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EFFECTS OF TASMAN SPIRIT OIL SPILL ON COASTAL BIRDS AT CLIFTON, KARACHI COAST, PAKISTAN

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ABSTRACT

The maximum impact of oil on bird fauna was recorded at the beaches of Clifton where Tasman Spirit Oil Spill (TSOS) took place. After the disaster, its crude oil spread over the feeding grounds of birds. The low bird diversity at Clifton was recorded. Most adverse effects were observed along the beaches of Clifton, Sea View and adjoining areas. Concentrations of polycyclic Aromatic Hydrocarbons were recorded from fresh dead specimens.

Key words: Coastal Birds, TSOS, Ecology, Benthic fauna.

INTRODUCTION

As soon as the news of oil spill was received, the Zoological Survey Department monitored the situation by visiting the coastline of Karachi extending from Khudi creek to Cape Monze to observe the impact of the spill on bird fauna. Several localities of Karachi coast are believed to be excellent feeding and roosting grounds for birds (WWF 2003). Ghalib and Hasnain (1994) have given a comprehensive account of birds of the Karachi coast. Their paper describes 93 species of birds of the Karachi coast, including Clifton beach. Ghalib and Hasnain (1997) have enlisted bird fauna of Clifton. The paper describes 75 species of birds which are reported from Clifton beach. Ahmed et al (1989) have worked on the vertebrate fauna of mangrove swamps of the Sindh coast and have recorded the avifauna of the mangrove areas. Hasan (1994) has described 62 species of birds of mangrove areas of Sindh including the Karachi coast. The paper also describes utilization of mangrove forests by birds. Hasan (1996) has given a comparative biodiversity of mangrove fauna of two localities, the Shah Bunder and the Korangi Creek system of Sindh coast. Hassan, 1996 paper also describes the ecology of birds. The Clifton area of Karachi coast like other parts of Karachi coast provide excellent feeding and roosting grounds for waders, such as oystercatcher, avocet, stilts, plovers, whimbrels, curlews, sandpipers, shanks, turn stone, knot, dunlin, sanderling etc. Beside the shore birds, egrets, herons, gulls, terns and flamingos are commonly observed at Clifton (Ghalib and Hasnain, 1997). According to Ghalib and Hasnain (1997), some rare water birds like velvet scoter (*Melanitta fusca*) and red breasted marganser (*Mergus serrator*) have also been recorded from this area. Waders usually feed in the intertidal zone, particularly during the low tide. The whole intertidal zone provides excellent food for wading birds particularly when the tide is falling. Among the other authors Siddqui *et al.,* (2001) have given comprehensive account of birds of Sindh including Sandspit Cape monze, Korangi/Phitti Creek, Rehri, Shah Bunder, Sando Bunder and Keti Bunder.

Birds either take food from the surface of the substrate or insert their bill into the sediment. Before the oil spill, plenty of food was available for wading birds. The food items which were available at Clifton beach include gastropod species such as *Babylonia spirata, Cyonia carinifera, Natica didyma, Tibia curta, Nassarius obockiensis, Conus magus and Thais persica; bivalve species such as Pholas spp. Cardium spp.* and *Mitra spp.* Among crustaceans, several species of crabs and shrimps are reported from the area. Annelids, polychaetes and aquatic insects were also available for wading birds. For other water birds such as egrets, herons, terns and gulls hundreds of different kinds of fishes were available to make the ecosystem diversified and food rich. But unfortunately recreational activities at Clifton are causing considerable disturbance to the shore birds. Mudflats and other available bird grounds in the area are being lost as a result of construction in the area.

After the recent disaster of the Tasman Spirit, the crude oil spread over the feeding grounds of these birds. Crude oil penetrated up to 1feet to 1.5 feet deep destroying all the remaining food and feeding grounds of birds.

The aim of the present study was to record bird diversity along with distribution along the Karachi coast, particularly the Clifton area after the oil spill and compares the findings with the previous studies. This will allow an evolution of the impact of the oil spill on bird fauna, especially waders which are generally seen in the intertidal zone and can be regarded as a principle indicator species. The Karachi coast has been divided into three zones: Karachi East, Karachi West and Clifton.

KARACHI EAST

Importance of Site: The study areas of Korangi, Phitti and Khudi are located on the southeast of Karachi and are characterized by a single species of mangroves, *Avicennia marina*. These areas are commercially important and provide excellent nursery grounds for young fish and shrimps. Shrimp is major export commodity, making up to 68% of the US$ 100 million that Pakistan earns as foreign exchange from fish exports. (Meynell and Qureshi, 1992). A large proportion of fish caught in Pakistan's coastal waters spend at least part of their life cycle in the mangroves or depend on food webs originating there. The area is a complex of small and large tidal creeks enriched with benthic fauna (Huda and Khan, 1996) which provide excellent feeding, roosting and breeding grounds for birds. Due to habitat diversity the areas also provide excellent refuge for migratory birds (Hasan 1996).

KARACHI WEST

Importance of Site: The area is famous for marine turtle breeding. It is also important wintering, passage and summering ground for shorebirds. Marine turtles live in the nearby marine areas and nest on the beaches. Females go up the sandy beach, dig holes about a meter deep and each deposits 100 – 120 eggs and then covers the eggs with sand. Hatchlings come out of the eggs, usually at night. The hatchlings are attracted by streetlights and go towards the road, where they were run over by vehicles or died from exposure. Due to the intervention and establishment of three enclosures for hatchling mortality by the Sindh Wildlife Department, the problem of hatchling's death has been largely overcome. The large variety of birds including flamingos, migratory waders and waterbirds make the backwaters, mangroves and saltpans, one of the most accessible and interesting areas for birds (Scott, 1989).

CLIFTON

Importance of Site: Clifton is an important staging and wintering area for shore birds and flamingos (*Phoenicopterus ruber*) (Scott, 1989).

METHODOLOGY

Study area: About 70 km coastline of Karachi, stretching from Khudi creek, east of Karachi to Cape Monze, west coast of Karachi consists of muddy beaches, mangroves thickets, sandy beaches, cliffs and backwaters. The area of Karachi east is very famous for mangrove thickets of mangroves (*Avicennia marina*) and serves as breeding ground for shrimp (*Peneoid spp.*). The area of western side is famous for turtle nesting and consists of backwaters, mudflats with mangrove, salt pans, low lying salt affected area, gullies and seasonal scrubs. The area on the southern edge of Karachi city consists of Clifton beach. It is a long sandy beach with small sand dunes and mudflats. The area serves as refuge for migratory as well as resident birds. Some very important species of birds have been reported from this area.

Extensive surveys were undertaken in the area of Clifton Beach from Keamari to Gizri (main affected area); Sandspit, Hawkesbay, Buleji and Cape Monze (west coast of Karachi); Korangi/Phitti Creek system and Khudi creek system (East coast of Karachi). According to our strategy, surveys were conducted at inter tidal zone and at shore waters as follows.

i. Surveys of inter tidal zone

Surveys were conducted at low tide or when the tide was receding. The census of birds was made with the help of spotting scope. To cover the entire area, two to three spots were selected for complete or maximum coverage of the area. In the small creeks where fixing of spotting scope was not possible, observations were made with the help of binoculars.

ii. Surveys in shore waters

On the eastern coast of Karachi, observations were made with the help of spotting scope, as the fixing of spotting scope was possible on small to large islands. For the surveys of Keamari and Clifton waters most observations were made using binoculars. The study areas of all the three sites were kept approximately the same. The birds which were observed again and again from the same site, average numbers were taken for data synthesis. The purpose of repeated surveys was to record maximum number of species (species diversity).

For biodiversity assessment, Shannon-Weinner index (H) was used:

$$H= -[\sum Pi \ln Pi]$$

Where H: is amount of Shannon-Weinner index, Pi is relative abundance of Pith species in the total, and lnPi is natural log of Pi. The objective of assessing biodiversity is to compare site or to provide data that can be used by others for comparing sites and to determined what effect the oil spill may have had on diversity and utilization of the area.

RESULTS

The avifauna, which was observed from Karachi east, comprises of 14 families, 26 genera and 47 species (Table 1). On the analyses of the data, 26 species were found to be common while 12 and 9 species were regarded as less common and rare.

The important bird species which recorded from Karachi east coast during recent surveys include white pelican (*Pelecanus onocrotalus*), grey heron (*Ardea cinerea*), spoonbill (*Platalea leucorodia major*), osprey (*Pandion haliaetus*), oyster catcher (*Haemantopus ostralegus*), little ringed plover (*Charadrius dubius*), kentish plover (*Charadrius alexandrinus*), grey plover (*Pluvialis squatarola*), sanderling (*Calidris alba*), curlew

sand piper (*Calidris ferruginea*), dunlin (*Calidris alpina*), blacktailed godwit (*Limosa limosa*), bartailed godwit (*Limosa lapponica*), whimbrel (*Numenius phoeopus*), curlew (*Numenius arquata*), red shank (*Tringa totanus*), marsh sand piper (*Tringa stagnatilis*), terek sand piper (*Tringa cinereus*) and common sand piper *(Actitis hypoleucos*). A complete list of birds observed from southeastern coast of Karachi is given in table 4.

During surveys, 39 species of birds were observed on west coast of Karachi, comprising of 14 families and 28 genera. On analyses of population status, 22 species of birds were regarded as common while the numbers of less common and rare were 12 and 5 respectively (Table 2).

Some of the important species of migratory birds that were noted on the west part of Karachi coast included little grebe (*Tachybaptes ruficollis*), white pelican (*Pelecanus onocrotalus*), spoonbill (*Platalea leucorodia major*), flamingos with youngs (*Phoenicopterus ruber*), oystercatcher (*Haematopus ostralegus*), avocet (*Recurvirostra avosetta*), little ringed plover (*Charadrius dubius*), kentish plover (*Charadrius alexandrinus*), mongolian plover (*Charadrius mongolus*), sanderling (*Charadrius alba*), curlew sand piper (*Calidris ferruginea*), dunlin (*Calidris alpina*), bartailed godwit (*limosa lapponica*), curlew (*Numenius arquata*), redshank (*Tringa totanus*) and sandwich tern (*Thalassens sandvicenus*). A Complete list of birds observed from Karachi west is given in table 4.

17 species of birds were reported from most affected area, comprising of 6 families and 9 genera, 13 species of birds regarded as common, while 4 species were less common (Table 3). Important bird fauna of Clifton recorded during recent surveys include little ringed plover (*Charadrius dubius*), kentish plover (*Charadrius alexandrinus*), mongolian plover (*Charadrius mongolus*), sanderling (*Calidris alba*), black-headed gull (*Larus ridibundus*), great blackheaded gull (*Larus ichthyaetus*), slenderbilled gull (*Larus genei*), herring gull (*Larus agentatus*), lesser blackbacked gull (*Larus fuscus*), gull-billed tern (*Gelochelidon nilotica*), common tern (*Sterna hirundo*) and little tern (*Sterna albifrons*). A Complete list of birds is given in table 4.

Status:

R = Rare

Lc = Less Common

C = Common

Criteria: R: 1-4 Lc: 5 –15 C: More than 15 for all birds except Brahminy Kite and Osprey.

Occurrence

Wv = Winter Visitor (observed on Karachi coast in winter months)

R = Resident (observed on Karachi coast throughout the year)

These areas are:

1. Clifton: Keamari, National Institute of Oceanography to Dodarya
2. Karachi West: Sandspit-Hawkesbay-Buleji-Cape Monze
3. Karachi East: Bandal Island (West), Bandal Island (East), Khudi Creek,

Korangi-Phitti Creek System and Khudi Creek System

DISCUSSION

The Shannon-Weiner biodiversity index was calculated in order to know the bird species diversity in different localities of Karachi coast. It was calculated based on the abundance of species by the following formula $H= -[\sum Pi \ lnPi]$, where H represents the symbol for the amount of diversity in an ecosystem, Pi represents the relative abundance to the total and the logarithm Pi represents the natural logarithm of it. The Shannon-Weiner is widely used species diversity index. The abundance of species is important. The presence of one individual belonging to a species is not necessarily indicative of the species being present in a large number when measuring biodiversity i.e. there is a need to take the abundance of species into account. There are numerous mathematical expressions for diversity that take both into account. This index assumes that the habitat contains an infinite number of individuals. According to Deshmukh (1986), species richness and relative abundance is the best parameter for measuring the biodiversity of the area.

Different localities of Karachi east were found to be the most diverse during the study period because it has a higher Shannon-Weiner biodiversity index than the others. The overall biodiversity index at Karachi east was estimated to be 2.71 (Table 6) which indicates better environment and rich diversity of avifauna. The amount of biodiversity at Clifton area of Karachi coast is estimated as 1.75 which is comparatively lower than the biodiversity of Karachi coast (eastern side). This indicates Clifton area is not environmentally sound and diversity with respect to avifauna is low. The comparison of biodiversity index of these two localities in respect of wading birds indicates and even worst situation at Clifton, where estimated biodiversity becomes even less 0.48 (Table 6) as compare to biodiversity of Karachi east. Despite the fact that other parts of Karachi coast have higher numbers of birds than Karachi east (Table 6), the number of species (species richness) and equitability of species found in Karachi east make this site more diversified. The biodiversity index (H) at Karachi west is 1.99 for all birds while biodiversity index for waders is about 1.29

The biodiversity of Karachi east (Mangrove areas) can be compared by the biodiversity results obtained by Arshad *et al.,* (2002) in their studies at

Table 1: Diversity of birds at Karachi east

#	Family	Genera	Species	Population status		
				C	LC	R
1	Pelecanidae	1	1			1
2	Phalacrocoracidae	1	3		2	1
3	Ardeidae	3	6	2	3	1
4	Threskiornithidae	1	1		1	
5	Phoenicopteridae	1	1	1		
6	Accipitridae	2	2	2		
7	Pandionidae	1	1	1		
8	Rostratulidae	1	1			1
9	Haematopodidae	1	1		1	
10	Recurvirostridae	1	1	1		
11	Charadriidae	2	6	3	2	1
12	Scolopacidae	5	11	6	3	2
13	Laridae	5	11	9		2
14	Corvidae	1	1	1		
	TOTAL:	**26**	**47**	**26**	**12**	**9**

Table 2: Diversity of birds at Karachi west

#	Family	Genera	Species	Population Status		
				C	LC	R
1.	Podicipitidae	1	1	1		
2.	Pelicanidae	1	1		1	
3.	Phalacrocoracidae	1	1	1		
4.	Ardeidae	3	5	1	4	
5.	Threskiornithidae	1	1		1	
6.	Phoenicopteridae	1	1	1		
7.	Accipitridae	2	2	2		
8.	Pandionidae	1	1			1
9.	Haematopodidae	1	1		1	
10	Recurvirostridae	2	2	2		
11	Charadriidae	3	5	3	1	1
12	Scolopacidae	4	7	4	1	2
13	Laridae	5	10	6	3	1
14	Corvidae	1	1	1		
	TOTAL:	**28**	**39**	**22**	**12**	**5**

Table 3: Diversity of birds at Clifton

#	Family	Genera	Species	Population Status		
				C	LC	R
1.	Ardeidae	2	3		3	
2.	Accipitridae	1	1	1		
3.	Charadriidae	1	3	3		
4	Scolopocidae	1	1	1		
5.	Laridae	3	8	7	1	
6.	Corvidae	1	1	1		
	TOTAL	**9**	**17**	**13**	**4**	

Makran coastal wetlands using the same methodology. The overall estimated biodiversity at Makran coast was 3.13 whereas in present study, the estimated biodiversity of Karachi east is 2.71 which is slightly low. The present study was conducted in October/November and first week of December while the

Table 4: Systematic list of birds showing distribution, numbers and population status in parenthesis on Karachi Coast

#	Species	Clifton	Karachi West	Karachi East	Occurrence
1	Little Grebe (*Tachybaptes ruficollis*)	-	20 (C)	-	Wv
2	White Pelican (*Pelecanis oncrotalus*)	-	12 (Lc)	4 (R)	Wv
3	Great Cormorant (*Phalacrocorax carbo*)	-	50 (C)	10 (Lc)	Wv
4	Indian Shag (*Phalacrocorax fuscicallis*)	-	-	8 (Lc)	Wv
5	Little Cormorant (*Phalacrocorax niger*)	-	-	4 (R)	R
6	Pond Heron (*Ardeola grayii*)	10 (Lc)	12 (Lc)	12 (Lc)	R
7	Reef Heron (*Egretta gularis*)	5 (Lc)	50 (Lc)	20 (Lc)	R
8	Little Egret (*Egretta garzetta*)	10 (Lc)	15 (C)	22 (C)	R
9	Median Egret (*Egretta intermedia*)	-	-	2 (R)	R
10	Large Egret (*Egretta alba*)	-	5 (Lc)	5 (Lc)	R
11	Grey Heron (*Ardea cinerea*)	-	15 (Lc)	14 (Lc)	Wv
12	Spoonbill (*Platalea leucorodia*)	-	12 ((Lc)	6 (Lc)	Wv
13	Flamingo (*Phoenicopterus ruber*)	-	102 (C)	250 (C)	R
14	Pariah Kite (*Milvus migrans)*	62 (C)	50 (C)	160 (C)	R
15	Brahminy Kite (*Haliastur indus*)	-	5 (C)	10 (C)	R
16	Osprey (*Pandion haliaetus)*	-	1 (R)	6 (Lc)	Wv
17	Painted Snipe (*Rostratula bengalensis*)	-	-	1 (R)	R
18	Oystercatcher (*Haematopus ostralegus*)	-	15 (Lc)	250 (C)	Wv
19	Avocet (*Recurvirostra avosetta*)	-	600 (C)	-	Wv
20	Black winged Stilt (*Himantopus himantopus*)	-	150 (C)	5 (Lc)	R
21	Little Ringed Plover (*Charadrius dubius*)	120 (C)	150 (C)	150 (C)	Wv
22	Ringed Plover (*Charadrius hiaticula*)	-	3 (R)	5 (Lc)	Wv
23	Kentish Plover (*Charadrius alexandrinus*)	2000 (C)	150 (C)	108 (C)	R
24	Mongolian Plover (*Charadrius mongolus*)	100 (C)	25 (C)	370 (C)	Wv
25	Greater Sand Plover (*Charadrius leschenaultii*)	-	-	2 (R)	Wv
26	Grey Plover (*Pluvialis squatarola*)	-	-	5 (Lc)	Wv
27	Red-wattled Lapwing (*Vanellus indicus*)	-	5 (Lc)	-	R
28	Sanderling (*Calidris alba*)	50 (C)	2000 (C)	50 (C)	Wv
29	Little Stint (*Calidris minuta*)	-	52 (C)	80 (C)	Wv
30	Curlew (*Calidris ferruginea*)	-	5 (Lc)	26 (C)	Wv
31	Dunlin (*Calidris alpina*)	-	4 (R)	25 (C)	Wv
32	Black-tailed Godwit (*Limosa limosa*)	-	-	6 (Lc)	Wv
33	Bartailed Godwit (*Limosa lapponica*)	-	2 (R)	2 (R)	Wv
34	Whimbrel (*Numenius phaeopus*)	-	-	1 (R)	Wv
35	Red Shank (*Tringa totanus*)	-	25 (C)	500 (C)	Wv
36	Marsh Sandpiper (*Tringa stagnatilis*)	-	-	5 (Lc)	Wv
37	Terek Sandpiper (*Tringa cinereus*)	-	-	10 (Lc)	Wv
38	Common Sandpiper (*Actitis hypoleucos*)	-	50 (C)	25 (C)	Wv
39	Great Blackheaded Gull (*Larus ichthyaetus*)	10 (Lc)	2 (R)	2 (R)	Wv
40	Blackheaded Gull (*Larus ridibundus*)	200 (C)	38 (C)	60 (C)	Wv
41	Brown-headed Gull (*Larus brunnicephalus*)	-	-	1 (R)	Wv
42	Slenderbilled Gull (*Larus genei*)	50 (C)	25 (C)	50 (C)	Wv
43	Herring Gull (*Larus argentatus*)	600 (C)	10 (LC)	1000 (C)	Wv
44	Lesser Blackheaded Gull (*Larus fuscus*)	600 (C)	10 (Lc)	50 (C)	Wv
45	Gull-billed Tern (*Gelochelidon nilotica*)	200 (C)	500 (C)	250 (C)	Wv
46	Caspian Tern (*Hydroprogeni caspia*)	-	8 (Lc)	50 (C)	Wv
47	Sandwitch Tern (*Thalassens sandvicenses*	-	50 (C)	250 (C)	Wv
48	Common Tern (*Sterna hirundo*)	50 (C)	20 (C)	60 (C)	Wv
49	Little Tern (*Sterna albifrons*)	500 (C)	500 (C)	50 (C)	Wv
50	House Crow (*Corvus splendens*)	Many (C)	Many (C)	Many (C)	R

Table 5: Diversity of birds in three localities of Karachi in Nov. Dec. 2003

Area	Families	Genera	Species	C	LC	R
Karachi East	14	27	47	26	12	9
Karachi West	14	28	39	22	12	5
Clifton	6	9	17	13	4	-

Table 6: Shannon-Weiner biodiversity index H values at different parts of Karachi coast.

Area	Abundance (All Birds)	Index H (All Birds)	Abundance (Waders)	Index H Waders)
Clifton	4565	1.75	2270	0.48
Karachi West	4751	1.99	3234	1.29
Karachi East	4013	2.71	1656	2.04

Table 7: Bird diversity at different localities of Karachi coast from 1999-2003

Area	1999	2000	2001	2002	2003	2003 Nov.,Dec.
Clifton	45	34	42	26	34	17
Sandspit, Hawkesbay (Karachi west)	-	-	-	29	30	39 (Area of Cape Monze included)
Korangi (Karachi east)	-	-	-	49	49	47

study period for Arshad *et al.,* (2002) was end of December and first 3 days of January in the areas where human population density is about 30 person/square kilometer (Arshad *et al.,* 2002).

From the comparison of the data of three localities of Karachi, more species of birds were recorded from the vicinity of Karachi east. Similarly the number of common species was more on this part of the coastline. The reason might be habitat biodiversity (β biodiversity) and rich benthic fauna in the area of Karachi east (Huda, 1996, Hasan, 1996), while the avifauna biodiversity at Clifton is much lower with 17 species (Table 5). At Clifton beach, crude oil spill has penetrated up to 1′ - 1.5′ deep in the soil (WWF, 2003), completely destroying the available intertidal zone. 39 species of birds, comprising of 28 Genera and 14 families were recorded from Karachi west which is comparatively lower than Karachi east (which had 47 species). The areas of Karachi west, Hawkes bay and Sandspit require some management (Scott, 1989) but can be considered far better in comparison with avifauna diversity at Clifton (Table 5).

Significantly, while Ghalib and Hasnain (1997) reported 75 species of birds from the Clifton area, the present study recorded only 17 species. This demonstrates that the oil spill seriously affected the avifauna diversity at Clifton.

According to David Li Zuo Wei and Taej Mundkur (2004) more or less same trend in bird diversity was observed from 1999 – 2003 on Clifton beach but during Novmber-December, 2003 after oil spill trends were changed with only 17 number of species on Clifton beach while on Karachi east (Korangi area) trends were not changed and species numbers are almost same. However on west part of Karachi, less number of species was observed in 2002-2003. During present study, the area of Cape Monze was also studied besides areas of Hawkes bay and Sandspit while studies of 2002-2003 were restricted to areas of Sandspit and Hawkes bay only (Table-7).

Some very important protected species of Sindh of the families Ardeidae, Threskiornithidae and Phoenicopteridae have been recorded from Clifton Beach (Ghalib and Hasnain, 1997) but during the recent surveys species of the family Phoenicopteridae (Flamingoes) and Threskiornithidae (Spoonbill) were absent after the oil spill. Species of family Ardeidae were very low in number. According to the waterfowl census of 2002, 166 flamingoes were recorded from the Clifton beach, but none were found during the present survey.

From Clifton only 2270 waders have been recorded during present study while previous studies shows more than 20,000 waders from the same locality (ZSD1988 cited from directory of Asian wetlands). The considerable suppression in avifauna diversity is almost certainly due to the Tasman Sprit oil spill.

According to ZSD's earlier surveys immediately after oil spill, no bird was present in the vicinity of Clifton except crows and kites, and they were there mainly to feed on dead fishes which were quite abundant at Clifton after oil spill. This shows severity of oil spill at Clifton. The first bird appearance was recorded on 17 /10/2003 two months after the oil spill.

The migration of birds from Clifton was due to the contamination degradation of the habitat. The benthic

communities on which birds feed were destroyed due to oil spill. The scarcity of food occurred and birds migrated to nearby beaches of Karachi. Now when the birds have started to return Clifton beach, the accumulation of hydrocarbons in their tissues may occur through feeding on contaminated benthic fauna. The accumulation of PAHs may change their breeding behaviour, migratory pattern population status etc.

Immediately after the oil spill, a few injured birds were recovered from main affected area, Clifton. The birds were unable to fly. Oil had clogged and stick bird's feathers. Cleaning of feathers did not solve the problem. Birds died from shock and injury. However recovery of such birds was in low numbers and most of the loss was in terms of habitat.

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