Pak. J. Bot., 41(5): 2507-2516, 2009.

STUDY OF VEGETATION AND SMOOTH COATED OTTER IN CHOTIARI WETLANDS COMPLEX, SANGHAR, SINDH, PAKISTAN

RAHMATULLAH QURESHI[1*], WASEEM AHMAD KHAN[2] AND BABAR KHAN[2]

[1]*Department of Botany, Pir Mehr Ali Shah Arid Agriculture University, Murree Road, Rawalpindi. Pakistan,*
[2] WWF-Pakistan.

Abstract

A preliminary vegetation and smooth coated otter survey was carried out in the month of October, 2006. The area was divided into 10 vegetation stands on the basis of physiognomic and habitat types. Various vegetation parameters like cover, frequency and density were recorded along each transect line using the line intercept method. Within vegetation stands, a total of 66 species belonging to 50 genera and 23 families were identified. In all, 10 plant communities were constructed based on Summed Dominance Ratio (SDR). The existing vegetation of the area was identified and categorized into 10 plant communities viz., 1) *Fagonia-Senna-Calotropis;* 2) *Pluchea-Dactyloctenium-Ochthochloa;* 3) *Dactyloctenium-Desmostachya-Pluchea*; 4) *Calotropis-Acacia-Alhagi;* 5) *Dactyloctenium*; 6) *Indigofera*; 7) *Desmostachya-Gynandropsis*; 8) *Desmostachya-Dactyloctenium-Indigofera*; 9) *Dactyloctenium* and 10) *Indigofera-Dactyloctenium-Indigofera*. There were 16 species which contributed in the formation of plant communities of the area. Among 10 different locations, *Desmostachya bippinata* was found as a dominant in 4 vegetation stands followed by *Dactyloctenium aegyptium, Indigofera argentea, Pluchea lanceolata* (each in 3 stands); *Calotropis procera, Dactyloctenium scindicum* and *Gynandropsis gynandra* (each in 2 stand). The remaining 9 species e.g., *Acacia nilotica*, *Alhagi maurorum, Corchorus tridens*, *Fagonia indica*, *Indigofera sessiliflora*, *Limeum indicum*, *Ochthochloa compressa*, *Pluchea wallichiana* and *Senna italica* shared in one vegetation stand. In addition, Smooth coated otter (*Lutrogale perspicillata sindica*) commonly known *Ludhro* was found in the project area. However, the Smooth coated otter is one of the least studied species in the country.

Introduction

Chotiari wetlands complex lies in Sindh province on western flanks of Nara desert commonly called as *Achhro Thar* (white sandy desert) at about 30 - 35 km northeast of Sanghar Town. The Reservoir occupies an area of about 18,000 hectares and has water storage capacity of 0.75 million acre feet (MAF) flooding an area of approximately 160 km2. The climate of this area is of tropical to subtropical type. The hottest months are May and June when average maximum daily temperature exceeds 40°C. The coolest months are December to February, when the maximum daily temperatures range from 25 to 30°C. Rainfall is sparse and erratic and is most frequent between July and August when it averages 40 mm monthly.

Various studies have been reported elsewhere on the vegetation (Kandari, 1990; Hajra & Rao, 1990; Asmus, 1990; Shimizu, 1991; Sing & Gupta, 1992; Hussain *et al*., 2000; Qureshi, 2008a). No study was undertaken earlier on the vegetation and Smoot coated otter from the study area. However, preliminary floristic checklist of species has been reported by Qureshi (2008b). The present study was launched to asses the vegetation and Sooth coated otter of the area under study.

*Corresponding author: E-mail: rahmatullahq@yahoo.com; phytotaxonomist@gmail.com
Tel. +9251-9290093; +92300-6730496

Materials and Methods

The vegetation study was undertaken in the month of October, 2006. The area was divided into 10 vegetation stands on the basis of physiognomic and habitat types. Various vegetation parameters like cover, frequency and density were recorded along each transect line using the line intercept method by following the work of Canfield (1940). Ten transects were randomly selected each measuring 50 meter for the determination of vegetation stands. Summed Dominance Ratio (SDR) was obtained for each species that was calculated by adding relative density, relative frequency and relative cover percentages and divided by three. On the basis of SDR, sampled vegetation was delineated into different plant communities. The community within each stand was named as the species having highest SDR irrespective of its habit. When two or more species closely approached each other in order of SDR, the community shared the names of these dominants. The name of the species with highest SDR appears first followed by other dominant species. Species other than the dominants were classified into co-dominants, associates and rare. Plant species were identified with the help of floristic matrials (Jafri, 1966; Nasir & Ali 1970-1989; Ali & Nasir 1989-1997; Ali & Qaiser, 1993-2007; Matthew, 1981-83; Batanouny, 1981; Boulos, 1991; Shetty & Singh, 1987 & 1991; Bhandari, 1978; Qureshi, 2004).

Results and Discussion

1. The vegetation: During the survey, a total of 66 species belonging to 50 genera and 23 families were identified within vegetation stands. Based on Summed Dominance Ratio (SDR), 10 plant communities were constructed. The existing vegetation of the area was dominated by 10 vegetation stands viz., 1) *Fagonia-Senna-Calotropis*; 2) *Pluchea-Dactyloctenium-Ochthochloa*; 3) *Dactyloctenium-Desmostachya-Pluchea*; 4) *Calotropis-Acacia-Alhagi*; 5) *Dactyloctenium*; 6) *Indigofera*; 7) *Desmostachya-Gynandropsis*; 8) *Desmostachya-Dactyloctenium-Indigofera*; 9) *Dactyloctenium* and 10) *Indigofera-Dactyloctenium- Indigofera*. There were 16 species, which contributed in the formation of plant communities of the area. Among 10 different locations, *Desmostachya bippinata* was found as a dominant in 4 vegetation stands followed by *Dactyloctenium aegyptium, Indigofera argentea, Pluchea lanceolata* (each in 3 stands); *Calotropis procera, Dactyloctenium scindicum* and *Gynandropsis gynandra* (each in 2 strand). The remaining 9 species e.g., *Acacia nilotica, Alhagi maurorum,Corchorus tridens, Fagonia indica, Indigofera sessiliflora, Limeum indicum, Ochthochloa compressa, Pluchea wallichiana* and *Senna italica* shared in one vegetation strand. On the basis of SDR, the vegetation stands were constructed and tabulated (Table 1). The communities and their associations are discussed as follows:

Stand # 1: *Fagonia-Senna-Calotropis* (Table 1)

This site is situated on outer side of the embankment locally called as *Harani*. This embankment is newly built therefore, plant species were relatively less in number and only three species were found dominating in the area. The plant community is consisting on *Fagonia indica, Senna italica* and *Calotropis procera*.

Stand # 2: *Pluchea-Desmostachya-Ochthochloa* (Table 1)

Table 1. Showing important values of plant species from Chotiari Wetland Complex.

S. No.	Plant species	Transects/Importance Value Index (IVI)										Freq. %
		St #1	St #2	St #3	St #4	St #5	St #6	St #7	St #8	St #9	St#10	
1	*Acacia jacquemontii* Benth.	-	-	-	-	-	-	-	-	-	2.68	10
2	*A. nilotica* (L.) Del. subsp *indica* (Benth.) Branan	-	-	-	17.49[b]	-	-	-	-	-	-	10
3	*Achyranthus aspera* L.	-	-	-	2.44	-	-	-	-	-	-	10
4	*Aerva javanica* (Burm.f.)Juss.	-	-	-	5.9	2.19	-	-	-	-	-	20
5	*Alhagi maurorum* Medic.	-	-	-	12.05[c]	-	-	-	-	-	-	10
6	*Amaranthus graecizans* L.	-	-	-	1.65	-	-	-	-	-	-	10
7	*Aristida adscensionis* L.	-	-	-	-	-	-	-	-	-	0.62	10
8	*A. funiculata* Trin. & Rupr.	-	-	-	-	-	-	-	-	-	0.74	10
9	*Blepharis sindica* Stocks ex. T. Anders.	-	-	-	-	0.73	-	-	0.75	-	-	20
10	*Boerhavia procumbens* Banks ex Roxb.	-	-	-	-	-	0.69	-	-	-	-	10
11	*Brachiaria ramosa* (L.) Stapf	-	-	-	-	0.79		-	-	1.68	-	20
12	*Calligonum polygonoides* L.	-	-	-	-	3.84	4.69	-	-	-	-	20
13	*Calotropis procera* (Ait.) Ait.f.	8.97[c]	3.72		29.3[a]	0.66	-	3.01	-	-	0.78	60
14	*Cenchrus biflorus* Roxb.	-	-	-	-	-	2.19	1.89	-	0.42	-	30
15	*C. pennisetiformis* Hochst. & Steud. ex Steud.	-	-	-	-	-	-	0.42	-	-	-	10
16	*Citrullus colocynthis* (L.) Schrad.	-	-	-	-	-	-	-	-	-	1.16	10
17	*Cleome scaposa* DC.	-	-	-	-	1.68	-	-	-	-	-	10
18	*Convolvulus glomeratus* Choisy.	-	-	-	2.48	-	-	-	-	-	-	10
19	*Corchorus depressus* (L.) Stocks	-	-	-	-	-	-	2.41	-	-	1.93	20
20	*C. tridens* L.	-	4.8	4.24		8.8	-	3.64	6.98	7.76	0.62	70
21	*Cordia gharaf* (Forsk.) Ehren. ex Asch.	-	-	-	3.32	-	-	-	-	-	-	10
22	*Crotalaria burhia* Ham. Ex Bth.	-	4.19	-	-	1.54	0.97	-	-	-	-	30
23	*Cuscuta chinensis* Lam.	-	-	-	-	-	-	0.99	-	-	-	10
24	*Cynodon dactylon* (L.) Pers.	-	-	-	1.69	-	-	-	-	-	-	10
25	*Cyperus rotundus* L.	-	-	0.38	-	-	-	-	-	-	-	10
26	*Dactyloctenium aegyptium* (L.) Willd.	-	-	31.81[a]	-	22.89[a]	-	3.99	3.31	5.54	19.32[b]	60
27	*D. scindicum* Boiss.	-	-	-	-	-	-	1.68	14.20[b]	40.1[a]	-	30
28	*Datura fastuosa* L.	-	-	-	1.94	-	-	-	-	-	-	10
29	*Desmostachya bipinnata* (L.) Stapf	-	10.33[b]	23.93[b]	-	-	-	39.96[a]	14.59[a]	7.52	-	50
30	*Eragrostis cilianensis* (All.) Lut. ex F.T. Hubbard	-	-	1.57	-	-	-	-	-	-	-	10
31	*E. ciliaris* (L.) R. Br.	-	-	-	-	1.15	-	-	-	-	0.7	20
32	*Euphorbia caducifolia* Haines	-	-	-	-	-	-	-	-	2.08	1.84	20
33	*E. clarkeana* Hk.f.	-	4.41	0.38	-	-	-	-	-	-	-	20

Table 1. (Cont'd.).

S. No.	Plant species	Transects/Importance Value Index (IVI)										Freq. %
		St #1	St #2	St #3	St #4	St #5	St #6	St #7	St #8	St #9	St#10	
34	*Fagonia indica* Burm.f.	77.14[a]	-	-	-	-	-	-	-	-	-	10
35	*Farsetia hamiltonii* Royle	-	4.28	-	-	-	-	-	-	-	-	10
36	*Gisekia pharnaceoides* L.	-	-	-	-	1.25	-	-	-	-	-	10
37	*Gynandropsis gynandra* (L.) Briq.	-	-	-	-	-	-	25.19[b]	2.44	8.05	-	30
38	*Heliotropium crispum* Desf.	-	-	-	-	-	-	0.51	-	-	1.23	20
39	*Indigofera argentea* Burm.f.	-	4.19	-	-	7.83	64.98[a]	0.42	13.52[c]	4.06	14.51[c]	70
40	*I. cordifolia* Heyne ex Roth	-	4.07	-	-	2.23	1.41	-	0.7	-	3.96	50
41	*I. hochstetteri* Baker	-	-	-	-	-	-	-	5.08	-	1.4	20
42	*I. sessiliflora* DC.	-	-	-	-	4.58	-	-	-	1.65	25.23[a]	30
43	*Leptadenia pyrotechnica* (Forssk.) Dcne.	-	-	-	-	-	-	-	-	-	3.91	10
44	*Limeum indicum* Stocks ex. T. And.	-	3.98	-	-	4.52	18.59[b]	-	3.5	-	2.5	50
45	*Lycium edgeworthii* Dunal	-	-	-	-	3.3	-	0.42		1.62	-	30
46	*L. ruthenicum* Murray	-	-	-	-	-	-	-	-	-	1.16	10
47	*Mukia maderaspatana* (L.) M.J. Roem.	-	-	-	4.72	-	-	-	-	-	-	10
48	*Ochthochloa compressa* (Forsk.) Hilu	-	9.42[c]	-	-	3.81	0.74	2.9	3.7	4.83	5.31	70
49	*Panicum turgidum* Forssk.	-	-	-	-	-	-	-	2.45	2.28	1.44	30
50	*Physalis divaricata* D. Don	-	-	-	-	-	-	0.45	-	-	-	10
51	*Pluchea lanceolata* (DC.) C.B. Clarke	-	41.52[a]	8.36[c]	-	7.95	-	-	4.67	1.69	-	50
52	*P. wallichiana* DC.	-	-	-	-	-	-	-	9.42	8.68	-	20
53	*Prosopis cineraria* (L.) Druce	-	-	-	-	7.18	-	0.42	-	-	-	20
54	*P. juliflora* Swartz	-	-	-	6.44	-	-	-	-	-	-	10
55	*Saccharum bengalense* Retz.	-	-	-	4.69	-	-	-	-	-	-	10
56	*Salvadora oleoides* Decne.	-	-	2.56	1.86	2.19	-	2.06		1.57	-	50
57	*Senna italica* Mill.	13.89[b]	5.09	-	-	1.55	-	-	-	-	-	30
58	*Sesuvium sesuvioides* (Fens) Verdi.	-	-	5.4		4.71	-	1.96	-	-	-	30
59	*Tephrosia strigosa* (Dalz.) Sant. & Mahcshw.	-	-	-	-	-	-	-	-	-	0.59	10
60	*Trianthema portulacastrum* L.	-	-	-	-	-	-	-	2.04	-	-	10
61	*T. triquetra* Rottl. and Willd.	-	-	6.89	-	-	-	-	-	-	-	10
62	*Tribulus longipetalus* Viv.	-	-	3.14	-	1.9	2.51	0.95	1.32	0.57	1.95	70
63	*T. ochroleucus* (Maire) Ozenda & Quezel	-	-	-	-	1.92	3.22	4.23	7.06	-	6.72	50
64	*T. terrestris* L.	-	-	-	2.25	0.79	-	2.51	-	-	-	30
65	*Zaleya pentandra* (L.) Jeffrey.	-	-	0.36	-	-	-	-	3.27	-	-	20
66	*Zygophyllum simplex* L.	-	-	-	1.78	-	-	-	-	-	-	10

Legend: St = Stand; a, b and c indicates 1st, 2nd and 3rd dominants respectively.

This transect located inside the embankment on northern side where sand dunes and small wetlands are interspersed. The vegetation stand comprised of *Pluchea lanceolata, Desmostachya bipinnata* and *Ochthochloa compressa.* The other co-dominant and allied species include *Senna italica, Corchorus tridens, Euphorbia clerkiana, Farsetia hemaltoni* and *Crotalaria burhia*. There were 12 species growing in association of dominants of the community.

Stand # 3: *Dactyloctenium-Desmostachya-Pluchea* (Table 1)

This site is called as *Sortham* and encircled by sand dunes representing typical desert flora. The community was comprised of *Dactyloctenium aegyptium, Desmostachya bipinnata* and *Pluchea lanceolata*. The other allied species include *Trianthema triquetra, Sesuvium sessoides* and *Ochthochloa compressa.* There were 12 species contributing in the formation of vegetation of the area. This area represented a tree *Salvadora oleoides*, however, *Cyperus rotundus, Euphorbia clerkiana* and *Zaleya pentandra* were noted as rare species in the area.

Stand # 4: *Calotropis-Acacia-Alhagi* (Table 1)

This site is situated inside the reservoir and called as *Khumbhari Basaat.* The members of plant community include *Calotropis procera, Acacia nilotica* and *Alhagi maurorum*. The other associated species consisting on *Mukia maderaspatana* and *Aerva javanica*. There were 16 species forming the vegetation type of this area. This site possesses trees like *Acacia nilotica, Cordia myxa, Dalbergia sissoo* and *Salvadora oleoides*.

Stand # 5: *Dactyloctenium aegyptium* (Table 1)

This site is located along the roadside leading to Phuleli called as *Kalach*. A monotypic grass *Dactyloctenium aegyptium* was forming thick pockets and heavily infested the area. The other important species of this site include *Corchorus tridens, Pluchea lanceolata* and *Indigofera argentea*. Maximum numbers of species (25 species) were record from this site contributing natural vegetation of the studied area. The most probable reason of phytodiversity of the area could be loamy nature of soil. Two trees viz. *Prosopis cineraria* and *Salvadora oleoides* were also recorded.

Stand # 6: *Indigofera argentea* (Table 1)

This site is situated at the bank of Noon Gharo Lake on sand dunes near a village. *Indigofera argentea* was growing as a single dominant and making dense population in this area. The other co-dominant species was *Limeum indicum* followed by desertic shrub *Calligonum polygonoides*. There were 10 species forming vegetation cover within the site.

Stand # 7: *Desmostachya-Gynandropsis* (Table 1)

This site is located on an island commonly called as *Lude Waro Daro*. This hummocky sand dune was encircled by water body. The dunal area was dominated by *Desmostachya bipinnata* and *Gynandropsis gynandra*. The other important species of this site include *Tribulus ochroleucus, Corchorus tridens, Dactyloctenium aegyptium* and *Calotropis procera.* Twenty-one species were found growing within this site.

Stand # 8: *Desmostachya-Dactyloctenium-Indigofera* (Table 1)

This site is located on another island called as *Pakhori*. The most dominant plant species such as *Desmostachya bipinnata, Dactyloctenium scindicum* and *Indigofera argentea* were forming a community in the studies site. The other co-dominant plant species were *Pluchea wallichana, Tribulus ochroleucus, Corchorus tridens* and *I. sessiliflora*. There were 18 species growing within this site.

Stand # 9: *Dactyloctenium scindicum* (Table 1)

This site is also located on dunal island called *Padhrio*. The monotypic grass *Dactyloctenium scindicum* was forming natural vegetation cover on this site. The co-dominant includes *Pluchea wallichana, Gynandropsis gynandra, Corchorus tridens* and *Desmostachya bipinnata*. Seventeen species were recorded from this site.

Stand # 10: *Indigofera-Dactyloctenium-Indigofera* (Table 1)

The transect is also located on the same island known as *Padhrio* and it is a typical desert site situated at the bank of reservoir. The site represented by good growth of grasses and bushes probably due to monsoonal rains. The area was dominated by *Indigofera sessiliflora, Dactyloctenium aegyptium* and *I. argentea*. The other important species of this locality include *Tribulus ochroleucus, Ochthochloa compressa* and *I. cordifolia.* This site represented by 23 species forming natural vegetation cover of this vicinity.

Single factor ANOVA: The statistics of plant species which contributed in plant association shows that the most dominant species was found *Fagonia indica* with a variance value of 595.058 followed by *Indigofera argentea, Desmostachya bipinata, Pluchea lanceolata* and *Dactyloctenium scindicum* (Table 2; Fig. 1). The least dominant species was *Corchorus tridens*.

Status of taxa: Based on Frequency %, the status of taxa was determined. There were four species commonly found with a 70% frequency percentage whereas, 8 species were frequent within the area. The highest numbers of species (31) were found as very rare with the frequency percentage of 10 (Table 1; Fig. 2).

Similar type of vegetation studies have been reported from in and outside of the country. Hussain *et al*., (2000) studied the vegetation of Ghalegay hills, District Swat and recorded plant associations of three vegetation zones such as Subtropical semi-evergreen, subtropical chir pine and blue pine temperate zones. They constructed three communities within three ecological zones of the study area. Celik *et al*., (2003) studied vegetation of Dilek Peninsula-Great Menderes Delta national park and discovered 3 new plant associations. Likewise, Ahmad *et al*., (2007) studied vegetation of Soon Valley with reference to leguminous plants. The results obtained on various parameters for species importance studied in Chotiari reservoir agree with the work of aforementioned studies. This wetland is located in the Nara Desert and another similar type of study on the either side (Sawan Wari of the Nara desert) has been reported by Qureshi (2008b) agrees with the present investigation on the vegetation. The findings of present work agree with the work carried out by Austin & Heyligers (1989) and Kirk-Patrick (1990).

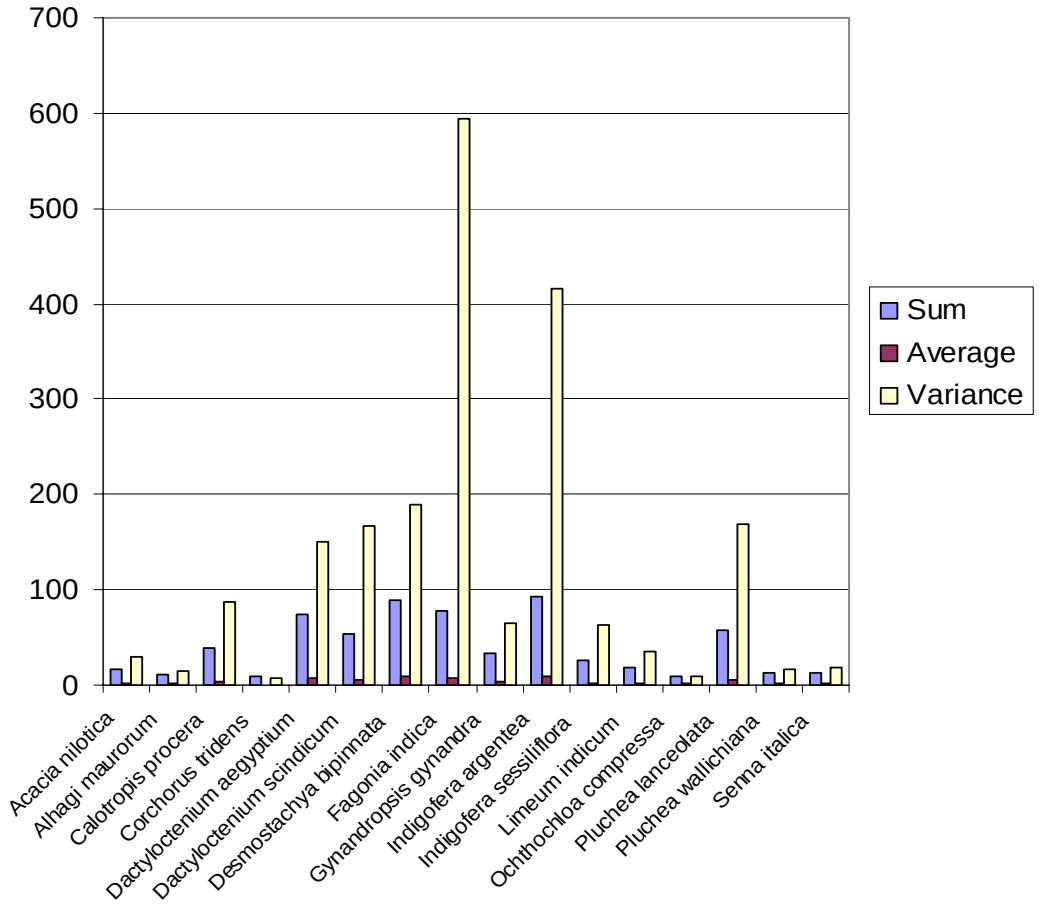

Fig. 1. Graphical presentation of ANOVA Test.

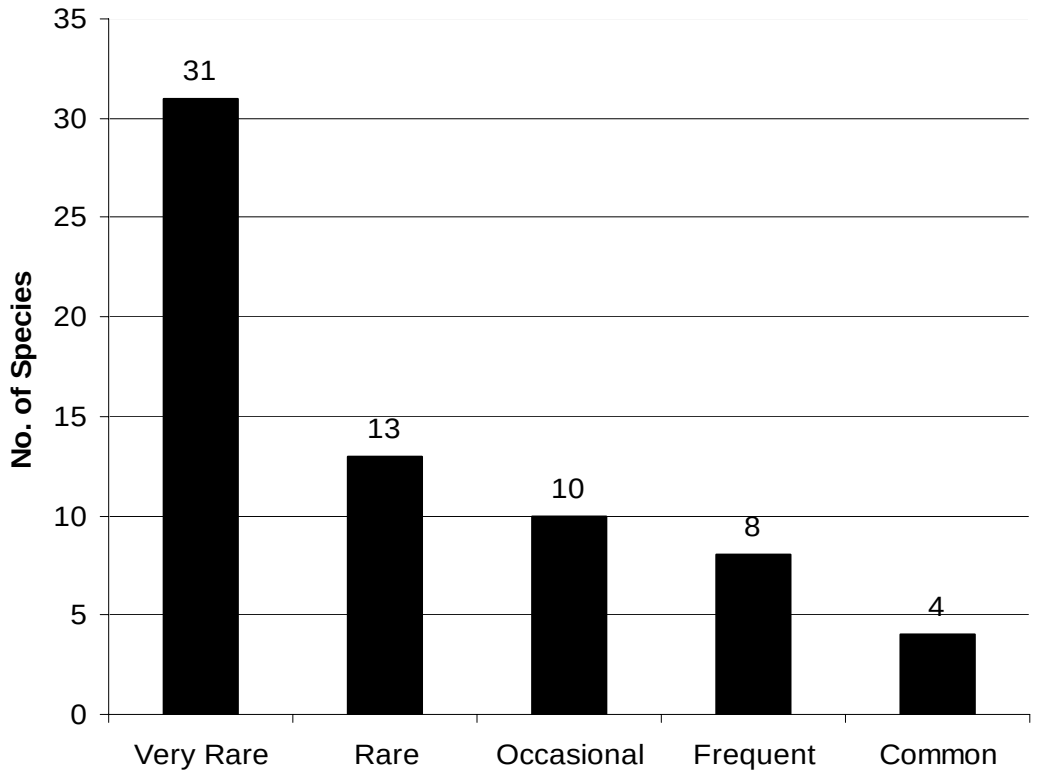

Fig. 2. Status of different Taxa on the basis of frequency (%) ranges.

Table 2. ANOVA of plant communities.

S. No.	Species	Sum	Average	Variance
1.	*Acacia nilotica*	17.49	1.749	30.59001
2.	*Alhagi maurorum*	12.05	1.205	14.52025
3.	*Calotropis procera*	38.27	3.827	88.05462
4.	*Corchorus tridens*	8.8	0.88	7.744
5.	*Dactyloctenium aegyptium*	74	7.4	151.1909
6.	*D. scindicum*	54	5.4	167.1556
7.	*Desmostachya bipinnata*	88.81	8.881	188.9224
8.	*Fagonia indica*	77.14	7.714	595.058
9.	*Gynandropsis gynandra*	33.24	3.324	65.42765
10.	*Indigofera argentea*	93.01	9.301	416.7383
11.	*I. sessiliflora*	25.23	2.523	63.65529
12.	*Limeum indicum*	18.59	1.859	34.55881
13.	*Ochthochloa compressa*	9.42	0.942	8.87364
14.	*Pluchea lanceolata*	57.83	5.783	169.1746
15.	*P. wallichiana*	12.68	1.268	16.07824
16.	*Senna italica*	13.89	1.389	19.29321

Table 3. Observation records of Smooth coated otter at nine different sites.

Site No.	Location	Estimated population	Direct observation	Indirect observations			
				Tracks	Spraint	Holts	Interview
1.	Head Jamrau	10 - 16	√	√	-	-	√
2.	Baqar Lake	4 - 6	-	√	-	-	√
3.	Dhalor Mori	4 - 6	-	√	-	-	√
4.	Khipro Canal	4 - 6	-	-	-	-	√
5.	Nara Canal	8	-	√	-	-	√
6.	Goth Leghari	8	-	√	-	√	√
7.	Chotiari	2 - 4	-	√	√	-	√
8.	Ibopoto	2 - 4	-	√	-	-	√
9.	Power House	8 - 10	√	√	√	-	√
Total population		**50 - 68**					

2. The Smooth coated otter: The Smooth coated otter (*Lutrogale perspicillata sindica*) found in Sindh is the sub-species of Smooth coated otter (Pocock, 1940). It is known as "Oodh Balao" in Urdu and "Ludhro" in Sindhi language.

Status of Smooth coated otter: At two out of the 09 sites in the Chotiari Wetlands Complex (site No. 1 & 9), the otter was directly observed while rest of the seven sites, confirmed on the basis of indirect evidences like tracks, spraints, holts, remains of eaten fish by otter and interviews with locals, fishermen and fish farmers (Table 3).

Population estimation of Smooth coated otter in the project area: The population of smooth coated otter was estimated around 59 (50 to 68) at all the sites (Table 3). This population estimation was based on interviews however at sites 5 and 8; Tracks Count Technique was also applied.

Conclusion

The vegetation of area studied was under immense biotic pressure for forage, fuel wood, timber wood, etc. The anthropogenic activities observed in the investigated area

seems to be a continuous threat as a result, the native species are gradually declining at an alarming rate therefore, a large number of species were found as rare. We conclude that the significance of Chotiari wetlands as an inimitable landscape cannot be overemphasized due to the presence of water bodies and the desert ecosystem within the same location. This combination of different ecosystems within the same area presents a wealth of flora and its subsequent association. Though we could not cover all locations for vegetation assessment, yet this study gives a valuable glimpse. It is therefore, suggested that a detailed study should be launched for understanding the ecology and vegetation of this area.

Major threats to smooth coated otter identified during the survey include: hunting for Fur Trade, habitat degradation, clearing of vegetation and human-otter conflicts due to sharing same habitat and food. The plant species viz. *Typha* spp., *Saccharum benghalensis* and *Phragmites karka* are important for shelter, refuge, cover and breeding place respectively for smooth coated otter. For the protection of the animals, these species are very important which provide habitat for the said animal. However, the aforementioned species are cut annually on large scale for matrices making, thatching of roofs, shelter belts and other household goods which expose the animal for extinction. Therefore, there is immediate need to conserve the natural habitats for the protection of wildlife.

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(Received for publication 22 January 2008)