

Study of the Carcass of Marine Animals Beached after "Tasman Spirit" Oil Spill at Karachi, Pakistan

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Abstract

"Tasman Spirit" oil spill occurred along the coast of Karachi, Pakistan in July 2003. An assessment of the immediate damage of fishes and other animals was made which revealed that a large number of fishes and other animals died immediately after the oil spill. The study further showed that distribution and abundance of marine animals were adversely affected along the beaches of Clifton, Sea View and adjoining areas which were directly affected by the oil spill. Analysis of the tissues of the dead animals revealed presence of high levels of polycyclic aromatic hydrocarbons.

Keyword: "Tasman Spirit" Oil Spill, carcass, polycyclic aromatic hydrocarbons, necropsy

Introduction:

Incident of grounding of oil tanker "Tasman Spirit" occurred in July 2003, which caused a major oil spill along Karachi coast. Following this spill, a large number of fishes and other marine animals were reported dead and beached at Clifton, Sea View and adjoining areas. Present paper describes the species composition, initial post mortem analysis and bioaccumulation of polycyclic aromatic hydrocarbon in the tissues of dead animals collected during and immediately after the oil spill.

About 235 species of fishes have been reported from the nearby mangrove areas on the eastern side of Clifton (Ahmed *et al.*, 1988). Hasan and Ahmed (2000) have estimated the percentage composition of different groups of shrimps and fishes in the area which reveals that shrimp contribute about 22% in the total catch whereas mullets contribute about 15%. Although marine turtles are not reported from Clifton beach but there are important nesting grounds of turtles at Hawkesbay and Sandspit western side of Clifton beach. Two species of marine turtles i.e. *Chelonia mydas* (green turtle) and *Lepidochelys olivacea* (olive Ridley turtle) are known from these beaches (Firdous, 1988). Among cetaceans, Indian humpback dolphin (*Sousa plumbea*) and black finless porpoise (*Neophocaena phocaenoides*) have been reported commonly from coastal waters of Karachi. Beaked sea snake (*Enhydrina schistosa*) is frequently found in the adjacent to Clifton (Hasan, 2004).

Materials and Methods:

Weekly surveys were conducted along the Clifton beach to determine the causes of mortality of

fishes and other marine animals from August to November 2003. Two main sites were selected along the Clifton beach, between old Clifton and sea view and between Dodarya to further east affected by oil spill. The first site was heavily affected, while the second site was less affected by the oil. One kilometer inter-tidal zone was surveyed by four persons along the beach for collection of carcasses.

The dead animals were identified (Munro, 1955; Bianchi, 1985; Hoda, 1988; Roberts 1997), weighed measured and wrapped in aluminum foil and frozen till further analysis.

Before analysis, samples were thawed and tissues of 34 specimens were removed with the help of scalpel and got analyzed at National Institute of Oceanography, Karachi for polycyclic aromatic hydrocarbons (PAHs) by high performance liquid chromatography (HPLC).

Results and Discussions:

Observations made during the major spill (August – October 2003) revealed high mortality of fishes and other animals either due to smearing of oil on the body especially gills or because of toxic effect of oil (Table-I). Out of 95 specimens of dead animals collected were comprised of 25 species of fishes and 5 species of crabs; of these 51 were studied in detailed for length, weight and necropsy. Local administration has carried out cleanup operation on the beach to remove oil, dead animals and affected sand, however, during this period a high mortality was observed. In one of such surveys carried out on 19th August, 2003 about 1,000 fishes were found to be dead in an area of 1 sq km. The study revealed that mullets

Liza tade and *L. vaigiensis* constitute the 50% of the dead animals. *Sardinellas* (*Sardinella spp.*) were observed to contribute 20% of collected specimens. Sea catfishes (*Arius spp.*), croakers (*Johnius spp.*), scat (*Scatophagus argus*), eels (species could not be identified due to mutilation), long-spine tripod fish (*Pseudotriacanthus strigilifer*), scorpion fishes, rays and guitar fishes were other dominant groups.

Two specimens of dead Olive Ridley turtles were collected from Clifton beach on 15th and 21st August, 2003 whereas one live specimen was observed to be beached in the area. The live specimen was smeared with oil. Among marine mammals, one dead black finless porpoise (*Neophocaena phocaenoides*) was collected on 24th August, 2003. One decomposed beaked sea

snake (*Enhydrina schistosa*) was also collected from Clifton beach.

After three months of the oil spill (October 2003 and onward), the number of dead animals decreased substantially. The major groups of fishes observed during this period were grey mullets, croakers, groupers, sardinellas, shads, terapons, ponyfishes, flounders, tripod fishes, soles, seabreams, scats, silver sillagos, queenfishes, flatheads, needle fishes, catfishes and pufferfishes. In addition, crabs (*Charybdis feriatus*, *Portunus sanguinolentus*, *P. pelagicus*, *Matuta planipes* and *Ocypoda votudula*) were also found among the dead fishes. Two dead specimens of olive ridley turtle (*Lepidochelys olivacea*) were collected from Clifton beach on 25th October, 2003 and 5th November, 2003, respectively. One specimen of dead bottlenose dolphin (*Tursiops truncatus*) was also reported on 5th November, 2003.

Table I: Dead animals collected from Clifton beach and adjacent areas after "Tasman Spirit" Oil Spill and Concentration of Polycyclic Aromatic Hydrocarbons (PAHs) in selected animals.

Locality	Collection	Species	L (cm)	W (g)	Comments	PAHs (ppb)
Casino	7-10-2003	Small scaled terapon (<i>Terapon jarbua</i>)	16.8	60	One eye absent. Skin oily. Whole body cavity filled with black substance.	10.33
Clifton (Ship)	17-10-2003	Mullet	12	25	Gills, skin and body cavity filled with black substance.	4.515
"	06-11-2003	Karanteen Sea bream (<i>Crenidens crenidens</i>)	16	70	Gills covered with oil. No gross abnormality seen in internal organs.	19.31
Clifton	21-10-2003	Sardinella (<i>Sardinella sp.</i>)	10	20	Gills and gut filled with black substance.	28.49
"	"	Sole	23	105	Eyes absent, Gills and skin covered with black substance. No abnormality seen in internal organs.	15.46
"	"	Big eyed scad (<i>Selar crumenophthalmus</i>)	20	80	Gills and skin black. Hemorrhage in gut.	15.41
"	"	Belanger's croaker (<i>Johnius belangeri</i>)	24	150	Gills and skin black. No gross abnormality seen in internal organs.	10.96
"	"	Blacked croaker (<i>Nibea maculata</i>)	15.9	52	Gills and skin covered with black substance. No abnormality seen in internal organs.	6.02
"	"	Small scaled terapon (<i>Terapon puta</i>)	13	45	Gills and skin filled with black substance. No abnormality seen in internal organs.	-

Locality	Collection	Species	L (cm)	W (g)	Comments	PAHs (ppb)
"	"	Mullet	13	45	Eyes absent. Gills black. Liver hemorrhagic.	6.08
"	"	Blue swimming crab (<i>Portunus sanguinolentus</i>)	11x 5.9	60	Carapace and internal organs filled with black substance.	20.75
"	"	Square-tail mullet (<i>Liza vaigensis</i>)	21.8	140	One eye absent, lesions on skin and whole body cavity filled with black substance.	-
"	"	Grouper (<i>Epinephelus sp.</i>)	22	100	Gills, skin, mouth black. Internal organs black.	-
"	22-10-2003	Spot-tail needlefish (<i>Strongyleura strongyleura</i>)	34	53	Gills clear, Gut black.	10.55
"	"	Puffer fish	18	85	Gut black	2.75
"	"	Short-nosed tripod fish (<i>Triacanthus biaculeatus</i>)	12.1	22	Black skin. No abnormality seen in internal organs.	5.59
"	"	Small scaled Terapon (<i>Terapon puta</i>) (live)	13	30	No abnormality seen in any part of the body.	11.62
"	25-10-2003	Crab (<i>Portunus sanguinolentus</i>)	2 x 1	14	No gross abnormality seen.	20
Casino	25-10-2003	Mullet	15.6	45	No abnormality seen in skin. Gills, liver, stomach filled with black substance.	11.65
"	25-10-2003	Splendid ponyfish (<i>Leiognathus splendens</i>)	11	25	Gills black. No abnormality seen in internal organs.	-
Marina Club Clifton	1-11-2003	Mullet	11	25	No gross abnormalities. Gills covered with black substance. Whole body blackened due to oil.	11.13
"	"	Bar tailed flathead (<i>Platycephalus indicus</i>)	9	15	No abnormalities seen in gills. Liver ulcerated. Injured tail.	20
Shireen Jinnah Colony	5-11-2003	Silver sillago (<i>Sillago sihama</i>)	16	40	Gills and stomach filled with black substance. No gross abnormality seen at skin and other organs.	7.96
"	"	Saddle grunt (<i>Pomadysis maculatum</i>)	18	80	Gills and skin have seen black. No gross abnormality seen in internal organs.	13.9
"	"	Mullet	16	50	Hemorrhagic gills, Eyes hemorrhagic. Skin covered with oil. Internal organs have also seen oily.	48.54
Marina Club (Ship) Clifton (Ship)	6-11-2003	Long-spined tripod fish (<i>Pseudotriacanthus strigillifer</i>)	15	40	Gills filled with oil.	20.60
"	6-11-2003	Blue spotted flounder (<i>Crossorhombus azureus</i>)	18	64	No abnormality seen.	29.32
"	"	Elongate sole (<i>Solea elongate</i>)	10.2	17	No gross abnormality seen.	-
Clifton (Ship)	6-11-2003	Slender barred pony fish (<i>Scutor insidiator</i>) (live)	9	11	No gross abnormality seen	6.12
"	"	Crab (<i>Charybdis feriatus</i>) (live)	4x2	5	Black carapace, Internal tissues filled with black substances.	6.43
"	"	Small scaled terapon (<i>Terapon puta</i>)	8.5	11	No gross abnormality seen.	-

Locality	Collection	Species	L (cm)	W (g)	Comments	PAHs (ppb)
Shireen Jinnah Colony	"	Needle scaled queen fish (<i>Scomberoides tol</i>)	20	35	No gross abnormality seen	-
"	"	Goby (live)	10	20	No gross abnormality seen	3.27
Clifton near Casino	7-11-2003	Bottlenose dolphin (<i>Tursiops truncates</i>)	300		Body was at least 10 days old.	26.47
"	7-11-2003	Ghost crab (<i>Ocypoda rotunduta</i>)	5x4	80	Carapace and internal organs filled with black substance.	-
"	8-11-2003	Blue swimming crab (<i>Partunus sanguinolentus</i>)	8 x 4	35	No gross abnormality seen.	-
Marina club Clifton	8-11-2003	Unidentified fish	30	200	Gills covered with black substance. Eyes absent. Body cavity filled with black substance.	12.78
"	"	Spotted Scat (<i>Scatophagus argus</i>)	19	10	Gills and skin covered with black substance. Eyes absent. Gut and other organs normal.	44.01
Clifton	10-11-2003	Mullet	16	51	Hemorrhagic eyes, gills covered with black substance. Black substance seen at skin. No gross abnormality seen in internal organs.	7.69
Shireen Jinnah Colony	11-11-2003	Mullet	15	34	Gills black. Eggs found near genital cavity. No gross abnormalities seen generally.	4.37
"	"	Mullet	18.5	30	Eyes absent. Injury at belly. Internal organs clear.	2.02
"	"	Bloch's gizzard shad (<i>Nematalosa nasus</i>)	15.8	44	One eye absent. Gills and whole body organs filled with black substance.	9.11
"	"	Silver sillago (<i>Sillago sihama</i>)	6	5	No gross abnormality seen.	6.39
NIO	15-11-2003	Slender billed gull (<i>Larus genei</i>)	40	230	No abnormality seen.	-
Jackson	17-11-2003	Croaker (<i>Otolithus sp.</i>)	18	85	One eye absent. Gills and skin blackened. Internal organs have been filled with black substance.	-
"	"	Indian Shad (<i>Tenualousa ilisha</i>)	15.5	30	One eye absent. Skin, gills, gut black. Injury at belly. Damaged organs.	-
"	"	Croaker (<i>Otolithus sp.</i>)	26.5	210	One eye absent. Specimen injured. Gills found black. Internal organs black.	-
"	"	Half beak (<i>Hemirhampus sp.</i>)	17	17	Gills, gut black, eyes black. No abnormality seen in internal organs.	-
"	"	Blue swimming crab (<i>Portunus plagicus</i>)	6x 2.5	15	Black carapace, Internal tissues filled with black substance.	-
"	"	Crab (<i>Matuta planipes</i>)	6 x 3	15	No gross abnormality seen.	-

The crud oil of "Tasman Spirit" was observed to affect the eyes, gastrointestinal and respiratory organs of most of the dead animals collected from oil smeared beaches. Fishes and other marine life are known to be affected by choking

of respiratory mechanism, deficiency of oxygen contents in sea water and smearing oils or its highly toxic leached chemicals of crud oil. A high mortality was also observed as an immediate effect of this oil pollution. Long term effect may

include accumulation of oil and its derivatives in the fatty tissues of fishes and other marine animals.

Table-I depicts the impact of oil on dead marine animals collected from Clifton beach and adjacent areas which reveals that most of dead animals have their bodies especially the gills smeared with oil. In some fishes, internal injury was observed but major cause of mortality seems to be the choking of respiratory organs. High level of oil in sea water is reported to cause irritation and cloudiness in eyes, accumulation of crud oil in gills and gastrointestinal tract (Website, 2007).

The highest concentration of polycyclic aromatic hydrocarbons 48.54 ppb was observed in a mullet while *Scatophagus argus* was reported to have a concentration of 44.02 ppb of PAHs (Table-I). Among the other fishes which have high concentrations of PAHs were *Sardinella sp.* (28.50 ppb), *Strongyleura strogyleura* (20.752 ppb), *Platycephalus indicus* (20 ppb) and *Pseudotriacanthus strigifer* (20 ppb). Swimming crabs (*Portunus sanguinolentus*) were reported to have PAHs concentration of 20 ppb. These species are inhabitant of shallow waters along the beaches. Since these species are exposed to oil spill, therefore, as expected, high level of PAH was noticed. Tissue of dolphin was observed to have contained high concentration of PAHs (Table I).

Among fishes caught alive from the area, *Crossorhombus azureus* and *Crenidens crenidens* were observed to have high concentration of PAHs. Based on PAHs concentration, these animal groups follow the potency order such as Fishes (mulletts) 48.54ppb, followed by crab 20 ppb. PAHs concentration as low as 1 ppb is known to exert toxic effects in marine organism (PEPA, 2004).

Conclusion:

Caracas surveys during this study period revealed that a variety of marine organisms killed by the oil spill. The large number of carcasses recorded was the result of direct lethal effects of PAHs. Due to oil spill, the poor water and sediment quality resulted in both lethal and sub lethal damages to marine fished and marine organisms.

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