RECORDS
ZOOLOGICAL SURVEY OF PAKISTAN

Volume XIII

1997

Volume XIII

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A special thanks go to Zoologist (Altaf Hussain Narejo) for his keen interest in the Online Directory of Zoological Survey of Pakistan.

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ZOOLOGICAL SURVEY OF PAKISTAN

Volume XIII

Edited and Published
By
The Director

Zoological Survey of Pakistan, Block 61, Pakistan Secretariat,
Shahrah-e-Iraq, Karachi—74200
1997

Records Zool. Sur. of Pak. Vol. XIII, 1—17. 1997.

EFFECT OF BHOOLA AND KATRA FISHING NETS IN THE INDUS DELTA, PAKISTAN

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ABSTRACT

The fishing gears, tidal trap net (Bhoola) and Katra (Surrounding net) are indiscriminately used in mangrove areas of Sindh Coast. These nets have detrimental impacts on fisheries and cause growth overfishing due to the minute size of the holes, which trap subadults and juvenile forms disturbing the maturing cycle of the fish and shrimps. The use of these harmful fishing gears in the areas of Keti Bundar and Shah Bundar which are already under serious over-exploitation, has excerbated growth over-fishing.

During the present study it has been estimated that an average of 74 Kgs of fish and 4.44 Kgs of shrimps are caught in one trip with Bhoolat net. The total estimated landing in one month by Bhoola was recorded as 473.6 *(± 50.56) metric tonnes of fish and 28.4 (± 5.6) metric tonnes of shrimps. Similarly, nearly 1.68 (± .52) metric tonnes of trash fish is caught in one trip with Katra net. The estimated total landing in one month by Katra was recorded as 5,040 (± 1572) metric tonnes. To stop these harmful practices, it is recommended that a community based management programme should be started at Keti Bundar, Shah Bundar and other remote areas of Sindh coast. This programme will highlight the importance of sustainable utilization of natural resources and may be helpful in management and conservation of natural resources.

* 95% Confidence Limit given in parenthesis.

INTRODUCTION

The fishing gears, tidal trap net (Bhoola) and Katra (surrounding net) are indiscriminately used in mangrove areas of Sindh Coast. These nets have detrimental impacts on fisheries sector. Some efforts to ban these fishing gears were initiated in early 1990's. The "Community Based Ban" imposed on tidal trap nets (Bhoolas) at Korangi Phitti System is the first attempt towards fisheries management within Indus Mangroves. However, this community based fisheries management is not effective in the areas beyond Korangi-Pitti Creek System. The ban was started in early 1990's by an informal agreement between the people of Ibrahim Hyderi, Rehri Goth and Lad Basti. The ban was proved to be a great success in the areas of Korangi/Phitti Creek System because 90% of the fishermen of Ibrahim Hyderi and Rehri Goth fish at Korangi/Phitti Creek System and people of these villages claims their property rights upto Khudi/Khai Creek System.

Katra net (Surrounding net) is another example of fishing gear which frequently operate in mangrove areas of Sindh Coast and have a reputation for being harmful to the fish stock in that they catch "small fish" which are the juveniles of commercially important species.

The aim of present study is to understand the operation of Bhoola, Katra nets and other harmful fishing gears within the mangroves and their effect on fish and shrimp juveniles. This sort of study may be helpful to understand the present situation of unmanaged fisheries in Indus Deltic region and to formulate recommendations which may be helpful for sustainable utilization in future.

GROWTH OVERFISHING

It has been observed that growth overfishing takes place in the mangrove areas of Sindh Coast (Van Zalingae et. al 1987, Hasan, 1993) and catches per unit effort (CPUE) have decreased in comparision with the previous studies. This decrease in landing is believed largely cause by the catching of juveniles of fish and shrimps (growth overfishing, Van Zalingae *et al* 1987 and Hasan, 1993). Previous studies by Zoological Survey Department have shown that over 235 fish species mainly the young of clupeids, catfishes, grey mullets, needlefishes, halfbeaks, barracuadas, threadfins, breams, ponyfish, slipmouth, carangids, croakers, whiting, groupers, snappers, gobies, flatfishes and sharks are frequently found in mangrove areas of Sindh Coast. Several shrimp species of which *Penaeus merguiensis, P. penicillatus, Metapenaeous affinis, M. stebbingi, Parapenaeopsis stylifera* and *P. sculptilis* are also found in mangrove areas of Sindh Coast (Van Zalingae *et al* 1986, Hasan 1993).

Due to increasing competition within fleet, low catches per unit effort and establishment of a big market for trash fish, there is a tendency to fish in more and more shallow waters and to use those fishing gears which require low inputs (manpower, time etc.) and costs (POL, expenditure etc.).

BHOOLA NET

About 200 Bhoola nets are in operation on Sindh Coast. Their use depend upon tides. The net is fixed for about 15—16 days a month. Bhoola is mounted when the high tide starts and remained fixed until the low tide. The fisherman changes its direction with the flow of incoming and outgoing waters. This fishing net has usually 3—4 types of mesh of different size and costs nearly 10,000 to 20,000 depending upon the size and the quality of the net.

Bhoola net has a bag like structure with a long tail. The length of Bhoola net usually ranges from 20 feet — 30 feet. The net forming the tail portion has a very small size mesh of a diameter of 0.5 cm. The middle portion of the Bhoola has two different mesh sized nets, having diameters of 0.8 and 2.0 cms. The mouth of the Bhoola net is made of a net having bigger mesh size, usually of 2.5 cms. The mouth of the Bhoola remains open in rounded form during operation with the help of two wooden poles, tied with ropes. The wooden poles remained fixed at the floor of the creek, separating the up and down sides of the mouth (Fig. 1). The other two sides remained open by the help of two ropes, one fixed by the bank of the creek and other by the anchor. Some portion of the creek is usually kept free for the transportation of other boats. This is done as a mutual understanding that everybody living on the coast has a free right to exploit the resource (common property rights). Bhoola nets require two persons for its operation. It has been observed that people of the Sindh Coast especially the people living at Keti Bundar and Shah Bundar prefer to install Bhoola net in a very near creek and in this way they minimize the inputs and costs incurred for this purpose. The Bhoola, Tidal nets are installed at spring tides for nearly 15—16 days a month. The Bhoola fishermen start fishing from the 9th of moon upto 16th at the time of full moon (spring tide). The second period start from the 25th of moon until the 2nd of new moon.

The movements of the tides disturb the food substances which flourish in the shallow waters around coasts and therefore fishes generally become more active on a flooding or ebbing tide. Tidal coasts, especially in warm seas, often contain a rich and varied population of organisms which follow the water movements in and out. The Bhoola nets which are mainly used during high tide have the ability to catch a large number of fishes of all sizes and stages.

Bhoola nets are frequently used in the areas of Keti Bundar and Shah Bundar. Some evidences of their use were also recorded from Dobbo Creek and Patiani Creek. Hajmaro,

Turshan and Rafuta creeks of Keti Bundar; Jhangh and Qalandri creeks of Shah Bundar were found more effected by the use of Bhoola nets (Fig. 2).

KATRA NET

The Katra nets are famous for being the cause of growth overfishing due to the minute size of the holes, which trap subadults and juvenile forms destroying the maturing cycle of the fish. These nets are widely used on Sindh coast (Personal observation at Keti Bundar and Phitti Creek System, 1994-95). Fishermen who are aware of the growing threat of these nets to fisheries resource base are against these fishing nets. However, those fishermen and large boat owners who benefit directly from the harvest of Katra nets feel these are "good" nets.

Small Katra nets are also frequently used in mangrove areas of Sindh Coast. Upon location of the fish school, Katra boats start fishing for them using encircling net. In the small creeks like Bakran they were found using a small Katra having a mesh size of 0.5 cms. The Katra net was introduced in the country some 20 years ago and has expanded rapidly during the last 10 years. It is constructed like a purse seine with the bunt in the centre and two latral wings. But instead of using "purse line" to enable the net to be closed like a purse, the Katra is pursed by hauling in, at the same time lead lines of the two wings, but also the Bunt's lead line goes on retrieving and the net thus is closed (Khan, 1986).

Katra nets are frequently used in the areas of Keti Bundar, Shah Bundar and Khudi/Khai of Sindh coast. Small boats operating with Katra were also observed from Phitti Creek system (Fig. 2).

METHODOLOGY

The available landings of Bhoola were quantitatively and qualitatively examined throughout the period of the study to estimate approximate total landing of fish and shrimps and the composition of the catch. The total number of Bhoola nets are estimated on personal observations and informations obtained by different fishermen working at different localities of Sindh coast. The number of trips by Bhoola nets were estimated by multiplying the number of nets with the working days (16) and then by (two high tides in a day).

The average landing for Bhoola/trip net was estimated by counting baskets of 10 Kgs, 30 Kgs and 60 Kgs of fish and shrimps off loaded in one trip and taking the average of such trips randomly sampled throughout the study period and the estimated total landings per month were estimated by multiplying the estimated average landing per trip by the total number of trips in a month.

In the case of Katra, the minimum total number of Katra boasts which operate daily were estimated about 100. The average landing by Katra/trip was estimated by counting the baskets of 60 Kgs (one hunner) in one trip and taking the average of such trips randomly sampled throughout the study period. The estimated total landings per month were estimated by multiplying the estimated average landing per trip by the total number of trips. Mathematical and statistical calculations are after Van Zalingae et al 1987, Hasan 1993, Johnson and Bhattacharyya 1987.

RESULTS AND DISCUSSIONS

It has been estimated that an average of 74 Kgs of fish and 4.44 Kgs of shrimps are caught in one trip with Bhoola net. The total estimated landing per month by Bhoola was recorded as 473.6 (± 50.56) metric tonnes of fish and 28.42 (± 5.6) metric tonnes of shrimps. The detail of the catch is given in Table 1A. The composition of the Bhoola catch was also recorded. The details of the composition alongwith measurements are provided in Table 2.

It has been estimated that an average of 1.68 metric tonnes of trash fish is caught in one trip with Katra net. The estimated total landing per month by Katra was recorded as 5040 metric tonnes (Table 18). The fish composition of the catch is provided in Table 3.

The fish and shrimp harvests by Bhoola and Katra and the composition of the catch clearly indicates that a servere growth overfishing takes place in mangroves of Sindh coast. The harvests of this level indicate that fish and shrimp stocks are being overexploited in a continuous manner without any restrictions.

If these types of practices left unchecked, overfishing to this extent may lead to a stock collapse, and ultimately catches per unit effort (CPUE) will further decline. The growth overfishing may also produce negative effects on the level of reproduction.

RECOMMENDATIONS

To stop Bhoola, Katra and other harmful fishing gears, it is recommended that a community based management programme should be initiated at Keti Bundar, Shah Bundar and other remote areas of Sindh coast. This programme may focus the following areas :

1. Possibility of alternative employment for the fishermen should be explored to minimise the pressue on fisheries natural resources. Alternative prefessions may be :

   (i) shrimp aquaculture
   (ii) Poultry
   (iii) Rice cultivation
   (iv) Handicrafts etc.

2. To break the monopoly system, a scheme providing loans to the fishermen for purchasing nets and other allied equipments on soft terms and conditions should be introduced in Keti Bundar, Shah Bundar and other remote areas of Sindh coast.

3. Mesh size regulation should be imposed. This can only be done in consultation with communities; educating them, and highlighting the importance of fish stocks for future.

4. There should be a complete ban on catching fish and shrimps at low tide in the small creeks of the mangrove area.

ACKNOWLEDGEMENTS

The authors would like to thank Mrs. Aban Marker Kabraji, IUCN Country Representative and Mr. Tahir Qureshi, Director, IUCN's Coastal Ecosystem Unit for their help and guidance during the period of research. The authors are also grateful to the people of Keti Bundar and Rehri Goth for their cooperation and hospitality.

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Table 1 (A) : ESTIMATION OF LANDINGS BY BHOOLA PER MONTH

a)	Estimated No. of trips for Bhoola :	6400
	Landing by Bhoola fishery (Fish Portion)	
b)	Estimated average landing/trip (Kgs)	74
	95% Confidence Limit	± 7.9
c)	Estimated landings per month (tons)	473.6
	95% Confidence Limit	± 50.56

ESTIMATION OF SHRIMP LANDING BY BHOOLA PER MONTH

d)	Estimated average landing/trip (Kgs)	4.44
	95% Confidence Limit	± .87
e)	Estimated landing per month (tons) :	28.42
	95% Confidence Limit	± 5.57

(B) : ESTIMATION OF LANDINGS BY KATRA PER MONTH

a)	Estimated No. of trips for Katra	3,000
b)	Estimated average landing/trip (Kgs)	1,680
	95% Confidence Limit	± 524
c)	Estimated landing per month (tonnes) :	5040
	95% Confidence Limit	± 1572

Table 2 : SPECIES COMPOSITION OF RANDOMLY SELECTED SAMPLES OF FISHES CAUGHT WITH BHOOLA NET

1	2	3	4	5	6
1. *Escualosa thoracata* (Valenciennes, 1847) White Sardine	Mithoo	10 cm	3 cm	5 cm	52
2. *Sardinella longiceps* (Valenciennes, 1847) Indian Oil Sardine	Luar	23 cm	12 cm	16 cm	10
3. *Sardinella sindensis* (Day, 1878) Sind Sardinella	Luar	17 cm	10 cm	14 cm	5
4. *Hilsa kelee* (Cuvier, 1829) Kelee Shad	Palli	25 cm	10 cm	15 cm	10
5. *Tenualosa ilisha* (Ham. Buch, 1822) Hilsa shad	Pulla	60 cm	12 cm	20 cm	4
6. *Anodontostoma chacunda* (Ham. Buch., 1822) Shortnose gizzard shad	Daddi-Palli	17 cm	12 cm	14 cm	2
7. *Nemotalosa nusus* (Bloch, 1795) Long-ray bony bream	Daddi-Palli	22 cm	10 cm	15 cm	5
8. *Hyporhamphus limbatus* (Valenciennes, 1846) Congaturi halfbeak	Thute	22 cm	15 cm		1

1	2	3	4	5	6
9. *Scomberoides commersonnianus* Lacepede, 1802 Talang Queen Fish	Aal	120 cm	16 cm	20 cm	6
10. *Scatophagus argus* (Bloch, 1788) Spotted butterfish	Kargi	30 cm	15 cm		1
11. *Lutjanus argentimaculatus* (Fersskal, 1775) Mangrove Red-snapper	Hira	120 cm	12 cm		1
12. *Lutjanus johnii* (Bloch, 1792) John's snapper	Hira	70 cm	15 cm	20 cm	4
13. *Sillago sihama* (Forsskal, 1775) Whiting Lady Fish	Bhambor	25 cm	10 cm	15 cm	10
14. *Gerres filmmentosus* Cuvier, 1829 Long-rayed silverbiddy	Jerki	25 cm	10 cm	15 cm	4
15. *Secutor insidiator* (Bloch, 1787) Slender barred Pony fish	Kamteri	10.5 cm	4 cm	6 cm	20
16. *Pomadasys maculatum* (Bloch, 1797) Spotted grunter	Dhotter	50 cm	15 cm	20 cm	2
17. *Pomadasys argenteus* (Forsskal, 1775) Lined silver grunter	Dhother	50 cm	10 cm		1

1	2	3	4	5	6
18. *Terapon theraps* (Cuvier, 1829) Large-scaled banded grunt	Ginghra	30 cm	11 cm		1
19. *Terapon puta* (Cuvier, 1829) Small scaled banded grunt	Ginghra	15 cm	8 cm		1
20. *Terapon jarbua* (Forsskal, 1775) Crescentperch	Ginghra	30 cm	8 cm	12 cm	2
21. *Eleutheronema tetradactylum* (Shaw, 1804) Four Finger threadfin	Seeri	200 cm	20 cm		1
22. *Polynemus heptadactylum* Cuvier, 1829 Seven Finger threadfin	Seeri	30 cm	15 cm		1
23. *Pampus chinensis* (Euphrasen, 1788) Chinese Silver pomfret	Suffaid poplet	60 cm	12 cm	16 cm	2
24. *Pampus argenteus* (Euphrasen, 1788) Silver pomfred	Suffaid poplet	60 cm	15 cm		1
25. *Johnius belangerii* (Cuvier, 1830) Belanger's croakers	Mushka	30 cm	12 cm	20 cm	10
26. *Mugil cephalus* Linnaeus, 1758 Grey mullet	Boi	35 cm	10 cm	20 cm	20

1	2	3	4	5	6
27. *Liza abu* (Heekel, 1846) Abu mullet	Boi-Mori	20 cm	10 cm	12 cm	12
28. *Liza vaigiensis* (Quoy & Gaimard, 1824) Squaretail mullet	Bhangan	35 cm	10 cm	15 cm	6
29. *Liza carinata* (Valenciennes, 1836) Keeled Mullet	Boi-Mori		12 cm		1
30. *Liza macrolepis* (Smith, 1849) Large scale mullet	Boi-chhodi	25 cm	18 cm	20 cm	9
31. *Liza subviridis* (Valenciennes, 1836) Green-black mullet	Boi-chhodi	25 cm	8 cm	15 cm	20
32. *Liza parsia* (Ham. and Buch. 1822) Gold-spot mullet	Boi	16 cm	8 cm		1
33. *Valamugil cunnesius* (Valenciennes, 1836) Round-head grey mullet	Boi	25 cm	15 cm	18 cm	2
34. *Valamugil speigleri* (Bleeker, 1858) Speiglers mullet	Boi	20 cm	12 cm		1

Table 3 : SPECIES COMPOSITION OF RANDOMLY SELECTED SAMPLES OF FISHES CAUGHT WITH KATRA NET. (KETI BUNDAR)

Scientific Name/English Name	Local Name	Size Maximum	Size of specimens observed		No. of specimens observed
			Min.	Max	
1	2	3	4	5	6
1. *Escualosa thoracata* (Cuvier, 1829) White sardine	Mithoo	10 cm	5 cm	10 cm	45
2. *Sardinella longiceps* Valenciennes, 1847 Indian Oil sardine	Luar	23 cm	12 cm	16 cm	21
3. *Sardinella sindensis* Day, 1878 Sindh Sardine	Luar	17 cm	10 cm	13 cm	18
4. *Leiognathus insidiator* Webs and de Beaufort, 1931 Pugnose Ponyfish	Kaentesi	10.5 cm	6 cm	10 cm	2
5. *Tenualosa ilisha* (Ham. Buch, 1822) River Shad	Palla	60 cm	20 cm		1
6. *Tenualosa toli* (Valenciennes, 1847) Toli Shad	Nur Palla	40 cm	25 cm		1
7. *Anodontostoma chacunda* (Ham. Buch., 1822) Shortnose Gizzard Shad	Daddi Palla	17 cm	10 cm	12 cm	2

1	2	3	4	5	6
8. *Nematalosa nasus* Bloch, 1795 Long-ray Bony bream	Daddi Palli	22 cm	10 cm	12 cm	4
9. *Hemiramphus far* (Forsskal, 1775) Black barred halfbeak	Thute	44 cm	20 cm		1
10. *Scomberoides commersonnianus*, Lecepede Talang queen fish	Aal	120 cm	25 cm		1
11. *Gerres poieti* Cuvier, 1829 Strongspine silverbiddy	Jerki	20 cm	14 cm	17 cm	3
12. *Gerres filammentosus* Cuvier, 1829 Long-rayed silverbiddy	Jerki	10.5 cm	5 cm	7 cm	2
13. *Leiognathus insidiator*, Webes and de Beaufort, 1931 Pugnose Ponyfish	Kaantesi	10.5 cm	6 cm	10 cm	2
14. *Pomadasys maculatum* (Bloch, 1797) Spotted Grunter	Dother	50 cm	10 cm		1
15. *Parastromateus niger* (Bloch, 1795) Black Pomfret	Kala Poplet	55 cm	29 cm		1

1	2	3	4	5		6
16.	*Terapon jarbua* (Forsskil, 1775) Jarbua terapon	Ginghra	30 cm	21 cm		1
17.	*Rastrelliger kanagurta* (Cuvier, 1817) Indian Mackerel	Surmai	35 cm	19 cm		1
18.	*Sillago sihama* (Forsskil, 1775) Silver sillago	Bhambor	25 cm	14 cm		1
19.	*Stolephorus commersonii* (Lacepede, 1803) Commerson's Anchovy	Phyasa	8 cm	6 cm		1
20.	*Pampus chinensis* (Euphrasen, 1788) Chinese Silver Pomfret	Sufaid Poplet				
21.	*Pampus argenteus* (Euphrasen, 1788) Silver Pomfret	Sufaid Poplet	60 cm	12 cm		1
22.	*Liza abu* (Heckel, 1846) Abu Mullet	Boi/Mori	20 cm	10 cm	12 cm	4

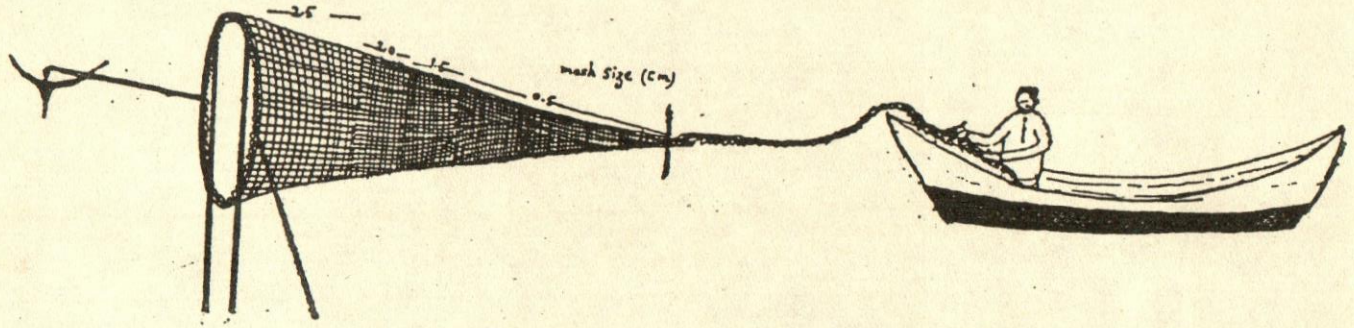
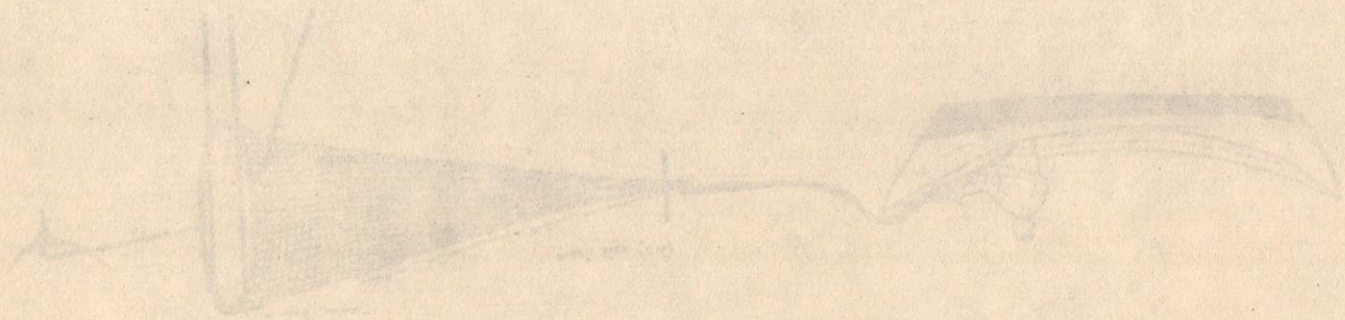


FIG. 1 BHOOLA NET



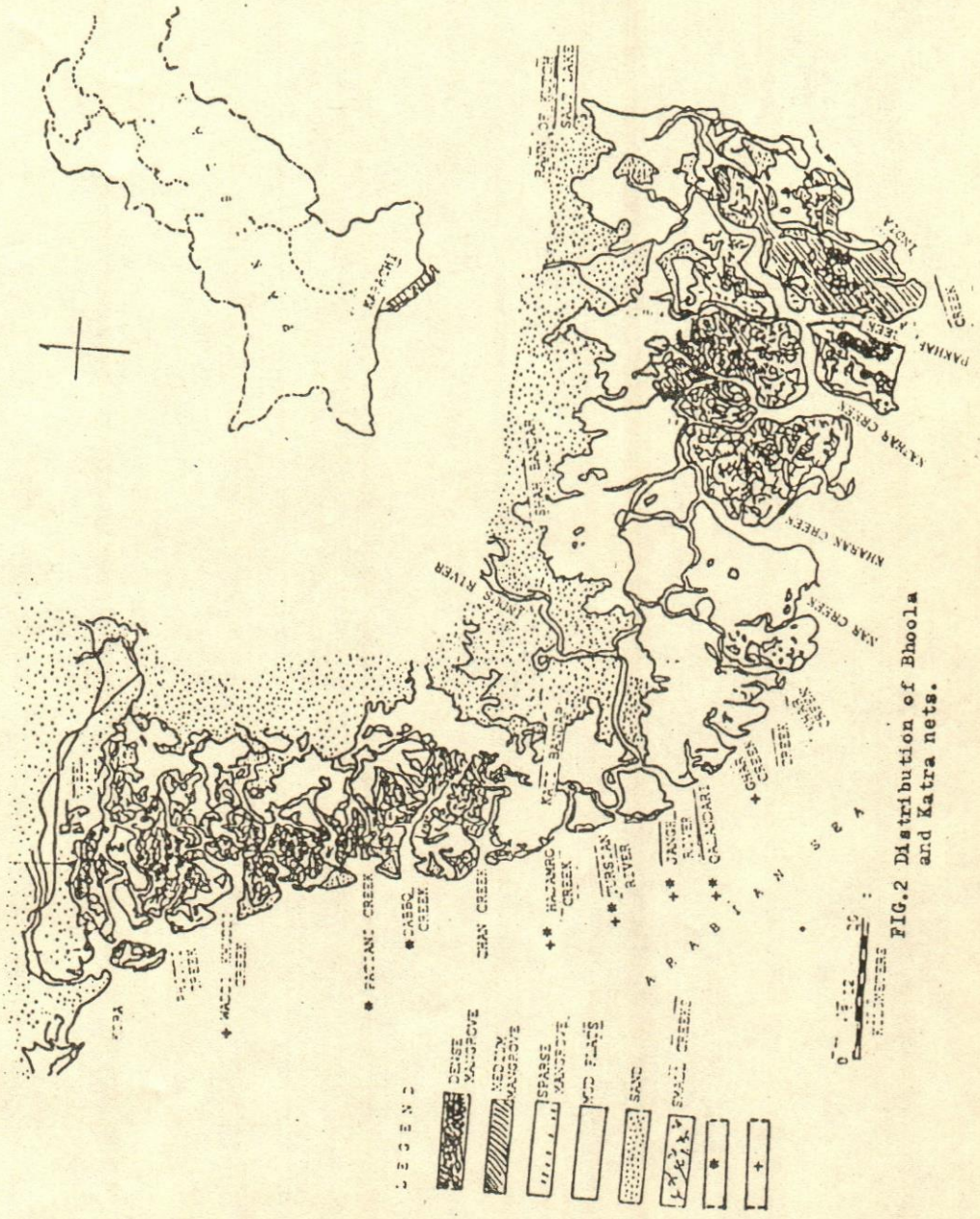


FIG.2 Distribution of Bhoola and Katra nets.

Records Zool. Sur. of Pak. Vol. XIII, 19—21. 1997.

WEIGHT ESTIMATION OF WILD GOATS (*CAPRA AEGAGRUS*)

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Linear body measurements are commonly used to estimate body weight of wild and domestic ungulates (Ross 1958; Rideout and Worthen 1975; Gray and Simpson 1979; Bunnell 1930), and are more easily obtained than live or hogdressed weights. In this paper we estimate live weights of wild goats (*Capra aegagrus*) from body length, chest circumference, and horn length.

We captured 26 female and 8 male wild goats at a perennial spring using a remotely-fired net gun (Edge *et al.* 1989) and leg-hold snares as part of a general ecology study conducted in Kirthar National Park, Pakistan. The following measurements were recorded for each animal (lengths were measured in mm) : weight (kg), body length (tip of nose, along back to base of tail), chest circumference (just behind front legs), total horn length (base to tip along anterior surface of longest horn), and annual increments of horn growth.

Equations for predicting weight of wild goats from other morphological characteristics were developed using linear regression (Table 1). Sample sizes vary between regressions because not all measurements were taken from all individuals, especially for young of the year. All independent variables (chest circumference [CH], body length [BL], total horn length [TH], and horn length minus first annulus [HL]) were correlated with the dependent variable live body weight (WT) for both sexes. However, the independent variables that explained the most variation in weight differed by sex. The best predictors of WT were horn measurements for males and body measurements for females. Bunnell (1980) noted that the social organization of horned ungulates appears to account for sexual differences in relationships between body weight and horn growth. Horn growth and body weight would be expected to be more strongly correlated in male rather than female wild goats because the species is dimorphic. Males invest more energy into body and horn growth while females invest more in reproduction. These predictions were supported by our analysis. The best predictor of WT was CH for females and TH for males; the variability in these independent variables explained 94.4% and 95.8% of the variation in live body weight respectively. However, our sample of males included only one large male, nearly twice as large as the next largest, that probably artificially increased the correlation between the two variables. Gray and Simpson (1979) suggested that correlations were stronger in both sexes for TH than for HL. This appears to be the case because the largest proportion of horn growth occurs during the

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first two years of life (Schaller 1977:100). In addition, brooming of the horn tips in adult wild goats is not a significant factor affecating total horn length.

The predictive value of the regression equations ($S_{Y.X}$) were greatest for females wild goats. The 95% confidence limits for weights of female wild goats range from ± 0.95 kg for mean CH to ± 2.20 kg for mean HL. These confidence limits are similar to those reported by Bunnell (1980) for Dall's sheep (Ovis dalli dalli) and mountain goats (*Oreamnos americanus*), and indicate the value of these equations for estimating body weight. The predictive value of regression equations were less for males; 95% confidence limits ranged from ± 5.01 kg for mean TH to ± 11.38 kg for mean BL. These confidence limits indicate that our regression equations for male wild goats will be in accurate, and thus, additional data will be needed to build regression models that have research and management value. The estimation of weight is of interest to wildlife ecologists, managers and hunters. This data should be collected from a larger sample of adult male wild goats, an age class that was poorly represented in our data.

Acknowledgements

This work was funded by the U.S. Fish and Wildlife Service Special Foreign Currency Program. The Sind Wildlife Management Board provided housing and transportation, and the Zoological Survey Department of Pakistan provided field assistance. The Montana Cooperative Wildlife Research Unit and the School of Forestry, University of Montana, provided equipment. We thank N. Ghani and S. Uddin for assistance in trapping wild goats.

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TABLE I : Regression relationships between live body weight and linear body measurements of wild goats from Kirthar National Park, Pakistan , 1986.
WT = Live body weight (kg). TH = Total horn length (mm) ;
CH = Chest circumference (mm) ; HL = Horn length minus first annulus (mm); BL = Body length (mm).

Regression equation	r^2	N	$S_{Y.x}$	P of Zero slope
Males				
WT = — 61.059 + 0.137CH	0.786	8	12.917	0.0033
WT = — 57.400 + 0.083BL	0.779	8	13.141	0.0037
WT = — 2.319 + 0.081HT	0.958	7	5.168	0.0001
WT = 7.896 + 0.097HL	0.950	7	6.184	0.0002
Females				
WT = — 25.928 + 0.076CH	0.944	26	2.344	0.0000
WT = — 28.874 + 0.050BL	0.860	26	3.707	0.0000
WT = 6.279 + 0.091TH	0.777	25	4.313	0.0000
WT = 20.134 + 0.069HL	0.378	22	4.947	0,0023

Records Zool. Sur. of Pak. Vol. XIII, 23—29. 1997.

OBSERVATIONS ON THE WATER BIRDS OF CLIFTON BEACH, KARACHI

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INTRODUCTION

The coastal wetlands of Pakistan have received relatively little attention though these are important in respect of the diversity of Birds. The huge flocks of migratory waders, egrets, herons, gulls and terns, cormorants, flamingoes are amongst the most spectacular phenomena to be witnessed on the coast. Roberts *et al.* (1986), Khanam and Ahmed (1988), Roberts (1991) and Ghalib and Hasnain (1994) have worked out the resident and migratory birds of the Karachi coast as a whole but they have not worked in detail on any particular coastal wetland of Karachi. However, the mid wintr counts have been made in January each year since 1986 by the Zoological Survey Department and Sindh Wildlife Department on some sites of Karachi coast and the results of these counts have been published by the IWRB, England and A.W.B., Malaysia (now known as Wetlands International). However, this study does not provide details of occurrence of birds and their status in any particular locality. Therefore, the present work was undertaken to study the distribution of the waterfowl on the Clifton Beach. This wetland has been identified for inclusion in the list of Wetlands of international importance under Ramsar Convention 1971 to which Pakistan is a signatory. The area has been of outstanding importance as many migratory bird species particularly the shorebirds use the area as staging and wintering ground. It used to support more than 20,000 birds in winter in the past. Though the number of birds on this wetland has been decreasing in the recent years due to increasing disturbances and habitat degradation yet significant populations of birds are still obseved there.

The Clifton beach is located on the south of Karachi city. It is a long sandy beach of about 8 km. in length with adjacent tidal mudflats backed by sand dunes. A portion of the beach is one of the prime recreational sites of Karachi. The habitat at the Clifton Beach is shrinking due to the development work in the area as the vast intertidal zone which was once available to serve as a potential feeding and resting ground for birds is now being developed for the residential and recreational purposes.

MATERIAL & METHOD

The Clifton Beach was visited once every month from January 1986 to December 1995 and the water bird fauna observed there was recorded. The species were observed and identified by using spottingscope and binocular. The identification of the birds in the field was carried out with the help of Heinzel et al (1972) and Snobe et al (1993).

RESULTS & DISCUSSIONS

75 species of waterbirds belonging to 6 orders and 14 families were recorded in the present study (Table I).

The migratory waterbirds leave the Clifton beach by the end of May and start arriving again in August-Septemebr. The peak season being December and January.

This area is important on account of having some species which have not been observed on other parts of the coast. These area little grebe, blacknecked grebe, gadwall, velvet scoter, painted snipe, eastern knot, common or fantail snipe, wood sandpiper, swift tern and whitewinged black tern.

Gizri creek area is very important as some waterbirds have been reported to be breeding in its mangroves. These include little cormorant, pond heron, reef heron, great white egret, little egret, night heron and sduander's little tern.

A sewage nullah carrying effluents from the nearby residential areas runs parallel to Gizri creek and falls into Arabian Sea. This nullah inhibits many species which are usually not observed on the coastal areas such as Snipes.

Down the back road to Gizri and on the sand dunes along towards mouth of Gizri creek, several Saunder's terns nest in May as well as Kentish Plover nests (Roberts, Pers. Comm.).

However, no evidance of their breeding was recorded during the present study. This may be due to urban development in the area, as well as due to increasing disturbance and changes in the environment of the area.

TABLE-I : LIST OF WATERBIRDS RECORDED FROM CLIFTON BEACH

Order	Family	Species	Common Name
PODICIPEDIFORMES	PODICIPEDIDAE	*Podiceps cristatus cristatus*	Great Crested Grebe.
		Podiceps nigricollis nigricollis	Black-necked Grebe.
		Tachybaptes ruficollis	Little Grebe.
PELECANIFORMES	PHALACROCORACIDAE	*Phalacrocorax carbo*	Common Cormorant.
		Phalacrocorax niger	Little Cormorant.
CICONIIFORMES	ARDEIDAE	*Ardeola grayii grayii*	Indian Pond Heron
		Egretta gularis sinensis	Reef Heron.
		Egretta garzetta garzetta	Little Egret
		Egretta intermedia intermedia	Intermediate Egret.
		Egretta alba modestus	Large Egret.
		Ardea cinerea	Grey Heron
		Ardea purpurea manilensis	Purple Heron
		Butorides striatus	Little Green Heron
		Nycticorax nycticorax	Night Heron.
	THRESKIORNITHIDAE	*Platalea leucorodia major*	White Spoonbill
	PHOENICOPTERIDAE	*Phoenicopterus ruber roseus*	Greater Flamingo

Order	Family	Species	Common Name
ANSERIFORMES	ANATIDAE	*Anas strepera*	Gadwall
		Melanitta fusca	Velvet Scotter
		Aythya ferina	European Pochard
		Mergus serrator	Red breasted Merganser.
GRUIFORMES	RALLIDAE	*Fulica atra*	Common Coot
CHARADRIIFORMES	HAEMATOPODIDAE	*Haematopus ostralegus ostralegus*	Oystercatcher
	BURHINIDAE	*Esacus recurvirostris*	Great Stone Plover
	ROSTRATULIDAE	*Rostratula bengalensis*	Painted Snipe.
	RECURVIROSTRIDAE	*Recurvirostra avosetta*	Avocet
		Himantopus himantopus himantopus	Black winged stilt.
	CHARADRIIDAE	*Vanellus indicus indicus*	Red-wattled Lapwing
		Vanellus gregrius	Sociable Plover.
		Vanellus vanellus	Lapwing
		Vanellus leucurus	White-Tailed Plover.
		Pluvialis squatarola	Grey Plover
		Pluvialis dominica fulva	Eastern American Golden Plover
		Charadrius hiaticula tundrae	Eastern Ringed Plover
		Charadrius dubius curonicus	Little Ringed Plover

Order	Family	Species	Common Name
		Charadrius alexandrinus alexandrinus	Kentish Plover
		Charadrius mongolus atrifrons	Mongolian Plover
		Charadrius leschenaultii	Greater Sand Plover.
	SCOLOPACIDAE	*Numenius phaeopus phaeopus*	Whimbrel
		Numenius arquata orientalis	Eastern Curlew
		Limosa lapponica lapponica	Bar tailed Godwit
		Limosa limosa	Black-tailed Godwit.
		Tringa glareola	Wood Sandpiper.
		Tringa totanus eurhinus	Redshank
		Tringa stagnatilis	Marsh Sandpiper
		Tringa nebularis	Greenshank
		Xenus cinereus	Terek Sandpiper
		Actitis hypoleucos	Common Sandpiper
		Arenaria arenaria interpres	Turnstone
		Calidris alba	Sanderling
		Calidris minuta	Little Stint
		Calidris temminckii	Temminck's Stint
		Calidris canvtus	Eastern Knot
		Gallinago gallinago	Common or Fantail snipe.
		Limicola falcinellus	Broadbilled sandpiper.
		Calidris ferruginea	Curlew Sandpiper
		Calidris alpina	Dunlin

Order	Family	Species	Common Name
	LARIDAE	*Larus hemprichii*	Sooty Gull
		Larus argentatus heuglini	Yellow legged Herring Gull
		Larus fuscus fuscus	Lesser Black backed Gull
		Larus ichthyaetus	Great Black headed Gull
		Larus ridibundus	Black headed Gull
		Larus brunnicephalus	Brown-headed Gull
		Larus genei	Slender-billed Gull
		Gelochelidon nilotica nilotica	Gullbilled Tern
		Hydroprogne caspia caspia	Caspian Tern
		Thalasseus bengalensis bengalensis	Lesser Crested Tern
		Thalasseus bergii	Swift or Large Crested Tern.
		Thalasseus sandvicensis sandvicensis.	Sandwich Tern
		Sterna hirundo hirundo	European Common Tern
		Sterna repressa	White cheeked Tern
		Sterna albifrons albifrons	Little Tern
		Sterna saundersi	Black Shafted Tern
		Sterna anaethetus fuligula	Bridled Tern
		Chlidonias hybrida	Whiskered Tern
		Chlidonias leucoptera	White-winged Black Tern.

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Records Zool. Sur. of Pak. Vol. XIII, 31—43. 1997.

SNAKES OF SARGODHA, PUNJAB, PAKISTAN

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ABSTRACT

Twenty two species of snakes belonging to sixteen genera *viz., Amphiesma, Argyrogena, Boiga, Bungarus, Coluber, Echis, Eryx, Lycodom, Lytorhynchus, Naja, Oligodon, Ptyas, Ramphotyphlops, Spalerosophis, Vipera* and *Xenochrophis* have been reported from District Sargodha.

INTRODUCTION

Snakes play in important role an agriculture as they predate on rodents and insects and their larvae (Deoras, 1964; Whitaker, 1978). It is, however, strange that these creaturs have been hated and considered harmful in Pakistan. It is a matter of common observation that people in villages generally do not tolerate the very sight of snakes and they tend to kill them on first sight. The researchers also have not cared to undertake any significant work on them. Accordingly, information about the systematic and biological aspects of these creatures is very much lacking.

Sargodha District which constitutes the area of our present study is a semi-arid subtropical lowland having high summer temperature and late summer monsoon rains (Ahmad, 1951). Except for some dry mountains about 10 miles towards the south-eastern side of Sargodha city, it mostly comprises a vast irrigated plain which is situated eastward to river Jhelum. Agricultural crops like wheat, gram, sugarcane, cotton, millet, maize, vegetables and fodder are generally grown while vast tracts of citrus plantations are also common here. "Sheashum" (*Dalbergia sissoo*) and "Kikar" (*Acacia arabica*) are the main irrigated plants which are found growing alongside canals and roads. Prior to the introduction of canal irrigation, this plain was mainly a desert scrubland, traditionally known as Kirana bar and only xerophytic plants like "Karir" (*Capparis decidua*) and "Wan" (*Salvadora oleoides*) grew here.

Unfortunately, nothing is known about the snake fauna of the old Kirana bar which existed before the introduction of canal irrigation in the year 1901. Consequently, we are just unable to know the changes that may have taken place in the number and kinds of snakes in the study area.

REVIEW OF LITERATURE

The general snake fauna of the Indo-Pakistan sub-continent has been studied by Boulenger (1893, 1894, 1896) and Smith (1943). In Pakistan, the snakes have been generally studied by Minton (1966) and Mertens (1969). Some further studies on regional basis have been made by Khan (1977) who studied the snakes of Jhang, Akram (1981, 1987) who studied the snakes of Faisalabad and the Central Punjab and Khan and Baig (1988) who listed the snakes of Jhelum District.

MATERIALS AND METHODS

As many as 127 snake specimens were collected during the course of this study (1987 to 1992) from towns and villages of Sargodha District. The snakes were mostly obtained in dead condition with the co-operation of villagers, farmers and college students. Each specimen was tagged with a code number which could be referred to that in the field note-book in which information pertaining date, locality (place of collection) and habitat was recorded. The numbers provided within parenthesis in the collection data of each species stand for the localities which have been as such indicated and keyed out in Fig. 1.

RESULTS AND DISCUSSION

Based on the total collection of snake specimens, twenty two species belonging to sixteen genera were indentified as constituting the snake fauna of Sargodha District. These species alongwith their collection data and habitats are mentioned below :

I. Family Boidae

i) Genus *Eryx* Daudin

1. *Eryx johni* Russell

Numerical data :— Snout vent length 420 — 630 mm (533.33 ± 105.98 mm) in males and 450 — 590 mm (526.66 ± 70.94 mm) in females. Tail length (50-70 mm) (58.33 ± 10.40 mm) in males and 50 — 68 mm (57.5 ± 8.22 mm) in females.

Collection data :— 1 male (5), 3.9.1989; 1 female (7), 7.4.1989; 1 female (9), 12.8.1989; 1 + (10), 7.6.1988; 10(12), 9.7.1988; 1 male (16), 7.8.1989; 1 male (17), 10.8.1989, 1 male (20) 6.7.1989.

Habitat : —Croplands (fodder, Maize and wheat fields).

Distribution :—Karachi (Sindh) (Boulenger, 1893); Balochistan), NWFP), Punjab), Sindh) (Smith, 1943); Las Bela (Balochistan, Hyderabad, Karachi, Nawab Shah, Sanghar, Tharparkar, Thattha (Sindh) (Minton, 1966); Sheikhupura (Punjab), Thattha (Sindh) (Mertens, 1969); Jhang, Mianwali (Punjab) (Khan, 1977, 1986); Jehlum (Punjab) (Khan and Baig, 1988).

II. Family colubridae

ii) Genus *Amphiesma* Dumeril, Bibron and Dumeril

2. *Amphiesma stolata* (Linnaeus)

Numerical data :—Snout vent length 28—41 mm (36.33 ± 10.40 mm) in males and 45—48 mm (46.5 ± 2.12 mm) in females. Tail length 6.5—9.5 mm (8.16 ± 1.52 mm) in males and 9-10 mm (9.5 ± 0.70 mm) in females.

Collection data :— 1 male (3), 7.6.1988, 1 male (4), 2.5.1989; 1 female (16) 15.4.1990; 1 female (17), 2.3.1990; 1 male (20), 14.7.1991.

Habitat :— Ponds with scanty aquatic vegetation, and water courses.

Distribution :— Sindh) (Boulenger, 1893); Balochistan), NWFP) (Smith, 1943); Peshawar (NWFP), Thattha (Sindh) (Minton, 1966); Sheikhupura (Punjab), Thattha (Sindh) (Mertens, 1969); Jhang (Punjab) (Khan, 1977); Jhelum (Punjab) (Khan and Baig, 1988).

iii) Genus *Argyrogena* Werner

3. *Argyrogena fasciolata* (Shaw)

Numerical data :— Snout vent length 650 mm in female. Tail length 240 mm in female.

Collection data :— 1 female (4), 7.8.1987.

Habitat :— Cultivated area with small bushes.

Distribution :— Hyderabad, Larkana, Thattha (Sindh) (Minton, 1966); Hyderabad, Thattha (Sindh) (Mertens, 1969).

iv) Genus *Boiga* Fitzinger

4. *Boga trigonata* (Schneider)

Numerical data: — Snout vent length 480 - 560 mm (520.0 ± 40.0 mm) in males and 340 - 610 mm (535,0 ± 106.06 mm) im females. Tail length 80 - 110 mm (95.0 ± 15.0 mm) in males and 120 - 125 mm (122.5 ± 3.53 mm) in females.

Collection data :— 1 male (4), 2.5.1988; 1 female (5), 5.8.1989, 1 male (7), 11.6.1989; 1 male (12), 6.5.1989; 1 female (17), 3.8.1989.

Habitat :— Croplands (barley, maize and vegetable fields).

Distribution :— Balochistan) (Boulenger, 1890); Balochistan), NWFP) (Smith 1943); Attock, Muzaffar Garh, Rawalpindi (Punjab), Hyderabad, Karachi, Thattha (Sindh) (Minton 1966); Karachi, Thattha (Sindh) (Mertens 1969); Jhang, Mianwali (Punjab) (Khan 1977, 1986); Jhelum (Punjab) (Khan and Baig 1988).

v) Genus *coluber* Linnaeus

5. *Coluber rhodorachis* (Jan)

Numerical data :— Snout vent length 475 - 540 mm (515.0 ± 35 mm) in males and 555 - 620 mm (587.0 ± 45.96 mm) in females. Tail length 165 - 210 mm (185.0 ± 22.9 mm) in males and 175 - 180 mm (177.5 ± 3.53 mm) in females.

Collection data :— 2 male (19), 21.7.1989; 1 male (20), 12.6.1989; 1 female (21), 15.6.1989; 1 female (22), 25.6.1990.

Habitat :— Cultivated area with fodder, maize and vegetables and citrus gardens.

Distribution :— Chaghi (Balochistan), Gilgit (Boulenger, 1890); Balochistan), Chitral (NWFP), Gilgit (Smith, 1943); Las Bela, Sibbi, Ziarat (Balochistan), Peshawar (NWF)), Dadu Sharif, Karachi, Thattha (Sindh) (Minton, 1966); Chaghi, Gwadar, Kharan, Quetta, (Balochistan), Abbottabad, Haripur, Mansehra (NWFP), Karachi (Sidh) (Mertens, 1969); Jhang, Mianwali (Khan, 1977, 1986); Jhelum (Punjab) (Khan and Baig 1988).

6. *Coluber ventromaculatus* (Gray)

Numerical data :— Snout vent length 480 mm in male and 475 - 680 mm (568.33 ± 103.72 mm) in females. Tail length 181 mm in male and 179 - 245 mm (213.0 ± 33.04 mm) in females.

Collection data :— 1 female (4), 12.4.1989; 1 female (5), 7.9.1990; 1 female (16), 15.5.1989; 1 male (17), 20.6.1989.

Habitat :— Wheat and sugracane fields.

Distribution :—Gwadar (Balochistan), Murree (Punjab), Karachi (Sindh) (Boulenger, 1890); Chitral (NWFP) (Smith, 1943); Las Bela (Balochistan), Karachi, Larkana, Sanghar, Thattha (Sindh) (Minton, 1966); Bahawalpur, Lahore (Punjab), Karachi, Larkana, Thattha (Sindh) Mertens, 1969); Jhang, Mianwali (Punjab) (Khan, 1977, 1986); Jhelum (Punjab) (Khan and Baig, 1988).

vi) Genus *Lycodon* Boie

7. *Lycodon aulicus aulicus* (Linn)

Numerical data :—Snout vent length 325 mm in male and 450 mm in female. Tail length 80 mm in male and 85 mm in female.

Collection data :— 1 male (4), 4.4.1989; 1 female (17), 9.6.1989.

Habitat :— Grassy area

Distribution :—Lahore (Punjab) (Mertens, 1969); Jhang (Punjab) (Khan, 1977).

8. *Lycodon striatus striatus (Shaw)*

Numerical data :— snount vent length 315 - 410 mm (362.5 ± 67.17 mm) in females. Tail length 60 - 85 mm (72.5 ± 17.67 mm) in females.

Collection data :— 1 female (3), 3.9.1989; 1 female (20), 5.7.1989.

Habitat :— Grassy area with clay soil.

Distribution :— Punjab) (Theobald, 1876); Dadu Sharif, Karachi (Sindh) (Murray, 1884); Sindh) (Boulenger, 1893); Balochistan, NWFP), Lahore (Punjab), Sindh) (Smith, 1943); Quetta, Las Bela (Balochistan), Hyderabad, Jacobbabd, Karachi, Nawabshah, Thattha (Sindh) (Minton), 1966); Karachi, Thattha (Sindh) (Mertens, 1969); Jhang (Punjab) (Khan, 1977).

vii) *Genus Lytorhynchus* Peters

9. *Lytorhynchus ridgewayi* Boulenger

Numerical data :— Snout vent length 210 mm in male. Tail length 48 mm in male.

Collection data :— 1 male (12), 11.7.1989.

Habitat :— Barren area with scanty vgetation.

Distribution :— Quetta, Sibbi (Balochistan) Smith, 1943, Minton, 1966); Sibi (Balochistan), (Mertens, 1969); Jhang (Punjab) (Khan, 1977).

viii) Genus *Oligodon* Bio

10. *Oligodon arnensis* (Shaw)

Numerical data :—Snout vent length 342 - 365 mm (353.5 ± 16.26 mm) in males and 415 mm in female. Tail length 65 - 78 mm (71.5 ± 9.19 mm) in males and 70 mm in female.

Collection data :—1 male (2), 11.7.1988; 1 male (4), 4.4.1989; 1 female (21), 5.7.1991.

Habitat :— Desolate areas and old broken houses.

Distribution :—Balochistan), Bannu (NWFP, Sindh) (Smith, 1943); Larkana, Thattha (Sindh) (Minton, 1966); Karachi, Thattha (Sindh) (Mertens, 1969); Jhang (Punjab) (Khan, 1977); Jhelum (Punjab) (Khan and Baig, 1988).

11. *Oligodon taeniolatus* (Jerdon)

Numerical data :—Snout vent length 400 mm in male and 377 mm in female. Tail length 60 mm in male and 58 mm in female.

Collection data :— 1 male (4), 2.4.1989; 1 female (10), 5.6.1991.

Habitat :—Human residential areas.

Distribution :—Balochistan), Sindh) (Smith, 1943); Las Bela (Balochistan), Rawalpindi (Punjab), Dadu Sharif, Karachi, Thattha (Sindh) (Minton, 1966); Balochistan), Mansehra (NWFP), Karachi, Thattha (Sindh) (Mertens, 1969); Jhang (Punjab) (Khan, 1977).

ix) Genus *Ptyas* Fitzinger

12. Ptyas mucosus (Linnaeus)

Numerical data :—Snout vent length 610 - 1340 mm (965.0 ± 380.0 mm) in males and 700 - 1320 mm (1101.25 ± 289.14 mm) in females. Tail length 155 - 440 mm (314.25 ± 145.35 mm) in males and 235 - 465 mm (389.5 ± 105.78 mm) in females.

Collection data :—1 male (1), 4.4.1989; 1 female (3), 2.4.1989; 2 female (4), 3.4.1989; 1 female (9) 6.6.1989; 1 male (13); 20.5.1990; 1 male (18) 2.3.1991; 1 male (20), 15.6.1992.

Habitat :— Croplands comprising wheat and vegetables, citrus gardens.

Distribution :—Balochistan), Chitral (NWFP) (Smith, 1943); Quetta (Balochistan), Dadu Sharif, Hyderabad, Thattha (Sindh) (Minton, 1966); Quetta, Loralai (Balochistan), Abbottabad, Mansehra (NWFP), Thattha (Sindh) (Merten, 1969); Jhang, Mianwali (Punjab) (Khan, 1977, 1986); Jhelum (Punjab) (Khan and Baig, 1988).

x) Genus *Spalerosophis* Jan

13. *Spalerosophis atriceps* (Fisher)

Numerical Data :— Snout vent length 965 - 1240 mm (1102.5 ± 194.45 mm) in males and 795 - 1500 mm (1188.0 ± 333.0 mm) in females. Tail length 260 - 305 mm (282.5 ± 31.81 mm) in males and 213 - 370 mm (302.6 ± 76.78 mm) in females.

Collection data :— 1 male (4), 11.5.1988; 1 female (8), 11.5.1988; 1 female (11), 15.7.1990; 1 female (19), 20.3.1989; 1 female (20) 20.9.1989; 1 female (21), 10.8.1989; 1 male (22), 2.5.1992.

Habitat :—Croplands (wheat, sugarcane, cotton and rice fields).

Distribution :—Gilgit (Smith, 1943); Las Bela, Quetta, Sibbi (Balochistan), Karachi, Nawabshah, Thattha (Sindh) (Minton, 1966).

14. *Spalerosphis diadema diadema* (Schlegel)

Numerical data :—Snout vent length 630 - 800 mm (715.0 ± 85.0 mm) in males and 875 -1040 mm (957.5 ± 116.67 mm) in females. Tail length 172 - 223 mm (193.33 ± 26.50 mm) in males and 250 - 280 mm (268.33 ± 16.07 mm) in females.

Collection data :— 1 male (5), 11.6.1988; 1 female (9); 20.10.1989; 1 female (12) 16.4.1988; 1 male (13), 20.5.1990; 1 male (21), 17.6.1991; 1 female (22), 11.5.1992.

Habitat :— Croplands (wheat, maize and fodder fields) and human dwellings.

Distribution :—Chaghi, Gwadar, Quetta, Turbat (Balochistan), (Punjab), Dadu Sharif, Karachi (Sindh) (Boulenger, 1890); (Balochistan) (Smith, 1943); Las Bela, Quetta (Balochistan), Swat (NWFP), Rawalpindi (Punjab) (Minton, 1966); Las Bela, Panjgur (Balochistan), Abbottabad (NWFP), Dadu Sharif, Hyderabad, Larkana, Thatta (Sindh) (Mertens, 1969); Jhang, Mianwali (Punjab) (Khan, 1977, 1986); Jehlum (Punjab) (Khan and Baig, 1988).

xi) Genus *Xenochrophis* Gunther

15. *Xenochrophis cerasogaster* (Cantor)

Numerical data :—Snout vent length 580 - 615 mm (597.5 ± 24.74 mm) in males. Tail length 112 - 121 mm (116.5 ± 6.36 mm) in males.

Collection data :—1 male (4), 17.4.1989; 1 male (12), 17.5.1989.

Habitat :—Ponds with aquatic vegetation and water channel.

Distribution :—Dadu Sharif, Hyderabad, Sanghar, Thattha (Sindh) (Minton, 1966); Thattha (Sindh) (Mertens, 1969).

16. *Xenochrophis piscator* (Schneider)

Numerical data :—Snout vent length 430 - 810 mm (557.75 ± 130.5 mm) in males and 515 - 1020 mm (688.0 ± 155.74 mm) in females. Tail length 205 - 350 mm (249.85 ± 49.84 mm) in males and 205 - 350 mm (272.5 ± 61.54 mm) in females.

Collection data :—8 male 6 female + (3), 17.5.1987, 19.6.1987, 9.6.1988, 15.7.1988, 20.5.1989, 11.3.1990, 13.5.1990.

Habitat :—Damp grasslands and canal sides.

Distribution :—Sindh) (Boulenger, 1893); (Balochistan, NWFP) (Smith, 1943); Jhang (Punjab), Hyderabad, Jacobabad, Thattha (Sindh) (Minton, 1966); Jacobabad, Thattha (Sindh) (Mertens, 1969); Jhang (Punjab) (Khan, 1977); Jhelum (Punjab) Khan and Baig, 1988).

17. *Xenochrophis sanctijohannis* (Boulenger)

Numerical data :—Snout vent length 335 - 755 mm (516.71 ± 27.0 mm) in males and 495 - 865 mm (609.36 ± 23.63 mm) in females. Tail length 185 - 325 mm (238.07 ± 9.06 mm) in males and 180 - 300 mm (218.9 ± 11.49 mm) in females.

Collection data :—13 male, 9 female (3), 26.4.1987, 3.6.1988, 12.5.1989, 21.6.1990; 2 female (4) 11.3.1989; 1 male (9), 7.4.1991.

Habitat :— Lower Jhelum canal and water channels.

Distribution :—Kashmir (Boulenger, 1893); Bahawalnagar, Bahawalpur (Punjab) (Khan, 1984).

III. Family Elapidae

xii) Genus *Bungarus* Daudin

18. *Bungarus caeruleus* (Schneider)

Numerical data :—Snout vent length 665 - 880 mm (751.0 ± 88.20 mm) in males and 650 - 700 mm (675.0 ± 35.35 mm) in females. Tail length 102 - 128 mm 117.4 ± 10.23 mm) in males and 112 - 120 mm (116.0 ± 5.65 mm) in females.

Collection data :—1 male (4), 4.5.1988; 1 female (5), 12.6.1989, 1 female (7), 14.5.1989; 1 male (10), 15.8.1990; 1 male (17), 19.7.1991; 1 male (22) 10.6.1990.

Habitat :—Cultivated areas near human dwellings.

Distribution :—Sindh) (Boulenger, 1897, Smith, 1943); Hyderabad, Jacobabad, Karachi, Thatta (Sindh) (Minton, 1966); Las Bela (Balochistan), Sialkot (Punjab), Tharparkar, Thattha (Sindh) (Mertens, 1969); Jhang (Punjab) (Khan, 1977); Jhelum (Punjab) (Khan and Baig, 1988).

xiii) Genus *Naja* Laurenti

19. *Naja naja naja* (Linnaeus)

Numerical data :—Snout vent length 890 - 1105 mm (965.0 ± 98.8 mm) in males and 800 - 1050 mm (930.0 ± 125.29 mm) in females. Tail length 200 - 215 mm (207.5 ± 6.45 mm) in males and 220 - 240 mm (231.66 ± 10.40 mm) in females.

Collection data :—2 male (2), 20.6.1988, 22.6.1988; 1 female (3), 12.4.1989; 1 female (5), 21.5.1989; 1 male (11), 1.7.1990; 1 male, 1 female (19) 22.6.1991, 25.6.1991.

Habitat :—Cultivated areas (wheat and sugarcane fields), citrus gardens and old houses.

Distribution :—Lasbela, Sibi (Balochistan), Peshawar (NWFP), Faisalabad, Rawalpindi (Punjab), Karachi, Khairpur, Sanghar, Thattha (Sindh) (Minton, 1966); Loralai (Balochistan), Karachi, Thattha (Sindh) (Mertens, 1969); Jhang (Punjab) (Khan, 1977).

IV. Family Typhlopidae

xiv) Genus *Ramphotyphlops* Fitzinger

20. *Ramphotyphlops braminus* (Daudin)

Numerical data :—Snout vent length 85 - 115 mm (98.62 ± 1023 mm) and tail length 2.1 - 2.9 mm (2.47 ± 0.28 mm).

Collection data :—2 sex unidentified (4), 11.7.1989, 5.11.1989; 1 sex unidentified (10), 1.6.1990; 1 sex unidentified (12), 7.5.1991; 2 sex unidentified (17), 14.2.1989; 1 sex unidentified (19), 15.3.1990; 1 sex identified (22) 22.5.1992.

Habitat :—Residential areas (bathrooms and grassy lawns).

Distribution :—Karachi (Sindh) (Boulenger, 1893); Peshawar (NWFP), Lahore (Punjab), Karachi Thattha (Sindh) (Minton, 1966); Karachi (Sindh) (Mertens, 1969); Jhang (Punjab) (Khan, 1977); Jhelum (Punjab) (Khan and Baig 1988).

V. Family Viperidae

xv) Genus *Echis* Merrem
21. *Echis carinatus* (Schneider)

Numerical data :—Snout vent length 375 - 460 mm (417.5 ± 60.10 mm) in males and 380 - 420 mm (403.33 ± 20.81 mm) in females. Tail length 40 - 57 mm (48.5 ± 12.02 mm) in males and 40 - 49 mm (46.2 ± 7.12 mm) in females.

Collection data :—1 male (5), 25.9.1989, 1 female (13), 17.5.1989; 1 female (19), 17.7.1991; 1 female (20), 16.8.1990; 1 male (21), 15.6.1989.

Habitat :— Barren land with a few bushes (saline soil).

Distribution :—Karachi (Sindh) (Boulenger, 1897); Chaghi (Balochistan), Kashmir (Smith, 1943); Chaghi, Kalat, Lasbela (Balochistan), Jhang (Punjab), Dadu Sharif, Hyderabad, Karachi, Nawabshah, Sanghar, Thattha, Tharparker (Sindh) (Minton, 1966); Chaghi (Balochistan), Sheikhupura (Punjab), Hyderabad, Karachi, Larkana, Tharparkar, Thattha (Sindh) (Mertens, 1969); Jhang (Punjab) (Khan, 1977); Jhelum (Punjab) (Khan and Baig, 1988).

xiv) Genus *vipera* Laurenti

22. *Vipera russelli* (Shaw)

Numerical data :—Snout vent length 690 mm in male and 700 mm in female. Tial length 133 mm in male and 130 mm in female.

Collection data :—1 male (6), 4.6.1989; 1 female (9), 11.6.1990.

Habitat :—Saline scrubland.

Distribution :—Balochistan, Kashmir, Sindh, (Smith, 1943); Jaccobabad, Thattha (Sindh) (Minton, 1966); Thattha (Sindh) (Merten, 1969); Jhang (Punjab) (Khan, 1977).

DISCUSSION

A look into the past literature revealed that of the twenty-two species that have been recorded from Sargodha District, ten species *viz., Eryx joni, Boiga trigonata, Coluber rhodorachis, Coluber ventromaculatus, Lycodon striatus striatus, Oligodon arnensis, Oligodon taeniolatus, Ptyas mucosus, Spalerosophis diadema diadema* and *Naja naja naja* had Pakistan wide distribution as they had been reported from Balochistan, NWFP, Punjab and Sindh provinces of the country (Murray, 1884; Theobald, 1876; Boulenger, 1890; Smith, 1943; Minton, 1966; Merten, 1969; Khan, 1977, 1986; Khan and Khalid, 1988). Three species *viz., Argyrogena fasciolata Spalerosophis atriceps* and *Xenochrophis cerasogaster* were previously known only from Sindh and/or Balochistan (Minton, 1966 and Mertens, 1969). So, they were being reported for the first time from Punjab province on the basis of their present record from Sargodha District. It was interesting to note that the species *Lycodon aulicus aulicus* and *Xenochrophis sancti johannis* had been so far reported only from Punjab province though the latter had also been recorded from Kashmir (Boulenger, 1893). This indicated that *Xenochrophis sancti johannis* had more extensive range in northern areas of the country than *Lycodon aulicus aulicus.*

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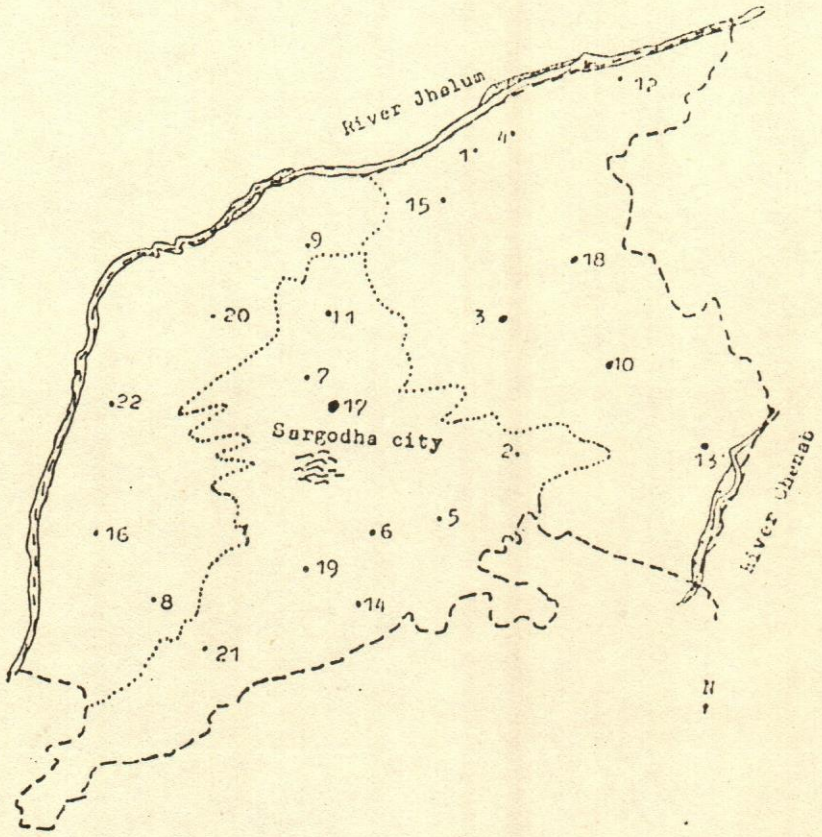
FIG 1: MAP OF SARGODHA DISTRICT
(showing localities of collection and their situation and distance from Sargodha city).



Key to localities with distance and direction from Sargodha city

1.	Alipur	80 km	N	12.	Miani	100 km	N
2.	Bhagatwala	35 km	E	13.	Mid Ranja	50 km	E
3.	Bhelwal	50 km	NE	14.	Nishtirabad	40 km	S
4.	Bhera	85 km	N	15.	Ramdas	80 km	N
5.	Chak No. 36 S.B.	27 km	SE	16.	Sahiwal	50 km	W
6.	Diryanawala	25 km	S	17.	Sargodha city	0 km	
7.	Dhrema	13 km	N	18.	Salam	55 km	NE
8.	Ferooka	50 km	SW	19.	Shaheenabad	35 km	S
9.	Kalara	50 km	N	20.	Shahpur	25 km	NW
10.	Kot Momin	55 km	E	21.	Silianwali	50 km	S
11.	Luck	30 km	N	22.	Wadhi	40 km	W

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SOME PROBLEMS WITH WETLANDS AND THEIR ASSOCIATED FAUNA IN PUNJAB

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ABSTRACT

Wetlands of Punjab Province are very important due to their verstile habitat and associated fauna. Due to overexploitation and habitat degradation, some important wildlife species has been exterminated from areas of these wetlands. Some others have been eliminated from most of their distribution ranges. Population of waterfowl has decreased in the past few years. Fish resource is also facing some negatively affecting factors. The paper deals with current ecological problems which these wetlands and associated fauna is facing in the province.

INTRODUCTION

Wetlands of Punjab province are important for having a large variety of fishes, amphibians, reptiles, birds and mammals. They used to support more than 2,50,000 waterfowl in winter in the past. A number of important waterfowl species *i.e.* Lesser Whistling Teal (*Dendrocygna javanica*), Ruddy Crake (*Pavo cristatus*), Painted Snipe (*Rastratula bengalensis*), etc. breed at these wetlands. Eight threatened species are found in the areas of these wetlands which include Indus Dolphin *(Platanista minor)*, Smooth-coated Otter *(Lutra perspicillata)*, White-headed Duck *(Oxyura leucocephala)*, Marbled Teal *(Marmoronetta angustirostris)*, Ferrugineus Duck *(Aythya nyroca)*, Pallas's fishing Eagle (*Haliaeetus leucoryphus*), Long-tailed Prinia *(Prinia burnesi)* and Spotted Pond Turtle *(Geoclemys hamiltoni)*.

The wetlands are facing a numbr of ecological problems. In the past some important species have been exterminated *i.e.* Crocodile *(Crocodilus palustris)*, Gavial *(Gavialus gengeticus)*, while some others have been exterminated from most of their previous distribution ranges *i.e.* Indus Dolphin (*Platanista minor*). Threatened species are yet under high pressure of hunting and habitat degradation and are struggling for survival. In the past few years population of wintering anatides has also been considerably declined. An important resident species, Cotton Teal *(Nettapus coromandelianus)* has not been seen in the past three years.

A number of workers have studied the fauna and ecology of these wetlands. Scot (1986) compiled A Directory of Asian Wetlands including wetlands of Punjab. Van et al compiled the Asian Waterfowl Census, 1987-93 including these wetlands. Azam (1994) reffered the problems of wetlands of the Salt Range.

IMPORTANT WETLANDS OF PUNJAB

There are a number of small and large water bodies in the province including barrages or headworks, lakes and marshy areas, which are important for wetland's dependent species. Most important and major wetlands include Chasma Barrage, Taunsa Barrage, Rasool Barrage, Uchali Lake, Khabbaki Lake, Jhalar Lake, Kalar Kahar Lake, Kharal Lake, Nammal Lake, Ghamaggar Lake and Lal Sunanra Reservoir. Riverine stretches, specially of Indus River, are also important for fishes and species like Indus Dolphin and Geese etc.

Following are some ecological problems which wetlands and their associated fauna are facing in Punjab :—

1. **Pollution :**

Industrial waste and untreated sewage is largely disposed in the irrigation system which cause high level of pollution. Chemicals used as fertilizers and pesticides including herbicides and insecticides also enter the rivers and lakes by rain. Industrial waste and pesticides may be lethal for fishes and other aquatic fauna while sewage disposal and fertilizers may cause eutrophication.

It has been reported that the pollution of Ravi River into which Lahore discharges its untreated waste has met 5,000 fever of fish per year (Chaudhry, 1994). Industries near Peshawar and Newshera are polluting the River Kabul which ultimately enter in the Indus.

Pesticides are being largely used in the surroundings of Indus, Chenab, Ravi and Sutlag Rivers. Insecticides are also being sprayed on rice and vegetables in catchment area of Kharal lake. All these pollutents may be lethal for inverteberates, fishes and their predators *i.e.* birds, dolphin etc. Even when pollution is not to the extent of fatal level, it may affect the breeding and growth of affected fishes and birds.

2. **Siltation and Sedimentation :**

Pond area of barrage and headworks *i.e.* Taunsa barrage, Chasma barrage, Rasool barrage, Head Qadirabad etc. are facing siltation and aquatic habitat on these wetlands is shrinking. Kharal lake has been silted up during past few years and its depth has much decreased. This was due to entrance of water of River Ravi during flood in 1992 and once by water of Lower Ravi Doab canal when its bund was accidently broken. Wetlands having dense vegetation *i.e.* Lal Suhnara lake, Kalar Kahar lake etc. have sedimentation due to decomposition of vegetative matter. Shrinkage of aquataic habitat on these wetlands is resulting in decline of associated fauna.

3. Eutrophication :

When a wetland is heavily loaded with neutrients, its ecology may be disbalanced and degraded as habitat of fishes and other aquatic fauna. This may be natural process but can be accelerated by human activity *i.e.* as a result of input of sewage disposal, fertilizers and livestock dung *etc.* Due to rapid inflow of neutrients, algae, phytoplanktons and macrophytes grow rapidly. When a wetland has dense submerged vegetation, there is high fluctuation in dissolved oxygen level, being very low at late night effecting fish growth. Even it may be lethal for fishes. Dense vegetation also degrades the wetland as habitat of wintering anatides. When eutrophication is at advanced stage, algal bloom can disconnect the light supply to the deeper region of water. This cause anaerobic conditions and bacterial contamination. Plants of deeper parts decay and produce toxic chemicals. This whole process disables the wetland for invertebrates, fishes and their predators. Lal Sunhara lake, Kalar Kahar lake and partially pond areas of barrages and headworks are facing this problem to some extent.

4. Deforestation :

Deforestation of riverine forest mainly for utilization of more land for agriculture purpose has deprived a number of important species from their natural habitat.

Hog Deer was once plentiful throughout the riverine tract of Sindh and Punjab which rapidly declined due to shrinkage of natural habitat and hunting pressure (Roberts, 1977).

Removal of riverine forest has effected wildlife population specially in the areas of tributries of Indus *i.e.* Jhelum, Chenab, Ravi and Sutlaj Rivers. Species like Hog Deer and Otters have almost completely been vanished from vicinities of these rivers. Riverine forest have been removed even from most of the areas of wildlife sancturies.

Wetlands having marginal and floating vegetation are important breeding grounds of resident waterfowl. When reeds and weeds are harvested after start or before the breeding season of waterfowl, it affects badly the population of breeding species.

5. Exotic and other species :

Intential or accidental introduction of exotic species in our riverine system and wetlands caused a number of ecological problems. *Bagarius bagarius* was rare species in our riverine system. Its population increased with the passage of time. Now it has became threat to major commercial fishes as their predators. All the important commercial fishes has been affected but population of *Rita rita* has been specially affected due to having similar habits and habitat.

Tilapia mosambica was introduced in Khabbaki lake and Kharal lake. This has badly degraded both the wetlands for waterfowl due to problem of food competation.

6. **Flood :**

Exessive flood in summer impact negatively on population of some species and groups of wetland's dependent species. Water overflows from riverine channels during flood and disperse in the surrounding area having big population of fishes in it. After flood have passed away, water in these areas dry up which become fatal for fishes in it. Drownsing and capturing of Hog Deer has been reported during flood of 1992 along riverine channel of Indus in Muzaffargarh and D. G. Khan districts. Nests and eggs of ground nesting waterfowl *i.e* Redwattled Lapwing *(Venellus indicus),* Blackwinged Stilt (*Himantopus himantopus*) etc. have also been found destroyed during flood.

7. **Water Deficiency :**

Some of the major wetlands are facing deficiency of water. Uchali lake, when full of water supported more than one lack waters fowl in winter in 1986. Its water level decreased after this and most of its area dried up due to which waterfowl population decreased. Water level of Nammal lake decreases in winter due to use of water for agriculture. Supply of rain water to Jhalar lake has been disconnected by a newly constructed road. Most of the pond areas of barrages and headworks become dry in winter. This deficiency of water badly affect diversity and population of fishes, waterfowl and other wetland's dependent species.

8. **Hunting and Pouchaing :**

Population of a number of species has declined due to hunting for game and fur trade. Hunting is even not unusual in the protected areas. Permit holders are not able to identify the protected species and the species like White-headed Duck, Marbled Teal, Lesser Whistling Teal and White-eyed Pochard etc. are victims of these hunters.

9. **Distrubances :**

Fishing and recreational boats, hunting, agriculture activities and livestock grazing cause exessive disturbances to waterfowl and other wildlife species.

10. **Overfishing :**

Fish contractors try to get maximum yield and they even violate the fishing rules *i.e. mesh size etc. This not only degrades the wetland for sustainable yeild of fish* resource but also impact negatively on the population of fish predators *i.e.* Otters, Egrets etc.

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BIOLOGY OF HOUBARA IN BALOCHISTAN (PAKISTAN) : SOME MORPHOMETRIC STUDIES

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ABSTRACT

Morphometric studies on a limited number of adults (males 9, females 7) and first winter subadults (males 5, females 6) suggest a healthy state of the birds of the population of Houbara (*Chlamydotis undulata macqueenii*) wintering in Baluchistan (Pakistan) between 1984 and 1987. Variation in the first winter birds are wider than that in adults. Weight of the birds collected from the field were lower than those reared captively from the eggs collected from the area. The difference has been ascribed to stable food supplied and limited activity level of the captive flock.

Introduction

Morphometric analysis is important in texonomic and ecomorphological studies. Such records on a species or a race help in knowing the general health of the population, can be used in judging the success of a captive rearing programme and as reference for future population studies.

A synopsis of the mensural data on some body parameters of the Asian race of the houbara (*Chlamydotis undulata macqueenii*) has appeared in Cramp and Simmons (1980), Ali and Ripley (1983) and Roberts (1991), based upon the available skins (Museum of Bombay Natural History Society and Royal Museum of Natural History) and the information recorded in previous literature (Baker 1912, 1922-31; Witherby *et al.* 1938-41). Some mention of these has also appeared in more recent scattered references. Alekseev (1980) recorded measurements on two adult males and two adult females, captured from the former USSR. Taylor (1985) has recorded measurements on a first wintering sub-adult captured from Sindh (Pakistan). Osborne (1989) has recently exploited the skins, available with the British Museum of Natural History, to suggest that the Arabian population has shorter wings, and wider and longer skull as compared with the Indian population. A synopsis of the available data on mensural records of this race appears in Table I.

The present study provides some data on different mensural parameters of hitherto uncatered population of the houbara (*C. u. macqueenii*) wintering in Baluchistan (Pakistan).

MATERIAL AND METHODS

A sample of 27 houbara *(C. u. macqueenii)*, captured by local hunters from Chagai and Kharan (Baluchistan, Pakistan) between 1984 and 1987 during winters, could be subjected to the present analysis. Each specimen was sexed (neck plumage and size) and aged (buff coloured tips of secondaries in the first winter sub-adults compared with brown-black in adults). The weight (using spring balance with a minimum count of 10 g), standing height and lengths of tarsi, bill (from tip to feathers above the hinder corner of nostril), wings and tail (in mm) were recorded using ordinary scale. Mather (1964) and Sokal and Rohlf (1969) were followed to arrive at different statistical parameters (means, standard errors of mean, coefficient of variance). Methods of maximum approximations and t-analysis (at 0.05 level) were used to test the significance of difference between samples and correlation coefficient for association between different parameters.

RESULTS AND DISCUSSION

The species being on a very rapid decline and live trapping being difficult and uncertain (Mian and Surahio 1983; Mian 1984, 1988; Taylor 1985) killing many birds for such an analysis was not considered advisible. Support of the falconers in this regard could had yielded elaborate data for a fuller analysis but our attempt was unsuccessful. The present sample (27 birds collected through local hunters) is though small with general standards of such a study, yet is sufficiently large with bustards/houbara standards. Recent comparable studies pertain to one (Taylor 1985) or few (Alekssev 1980) individuals.

A synopsis of the available data (9 adult males, 7 adult females, 5 first winter juvenile male, 6 first winter females) on different body parameters is presented in Table II. These measurements are in general agreement with those reported earlier on *C. u. macqueenii* (Table I : Ali and Ripley 1983, Cramp and Simmons 1980, Alekseev 1980, Taylor 1985, Baker 1912, 1922-31, Witherby et al. 1938-41). This may suggest that the recent decline in the population and contraction of the available habitat, especially in its summering grounds (Ponomareva 1979), has no significant effect on the general health of the individuals of this race.

The data (Table II) suggest that though the adult males are consistently larger than the adult females, yet the sexes are not significantly different with regard to different morphometric characters, except for the body weight and the total length. Sexual dimorphism in weight has been frequently quoted in previous reports (Cramp and Simmons 1980, Ali and Ripley 1983). The present results suggest that the females are 27.8% smaller than the males, which go in conformity with Goriup (1981, 1983). The previous records

(referred to be Cramp and Simmons 1980, Ali and Ripley 1983, Roberts 1991) suggest that it is difficult to separate the sexes in the field though males sometimes look robust.

No significant dimorphism has been suggested in the data on first winter males and females. These results get support from frequently referred observation suggesting that the sexes are difficult to be separated morphologically in juvenile/first winter sub-adults (Taylor 1985, Ali and Ripley 1983).

The first winter sub-adults are significantly smaller than the adult (Table III). This is especially true for males. The adult females are also larger than first winter females except for body, bill and wing lengths. No valid explanation can be afforded for such an insignificance of the difference, though it partly confirms the report of Cramp and Simmons (1980) suggesting that the juveniles resemble the adults with regard to size of the bill and the tarsus.

A comparisin of body weights of the first winter wild caught sub-adults with that recorded for the flock being reared at Saudi National Wildlife Research Centre, Taif (Saudi Arabia; Gaucher et al. 1986) suggests that the captively reared birds are heavier. This can be explained on the basis of a better rearing conditions, supplementary diet and limited movements under captive rearing. This may suggest a better general health of the captive flock as compared with those growing in nature. However, our present suggestion has no bearing on the suitability level of the captively reared flock in nature. The weights of the first winter sub-adults, provided under the present study, go in a good degree of conformity with that of a signle female, recorded by Taylor (1985; Table I).

The data suggest a consistently higher coefficient of variance in the first winter sub-adults (Table III) as compared with those in the adults. This suggests that a wider variation existis in different morphometric parameters of the first winter sub-adults as compared with the adults. Such a difference can be expected under the variation in age (egg hatching starts from early April and lasts till June, Panomereva 1979, Alekseev 1980), genetic background and the rearing conditions of the sub-adults. In adults such variation can only be ascribed to the genetic variations and to a minor extent the rearing conditions.

The values of correlation coefficient (Table IV) suggest a highly significant correlation between the different morphometric characters under the present study. No parallel study is available on houbara and/or other bustard species. However, it suggests a proportionate development of the different body parts.

ACKNOWLEDGEMENT

This study was partially supported by WWF-Pakistan and Baluchistan Forest Department. Thanks are due to a number of hunters and wildlife staff for their cooperation in collection of the research material.

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Table-I : A synopsis of the available information on morphometrics of *Chlamydotis undulate macqueenii.* A = Alekseev 1980, A&R = Ali and Ripley 1983, B = Bakar 1912, C&S = Cramp and Simmons 1980, G = Goriup 1981, H&M = Hume and Marshall 1978-80, O = Osborne 1989, R = Roberts 1991, T = Taylor 1985, W = Witherby et al. 1938-41. The figure appearing in the centre indicate general sub-species.

Parameter	Male	Female
ADULTS		
Weight (g)	1,800-2,400 (A&R, H&M) 2,000 (A, G) 1,900 (R, B)	1,200-1,700 (A&R, H&M) 1,200 (A, G) 1,700 (R, B)
Height (mm)	6,000 (A&R) 7,000 (G)	
Length (mm)	730 (A&R) 550-650 (R)	660 (A&R)
Tarsus (mm)	98.8 (91-106, C&S) 95, 96 (A) 93-102 (W) 125 (B)	89.6 (83-97, C&S) 90, 91 (A)
Bill (mm)	32.9* (30-36, C&S) 40, 44 (A) 34-38 (B) 35-42 (W)	30.4* (C&S) 34, 38 (A) 30-34 (B) 32-36 (W)
Wing (mm)	407 (393-431, C&S) 400, 415 (A) 363-411 (B) 383-430 (W) 401.6 (Indian stock, 0) 393.0 (Arabian stock, 0)	368 (357-377, C&S) 365, 370 (A)
Wingspan (mm)	1350-1700 (R)	
Tail (mm)	215 (197-230, C&S) 220, 250 (A) 216-241 (B) 185-205 (W) 180 (R)	192 (181-207, C&S) 200, 230 (A)

Parameter	Male	Female
JUVENILES		
Weight (g)		1,100 (T)
Tarsus (mm)	Like adults (C&S)	Like adults (C&S) 357 (T)
Bill (mm)	Like adults (C&S)	Like adults (C&S) 53.5** (T)
Wing (mm)	388 (362-412, C&S)	359 (346-371, C&S)
Tail (mm)	208 (199-219, C&S)	183 (164-197, C&S)

* tip to feathers above corner of nostril

** tip to back of mouth

Table II : Mean ± standard error of mean of different morphometric parameters from a sample of the population of *Chlamydotis undulata macqueenii* wintering in Baluchistan during 1984-87. Figures in parenthesis indicate ranges.

Parameter		Adults		Juveniles	
		Male	Female	Male	Female
n		9	7	5	6
Weight	(g)	1927 ± 62 (1620-2125)	1392 ± 60 (1170-1550)	1130 ± 105 (910-1310)	1030 ± 82 (810-1270)
Height	(mm)	688 ± 22 (627-763)	663 ± 30 (609-791)	479 ± 43 (407-597)	456 ± 33 (393-566)
Length	(mm)	722 ± 21 (634-825)	625 ± 27 (556-714)	576 ± 52 (480-724)	533 ± 38 (463-665)
Tarsus	(mm)	99 ± 4 (85-111)	88 ± 4 (79-101)	73 ± 6 (66-95)	67 ± 4 (60-86)
Bill*	(mm)	34 ± 1 (29-41)	33 ± 1 (27-36)	27 ± 2 (23-33)	26 ± 2 (23-33)
Wing	(mm)	406 ± 13 (373-487)	365 ± 15 (331-430)	279 ± 24 (235-354)	254 ± 20 (201-308)
Tail	(mm)	221 ± 6 (191-248)	205 ± 8 (179-233)	161 ± 12 (142-204)	151 ± 10 (127-177)

* from tip to feathers above hind corner of nostril

Table III : Statistical parameters (coefficient of variance = standard deviation/mean X100; and t-value) calculated from morphometric data on the population of *Chlamydotis undulata macqueenii*, wintering in Baluchistan during 1984—87 period.

Parameter	Coefficient of variance				t-value			
	Adults		Juveniles		AM:AF	JM:JF	AM:JM	AF:JF
	Male	Female	Male	Female				
Height	9.60	11.42	20.08	19.51	6.88*	0.76	6.51	3.56*
Height	9.74	12.07	20.04	17.54	0.67	0.43	4.31*	4.65*
Length	8.73	11.36	20.14	17.26	2.85*	0.67	2.61*	1.99
Tarsus	11.11	11.36	17.81	16.42	2.09	0.82	3.78*	3.58*
Bill	8.82	12.12	18.52	19.23	0.55	0.33	2.85*	1.08
Wing	9.36	10.96	19.35	18.90	2.08	0.33	4.66*	0.97
Tail	8.14	10.73	16.77	17.73	1.56	0.80	4.45*	4.10*
	Significance level at		0.05		2.15	2.26	2.18	2.20
			n		14	9	12	11

* Significant at 0.05 level.

@ AM = Adult male AF = Adult female
JM = Juvenile male JF = Juvenile female

Table IV: Correlation coefficients between different morphometric parameters sampled from the population of *Chlamydotis undulata macqueenii*, wintering in Baluchistan during 1984—87. (n = 52, correlation coefficient at 0.05 level = 0.27).

	Weight	Height	Length	Tarsus	Bill	Wing	Tail
Weight	—	0.74	0.77	0.72	0.93	0.81	0.74
Height	0.74	—	0.93	0.91	0.84	0.93	0.80
Length	0.77	0.93	—	0.90	0.94	0.91	0.81
Tarsus	0.72	0.91	0.90	—	0.86	0.84	0.78
Bill	0.93	0.84	0.94	0.86	—	0.90	0.87
Wing	0.81	0.93	0.91	0.84	0.90	—	0.84
Tail	0.74	0.80	0.81	0.78	0.87	0.84	—

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A REVISED CHECKLIST OF REPTILES OF PAKISTAN

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Order : Chelonia
Family : Emydidae

1.	*Geoclemys hamiltonii*	Spotted Pond Turtle
2.	*Hardella thurjii*	Brahminy River Turtle
3.	*Kachuga smithii*	Brown River Turtle
4.	*Kachuga tecta tecta*	Indian Sawback Turtle

Family : Testudinidae

5.	*Testudo elegans*	Indian Star Tortoise.
6.	*Testudo horsfieldii*	Afghan Tortoise.

Family : Cheloniidae

7.	*Chelonia mydas japonica*	Indian Ocean Green Turtle.
8.	*Eretmochelys imbricata bissa*	Pacific Hawksbill Turtle.
9.	*Lepidochelys olivacea olivacea*	Pacific Ridley Turtle.
10.	*Caretta Caretta gigas*	The Lager Headed Turtle.

Family : Dermochelyidae

11.	*Dermochelys Coriacea*	Leatherback Sea Turtle.

Family : Trionchidae

12.	*Chitra indica*	Narrow-headed Softshell Turtle.
13.	*Lissemys punctata punctata*	Indian Flap-Shell Turtle.
14.	*Trionyx gangeticus*	Indian Soft-Shell Turtle.
15.	*Trionyx hurum*	

Order : Crocodilia
Family : Corocodylidae

16.	*Crocodylus palustris palustris*	Snub-Nosed Crocodile.

Family : Gavialidae

17.	*Gavialis gangeticus*	Gavial

Order : Squamata
Family : Gekkonidae

18.	*Agamura agamuroides*	Nikolsky Spider Gecko.
19.	*Agamura femoralis*	Sharp-tailed Spider Gecko
20.	*Agamura persica*	Blunt-tailed spider Gecko
21.	*Alsophylax (Bunopus) tuberculatus*	Baloch Rock Gecko.
22.	*Eublepharis macularius*	Fat-tailed Gecko.
23.	*Cyrtodactylus chitralensis*	
24.	*Cyrtodactylus fedtschenkoi*	Turkestan Rock Gecko.
25.	*Cyrtodactylus kachhensis kachhensis*	Warty Rock Gecko.
26.	*Cyrtodactylus kachhensis watsoni*	Quetta Rock Gecko.
27.	*Cyrtodactylus montiumsalsorum*	Salt Range Rock Gecko.
28.	*Cyrtodactylus scaber*	Keeled Rock Gecko.
29.	*Cyrtodactylus stoliczkai*	Karakoram Rock Gecko.
30.	*Cyrtodactylus mintoni*	
31.	*Cyrtodactylus dattanensis*	
32.	*Microgekko persica*	
33.	*Microgekko depressus*	
34.	*Hemidactylus brookii brookii*	Spotted Indian House Gecko.
35.	*Hemidactylus flaviviridis*	Yellow-bellied House Gecko.
36.	*Hemidactylus frenatus*	South Asian Waif Gecko.
37.	*Hemidactylus leschenaultii*	Bark Gecko.
38.	*Hemidactylus persicus*	Persian Gecko.
39.	*Hemidactylus triedrus triedrus*	Bloched Gecko.
40.	*Hemidactylus turcicus turcicus*	Mediterranean Gecko.
41.	*Ptyodactylus homolepis*	
42.	*Stenodactylus lumsdenii*	
43.	*Stenodactylus maynardi*	Whip-tailed Sand Gecko.
44.	*Stenodactylus orientalis*	Sindh Sand Gecko.
45.	*Teratolepis fasciata*	
46.	*Teratoscincus microlepis*	Baluch Plate-tailed Gecko
47.	*Teratoscincus scincus*	Turkestan Plate-tailed Gecko.
48.	*Tropiocolotes depressus*	Mountain Dwarf Gecko.
49.	*Tropiocolotes helenae*	Banded Dwarf Gecko.

Family : Agamidae

50.	*Stellio agrorensis*	
51.	*Stellio caucasicus erythrogastrus*	Caucasian Rock Agama
52.	*Stellio himalayanus himalayanus*	Himalayan Rock Agama
53.	*Stellio melanurus*	Black Rock Agama.
54.	*Stellio melanurus liratus*	Yellow-headed Black Agama
55.	*Stellio melanurus melanurus*	
56.	*Stellio nuptus nuptus*	Large Scaled Agama
57.	*Stellio nupta fusca*	Yellow-headed Agama.
58.	*Stellio tuberculatus*	Kashmir Rock Agama
59.	*Trapelus agilis isolepis*	Brilliant Agama
60.	*Trapelus rubrigularis*	Red-throated Ground Agama
61.	*Trapelus ruderatus*	
62.	*Trapelus ruderata baluchiana*	Commonn Ground Agama.
63.	*Brachysaura minor*	Small Ground Agama
64.	*Calotes versicolor*	Indian Garden Lizard
65.	*Phrynocephalus clarkorum*	Clark's Toad-headed Agama
66.	*Phrynocephalus euptilopus*	Beautiful Toad-headed Agama
67.	*Phrynocephalus luteoguttatus*	Yellow-Speckeld Toad-headed Agama.
68.	*Phrynocephalus maculatus maculatus*	Black-tailed Toad Agama
69.	*Phrynocephalus ornatus*	Ornate Toad-headed Agama
70.	*Phrynocephalus scutellatus*	Gray Toad-headed Agama
71.	*Uromastix asmussi*	Baloch Spiny-tailed Lizard
72.	*Uromastix hardwickii*	Indian Spiny- tailed Lizard

Family : Chamaeleonidae

73.	*Chamaeleo chamaeleon zeylanicus*	Indian Chameleon.

Family : Lacertidae

74.	*Acanthodactylus cantoris cantoris*	Indian Fringe-toed Sand Lizard.
75.	*Acanthodactylus cantoris blanfordii*	Mekran Fringe-toed Sand Lizard.
76.	*Acanthodactylus micropholis*	Yellow-tailed Sand Lizard.
77.	*Eremias acutirostris*	Reticulate Desert Lacerta.
78.	*Eremias aporosceles*	Chagai Desert Lacerta.
79.	*Eremias brevirostris*	Short-nosed Desert Lacerta

80. *Eremias fasciata* Yellow-headed Desert Lacerta
81. *Eremias guttulata watsonana* Long-tailed Desert Lacerta
82. *Eremias scripta* Caspian Desert Lacerta
83. *Eremias velox persica* Persian Steppe Lacerta.
84. *Ophisops elegans elegans* Elegant Snake-eyed Lacerta.
85. *Ophisops jerdonii* Punjab Snake-eyed Lacerta.
86. *Ophisops Blanfordi* Blanfords Snake-eyed Lacerta.
87. *Ophisops microlepis* Indian Snake-eyed Lacerta.

Family : Scincidae

88. *Ablepharus grayanus* Earless Dwarf Skink.
89. *Ablepharus pannonicus* Eastern Dwarf Skink.
90. *Chalcides ocellatus ocellatus* Ocellated Skink.
91. *Eumeces schneiderii blythianus* Orange-tailed Skink.
92. *Eumeces schneiderii zarudnyi* Zarudny's Skink.
93. *Eumeces taeniolatus* Yellow-bellied Mole Skink.
94. *Leiolopisma (Scincella) himalayana* Himalayan Ground Skink.
95. *Leiolopisma (Scincella) ladacensis* Glacier Skink.
96. *Mabuya dissimilis* Striped Grass Skink.
97. *Mabuya macularia* Bronze Grass Skink.
98. *Mabuya carinata* Many Keeled Grass Skink.
99. *Ophiomorus blanfordi* Mekkran Sand Swimmer.
100. *Ophiomorus brevipes* Short-toed Sand Swimmer.
101. *Ophiomorus raitmai* Indus Sand Swimmer.
102. *Ophiomorus tridactylus* Afghan Sand Swimmer.
103. *Riopa punctata* Dotted Garden Skink.

Family : Varanidae

104. *Varanus flavescens* Yellow-headed Monitor.
105. *Varanus bengalensis* Indian Monitor.
106. *Varanus griseus caspius* Transcaspian Desert Monitor.
107. *Varanus griseus koniecznyi* Indian Desert Monitor.

Order : Ophidia
Sub-Order : Serpentis (Snake)

Family : Typhlopidae

108. *Typhlops braminus* Brahminy Blind Snake.
109. *Typhlops porrectus* Slender Blind Snake.

Family : Leptotyphlopidae

110.	*Leptotyphlops blanfordii*	Sindh Thread Snake.
111.	*Leptotyphlops macrorhynchus*	Beaked Thread Snake.

Family : Boidae

112.	*Eryx conicus*	Russell's Sand Boa.
113.	*Eryx johnii johnii*Indian Sand Boa.	
114.	*Eryx tataricus speciosus*	Tartary Sand Boa.
115.	*Python molurus molurus*	Indian Python.

Family : Colubridae

116.	*Boiga trigonata trigonata*	Indian Gamma Snake.
117.	*Boiga trigonata melanocephala*	Dark-headed Gamma Snake.
118.	*Coluber fasciolatus*	Banded Racer.
119.	*Coluber karelini karelini*	Spotted Desert Racer
120.	*Coluber karelini mintonorum*	
121.	*Coluber ravergeiri ravergeiri*	Mountain Racer.
122.	*Coluber rhodorachis ladacensis*	Cliff Racer
123.	*Coluber ventromaculatus*	Glossy-bellied Racer
124.	*Dendrelaphis tristis*	Common Indian Bronze-back Snake.
125.	*Eirenis persica walteri*	Dark-headed Dwarf Racer.
126.	*Enhydris pakistanica*	Sindh River Snake.
127.	*Lycodon aulicus aulicus*	Common Wolf Snake.
128.	*Lycodon striatus striatus*	Northern Wolf Snake.
129.	*Lycodon striatus bicolor*	Golden Spotted Wolf Snake.
130.	*Lycodon travancoricus*	Travancore Wolf Snake.
131.	*Lytorhynchus maynardi*	Maynard's Awl-headed Snake.
132.	*Lytorhynchus paradoxus*	Sindh Awl-headed Snake.
133.	*Lytorhynchus ridgewayi*	Afaghan Awl-headed Snake.
134.	*Natrix (Amphiesma) platyceps*	Flat-headed Keelback.
135.	*Natrix (Amphiesma) sieboldii*	
136.	*Natrix (Amphiesma) Stolata stolata*	Striped Keelback
137.	*Natrix (Natrix) tessellata tessellata*	Tessellated Water Snake.
138.	*Natrix (xenochrophis) cerasogaster*	Dark-bellied Marsh Snake.
139.	*Natrix (xenochrophis) piscator piscator*	Checkered Keelback.

140. *Oligodon arnensis*Russet Kukri Snake.
141. *Oligodon taeniolatus* Streaked Kukri Snake.
142. *Psammophis condanarus condanarus* Indian Sand Snake.
143. *Psammophis leithii* Pakistan Ribbon Snake.
144. *Psammophis lineolatus* Steppe Ribbon Snake.
145. *Psammophis schokari* Afro-asian Sand Snake.
146. *Ptyas mucosus* Dhaman
147. *Spalerosophis arenarius* Red-Spotted Diadem Snake.
148. *Spalerosophis diadema diadema* Eastern Diadem Snake.
149. *Spalerosophis diadema schirazianus* Persian Diadem Snake.
150. *Telescopus rhinopoma* Indian Desert Cat Snake.

Family : Elapidae

151. *Bungarus caeruleus* Indian Krait.
152. *Naja naja naja* Indian Cobra.
153. *Naja naja oxiana*Oxus Cobra.

Family : Hydrophiidae

154. *Astrotia stokesii*Stoke's Sea Snake
155. Enhydrina schistosa Beaked Sea Snake.
156. *Hydrophis caerulescens caerulescens* Many-Toothed Sea Snake.
157. *Hydrophis cyanocinctus* Annulated Sea Snake.
158. *Hydrophis fasciatus fasciatus* Spotted Sea Snake.
159. *Hydrophis lapemoides* Persian Gulf Sea Snake.
160. *Hydrophis mamillaris* Bombay Sea Snake.
161. *Hydrophis ornatus ornatus* Ornate Sea Snake.
162. *Hydrophis spiralis*Yellow Sea Snake.
163. *Lapemis curtus* Short Sea Snake.
164. *Microcephalophis cantoris* Cantor's Small-Headed Sea Snake.
165. *Microcephalophis gracilis gracilis* Common Small-Headed Sea Snake.
166. *Pelamydrus platurus* Pelagic Sea Snake.
167. *Praescutata viperina* Viperine Sea Snake.

Family : Viperidae

168. *Echis carinatus pyramidum* Saw-Scaled Viper.
169. *Echis carinatus sochureki* Eastern Saw-Scaled Viper.
170. *Echis carinatus multisquamatus* Transcaspian Saw-Scaled Viper.
171. *Echis carinatus astolae* Astola Saw-Scaled Viper.
172. *Eristicophis macmahonii* Leaf-nosed Viper.
173. *Pseudocerastes persicus persicus* Persian Horned Viper.
174. *Vipera labetina obtusa* Levantine Viper.
175. *Vipera russelii russelii* Russell's Viper.
176. *Agkistrodon himalayanus* Himalayan Pit Viper.

ACKNOWLEDGEMENT

I thank Director, Zoological Survey Department, Karachi for providing the necessary research facilities. Special thanks are due to Dr. Walter Auffenberg, Distinguished curator, Florida State Museum, Florida, U.S.A. for providing funds for field and laboratory work and for supplying literatures.

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Records Zool. Sur. of Pak. Vol. XIII, 71—73. 1997.

A NOTE ON BREEDING OF SAURUS CRANE (*GRUS ANTIGON*) AT BHANSAR LAKE, NAGARPARKAR, DISTRICT THARPARKAR

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Of the 15 species of cranes found in the world, four species of cranes have been found in Pakistan. Three species of these are migrant through Pakistan. Eurasian crane *(Grus grus)* and Demoselle crane *(Anthropoides vergo)* are regular passage migrant through the country while Siberian crane *(Grus leucugeranus)* is occasionally seen during journey.

Saurus crane (*Grus antigon*) which was once resident and breeding bird has become extinct in the country. However, Eates saw two pair in Larkana district on Drig lake in 1929 and Mirbars (professional fisherman) took a pair of fledged chicks from the same locality in the same year. In 1939 a breeding pair was found in Larkana on one of the larger lakes. This was last record of breeding of the species in Pakistan.

Now the authors recorded breeding of the species at Bhansar lake near Nagarparkar, district Tharparkar.

On 18-12-1994 a pair with two youngs was seen at the lake. According to the people of Bhansar, a small village near the lake, the pair has bred at the same lake.

On 21-2-1995 again the lake was visited, the pair was yet found at the lake with one of its offspring. What has happened with the second is not known.

Another survey of the lake was conducted on 28-11-1995. The pair was once again found with two youngs. These were broods of this years. This indicates that the pair is breeding regularly at the site.

The Bhansar lake is a small lake few kilometers east of Nagarparkar. It has an approximate area of 1/2 sq. Km. It is a seasonal lake dependent on rainfall. It usually become full in moonson and dry up in late winter or spring. It is used for drinking of water, bathing, livestock drinking and grazing.

The lake is without aquatic macrophyte having dense reeds in the western marshy areas. The adjacent surrounding land is barren. *Prosopis juliflora, Capparis decideua,*

Savidora oleoides and *Ziziphus nemmularia* are the major plant species found in the adjacent areas. Surrounding lands at some distance are cultivated with cerial crops.

There is a small village named Bhansar close to the lake which has a population of about 250 people.

PROBLEMS AND THREATS

Following are the some problems which cranes face at the wetland.

1. Droughtness :

The Bhansar lake is dependent on rain water. In the moonson season the rain water accumulates in it while it usually dry in late winter or spring. In this season cranes are forced to leave the site.

2. Reed Harvesting :

Dense reed in the marshy area of western sides of the lake provides shelter to the cranes and their youngs. In the winter, when marshy area become dry, the reeds are harvested by the local peoples. This devoids cranes from shelter.

3. Disturbances :

When the reeds have been harvested a number of buffalows, cows and goats are found in the area inhabited by cranes. Though the graziers have friendly attitude towards the cranes yet they face excessive disturbance through this practice and are seen flying here and there during the whole day.

4. Predators :

Some of the raptors and carnivorous species are found in the surrounding areas of the lake, which may attacke the youngs or eggs of cranes. Of the raptors, Kestral *(Falco tinnuculus)*, *Short*-toed Eagle (*Circaetus gallicus*) White-eyed Buzzard (*Butaster teesa*), Long legged Buzzard (*Buteo rufinus*) and Imperial Eagle (*Aquila helica*) were found in the adjacent surrounding areas.

Of the carnivorous mammals, Small Indian Mangoose (*Herpetes auropunctatus*), Grey Mangoose (*Herpetes edwarsi*) Desert Cat (*Felis libyca*), Jungle Cat (*Felis chaus*), Jackal (*Canis aurius*) and Indian Fox (*Vulpus bengalensis*) are reported to be occur in surroundings.

Future Prospect :

Further studies on the presence and breeding of the bird at the site are required. If breeding continue, details ecological studies on feeding and breeding requirements of the bird are needed. Then wetland may be managed for provision of better condition to the birds.

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Records Zool. Sur. of Pak. Vol. XIII, 75—77. 1997.

FIRST RECORD OF *CAMALLANUS MASTACEMBELI* (SAHAY AND SINHA, 1966) AGRAWAL, 1967 (NEMATODA : CAMALLANIDAE) FROM PAKISTAN

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Camallanus mastacembeli (Sahay and Sinha, 1966) Agrawal, 1967 is being reported for the first time from Pakistan, representing a westward extension of its distribution. These nematodes of the family Camallanidae Railliet and Henry, 1915 were collected from the same host, *Mastacembelus armatus* (Lacepede), a freshwater fish obtained from Karachi, fish market, harboured these worms in the intestine. Only two fishes, out of ten examined, yielded these parasites; one host found infected with nine males and an equal number of females, Regd. No. N-808 and the other with a single female, Regd. No. N-925, deposited in the Museum of Zoological Survey Department, Karachi.

Sahay and Sinha (Jap. J. Med. Sci. Biol., 19 : 247-252, 1966) described the species *Zeylanema mastacembeli* from *Mastacembelus armatus* from eastern India. Sood [Ind. J. Helm., 20(2) : 83-110, 1968] transferred this species to the genus *Camallanus* Railliet and Henry, 1915 and proposed a new name *C. patni* due to the presence of *C. mastacembeli* Agrawal, 1967. Being contrary to the Rules of Zoological Nomenclature, Ghosh and Majundar [Folia Parasit., 25(4) : 317-322, 1978] renamed *Zeylanema mastacembeli* to *Camallanus mastacembeli* and treated Agrawal's species as its synonym.

In all essential morphometric details these camallanid parasites closely resemble with *Camallanus mastacembeli* (Sahay and Sinha, 1966) Agrawal, 1967. The accountable differences include the body, more delicate, filiform and smaller in size, male 8.8 - 16.3 mm long; 0.15 - 0.18 mm wide and females 12.4 - 16.3 mm long; 0.15 - 0.18 mm wide against those in *C. mastacembeli,* males 11.6 - 12.6 mm long; 0.20 mm wide and females 19.2 - 26.2 mm long; 0.22 - 0. 27 mm wide. The males posses 4 pairs of postanal caudal papillae in two groups of 3 pairs close together and 1 pair near tail tip in the present specimens (Fig. 1A) contrary to only 2 pairs of postanal papillae in the described form. And the females in nematodes under report bear a pair of papillae, 94 - 107 µm from the bluntly bifid tail tip, (Fig 1B) whereas the Indian species has bluntly pointed tail tip.

These variations are sufficient to identify the present camallanid nematodes as *Camallanus mastacembeli* and first time reported from this fish in Pakistan.

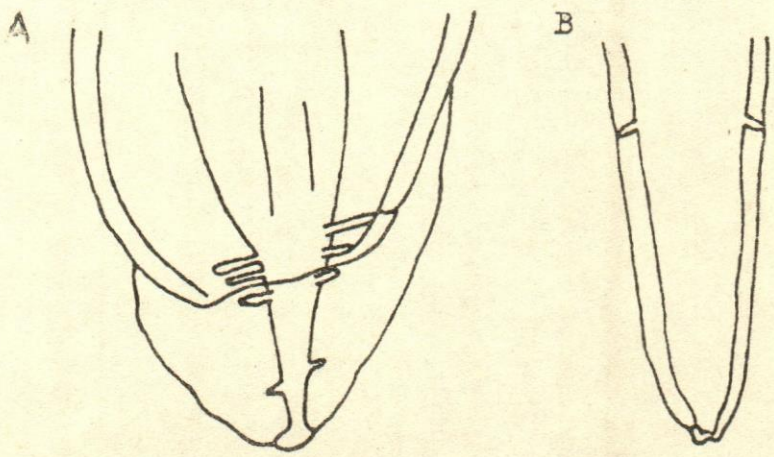

FIG 1 AB 0.05mm

Fig. A Posterior end of male, ventral view
Fig. B Posterior end of female, ventral view

Records Zool. Sur. of Pak. Vol. XIII, 79—81. 1997.

ON MORPHOLOGICAL VARIATIONS ENCOUNTERED IN *ASCARIDIA GALLI*, THE 'LARGE ROUNDWORM' OF FOWL

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The study of a large number of *Ascardia galli* (Schrank, 1788) Freeborn, 1923 (= *A. lineata* (Schneider, 1866), a nematode of the family Ascarididae Blanchard, 1849, cosmopolitan in distribution, infesting the small intestine chiefly of Galliforms, obtained from *Gallus domesticus,* collected from the poultry market in Karachi revealed the presence of some rarely recorded morphological variations.

The outer margin of the dorsal lip often appears to be notched (Fig. A); the lateral lips in many cases possess two papillae (Fig. B) as reported by Schwartz (J. Agric. Res., 30, 763-772; 1925) for *A. lineata* as does Lane (Ind. J. Med. Res., 2, 655-669; 1914) for *A. hamia,* a synonymn of *A. galli* and the medial and lateral lobes of each lip seems to have a different ratio of size than figured by Ackert (Par., 23, 360-379; 1931).

The cervicalpapillae vary in number from one to two pairs (Fig. C) rather than 'occasionally a single pair' as described by Ackert; farther back exist 'nuchal papillae' as called by Lane, in a series of five to six pairs in the lateral position and ten to twenty pairs of papillae at irregular intervals covering two thirds of the body length as examined in some males and females.

The proximal ends of the oesophageal lobes contain small conical tooth-like structures (Fig. D) four by the medial lobe and one but larger in size by each subventral lobe.

In the male, the tail has a more pronounced caudal alae than illustrated by Ackert. The third pair of the preanal papillae located at a level of outer margin of the cloacal opening (Fig. E) rather than more or less in between cloaca and sucker. The spicule tip has a large semicicular ala (Fig. F).

In the female, the tail exhibits often two pairs of papillae whereas Vasilev (Izvest. Tsent. Khelm. Lab. Sofia, 7, 5-10; 1962) described a single pair.

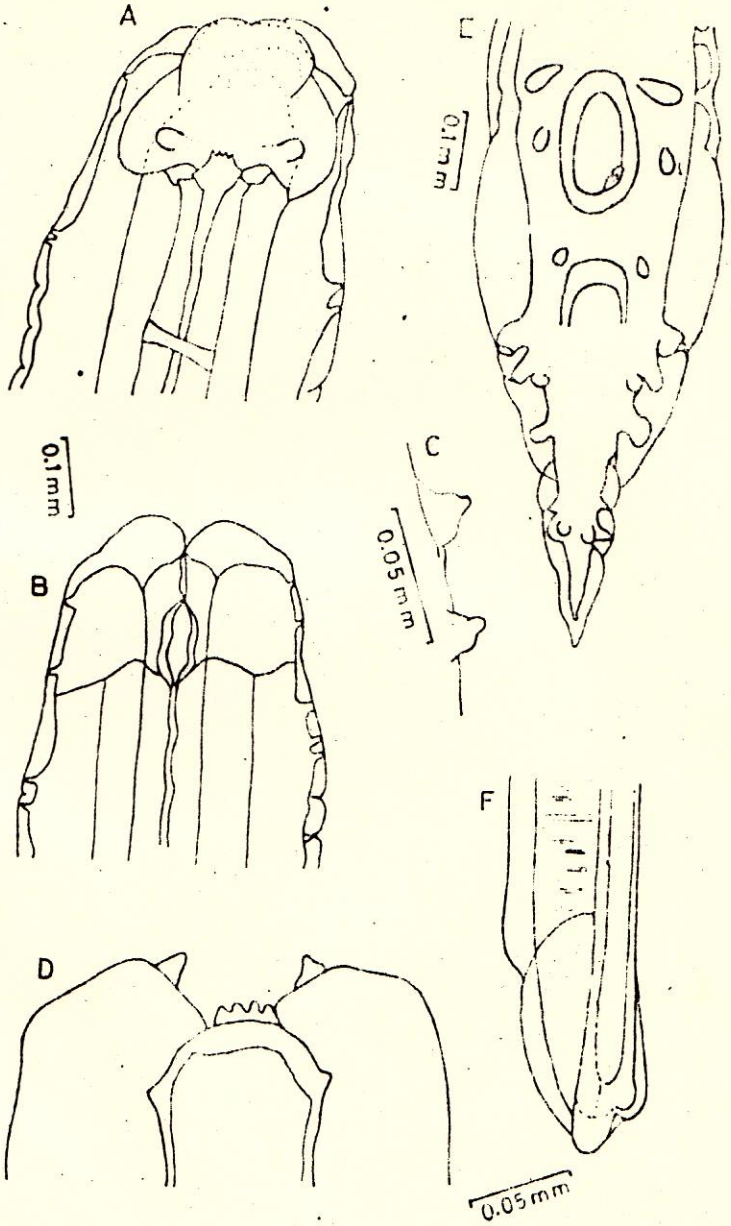

Fig. A. Anterior extremity, dorsal view
B. Anterior extremity, lateral view
C. Cervical papillae, lateral viw
D. Anterior extremity, dorsal view
E. Posterior extremity, ventrol view
F. Spicule tip, lateral view

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PRINTING CORPORATION OF PAKISTAN PRESS, KARACHI.