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ETHOLOGICAL OBSERVATIONS ON SOME BIRDS OF CHASHMA BARRAGE

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ABSTRACT

This paper records the learned and innate behavior of some birds, local as well as migratory, at the left marginal water reservoirs of Chashma Barrage on river Indus, Punjab. The study includes ethological observations on some birds in relation to the habitat conditions of the Chashma Barrage, in five field trips of 3 to 4 days each, in mid-winter and spring 2013 and 2014. The performance of specific behaviours i.e. appetitive behaviour, anonymous association, consummatory behaviour, eco-ethology, escape behaviour and roosting behaviour was inter-related to the state of the habitats of the study area. The Chashma Barrage is the first main staging area of the winter migrant birds on the Indus Flyway, due to its huge water reservoirs. There are also large areas of shallow water ponds having luxuriant marginal growth and floating flora which provide breeding as well as wintering habitat for the local birds. Seventy two (72) bird species were observed at the Chashma Barrage during the study period. Out of these, 49 species were studied in some detail. Most of the local dryland species live in association with humans, in various ways for feeding and breeding in urban, as well as in rural environment.

1. INTRODUCTION

This paper gives ethological observations of some wetland and some dryland birds of Chashma Barrage. Ethological observations on each species have been described. The impacts of bio-physical and anthropogenic environment on the ethology of birds observed during the study period have also been given.

For ethological terminology, Grzimek [1] is followed. These terms have also been explained in the paper. By early 1970's 'Ethology' had gradually developed its vocabulary. However, it was not easy to find truly objective and descriptive terms for certain processes.

There was trend to carelessly interpret behavioural traits. The ethological terms were not always used in the same manner. Several terms were used to refer to the same thing. Moreover, many books were using terms with different meanings, which led to certain confusions. Hence, there was some disagreement with the ethological definitions. Grzimek [1] often used certain technical terms, in his book which conveyed precisely their meanings and explanations of the concept. The purpose for the use of these ethological terms in this paper is to make the behavioural observations more clear.

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2. MATERIALS AND METHODS

2.1 Chashma Barrage

It is a multipurpose Barrage located at river Indus, district Mianwali. It stores water in huge reservoirs for the Chashma-Jhelum Link Canal and for the constant supply of water to a 120 Megawatt Hydropower Plant. Since, Chashma Barrage is the first staging ground for many winter migrants, these reservoirs attract large flocks of birds in winter and early spring.

A large area of Chashma Barrageis a wildlife sanctuary, under the Punjab Wildlife Act 1970. It is also a 'Ramsar site'. Yet, anthropogenic activities, which include the commercial fisheries, reed cutting, thatching material harvest and tourism disturbance, are giving negative impacts, on mainly the waterfowl. This keeps the birds on the alert. The impact of these disturbances on the behaviour of the birds has been explained in this paper.

Fig. 1: Location Map of the Study Area

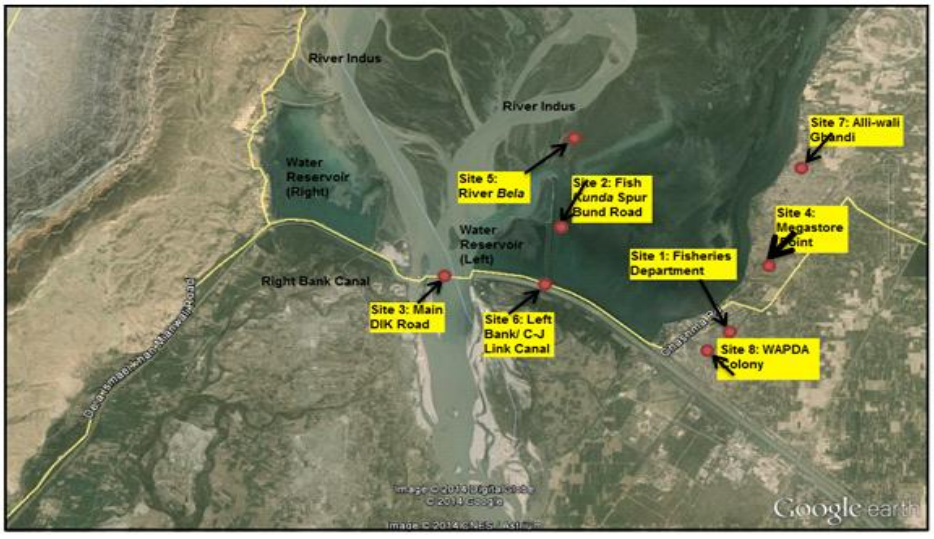

Fig. 2: Observation points at Chashma Barrage Wildlife Sanctuary

Observation points at Chashma Barrage: The wildlife sanctuary was divided into 8 observation points randomly (Fig. 2).

Field Visits: The visits to the study area are tabled below.

Table 1: Schedule of field trips to Chashma Barrage

S.No.	Location	Date	Month	Year
1.	Chashma Barrage	05^{th} - 08^{th}	February	2013
2.	Chashma Barrage	14^{th}- 17^{th}	March	2013
3.	Chashma Barrage	05^{th} - 08^{th}	April	2013
4.	Chashma Barrage	20^{th} -22^{th}	February	2014
5.	Chashma Barrage	31^{st} - 2^{nd}	October - November	2014

*Both local and migratory birds were studied. Summer observations were not made due to summer flood season and also because of the absence of wintering birds.
*The site was visited in these months for a period of two to three days only.

2.2 Field data collection

Apparatus/Tools: The observations were made using binoculars (10 x 50 mm) and bird species were identified using 'A field guide to Birds of Pakistan' by Z. B. Mirza [3]. The surveys were carried out on foot.Locations were marked on maps (Fig. 2) with details of the coordinates (Table 3).

Sampling Method: *Ad Libitum* Sampling rule was adopted to record the ethological observations in birds.

The birds were selected randomly and the observations were made for a considerable period of time to observe different activities in individual as well as group of birds. Notes and onsite observations were taken by quietly sitting or standing at a place of clear visibility. All movements, postures and responses of birds were observed in detail. Since, it was not possible to record each and every activity/behaviour of all the selected birds, therefore, the results of these observations are based on what was 'visible', 'attractive' and 'relevant' at the given time.

Ethogram

Grzimek [1] was followed to formulate inventory of bird ethology observed during the study period in the table below:

Table 2: Ethogram

S. No.	Behaviour	Description of behaviour
1.	**Appetitive behaviour**	Variable sequence of movements in search of food / prey, i.e. diving into water, probing into mud or picking up prey from the water or ground or catching in the air.
2.	**Consummatory behaviour**	Exclusive behavior, shown after appetitive behavior to digest food or rest or time lapse for next activity.
3.	**Eco-ethology**	Parallel behavioral adaptations of more than one species, expressed when similar food is available to them in the same area. It can be gulls &terns surface feeding in the same way or it can be Pied Kingfisher and White-breasted Kingfisher, which hover to precisely locate prey in water.
4.	**Commensalism**	A biological relationship between two organisms where one is benefited from the other while the other remains unaffected.
5.	**Anonymous association**	Activities in a mixed flock of different species in an area for example, roosting, flocking, resting or feeding.
6.	**Roosting**	Perching for a short or a long time singly or in a flock.
7.	**Orientation**	The ability of birds to direct their position and movement according to

		certain conditions.
8.	**Escape/defense behaviour**	Response to stimuli indicative of danger e.g. dashing onto vegetation, taking to wings, compacting in a flock or expressing ambivalence or any pattern of behaviour to scare off or distract an intruder such as chasing or quarreling.
9.	**Escape distance**	Flight distance or minimum limit if intruded upon by a predator; the bird will flee to avoid predation/threat.
10.	**Latency period**	The time interval between signal and response. Latency period in a bird determines escape distance.
11.	**Ambivalence**	Compact flocking along with pattering wings, which is fast beating of wings to produce loud noise and at the same time running over the surface of water before getting air borne or attacked.

Table 3 gives description of the observation points at Chashma Barrage.

Table 3: Description of observation points at Chashma Barrage Wildlife Sanctuary

S. No.	Observation Points	Coordinates	Description of the sites
1.	Fisheries Department	N 32° 25′ 05.2", E 71° 26′ 13.9"	A fish hatchery on left marginal main reservoir which is semi-enclosed basin partially separated from main river channel by a bund. The observations were taken from its back side facing the water body.
2.	Machi/Fish Kunda Spur Bund Road	N 32° 27′ 05.3", E 71° 23′ 53.5"	An embankment built on marginal water reservoir.
3.	DIK Road	N 32° 41' 11.4", E 71° 44' 47.7"	Main Dera Ismail Khan Road on the margin of the Indus river and reservoirs. The road connects D. I. Khan to Mianwali through Chashma Barrage.
4.	Megastore point	N 32° 25′ 44.8", E 71° 23′ 49.5"	A market with a famous restaurant "Green Lagoon" and shopping mart, "Megastore" built at the edge of left reservoir. The shoreline along this commercial area is mostly polluted by household garbage and hospital waste.
5.	River *Bela*	N 32° 25′ 05.7", E 71° 27′ 49.5"	These are mainly islands of silt and mud with*Typha* sp. and *Phragmites* sp. dominating the area and also have some temporary small patches of stagnant water.
6.	Chashma-Jhelum link canal	N 31° 27′ 32.8", E 74° 22′ 24.2"	A Canal that runs from Chashma Barrage to the River Jhelum. Trees and moderately thick *Typha* and *Phragmites* are grown at the edges of this canal.
7.	Ali-walliGhandi	N 32° 47' 75.5", E 71° 48' 63.3"	An area of mud and silt deposits which is often submerged under the water of its marginal river channel. When water reduces, it still remains moist and muddy with puddles of water. It is grazed area with some *Typha* sp. and *Phragmites* sp. at some places.
8.	WAPDA Colony	N 32° 42' 04.7", E 71° 44' 32.9"	An urbanized area with horticulture. It is a colony including WAPDA Rest House, Chashma Hydro Power Project (CHP) Rest House, markets and residences.

3. RESULT AND DISCUSSION

At Chasma Barrage 72 bird species were counted and 49 of these were ethologically studied.

3.1 Grebes: Family Podicipedidae

The observations were made on the following grebe species;

- **a)** Little Grebe*(Tachybaptusruficollis)*
- **b)** Black-necked Grebe *(Podicepsnigricollis)*
- **c)** Great-crested Grebe*(Podicepscristatus)*

Appetitive behaviour: Grebes express appetitive behavior mainly by diving underwater. Sometimes they catch tiny fish and hold it in the bill, perhaps to kill it before swallowing. Occasionally, they catch a tiny prey from water surface with the jerk of their neck.

Anonymous association: These are often in anonymous association with other birds, mostly coots. Their feeding in association benefits them from alarm signals of their associates.

Orientation: In windy weather, the floating birds get drifted slowly in wind direction. Grebes orientate to face the wind and paddle to remain almost in the same place.

Escape behaviour: Grebes have their latency period inversely proportional to alarm signals on the sudden approach of a flying bird predator i.e. if the predator is flying low, grebes suddenly dive and appear at a different place, after about 45 seconds. The escape distance is then longer and the latency period is shorter. On the contrary, if the predator is flying high up, the latency period is relaxed and escape distance is shortened. If the predator swoop-dives from above, the grebes just disappear underwater in their attempt to escape the attack. They also float in the floating vegetation projecting above the water surface to forage camouflaged. When depredation from air is sensed the scattered flock swims fast to compact, as precautionary defense.

3.2 Cormorants: Family Phalacrocoridae

The observations were made on the following cormorant species;

a) Eurasian Cormorant *(Phalacrocoraxcarbo)*
b) Indian Cormorant *(Phalacrocoraxfuscicolli)*
c) Little/Javanese Cormorant *(Phalacrocoraxniger)*

Appetitive behaviour: Cormorants mostly express appetitive behavior by swimming & searching, and by diving underwater to chase and catch fish collectively or singly.

Consummatory behaviour: Cormorants perform consummatory behavior by perching/sitting on large shrubs, trees or raised banks or projections. While doing so, these often spread their wings and tails to dry. During the study period, Eurasian Cormorants and Indian Cormorants were spotted perched in a mixed flock, on 8 – 10 tall dead trees. Up to 30 birds were seen on each tree, in the morning around 1000 hours. These were quite exposed.

Nocturnal roosting behaviour: The cormorants roost for the night in mixed flocks on any tree of the area and also in thick *Typha* sp. & *Phragmites* sp. tall growth.

Escape behaviour: In a large flock in water, sometimes some birds dive as a flying predator comes straight over them, with a short escape distance. Individual but scattered swimming birds dive most often as the predator approaches. However, if the escape distance is long, these express ambivalence by forming a compact flock to appear as a large compact black patch.

3.3 Egrets: Family Ardeidae

The observations were made on the following egret species;

a) Little Egret *(Egrettagarzetta)*
b) Intermediate Egret *(Egrettaintermedia)*
c) Great Egret *(Egrettaalba)*
d) Cattle Egret *(Bubulcus ibis)*

Appetitive behaviour: These birds variously perform appetitive behavior i.e. wading, walking or running to pick food. All egrets stand still in water or near its edge, in wait for a passing by prey in water. They dart at the prey with a jab of their long neck and pointed bill.

Anonymous feeding association: The Little Egret *Egretta garzetta* and the Intermediate Egret *Egretta intermedia* often forage in anonymous association. The Large Egret *Egretta alba* forages alone.

Roosting behaviour: The Little Egret and the Intermediate Egret diurnally roost on tree branches, sometimes with Indian Pond Heron *Ardeola grayii*. At dusk, some birds fly to a tree close to their night roosting place. Initially they prefer to sit on top branches and keep their neck raised, so that they are more exposed and visible from distance. More egrets arrive soon and sit similarly in that tree. Their number increases and the tree is studded white as the dark starts prevailing. When no more birds arrive, all perching birds suddenly fly to their night roosting place; this could be thick and tall water reeds or another tree with thick foliage.

Escape behaviour: Egrets freeze on approach of a potential threat, but fly when more alarmed. In case of a flock birds fly when there is longer escape distance.

Eco-ethology: The Cattle Egret *Bubulcus ibis* and the grazing domestic livestock have commensalism between them. The grazing domestic livestock dislodge insects mainly grasshoppers hiding in the grass, by their hooves as they graze and move. Cattle Egrets locate the dislodged grasshoppers and consume. This way the rangeland remains healthy and the livestock gets more grass available to graze.

3.4 Indian Pond Heron: *Ardeola grayii*

Appetitive behaviour: It is performed by "stalking" i.e. standing still and suddenly darting at the prey. It keeps its bill slightly submerged in shallow water and at the same time, keeps it slightly shaking perhaps for better vision underwater.

Anonymous association: These mostly perform solitary feeding but anonymous association is also seen with Intermediate Egret, Little Egret and other herons, when prey is abundantly available.

Escape behaviour: These are camouflaged by standing still to blend with the surroundings in order to express escape behavior. Flight is another way of escaping threats in case of shorter latency period and longer escape distance.

3.5 Ducks: Family Anatidae

The observations were made on the following waterfowl species;

a)	Northern Shoveler	*(Anas clypeata)*
b)	Northern Pintail	*(Anas acuta)*
c)	Mallard	*(Anas platyrhynchos)*
d)	Common Pochard	*(Aythya ferina)*
e)	Red-crested Pochard	*(Netta rufina)*
f)	Scaup	*(Aythya marila)*
g)	Shelduck	*(Tadorna tadorna)*
h)	Common Teal	*(Anas crecca)*
i)	Tufted Duck	*(Aythya fuligula)*

Appetitive behaviour: Common Pochard *Aythya ferina*, Red-crested Pochard *Netta rufina*, Tufted Duck *Aythya fuligula* and Scaup *Aythya marila* feed underwater throughout the day by diving. Big flocks of dabbling ducks that include Northern Shoveler *Anas clypeata*, Northern Pintail *Anas acuta*, Mallard *Anas platyrhynchos*, Common Teal *Anas crecca* and Shelduck *Tadorna tadorna*, mostly rest throughout the day in widely open water and occasionally dip their bills for surface filter feeding.

Anonymous association: During the day time the ducks float in anonymous association with various species, mainly the huge flocks of coots. In the shallow water/mud, the dabbling ducks intermingle with one another in probing food. While resting among the diurnally active coots, ducks avoid going closer to the water edge. It can be suggested that anonymous flocking behavior offers them security and vigilance against predators especially when resting ducks have their bills placed under scapulars.

Orientation: When the waterfowl on the surface of water, get drifted by the wind, these orientate against the direction of wind and paddle or fly back to almost the same place again.

Consummatory behaviour: After foraging period, the birds float in rest.

Escape behaviour: Dabblers express escape behaviour by ambivalence. Collective ambivalent behavior is expressed by sudden rising of their heads and movement in their positions to form compact patch, as short latency period. This sudden movement is beneficial for the sleeping, preening or resting ducks. The diving ducks express escape behaviour by diving. The birds which dive underwater when a Marsh Harrier *Circus aeruginosus* approaches, have short latency period and longer escape distance. These reappear on the surface at a different place, around 30 feet or so, after approximately in less than a minute. The ducks also have an innate ability to distinguish between a potential predator and an ordinary raptor. Therefore, when a Pariah Kite *Milvus migrans* approaches them, none of the ducks are bothered.

3.6 Pariah Kite: *Milvus migrans*

Appetitive behavior: Kites are mainly scavengers and sometimes predators of unattended domestic chicks. They maneuver during the flight and suddenly swoop-dive towards their target.

Roosting behaviour: Communal diurnal and nocturnal roosting is common among Pariah Kites. Flocks also roost on ground perhaps for digestion.

Response to disturbances: These express short latency period in case of human disturbances or teasing crows *Corvus splendens*. Upon disturbance, the Kites fly up, rise high and start gliding or soaring in the sky.

3.7 Marsh Harrier: *Circus aeruginosus*

Appetitive behavior: These fly low over the aquatic reeds, when they are in search of a prey. The predator can see the prey only when it suddenly appears over the reeds, then its swoop-dives for the prey. A water body with well grown cover vegetation suits the flying predator. These soar in usually high circles and mostly cover a large area to locate food.

Roosting behaviour: They are usually solitary in diurnal roosting. According to the second author, during winters, in Pakistan these are particularly communal nocturnal roosting birds. Before roosting at dusk, they appear from various directions, in an area, usually marshes, with thick and tall water reeds, start circling over, until all birds reach there. Then suddenly they disappear in the roosting site.

3.8 Coot: *Fulica atra*

Appetitive behaviour: Coots exhibit flexibility in appetitive behavior i.e. dive in deeper water and feed by upending in shallow water.

Anonymous association: Large flocks of coots let the other aquatic birds associate with them, while resting or feeding. This gives collective security to all associates.

Escape behaviour: Coots express escape behaviour in three different ways; diving, taking to wings and ambivalence. These are usually in large flocks. They have short latency period and respond to danger. In case of approaching threat, most commonly the Marsh harrier, they express ambivalence. The entire flock takes off with pattering wing beats and at the same time running over the water surface. The collective pattering sound of the wing beats of a large flock may create confusion for the predator in targeting a prey. However, if any bird gets separated from the flock, it is then more vulnerable to depredation. But if the separated bird dives under water, it gets the chance to escape.

3.9 Black-winged Stilt: *Himantopus himantopus*

Appetitive behaviour: This bird moves on muddy soil and also wades in shallow water and probes mud or water with its long bill. Sometimes it even dips its head in water to pick food from under water.

Anonymous association: This bird has anonymous association with all waders and is benefited with collective vigilance of all birds.

Escape behavior: It includes huddling together or flight. When a flying predator approaches suddenly, the latency period is short and it takes to wings.

3.10 Gulls: Family Laridae

The observations were made on the following Gull species;

a)	Black-headed Gulls	*(Larus ridibundus)*
b)	Common Gulls	*(Larus canus)*
c)	Herring Gulls	*(Larusar gentatus)*
d)	Brown headed Gulls	*(Larus brunnicephalus)*
e)	Greater Black-backed Gulls	*(Larus ichthyaetus)*

Appetitive behaviour: These fly low and attempt to catch water surfacing fish by scoop-diving or by shallow plunge diving. Each attempt may not be successful.

Anonymous foraging association: Gulls most often forage together with terns. The second author observed that these also associate with cormorants to get an opportunity of catching thrown away bolus (meat and bones wrapped up in slime) by cormorants, from which the gulls find some undigested food.

Defense or escape behaviour: These chase away an intruder like the Pariah Kite. However, individual birds, if sitting in water, show short latency period and take to wings, if a kite is approaching. The escape distance is longer in case of a Marsh Harrier.

3.11 Terns: Family Sternidae

The observations were made on the following Tern species;

a)	Gull-billed Tern	*(Gelochelidon nilotica)*
b)	Black-bellied Tern	*(Sterna acuticauda)*
c)	Caspian Tern	*(Hydroprogne caspia)*
d)	Indian River Tern	*(Sterna aurantia)*
e)	Whiskered Tern	*(Chlidonias hybridus)*

Appetitive behavior: These fly low over the water to feed on surfacing tiny fish. Sometimes these plunge dive into the water and submerge completely for a catch. These also scavenge from water surface and the garbage near the fish shops at the barrage.

Anonymous foraging association: The gulls and terns hunt close to one another in case of more food availability**.**

Defensive or escape behaviour: While sitting on ground these start mobbing and sometimes take to wings if a predator bird's direction of approach is straight towards them, even though it is sufficiently

far. Sometimes, terns tease a predator on wings from above and behind and chase it away. In case of the sudden appearance of a flying predator, these terns fly away together, close to one another, which is shorter latency period and longer escape distance.

3.12 The Great Coucal: *Centropus sinensis*

Appetitive behavior: It is an omnivorous bird. It hides in water reeds and comes out to feed in close by areas anytime during the day. It also feeds on floating plants and in grassy areas.

Escape behaviour: It dashes into the water reed thickets, when alarmed.

3.13 King fishers: Family Alcedines

The observations were made on the following Kingfisher species;

a) Eurasian Common Kingfisher *(Halcyon smyrnensis)*

b) Pied Kingfishers *(Ceryle rudis)*

Appetitive behaviour: All kingfishers express appetitive behaviour by stalking their prey either by sitting on a perch over-looking the water or by hovering over water. White breasted Kingfisher *Halcyon smyrnensis* plunge-dives directly into water from a perch. It comes out and often flies back to its perch. Same is the behavior of the Pied Kingfisher *Ceryle rudis*. These birds also often hover to target underwater prey, and may not dive if not decided.

Escape behaviour: These express escape behaviour by flying to a secure place. The birds show a shorter latency period and longer escape distance.

3.14 Little Green Bee-eater: *Merops orientalis*

Appetitive behaviour: During winters, it chases flying insects solitarily to express appetitive behavior. However, flocks of this bird also feed together when the flying insects are abundant, usually during the rainy season. Smaller insects are swallowed but relatively larger insects are first crushed by striking its bill against its perch. Another type of appetitive behaviour is gliding and scanning of the surroundings.

Nocturnal roosting behaviour: Six to seven or more birds sit close packed to one another on a tree branch.

Preening behavior: During day time resting, they dress their feathers with their long bills for a short while and the ritual is continued in the evening as well.

Escape behaviour: These have short latency period in response to disturbances.

3.15 Hoopoe: *Upupa epops*

Appetitive behavior: It walks around and probes grassy moist soil for grubs. It gives short jabs of its long slender bill on the ground and sometimes it inserts its bill deep if the soil is soft to extract grubs.

Escape behaviour: Hoopoes take to wings as escape behaviour. However, they are not shy of humans if busy digging. The bird performs powerful undulating flight with slow wing beats.

3.16 Wagtails: Family Motacillidae

The observations were made on the following Wagtail species;

a) Large Pied Wagtail *(Motacilla maderaspatensis)*

b) Grey Wagtail *(Motacilla cinerea)*

c) Hodgson's Pied Wagtail *(Motacilla alba alboides)*

d) Siberian Pied wagtail *(Motacilla albadukhensis)*

e) Yellow headed Black collared Wagtail *(Motacilla citreolacitreola)*

f) Grey-headed Yellow Wagtail *(Motacilla flavathunbergi)*

Appetitive behaviour: Wagtails express appetitive behaviour by probing in moist soil and even pursuing the prey with rapid undulating flight, walking or running on the ground or shallow water to pick up prey from or near the water surface.

Night roosting behaviour: It was observed that Wagtails engage in communal night roosting. The mixed flocks fly low over the roosting site and keep on dropping in the vegetation growth for night roosting (huge dense flocks like a storm cloud of mixed birds come flying over night roosting vegetation and dropped into it like rainfall). This was previously also observed in Balloki Head works by S. Irshad & Mirza [2].

Escape behaviour: They have short latency period on ground.

3.17 Red-vented Bulbul: *Pycnonotus cafer*

Appetitive behaviour: It is fructivorous as well as insectivorous bird. It was previously observed by the second author to feed on insects coming for nectar of

*Zizyphus numalaria*f lowers. The sting of sting insects was rubbed off on the perch.

Roosting behaviour: It is a communal night roosting bird. Some birds sit packed side by side on a branch, sometimes having faces on the opposite sides. The roosting is noisy.

3.18 Common Babbler: *Turdoides caudatus*

Appetitive behavior: It picks insects usually under the fallen leaves on ground. It also gleans on small insects by inserting its beak into cracks and crevices present on tree trunks at ground level.

Escape behaviour: Latency period is short and these birds dash into nearby vegetation.

3.19 Black Drongo: *Dicrurus macrocercus*

Appetitive behaviour: It perches either on the tree branches or electric wires to catch flying insects in short sorties. It often sits on the back of grazing domestic livestockto catch grasshoppers dislodged by the cattle. Occasionally it also catches insects from the surface of water.

Defensive or escape behaviour: It is fearless of Pariah Kite and crows; rather it often chases them away in flight.

3.20 Black Starling: *Sturnus vulgaris*

Appetitive behaviour: These fly straight to where fresh dung is available or where livestock is grazing.

Anonymous foraging association: Starlings feed in flocks and also in association with the flocks of Bank Mynas and Common Mynas. Their movement on the ground dislodges flying insects hidden in the grass which attracts also the Black Drongo and Red-vented Bulbuls to the feeding area.

Roosting behaviour: The following is the observation of the second author: Black Starlings being gregarious, feed and roost in small and large flocks. The roosting is noisy with a lot of droppings at the roost site. Communal night-roosting is with sunset. In the evening before roosting, small flocks start circling over the roosting site. Several small flocks from all directions keep joining them which results in the formation of a huge flock, which can be visible from long distance. This huge flock suddenly dives into a roost place, such as in the water reeds.

Escape behaviour: In winters these move in flocks. The larger flocks of starlings fly as a single unit with a lot of precision to avoid predators.

4. CONCLUSION

Both bio-physical and anthropogenic habitat conditions have a significant impact on the bird ethology. Some of the notable points concluded are as under;

Bio-Physical Environment

Open waters of huge reservoirs give security to floating birds. As a result thousands of waterfowl spend most of the daytime in the center away from the banks at Chashma Barrage. Droppings of birds throughout the day increase water's fertility, due to which food chain is enriched. The fast wind that often blows in the study area drifts fish to a side where gulls and terns concentrate in large numbers to feed on surfacing tiny fish. Stagnant water habitat provides feeding to the kingfishers.

Anthropogenic environment

Garbage dumping near fish restaurants attracts scavenger species like crows, Common Myna and Pariah Kite in huge numbers. Sometimes, they chase/scare away other bird species. Inside the Wildlife Sanctuary, few acres of silt and sand deposit land are cultivated with wheat in winters which has disturbed the natural habitat of the area's avifauna. There are incidences of illegal hunting and duck netting in the Wildlife Sanctuary. Sociable Plover, White-tailed Lapwing and Green Plover visit the area which may also be shot.

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REFERENCES

[1] Grzimek. Dictionary of Ethological terms. Encylopedia of Ethology. Van Nostrand-Reinhold, NewYork, Toronto, London, Melbourne. 1977; 685-700.

[2] Irshad S., Mirza Z.B. Ecological and Socio-economic linkages of birds of Ravi River Habitats. Pakistan Journal of Zoology. 2011; 43(1):113-122.

[3] Z.B. Mirza. A Field guide to the birds of Pakistan. Book land Publication; 2007.