08
<u>Polyplax pricei</u>	<u>Rattus nitidus</u> (1)	100.00
<u>Polyplax reclinata</u>	<u>Suncus murinus</u> (11)	100.00
<u>Polyplax spinulosa</u>	<u>Tatera indica</u> (2)	100.00
<u>Polyplax stephensi</u>	<u>Mus musculus urbanus</u> (1)	100.00
<u>Polyplax serrata</u>	<u>Rattus nitidus</u> (1)	100.00
<u>Solenopotes capillatus</u>	<u>Axis axis</u> (2)	100.00
<u>Solenopotes muntiacus</u>	<u>Muntiacus muntjak</u> (3)	100.00
<u>Parafelicola viverriculae</u>	<u>Viverra</u> sp.(1)	100.00

APPENDIX III.

TOTAL NUMBER OF ECTOPARASITES COLLECTED

<u>Ectoparasite</u>	<u>Number Collected</u>	<u>% of this Ectoparasite</u>	<u>% of all Ectoparasites</u>
Siphonaptera			
<u>Acropsylla episema</u>	8	000.14	000.02
<u>Amphalius clarus</u>	119	002.01	000.33
<u>Amphipsylla</u>			
<u>quadratedigita</u>	25	000.42	000.07
<u>Amphipsylla</u> sp. 1	20	000.34	000.05
<u>Amphipsylla</u> sp. 2	183	003.10	000.50
<u>Ancistropsylla nepalensis</u>	163	002.76	000.45
<u>Callopsylla fusca</u>	30	000.51	000.08
<u>Callopsylla kaznakovi</u>	1	000.02	000.00
<u>Callopsylla gemina</u>	3	000.05	000.01
<u>Citellophilus mygala</u>	61	001.03	000.17
<u>Citellophilus atallahi</u>	13	000.22	000.04
<u>Callopsylla</u> sp. 1	62	001.05	000.17
<u>Ceratophyllus enefdei</u>	7	000.12	000.02
<u>Ceratophyllus fringillae</u>	1	000.02	000.00
<u>Ceratopsyllus gallinae</u>			
<u>gallinae</u>	2	000.03	000.01
<u>Chaetopsylla gracilis</u>	19	000.32	000.05
<u>Chaetopsylla homoea homoea</u>	106	001.79	000.29
<u>Chaetopsylla lasia</u>	1	000.02	000.00
<u>Ctenocephalides felis</u>			
<u>felis</u>	64	001.08	000.18
<u>Ctenocephalides felis</u>			
<u>orientis</u>	828	014.02	002.27
<u>Ctenophyllus (Geusibia)</u>	194	003.28	000.53
<u>Ctenophyllus triangularis</u>	5	000.08	000.01
<u>Ctenophyllus</u> sp. 3	3	000.05	000.01
<u>Dasyopsyllus gallinulae</u>	4	000.07	000.01
<u>Doratopsylla coreana</u>	9	000.15	000.02
<u>Euhoplopsyllus glacialis</u>			
<u>profugus</u>	4	000.07	000.01
<u>Frontopsylla</u> sp.	53	000.90	000.15
<u>Frontopsylla spadix</u>	11	000.19	000.03
<u>Genoneopsylla longisetosa</u>	19	000.32	000.05
<u>Hystrihopsylla n. sp.</u>	13	000.22	000.04
<u>Ischnopsyllus indicus</u>	1	000.02	000.00
<u>Macrostylophora hastata</u>	3	000.05	000.01
<u>Macrostylophora lupata</u>	81	001.37	000.23
<u>Mitchella exsula</u>	1	000.02	000.00
<u>Neopsylla angustimanubra</u>	41	000.59	000.11
<u>Neopsylla mantissa</u>	44	000.75	000.12
<u>Neopsylla marleanae</u>	210	003.56	000.57

<u>Ectoparasite</u>	<u>Number Collected</u>	<u>% of this Ectoparasite</u>	<u>% of all Ectoparasites</u>
<u>Neopsylla pagea</u>	31	000.52	000.08
<u>Neopsylla secura</u>	676	011.45	001.85
<u>Neopsylla sp.</u>	4	000.07	000.01
<u>Neopsylla stevensi</u>	13	000.22	000.04
<u>Nosopsyllus sp.</u>	80	001.35	000.22
<u>Nosopsyllus punjabensis</u>	40	000.68	000.11
<u>Nosopsyllus simla</u>	20	000.34	000.05
<u>Palaeopsylla helenae</u>	215	003.64	000.59
<u>Palaeopsylla remota</u>	32	000.54	000.09
<u>Palaeopsylla tauberi</u>	301	005.10	000.82
<u>Palaeopsylla #1</u>	5	000.08	000.01
<u>Palaeopsylla #2</u>	10	000.17	000.03
<u>Palaeopsylla #3</u>	2	000.03	000.01
<u>Paraceras sauteri</u>	9	000.15	000.02
<u>Paradoxopsyllus acanthus</u>	169	002.86	000.46
<u>Paradoxopsyllus custodis</u>	35	000.59	000.10
<u>Paradoxopsyllus digitatus</u>	34	000.58	000.09
<u>Paradoxopsyllus n. sp.</u>	14	000.24	000.04
<u>Paradoxopsyllus hollandi</u>	46	000.78	000.13
<u>Paradoxopsyllus magnificus</u>	42	000.71	000.11
<u>Paradoxopsyllus mustangensis</u>	34	000.58	000.09
<u>Paradoxopsyllus oribatus</u>	48	000.81	000.13
<u>Paradoxopsyllus paraphaeopis</u>	3	000.05	000.01
<u>Paradoxopsyllus spinosus</u>	4	000.24	000.04
<u>Paraneopsylla ioffi nepali</u>	17	000.29	000.05
<u>Pulex irritans</u>	182	003.08	000.50
<u>Rhadinopsylla sp. 1</u>	29	000.49	000.08
<u>Rhadinopsylla sp. 2</u>	14	000.24	000.04
<u>Rowleyella arborea</u>	21	000.36	000.06
<u>Smitipsylla maseri</u>	196	003.32	000.54
<u>Smitipsylla prodigiosa</u>	5	000.08	000.01
<u>Stenischia pagiana</u>	3	000.05	000.01
<u>Stenischia sp.</u>	54	000.91	000.15
<u>Stenoponia himalayana</u>	107	001.81	000.29
<u>Stivalius aporus</u>	7	000.12	000.02
<u>Lentistivalius ferinis</u>	29	000.49	000.08
<u>Thaumapsylla breviceps</u>			
<u>orientalis</u>	493	008.35	001.35
<u>Vermipsylla alakurt</u>	313	005.30	000.86
<u>Xenodaeria telios</u>	87	001.47	000.24
<u>Xenopsylla astia</u>	23	000.39	000.06
<u>Xenopsylla cheopis</u>	2	000.03	000.01
<u>New genus</u>	17	000.29	000.05
<u>Peromyscopsylla himalaica</u>	1	000.02	000.00

<u>Ectoparasite</u>	<u>Number Collected</u>	<u>% of this Ectoparasite</u>	<u>% of all Ectoparasites</u>
<u>Malaraeus</u> n. sp.	17	000.29	000.05
Totals for this type of ectoparasite	5906	100.00	016.17
<u>Ixodoidea</u>			
<u>Amblyomma</u> sp.	6	000.03	000.02
<u>Anomalohimalaya</u> <u>lama</u>	102	000.48	000.28
<u>Argas</u> <u>hermanni</u>	3	000.01	000.01
<u>Argas</u> <u>himalayensis</u>	2	000.01	000.01
<u>Argas</u> <u>vespertilionis</u> group	40	000.19	000.11
<u>Argas</u> sp. #2	2	000.01	000.01
<u>Argas</u> sp.	2	000.01	000.01
<u>Boophilus</u> <u>microplus</u>	4875	023.15	013.35
<u>Dermacentor</u> <u>auratus</u>	128	000.61	000.35
<u>Dermacentor</u> <u>atrosignatus</u>	2	000.01	000.01
<u>Dermacentor</u> <u>everestianus</u>	538	002.55	001.47
<u>Dermacentor</u> sp.	36	000.17	000.10
<u>Haemaphysalis</u> <u>aborensis</u>	2	000.01	000.01
<u>Haemaphysalis</u> <u>anomala</u>	7	000.03	000.02
<u>Haemaphysalis</u> <u>aponommoides</u>	2373	011.27	006.50
<u>Haemaphysalis</u> <u>birmaniae</u>	1350	006.41	003.70
<u>Haemaphysalis</u> <u>bispinosa</u>	3587	017.03	009.82
<u>Haemaphysalis</u> <u>canestrinii</u>	4	000.02	000.01
<u>Haemaphysalis</u> <u>cornupunctata</u>	94	000.45	000.26
<u>Haemaphysalis</u> <u>doenitzi</u>	15	000.07	000.04
<u>Haemaphysalis</u> <u>garhwalensis</u>	3	000.01	000.01
<u>Haemaphysalis</u> <u>himalaya</u>	711	003.38	001.95
<u>Haemaphysalis</u> <u>howletti</u>	56	000.27	000.15
<u>Haemaphysalis</u> <u>indica</u>	138	000.66	000.38
<u>Haemaphysalis</u> <u>minuta</u>	80	000.38	000.22
<u>Haemaphysalis</u> <u>montgomeryi</u>	193	000.92	000.53
<u>Haemaphysalis</u> <u>nepalensis</u>	1879	008.92	005.14
<u>Haemaphysalis</u> <u>ornithophila</u>	2	000.01	000.01
<u>Haemaphysalis</u> <u>ramachandrai</u>	25	000.12	000.07
<u>Haemaphysalis</u> <u>spinigera</u>	21	000.10	000.06
<u>Haemaphysalis</u> <u>warburtoni</u>	463	002.20	001.27
<u>Haemaphysalis</u> <u>wellingtoni</u>	140	000.66	000.38
<u>Haemaphysalis</u> sp.	420	001.99	001.15
<u>Haemaphysalis</u> <u>darjeeling</u>	1	000.00	000.00

<u>Ectoparasite</u>	<u>Number Collected</u>	<u>% of this Ectoparasite</u>	<u>% of all Ectoparasites</u>
<u>Hyalomma anatolicum</u>			
<u>anatolicum</u>	3	000.01	000.01
<u>Hyalomma brevipunctata</u>	19	000.09	000.05
<u>Hyalomma detritum</u>	1	000.00	000.00
<u>Hyalomma marginatum</u>			
<u>isaaci</u>	12	000.05	000.03
<u>Hyalomma marginatum</u>			
<u>turanicum</u>	66	000.31	000.18
<u>Hyalomma sp.</u>	188	000.80	000.51
<u>Ixodes acutitarsus</u>	408	001.94	001.12
<u>Ixodes himalayensis</u>	41	000.19	000.11
<u>Ixodes hyatti</u>	85	000.40	000.23
<u>Ixodes mitchelli</u>	47	000.22	000.13
<u>Ixodes nuttallianus</u>	87	000.41	000.24
<u>Ixodes lindbergi</u>			
(="ovatus")	1183	005.62	003.24
<u>Ixodes redikorzevi group</u>	100	000.47	000.27
<u>Ixodes shahi</u>	16	000.08	000.04
<u>Ixodes tanuki</u>	27	000.13	000.07
<u>Ixodes sp. 1</u>	193	000.92	000.53
<u>Ixodes sp. 2</u>	76	000.36	000.21
<u>Ixodes sp. A</u>	27	000.13	000.07
<u>Ixodes sp. B</u>	52	000.25	000.02
<u>Ixodes sp. B facies</u>	7	000.03	000.02
<u>Ixodes kuntzi</u>	1	000.00	000.00
<u>Ixodes berlesei</u>	4	000.02	000.01
<u>Ornithodoros coniceps</u>	11	000.05	000.03
<u>Ornithodoros</u>			
(<u>Reticulinasus</u>)	205	000.97	000.56
<u>piriformis</u>			
<u>Rhipicephalus</u>			
<u>haemaphysaloides</u>	841	003.99	002.30
<u>Rhipicephalus</u>			
<u>ramachandrai</u>	1	000.00	000.00
<u>Rhipicephalus sanguineus</u>	1	000.00	000.00
<u>Rhipicephalus turanicus</u>	56	000.27	000.15
<u>Rhipicephalus sp.</u>	2	000.01	000.01
Totals for this type of ectoparasite	21061	100.00	057.66
Diptera			
<u>Hippobosca longipennis</u>	51	017.23	000.14
<u>Icosta maquilingensis</u>	3	001.01	000.01
<u>Lipoptena axis</u>	62	020.95	000.17
<u>Lipoptena pauciseta</u>	2	000.68	000.01
<u>Lipoptena timida</u>	1	000.34	000.00
<u>Lipoptena weidneri</u>	18	006.08	000.05

<u>Ectoparasite</u>	<u>Number Collected</u>	<u>% of this Ectoparasite</u>	<u>% of all Ectoparasites</u>
<u>Melophagus ovinus</u>	38	012.84	000.10
<u>Ornithoica bistativa</u>	1	000.34	000.00
<u>Ornithomya avicularia</u>	5	001.69	000.01
<u>Ornithophila metallica</u>	1	000.34	000.00
<u>Phthona leptoptera</u>	4	001.35	000.01
<u>Pseudolynchia canariensis</u>	6	002.03	000.02
<u>Nycteribiids</u> (<u>Nycteribiidae</u>)	52	017.57	000.14
<u>Cyclopodia sykesii</u>	51	017.23	000.14
<u>Streblids</u> (<u>Streblidae</u>)	1	000.34	000.00
Totals for this type of ectoparasite	296	100.00	000.81
<u>Mites</u>			
<u>Androlaelaps</u> sp.	2	000.05	000.01
<u>Androlaelaps fahrenheitzi</u>	30	000.81	000.08
<u>Androlaelaps hermaphrodita</u>	3	000.08	000.01
<u>Androlaelaps</u> <u>macroventralis</u>	5	000.13	000.01
<u>Androlaelaps marshalli</u>	2	000.05	000.01
<u>Androlaelaps pavlovskii</u>	19	000.51	000.05
<u>Androlaelaps soricinus</u>	85	002.29	000.23
<u>Androlaelaps triangularis</u>	5	000.13	000.01
<u>Cheyletus</u> sp.	2	000.05	000.01
<u>Dermanyssus</u> sp.	1	000.03	000.00
<u>Eucheyletia sinensis</u>	2	000.05	000.01
<u>Eulaelaps stabularis</u>	38	001.03	000.10
<u>Gahrlepiea</u> (<u>Schoengastiella</u>) sp.	16	000.43	000.04
<u>Haemogamasus</u> sp.	8	000.22	000.02
<u>Haemogamasus citelli</u>	2	000.05	000.01
<u>Haemogamasus dorsalis</u>	7	000.19	000.02
<u>Haemogamasus horridus</u>	2	000.05	000.01
<u>Haemogamasus japonicus</u>	2	000.05	000.01
<u>Haemogamasus nidiformis</u>	97	002.62	000.27
<u>Haemogamasus oliviformis</u>	23	000.62	000.06
<u>Haemogamasus suncus</u>	231	006.23	000.63
<u>Haemolaelaps</u> sp.	5	000.13	000.01
<u>Haemolaelaps fenilis</u>	2	000.05	000.01
<u>Haemolaelaps traubi</u>	2	000.05	000.01
<u>Haemolaelaps triangularis</u>	33	000.89	000.09
<u>Haemolaelaps fahrenheitzi</u>	2	000.05	000.01
<u>Histionyssus</u> sp.	25	000.70	000.07
<u>Histionyssus latiscutatus</u>	64	001.73	000.18
<u>Histionyssus suncus</u>	2	000.05	000.01
<u>Hypoaspis</u> sp.	7	000.19	000.02
<u>Hypoaspis lubrica</u>	16	000.43	000.04

<u>Ectoparasite</u>	<u>Number Collected</u>	<u>% of this Ectoparasite</u>	<u>% of all Ectoparasites</u>
<u>Hypoaspis miles</u>	1	000.03	000.00
<u>Hypoaspis sardoa</u>	10	000.27	000.03
<u>Laelaps sp.</u>	70	001.89	000.19
<u>Laelaps algericus</u>	1902	051.34	005.21
<u>Laelaps agilis</u>	21	000.57	000.06
<u>Laelaps buxtoni</u>	3	000.08	000.01
<u>Laelaps echidnina</u>	119	003.21	000.33
<u>Laelaps myonyssognathus</u>	34	000.92	000.09
<u>Laelaps nuttalli</u>	149	004.02	000.41
<u>Laelaps traubi</u>	106	002.86	000.29
<u>Laelaps turkestanica</u>	350	009.45	000.96
<u>Liponyssoides muris</u>	3	000.08	000.01
<u>Myonyssus montanus</u>	51	001.38	000.14
<u>Myonyssus tuberosus</u>	13	000.35	000.04
<u>Ornithonyssus bacoti</u>	3	000.08	000.01
<u>Ornithonyssus bursa</u>	3	000.08	000.01
<u>Ornithonyssus sylviarum</u>	3	000.08	000.01
<u>Pellonyssus viator</u>	10	000.27	000.03
<u>Proctophyllodes sp.</u>	4	000.11	000.01
<u>Proterothrix sp.</u>	4	000.11	000.01
<u>Rhizolaelaps inaequipites</u>	9	000.24	000.02
<u>Spinturnex sp.</u>	5	000.13	000.01
<u>Spinturnex plecotinus</u>	2	000.05	000.01
<u>Falculifer rostratus</u>	7	000.19	000.02
<u>Pterolichus obtusus</u>	21	000.57	000.06
<u>Sokoloviana sp.</u>	4	000.11	000.01
<u>Macrochelidae</u>	5	000.13	000.01
<u>Ascidae</u>	9	000.24	000.02
<u>Pachylaelapidae</u>	3	000.08	000.01
<u>Parasitidae</u>	2	000.05	000.01
<u>Pyemotidae</u>	2	000.05	000.01
<u>Amerosiidae</u>	1	000.03	000.00
<u>Neolaelaps spinosus</u>	31	000.84	000.08
<u>Phytoseiidae</u>	1	000.03	000.00
<u>Macrocheles sp.</u>	2	000.05	000.01
<u>Listrophoridae</u>	1	000.03	000.00
Totals for this type of ectoparasite	3705	100.00	010.14
Mallophaga			
<u>Actornithophilus</u>			
<u>hoplopteri</u>	40	001.18	000.11
<u>Amyrsidea minuta</u>	58	001.71	000.16
<u>Amyrsidea phaeostoma</u>	2	000.06	000.01
<u>Amyrsidea sp.</u>	123	003.62	000.34
<u>Anaticola crassicornis</u>	6	000.18	000.02

<u>Ectoparasite</u>	<u>Number Collected</u>	<u>% of this Ectoparasite</u>	<u>% of all Ectoparasites</u>
<u>Bovicola hemitragi</u>	18	000.53	000.05
<u>Bovicola limbata</u>	186	005.47	000.51
<u>Bovicola ovis</u>	13	000.38	000.04
<u>Bovicola caprae</u>	10	000.29	000.03
<u>Bovicola dimorpha</u>	7	000.21	000.02
<u>Bovicola bovis</u>	6	000.18	000.02
<u>Bovicola sp.</u>	3	000.09	000.01
<u>Bruelia daumae</u>	19	000.55	000.05
<u>Bruelia mahraestan</u>	22	000.65	000.06
<u>Bruelia meinertzhageni</u>	2	000.06	000.01
<u>Bruelia saliemii mollii</u>	12	000.35	000.03
<u>Bruelia saliemii saliemii</u>	4	000.12	000.01
<u>Bruelia sehri</u>	12	000.35	000.03
<u>Bruelia sp.</u>	48	001.41	000.13
<u>Bruelia biguttata</u>	21	000.62	000.06
<u>Chelopistes lervicola</u>	72	002.12	000.20
<u>Colinicola meinertzhageni</u>	27	000.79	000.07
<u>Colocerus sp.</u>	53	001.56	000.15
<u>Colpocephalum fregili</u>	4	000.12	000.01
<u>Colpocephalum tausi</u>	102	003.00	000.28
<u>Colpocephalum turbinatum</u>	36	001.05	000.10
<u>Columbicola columbae</u>	30	000.88	000.08
<u> bacillus</u>			
<u>Columbicola guimaraesi</u>	5	000.15	000.01
<u>Columbicola orientalis</u>	33	000.97	000.09
<u>Columbicola tschulyschman</u>	59	001.74	000.16
<u>Craspedorrhynchus nisi</u>	11	000.32	000.03
<u>Craspedorrhynchus</u>			
<u> spathulatus</u>	7	000.21	000.02
<u>Cuculogaster theresae</u>	22	000.65	000.06
<u>Cuculogaster obscurior</u>	1	000.03	000.00
<u>Cuculiphilus snodgrassi</u>	17	000.50	000.05
<u>Degeeriella regalis</u>	23	000.68	000.06
<u>Falcolius jordani</u>	2	000.06	000.01
<u>Felicola rohani</u>	102	003.00	000.28
<u>Goniocotes creber</u>	1	000.03	000.00
<u>Goniocotes haplogonus</u>	189	005.56	000.52
<u>Goniocotes rectangulatus</u>	8	000.24	000.02
<u>Goniocotes sp.</u>	49	001.44	000.13
<u>Goniocotes diplogonus</u>	15	000.44	000.04
<u>Goniocotes alatus</u>	1	000.03	000.00
<u>Gonoides dentatus</u>	6	000.18	000.02
<u>Gonoides dispar</u>	5	000.15	000.01
<u>Gonoides dissimilis</u>	24	000.71	000.07
<u>Gonoides eurygaster</u>	130	003.83	000.36
<u>Gonoides ithaginis</u>	49	001.44	000.13
<u>Gonoides megaceros</u>	8	000.24	000.02

<u>Ectoparasite</u>	<u>Number Collected</u>	<u>% of this Ectoparasite</u>	<u>% of all Ectoparasites</u>
<u>Gonoides meinertzhageni</u>	6	000.18	000.02
<u>Gonoides pavonis</u>	74	002.18	000.20
<u>Gonoides sp.</u>	2	000.06	000.01
<u>Gonoides spinicornis</u>	5	000.15	000.01
<u>Heterodoxus spiniger</u>	103	003.03	000.28
<u>Kurodaia deignani</u>	8	000.24	000.02
<u>Laemobothrion maximum</u>	4	000.12	000.01
<u>Lagopoecus heterotypus</u>	43	001.27	000.12
<u>Lagopoecus sp.</u>	33	000.97	000.09
<u>Lagopoecus meinertzhageni</u>	3	000.09	000.01
<u>Lipeurus caponis</u>	57	001.68	000.16
<u>Lipeurus pavo</u>	29	000.85	000.08
<u>Lipeurus sp.</u>	12	000.35	000.03
<u>Lipeurus introductus</u>	5	000.15	000.01
<u>Menacanthus kalatitar</u>	37	001.09	000.10
<u>Menacanthus sp.</u>	114	003.35	000.31
<u>Menacanthus stramineus</u>	5	000.15	000.01
<u>Menopon gallinae</u>	280	008.24	000.77
<u>Menopon interpositum</u>	1	000.03	000.00
<u>Meropoecus caprai</u>	1	000.03	000.00
<u>Myrsidea satbhai</u>	43	001.27	000.12
<u>Myrsidea sp.</u>	26	000.77	000.07
<u>Myrsidea anaspila</u>	2	000.06	000.01
<u>Myrsidea insolita</u>	10	000.20	000.03
<u>Oxylipeurus baileyi</u>			
<u>ithaginis</u>	147	004.33	000.40
<u>Oxylipeurus himalayensis</u>			
<u>burmeisteri</u>	292	008.59	000.80
<u>Penenirmus zeylanicus</u>	12	000.35	000.03
<u>Penenirmus sp.</u>	1	000.03	000.00
<u>Philopterus extraneus</u>	16	000.47	000.04
<u>Philopterus sp.</u>	57	001.68	000.16
<u>Quadriceps bicuspis</u>	21	000.62	000.06
<u>Quadriceps dasi</u>	10	000.29	000.03
<u>Quadriceps hoplopteri</u>	96	002.83	000.26
<u>Quadriceps insignis</u>	3	000.09	000.01
<u>Quadriceps sp.</u>	2	000.06	000.01
<u>Saemundssonina africana</u>	6	000.18	000.02
<u>Strachiella mustelae</u>	16	000.47	000.04
<u>Strigiphilus bramae</u>	17	000.50	000.05
<u>Strigiphilus ketupae</u>	27	000.79	000.07
<u>Trichodectes canis</u>	35	001.03	000.10
<u>Turniccla angustissimus</u>	8	000.24	000.02
<u>Alcedoecus annularis</u>	6	000.18	000.02
<u>Meromenopon sp.</u>	1	000.03	000.00
<u>Alcedoffula alcedinis</u>	6	000.18	000.02
<u>Cuculicola sp.</u>	4	000.12	000.01

<u>Ectoparasite</u>	<u>Number Collected</u>	<u>% of this Ectoparasite</u>	<u>% of all Ectoparasites</u>
<u>Mulcticola</u> sp.	7	000.21	000.02
<u>Echinophilopterus</u> sp.	2	000.06	000.01
Totals for this type of ectoparasite	3398	100.00	009.30
Anoplura			
<u>Ancistroplax</u> <u>crocidurae</u>	10	000.46	000.03
<u>Ancistroplax</u> sp.	3	000.14	000.01
<u>Enderleinellus</u> <u>nishimauri</u>	17	000.79	000.05
<u>Haematopinus</u> <u>eurysternus</u>	3	000.14	000.01
<u>Haematopinus</u> <u>suis</u>	124	005.74	000.34
<u>Haematopinus</u> <u>tuberculatus</u>	121	005.60	000.33
<u>Haemodipsus</u> <u>lyriocephalus</u>	109	005.04	000.30
<u>Haemodipsus</u> <u>ventricosus</u>	12	000.56	000.03
<u>Hoplopleura</u> <u>acanthopus</u>	213	009.86	000.58
<u>Hoplopleura</u> <u>capitosa</u>	381	017.63	001.04
<u>Hoplopleura</u> <u>maniculata</u>	148	006.85	000.41
<u>Hoplopleura</u> <u>ochotonae</u>	24	001.11	000.07
<u>Hoplopleura</u> <u>oenomydis</u>	12	000.56	000.03
<u>Hoplopleura</u> <u>pacifica</u>	99	004.58	000.27
<u>Hoplopleura</u> <u>sicata</u>	33	001.53	000.09
<u>Hoplopleura</u> <u>dissicula</u>	19	000.88	000.05
<u>Hoplopleura</u> <u>affinis</u>	5	000.23	000.01
<u>Hoplopleura</u> <u>erismata</u>	11	000.51	000.03
<u>Hoplopleura</u> sp.	12	000.56	000.03
<u>Linognathus</u> <u>africanus</u>	80	003.70	000.22
<u>Linognathus</u> <u>setosus</u>	3	000.14	000.01
<u>Linognathus</u> <u>vituli</u>	79	003.66	000.22
<u>Linognathus</u> sp.	1	000.05	000.00
<u>Neohaematopinus</u> <u>echinatus</u>	23	001.06	000.06
<u>Neohaematopinus</u> <u>elbeli</u>	6	000.28	000.02
<u>Neohaematopinus</u> <u>petauristae</u>	24	001.11	000.07
<u>Neohaematopinus</u> sp.	3	000.14	000.01
<u>Pediculus</u> <u>humanus</u>	64	002.96	000.18
<u>Polyplax</u> <u>asiatica</u>	100	004.63	000.27
<u>Polyplax</u> <u>pricei</u>	1	000.05	000.00
<u>Polyplax</u> <u>reclinata</u>	271	012.54	000.74
<u>Polyplax</u> sp.	46	002.13	000.13
<u>Polyplax</u> <u>spinulosa</u>	8	000.37	000.02
<u>Polyplax</u> <u>stephensi</u>	1	000.05	000.00
<u>Polyplax</u> <u>serrata</u>	1	000.05	000.00
<u>Solenopotes</u> <u>capillatus</u>	2	000.09	000.01
<u>Solenopotes</u> <u>muntiacus</u>	62	002.87	000.17
<u>Haematomyzus</u> <u>elephantis</u>	30	001.39	000.08
Totals for this type of ectoparasite	2161	100.00	005.92

APPENDIX IV.

MAMMALS COLLECTED FROM EACH LIFE ZONE

Terai (West)

<u>Mammal</u>	<u>Number Collected</u>	<u>% in Terai (West) Life Zone</u>	<u>% in all Life Zones</u>
<u>Antilope cervicapra</u>	2	001.56	000.05
<u>Axis axis</u>	6	004.69	000.16
<u>A. porcinus</u>	3	002.34	000.08
<u>Bandicota bengalensis</u>	2	001.56	000.05
<u>Boselaphus tragocamelus</u>	3	002.34	000.08
<u>Canis aureus</u>	7	005.47	000.18
<u>Cervus unicolor</u>	2	001.56	000.05
<u>Crocidura sp.</u>	1	000.78	000.02
<u>Felis chaus</u>	7	005.47	000.18
<u>F. viverrina</u>	1	000.78	000.02
<u>Funambulus pennanti</u>	7	005.47	000.18
<u>Golunda ellioti myothrix</u>	2	001.56	000.05
<u>Herpestes edwardsi</u>	2	001.56	000.05
<u>Lepus nigricollis ruficaudatus</u>	5	003.91	000.13
<u>Millardia meltada pallidor</u>	9	007.03	000.24
<u>Mus booduga</u>	27	021.09	000.75
<u>Panthera pardus</u>	1	000.78	000.02
<u>P. tigris</u>	2	001.56	000.05
<u>Paradoxurus hermaphroditus</u>	1	000.78	000.02
<u>Petaurista petaurista</u>	2	001.56	000.05
<u>Rattus rattus brunneusculus</u>	22	017.19	000.60
<u>Suncus murinus</u>	4	003.13	000.10
<u>S. stoliczkanus</u>	2	001.56	000.05
<u>Sus scrofa cristatus</u>	2	001.56	000.05
<u>Tatera indica</u>	1	000.78	000.02
<u>Vandeleuria oleracea</u>			
<u>dumeticola</u>	4	003.13	000.10
<u>Vulpes bengalensis</u>	1	000.78	000.02
Totals for this Life Zone	128	100.00	3.35

Terai (East)

		<u>% in Terai (East) Life Zone</u>	
<u>Axis axis</u>	3	006.67	000.08
<u>Boselaphus tragocamelus</u>	1	002.22	000.02
<u>Canis aureus</u>	1	002.22	000.02
<u>Cannomys badius</u>	2	004.44	000.05

<u>Mammal</u>	<u>Number Collected</u>	<u>% in Terai (East) Life Zone</u>	<u>% in all Life Zones</u>
<u>Cervus unicolor</u>	1	002.22	000.02
<u>Felis chaus</u>	4	008.89	000.10
<u>Funambulus pennanti</u>	5	011.11	000.13
<u>Herpestes edwardsi</u>	1	002.22	000.02
<u>Lepus nigricollis ruficaudatus</u>	1	002.22	000.02
<u>Macaca mulatta</u>	2	004.44	000.05
<u>Mus booduga</u>	7	015.57	000.18
<u>M. cervicolor</u>	1	002.22	000.02
<u>Panthera pardus</u>	1	002.22	000.02
<u>P. tigris</u>	3	006.67	000.08
<u>Rattus rattus brunneusculus</u>	8	017.79	000.21
<u>Suncus murinus</u>	1	002.22	000.02
<u>Sus scrofa cristatus</u>	2	004.44	000.05
<u>Vulpes bengalensis</u>	1	002.22	000.02
Totals for this Life Zone	45	100.00	1.11

Siwaliks

		<u>% in Siwaliks Life Zone</u>	
<u>Bandicota bengalensis</u>	1	002.50	000.02
<u>Callosciurus pygerythrus</u>	12	030.00	000.32
<u>Canis aureus</u>	3	007.50	000.08
<u>Cannomys badius</u>	2	005.00	000.05
<u>Cervus unicolor</u>	1	002.50	000.02
<u>Felis bengalensis</u>	1	002.50	000.02
<u>F. chaus</u>	1	002.50	000.02
<u>Funambulus pennanti</u>	1	002.50	000.02
<u>Herpestes auropunctatus</u>	5	012.50	000.13
<u>H. edwardsi</u>	5	012.50	000.13
<u>Lepus nigricollis ruficaudatus</u>	2	005.00	000.05
<u>Muntiacus muntjak</u>	1	002.50	000.02
<u>Mus booduga</u>	2	005.00	000.05
<u>Suncus murinus</u>	1	002.50	000.02
<u>Sus scrofa cristatus</u>	1	002.50	000.02
<u>Viverra zibetha</u>	1	002.50	000.02
Totals for this Life Zone	40	100.00	0.99

Mahabharat Lekh

		<u>% in Mahabharat Lekh Life Zone</u>	
<u>Callosciurus pygerythrus</u>	5	003.01	000.13
<u>Canis aureus</u>	3	001.80	000.08

<u>Mammal</u>	<u>Number</u> <u>Collected</u>	<u>% in</u> <u>Mahabharat Lekh</u> <u>Life Zone</u>	<u>% in all</u> <u>Life Zones</u>
<u>Felis bengalensis</u>	2	001.20	000.05
<u>F. chaus</u>	2	001.20	000.05
<u>Herpestes auropunctatus</u>	10	006.02	000.27
<u>H. edwardsi</u>	1	000.60	000.02
<u>Lepus nigricollis ruficaudatus</u>	5	003.01	000.13
<u>Macaca mulatta</u>	1	000.60	000.02
<u>Manis pentadactyla</u>	1	000.60	000.02
<u>Martes flavigula</u>	2	001.20	000.05
<u>Muntiacus muntjak</u>	2	001.20	000.05
<u>Mus musculus ssp.</u>	1	000.60	000.02
<u>M. m. homourus</u>	12	007.25	000.32
<u>M. m. urbanus</u>	37	022.30	001.00
<u>Petaurista magnificus</u>	1	000.60	000.02
<u>Rattus nitidus</u>	2	001.20	000.05
<u>R. rattus brunneus</u>	47	028.31	001.30
<u>R. r. brunneusculus</u>	25	015.10	000.70
<u>Viverra zibetha</u>	1	000.60	000.02
<u>Vulpes bengalensis</u>	3	001.80	000.08
Totals for this Life Zone	166	100.00	4.46

<u>Duns</u>		<u>% in</u> <u>Duns</u> <u>Life Zone</u>	
<u>Axis axis</u>	3	005.35	000.08
<u>Bandicota bengalensis</u>	1	001.79	000.02
<u>Canis aureus</u>	1	001.79	000.02
<u>Cervus unicolor</u>	1	001.79	000.02
<u>Crocidura sp.</u>	2	003.57	000.05
<u>Felis chaus</u>	1	001.79	000.02
<u>F. viverrina</u>	1	001.79	000.02
<u>Funambulus pennanti</u>	3	005.35	000.08
<u>Herpestes edwardsi</u>	1	001.79	000.02
<u>Lepus nigricollis ruficaudatus</u>	3	005.35	000.08
<u>Millardia meltada pallidor</u>	3	005.35	000.08
<u>Mus booduga</u>	2	003.57	000.05
<u>M. cervicolor</u>	2	003.57	000.05
<u>M. platythrix gorkha</u>	5	008.93	000.13
<u>Nesokia indica</u>	3	005.35	000.08
<u>Panthera tigris</u>	1	001.79	000.02
<u>Rattus rattus brunneusculus</u>	5	008.93	000.13
<u>Suncus murinus</u>	12	021.43	000.32
<u>Sus scrofa cristatus</u>	1	001.79	000.02
<u>Tatera indica</u>	2	003.57	000.05

<u>Mammals</u>	<u>Number Collected</u>	<u>% in Duns Life Zone</u>	<u>% in all Life Zones</u>
<u>Vandeleuria oleracea</u>			
<u>dumeticola</u>	1	001.79	000.02
<u>Vulpes bengalensis</u>	2	003.57	000.05
Totals for this Life Zone	56	100.00	1.41

<u>Midlands (West)</u>	<u>Number Collected</u>	<u>% in Midlands (West) Life Zone</u>	<u>% in all Life Zones</u>
<u>Ailurus fulgens</u>	1	000.21	000.02
<u>Apodemus flavicollis</u>	101	021.17	002.75
<u>A. sylvaticus</u>	29	006.08	000.80
<u>Canis aureus</u>	2	000.42	000.05
<u>Crocidura horsfieldi</u>	13	002.72	000.35
<u>Martes flavigula</u>	1	000.21	000.02
<u>Mus musculus homourus</u>	114	023.90	003.10
<u>M. m. urbanus</u>	10	002.10	000.27
<u>Mustela sibirica</u>	2	000.42	000.05
<u>Ochotona roylei</u>	1	000.21	000.02
<u>Petaurista magnificus</u>	1	000.21	000.02
<u>Pitymys sikimensis</u>	117	024.54	003.21
<u>Rattus turkestanicus</u>	45	009.43	001.21
<u>Sorex minutus</u>	3	000.63	000.08
<u>Soriculus caudatus</u>	13	002.73	000.35
<u>S. nigrescens</u>	21	004.40	000.60
<u>Suncus murinus</u>			
Totals for this Life Zone	477	100.00	12.98

<u>Midlands (Central)</u>		<u>% in Midlands (Central) Life Zone</u>	
<u>Ailurus fulgens</u>	1	000.08	000.02
<u>Capricornis sumatraensis</u>	3	000.24	000.08
<u>Crocidura attenuata</u>	1	000.08	000.02
<u>Cuon alpinus</u>	1	000.08	000.02
<u>Dremomys lokriah</u>	18	001.49	000.50
<u>Golunda ellioti myothrix</u>	2	000.16	000.05
<u>Hemitragus jemlahicus</u>	1	000.08	000.02
<u>Hylomys alboniger</u>	4	000.33	000.10
<u>Lepus nigricollis ruficaudatus</u>	1	000.08	000.02
<u>Martes flavigula</u>	1	000.08	000.02
<u>Muntiacus muntjak</u>	4	000.33	000.10

Midlands (Central)

<u>Mammals</u>	<u>Number Collected</u>	<u>% in Midlands (Central) Life Zone</u>	<u>% in all Life Zones</u>
<u>Mus musculus ssp.</u>	35	002.89	000.95
<u>M. m. homourus</u>	196	016.19	005.40
<u>M. m. urbanus</u>	348	028.75	009.52
<u>Mustela sibirica</u>	5	000.41	000.13
<u>Nemorhaedus goral</u>	4	000.33	000.16
<u>Ochotona roylei</u>	93	007.69	002.56
<u>Petaurista elegans caniceps</u>	3	000.24	000.08
<u>P. magnificus</u>	13	001.07	000.35
<u>Pitymys sikimensis</u>	78	006.45	002.15
<u>Presbytis entellus</u>	2	000.16	000.05
<u>Rattus sp.</u>	1	000.08	000.02
<u>R. eha</u>	10	000.83	000.27
<u>R. fulvescens</u>	53	004.39	001.45
<u>R. nitidus</u>	9	000.74	000.24
<u>R. niviventer</u>	31	002.56	000.84
<u>R. rattus ssp.</u>	4	000.33	000.10
<u>R. r. brunneusculus</u>	11	000.91	000.29
<u>R. turkestanicus</u>	33	002.73	000.89
<u>Sorex cylindricauda</u>	35	002.89	000.95
<u>Soriculus caudatus</u>	87	007.18	002.40
<u>S. leucops</u>	2	000.16	000.05
<u>S. nigrescens</u>	85	007.02	002.35
<u>Suncus etruscus pygmaeoides</u>	10	000.83	000.27
<u>S. murinus</u>	16	001.32	000.43
<u>Vandeleuria oleracea</u>			
<u>dumeticola</u>	2	000.16	000.05
<u>V. o. modesta</u>	8	000.66	000.21
Totals for this Life Zone	1211	100.00	33.11

Midlands (East)

		<u>% in Midlands (East) Life Zone</u>	
<u>Ailurus fulgens</u>	1	000.15	000.02
<u>Belomys pearsoni</u>	2	000.30	000.05
<u>Callosciurus pygerythrus</u>	2	000.30	000.05
<u>Canis aureus</u>	2	000.30	000.05
<u>Capricornis sumatraensis</u>	3	000.45	000.08
<u>Crocidura attenuata</u>	2	000.30	000.05
<u>Dremomys lokriah</u>	10	001.50	000.27
<u>Felis chaus</u>	1	000.15	000.02
<u>Manis pentadactyla</u>	1	000.15	000.02
<u>Martes flavigula</u>	2	000.30	000.05
<u>Muntiacus m. atjak</u>	5	000.75	000.13

Midlands (East)

<u>Mammals</u>	<u>Number Collected</u>	<u>% in Midlands (East) Life Zone</u>	<u>% in all Life Zones</u>
<u>Mus booduga</u>	4	000.60	000.10
<u>M. cervicolor</u>	1	000.15	000.02
<u>M. musculus ssp.</u>	5	000.75	000.13
<u>M. m. homourus</u>	116	017.42	003.16
<u>M. m. urbanus</u>	35	005.26	000.94
<u>Nectogale elegans</u>	3	000.45	000.08
<u>Nemorhaedus goral</u>	2	000.30	000.05
<u>Ochotona roylei</u>	4	000.60	000.10
<u>Paguma larvata</u>	4	000.60	000.10
<u>Petaurista elegans caniceps</u>	7	001.05	000.18
<u>P. magnificus</u>	5	000.75	000.13
<u>Pitymys sikimensis</u>	101	015.17	002.75
<u>Rattus eha</u>	57	008.56	001.54
<u>R. fulvescens</u>	44	006.61	001.19
<u>R. niviventer</u>	1	000.15	000.02
<u>R. rattus ssp.</u>	42	006.31	001.14
<u>R. turkestanicus</u>	7	001.05	000.18
<u>Ratufa bicolor</u>	2	000.30	000.05
<u>Sorex cylindricauda</u>	8	001.20	000.21
<u>Soriculus caudatus</u>	94	014.11	002.56
<u>S. leucops</u>	3	000.45	000.08
<u>S. nigrescens</u>	76	011.41	002.06
<u>Suncus murinus</u>	10	001.50	000.27
<u>Sus scrofa cristatus</u>	1	000.15	000.02
<u>Viverra zibetha</u>	3	000.45	000.08
Totals for this Life Zone	666	100.00	17.93

Inner Himalayas

		<u>% in Inner Himalayas Life Zone</u>	
<u>Alticola stracheyi</u>	5	000.78	000.13
<u>Hemitragus jemlahicus</u>	3	000.47	000.08
<u>Martes flavigula</u>	2	000.31	000.05
<u>Mus musculus homourus</u>	93	014.59	002.55
<u>M. m. urbanus</u>	110	017.25	002.98
<u>Mustela sibirica</u>	5	000.78	000.13
<u>Ochotona roylei</u>	45	007.06	001.22
<u>Pitymys sikimensis</u>	60	009.40	001.62
<u>Pseudois nayaur</u>	1	000.15	000.02
<u>Rattus eha</u>	75	011.77	002.05
<u>R. nitidus</u>	5	000.78	000.13
<u>R. turkestanicus</u>	5	000.78	000.13
<u>Sorex cylindricauda</u>	30	004.70	000.81

Inner Himalayas

<u>Mammals</u>	<u>Number Collected</u>	<u>% in Inner Himalayas Life Zone</u>	<u>% in all Life Zones</u>
<u>Soriculus caudatus</u>	134	021.00	003.68
<u>S. nigrescens</u>	63	009.87	001.74
Totals for this Life Zone	638	100.00	17.32

Tibetan Plateau

		<u>% in Tibetan Plateau Life Zone</u>	
<u>Alticola stoliczkanus</u>	2	008.58	000.62
<u>Apodemus sylvaticus</u>	170	063.43	004.70
<u>Lepus oiostolus</u>	3	001.12	000.08
<u>Mus musculus ssp.</u>	30	011.20	000.83
<u>Mustela altaica</u>	1	000.37	000.02
<u>Ochotona daurica</u>	5	001.87	000.13
<u>O. macrotis</u>	1	000.37	000.02
<u>O. sp.</u>	4	001.49	000.10
<u>Pitymys leucurus</u>	21	007.84	000.59
<u>Presbytis entellus</u>	1	000.37	000.02
<u>Rattus rattus ssp.</u>	5	001.87	000.13
<u>Sorex minutus</u>	3	001.12	000.08
<u>Vulpes ferrilata</u>	1	000.87	000.02
Totals for this Life Zone	268	100.00	7.34

OVERALL TOTALS FOR ALL LIFE

ZONES	<u>3695</u>		<u>100.00</u>
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