(1987)

Zahavi. A., The theory of signal selection and some of its implications. Proc. Inter. Symp. Biol. Evol. (V.P. Delfino ed.) Adriatica Editrica Bari

① Characters such as long tails in Birds or large antlers in mammals, may function as reliable signals for physical vigour because of the burden they impose on their bearers.

② The increased predation risk, due to bright colours, is compensated for by the benefit of advertising the ability of the signaller to evade predators.

③ Signals have to be clear enough to be differentiated from the background noise and from other signals. (Quoting Smith W.J. 1977).

④ In threat signals a movement sideways may be easier to observe than and ∴ clearer than a movement forward. However of all possible movements the forward movement has been chosen to signal high motivation to attack. Suggests that the risk involved in moving towards the rival has been selected as the optimal threat signal because it is the most reliable one.

⑤ In roaring stags (Clutton-Brock & Albon 1979) ~~and the evolution of~~ observed that roaring exhausts stags. They suggest that as the same muscles are used for fighting the stags is actually displaying honestly its potential to fight. Zahavi suggests that roaring is selected as a threat signal because it exhausts the stags and because of the large risk involved to an exhausted stag when facing its rival.

(6) regular coloration pattern.

Closely related species often inhabit different niches and consequently evolve different morphological adaptations and these differences are displayed by different patterns.

On the other hand it is reasonable to expect convergence of patterns in species with similar morphological or behavorial adaptations.

Baker R.R. (1985) Animal Behaviour 33: 1387-1388

In 3 speces (northern orioles Icterus galbula; redstats Setophaga ruticilla and Indigo bunting Passerina cyanea) brightly colored mals arrived in breeding grounds before the more cryptic colored ♂s and thus had access to better territories. ♀s were not responding in redstats to eat brighter colours but to the better quality of territory which in turn was due simply to earlier arrival and not to better defence.

The 3 studies do not show that bright ♂ plumage per se confers an advantage over dull plumage in acquiring ♀s.

C.3. Barnard 1983. Animal Behaviour : ecology and evolution. Croom Helm . london.

1) Under anti predator behaviour :-
Many species such as ptarmigan (Lagopus mutus), snipe (capella gallinago) and others including antelopes flee from predators in characteristic zig zag fashion. Rapid unexpected changes in flight direction make it dificult for a predator to track prey.

Brown D.E. 1982. Sex ratios, sexual selection and sexual dimorphism in waterfowl. American Birds Vol. 36 No. 3. pp 258-260.

(1) imbalanced sex ratios favoury ♂s waterfowl due to greater ♀ mortality — sex ratio 50:50 at hatching.

(2) Degree of sex ratio imbalance appear related to the ~~degree~~ length of pair bond.

(3) Apparent relationship between imbalanced sex ratios favoury ♂s and sexual dimorphism in North American quails and hypothesized that male preponderance is a function of sexual selection.

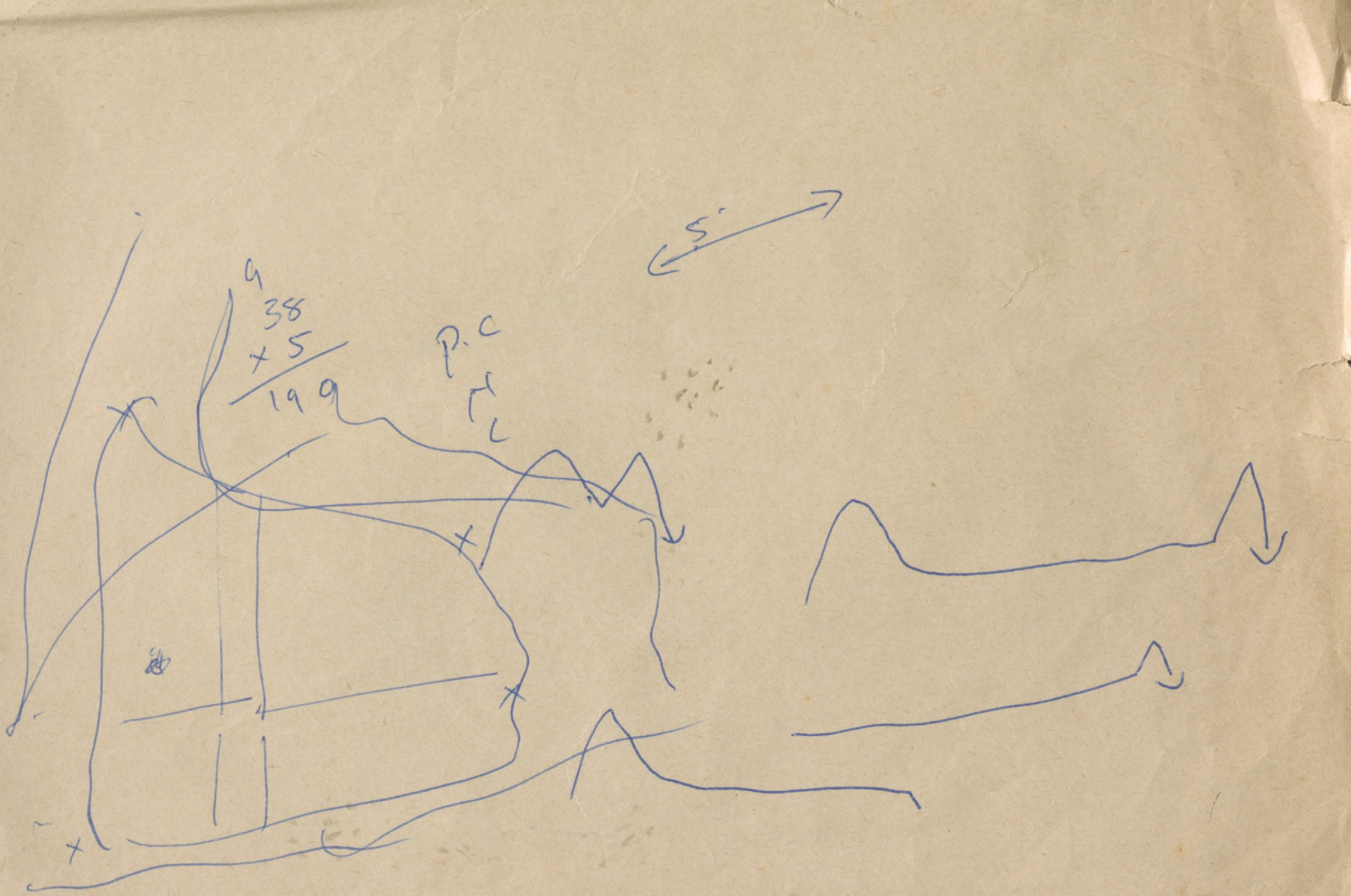
(4) ~~Sex ratio~~ If sex ratio is a function of ~~natural~~ sexual selection and intra sexual competition then species in which least disparate sex ratio will have least dimorphism and have longest pair bond

(5) The shorter the period for male selection the greater the need for more males to select from.

(6) less migratory species have longer periods for mate selection.

BERGSTROM, P. W. 1988:
Breeding displays & vocalisations of Wilson's plovers.
Wilson Bull. 100: 36-49

(Dept. of Biol., Washington & Lee Univ., Lexington, VA 24450, USA)


S
38
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199
P.C

GAULIN STEVEN S.C. & Randall Co. ~~Kaufmann~~ Fitzgerald. 1985

J mammal 69(2): 311-319.

Home range size as a predictor of mating system in Microtus.

(Dep. of Anthropol. Univ. Pittsburgh, Pittsburgh, P.A. 15260

I Shipley F.S. Re 4 egg clutch limit in the Charadrii.
An experiment with American avocets.

In the American avocets (Recurvirostra americana)
some nests were destroyed by inundation.
~~Eptoc~~. 12 % of eggs/nest/yoy were destroyed
by weather.

II Slagsvold Tore (1984). Clutch size variation
of Birds in Relation to Nest Predation: on the
cost of Reproduction.
Journal of Animal Ecology (1984), 53 945-953

Quoting (Perrins and others) says that for the great
tit, the rate of juvenile ~~predation~~ survival is
much lower for young fledged from late broods than
for those fledged earlier ~~than~~ on in the breeding
season. (as much as 50% less for the latter ones).

III Montgomery Slatkin 1984 Ecological
causes of sexual dimorphism.
Evolution 38 (3), 622-630

Presents a complicated model that concludes
that sexual dimorphism can result due to the action of
~~from~~ purely
ecological forces.

Vijay Prakash Singh. (1981 or 1982) → date not given.

Bio-ecological studies on Cervus duvauceli duvauceli, Swamp-deer (Barasingha) in Dudhwa forest near Indo-Nepal border.

Phd. Thesis submitted at Kanpur university, Kanpur.

1) Schan Scomburgk deer (Cervus duvauceli scomberghi)
3rd subspecies of barasingha was frequently found in the swampy ~~areas~~ of open grass plains of Thailand.
Due to human pressure was forced to move into forests away from its natural habitat where it finally became extinct in the 1930's.

(2) Present distribution of swamp deer in U.P.
Pilibhit (a) ~~Alon~~ In swampy grasslands along Sharda canal and Mala river.
(b) Faizulganj block
(c) Gunhan
(d) Lagabbaga (which adjoins Shukha phanta which holds second largest population of swamp deer in the world.)
(e) Populations = c. 400, 50 in Faizullganj, 25 in Gunhan 100 in ~~lagha~~ laggabhagga, 100 between sharda canal & sharda sagar dam (Mahoh & Surai forest ranges and c. 25 in Mala forest range.

Dudhwa N.P.

Total c. 1400
Sathiana block = 932
Belghat block (Nawalkhal) = few
Chottapallia block (Banhey taal) = 173
Kakraha - 221
Bhadi block - 35
Churella taal (Kaudoria block) - Few
Nagra block (Nagra taal) 40

South Kheri forest division.
restricted to grasslands along ul river & Shaditaal
Kishanpur sanctuary :- practically all of the main
suitable swamp deer habitat has been converted
either into eucalyptus plantations or under cultivation.
ul river is seasonal hence allmost all water
sources & habitat dominated by domestic
animals. Due to this swamp deer have to take
shelter in thick forest.
ul river bank in Madha & Bhira blocks
c. 50 animal.
Shaditaal = 175 swamp deer.

Bahraich forest division.
most of grassland areas converted into Eucalyptus
plantations. Remaining habitat under pressure from
domestic animals & human use. A population
of 41 animals remain in Motipur range.

(3) Movement.

(a) Prior to Rains they are found in low open
areas in small groups and solitary. ♀s with fawn
or pregnant does remain away from main
herd and stay mostly in tall grasses.

(b) With the monsoons the grasslands are flooded.

(c) Except Sathiana block, other areas are
surrounded by sal or mixed forests. Swamp deer
pass unfavourable conditions in these areas forest
in small groups of 2 to 5 individuals.

(d) In Sathiana region they move outside the
park. Nights they feed on crop, and days are
spent in sugar cane fields or in grassy
patches.

(e) Winter also they are seen outside the park.
(f) ~~Early part of rut is spent in the cultivated area~~
of Gnola

(f) ♂ congregate on grassy phantas when controlled
burning is over. large herds seen during this time.

④ Rutting

(a) First stag in hard antlers seen in end August. By end september almost all stags are in hard antlers.

(b) Stags remain in hard antlers (peak) from September to January.

(c) first ruttin call heard in last week of august & last in last week of January

(d) durin early part of rut stags and hinds move away from park into ghola

(e) Mating period over by November but ruttin calls heard upto February correspondingly

(f) start of Ruttin period govern ^ by early or late monsoons.

(g) wallowin sites remain same every year.

⑤ Causes for decline.

① loss of habitat.
(a) plantations
(b) agriculture.

② Fire :- natural fires & came destruction to habitat.

③ Floods.

(a) Rivers & Nalas are flooded & swamp deer area is submerged durin monsoons. Hence deer are forced to migrate in the upper areas of ghola and other places.

(b) Fawnin in July occurs in lowlyin areas hence affected by first showers resultin in heavy fawn mortality.

④ Poachin :-

(a) common outside park especially near the nepal border.
(b) More common durin monsoon as animals move out of the park.
(c) Recorded 16 cases of poachin (incl. Hog deer chital and boar) durin August & September 1979.
(d) Poachin mainly for tropiy and antlers which have a medicinal & other values.

(~~4~~) (5) Predation.

(a) Tiger. out of 127 ~~100~~ kills, droppings and skulls examined 57 were of swamp deer 44·88%.

(b) Jackals are common predators of fawns and yearlings. latter being hunted by pack. and former when hidden in the grass.

DUDHWA NATIONAL PARK.

SOURCE:- MANAGEMENT OF RE-INTRODUCED INDIAN RHINOCEROS — A PIONEER EXPERIMENT

(Prepared by) R.C. SINGH (Director Dudhwa N.P.)(ex))

August 1985. (First report based on actual monitoring data)

unpublished report.

I History

(1) Area of National Park and surroundings taken over from private ownership in 1961 and reserved as forest land.

(2) In 1862 Brandis (the then Superintendent of forests) oversaw the demarcation and preperation of detailed maps of the forest

(3) In 1886 the ~~first~~ first working plan was prepared by A.F. Brown. Since then these have been ~~perfect~~ periodically revised

(4) 'Plantation schemes' began aronnd 1950-51. Sheeshum (Dalbergia sissoo) and Semal Bamab ceiba (Bombax sein ceiba) were planted in extensively in grasslands these then being considered as non-productive land. Mixed forests were clear felled and mono-culture of exotics like Teak (Tectona grandis) and Eucalyptus were planted. (Eucalyptus also planted in grasslands.)

(5) In 1958 c.63 sq. kms ~~it~~ was declared a wildlife sanctuary called the Sonaripur Sanctuary

(6) In 1968 this was extended to cover 212 sq. kms and was renamed as ~~the~~ Dudhwa Sanctuary

(7) On 1st February 1977 Dudhwa National Park came into existence with a core area of about 490 sq. kms with an additional 124 sq. kms as a buffer zone.

II Coordinates, area, etc

(1) Elevation above sea level varies from 182 mts in the extreme north to 150 mts in the south east.

(2) lies between latitudes 28° 24' & 28° 27' and longitudes 80° 31' and 80° 52'

(3) Area 614.343 sq kms. incl. Buffer zone.

III Forest type

Vegetation type.	Area sq. km	Percentage
Sal (Shorea robusta dominated dense forest	332.353	~~54.097~~ 54.098
Grasslands	113.14	18.4164
Sissoo dominated open forests with grasses	42.11	6.8545
Teak plantations	40.11	6.52893
Jamun (Syzigium cumini) dominated forests found along streams	31.92	5.1958
Khair (Acacia catechu) dominated open forests with grasses	21.16	3.44433
waterbodies & wetlands	~~15.4~~ 18.33	2.9837
Eucalyptus plantation	14.22	2.31467
Rest houses rds railway lines etc	1.00	0.16278
	614.343	99.99911

(is satellite pictures taken on 10/11/1981 area in summer will be less).

Computed from satellite Remote sensing techniques and old forest records.

satellite data from land Sat - 3 pass at 10/11/81.

IV Official census of Mammals as on May 1985

Sl no	Species	Approx Nos	Scientific name
1	Tiger	80	Panthera tigris
2	leopard	8	Panthera pardus
3	Jungle cat	201	Felis chaus
4	leopard cat	153	Felis benghalensis
5	Fishing cat	308	Felis ~~viver~~ viverina
6	Indian Ratel	103	Mellivora capensis
7	Indian Fox	59	Vulpes bengalensis
8	Jachal	104	Canis aureus
9	Small Indiancivet	19	Vivericala indica
10	Indian otter	309	Lutra perspcillata
11	Sloth bear	80	Melursus ursinus
12	wild boar	5000	Sus scrofa
13	swamp deer	2750	~~Axis~~ a Cervus duvauceli duvauceli
14	Spotted deer	9000	Axis axis
15	Hog deer	4000	Axis porcinus
16	Barking deer	750	Muntiacus muntijak
17	Sambar	700	Cervus unicolor
18	Blue bull	600	Boselaphus tragocamelus.

V Detailed study of the 'tevai' in general and Dudhwa in particular carried out by S.K seth Silviculturist U.P. Forest Dept. (1959)

Main grass species were.

Arundo donax
Fragmites karka
Narenga porphyrocoma
Desmostachya bipinnata
Bothriochlon pertusa
Saccharum spontaneum
Imperata cylindrica
Heteropogon contortus
Sacharum munja
Themeda Arundinacea
Himarthria compressa
Andropogon intermedius
Cymbopogon martini

Vetiveria zizanoides
& Cynodon dactylon
Narenga porphyrocoma
Typha elephantina
~~Para~~ Panicum paludosum
Peretis indica
Dactyloctenium aegyptium
Setaria glauca.
etc.

VI In December 1983 a study carried out ~~by~~ by A. N. Chaturvedi (Conservator of forests, Research and development circle U.P. forest dept.) to assess the productivity of grasslands.

It revealed that:-

① total area occupied by grasses (of V) is ~~about~~ 119.6 sq. kms including grasslands & open forests.

② mean quantity of grass available per $1m^2$ quadrat = 2788 gms.; 27.88 tonnes per ha. S.D = 8.36 tonnes per Ha.

③ Productivity of green grass in Dudhwa = c. 2,33,459 tonnes of green grass.

④ In winter moisture is 23% in terms of dry grass productivity of dry grass = 22.66 tonnes per ha. S.D = 6.66 tonnes per ha.

VII Salukajur Rhino enclosure.

① Area of 27.4176 sq kms has ~~been~~ been enclosed in the south Sonaripur range

② Eight well dispersed waterholes/lakes.

③ Electric fence ~~about 18.5 kms long.~~

a) c. 18.5 kms long.
b) 2 strands.
c) Ht of 1st strand .6 m from ground.
d) " of 2nd strand 1 m " "
e) Total nos of posts 2390 (1903 posts & 487 standing trees)
f) Av. distance between posts 5 m.
g) Batteries. 2, 12 volts 25 plated batteries connected in series
h) Energizer - 'Gallagher energizer' (New zealand) 4-5 mega volt pulses at 50-60 pulses per minute

④ Rhinos. (2♂+3♀)

a) Assam (5) arrived on 1/4/84 released on 20/4/84 (3) & 9/5/84 (1). 1♀ (pregnant) died in stockade on 12/4/84 other ♀ died 31/7/88

b) Nepal (4♀) Arrived 29/3/85 ① & 1/4/85 ③. Released :- 30/3/85 ① 5/4/85 ① and 9/4/85 ②

VIII.1 Miscellaneous.

① Prior to 1977 nearly 30-35 thousand domestic cattle used to graze in the Dudhwa forests. (A number of places ~~are~~ still still have the name 'gowdi' or cattle camp attached to them. e.g. Kaima gowdi (↳ pers enquiries)

② In one year that is by 1978 this was totall banned [this is largely due to the fact that majority of the cattles ~~these~~ cattle came from well away and on a sort of permit basis]→(pers. enquiries) this inside the core area of 490 sq.km. In the buffer zone some amount of grazing still goes on.

③ During R.L. Singh's tenure ~~of~~ from Sept 1976 - Feb 1978 not a single instance of maneating recorded inside or outside the park.

④ From 2nd March 1978 to July 1985 more than 1410 human beings killed/eaten.

⑤ Outside park c. 35 tigers live permanently in sugar cane field.

⑥ C. 800 sq. km of forest ~~have~~ /grasslands have been turned to agriculture in the last 30-35 yrs.

⑦ 3 sugar mills near ~~near~~ the park at Palia Bellraein & Samparnanagar

⑧ ~~8~~ last Rhino seen in the Dudhwa region dates back to 1878

KHERI: A GAZETTEER VOL. XLII

DISTRICT GAZETTEERS OF THE UNITED PROVINCES OF AGRA AND OUDH

BY H.R. NEVILL, I.C.S

ALLAHABAD, Printed by F. LUKER GOVT PRESS UNITED PROVINCES 1905

I Topography

1) Vast alluvial plain northern half covered by forests. Numerous channels, watercourses & rivers.
2) Only irregularities in is by low river beds and high banks which flank them on either side
3) A series of fairly high plateaux ~~with~~ seperated by rivers, flowing from North west, each bordered by low alluvial belts of varying ~~text~~ width.
4) Altitude = 600 ft in the extreme north along the Mohan river to 375 ft in the south eastern corner.

II tracts of land. = 4 main ones.

1) Trans Gumti (in the southwest) (parganas of Paigacwan & Mah Muhamadi) adjoins Shahjanpur. Eastern portion is low lying and is covered in places by grassy wastes and dhak jungle
2) IInd tract lying between Gumti & Kathna mostly high and sandy
3) east of Kathna central tract :- parganas of Kheri Haidarabad, Kasta & Paila, richest has loamy soil Kukra Mailani included geographically interior to the rest, more than half is covere by forest and the agricultural areas are exposed to the ravages of wild animals
4) last tract beyond the M. Wild land, cut by innumerable channels, flooded duriy the rains the North is all forests and wild animals do great damage to crops in the neighbourhood. Cultivation of the shifting type

III rivers. belong to two main system.
1) Gomti
2) Ghagra

a) Sukheta belongs to the ganges system
b) Gomti on right bank 2 small tributaries both called Chuha. River flanked by high sandy uplands and patches of tarai
c) Kathna is east of the gomti and arises from Moti Jhil of ~~Shajhanpur~~ Shahjahanpur. Banks are covered almost throughout with Jungle on either side

IV Forests.
Most important in oudh amounting in nearly half the forest lands of oudh. Contains superior timber to Gonda and Bahraich
Forest area which includes all the reserved lands whether covered with trees or not covers the greater part of Khairigarh, a considerable portion of Pallia and Nighasan in the north and in the west forest cover most of the Bhur and Kuhra Mailani parganas. Rose forests ~~stretch~~ stretch along the banks of the rivers as far as Hardoi and Sitapur districts.
A continuous tract of forest all along the kathna from Mailani to the southern boundary of the districts.
Eastern banks of Gumti has forest patches upto Muhamadi; Along the ill there are unbroken forests extending to within a short distance of Lakhimpur.

Total forest area = 563 sq. miles of which 113 sq. miles is in private hands.

IV History of forests.

1861 :- ~~385 278 of Kheri~~ 278 sq. miles of Khairigarh and 25 sq miles of Bhur were taken over by govt. and preserved as forest lands
Remaining 347 square miles were divided into lots of 5000 acres or less and given to men of supposed enterprise. A> these was many dificult honour the contract of cutting a quarter of the forest and bring a quater of the land under agriculture

within 12 years grants covering over 120 sq. miles were taken back by the govt.

Before it came under govt. control forests had been worked for sal by the Raja of Khairigarh, also (Elsewhere nothing was done except tapping of resin) watercourse and adjoining cultivated lands.

1861 selected felling started of superior timber and exported to Bahramghat

1882 Demand for Railway sleepers started.

1878 khair forests were largely exploited and by 1905 it had bee worked out.

upto 1891 felling departmentally carried out Subsequently by contractors.

Produce

1) Sal timber : av. annual felling (exported in the form of sleepers, logs and poles) between 1896 and 1901 = 362,000 cubic feet
69,000 cubic feet of asaina (Terminalia tomentosa)

Wild animals.

by 1905 both elephant and buffalo had disappeared from though earlier both were said to be common.
Tigers still exist but fallen back to the spread of cultivation and are present- in the less accessible jungles
leopards still fairly common.
wolf, wild dog, jackal, hyaena & fox still present
wild cattle in some of the forests. Bears in the north

Black buck abound between Katkna and the Gumti and beyond Katkna in Kukra & Bhur. In smaller numbers on the west bank of the Gumti and near the Sukheta and North of the Chauka from Pallia to Dhaurahra
Nilgai common

Hog deer met with in great numbers in the ravines and ancient watercourses. found in Khairigarh and Kuhra and in marshes and open wastes on either side of the Chanka (sanda). Also along the Ull but have disappeared.

Swamp deer exist in diminishing numbers along the chanka especially in the extreme northwest of Bhur. A few one time present in grass jungle of Daurha Daurahra to the south of the Sukheta but here have become practically extinct

Sambhar barking deer, chausingha confined to forest tracks

Great (Indian?) bustard present near Matera but now almost unknown

Florican very common in former days in Bhur but have been greatly reduced

Cattle census
calculated as
1860:- 517,600 cows, & plough bulls / buffaloes. (all type
first regular settlement nos. returned as 598,674
7·17 plough animals per plough
August 1899. regular cattle census
243,404 - Bullocks & bulls
42,101 ♂ buffaloes

beginning 1904
Plough animals 335,265 including 56,302 buffaloes
av. 2·5 animals per plough
cows - 344,996, cow buffaloes 70,585, and young stock 291,289
Milk-yield small (even of stall fed animals average 1/2 ser to 1 ser per day

last returns showed

61,720 sheep
309,928 goat

av. annual rainfall from 1870 to 1904 = 45.9 inches

Cultivation

1865 :- area under plough = 793,942 acres (53 %)
1875 :- " " " 778,615 " (51 %)
↓ except Bhrar. (drop due to epidemics)

1885 826,974 acres
1893 807,750 "
1893→ ~~4th~~ would decline owing to very wet season then famine of 1896-97 (716,809 acres)

av. 1894 to 1897 (inclusive) = 751,700
" ~~1894~~ 1900 to 1904 = 842,000 ~~when~~
when 54% excluding forest land under cultivation

People

1869, (doubtful data due to paucity of qualified enumerators) 738,089 people 242 per sq. mile
increasing to 281 if forests excluded
1,582 villages & towns

1881, 831,922, 278 per sq. mile
1,655 villages & towns

1891 903,695, 304.7 per sq. mile
1,711 towns & villages

1901, 905,138 (low rate due to bad season etc)
305.5 per sq. mile. Excl. forest 360.2 per sq. mile

Khasi most sparsely populated district of Oudh. 1664 towns & villages.

Religion.
1911 census.

780,659 Hindus, 123,702 Muslims
473 Christians, 183 Aryas, 88 Sikhs, 21 Jains
& 12 Buddhists.

Area of Kheri :-
1,896,457 acres or 2,963 sq. miles.

On the evolution of Mating system in Birds and Mammals.

Orians. G.H. 1969 The American Naturalist. 103: 934. 589-603.

(1) The failure to mate with one ~~mate~~ individual will be followed ~~by~~ by an opportunity to mate with other individuals with such a high probability that the loss in reproductive output resulting from rejection of a potential mate is on the average less than the average gain that can be realized by obtain a mate of superior fitness. (& ~~Fisher~~ Fisher 1958)

(2) Males of many species court rather indiscriminately and can, especially when deprived of sexual activity for some time be induced to mate with remarkably incomplete stimulus objects.

(3) In polygynous system there should be a very keen competition among ♂s for better quality territories as possession of high quality territory is likely to result in the attraction of more than one ♀.

(4) Contests for such territories should lead to the stronger ~~evolution~~ selection of secondary sexual characteristics useful to such contests.

(5) Selander (1958) has demonstrated a strong correlation between the amount of sexual dimorphism in size and the degree of polygyny and promiscuity in mating patterns among American blackbirds.

(6) the stron competition among ♂s for suitable territories and the failure of males with poor territories to find a mate at all should produce a floatly population of non-breeding ♂s. Such floatly populations are a characteristic of many polygynous species.

(7) Assuming that older & more experienced ♂s have a better advantge in gettn territory, chatty success of Young ♂s should be very low.

(1) Conceived in 1948

(2) Begins at Harike, below the junction of the Sutlej and Beas

(3) Carries water for 169 km through punjab before entering Rajasthan at Manitanwali

(4) Moves through Ganganagar, Bikaner & Jaisalmer districts. Its distributories and water courses stretch out to Sadhyar, Churu & Barmer districts — 450 km

(5) Expected to irrigate 13.88 lakh hectare. majority along the Pak border.

Courtship display sounds by wing / tail in birds.

Fundamentals of Ornithology

Josselyn Van Tyne & Andrew J. Berger

New York : John Wiley & Sons. Inc. 1959

PP. 131 – 134

(1) Drumming accomplished by wings as in case of Ruffed Grouse (Bonasa umbellus).

(2) Wings of the Woodcock (Philohela minor) responsible for a melodious ~~song~~ sound during springtime courtship flights.

(3) Male Nighthawk (Chordeiles) during breeding season – interrupts ~~it~~ lazy, erratic and somewhat flight high above the ground to dive earthward when close to the ground, the bird pulls out of its dive and the air rushing through its wing feathers produces a characteristic booming sound.

(4) [Collingwood Ingram 1956 : 673) ← nuptial flight of Tetrao tetrao ~~Otis~~ structural modification of 7th primary is believed to account for a flight whistle ((while indulging in this performance the wings are kept much depressed, like those of a drake about to land, while the head is held outstretched and carried in an almost erect position. Throughout this highly mannered flight one can distinctly hear a curious whistling sound. Although proof is lacking, there can be little doubt that this is caused by air passing through one or more gaps created by the abnormally-shaped fourth primary in each wing. In the male of this species, but not in the ♀ (or in 1st years ♂), this feather is appreciably shorter than either of its neighbours, while its is further characterized by having its web deeply and assymetrically emarginate on both sides of the shaft.)) [Ingram, Collingwood. 1956 Mechanical Sounds in Bird Life, Part II. Illustrated London News, Oct 20. 1956 : 673]

(5) wings of ♂ waglers Oropendola (Zarynchus wagleri) make a "loud startling rushing roar, such as might be produced by the sudden violent tearing of some textile" (Chapman, 1928 [Chapman, James. P. 1922. Nesting Habits of wagler's Oropendola (Zarynchus wagleri) on Barro Colorado Island. Bulletin of American ~~Natural~~ Museum of Natural History. 55 : 123 – 166].

(6) Some Neotropical Manakins (Pipridae) Range S. Mexico — Paraguay. ♂♂ have ~~spectacular~~ striking & varied display dances. (louder, more spectacular sounds are made by remiges in many spp.)
Some of these spp. combine nonvocal sounds in leks in the jungle. The mechanical sounds produced have been likened to a "muffled rattling of dried peas in their pods", "the crack of a whip", "a sharp percussive snap"; All presumed to result from specialized features of the wing feathers and muscles.
Re webs of the 4 outermost primaries are very narrow, leaving gaps between the feathers: there is a thickening in the shafts of the first four or five secondaries; and 2 of the forearm muscles (Flexor carpi ulnaris and flexor digitorium superficialis give rise to tendinous slips that insert on the bases of the secondaries (some other birds however have a similar muscle arrangement).

(~~7~~) Chapman, Frank. M. 1935. The courtship of Gould's Manakin (Manacus vitellinus vitellinus) on Barro Colorado Island. Bull. Amer. Mus. Nat. Hist. 68: 471-525.

(7) Singing hummingbird (Campylopterus curvipennis) notable for curiously curved and much stiffened wing feathers - which produce a roar as bird flies about in the undergrowth in which it sings.
Sutton, George Miksch. 1945. At a bend in a Mexican River. Audubon Magazine, 47: 239-242.

(8) Tail feather of common snipe (Capella gallinago) while in aerial display involving a bleating flight produced by the relatively 'slow quivering' of the half open wings superimposed on the much more rapid vibrations of the tail feathers.

~~Bird Notes.~~

~~The Journal of the foreign bird club.~~

My Little bustard. (Otis tetrax)

By Wesley T. Page ~~F.Z.S. M.B.O.U.~~

Bird Notes : VI (Series III) : 131-133. 1923

This Charming bird came in to my possession in 1922 as a gift from my friend and fellow member, Mr G. Falkner, It was then quite Juvenile, though fully grown, time has proved it to be female, and I hope I may get a mate for it in near future. Mr Falkner brought it back with him from a short visit to ~~east~~ British east Africa.

Ever since its arrival it has been a great favourite with me. It is very tame and could easily be trained to follow one about like a dog.

It is easily catered for, eats earth worms ~~easily~~ greedily, and bolts a medium sized mouse which after killing it. The menu provided for it consists of moistened biscuit meal, such as given to poultry which contains cracked as a morning meal., and in the evening mixed poultry corn, and it thrives thereupon and is in the pink of condition.

It has no gaudy colouration, but is a beautiful arrangement Sandy brown and buff is very finely pencilled with darker brown, the plumage of the back and wings blotched & fringed with black. The centre of abdomen and ventral region whitish buff. The male in breeding

is more greyish in upper parts not blotched with black, cheeks and throat dark grey enclosed by a white loop, below this a broad black collar, again enclosed by a crescentic band of white and then another of black. In winter he closely resembles his mate.

Howard Saunder's Manual of British Birds record the following habits and characteristic

" Unlike the great bustard (O. tarda) the little bustard was never more than a wanderer to the British isles . . . . . it is a winter visitor to germany, France, Italy and Germany and a resident species in Southern Italy. Plentiful along the Danube valley, Balkan peninsula, Turkey & Greece and Southern Russia. Eastward it extends to Turkestan and on migration it is known to cross the lofty pamirs. Plateau on the way to its winter quarter in N.W. India

In Africa, north of the Sahara, it is abundant, being well known in Algeria and Tunis by the name of Poule de carthage it is however rare in egypt.

The male assumes his breeding plumage in April, at which time he selects a spot about three feet in diameter, on which he passes several hrs each day with head &

neck thrown back, wings somewhat extended and tail erect, pouring forth its peculiar cry of pout, pout tumping up at the conclusion of each call and striking the ground in a peculiar manner on his descent. At this season Mr Abel Chapman found that the throat became dilated. Conflicts takes place for the females, but instead of uniting in flocks with the latter are incubating. Each male is to be found in the vicinity of a hen. The nest slightly made of dry grass is placed on the ground, among herbage sufficiently high to conceal the bird. The eggs 3-4 in number are of a very glossy olive brown or pale green clouded with darker patches, and often beautifully zoned with buffons, measurements 1.95 by 1.5 in. The first clutch is laid about the end of May, a second being frequently produced in the IInd part of July. The food consists of herbs grain, insects, slug, small snails, frogs, feild mice, &c The male rises with a loud clatter of his wings, but the female sits remarkably close. In autumn the birds form large packs which afterwards breake up in to small parties.

My Specimen though a hen, has shown many of the above attributes. She sits close on a squat she has chosen amid coarse grass and her call is coarse and bark like, and can be

interpreted as an industin. Her contour is elegant and she appears at her best when something unusual has arrested her attention. She than pulls herself very erect. Stretching her neck to the utmost (at this time it is less than an inch in diameter, and one wonders how she manages to swallow an all but full grown mouse) Stands almost without movement, Save that the head almost imperceptibility is quitely turned, so that her Clear piercing eyes can have free range She is than really stately in her appearance. and beauty of her finely lined & blotched plumage is most strikingly evident. The only time she has ever shown alarm with me has been when it has been necessary to pick her up, but once in your hands she ceases to struggle and looks calmly around her. Her enclosure can be entered without alarming her; she merely with dignified gait moves out of your way.

Though only an odd bird - I long for a mate for her, no price could tempt me to part with her, and I donot as a rule love odd birds, she at any rate will live her life with me whether I succeed in getting a mate for her not. Can I say more,

—x—.

Noted fully.

Cowan I. McT & Holloway C.W. (1973). Threatened deer of the world: ~~Research programmes of conservation~~ conservation status. Biological Conservation 5(4): 243-50.

(1) The major cause for the decline in deer population all over the world has been over exploitation by hunting.
(2) Some species have been seriously affected by overhunting.
(3) 40% of threatened deer taxa occur on moist, relatively fertile land within a basically arid ecosystem.

Threatened Deer 1978 IUCN MORGES SWITZERLAND.

(A.) The Manipur brow-antlered deer (Cervus eldi eldi) - A case history. M.K RANJITSINH. 26-32

(1) In the critically low population level of the 'Sangai' poaching was a factor that ~~seriously~~ affected an increase of populations. This ~~primarily~~ by agriculturists who surround and bisected the ♀ deer habitat at Keibul lamjao ~~as~~ N.P who were freely provided with crop protection guns.

(5) The Argentina Pampas deer or venado (Ozotoceros bezoarticus ~~bezo artic~~ celer). 33-45 Jackson J.E.

— Poaching considered to be the main threat to this deer.

(c) Himalayan musk deer (Moschus moschiferus moschiferus)

Green M.J.B. 56-64.
— Severely hunted for musk.

(d) Kashim deer (Cervus elaphus hanglu) in Dachigam

Kurt. Kurt F. 87 - 108

- Hangul move up to upper dachigam dur the summer and then move down to lower dachigam in winter, come thy also do the rutty.

- poachly has been main cause for decline. coupled with livestock grazing

(e) Re present Status of the Bactrian deer (Cervus elaphus bactrianus) in the USSR. Bannikov. A. 159-172.

- Rutty sites are permanet from year to year
- under favourable condition deer are resident. Migration occurs only during major spring and summer river floods.

Threatend deer of the world: Research and Conservation projects under the IUCN PROGRAMME

Colin Holloway 1975 Deer Vol. 3 No 8.

(1) Over exploitation by hunting or modification of habitat lead to extinction.

(2) Deer in naturally fertile habitats have been frequntly been ousted by agriculturists, and most species have been in particular pressure from hunter for meat, hide and antlers.

(3) Most threatend deer species occur in isolated rural areas of developing countries where wildlife poaching and pressure on wildlife habitats, to graze stock, cut grass or collect fuel is frequntly intense.

(1977)

Barrette. C. Some aspects of the Behaviour of Muntjacs in Wilpattu National Park.

Mammalia 41:1, 1-33

(1) Population Composition.

100 ad ♀ : 91 ad ♂ : 37 Juvenile (16 ♂ + 21 ♀) : 50 fawn.

(2) Muntjacs are solitary.

64.5% of animals observed were alone.

avege group size 1.41.

Ad. ♂s	solitary	70.8% of sightings.
Ad ♀	—	65.2% " "
Y M	—	57.1% " "
Y F	—	45.2% " "
Fawn	—	0% " "

(3) All fawns observed (♂ sightings) were accompanied by ♀ (all fawns seen were between 2–6 months)

(4) Figures emphasize that solitary mammals are not isolated from each other at all times; they do meet and more than might be expected.

M = ♂ (adult) F = adult ♀
YF = Young ♀ YM = Young ♂ BF = fawn.

Group composition	# times.
M + F + YF	6
M + F + YM	4
M + F + BF	1
M + F + 2YF	1
F + 2YF	1
F + YF + YM	1
F + 2YF + YM	1

Pair composition	Nos. of observation	
M + M	3	(3%)
M + F	79	(78%)
M + YM	11	(11%)
M + YF	8	(8%)
F + F	4	(3%)
F + YM	13	(10%)
F + YF	30	(23%)
F + BF	7	(5%)

(5) ♂

Abscence of synchrony between ♂ sexual activity and antler growth.

Two deviations from typical patterns.

Annual cycle of antlers is synchronous for all ♂'s.

Inpite of this fawns are born in every month ~~of~~ of the year.

Muntjacs ♂'s are able to mate while in velvet.

In free living Muntjack in Britain testes are active throughout the year irrespective of the condition of the antlers

(6) Ad ♂ with ad ♂ or ad ♀ with ad ♀ always ~~usually~~ interacted agressively.

(7) Muntjacs need water. Due to Annal drought animals tend to congregate at villus (water bodies)

73·6% of Muntjacs seen in forest were solitary.
" " " villus " "
60·9% "

(8) Muntjacs are mostly fruit ~~feeders~~ & flower feeders. i.e. things which fall from trees. ∴ food is scattard over wide areas. No Advantage of agression to oth individuals / No advantage in following oth individuals as once an animal has eaten a fruit there is nothg left there.

In contrast grassland grazers find successive mouthfuls of grass and hence need not protect food source or area.

(9) SSFR (small solitary forest ruminants) could not form groups and maintain large groups because of visually obstructive cover. They would have to maintain contact through calls (as in primates), which they do not. By move silently. Groups ~~are~~ disadvantageous because of scattered food source.

(10) due to thick cover long rage communication is by olfactory means. SSFR use scent marking for communication

(11) Being thinly distributed, SSFR get to encounter only few individuals in a given time (and their lifetime). Muntjacs each other as individuals and by olfaction. seem to recognise

There is some evidence that ~~or~~ some species of SSFR exhibit lasting pair bonds.

(12) Another favourable consequence of very small solitary, living at low density and in thick cover is that SSFR are well protected from predators by sight. This is the best strategy for ~~many~~ SSFR who are too small to outrun a predator or defend itself directly. So when caught out in the open they rush for cover, but once in cover run only a short distance.

(13) Most likely not territorial.

(14) 'Solitary' should be used only to describe the spatio-temporal distribution of individuals — and not to indicate 'asocial'.

Schaat C.D (1978) Population size and structure and Habitat relations of the Barasingha (Cervus d. duvaucelli) in Sukla Phanta Wildlife Reserve, Nepal.

Phd thesis Michigan State University.

(1) 5 permanent swallows and data indicates that certain area are traditional rutting area.

(2) Between 1974 and 1976 fawn/100 ♀ varied between 33.9 and 42.6

Wittenberger J.F. 1976. The ecological factors selecting for Polygyny in altricial birds.

The American Naturalist Vol. 110. No. 975, 779-799.

(1) In the bobolink Dolichonyx oryzivorous, nests in wet meadows are subject to destruction by flooding and predation, those in dry meadows are subject to high predation rates and nests in mesic meadows are less frequently destroyed by these means.

(relates food to quality of territory).

suggests that superior foraging conditions increase success of secondary ♀s in optimal habitat while predation flooding and lower food availability reduce the success of primary females in marginal habitats.

Martin T.E. 1987. Food as a limit on Breeding birds: A life-history perspective.

Ann. Rev. Ecol. Syst. 18: 453-487.

① Work at level of populations and communities has led to the arguments that food limitation and competition are more important in winter than the breeding season. It is commonly agreed that food is super abundant during the breeding season.

② One Response of Parent birds to limited energy reserves:- Some species may not breed at all in that season. This response is only profitable for long-lived birds - that have a high probability of breeding in the future. Typically seen in precocial birds and also in altricial raptors.

③ later initiation of nesting can be detrimental because it can cause production of young when food supplies are declining.

CCLANDE MARTIN 1977 :- Status and Ecology of the Barasingha (Cervus duvaucelli branderi) in Kanha National Park (INDIA). JBNHS, 74, No 1 ✓

(1) In 1972 only 4 forest divisions, Pilibhit, North Kheri, South Kheri & Bahraich had S. deer.

(2) → Distinct movement ~~seperate~~ cool & dry and wet season ranges of Barasingha.

(a) Barasingha move to growing (north) wet season range after onset of monsoon in June & July and return to cool & dry season range (south) in November & December. (Distance between both ranges 7 km (airline km).

(b) ♂s go first. ♀s & young after wards.

(c) a

(c) Migration routes generally along river courses that connect the two meadows.

(d) Migration between seasonal ranges in deer is well documented for elk (Cervus canadensis) see Altmann 1952 Picton 1950, Craighead et al 1973) and moose (Alces alces) see (Edwards & Ritcey 1956) & (Phillips et al 1973). (Movements largely due to snow)

(e) These wanderings (d) can be understood as adaptations to seasonally different food conditions in different areas.

(f) Central India barasingha's ~~movements~~ adaptations may be parallel to d & e.

(g) In cold climates it is snow, in central India it is scarcity of water that effects spatial limitations

(h) ~~as~~ Water ~~effects~~ has a direct influence on the structure of grass flora, in so far as grass conditions is more eutrophic where water conditions are good.

(3) Traditions

a) Deer are known to have a strong tendency to return to their seasonal ranges over the years, as has been shown by (see - Dasman & taber 1956, Robinette (1966) Geist (1966) Knight (1970), Craighead et al (1972).

(b) In old fallows deer areas, Uecherman (1968) mentions that the same rutting grounds were frequented over 50 years or more.

(c) Martins study in comparison with Shchallers (1967) study showed that the composite cool & dry season raye of barasingha remained located in the same area around kanha meadow.

(d) The ruttin (in both periods under this study) was restricted to kanha meadow.

(e) More conspicous was the use of the same wallows for both years.

(f) At least one of the rutting wallows was the same for 1964/65 and 1972/73 - which suggests a strong traditional bond at least to the rutting ground.

(g) loyalty to kanha meadow as a rutting ground may have evolved due to abundance of water and green foraye during cool & dry season. Moreover kanha meadow has had legal protection since 1935.

(h) Schaller Barasingha started repopulating souph meadow (monsoon raye) only after 1969 when the village there was translocated. Schaller (1967) shows that the deer used to leave kanha meadow (cool & dry season raye) during rains.

(i) Due to their grassland preference, Martin assumes that the Northern (souph) meadows were always frequented.

(j) Due to prescence of cattle & men until 1969, barasingha probably forced to disperse into marginal land. So dispersal of deer in growing season was probably wider before '69 than Martin's study.

(k) It is likely that (j) had a negative influence on on coherence & population dynamics of the herd, even more so became fawnin occurs in this period.

(4) Growing season raye monsoon. (souph meadow)

(a) Souph was referred to as being one of the best areas to see barasingha at the beginning of this century.

(b) 1964-65 Schaller records no barasingha & f. Dept. records no deer for many years. (Panwar 1973)

(c) yet barasingha were sedentary in souph throughout monsoon period during Martin's study.

(d) Martin (1973) suggests that the grassland composition that evolved at souph after 1969 when the human

were translocated probably meets in ideal way: the monsoon & requirements of the barasinghe..

(5) Reproductive success.
Martin gets 26·7 | 100 ♀s for 1971, 41·2 | 100 ♀s for 1972 & 36·1 | 100 for 1973. for fawns (not including yearlin that had been dropped the previous season. Census thus included fawns that had outlasted early fawn mortality.

·X· Considering other monoestrous deer these rates support normal production. (see also Knight, 1970 & Craighead et al 1973).

Schaller 1967 gets 15 | 100 ♀s in 1964 and 16 | 100 in 1965. Explanation given by him is outbreaks of brucellosis which causes early abortion by of the foetus.

Martin's alternate explanation is that prior to 1969 Bough meadow or the main cool & dry range and fawning grounds was seriously affected by men & cattle. This would have caused wider dispersal of individuals from the population home range, which led to casualities in more distant areas.

Fawning grounds for this period remain unknown.

Fawning sites in disturbed or very distant areas would have caused higher early fawn mortality.

Fleming R.L. Jr. & Fleming R.L. Sr. 1973
SOME snakes from nepal JBNHS 70;
426-437.

Indian bronzeback (D. tristis) common
snake of Nepali lowlands — first record of
this snake from nepal.

Daniel J.C. 1983 ; the Book of Indian Reptiles Bombay Natural History Society. Bombay. P. 86.

Distribution :- Bengal, Eastern Himalayas and countries to the east.

Habits similar to C. Bronze backed tree snake

✗ Acharji. M.N 1946 – sone snakes Benares U.P JBNHS 46 344-347.

✗ Bedom R.H. 1962 Vol. 59 430-46

✗ Whittaker 1969 JBNHS 66 383-385

✗ IGN " 1971 " 68 - 461 - 463

✓ Flemming 1973 70 426 - 437

✗ Biswas 1975 72 774-777

✗ Whittaker 1977 74(3) 539-

✗ Biswas 1984 81 (2) 476 - 481

✗ Murth T.S.N. 1987 84(2) 444 - 445

Daniel:- the book of Indian reptiles.

Painted Bronzeback.

Dendrelaphis pictus (Gmelin)

Dist.

Bengal, eastern Himalayas and countries to the east.

Wood - 1910 (JBNHS): A popular treatise on the common Indian snakes. ↓ pp.... vol.

Doubts the one record from Colonel Bedome's collection from south India. Never seen one in western ~~India~~ Himalayas

Fauna of british India: Reptilia & Amphibia

Vol. III M.A. SMITH

M.A. Smith. 1943 Fauna of British India, Ceylon & Burma Vol III. Taylor & Francis London. pp. 242 to 244.

Range:- whole of Indo-chinese region, from Bengal and the eastern Himalayas to Southern China. Common in many places, both hills and plains. Its occurrence in peninsula India is open to doubt. (wall 1910, 1923)

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4) M. Singh pers. comm.
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7) Phillips et al 1973
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Summer movements of Female Moose and
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51(2): 342-352

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Oryx 12 : 41-48

③ Pillips R.L., Berg W.E, Sinitt D.B; 1973
Moose movement patterns and Range use in
Northwestern Minnesota.
J. wildl. Manage. 37(3): 266-278

④ Schaller Martin. C. 1977. Status and ecology
of the Barasingha (cervus duvancelii branderi)
in kanha National Park (India).
SBNHS 74 (1) pp 60 - 132

⑤ Schaller. G. B. 1967. The deer and the Tiger.
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Re university of chicago press. Chicago.

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in the Dudwa Sanctuary. Oryx 13. 495: 498

~~eds. E duffey and A.J. watt. Re scientific~~

~~Nicholas J.~~ Georgiadis N.J. and McNaughton S.J. 1988 Interactions between grazers and a cyanogenic grass, Cynodon plectostachyus. Oikos. 51: 343-350.

Suggests.

1) Heavy grazing and trampling by large mammals increases the relative abundance and by inference the fitness of C. plectostachyus.

2) The grass exhibits marked morphological plasticity, depending on the intensity of previous grazing and trampling, but productivity is unaffected.

Olson B.E. and Richards J.H. 1988. ~~Tussock~~ regrowth after grazing: intercalary meristem and ~~ascillary~~ bud activity of tillers of Agropyron desertorum.

Kirsch, L.M.; H.F. Duebbert & Kruse A.D. 1978 Grazing and Haying effects on habitats of upland nesting birds. ~~43rd~~ Trans. North Am. ~~American Wildlife conference~~ and Natur. Resource Conf. 43: 486-497.

1) Although there is considerable evidence that annual cover removal on upland habitats by grazing or haying is detrimental to the production of most upland nesting birds; periodic treatments to remove cover on designated areas by fire, grazing or mowing may be desirable for the long-term maintenance of upland nesting habitats in their best ecological condition.

2) Reviewed literature to show that: Upland nesting ducks

a) ~~all~~ nearly all duck nests found in western South Dakota were in the tallest, most dense cover available.

b) In oregon densities of dabbling duck nests highest on units where grazing and mowing were prohibited. Also reported that density of residual cover was the single best habitat parameter for distinguishing nest sites from random (presumably non-nest) sites.

c) In Montana waterfowl pair populations and brood numbers increased with increase in residual vegetation.

d) In Utah, waterfowl chose nest sites with taller vegetation and nesting tended to decrease with increased grazing pressure.

e) In Montana, greatest density of duck pairs that were ungrazed the previous growing season and had residual vegetation.

f). Significantly more nests in unmowed blocks as compared with mowed blocks on an inter-state highway right-of-way in N. Dakota. Data showed 5 times greater hatched nests of mallard, gadwalls & Pintails in unmowed than on mowed plots.

∴ Considerable evidence to show that no grazing or light grazing resulting in residual vegetation had much greater nesting density/success than on areas where mowing or grazing was done.

Upland game birds.

a) Most species of upland game birds have a strong preference for nesting cover with an abundance of residual vegetation. The importance of undisturbed grassy or grassy and herbaceous habitat to production of ringnecked pheasants (Phasianus colchicus) has been shown by many Authors.

b) Nesting and brood-rearing activities of prairie chickens (Tympanuchus cupido) and sharp-tailed grouse (Pedioecetes phasianellus) are greatly influenced by annual grazing or haying which reduce the quantity of residual cover.

(X) c) Periodic prescribed burning has been used successfully in maintaining in a highly productive condition for prairie chicken. Prescribed burning played a significant role in dramatic prairie chicken population increases. A prescribed burning at 3-5 year intervals was prescribed for maintaining productive prairie chicken habitat.

Non game birds.

a) Native passerine birds had highest pair density on undisturbed grasslands followed by hayed and then on grazed. Also grazing or mowing completely eliminated some species while increasing others.

b) The upland sandpiper (Bartramia longicanda) in N. Dakota had highest success (71%) in burned and undisturbed prairie compared with 48% in grazed prairie. Nests hatched in burned areas were 5 times higher in burned habitat than grazed and 2 tims in undisturbed over grazed.

(X) Concludes that some species of nongame birds are adversely affected by grazing and haying, others are unaffected and some benefit from these practices.

In their own study on duck nesting activities.

3) Re strong relationship between higher nest densities and undisturbed cover is clearly related to the presence of residual vegetation of sufficient height and density to attract nesting hens. ∴ cover management programmes that remove all or part of the vegetation annually would be expected to have an adverse effect on these upland nesting birds.

(X) (4) Prefer the use of fire or grazing rather than ~~mowing~~ mowing as a technique to manipulate vegetation. In general, treatment is related to productivity of the site. For example, areas of tall grass prairie on fertile soil in the 20 - 30 inch precipitation zone (508 - 762 mm) may require treatment every 2 to 4 years.

Re drier the area the longer this gap should be.

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taken from Shotgun & Sunlight.

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Am. Nat. Vol. 123. pp. 873 - 875.

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sexual dimorphism. Evolution. 38(3)
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(5) Howard R.D. 1983. Sexual selection and Variation in reproductive success in a long lived organism. The Am. Nat. vol. 122, No 3. pp 39-32

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(5) Madhav Gadgil. 1972 Male Dimorphism as a consequence of sexual selection. Re Am. Nat. vol. 106. No 951. pp. 574-580.

(6) David lack. (1941) Some aspects of instinctive behaviour and display in birds. Ibis: V pp. 401-441.

(7) Perrins. C.M. 1969 The timing of birds breeding season. Ibis. 112., pp 242-255.

(8) Wittenberger J.F. 1978 Re evolution of mating system in Grouse. Condor 80: 126-137.

(9) Vicente Eva et al. 1987. Breeding success of the great Bustard Otis tarda Ibis 129: 364-370.

(10) Brodsky C.M. 1988 Ornament size influences mating success in males. Anim Behav. 1988, 36 662-667.

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Florican

Jahangir - the naturalist, By M.A. Alvi & A. Rahman, 1968 Monograph series No 3. The National Institute of Sciences of India.

"It is a strange thing that the oesophagus in all animals, which the Turks call halq is simple from the top of the throat to the crop, while in the case of bustard it is different. In the bustard it is simple for a length of four finger-breadth from the throat and there it divides into two branches and in this form, reaches the crop".

"The chaz is of two kinds; one is mottled black and the other buff. I now discovered that they are not two kinds, but that which is mottled black is the male, and that which is buff is the female. The proof of it is this; the mottled one had testicles, the buff one had eggs (inside it). This has been repeatedly verified."

Page

Jahangir also noted that Bustard (Taghdagh) ~~ote~~ is not found in Kashmir. The other bustard identified by Jahangir ~~was~~ was Tughdari, Chlamydotis nigriceps. Both are found in Iran also.

Bustards

Family Otididae By Salim Ali & S. Dillon Ripley 1969.

Handbook of the Birds of India & Pakistan, Vol 2. p. 184-

1) Great Bustard (Otis tarda dybowskii).

Rare vagrant in winter. Has been recorded less than a dozen times in the last 70 years at long intervals. in West Pakistan; all in years of particularly severe winters further north in central Asia. Casual in North India.

2) Eastern Little Bustard. (Otis tetrax orientalis).

Rather rare but fairly regular winter visitor to northern West Pakistan, frequently taken in Peshawar and adjoing districts. One record from Gilgit and several sporadic ones from Kashmir, the latest in January 1964. Stragglers have been obtained in Ludhiana and Gurdaspur Districts, Punjab, Saharanpur, U.P.

3) Great Indian Bustard. Choriotis nigriceps

Once ranged from West Pakistan (Sind, Punjab) to W. Bengal and Orissa, and southward through the Peninsula to southern Madras.

4) Houbara Bustard. Chlamydotis undulata macqueenii

Breeds in small numbers in Baluchistan. (Makran). Common winter visitor to the rest of West Pakistan straggling east to Delhi. Southward through Rajasthan and N. Gujarat (Banaskanta, Kutch, N.W. Saurashtra) Extralimit Breeds from the Syrian desert, S.E. Transcaucasia and Transcaspia, Sinai Peninsula, Arabia, E. Persia. and Baluchistan. Winters chiefly in Palestine, Arabia, N.W. India, and Egypt.

5) Bengal Florican. Eupodotis bengalensis bengalensis

6) Lesser Florican. Sp. Sypheotides indica.

Great Indian Bustard

(1) In January 1956, I saw a fine male in Jhansi in U.P. Hombara.

In 1950, General Williams saw four men, about 60 miles from Delhi on the road to Jaipur, with a Hombara which they have shot.

By Usha Ganguli. - A Guide to the Birds of the 1975. Delhi Area.

ICAR ~~CSIR~~ Publication New Delhi.

LIST OF SOME PLANTS COLLECTED IN SAILANA KHARMOR SANCTUARY IN SEPTEMBER-OCTOBER 1984

Families arranged alphabetically

ACANTHACEAE

1. Andrographis echioides (L.)Nees
2. # Rungia sp.

AMARANTHACEAE

1. Achyranthes aspera L.
2. Alternanthera sessilis ~~R.Br.~~ (Linn.) ~~DC~~ R. Br. ~~ex DC.~~
3. Celosia argentea L.

ASTERACEAE

1. Ageratum conyzoides L.
2. Bidens biternata (Lour.) Merr. & Sherff ~~ex Sherff~~
3. * ~~Blainvillea latifolia (L.f.) DC.~~ acmella, (L.) Philipson Syn. B. rhomboidea Cass
4. Echinops echinatus Roxb.
5. = Eclipta erecta L. Eclipta prostrata (L.) Linn.
6. Glossocardia bosvallea ~~DC.~~ (L.f.) DC.
7. = Launaea nudicaulis Hook.f. — Launea fallax (Jaub. & Spach) O. Kuntze
8. Tridax procumbens L.
9. # Vernonia sp.

BORAGINACEAE

1. * Trichodesma indicum ~~R.Br. Prodr.~~ (L.) Lehmann var. amplexicaulis (Roth.) Cooke
   syn. T. amplexicaule ~~(sp.)~~ Roth

CAPPARIDACEAE

1. Cleome simplicifolia H.f. & T.
2. Cleome viscosa L.

COMMELINACEAE

1. Cyanotis fasciculata (Heyne ex Roth.) Schultes f.

CONVOLVULACEAE

1. Evolvulus alsinoides L.
2. Ipomoea eriocarpa R.Br.
3. Ipomoea nil (L.) Roth
4. Ipomoea pes-tigridis L.
5. = Merremia emarginata Hallier f. Merremia gangetica (L.) Cufod.

CUCURBITACEAE

1. Mukia maderaspatana (L.) M. Roemer

CYPERACEAE

1. Cyperus iria L.
2. # Cyperus sp.
3. Fimbristylis dichotoma (Linn) Vahl
4. # Fimbristylis sp.

→ There is no need of a coma after the binomial.

If you have specimens of these, then I would like to see them for their correct identities. ! Gupta

EUPHORBIACEAE

1. Acalypha indica, L.
2. Euphorbia hirta, L.
3. Euphorbia geniculata, Ortega
4. Euphorbia parviflora, L.
5. = Phyllanthus simplex, Retz. Phyllanthus virgatus Forst. f.
6. Phyllanthus sp.

FABACEAE

1. Alysicarpus bupleurifolius, DC. (Linn.)
2. Alysicarpus pubescens, Law
3. Alysicarpus rugosus, DC. var. Heyneanus, Baker (Wight)
4. Alysicarpus tetragonolobus, Edgew.
5. Alysicarpus vaginalis, DC. (L.)
6. Atylosia platycarpa, Benth.
7. Cassia absus, L.
8. Cassia mimosoides, L.
9. Cassia tora, L.
10. Crotalaria calycina, Schrank
11. Crotalaria filipes, Benth.
12. Crotalaria linifolia, L.f.
13. Crotalaria orixensis, Willd.
14. = Desmodium diffusum, DC.
15. Desmodium triflorum, DC. (Linn.) Desmodium laxiflorum DC.
16. Desmodium sp.
17. Heylandia latebrosa, DC.
18. Indiocfera cordifolia, Heyne
19. Indigofera glandulosa, ~~Willd.~~ Roxb. ex Willd.
20. Indigofera linifolia, Retz.
21. Indigofera oblongifolia, Forsk.
22. = Phaseolus trilobatus, (L.) Schreb. Vigna Triloba (L.) verdcourt
23. = Sesbania aculeata, ~~Poir~~ Pers. → Sesbania bispinosa (Jacq.) Fawcett.
24. = Smithia geminiflora, Roth
25. = Tephrosia tenuis, Wall. Tephrosia strigosa (Roxb.) Sant. & Mahesw.
26. Zornia gibbosa, Spanoghe

269 — +4 Unidentified spp.

GENTIANACEAE

1. = Enicostema littorale, Blume Enicostemma axillare (Lamk.) A. Raynal

LAMIACEAE

1. = Ocimum sanctum, L. Ocimum tenuiflorum L.

MALVACEAE

1. = Hibiscus esculentus, L. Abelmoschus esculentus (L.) Moench.
2. Sida spinosa, L.

MOLLUGINACEAE

1. Mollugo pentaphylla, L.

ORCHIDACEAE

1. Habenaria marginata, Colleb.

OXALIDACEAE

1. Biophytum sensitivum, DC. (L.)

POACEAE

1. Andropogon pumilus, Roxb.
2. Apluda mutica, L.
3. Aristida funiculata, Trin. & Rupr.
4. Arthraxon inermis, Hook.f. / lancifolius, (Trin.)Hockst.
5. Arthraxon prionodes, (Steud.) Dandy
6. Bothriochloa pertusa, (L.) A. Camus
7. Brachiaria eruciformis, (Smith) Griseb.
8. Capillipedium huegelii, Stapf — huegelii (Hack.) A. Camus
9. Chloris virgata, Sw.
10. Chrysopogon sp.
11. Coix lachryma-jobi, L.
12. Cymbopogon martinii, (Roxb.) Watson
13. Cynodon dactylon, Pers. — (L.) Pers.
14. Dactyloctenium aegyptium, (L.) P. Beauv.
15. Dichanthium aristatum, (Poir.) C.E.Hubb.
16. Digitaria ciliaris, (Retz.) Koeler
17. Digitaria stricta, Roth ex Roemer et Schultes
18. Digitaria sp.
19. Dinebra retroflexa, (Vahl) Panzer. — Dinebra
20. Echinochloa colonum, (L.) Link
21. Eleusine indica, Gaertn. — (L.) Gaertn.
22. Eragrostis gangetica, Steud. — (Roxb.) Steud.
23. Eragrostis tenella, Roem. & Schult. — (L.) P. Beauv.
24. Eragrostis sp..
25. Hackelochloa granularis, (L.) Kuntze
26. Heteropogon contortus, (L.) P.Beauv.
27. Ischaemum rugosum, Salisb.
28. Iseilema anthephoroides, Hackel
29. Melenocenchris jacquemontii, Jaub. & Spach.
30. Oryza rufipogon, Griff.
31. Oryza / Leersia sp.
32. Panicum atrosanguineum, Hochst
33. Panicum trypheron, Schult.
34. Panicum sp. / Isachne sp.
35. Pennisetum hohenackeri, Hochst. ex Steud.
36. Pseudanthistiria heteroclita, (Roxb.) Hook.f.
37. Schima nervosum, (Rottl.) Stapf
38. Setaria pallide-fusca, (Schum.) Stapf & C.E.Hubb.
39. Setaria tomentosa, (Roxb.) Kunth
40. Setaria sp.
41. Sorghum sp.
42. Sporobolus diander, (Retz.) P.Beauv.
43. Thelepogon elegans, Roth
44. Themeda quadrivalvis, (L.) Kuntze
45. Tripogon jacquemontii, Stapf
46. Urochloa panicoides, P.Beauv.

© (Crop-plants are not included)

POLYGALACEAE

1. = Polygala chinensis, ? Haut. non L. — Polygala arvensis Willd.

PRIMULACEAE

1. Anagallis pumilla, Sw.

RUBIACEAE

1. = Borreria hispida, (L.)Schumann — Borreria articularis (L.f.) Will.
2. = Borreria stricta, Schumann — Borreria pusilla (Wall.) DC.
3. Neanotis sp.
4. Oldenlandia corymbosa, L.

© Since you study the vegetation as part of the ecological factor in bird study - the crop plants may be of particular importance and should have been included here.

SCROPHULARIACEAE

1. Sopubia delphinifolia, G.Don
2. Striga angustifolia, (D.Don) C.J.Saldanha

TILIACEAE

1. Corchorus fascicularis, Lam.
2. Corchorus olitorius, L.
3. Triumfetta pentandra, A.Rich.
4. Triumfetta rhomboidea, Jacq.

VERBENACEAE

1. Clerodendrum serratum, ~~Spreng~~ (L.) Moon
syn. Clerodendron serratum, Spreng

(For identification mainly "Flora of Bombay Presidency" by T. Cooke has been used. Nomenclature is as far as possible brought upto date # and in case of nomenclatural change Cooke's name is given as synonym.)

with help of Prof. (Dr.) S. M. Almeida

Mock. D. W. 1983 On the study of Avian mating systems. in Perspectives in ornithology. eds. Alan H. Brush & George. A. Clark Jr. Cambridge University press.

(1) Sexual selection can be defined as the within-sex variance in mating ~~system~~ success from intrasexual selection and/or opposite sex choosiness. Simply put = " when one sex becomes a limiting factor for the other."

(2) As ♀s are limiting sex ♂s compete among themselves for as many ♀s as they can get so that all ♀s reproduce roughly equally and some ♂s enjoy greater success than other

(3) Epigamic (or intersexual) selection refers to the ways in which either sex, but predominantly the limiting sex, exerts its power of preference. This is held primarily responsible for the flamboyance of birds of paradise.

Intrasexual selection refers to the competition among ♂s (less commonly among ♀s) and leads to such anomalies as extreme sexual dimorphism in size (e.g. elephant seals).

(4) Promiscuity :- for polygynous system in which no pair bonds form, and ♂s contribute only gametes for the production of offspring. Such species are usually precocial.

Polygyny := occurs when 1 ♂ mates with at least 2 ♀s more or less concurrently. Re essential distinction from promiscuity is that the ~~for~~ polygynous ♂s has some kind of social relationship

with the ♀s and contributes post zygotically to the offspring whereas promiscuous ♂s do not.

Eff (♂s continuing support may be as indirect as territorial defense that conceivably sufficient food).

logic of polygyny = monogamy with a pauper vs polygyny with a tycoon.

♀s jointly a harem must choose the lesser of 2 evils whenever ♂s can monopolize resources critical to her.

{{ ♂ Red winged Blackbirds (Agelaius phoeniceus) in the midwest commonly provide parental care, but males in the far western parts of the species rarely seldom do so)) (Payne 1979)

(51) Monogamy may be defined as "a prolonged association and essentially exclusive mating relationship between one ♂ & one ♀.

An estimated 91% of all avian taxa are primarily monogamous (Lack 1968)

Polyandry :- ♀ mates with 2 or more ♂s which then perform most of the parental care.

Wittenberger J.F. 1978 : The evolution of mating systems in grouse. Condor 80 : 126-137

(1) ♀s of promiscuous species of grouse visit on the ♂s territory only coincidentally, and do not associate with ♂s during nesting period except to copulate.

(2) Lack (1968) suggests that traditional display sites are used by males because they have proven safe from predators. (However location can easily be learnt by predators hence vulnerability may actually be higher at these sites) e.g. Gullion & Marshall (1968) found that male ruffed grouse having perennial drumming logs have a lower life expectancy than ♂s using transient logs.

Alternate explanation is that ♀s can more ~~easily~~ safely approach and mate at familiar sites than at unfamiliar ones. In this event ♂s would attract and copulate with more females at traditional sites even though their expected longevity is reduced.

The use of traditional sites should evolve whenever the propensity for ♀s to mate at familiar sites offsets any reduction in male life expectancy.

Hilden, O. 1965 Habitat Selection in birds: A review.
Ann. Zool. Fenn. 2: 53-75.

1) The territory is often occupied long before the factors affecting the success of breeding e.g. food supply are observable.

2) Understanding of the mechanism involved in habitat selection is greatly aided by the distinction drawn by Baker (1938) between ultimate and proximate factors in biological causation. In habitat selection, the former are essential for the survival of the species, and constitute the underlying reasons determing why each species breeds in its specific environment. The latter, on the other hand, only serve to release the settling reaction and need not necessarily have any such biological significance to the species as such.

(3) old birds → tolerate more disturbances in their breeding places without abandoning them. Thus site tenacity, strengthening in the course of years, modifies the habitat selection mechanism and causes a return even to a place which is outside the habitat range determined by the innate releasing mechanism.

(4) The return to the former territory, in spite of deterioration of the habitat, clearly reveals that site tenacity represents a return to a geographical locality which has become familiar and not towards a certain type of environment.

[Baker, J.R. 1938 The evolution of breeding seasons. G.R. De Beer: Evolution. Essays on aspects of evolutionary biology presented to E.S. Goodrich, 161-177. Oxford]

Fogden M.P.C. 1972. The seasonality and population dynamics of equatorial forest birds in Sarawak. The Ibis. Vol 114. No 3. & pp. 307-343.

① Though insects relatively evenly distributed in space and time greatest abundance for a few months during and after the north east monsoon. and least abundant before the monsoon.

Because rainfall pattern is fairly consistent from year to year, the lean season is a regular annually recurring period.

There is no annually recurring period when fruit is always scarce.

② ∴ That this is so is suggested by the fact that the annual cycle of insectivorous birds is organised so that during the lean season there is a complete cessation of any activities that increase their energy demands beyond a simple maintenance level.

③ ∴ Moult ~~is completely arrested~~, breeding and parental care come to a halt at the beginning of the lean season.

Moult that is incomplete is arrested.

④ Ward (1969) suggested "the level of tissue protein may have important repercussions on the timing of both reproduction and moult, and might even be the main regulating mechanism. Although ~~tissue protein~~ seasonal changes in the level of tissue protein must be geared to changes in protein availability (i.e. in insect food abundance), internal regulation by this means would not require any perception of an environmental change through the external sense organs."

Fogden concludes similarly for why insectivorous equatorial birds breed at specific times rather than whenever a heavy rainfall occurs.

Eds. Duffey - E. & A.S. Watt. (?) The scientific management of Animal and Plant communities for conservation. 11th symposium of the British ecological Society. Blackwell scientific publications. Oxford.

— Morris M.G. - The management of grasslands for the conservation of invertebrate animals. pp 527 - 552

① Dryer lowland grasslands of Britain are usually managed by burning, mowing or grazing in increasing order of importance. Other methods like rotovating or ploughing are considerably important as methods of altering grasslands.

little information on rotovating or ploughing on invertebrate fauna of grassland.

② All methods of managing grassland have in common the effect of reducing the amount of plant material present in the managed area and of lowering the mean height of vegetation.

③ Few studies on the effect of burning on population of invertebrates.

On lepidopterous larvae - ~~burning~~ a 15 fold reduction was seen on burnt plots as against unburnt plots. though burning did not invariably reduce the size of population. Indirect effect fire destroys litter and hence exposing larvae to vigors of overwintering in open condition

④ In another study individuals of orthoptera and coleoptera were more numerous on plots with sparse litter (burnt) than on those with deep litter (unburnt) — more effective methods required before results can be confirmed.

— D.H.N. Spence and A. Angus. African grassland management - burning and grazing in Murchison Falls National Park, Uganda. (see above for source book) pp. 319-331.

① After 2 yrs data evidence that shrub regeneration and herb improvement in Sporobolus - Setaria grassland will only follow reduction of grazing. Fire protection in these grasslands without respite from grazing is of little value. [grazing wild ungulates].

② In Combretum - Terminalia woodland absence of grazing ~~and burning brings~~ produced an increase in shrubs over 61 cm by 50%

Bock. E.C., ~~Saner~~ H. Block J.H, KENNEY W.R, and Hawthorne M.V. 1984. Response of Birds, Rodents and vegetation to livestock Exclosure in a semidesert grassland site. Journal of Range Management. Vol. 37. No 3. pp 239-242.

Compares totall protected and partially protected grasslands. Partially protected v. light graeing 1 cow/10 ha.

(1) live stock exclosure supported 65% more grass cover, a comparatively heterogeneous grass community, significantly more herb cover, more woody plants and various shrub species were ~~either~~ denser ~~and~~ and/or larger on the protected site.

(2) Collectively graeing appears to favour birds over rodents. Rodents are probably better adapted to forage in areas of dense cover because of olfactory senses. Birds became of visual orientation and mobility could adapt better as a group to avoid aerial predators in the open and to forage in sites with patchily distributed food resources and where food and cover may be physically seperated.

KRAPU G.A. (1974) Feeding ecology of Pintail hens during Reproduction.

The Auk 91: 278-290.

(1) shows that invertebrate foods are maximum during follicle development and laying stages and this declines sharply once the postlaying period began.

(2) findings support the suggestion that availability of aquatic invertebrates is a major proximate factor influencing the onset of laying.

(3) Invertebrate supply is controlled by existing water conditions.

(4) It breeding response of pintails is govern by the emgence of aquatic ~~the~~ invertebrates with the flooding of shallow wetlands, reduced breeding activity during droughts follows as the major foods of egg producing hens are not available.

I Morgan-Davies A.M. (1965) On the Kori Bustard, Ardeotis Kori (Burchell) in Northeastern Tanzania

Bull. Brit. Ornithol. Club - 85

① Breeding season commences ~~erect~~ approximately with the onset of the long rains about February and continues till about early May, by which time most eggs will have hatched.

II Mukherjee A.K. 1986 The ecology and conservation of Royal florican, Eupodotis bengalensis (Gmelin) In wildlife wealth of India. T.J. Majupuria Teepress services L.P. Thailand.

A rehash of earlier information

III Gorrup P.D. 1982 Distraction behaviour of Great Bustard. British Birds 75(6)

Describes distraction display by a ♀ Great bustard.

IV Orr G.L. Maclean, C.M Maclean, J.N. Geldenhuys and D.G. Allan. 1983. Group size in blue korhaan. Ostrich 54(4): 243-244.
Breeding Season = September to January.
Young remain with adult pairs at least until the following Spring.

pattern. The Fig however shows a lower grass height value for 1986 than 1985, while in actual terms maximum grass height reached in 1985 was 23.3 % less than that of 1986. However when the differnce in amount of rainfall recieved in 1986 over 1985 is

but most of a contiguous ~~gr~~ grassland gets burnt in a single fire, leaving behind small isolated patches of unburnt grass, varying density of ~~gra~~ burnt grass stalks (which depending on the species of dominating the grass cover, time of burning and intensity of fire) & ~~and~~

Grassland fires are surface fires, & and move swiftly. They do not burn standing live trees though fallen dead trees often catch fire. The fires stop when a) they reach the edge of the forest, b) the coolness and dew of the night put it out and c) the entire grassland area burnt.

~~Major biotic changes coi~~ The ~~fix~~ period of grassland ~~setting~~ fire comes and coincides with some major biotic changes in the area. The fires precede spring and result in large congregation of swamp deer on ~~the~~ recently burnt grasslands. It marginally precedes the leafing of Sheeshum and the fawning of cheetal. Inward migration of birds like the bee-eaters, outward migration of swallows (red rumped and common) and ~~the~~ allows the establishment of territories of the Bengal Florican.

LACK. D. The Natural regulation of Animal numbers.
1954. Clarendon press. Oxford.

(1) Clutch size for each bird is limited by ~~the amount~~ natural selection, ~~of food that~~ to correspond with the largest number of young for which the parents can on average provide enough food.

(2) Average clutch size (in some species) varies according to ~~seasonal~~ years of good or poor rainfall. e.g. 2 species of starlings, 2 of weaver birds, bustard (see Moreau 1944)

(3) Clearly shows the adjustment of peak breeding in 2 species of tits with the varying peaks of caterpillar population over 4 successive years. (coal tit & great tit)

(4) Food available for young is major determining factor for breeding season.

(5) In some species when an individual continues breeding unusually late its moult time ~~or~~ may be delayed e.g. Robins, Great crested grebe and Pheasant

(6) Unequal sex ratio in adults ~~(sexes)~~ may be due to an unequal ratio at hatching or a heavier mortality in or the other sex.

(7) Sex ratio is nearly equal in young in species studied so far. Adult ♂s are however in many species more than adult ♀s. This is supposedly due to ♀s having a higher mortality than ♂s, as seen in many ducks, gallinaceous birds and a penguin.

(8) In rutted grouse - out of identified kills of adults - 21% by foxes, 13% by horned owls, 15% by hawks of various species and 45% either by hawks or owls.

[In the area rutted grouse formed only 5% of the prey base for owls horned & red foxes 4%].

(Only ~~about~~ 28.2% of total adult population were killed by predators)

(1) In birds does not record cases of birds breeding in both cultivary and breedy grouse. Inpte of conditions being favourable (in many species) in both areas.

The ecology of Animal movements. 1983. Eds.
I.R. Swingland & P.J. Greenwood. Clarendon press
oxford.

A.R.E. Sinclair. The function of distance movements
in vertebrates.

(1) A critical factor determing breeding success is the
amount of food available for building up body reserves
just prior to birth or laying eggs. — Thus there must
be strong selection for animals to place ~~them selves~~
themselves in environments where there is a superabundance
of food prior to breeding.

(2) The white throated bee-eater (Aeroops albicollis) are
inter-tropical migrants, breeding just south of the
Sahara in the June-september rains and then
moving south to southern Tanzania and Zaire for
their rainy season. Merops nubicus also behaves like this.

(3) Some migration clearly have the function of tinelly
suitable areas in which to breed. E.g. the convergence of
large population on isolated and scarce islands or rocky
cliffs.

~~other~~ examples - Gannets, shearwaters, albatrosses, mammalian
pinnipeds, green turtle, some anadromous fish.

4. The main characteristics of these species are a general
nomadic existence in the oceans and a migration to highly
specific breeding sites.

④ Though alternate strategies (like storing food) exist for resource restriction, the majority of the species adopt the strategy of migration by following temprory good condition.

⑤ Most bird species are constraind for certain periods for the purpose of breeding. Hence they must find areas of suffiCient resource abundance for long enough to ensure succesfull breeding. Resource super abundance that lasts for shorter periods of time cannot be used or there should be selection for individuals that can reduce the period of breedin residency. Such environments are also characterized by both unpredictability of both the timing and location of the high resource areas. Thus selection should favour those that adopt a nomadic existence rather than following fixed migration from a non-breeding to breeding range.

⑥ X of 32 bird species ~~that~~ ~~having resident and~~ having resident African and migrant Palearctic migrant populations, 24 of them show subspecific differences in their populations.

This may point to why so many Palearctic species overlap with closely related species in Africa — resident species from which they could have evolved sympatrically.

Haartman L. V. ~~1946~~ 1956. Territory in the Pied flycatcher Muscicapa hypoleuca.

(1) Nearly all the surviving males, some females and a few first-year birds retund to the breeding area.

(2) Most encounters do not result in real fights, but the intruder recedes immediately when the territory owner shows threat display.

(3) The male pied. flycatcher does not show definite territorial behaviour before finding a suitable nest-hole.

(4) In species with unspecialized nesting biology, territory is chosen before nest-site.

Armstrong E. A. 1956. Territory in the wren
IBIS 98: 430-437.

(1) Territory is basically concerned with sex and the reproductive functions, and territorialism is a device to restrict dysgenic fighting while permitting healthy competition.

(2) Threat displays have evolved from the 'raw material' of conflict of tendencies to attach & flee. Later that ~~it~~ territorialism is the stereotyped expression of these impulses, with reference to, the site, actual or potential, of Reproductive activity.

(3) But it is possible that ritualism of threat display arose more in connection with sexual motivation than for e.g. foraging area.

(4) In some species this has resolved into singing rather than posture (singing thrush Turdus ericetorum); in Ruff entirely posturing. but both forms of activity are territorial.

Snow. D.W. 1956. Territory in the Blackbird. Turdus merula

IBIS : 98 : 438 - 447.

(1) Re main essential of a territory is that it should contain suitable cover for nest.

(2) Males defend against males and females against females. Established adults do not drive out indiscriminately all intruders. It is quite clear that they know all their established neighbours, and many of the local unestablished young birds individually.

(X) It is clear that territorial defense is directed against individuals which represents a potential threat to the owners territory.

Young H. Territorial Activites of the American Robin. Turdus migratorius. IBIS 98 : 448 - 452.

(1) Many disputes setted by threat display, actual combat is common, particularly in the beginning of the season. Quarelling birds seem to attract other, so that there are frequent organized "gay fights"; the value of which remains obscure

(2) As in most species fights are most numerous in the early part of the breedly season.

Dinerstein. E. (1979) An ecological survey of the Royal Karnali - Bardia wildlife Reseve; Nepal. Part I: Vegetation, modifying factors, and successional relationships.

Biol. Conserv. (15) pp 127 - 150.

(i) Royal karnali Bardia - southeastern Nepal 81°20' E, 28°35' N.

(2) declared wildlife sanctuary in 1975 from Royal hunting reserve.

(3) grazing, fuelwood / timber and poaching until 1975.

(4) climate :- Actual monsoon starts in end June. but heavy premonsoon showers in April & May quite common. monsoon ends in early October.

(check) → As the monsoon originates in the Bay of Bengal and arrives from the south east, it has been found that the western terrai recieves less rainfall than the eastern terrai and the duration of rain is also shorter.

(5) Northern border in Siwalik (churia ridge), the southern section is characteristic of the loco-lying unbroken terrain of the terrai. Re broad alluvial plain, sloping away from the churias is known as Bhaber (most of Bardia fits that).

Bhaber characteristic of boulders, cobbles and coarse sand layers amidst silt and clay.

(6) Annually Geruwa and Babai rivers deposit large amounts of silt on their flood plains and along their banks. several smaller seasonal stream.

⑦ Why does Shorea robusta form such a large % of forest cover in ~~Western~~ Nepal ~~and Indian~~ terrai and India?

a) Possibly
a) Cumulative effects of uncontrolled burning practices. which favour sal, a fire resistant species.

b) ~~Acacia~~ Seeds have a high quantity of tannins ~~to~~ in response to secondary pressures of seed predators. — this may explain dominance of forest associations.

⑧ Dalbergia cissoo and Accacia catechu form the first seral stand of trees along the major river courses of the terrai as they are able to withstand flooding.

⑨ Savannah habitat dominated by Bombax ceiba is common.

Difference: between grassland and savannah is associated with the degree of human interference that has taken place.

Both types grasslands dominated by I. cylindrica, Eriauthus ravennae and Vetiveria zyzanoicles.

grassland has less trees while Bombax savannah has more trees and greater diversity.

Bombax ceiba important in grassland succession as it is resistant to fire, grazing and flood

(10) In areas severely overgrazed by cattle, unpalatable shrubs such as cassia tora and Aegeratum conyzoides are locally dominant. Chrysopogon aciculatus ~~alone~~ which causes mechanical injury to grazers along with less desirable annual grasses may increase with further deterioration of range land.

(11) During monsoon visibility and movement become restricted by the tall grass understory.

(12) Majority of grasses are C_4 photosynthesisers
-> ~~those that~~ Four Carbon dicarboxilic acid cyle. -
large number of tropical grasses are C_4 possibly
in response to warm growing condition.
Under higher temperatures C_4 pathways allow
for an increased photosynthetic rate and a more
rapid growth rate than C_3 plants under
similar environmental condition.

These include Arundo donax, Phragmites ~~karka~~ sp.
Panicum spp., Bracharia sp. Digitaria sp, Chrysopogon sp
Cymbopogon spp., Heteropogon sp contortus, Eriauthus sp
I. cylindrica, Sacharum spontaneum, Cynodon dactylon,
Paspalum distichum, Pennisetum sp, Setaria sp; Coixa
lachryma-jabi, Dactyloctenium aegyptium, Eragarostis spp.
Rheeda triandra, Echinocloa colonum and Sporobolus sp.

[Refer Smith B.N & Brown W.V. (1973).
The Kranz syndrome in Graminae as indicated by
by carbon Isotopic Ratios. Am. J. Bot. 60 505-13]

(13) Abiotic factors which influence plant succession in the terai are length of monsoon, the total amount of rainfall, seasonal flooding and soil condition. Biotic - grazing, burning, cultivation, logging, loping and thatch grass cutting.

(14) Attributes differences in Bardia and Chitwan/Kaziranga (dominated by taller grasses like E. ravinnae, Sacharum, A. donaxe, P. kacha) to length of rainy season and total amount precipitation. Because drier tall grass areas are ~~absent~~ small majority areas are short grass.

∴ In addition the riverain grasslands at Chitwan remain inundated longer than Bardia and may have an effect on species composition, favouring tussock formation perennials which appears to be an adaptation to such moist conditions.

(15) where only occasional burning occurs Eriantus ravinnae, Sacharum spontaneum S. benghalense, Teneda sp. with heavy grazing, more frequent fires or both combined I. cylindrica thrives. I. cylindrica is the only grass species to flower soon after fires. Its seeds are well adapted for rapid germination. Finally I. cylindrica spreads by a tenacious rhizome forming dense tussocks that make it difficult for other species to become established. This gives I. cylindrica an advantage over other grass species.

~~Avian~~

Faaborg. J. 1982. Avian population fluctuations during drought conditions in Puerto Rico.

~~Wilts~~. Wilson Bull. 94: 20-30.

① Most puerto rican birds breed during the may-June rainy season.

② During drought frugivores declined sharply while gleaning insectivores least, ~~as~~

Suggests that insects ~~became~~ are a yield of secondary productivity and hence become scarce but not absent. whereas fruits are a primary produce and can become absent.

Perrins C M ___ Timing of Birds breeding seasons.

IBIS 112 242 - 255.

(1) food shortage has a direct influence on the adult as interval between egg laped and hatched can also have a significant increase in food supply.

(2) ♀ needs surplus food not only for forming eggs, but also well before she can have young in the nest

(3) In all species at least 3 weeks must elapse ~~before~~ between time of sufficient food and time of having young in nest.

John F. Mundahl. 1982. Wilson Bull. 94 (4) 515 - 530. Role specialization in the parental and territorial behaviour of the killdeer.

1) Aggressive displays and behaviour by males was maximum in the preverting period and then decreased significatly in the egg laying and incubation period before rising again in the brooding period.

2) Description of agonistic interaction.

a) Aerial intrusions result in an increased rate of calling and also 'killdeer flights' (Done by both ♂ & ♀ but mostly ♂).

b) Approach on foot resulted in ground chases.

c) more evenly matched resulted in standoffs and parallel confrontations.

Wiens, A. J. 1969. An approach to the study of ecological relationships among grassland birds.

Ornithological Monographs No. 8. The American ornithologist Union.

① Initial territory establishment:- All species began establishing territories immediately after arrival. When territory establishment began boundaries are indistinct. In grasshopper sparrows they remained within the site but when flushed 4-5 times flew off considerable distances. Within a few days however territory attachment increased and birds could be flushed repeatedly within its territory. (20 times to obtain sample)

② Territory fluctuations:- mapping revealed that, in species studied territory establishment was a gradual ongoing process, new individuals continuing to immigrate into the area and establish territories well after the first territories were set up.

③ Sequential mapping of territory boundaries also showed that, once established territories were not spatially fixed but continued to change in ~~space~~ shape, size and location through the breeding season.

Geist. V. and Bayer. M. 1988. Sexual dimorphism in cervidae and its relation to habitat.

J. Zool. lond. 214 pp 45-53.

(1) In African antelopes sexual dimorphism is a curve linear function of the 'openess' of habitats. Species from dense cover or very open areas tend to converge towards male-like monomorphism.

(2) In cervids sexual weight dimorphism increases with the ~~do~~ body size of males. larger the individuals greater the discrepancy.

Odum E.P. and E.J. Kuenzler. 1955. Measurement of territory and home range size in birds. The Auk 72: 128-137

Tinbergen. N. 1957. The Functions of Territory 4: 14-27.

Hinde. R.A. 1956. The biological significance of the territories of birds. IBIS 98: 340-369.

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Pettersen, R. 1987. Bird community changes in alder forests due to grazing by cattle. Fauna norv., Ser. C, Cinclus: 10: 1-6.

i) when grazed by cattle, the size of the whole bird community was reduced from between 46 - 60% depending on the intensity of grazing. These reductions may occur because grazing reduces & changes the composition of the vegetation in the field and bush layer.

David McFarland 1985. Animal Behaviour. Psychobiology, Ethology and Evolution. Pitman Press, Bath, U.K.

(1) Removal of broken eggshells from the region of the nest is a function possibly to help maintain nest camouflage. This seen in species where nest predation is high and not in species with low nest predation.

(2) Tinbergen et al 1962. Predators crows quickly learnt the association of eggshell near eggs in an experiment to prove ~~nest~~ nest predation prevention by removal of eggshells.

Tinbergen N., Broekhuysen G.J., Feekes F, Houghton J.C.W., Kruuk H, Szulc.E. (1962). Eggshell removal by the black headed gull Larus ribundus L.: a behavioral component of camouflage. Behaviour 19, 74-118.

~~predators~~ In Experiment showed that if eggshells were left behind then predators soon learnt the presence of eggs/chicks. Moreover eggshells are easily spotted from the air.

Parents does not immediately remove eggshell but does so after an hour or two so that the delay allows chick to dry, become more robust and better camouflaged.

(5) Species with short life expetancy can be expected to have high fecundity to compensate while longer lived species may find ~~lower~~ low fecundity increases overall fitness, especially if the resources available to the offspring are limited. In general the more time and energy that a parent expends on a particular offspring the fitter that offspring will be.

(4) Aggression.

- Hawk strategy - fight and cause injury or kill opponent
- dove " - threat display to cause but avoid serious fighting.

Exclusively either of this is not an ~~bourgeois~~ mixed strategy. Evolutionarily stable strategy. Because inroads can be made by one system into an exclusively other system.

- Mixed strategy is when both occur with a population or within an individual roughly hawk on 7/12 of occasions and dover on 5/12.

- Bourgeois strategy - where individual behaves like a hawk when owner of territory and like a dove when it is an intruder in territory of another.

- all three are present in nature. Some mating is not rare/unlikely and in the absence of dangerous weapons bourgeois, when dangerous weapons - dove -, when rare one time

mating than hawk. The last is frequently seen in nature.

⑤ In fighting red deer, there is a 25% chance that ~~are~~ stag will be permanently injured in its life time by fighting.

♀ have little or no choice of sexual partner and are herded in harems by successful males.

♀ should physical fighting be more prone in species where ♀ has no choice but has to mate with the harem owner. In species where ♀ chooses mate fighting cannot play such a role. Hence in Harem system than in ♀ choice system.

⑥ If a female prolongs courtship behaviour in male then it is better suited to assess male's fitness.

⑦ A female mates with a sexually more attractive male became chances of having more grandchildren increases.

⑧ Zahavi's Handicap theory can act only in very few cases.

C. N. Slobodchikoff 1988. The Ecology of Social Behaviour. Academic press inc. San diego.

Barlow G.W. "Monogamy in Relation to Resources. pp. 55-79.

① Assumes that spatio-temporal patterns of animals particularly females is set by the spatio-temporal patterns of limiting resources. Due to asymetry in reproductive biology in ♂s and ♀s, males try and monopolize ♀s. When food resources are dispersed and of low quality, and territoriality is economically feasible, one male will monopolize one female, resulting in monogamy.

Monogamy — ① Exclusive — ♂+♀ spawn/copulate repeatedly

② Biparental — ♂+♀ remain together until young are independent.

Geist. V. 1977. A comparison of social adaptations in relation to ecology in Galliniaceous bird and ungulate societies. Ann. Rev. Ecol. Syst. 8: 193-207

① Sexual dimorphism increases in forms that progressively depart from ancestral pairbonding; territorial species adapting to environment requiring increasingly greater opportunism in food exploitation. ♀s become less conspicuous to predators, by becoming cryptic and less conspicuous in behaviour. ♂s become more conspicuous by virtue of larger display organs more prolonged displays than ♀s of parent species.

② In open areas gregariousness becomes a mean of reducing predation. Under these circumstances ~~predation~~ sexual dimorphism can reduce for several reasons. ① ♀s can no longer expect protection from subordinate ♂s ~~from~~ by dominant ♂s. → so more mimicry acts as a buffer ② centre of flock safest so jostling to reach centre and competition in food will select for equal sizes or reduced sexual dimorphism

③ Under pressures of scarce food or high predation, monomorphism is selected for as it allows a greater time devoted to feeding and also permit a closer social distance.

(3) Dimorphic males may shed their symbols of maleness and mimic ♀s outside the breeding season and will then join ♀ flocks. This aids in reduced predation, when ♂s are exhausted after rut/displays and when they are the less abundant sex and ∴ conspicuous to predators.

(4) An alternative is when dimorphic ♂s form unisex flocks. This seperation is possibly linked to the exploitation of different food and or habitats by the sexes. Indicators of this are moral, capercaillie and ptarmigan. (GIB?)

Function and Evolution in Behaviour. Essays in honour of Professor Niko Tinbergen (1975)

Editors Gerard Baerends, Colin Beer, and Aubrey Manning. Clarendon Press OXFORD.

McKinney. F. The evolution of duck displays pp. 331 – 357.

(1) Male courtship displays serve atleast 5 functions; attracting ♀s attention, specifying which ♀ is courted, holding the ♀s attention, leading her away and helping ♂s compete with rival ♂'s.

Attention getting displays tend to be sudden startling performances and involve motions that are distinctly different from predictable everyday activities. Plumage features often reinforce the optical effect. Many of these displays are derived from or related to alert, alarm or escape behaviour as for other birds are most responsive to sign of alarm in their companions.

(2) Tendency to synchronize displays inbuilt by males is well established in mallard and green winged teal Anas crecca as a means to compete with rival male and to prevent any one male from attracting sole attention of ♀.

Mendelssohn H., U. Marder & M. Stavy (1979)

Captive breeding of the Houbara (Chlamydotis undulata macqueeni) and a Description of its display.

(1) In Israel in good breeding areas pairs are found at distances of 1-2 km from each other. In desert area distances inbetween may be upto 5-10 km.

(2) Chicks are able to fly when 5 weeks old ~~and~~ reach adult size at 6 month.

(3) Display.

(a) Male is stationary. Slowly the elongated head ~~and~~ feathers spread in all directions.

(b) then the white long neck feathers are raised forward.

(c) The black neck-feathers are also ruffled, but less so than the white ones, which continue to rise.

(d) The wing tips are somewhat lifted, the tail lowered, and the head is drawn back and rests on the shoulders. The bird begins a slow run with exaggerated steps.

(e) the white neck plumes continue to rise and eventually after a minute completely cover the drawn back head giving the appearance of a white ball. The bird is still running.

(+) This display is continued for a number of minutes and up to an hour or two but with frequent intermissions when he returns to the initial stages of the display.

(9) After a series of displays, he may return to normal feed rest and start again.

(H) Courtship display

~~Neck extension~~ while displaying when ♂ came near ♀ he would extend neck towards her, lower white neck plumes and spread black ones laterally.

(1) One hand reared ♀ on one occasion showed the complete sequence of the male sexual display including the neck extension and rattling of the black plumes.

(4) As in other bustards Houbara make no real nest. Nest scrape surrounded by loose rim fits incubating ♀ exactly.

(5) Incubation period of Houbara = 23 days
" " " C. Bustard = 21 days

(6) Time lapse between eggs were most often two days and twice 3 days

(7) Captive birds normally laid 2 eggs South 1.
(8) 2 ♂s resting over 60 m apart showed remarkable synronisation of oviposition.

Queller C.D. 1987. The evolution of leks through female choice. Anim. Behav. 35 1424-1432

(1) Clustering of ♂s in ~~small~~ relatively small display arenas or leks should make it easy for ♀s to compare them and express whatever preferences they may have.

(2) The preferences often seem to be strong with a few ♂s obtaining most of the matings (see Bradbury et al 1985.)

(3) It seems likely that ♀ choice has led to the elaborate displays of many lekking species, although ♂ ♂ competition may have also played a role.

(4) Besides choosing individual ♂s, ♀s can choose between leks, basing their choice on some aggregate characteristic of all the males in a lek. A preference based on the number of males in a lek is particularly interesting because it could provide a selective force for the evolution of leks.

(5) In most ♀ choice models, preference for a male trait is balanced by natural selection against it. The same balance is possible in the lek models (e.g., increased predation on ♂s at certain lek sizes). ~~It may take~~ Other possibilities are increased display frequency due to competition, or increased fighting among ♂s.

(6) Central ♂s attain high mating success in some (though not all) lekking species, a phenomenon that has been attributed ~~explained~~ either to superior males to hold central territories or to a ♀ preference for these areas because they offer security from predators. (See Wittenberger 1979.) The hypothesis that preference for males in central or the densest part of lek is a manifestation of the preference that selected for leks themselves.

Carrick · R. 1963. Ecological significance of territory in the Australian Magpie, Gymnorhina tibicen

Proc. Intrenatl. Congr. 13: 740-753.

(1) Adult plumage pattern of Australian magpie, jet black underparts, white nape, rump and caudal, advertises the fact that predation on it is unlikely to be important.

(2) 5 categories in the territorial system

(a) permanent groups hold territories that posses supply food / shelter / nesting sites. At virtually all successfull breeding done by these birds. Permanent groups contain birds of all ages.

(b) Maybe groups have territories with an inadequate amount of feeding area & cover. Rare breeding success. Comp only of ad. birds.

(c) Mobile groups commute between feeding and roosting/nesting areas. No breeding success

(d) Open groups in areas of adequate food but not roosting/nesting trees. and have to commute for the same. They do not attempt nesting

(e) Flock birds are non territorial. Of all ages and sexes

(3) Between 1955 – 1962 16 of original 38 permanent groups were still within same territories. 20% of ♂ and 18% of ♀ were in territories where first ringed in 1955/56. Says these figures are low due to human interference that would not occur over most of birds range

Deshmuch. I. (1986) Primary productivity of a grassland in Nairobi National Park, Kenya. Jour. of Appl. Ecol. 23, 115-123.

As a result of the low rains (March-April) net primary productivity (dry matter) was 651 g m^{-2} and as a result of the short rains (October - December), 420 g m^{-2}

Brabbury J.W. 1981 Re evolution of leks. pp 135-169

In Natural selection and Social behaviour

ed. Richard. D. Alescander & D.W. Tinkle.

1) Defines lek :- a) No ♂ parental care b) arena or lek to which ♀s come and on which most matings occur. Arena is a site where several ♂s aggregate and does not fill the habitat ~~or~~ used for life history activities. c) display sites of ♂ contain no significant resources except ♂s themselves. d) ♀ can select a male at an arena.

2) lek mating system are associated with some of the most spectacular patterns of male adornments and display known in animals.

3) lek mating is a rare alternative to more common ♂s strategies such as resource defense of female defense.

④ In groups such as grouse or birds of paradise there is a continuum from uniform fields of males on contiguous territories through an intermediate dispersion in which males have somewhat smaller territories and show a slight clustering to the highly aggregated territories and large inter-arena distances of the classical lek. Intermediate forms have been called exploded or quasi leks.

(4 cont.) and males are often just barely within sighting or hearing of each other and the clustering is only apparent as a result of careful mapping.

(5) exploded lek dispersion patterns are quite common in most taxonomic groups that have classical leks. In birds-of-paradise it is more common than classical lek dispersion.

Trail M.P 1985 Courtship disruption modifies Mate choice in a lek-breeding bird. Science 227; 778-780

(1) The lekking system is generally considered to be particularly favorable for the operation of mate choice because ♀s of lek species receive no resources from males, initiate mating by solicitation and are not subject to forced copulation.

(2) Courtship disruption can be defined as any interference in courtship and mating that decreases the number of complete copulations performed by a male or that ~~decreases~~ increases the time and energy required to perform them.

(3) In male ~~Guianan~~ Guianan cock of the rock (Rupicola rupicola) mating success in ♂s is highly skewed (as in other lekking birds) and most successful ♂s perform c. 30% of all ~~successful~~ matings per year and 67% of territorial ♂s failing to mate at all each year.

(4) Two types of disruption ~~aggressive~~ confrontational and non confrontational. In the more aggressive ~~confrontational~~ confrontational disruption, disrupting ♂s had a greater chance of mating with a the ♀s that they disrupted

(5) Interrupted ♀s visit a significantly larger number of ♂ prior to copulation than ♀s that are successfully mated the first time. Interrupted ♀s were more likely to mate with more than one ♂.

Brown, J. L. and Orians G. H. 1970. Spacing patterns in mobile animals. Annu. Rev. Ecol. Syst. 1: 239–262.

Ward. S.A. 1987. Optimal habitat selection in time-limited dispersers. The American Naturalist. Vol. 129 No 4. pp. 568-579.

① The life cycles of a wide variety of organisms include a dispersal phase that precedes reproduction. The main function of this stage is to select an appropriate habitat for reproduction and the development of offspring.

The model's main predictions are.

1) During dispersion there should be an initial 'discrimination phase' during which inferior habitats should ~~not be~~ never be accepted; after this period, both superior and inferior habitats should be accepted whenever they are encountered.

2) The duration of the optimal discrimination phase increases with a) the searching efficiency and time available for searching. b) The abundance of optimal habitats a c) the abundance of inferior habitats d) the difference between the suitabilities of the two habitats e) the survival during the dispersal period.

3- ~~Another important~~ Density dependent regulation of populations within habitats reduces the optimal discrimination phase; that is soft selection should prevent extreme habitat specificity.

4) Another imp. factor is the failure to mate. In species that mate after settling in a habitat mating success depends on habitat choice. The model predicts that males (which are assumed to mate many times) and females (which mate only once) should be equally specific in their choice of habitats.

5) The optimal discrimination phase of species that mate after settling in the habitat is much greater than that of ~~parthenogenetic~~ organisms that mate prior to the dispersal phase.

Ecological Aspects of Social Evolution; Birds and Mammals.
Eds. Rubenstein a D.I & Wrangham R.W. (1986).
Princeton University Press. ~~pp 2th~~

- The evolution of Mating strategies in Male antelopes.
C.M Gosling pp 244-251.

(1) Almost all parental care by females, male investment is mainly by gametes. Qs have to suckle young, groom, and defend young. offspring stay with young for months atleat.

(2) a) selection should maximise the production of offspring that survive to independence. (b) the large nutrient needs for pregnancy and lactation (c) the observation that Qs ungulates need to spend most time in feeding or ruminating, it can be argued that Qs need to maximise nutrient intake for reproduction. They should also minimise risks of predation and this may be main reason why they join groups.

(3) outcome of contests for a resource depends on the relative competitive ability of the contestants and the value of the resource to each contestant. — a resource more valuable to one will make it fight harder and the other will avoid wasteful combat.

(4) competitive ability is often correlated with ~~body size~~ morphological and physiological attributes. Body size affects ~~in antelopes~~ the outcome of contests in various invertebrates.
In antelopes only effect of age has been documented, but age, body size, horn size and shape, ~~and~~ strength and body condition must also play a role.

(5) Individuals may recognise each other and avoid encounters with those they have lost to in previous contacts.

Where males live and mate ~~together~~ in groups dominance status of ~~males~~ individuals determine their success in mating.

(6) As (5) depends on remembering dominance it is called an "individual reference of dominance".

Alpha males may maintain their status by threats when their competitive ability has declind below group members.

(7) Owner ♂'s have lot more to loose than intruding ♂'s - e.g. higher predation risk, reduced Reproductive success and hence will fight harder. Where a ♂'s has owners advantage it will pay the intruder to avoid costs of encounter and by both identifying it and withdrawing early.

"Resource reference of dominance" = link between owner and resource that distinguishes it.

∴ The identification of owners (a special case of competitor assesment) is thus critical and selection would be expected to favour the ability of owners to advertise their status.

~~Owners~~ Intruders will usually avoid an escalated contest with a territorial male.

(8) If female moves to optimize nutrient intake then ♂s have 2 main options.

(a) follow ♀s and maintain dominance over other following ♂s – mainly when resources are scarce and widespread.

(b) defend an area that ♀s visit and defend this area against other ♂s (resource defense territoriality)

(c) a specialized form of (c) is to form leks.

9) Conditions that may lead to 8(b) area

a) high quality and clumped food resource so ♀s form feeding aggregations

b) A high degree of breeding synchronicity.

(c) males in familiar areas are less likely to be killed by predators than those in areas which are relatively unknown. In general animals that like in small areas should be more familiar ~~which~~ with such details than those in larger areas.

(10) In antelope territories appear to be spatial references for dominances during reproductive behaviour and in almost all territorial antelopes only territorial ♂s mate.

(11) <u>lekking</u>:- occurs in atleast 3 species of antelope. Territories in centre are smaller than periphery and in all 3 species some ♂s defend resource territories (dispersed lek??). ~~Intramale distance~~ of diameter of territory at centre of lek – kob 15–35 mts, topi 25–40 mts and lechwe 15 mts. / in 18000 kob/ 400 sq km in Tora game reserve there are 18 leks each with between 30–40 males.

(12) Once territorial males form clumps then more intense intrasexual competition for territories in clumps and ♀ choice of ♂s who get such territories may lead to a runaway process involving choice and further territory compression. At some point resources in territories may become less important in attracting ♀s than the quality and local abundance of males.

(13) Summarizes possible model evolution of lekking in antelopes

a) A tendency of resource defence territories to become compressed in patches of high-quality became ♀s visit these in large numbers

b) both ♀s and territorial ♂s rest in patches of open habitat where predation is low.

c) where open habitat crosses a territory boundary territorial ♂s tend to clump. This tendency increases for social and/or antipredatory reasons and became ♂s that attempt takeover of territories smaller temporary territories next to patches of open habitat in existing territories became these are activity centres where mating and defence occur.

[given only c. leks do not occur because a) fitness costs of competition is higher than the benefits of increased mating and b) because benefits to ♀ from mate choice are lower than costs of aggregation]

d) the runaway process involving ♀ choice, further territory compression and eventual lekking is initiated when ♂ and/or ♀ numbers are boosted by additional factors such as favoured migration routes.

(14) mating strategies of following, defending a resource and lekking do not occur exclusively in single species or in single populations. In a number of species two of these exist and in some topi all three may exist.

(15) Alternative to lekking some male kobs defend large territories away from leks and such males are often regarded as being having been unsuccessful in getting central lek territories.

This could be it not under genetic control i.e. old or injured ♂s. No evidence for this even though there is a slight tendency for non-lekking ♂s to be slightly older. It may simply be an alternate strategy.

(16) Males that obtain central lek territories get a very high level of mating but costs also are high. Such territories are held only for a few hours or days and all it a ♂ fails to get such a territory then it may incur high costs without commensurate benefits.

(17) Alternatively ♂s on resource based territories get fewer ♀s but cost is also low. RBT ♂s spend only 1% of time in defence while L ♂s spend 8%

Jarvi. T., Rostaff. E., Bakken. M. and Zumsteg. B. (1987)
Evolution of variation in male secondary sexual characteristics. A test of eight hypotheses applied to pied flycatchers.
Behav. Ecol. Sociobol. 20: 161-169.

(1) ♂ pied flycatchers Ficedula hypoleuca exhibits sexual dimorphism in its plumage varying from female like Brown to Jet black.

(2) ♂s grew blacker as they grew older

(3) Black ♂s attacked black dummies more frequently than brown dummies.

(4) Darker ♂s occupied better nesting sites ~~and~~ Better habitat quality occupied by dark ♂s. Density of breeding pairs was higher in better habitat.

(5) Darker ♂s arrived before brown ♂s

(6) Dark ♂s paired significantly earlier than lighter ♂s.

(7) Perhaps due to earlier nesting, 10 day old chick of Darker ♂s were significantly heavier than those of lighter ♂s.

(8) Brown ♂s survived better during non breeding season than black ♂s

(9) Some ♂s remained brown for several years. Others became black in the first breeding season.

(10) Concludes :- The observed variation in male plumage coloration has evolved as a means of signalling fighting ability, and social status. Conspicuously coloured ♂s gain a better mating advantage, as by mating with dominant ♂s ♀s gain access to better quality territories

However by being conspicuous the ~~are~~ black males carry a handicap which can be reduced by being in good physical condition, and compensated by a fisherian mating advantage.

Wallace · B. ~~1958~~ 1957. Ritualistic combat and allometry
The American Naturalist Vol. 129. No 5. pp 775-776.

① Among animals, much of the competition between individuals is more a matter of ritual than of actual combat. It matter lead to a physical combat, the relative sizes of combatants are of primary importance — larger animals are almost always the victors.

In order for variation in size to be effective in determing the outcome of ritualistic encounters it must be perceived. A Perceptions tend to be inaccurate, (webers law) claims that a 10-15% difference must exist before thy can be said to differ with certainity.

10% size increase = 3% lineal increase if object is roughly spherical in shape. which will result in 40% chance of error in judgment as against 50 if measurments are identical.

② If lineal and/or areal devices are to convey accurate and interpretable information concerning an individuals size (volume or mass), these devices must exhibit allometric? growth.

Gibson M.R. & Bradbury J.W. 1986. Male & female mating strategies on sage-grouse leks. In. D.I. Rubenstein & R.W. Wrangham (eds). Ecological aspects of social Evolution pp. 379-398. Princeton university pres. Princeton.

(1) lek system commonly defined by four criteria. a) absence of parental care b) clusters of displaying males, c) location of mating aggregations away from resources needed by ♀s d) apparent freedom of ♀s to choose mates.

(2) In sage grouse leks form from a few hrs each day at dawn (and at dusk and on moonlight nights in peak season) between end March and early may. Typically leks host 20-100 males each and are located at 1-3 km intervals throughout suitable habitat. Some sites are used annually and others are used only when population densities are high. ♀s visit leks singly or in groups from end march to early may and mating is concentrated in a ten to fourteen day period.

(3) A positive correlation is seen in the degree of male clustering and ♀ range size.

(4) Male self advertisement contrasted with resource or mate defence has been suggested to be a default strategy adopted when high ♀ mobility makes these more

common alternatives untenable.

(5) Golden eagles take up to 5% of displaying sage grouse.

(6) Stable leks :- In many leks, most ♂ sage grouse occupy small display rayes (territories ca. 0.01 ha) of exclusive use and broad margins that overlap the rage of neighbours. Few ♂s occupy layer areas with more overlaps with other ♂s, or move between small noncontiguous display ranges, on the same lek or between 2 different leks, throughout the breeding season. ∴ spatial & social encounter restricted to rage overlaps between territorial ♂s.

(7) Agnostic interactions as a rule have no winner or losers. ♂s invariably win fights in their core area and without consequence to territorial status loose in another core area.

(8) Copulation interruption reshuffle ♀ mate choice, who may choice earlier ♂, attacker, another ♂ or leave the lek unmated.

(9) Data suggests that copulation interference is at best only a minor contributor to variance in male mating success.

(10) It has been suggested that intensification of fighting in successful ♂s has been cited as evidence that ♂s compete more intensely for sites at which ♀s mate, with the premise result that only more dominant males achieve breeding status. Authors do not find evidence to corroborate this.

(11) Unstable leks: ~~for some years~~ The leks are shifted dmy the season, or from day to day, or both and are a regular feature in some grouse leks.

(11a) ♂ lek display rates were significantly lower than in stable leks. As a result ♂s interacted freely with most other.

(11b) fighting charged with clear cut dominance relationships among ♂s. and were more frequently decisive, and compared to stable leks were much shorter.

(11c) winner of fights often appear to gain or maintain access to ♀s at the expense of losers.

(12) Most ♀ visit leks for two to 3 days prior to mating, mate once, and then lay a clutch without additional mating. Some ♀s visit the same lek repeatedly while other ~~more~~ visit two or more leks on different visits. Thus prior to mating opportunities exist for extensive and repeated sampling of ♂s.

(12a) typically ♀s flew onto the lek, took a low windy paths that took them through the territories of 10–11 displaying ♂s. This pattern was characteristic of ♀s that did not mate dmy a visit and those that did, of the latter most mated with males that they had passed earlier in their visit, some of them more ~~betw~~ repeatedly between chosen males and one or two other suggesting sequential comparison of males.

(12b) by contrast other ♀s moved ~~drive~~ directly from their arrival point to ~~on~~ a male and mated without preliminary sampling. This suggest either relatively instantaneous choice or

or that choice was based on an earlier visit.

(13) Summary whether spatial position is responsible for male mating success skew, suggest that due to default the data support phenotypic cues as against spatial position, i.e. centralized location of dominant males within lek.

(14) ~~Preliminary~~ data suggests that strut rate is positively correlated to mating success. But high strut rate is not sufficient to ensure mating success.
Analyses also indicates ~~several~~ individual variation in acoustic displays, one of which is positively linked to mating success.

(15) Possibility of ♀ choice copying ~~occurs~~ arises from synchronous visits by ♀s to a lek.
30-59 % of ♀s had chances to observe mating on previous lek visits.
64% of ♀s had opportunity to observe mating on the day they mated
18-27 % of ♀ had no opportunity to observe mating.

(16) ♀s disrupt mating by other ♀s when competing for same ♂s.

lekking versus solitary display: temporal variations in dispersion in the buff breasted sandpiper.

S.G. Prwett-Jones 1988. Anim. Behav. 36, 1740-1752.

(1) Dispersion in lek species is best viewed as one special case of spacing in promiscous systems generally. Because number of promiscous species show lek-like dynamics in their mating system, but vary in the spatial dispersion of males.

(2) Birds visited study site 5 days prior to ther settling permanently. They foraged on the study site, occasionally displayed, but moved on after short periods. usually from 1-3h.

(3) In two leks - one settled gradually seven days to reach total number. Display territories were in areas originally covered by receding snow.

In the second lek was rapidly settled. On day 2 15 males were holding display territories.

(4) Breedy population not distributed evenly across the tundra habitat, but rather as groups of males at lek sites and groups of ♀s that nested around them sites. (mean nest to lek distance was 292 m², 524 m). (closest other lek was 6 km, 3 km)

(5) None of c. 50 adult ♂s were resighted at In subsequent years. No natal philopatry & breedy site fidelity.

(6) lekky display lasted for about 2 weeks. for the next two weeks an unusual period was seen when solitary ♂s displayed on ~~solitary~~ dispersed sites occasionally for short periods often just a few hours before leaving. Nos of ♂ fluctuated from day to day as did the sites.
In most cases ♂ displayed near or encompassed nesting sites. ♀ however rarely interacted with the ♂s.

(7) Nesting began only ~~a week~~ 5 days after lekking began.

(8) 32% of ♀ visits to ♂s were disrupted by intruding ♂s. The propotion of visits ♀ that interacted with ♂s. influenced the propability that the visit would be disrupted.

(9) Matings among ♂s were highly skewed. (only 9 of 21 ♂s, 1 ♂ obtaing 30% of copulations) (3 of 5 ♂s (♂ obtaing 77% of copulations)

(10) Mating success of ♂s was not related to their ability to repel disruptions.

(11) During first several days of ♀ lek activity ♀s moved in small groups. once incubation began, ♀s moved solitarily, at least on their visit to ♂s.

(12) Parasitic Jaeger (Stercorarius parasiticus) dived twice at a displaying ♂.

(13) The unpredictability of buff breasted sandpiper both temporally and spatially suggest that it is a highly opportunistic breeder. A narrow time window of environmental suitability in the arctic may cause this and also would be dependent on a high degree of synchronisation among the sexes.

(14) The change from clumped to distant territories is not an alternative display strategy as the display tactic of the ♂ remained the same. i.e. engage in self-advertisement on non-resource based territories.

(15) The dynamic of dispersion circumstantially fits the Hot-spot model of lek evolution.

ZAHAVI A. 1975 Mate selection - A selection for a handicap. J. Theor. Biol. 53, 205-214.

(1) ~~Bateat~~ suggests that any exaggerated character ♂ selected through mate preference, e.g. ~~not~~ long tail of peacock etc, confers a handicap (survival) on the bearer. Therefore by possessing such a character/display the bearer is showing its ability to survive inspite of the handicap. ∴ ♀ find it easy to test/choose for quality, which she will not be able to discern in a ♂ that is genotypically similar but does not display a handicap.

(2) Some species, and often one of the sexes (which invests most in parental care) cannot easily be pushed into a handicap because the pressures of natural selection are too tight.

(3) Good quality birds can take larger risks, it is not suprising that sexual displays in many cases evolved to proclaim quality by showing the amount of risk the bird can take and still survive.

Tinbergen · N· 1957 . The functions of territory. Bird study 4 (1) : 14-27.

Suggests that interspecific hostility – agression to same sex and retreat of intruder are all mechanisms of dispersal.

Bengal florican display

(1) T.C. Jerdon : Birds of India Vol III : 616-626 1864

- February to April stalking in thin grass -
  Though he says it breeds from June to August - is above another on its tendency to display from short grass?
- describes display as a perpendicular rise with a hurried flapping of wings, occasionally stopping for a second or two ~~before~~ then rising still higher. Also describes the puffing of neck and ~~breast~~ breast feathers. Accompanied by a humming sound.
- courtship display describe as trailing of wings, cocking of tail and humming like a turkey cock. [Jerdon often seen this]
- In general a silent bird but if startled will rise with a shrill metallic 'chik-chik' occasionally repeated through the flight.

(2) E.C. Stuart Baker Game birds of India, Burma & Ceylon Vol II 1921

- breeding season commences in march extends into June
- majority of eggs end March to mid April
  [out of 85 eggs recorded by him Feb-2, March-24 April-35 May-13 June-8 July-4]
- Quoting Hume who quotes Hodgson :- Describes the display fairly accurately except includes a humming sound - also
- continues to describe courtship display as in Jerdon (like a turkey cock)
- quoting C.B Macgregor as rising beaten from ground and hovering on quivering wings some 10-20 ft of the ground. Has seen them display twice after sunset.
- quoting Primrose as rising a few feet above the grass and after hovering for a ~~while~~ few seconds dropping back to the ground.
- In write up of lesser florican says Bengal florican display identical to lesser florican.

Bengal florican plumage

I. T.C. Jerdon : 1864 ; Birds of India Vol III 616-626

1) ~~Young~~ Young ♂ birds at first like female

2) Male in non breeding plumage (perhaps only younger birds) have head neck & wing coverts like ♀, primaries white & lower plumage (belly black) like in Gould's picture. Many birds like this are killed in winter & upto July.

(3) Thinks that 1st year ♂s do not assume this plumage and is the winter plumage of all other age groups except perhaps very old ♂s

(4) Perhaps ~~last~~ previous year ♂s (do not breed in the 1st breeding season) do not assume full breeding plumage until 2nd spring moult

(5) It is possible that Adult cocks always retain breeding plumage. In February has shot cock birds with whole neck & head black, but the pectoral plumes & crest not developed and the feathers of the neck thin & short

(6) quotes Hodgson who says that cock Floricans retain breeding plumage but ~~beard~~ crest and breast hackles ~~are~~ in their fullness are only assumed as a nuptial dress

(7) Says not had much opportunity to decides but compares it with C. florican (calls it analogous) and assumes that all except perhaps very old ♂s loose a some of the black on head & neck.

II E.C. STUART BAKER 1921 : Game birds of India Burma and Ceylon Vol II

(1) Young ♂s at first like ♀ - commences to assume adult plumage (B & t) in first spring moult. Ren probably reverts to ♀ plumage ~~then~~ in Autumn ~~and in 2nd spring to~~ but retaining white of wings.

(2) Adult plumage assumed in an irregular manner.

(i) some young birds adult plmage assumed breast & downwards & except for white wings rest as in ♀

(ii) white wings are however first to show themselves.

(iii) Other ♂s retain upperparts like ♀, but commence to assume black feathers of throat and ~~for~~ below breast to a lesser degree.

(iv) One imm. ♂ he examined:- Had great deal of black from below chin to the breast; Entire upperparts as in ♀ with the exception of few white feathers among wing coverts; From lower breast downwards the whole lower plumage is a soiled white, with a good many black & vermiculated feathers showing all over.

(v) Observation & conclusion of (iv) based on one specimen.

(3) Concludes ~~that~~ that ♂s do not have seperate winter & breeding plumage.

(4) Quotes Blyth (who was responsible for the then accepted belief that ♂s assume a semi ♀ like non breeding plumage)

Blyth- has witnessed apparently from a captive of the change to a ♀ or partial ♀ plumage and the subsequent renewal of the breeding plumage. Renewal was not complete in the captive ♂ which he put down to the effects of captivity - He has observed this also from the skins of wild birds.

(5) Quotes Hodgson who says:- 2 moults annually - one from march to May and a switter one from August to September. Imm. ♂s upto beginning of March resemble ♀ entirely - then moult gradually into adult plumage - (never reverting back to the ♀ plumage as in likh) on after the breeding season.
There is no nuptial plumage in this species, and regards only the hackles & crest of neck & head & breast in their fullness as such.

(6) Baker makes a correction that the imm ♂s ~~retain~~ gain complete adult plumage after the ~~first~~ 3rd 4th moult (2nd year) after which they do not revert to ♀ or partial ♀ plumage. Unlike not as Hodgson says the 1st or 2nd moult.

(7) Says that fully plumaged ♂s are seen in winter from November to end of February. Has seen adult cocks moulting ~~from~~ in April from breeding plumage to breeding plumage.

(8) Has several times seen non-adult cocks in an intermediate state moulting in autumn - to a semi ♀ condition

(9) Transition ♂ - 1st Autumn moult ♀ like plumage
♀ 2nd 1st Spring moult intermediate to both sexes.

IInd Autumn moult - looses certain amount of (spring moult) colour & becomes more like a ♀

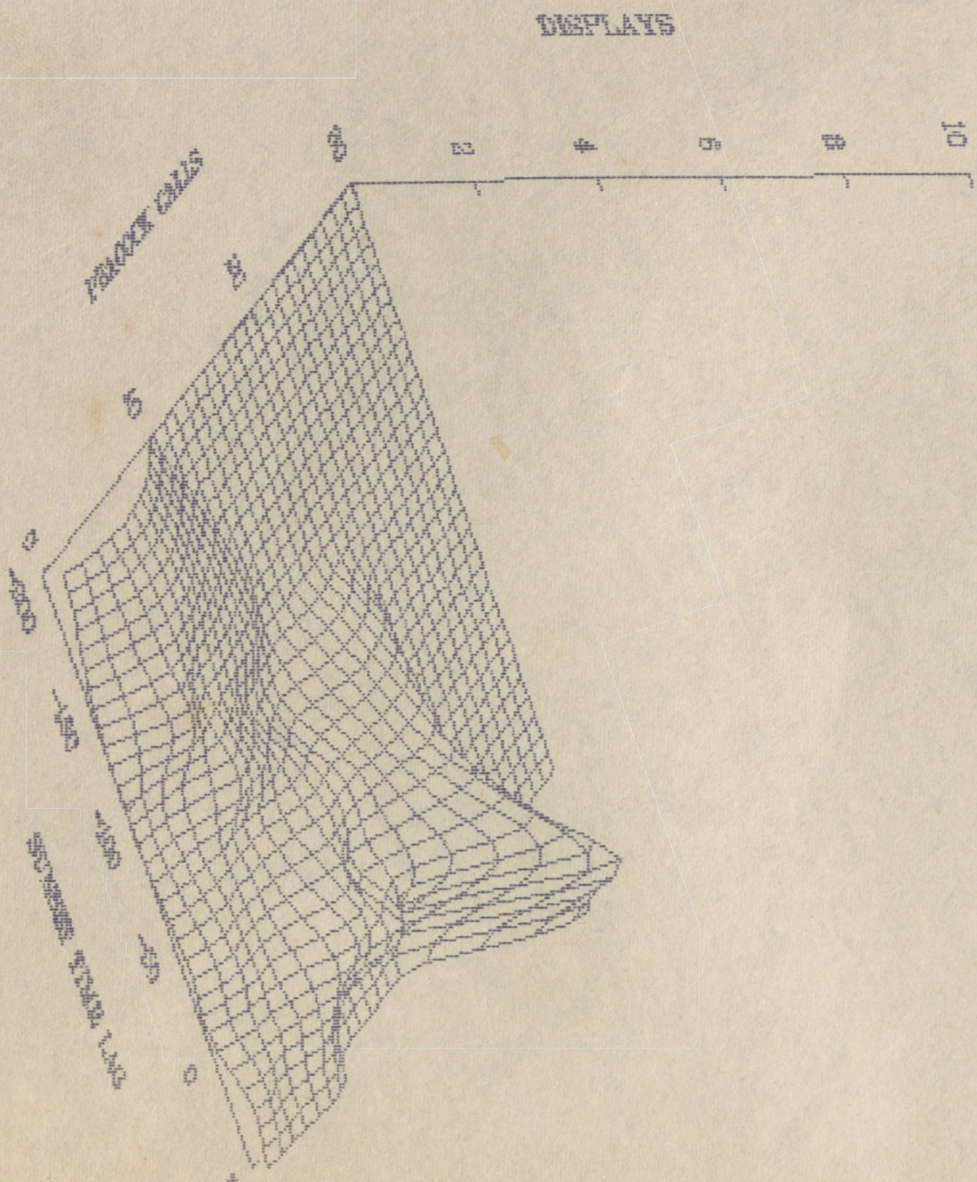
2nd Spring moult goes still further into adult plumage and on completion of this moult when he is just under 2yrs of age assumes complete adult plumage.

IIIrd Autumn moult. If plumage not completed in IInd spring moult then completed now.

(10) After (9) there is no further retrograde step.

(11) Has seen may cock in ♀ or partial ♀ plumage in winter but says these were all very small and did not exceed 2 - 2½ lbs.

CYTARABINE
0.0
0.2
0.4
0.6
0.8
1.0
TUMOR CELLS
0
2
4
6
8
10
TISPLATIN


DISPLAYS
10

Stanley Cramp (chief editor) 1980. Handbook of the Birds of Europe, the Middle east and North Africa. Vol II Hawks to Bustards. OXFORD UNIV. PRESS. LONDON.

FAMILY OTIDIDAE (BUSTARDS)

(1) About 23 species; all rather closely related, often classified into several genera — the 11 currently.

(2) Many differences between species in shape and position of ornaments and wide variety of display indicate long isolation between them and ancient origin of family.

(3) Bodies heavy and robust, with flattened head and rather thick-set necks in larger species, neck much more slender in smaller species.

(4) larger species show considerable sexual dimorphism in size.

(5) Plumage colours varies widely. Generally upperparts cryptically coloured and belly white, sandy, or black, wing often showing bold pattern with much white in flight, and tail contrastingly barred.

(6) Eupodotis with black underparts live in more sheltered habitats, solitarily, and have spectacular aerial displays;. Rose without black on belly live in open country, gregariously and have no aerial display. (See original for reference)

(7) Head neck and chest plumage differs according to species, often with peculiar ornamental or lanceolate feathers usually growing in distinct feather tracts.

(8) Sexes similar in ~~some~~ few genera, and in some other outside breeding season. ♂s generally brighter than ♀s.

(9) Generally one moult a year, in some species ornamental feather tracts have 2nd nonbreeding moult.

(10) In warmer climates, resident, locally migratory or seasonally nomadic. In particular Arcleotis and Neotis show strong ~~response~~ movements in response to rain.

(11) Family groups coalesce into flocks after breeding season. Gregarious on passage and in winter quarters.

(12) Move diurnally (not in formation). Migrate overland on wide fronts, ~~on wide fronts~~ as far as possible. Generally fly low but will rise to 3500m to cross mountain ranges.

(13) Gregarious in temperate ~~climates~~ region. Notably less so in warmer climates where some species notably solitary and flock sizes usually smaller.

(14) Displays by smaller species involve anything from short flutter jumps to full flight displays with strong ~~b~~ wing beats and conspicuous 'parachuting' descents.

(15) Smaller species also heavily dependent on far-carrying, persistent, ~~ammunical~~ ranging calls in self advertisment. Larger species ~~in~~

(Ardeotis and Neotis) generally also have booming display calls but less persistent.

(16) Never bathe. Only dustbathing. Never rest on one leg and show true yawning.

(17) laying intervals 2-3 days. Incubation periods 20-28 days only ♀s incubate.

(18) Hatching generally synchronous in which case eggshells left in nest.

(19) Fledgling period 30-35 days.

On the "showing off" of the Australian Bustard

(Eupodotis australis)

Garrod A.H. 1874 Proc Zool. Soc. London.

(1) Shows that there is no 'Gular pouch' in ♂ Australian bustards

(2) No prescence of sublingual orifice but distinctly noticed a median Frenum linguae

(3) Otis tarda has a distinct gular pouch

(4) two effects very similar in appearance, in ~~two~~ closely allied birds, may be the result of ~~two~~ different mechanisms. ~~In Otis tarda~~

(5) Duy display in both ~~three~~ birds, a distention with air of a well differentiated bag, which is in both cases lined with a true mucous membrane.

(6) In Otis tarda this is a special structure in front of the wind pipe, opening under the tongue, In Australian bustard it is simply a highly dilated ~~Pharynx~~ oesophagus.

Aan Mackworth-Praed C.W & C.H.B Grant 1962

African handbook of Birds Series 2

Species	♂ colour	♀ colour	colour of belly	display
E. caerulescens (blue bustard)	(325-356)		blue slate	
E. oligorsli (Oligors bustard)	(320-361)		Ashy brown	
E. ruppelli (Ruppells bustard	(320-361) smaller (305-327)		buffish white	
E. melanogaster (black bellied)	(311-359)		black	
E. afra black bustard	(278-310)		black	
E. rueppelli (buff crested bustard)	(226-273)		earth black	aerial
Kori	710 to 760 mm	525 to 620 mm	white	
Neotis ludwigii	530-533 mm	446 mm	white	
N. denhami	557-583	460-490	brown	

Riggan J.P, Goode S., Jacks M.P & Lockwood M.R. 1988

Interactions of fire and community development in chaparral of Southern California.

Ecological Monograph 58 (3) pp 155-176

- where species must reproduce from seeds are predominant composition can be altered by a single fire with little or no recruitment after initial post-fire establishment.

Keast J.A & A.J. Marshall (1954). Reproduction in Australian Desert Birds. Proc. Zool. Soc. London 124: 493 - 499.

① In bad years few birds attempt to breed but migrate but when drought breaks they return and commence breeding.

② When good rain birds may breed twice or at any time following rain

Davies S.J.J.F 1979, The breeding season of birds in South-western Australia. Journal of the Royal society of western Australia, Vol 62, Parts 1-4, pp. 53-64.

① Earlier studies demonstrate that most breeding birds in S. western Australia occur in spring, but a Autumn breeding (unseasonal) does occur sometimes, associated with unseasonal autumn rains. All authors agreed that food must be the main cause and an early speculation that ~~was~~ an important proximate factor timing the breeding was rainfall itself lost ground in favour of the speculation that the environmental effects of the rainfall may be more important.

Katewa S.S. and Tiagi Y.D. 1983. Grasses of Udaipur district (Rajasthan state). JBNHS. Vol. 80. No. 2. 370-379.

Collected 136 species of grasses from this district and over 85% flower and fruit during the monsoon.

I White D.M (1984?) Captive breedy of the Australian bustard (Ardeotis australis) at Serendipi Wildlife Research Station.

(1) ♂s display between June & November

(2) Incubation period 23-24 days

(3) Aggressive fighting between ♂s during breedy season resulted in 3 deaths.

(4) ♂ copulated at 3yrs 11mths / youngest ♂ displaying at 2 yrs of age. Youngest ♀ to lay was 3 yrs old.

(5)

II W.W. Howells and K.S. Flynn (1979) the occurence of Denham's bustard at Wankie National Park and in Northwest Rhodesia with notes on movement and Behaviour. (observation from one bird mainly)

(1) on one occasion ~~bustas~~ Denham's bustard was seen feeding in whilst wading in thigh deep water. Foraging probably on small frogs (Bufo sp.)

(2) Seen eating termites on two occasions, both alates and active, alates from ground and air. on other occasions appeared to be feeding on grass.

(3) Preening was normally carried out about 30 min before roosting (last light) and lasted between 5 and 20 minutes. Always perched standing.

(4) whilsts preening the bustard would regularly flirt its tail by raising it and spreading it before lowering it again. Usually tail held up for few seconds only but on one occasion held up for nearly 3 minutes.

(5) As against c. display when layer bustards inflate neck and hold tail at acute angle, Denham were never seen to inflate neck and under tail coverts were also never seen to be fanned.

(7) whilst stationary both wings would hang limply with remiges almost touching the ground. On starting to walk they were flicked into position.

(8) (i) Series of short post preening displays which were variable and inconsistent in composition. Only two manouvers seen to occur with any regularity.

(a) strutting posture similar to domestic cock turkey with lowered tail flirted and fanned occurred frequently among post preening display and often terminated them.

(b) 'tumble flight', resembling display flight of E. ruficrista. In this display bustard shoots up to height of c. 7 meters and falls to the ground, wings are snapped open at the last moment before landing. On touching down stands motionless momentarily before moving forward.

(ii) other movements.

(a) the pattern S rapidly traversed within a distance of c. 5m. Seen twice on one occasion.

(b) Similar to 'tumble flight', but instead of stalling at peak of climb, the bustard spread its wings and flew strongly for 40 m. On landing adopted "strutting" posture immediately.

(8) at the end of a preen session it would suddenly jump vertically to c. 3mts, stall then spiral to the ground where it would adopt the stuffy posture whilst rump a few mts.

(9) A monsoon breeder. between November and March main rainfall between mid November and mid ~~March~~ Feb.

(10) though recorded in N.W. Rhodesia mainly during monsoon months, when recorded breedy elsewhere, there are no record breeding in N.W. Rhodesia.

Bannerman. D.A. 1931. The birds of tropical west Africa. Oliver & Boyd. London.

Dem Arabian Bustard.

(1) Marked migration northwards along the rains. Possibly from the tree Savannah country into the more arid Saharan belt.

(2) Found along with Denham's bustard (often together) in small parties. Birds generally seen in flight in the early morning flew height 500-1500 feet. Northward migration between early June and Mid August.

Denhams bustard.

(1) Around lake chad often in company of black bellied bustard.

(2) A traveller often had the opportunity of observing them as kept apart from Qs. Usually seen singly or in small flocks.

(3) quotes description of display, as puffed out like a proud turkey but more so, appeared to be quite white, and twisted one way and another, round and round, as it strutted about an area barely 20 ft^2

white bellied bustard.

(1) usually in pairs, occasionaly upto 3 or 4.

(2) Nesting season lasts throughout summer.

Priest C.D. 1939. Re birds of Southern Rhodesia Vol. 2.
William Clowes & Sons ltd. London.

kori bustard.

(1) Appears to be partially migratory, its movements probably depending on rainfall.

ludwigs bustard.

(1) feed on clover and young soft weeds and grass apart from insects etc.

(2) occasionally a bird would be seen in the distance revolving slowly round and round, his big white neck glistening and his tail feathers and wing coverts stuck up like a frill around him, accompanied whith his deep humming love note.

Redcrested bustard

(1) ♂s display by rising from one to two hundred feet in the air, then allowing itself to drop like a dead weight from that height, only breaking its fall within a few feet of the ground on suddenly opening its wings.

~~Petretti. F. 1986. Notes on~~

Black bellied bustards.

(September - October)

① During the breeding season, as many as 7 ♂♂ seen chasing one another around the veld.

② Perhaps displays at night as has heard 'aar poop' call.

③ Call - a clear whistle followed by a 'pop' (like a cork being drawn from bottle); a drawling whistle a long pause and then 'pop'

Species	♂ wt/g	♀ wt/g	♂ wt	♀ wt.	
Kori	790	650	16		
Ludwigs	546	444	~~(3.275)~~ (3.375?)		
Denhams	584·2	457·2	9.675		
(Barroum) Blue?	292·1	266·7			
~~red~~crested	~~290~~ 270	—			
Blackbellied	380	—			
Black	250	250			

Hand book of the birds of Europe, the middle east and North Africa
Cramp et al 1980

Species	♂ wing	♀ wing	colour of belly	♂ weight	♀ weight	Display
Tetraxlethura (Little bustard)	250 (254)	245 (255)	white	975, 940, 960, 794	740-910	
Denhams Bustard	612	507	white	4500	3200	
Nubian	♂ upto 30% larger than ♀		white	♂ 440+		
Houbara	407 (388)	368 (359)	white	3175 (1800-2400)	2500 (1200-1700)	
Arabian	638	554	white	7700-10000		
Great	617	486	white	8883	4421	

Dannerman D.A 1931 : The birds of tropical west Africa.
Oliver & Boyd London.

species	♂ wing	♀ wing	colour of belly	♂ weight	♀ weight
Arabian	570-585	512-550	white	17-22 lbs	
Denhams	580-640	~~495-515~~ 500-535			
Nubian	440-451	350-400			
white bellied	266-285	260-275			
bustard	249-257	240-246			
Black bellied	325-355	310-331			

Giplin, M.E. & Soule, M.E. 1986. MINIMum viable populations: processes of species extinction.

① Extinction can be classified into two kinds: Deterministic and stochastic.

a) Deterministic extinction occurs when something essential is removed (space, shelter, food), or when something lethal is introduced. Extinction due to habitat loss is deterministic.

The total extinction of a species done to habitat loss, however can only occur 1) when the species is a local endemic, 2) when it is already on the verge of extinction 3) when human or global events cause wholesale habitat destruction.

stochastic extinctions are those that result from normal, random changes or environmental perturbations. Usually such perturbations thin a population but do not destroy it; once thinned however the population is at an increased risk from the same or from a different kind of random event. The smaller a population, the greater its vulnerability to such ~~permanent~~ perturbations; the shorter the interval between such events, the more likely the population will be pushed over the brink before it can recover to a safe size.

May extinctions are the result of a deterministic event that brings the population into a size range where rather frequent or probable stochastic events can easily terminate it. For. e.g., habitat destruction or over-harvesting will reduce a population to the point where a stochastic extinction is inevitable.

Demographic stochasticity :- defined as the chance variation in individual birth and death. In a small population, extinction can occur randomly because of high death rates or low birth rates. A population is not safe from such a chance failure in recruitment until it has a large number of members.

Environment stochasticity :- two general routes to the domain of strong demographic stochasticity
a) decrease in habitat stochasticity b) deterioriation in environmental quality.

Identities & 4 loops that result in extinction.

a) R vortex :- often chance lowering of population size (N) and an increase in the variance of population growth (var-R) make the population vulnerable to further disturbances, in turn decreasing N and increasing var-R.
e.g. where the early distmbances alter the age structure of a population in such a way as to make it more vulnerable to subsequent distmbances.

Or, an alteration of the sex ratio away from 50:50 could lead to even greater variation in birth and death rates (due for e.g. to increased difficulty in finding mates).

D. Vortex

A lowering N_e and increasing Var R can alter the spatial distribution of a population and can increase the patchiness of its distribution

Fragmentation has a number of detrimental effects.

a) Probability of extinction at a local patch varies inversely with the population size of the patch.; more fragmented distributions are likely to

b) increase further the rate of local extinction, further exacarebating the problem of isolation

b).

F. vortex. - 9

This is genetic, Inbreeding and inbreeding depression which affect most components of population phenotype resulting in extinction.

A vortex.

Also genetic but acts differently from F vortex in that it affects the precision with which selection 'tunes' a population to its environment.

Oring. L.W. 1982. Avian mating systems in Avian Biology Vol. VI 1-92.

① defin mating system.
eg Promiscous is defined as Male dominance polygyny. In this mates or critical resources are not economically monopolizable. Males compete for females by sorting out positions of dominance and/or directly demonstrating quality through display. Territory size and degree of male aggregations are inversely related to the size of ♀ home range. Extreme aggregation (leks) occur. Whe ♀ home ranges are mobile, a ♀ pursuit strategy may develop.

② ♂ emancipation :- » superabandance of critical resources, many ♂ defence of resources unnecessary and hence uneconomical.
2) unpredictibality of critical resources in time/and or space. 3) situation in which ~~groups of ♀s~~ resources or mates are clumped in a defensible pattern but the cost of defence is too high.

③ Male dominance Polygyny : dispersed ;- ♂'s occupy large territories containg display sites, food and cover. ♀s reside in exclusive home ranges which may or may not overlap with ♂ territories.

(4) (i) ♂ are widely distributed in large territories over suitable habitat.

(ii) Home ranges are markedly smaller than in related leh species.

(iii) ♂ ♀ interaction are limited to courtship and mating.

(iv) Defence may be concentrated to display sites though most of home range is defended.

(v) many ♀ homeranges/territories may overlap a single ♂.

(vi) ♀s usually visit more than 1 ♂ before mating.

(vii) ♀s do not necessarily ~~mate~~ nest in territory of ♂ with whom she has mated

(viii) Solitary tendencies prevail, except for ♀/brood and/or juvenile ♂ groups.

(5) Ruffed grouse.

(i) ♂ home range 3-6 ha. with overlap between adjacent territories from very little to 60%. (Archibald 1976)

(ii) each territory contains display sites usually large fallen logs. In densely forested area.

(iii) Territories that have been used ~~for~~ continuously for many years have numerous acceptable display sites, are located towards the centre of ~~display ct~~ ~~display clusters~~. clumps of territories and are occupied by long lived birds.

(iv) ♂ appear to occupy sites for life (only 2 of 141 ♂s switched) Boag 1976.

(v) Before laying ♀s have large home ranges (c. 12 ha) probably reflect visits to several display sites. ~~One lady~~ ♀ home range during brooding include different habitats than used previously and are often long distances from the nest. Hence ♀s utilize areas that are too large for ♂s to defend.

(6) Spruce grouse.

~~Among species~~

(i) ad ♂s remain closely associated with the same block of Habitat throughout the year. and may occasionally join ♀s in winter flocks.

(ii) In display period ♂ home range are 1/2 size of ♀ home range. All ♂s adults and yearlings occupy exclusive territories. All ♀s occupy mutually exclusive territories.

(iii) overlap between ♂s = 5% and is same as overlap between ♀s

(iv) greater overlap between ♂s & ♀, ♀ ad ♂s overlap ad ♀ 17%, ad ♀ overlap ad ♂ 12%.

(v) Yearling ♂s establish territories avail adult ♂s or restrict activities to peripheral area. Yearly ♂s appear to fill vacated territories in preference to establishing new ones. ♀s are ♂ spaced around ♂s.

(vi) This clumping may be due to social attraction or to habitat selection.

C. (7) M·D·P: Intermediate dispersion.
Is inbetween leks and dispersed.

(i) In village indigo birds [quotty Payne & Payne (1977)] may display sites were traditional being passed from 1♂ to another.

(ii) matin success skewed in 2 14 bird population 1♂ got 66% and in the other 1♂ got 86% of copulations.

(iii) Successfull ♂s ~~got~~ say more often than unsuccessfull one Sexual selection appear to be effected primarily through song.

(iv) ♂s tried to obtain superior call sites, and it appear that more older, more experienced birds had the best site.

D. (8) M·D·P. Clumped. leks.

(i) suggests that the term lek be used for

a) A group of ♂s defends small closely positioned courts used only for mating i.e. the courts contain minimal resources other than ♂s themselves.

(b) ♀s visit the arena only for choosing mate & mating

(c) ♀s sort off the arena where they provide parental care.

(ii) clumped M.D.P. systems are further typified by large ♂♂ & home ranges.

(iii) Intense competion for territories/arenas where most mating occurs e.g. central ~~few~~ territories in Sharptailed grouse, Greater prairie-chickens and Black grouse.

(iv) great variation in ♂ mating success. with few as (5-30%) of ♂s obtaing most (70-95%) copulations.

(v) Because of this extreme sexual selection ♂s of most species have evolved large size relative to females, bizarre plumage and/or exceedingly complex displays.

(vi) ♂s that do have minimal chances of mating have alternate strategies such as in lek grouse peripheral ♂s chase ♀s off the lek, or intercept them as they come in. Central ♂ usually remain within their territories even if ♀s leave.

Great Bustard reported to lek (Gewalt 1959 in german)

(9) North american Prairie grouse.

(i) Sharptailed grouse & greater prairie chicken males display from territories as small as 10m in diametre but this becomes larger towards the periphery.

(ii) arenas are in exposed spots generally a long distance from potential hiding places of predators

(iii) lek size is highly variable but 5–20 ♂s are most common. Interlek distance varies with habitat heterogeneity. leks in prime habitat average little over 2 km apart.

(iv) ♂s visit arenas thruout year, but daily visits occur only from March to June.

(v) most ♂s arrive at leks long before sunrise and soon come singly other in groups. Display lasts afew hours after which males forage in their large home ranges. Afternoon display is also common

(vi) visits to leks are less frequent during times of cold, heavy cloud cover, high wind or precipitation.

(vii) Non territorial ♂, usually yearlings, try to often establish themselves in the early season but abandon the effort. They make brief visits to several leks, filling vaccancies that arise. Solitary displaying ♂ (off the lek) rarely get matings.

(viii) During early territorial phase ♀ visitation is rare and ♂ competition / aggression is intense. ♀s begin arriving in early April with maximum visitations c. 10 April. Copulation peaks 10 days later. A few centrally located ♂s (1-3) achieve odd nearly all copulations. ♂s strive to occupy central territories that tend to be the property of older layer bird. ♀s too exhibit preference of central territories.

(ix) Presence of ♀s results in reduced overt agression and increased ~~display~~ advertisement and courtship.

(x) In one area Greater Prarie chicken nests were on average 2000m from lek where mating had taken place but only 1000m from nearest lek.

(xi) Home rages of prelayg ♀ are much larger than at other time of breedig season.

(xii) Follow predation second nesting attempts average 760m from the 1st (extreme upto 5600m). And 2nd nonaroge overlaps only 5% of the original. Report of a ♀ sharptailed grouse that moved 20k.m. after losing a nest. Females whose nests were successfull return in subsequent years to nest within few metres of the previously successfull nst. of 5 marked ♀s observed 2yrs in arow, 4 returned to their previous lek.

(10) White bearded Manakin.

(i) ~~displ~~ ♂s defend courts 15-90cm in diamtre which are cleared on the forest floor. Courts are 10-100cm or more apart: an arena contains 6-50 resident ♂, ~~furthe~~

(ii) Re court and the area immediately around it are used for most of the daylight hows of the year.

(iii). Once established on a court ♂s remain as log as thy can physically which is 10yrs or more. Thus establishment of new territories is rare, and competition for courts is keen.

(iv) few ♂s do all the matings. In one lek a style ♂ achieved 73.3% and 30% of ♂s did 95.4% of matings.

(v) ♀s mate several times per ♀ clutch and often have several clutches per season. ♀s are not permanently associated with any one lek. ♀s appear to asses a number of mates before and sometimes after a copulation.

(11) Ruff.

(i) ♂s display from bare courts about 30cm in diametre, seperated by 1-1.5m. leks of 70 ♂ have been recorded, usually less than 20.

(ii) Independent ♂s dark ruffs, satellite ♂s white/light ruffs. only independent ♂s hold territories. Satellites have resident territories, change territories and visit different leks. They are usually tolerated on small leks but are attacked on large leks.

(iii) ♀s choses ♂ by moving within and among leks. chosen territory may also have a satellite. Presence of ♀ increases aggression of independent to satellite but not viceversa. Hence satellites mate when resident is away.

(iv) On large leks almost all copulations by residents. On ~~small~~ small leks, presence of satellites frequently increases mating chances for both residents & Satellites.

(12) Hypotheses for leking.

(i) Stimulus pooling:- that in groups combined signalling may enhance mating chances, and/or increased stimulation to one another.
However, Bradbury (1981) showed that in terms of signal broadcast geometry males can be expected to do less well when in clumps than in ~~isolated~~ when displaying solitarily.

(ii) predator avoidance:-
May authors feel that predator detection is one of or the factor leading to communal display. Safety with more eyes and ears.
Gs Wittenberger (1978) argues that Gs are safer on communal display sites - and this preference may contribute to lek evolution.
Orin concludes that lek groups are definitely less vulnerable than if displaying solitarily in an open field.

In solitary displaying rutted groups one study found lesser life expectancy of ♂s at traditional sites and another found just the opposite.

(iii) ♀ Females benefit:-
Suggest that ♀s benefitted from ♂ clusters because this provides them with a forum for evaluation of the quality of ♂s, as indicated by longevity and physical prowess.

Enquist M 1985 Communication during aggressive interactions with particular reference to variation in choice of behaviour.

Animal. Behaviour 33; 1152-1161

(i) Defines communication as a change in the animals casual factor state due to the Behaviour or appearance of another animal that may influence the process of decision making in the future.

(ii) longer interactions will permit more accurate estimates of fighting ability.

long interaction may favour the use of repetitive behaviour that allows an indirect assesment ~~to~~ of ability to inflict cost whereas in shorter interaction a variety of displays may be more favourable.

Kemp A.C. & Maclean G.L. (1973): Neonatal Plumage patterns of three banded and temminck's courser and their bearing on courser genera. Ostrich 44:80-81

- Based on the neonatal plumage of chicks of Cursorius temminchi, Rhinoptilus cinctus and Rhinoptilus africanus sugest that due to the marked difference among all 3 both Rhinoptilu species should be placed in different genera.

Petretti F. 1986
Notes on the status of the Bustards in Italy.
5th Bustard Symposium, Szarvas (Hungary)

(1) ~~55~~ 73.5 % of otis tarda recoverd in ~~Povalley~~ Italy was dunng December & January which may be related to northern populations

(2) 58.3 % were ♀s and 41.7 % were ♂s of 72 sexed birds recoverd. Seems usual as ♀s wander more than ♂s ?. (??) (perhaps biased sex ratio)

(3) In less than 30 yrs (1950 – 1970/85) are of known distribution dropped to 16 % of former estimate

(4) Records the dissapearance of 2 lek grounds from 1982. One area from 1983 onwards other from 1984 onwards. Did not see any obvious transformation in the landscape to justify dissapearance of displaying ♂s. Suggests that that lek sites can may be displaced (circle the main) platue of 13000 hectares according to the degree of human disturbance at the beginng of the display season.

(5) Small areas of manmanaged partnes with barley evene mainly used by birds to forage at dawn and dusk, while perepheral wheat fields were visited by flushed individuals.

(6) Never observed little bustards in the breeding area during the post breeding season, from August to March. Shepherds & farmers confirm that ♂s usually appear on leks grounds in the second half of April.

(7) Display from mid April to mid July.
Nesting from mid March to end July.

(8) Main wintering area of studied population is close to breeding grounds, only 5-15 km from display sites of ♂s.

Cairns. W. E. 1982. Biology and behaviour of breeding piping plovers. Wilson Bull., 94(4) 531-545

1) At least some birds returned to their territories a second year (site fidelity).

2) Describes threats and fights (are in ch 2).

Site fidelity reported in other plovers.

(x) The tendency for adults to return to a former breeding area (& sometimes nesting site as well) has been reported for a nos. of plover species, including.

a) Piping plover :-

b) Ringed Plover (C. hiaticula). Bub, H. (1962). Plauberingungen am Sandregenpfeifer (Charadrius hraticula). J. Orn. 103: 243-249.

(x) c) Killdeer (C. vociferus). Lenington. S. and Mace T. (1975) Mate fidelity and nesting site tenacity in the killdeer. Auk 92: 149-151

d) Kentish Plover. (C. a. alexandrinus)

e) Mountain Plover (C. montanus) Graul. W. D. 1973. Adaptive aspects of the mountain plover social system Livin bird. 12: 69-94.

(x) Few first year birds return to breed in the area of hatching among charadrius plovers, as suggested by an $\underline{<}$ 5% returns rates for Ringed, Piping & Kentish Plovers. (Lenington & Mace 1975).

Knapp. A.K. 1985. Effect of fire and drought on the ecophysiology of Andropogon gerardii and Panicum virgatum in a tall grass prarie.

Ecology 66(4) pp 1309-1320.

North American tall gra

① Fire and drought an inherent feature of prairies ecosystem - and both natural and Manmade fires probably have occurd throughout the 10,000 yr history.

② Consequntly dominnt grasses are well adapted to fire and usually show increasd post fire vigour - particularly in sites protected from fire for a number of years.

③ Fire, however does not alter the composition of dominnt prarie vegetation as dramatically as in other ecosystems. though severe droughts may.

④ An important consequence of fire in tallgrass prarie is the removal of the previous years standing dead biomass and litter.

Due to removal of shading effect of old biomass and resulted in net photosynthesis is greater in emrly shoots than in same of unburned area. - leafs are also bigger in burnt than unburnt areas.

⑤ Nitrogen use efficiency (when water not limiting) was greater in burnt than unburnd area. - other study suggests greater uptake of N. (per unit ground area) a early in the growing season in burned than unburned prarie.

⑥ In contrast to many ecosystems, the dominat species are favoured by burning

1986

Ded R Deb Roy . S . 1 Fire in wet grassland habitats of Assam. Indian forester pp 914-917.

@ outlines the patch burn method at Manas

coherly burning commences as the monsoon recedes ~~Resulting~~ and continuing upto mid April.

First high ground grasses begin dryly and then low ground. Results in a mosaic of diffent heights and growth stages of grass.

Sexual selection, lek and Arena behaviour, and sexual size dimorphism in birds.

Payne R.B. 1984. Ornithological Monographs No. 33. The American Ornithologists Union. Washington D.C.

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(1) Darwin (1871) – sexual selection ← evolution of characters necessary/useful in attracting ♀s for sex.–
Natural selection ← characters simply for surviving.

(2) Sexual selection works in two ways. (1) Intra sexual selection (where ♂s compete directly for position in mating area/social unit. (2) Inter sexual – involves ♀s actual choice of one male over other irrespective of competition between males.

(3) Definition of lek
a) several ♂s display at arenas
(b) ♂s provide no significant resources to ♀s
(c) ♀ chooses among ♂s – no forced sex/courtship by one ♂
(d) ♂s take no part in parental care.

(4) In some species (notably some manakins) two males rather than one share a display arena

(5) Dispersed lek or exploded arena – males generally defend the display site or territory against other ♂s. Irrespective of how close neighbours may be.

(6) Indicates that the biological consequence of variance in mating success and degree of sexual selection is similar in exploded arenas and lekking systems.

(7) Spacing of male lawes six crowned birds of paradise in New Guinea varies, with some in leks and others on isolated, outlying display arenas

(5) (a) In some lekking birds female choose ♂'s most successfull in intermale competition.

(b) In some ♂'s display give aggressive-like displays to ♀s - similar to ones they give their competitive neighbours. ♀s may then use these displays to assess the qualities of these males as mates.

(c) aggressive displays in some species:-

(i) May grouse ♂ approach ♀s with body crouched, wings exposed and a rapid run - a similar action are directed toward other ♂'s on their display territories.

(ii) Displays of lekking Ruff & Great snipe (Gallinago media) are directed to other ♂'s. Same aggressive postures may be used towards ♀ when she arrives at the lek.

(iii) Anna's Hummingbird. (Calypte anna) begin their courtship with an aggressive display dive like that given to other ♂'s

(iv) Male Satin Bowerbirds (Ptilonorynchus violaceus) give a tuft hunch posture toward visiting ♀s much as they do to visiting rival ♂'s

(vi) Indigo birds fly towards and hover over a ♀ with the same behaviour sequence used in driving away an intruding ♂.

(9) Aggressive behaviours, are commonly ritualized into the courtship displays of both polygynists and pair forming monogamists as well as into those of lekking birds.

(10) Certain other lekking birds do not appear to have aggresive displays towards ♀s. As ♂'s in better physical condition may be more successfull in competition, males may be displaying their condition to assessing ♀s.

(11) Young ♂ Satin Bowerbirds for first few years of life have ♀ like plumage. They visit the arenas where they are attacked by older resident ♂s. Their plumages lack the bright colours and hence the signals to elicit aggressiveness by resident ♂s.

~~Aggressiveness by adults to juveniles, etc. appearance~~

This suggests that alternate mating strategies are not important and that bright colours and large size of ♂ lek birds are often an evolutionary result of social competition.

(12) Another ♂ behaviour is disturbance ~~of~~/interference of displaying resident ♂ at his site. These 'polar' may make with the ♀ after a disturbance, but more often just harass the local resident ♂.

(13) Interactions between residents and intruders are aggressive and may determine spacing of males in leks.

(14) If sexual selection is effected largely through combative competition among ♂s then ♂s should be relatively larger in lekking and polygynous species large size may be associated with success in battle.

(15) As potential gain in breeding success is higher in promiscuous species, fighting and large size would be expected to figure prominently in promiscuous & polygynous species.

(16) If sexual selection is effected largely through ♀ choice, then there is no reason to expect ♂s to be larger than ♀s. ♀s may choose smaller ♂s for agility, or brighter ♂s for beauty, rather than larger ♂s for combat.

(17) Buteos are sexually dimorphic in size, males are smaller than ♀s in all except Cooper's & Broad-winged Hawks and suggests that evolution of size dimorphism is a result of sexual selection.

As larger species are more dimorphic than smaller ones, the sexual size dimorphism is explained by size as well as mating system.

(18) Certain Hummingbirds produce whistles with their wings while displaying; individual ♂s display apart from each other and defend territories; males may be structurally modified for sound production.

(19) In some manakins ♂s have structurally modified wing feathers to produce mechanical sounds during courtship. Manacus manacus has stiff, curved, narrow primaries. Ilicura militaris has thick shafts to primaries. Machaeropterus regulus and M. pyrocephalus have enlarged secondary shafts and M. deliciosus has the secondaries modified with highly specialized porcupine quill like feathers. Only M. Manacus ♀s have wings like ♂s other ~~same as~~ normal.

(20) In certain manakins with mechanical sound in display ♂s have no obvious morphological feather modifications and why feathers resemble those of ♀s.

(21) In the tyrant flycatcher — (Miovetes olaginaeus) ♂s are 10% larger than ♀s, display from dispersed areas call out of sight of each other and have an emaginate wing

(22) In hermits, Manakins and hummingbirds the smallest species have ♀s larger than ♂s and the smallest of these are the most dimorphic.

(23) Taxa with reversed sex dimorphism tend to have males with aerial displays.

(24) Taxonomic groups with reversed sex dimorphism do not have less aggression or alternate mating strategies.

Guillon G.G. 1981. Non-Drumming males in a ruffed grouse population. Wilson Bull. 93: 372-382.

The presence of non-~~terr~~ displaying and presumed non-territorial males is known ~~in~~ among some Tetraonidae.

a) Red grouse (Lagopus lagopus) Jenkins. D., Watson A., & G.R. Miller 1967. Population fluctuations in the Red grouse Lagopus lagopus scoticus. J. anim. Ecol. 36: 97-122.

~~b)~~ + Show an excess of males which are non-territorial and usually relegated to a surplus ~~ex~~ which dies or emigrate fairly quickly.

5) White-tailed Ptarmigan. Hoffmann, R.W. & C.E. Braun 1975. Migration of a wintering population of white tailed ptarmigan in Colorado. J. wildl. Manage. 39: 485-490.

— non-territorial sub adult males in population.

c) Spruce Grouse (Canachites canadensis). Ellison, L.M. 1971. Territoriality in Alaskan Spruce grouse. Auk 88: 652-664

d) Blue grouse: Zwickel, F.C. & J.F. Bendell, 1967. Early mortality and the regulation of numbers in Blue grouse. Can. J. Zool. 45: 817-851.

e) Lekking Black grouse (Lyrurus tetrix). Robel. 1969. Movements and flock stratification within a population of Blackcocks. in Scotland. J. Anim. Ecol. 38: 755-763.

- documented the existence of a non-territorial component ~~of~~ among lekking Black grouse.

f). Sharp-tailed grouse (Pediocetes phasianellus). Rippin, A.B. & Boag D.A. 1974. Recruitment to populations of male sharp-tailed grouse. J. wildl. Manage. 38: 616-621.

P.T.O.

1) If late enough yearlings may even displace older established males, forcing the latter to move to other usually inferior sites (Guillion C.W. 1967, Selection and use of drumming sites by male Ruffed grouse. Auk. 84:57-112)

2) ~~Speculates~~ ~~It cannot be said that the late number of non-drummers at Eloquet~~. Non-drummers do not represent individuals not finding suitable drumming sites, as evidenced by the presence of non-drummers inspite of presence of unoccupied known drumming sites.

3) Speculates that in prime cover, non-drummers preferred to await their turn to occupy an activity centre rather than use ~~the~~ a poorer quality habitat.

4) Some birds never become drummers, and very ~~so~~ rarely some drummers relinquish their sites and become non-drummers.

study period 23 years.

5) non-drumming component least when population was lowest and greatest when the population reached peak abundance.

6) Site association. & site fidelity present.

Ferguson R.S. 1981 Territorial attachment and mate fidelity by horned Grebes. Wilson. Bull. 93: 560-561.

Gives evidence th. to show that Horned grebes Podiceps auritus show site fidelity.

W. John Smith — 1977 Re behaviour of communicating
An ethological Approach.

(p-378)

① Re location of a communicator performing visible displays is apparent if the displays are seen.
Re likelihood of detection of by predators can be reduced, however, by limiting the amount of time during which the displayer renders the communicator conspicuous.
May use 'badges' that are concealed or inconspicuous when not in use. as in the bright flash pattern on wing or rump as some birds take to flight.

p. 292

① ♀s are attracted to territorial ♂s who are displaying their readiness to interact. When ♀ intruder into ♂'s territory he usually directs to her the same displays and even attack behaviour with which he responds to a male opponent. Her response however differs from a ♂ and appeases territory ♂ who will perform similarly to reassure her.

Brodsky L.M. 1988. Ornament size influences mating success in male rock ptarmigan.

Anim. Behav. 36, 662-667.

① Numerous studies have demonstrated a positive relationship between body size and mating success. Since the most widespread form of active male acquisition is mediated through male-male competition it stands to reason that the largest males could be the most successful competitors.

② In widowbirds variation in tail length can influence mal mating success - longest tails had most mates.

rock ptarmigan

③ Re males with the largest, ~~color~~ undamaged combs had the most mates. ∴ combs are a target of sexual selection and influence mating success.

④ Re relationship between comb size and dominance is well established in grouse. Comb size is correlated with overall dominance, reflects an individuals testosterone level and thus his aggressive behaviour.

In willow ptarmigan ♂ winners had larger combs than losers. In red grouse male with the largest combs are the most aggressive.

(5) Combs are a target of attack during a fight.
∴ ♂ with large combs reflect aggressiveness and their condition reflects a ♂'s success as a fighter.

(6) In rock ptarmigan variation in mating success can due to variation in ornament size. It also demonstrates a novel, non-genetic trait, which similar in colour to the target can also influence a male's mating success.

(male with comb coloured leg bands had more mates than non banded ♂'s).

Brodsky C.M. 1988. Mating tactics of male rock ptarmigan Lagopus mutus: a conditional mating strategy. Anim. Behav. 36, 335-342.

(1) ♂ closely guard/remain with ♀ during her receptive period. Once ♀s begin incubating ♂s began 'gallivanting' by intruding into territories that still had receptive ♀s. Success of this strategy was not measured but appear small

(2) Gallivanting ♂s may capitalize on resident ♂ absenteeism.

(3) Gallivanting is possible because ♀ receptive ♀s are spread when some are mating - this ~~possibly~~ due to heavy nest predation. Thus a gallivanting strategy is possible only in a asynchronous mating pattern.

Partridge. C. and Harvey P. (1986). Contentions issues in sexual selection. Nature Vol. 323 No. 6089 pp 580-581. Macmillan Journals Ltd.

① Though not a fashionable view it could be that the elaborate species-specific ornaments of many birds have evolved to prevent ~~member~~ individuals from mating with members of other species.

Darwin noted that related species often differ most in male secondary sexual characters.

SHine. R. 1988. The evolution of large body size in Females: A critique ~~on~~ of Darwin's "Fecundity Advantage" Model. The American Naturalist. Vol. 131. No.1. pp 124-131

① Darwin's "Fecundity Advantage" model suggests that a preponderance of females to attain greater body size than males in most taxa is probably due to the advantage of larger ♀s being able to produce greater number of Ova and hence leave more copies of her genes in succeeding generations.

② Strong evidence is available to show the increase clutch size with body weight in many invertebrates and ectothermic vertebrates.

③ Though some endothermic vertebrates show ② it is less clearly correlated and this may reflect on the limited range of adult body size caused by determinate growth.

④ Argues that life history theory predicts that traits ~~to~~ should evolve lifetime reproductive succes and not instantaneous succes.
∴ if resources are limiting ♀ has to either invest in growth or reproduction. – and in the long run ~~should~~ reproductive succes, should not vary.

⑤ Authors argument does not show the 'Fecundity Advantage' model invalid but does show that it applies to only a limited set of species.

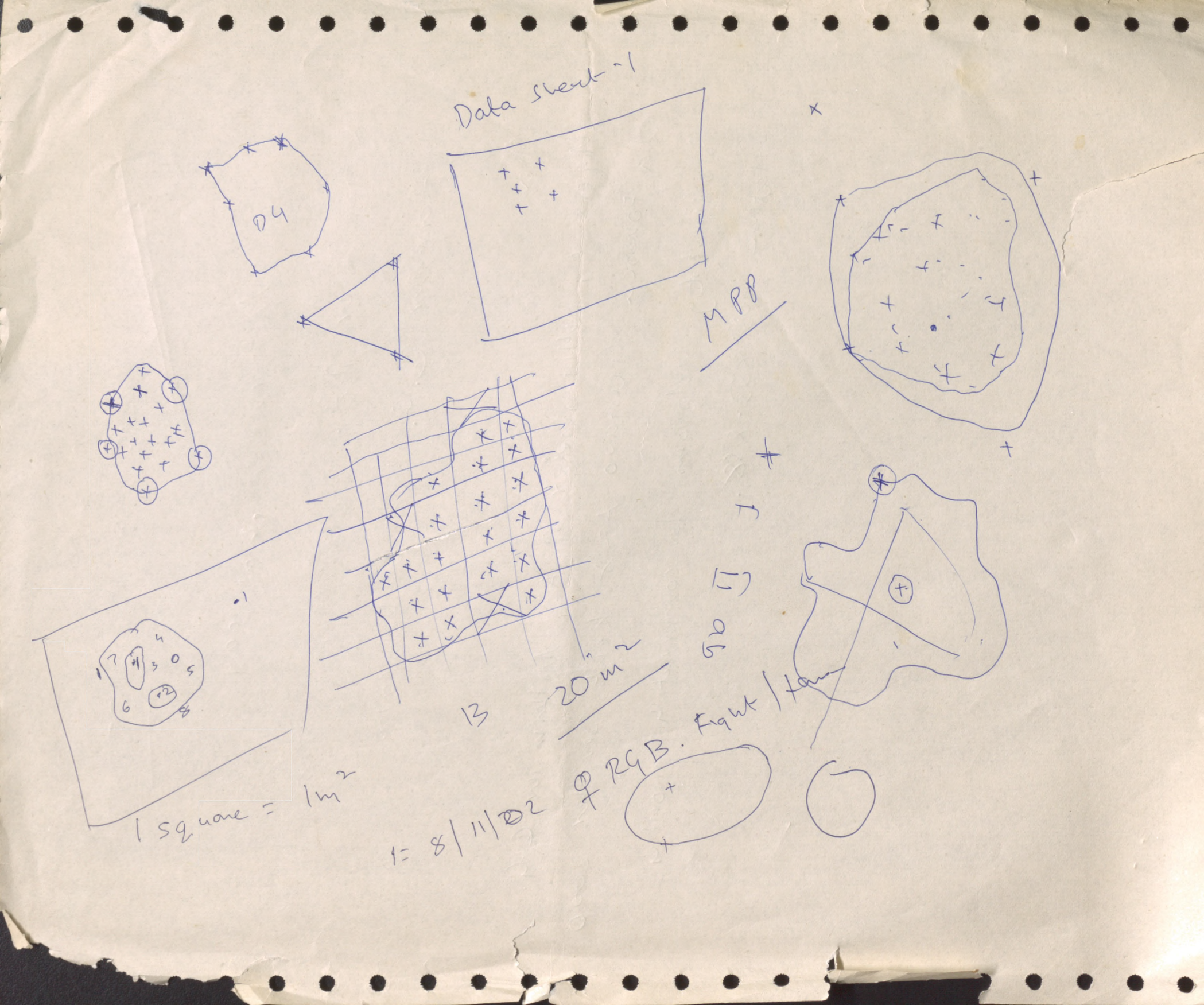
⑥ Among others.
∴ There may be circumstances wherein sexual selection favors relatively small size in males, perhaps because of enhanced mobility.

Indo-Burma 25

Mittermeier et al 1999

Mittermeier, R.A., Myers. N., Robles Gil, P.R.,
Mittermeier, G.G. 1999. Hotspots.

Myers N, Mittermeier, R.A., Mittermeier G.G.
da Fonesca Gustavo AB & Kent Jenitter 2000.
Biodiversity hotspots for conservation priorities
Nature 403: 853-858.


Data sheet-1
D4
MPB
1 square = 1m²
13
20 m²
1= 8/11/D2 of RGB. Right/Left

① Robertson, B.C. 1996. Vocal mate recognition in a monogamous flock-forming bird, the silvereye, ~~Zosterops~~ Zosterops lateralis. Anim. Behav. 51, 303-311.

- Presents evidence ~~that~~ of vocal mate recognition in a species that maintains pair bonds within foreign flocks.

② Levin, R.N. 1996. Song behaviour and reproductive strategies in a duetting wren, Thryothorus nigricapillus: I. Removal experiments. Anim Behav. 52, 1093-1106.

- Individual repertoire and duet precision do not change following a change in mates, refuting the pair bond maintenance hypothesis.
- unpaired mates do not loose their territories, failing to support that duets are necessary for territory defence.
- ♂, ♀ song serve different functions. Lone males called ~~significantly less~~ dramatically more often.
lone ♂s may ~~use~~ sing to attract ♀s.; males may duet to assess new mates.
- ♀ songs may be directed to competitive ♀s.
- Territory residency more important for ♂s than ♀s in mate acquisition.
- ~~Now~~ widely accepted ~~hypothesis~~ hypotheses ~~that~~ that duetting functions in joint territory defence and/or pair bond maintenance. (Thorpe 1972, Farabaugh 1982) Not supported by this study

- paired ♀s but not ♂s intrude into neighbouring territories
- For both ~~parent~~ sexes, territory possession is a pre requisite for mate acquisition.

Further evidence of all above in.

Levin, R.N. 1996. Song behaviour and reproductive strategies in a duetting wren, T. nigricapillus: II. Playback experiments.