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# ECO NEWS

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C.P.R. ENVIRONMENTAL EDUCATION CENTRE

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A Centre of Excellence of the Ministry of Environment and Forests, Government of India.

# C.P.R. ENVIRONMENTAL EDUCATION CENTRE

## Established in 1989

- ✯ **1980** - The C.P. Ramaswami Aiyar Foundation starts nature education for teachers and students.
- ✯ **1989** - C.P.R. Environmental Education Centre (CPREEC) established jointly by the Ministry of Environment and Forests and the C.P. Ramaswami Aiyar Foundation as a Centre of Excellence of the Ministry of Environment and Forests. Government of India.

## Our Mission

- ✯ To increase knowledge, awareness and interest among the public about the environment in all its aspects
- ✯ To develop resource materials for environmental education and awareness raising
- ✯ To conduct training programmes for a wide cross-section of people
- ✯ To take up environmental projects for demonstration and research

## Our Activities

- ✯ Training and awareness raising
- ✯ Awareness to and through action
- ✯ Awareness programmes in ecologically fragile areas
- ✯ Conservation of the ecological heritage
- ✯ Research and surveys
- ✯ Generation of resource materials
- ✯ Exhibitions
- ✯ Courses, seminars and symposia

## Facilities

- ✯ Environmental Laboratory
- ✯ Library
- ✯ Computer Division
- ✯ Publications Division

## Geographical Spread

CPREEC's activities extend to

- ✯ Andaman & Nicobar Islands
- ✯ Andhra Pradesh
- ✯ Goa
- ✯ Karnataka
- ✯ Kerala
- ✯ Maharashtra
- ✯ Orissa
- ✯ Tamilnadu
- ✯ Puducherry

## NGO Network

CPREEC has an extensive network of about 600 NGOs. All educational programmes are carried out in partnership with select NGOs, Universities, Colleges and Schools.

## Publications

- ✯ Activity and information books and pamphlets for children
- ✯ Environmental training guides and kits for teachers
- ✯ Researched Publications
- ✯ Colourful and informative posters
- ✯ *ECONEWS* - A quarterly magazine
- ✯ *Indian Journal of Environmental Education*, a peer-reviewed journal

## Exhibitions

CPREEC designs three new exhibitions every year and has a bank of mobile exhibitions that travel all over India.

## Environmental Education

- ✯ Green Schools of India (GSI)
- ✯ Training programmes for Teachers
- ✯ Training programmes for School and College Students
- ✯ Environmental Law Education

## Special Projects

- ✯ National Green Corps (NGC)
- ✯ Biomedical Waste
- ✯ Biodiversity Conservation

## Research and Surveys

- ✯ Sustainable Technologies
- ✯ Surveys of Natural Resources
- ✯ Socio-Economic Surveys
- ✯ Lab to Field Technology Transfer

# Contents

# Conservation of Ousteri lake, Puducherry

**Dr. T. Sundarmoorthy**

Wetlands provide a number of ecological services to mankind and also to living organisms. The survival of wetland birds depends on the ecological status of the aquatic ecosystem and the surrounding terrestrial area. Apart from their ecological value, wetlands are important for their socio-economical and aesthetical value. The Asian wetland supports about 20% of the globally threatened bird species. Unfortunately in India, many wetlands are facing threats due to anthropogenic pressure. The Government of India under the National Wetlands Conservation Programme (NWCP) has identified 115 wetlands for the conservation programme.

Of the 82 wetlands (including large and small wetlands) found in the Puducherry Union territory, Ousteri lake is the only lake which comes under NWCP. Ousteri is the largest lake in Puducherry. The lake is situated near Oosudu village (11° 57' N 79° 45' N). The eastern and northern part of the lake lies in Tamil Nadu State and the remaining area in the Union Territory of Puducherry. The total water spread area of the lake is about 390ha. The climate of Ouestri lake is tropical, the mean annual temperature is 30c; the mean rain fall is about 1311 to 1172mm. The lake has been identified as one of the important wetlands of Asia by IUCN and the lake has been declared as the first bird sanctuary in the Puducherry region in 2008.

The lake attracts a large number of wetland birds during the migratory season. It also supports a variety of fishes and other aquatic organisms. In general, the lake supports a large number of flora and fauna and provides ecological services such as recharging the underground water table and livelihood benefits for the local community.

The villages near the lake are Kadapperi kuppam, Kondimedu and Poothurai, all of which come under the south Arcot district of Tamil Nadu. The Kaliveli lake of Tamilnadu is 16km north of Ousteri Lake and the migratory birds visit both wetlands during the season. Most of the migratory species are from northern countries like Russia and China. The basic details about the Ousteri wetland are available from the Gazetteer of Puducherry and the Public works Department, Government of Puducherry. A few scientific studies are available about Ouestri lake.

The biodiversity richness (see tables) of lake is quite high especially the faunal richness. There are 100 plants, 25 species of fishes, 10 species of spiders, 49 species of butterflies, 10 species of reptiles, 166 species of birds and 14 species of mammals. Of the 25 species of fishes recorded two are endangered and four are vulnerable. The fisheries department introduced some fish species for commercial exploitation; this practice should be stopped to maintain the ecological balance of the lake. The scrub jungle around the lake supports about 49 species of butterflies, these butterflies are not only a food item for the land birds around the lake but also serve as an agent for pollination to the agricultural crops

in the surrounding area. Ten species of amphibians are found in and around the lake; out of this one species (Common Indian toad) comes under the category of vulnerable status as per IUCN.

Among the three turtles, the Indian starred tortoise two lizards (Indian Chameleon and Indian Monitored Lizard) are vulnerable. Among the 16 snake species the Indian Rock Python comes under the list of endangered species. The rich avifauna comprise of 166 bird species, 75 are aquatic and 91are land birds, the White bellied Sea Eagle is an endangered species, the spoon billed sand piper is critically endangered, nine species of birds come under the category of near threatened. Of the 166 bird species, 13 species come under the Schedule I of the Indian Wildlife Protection Act 1972. Among the 14 species of mammals recorded around the lake only the Indian jackal is under Schedule I of the Wildlife Protection Act, 1972.

The Ousteri lake is well recognized by the national and international bodies as an important wintering ground for migratory birds. The habitat protection and improvement are essential for the long term conservation and management of this wetland. The SACON, has prepared a comprehensive management action plan for the long term sustainability of Ousteri lake in 2011. According to their report, the major threats are siltation, weed invasion, agriculture, poaching of birds and unsustainable fishing.

To avoid eutropication of the lake immediate action is required from the local community as well as from the government departments. Tourism activities should be minimized to avoid disturbance to the birds and also to avoid pollution. Dumping of solid waste in

**Figure : 1. Location of Ousteri Lake**

certain areas of the lake bund should be stopped.

When compared to the nearby wetlands, Ousteri Lake is in a better condition. Hence it is very important to prepare an immediate conservation policy for sustainable management of this valuable lake. The research institutions and universities should come forward to monitor the lake ecosystem to know more about the seasonal variation in the species diversity. Such studies will help in understanding the lake ecosystem and its services. Since this lake comes under both Tamilnadu and Pondicherry, it is very essential to constitute a joint scientific committee to advise both governments for better management.

**Table 1 : Biodiversity richness of Ousteri Lake.**

| S.No | Group | Number of Species |
|---|---|---|
| 1. | Plants | 100 |
| 2. | Arachinids | 10 |
| 3. | Fishes | 25 |
| 4. | Butterflies | 49 |
| 5. | Amphibians | 10 |
| 6. | Reptiles | 10 |
| 7. | Birds | 166 |
| 8. | Mammals | 14 |

**Table – 2: List of Fish species recorded from Ousteri lake**

| Sl.No. | Tamil Name | Common name | Scientific Name | IUCN status(1996) |
|---|---|---|---|---|
| 1 | Catla | *Catla | *Catla Catla* | VU |
| 2 | Jilabi Kendai | Tilapia | *Oreochromis mossambica* | Ex |
| 3 | Viraal | Striped Snakehead | *Channa striatus* | LRlc |
| 4 | Rogu Kendai | *Rohu | *Labeo rohita* | LRnt |
| 5 | Kalbasu | Kalbasu | *Labeocalbasu* | LRnt |
| 6 | Mirukula | *Mrigal | *Cirrhinus mrigala* | LRnt |
| 7 | Kezhuthi | Striped Dwarf Catfish | *Mystus vittatus* | VU |
| 8 | Theli | Stinging catfish | *Heteropneustes fossilis* | VU |
| 9 | Koravai | Asiatic snake head | *Channa orientalis* | VU |

| Sl.No. | Tamil Name | Common name | Scientific Name | IUCN status(1996) |
|---|---|---|---|---|
| 10 | Kurali Koravai | Spotted Snake head | *Channa punctatus* | LRnt |
| 11 | Paambu Meen | Giant snake head | *Channa marulius* | LRnt |
| 12 | Vilaangu | Indian Shortfin eel | *Anguilla bicolor* | LRnt |
| 13 | Kulla Kendai | *Grass carp | *Ctenopharyngodon idella* | LRnt |
| 14 | Kendai | *Common carp | *Cyprinus carpio* | Ex |
| 15 | Potla Kendai | Indian Potassi | *Pseudeutropius atherinoides* | EN |
| 16 | Silver Kendai | *Silver carp | *Hympophthalmichthys molitrix* | Ex |
| 17 | Iraal | Prawn | *Fenneropenaeus indicus* | - |
| 18 | Aara | Striped Spiny eel | *Macrognathus pancalus* | LRnt |
| 19 | Kosu Meen | Mosquito fish | *Gambusia affinis* | LRlc |
| 20 | Uzhavai | Sleepy goby | *Glossogobius giuris* | LRnt |
| 21 | Senil | Magur | *Clarias batrachus* | VU |
| 22 | Sellakaachi | Orange chromide | *Etroplus maculates* | EN |
| 23 | Sellavaachi | Green chromide | *Etroplus suratensis* | VU |
| 24 | Vella Kezhuthi | Gangetic mystus | *Mystus cavasius* | LRnt |
| 25 | Kondai Kezhuthi | Long-whiskered catfish | *Mystus gulio* | VU |

*Species introduced by the fisheries department

VU-Vulnerable; LRlc-Low risk-least concern; LRnt-Low Risk-near threatened; EN-Endangered; Ex-Exotic species.

(***Source: SACON report, 2011)***

## Table – 3 List of Arachnids species found in Ouestri

| Sl.No. | Family Name | Comman Name | *Species Name* |
|---|---|---|---|
| 1. | Buthidae | Indian red scorpion | *Hottentotta tumulus* |
| 2. | Scorpionidae | Emperor scorpion | *Pandinus imperator* |
| 3. | Argiope | Grass cross spider | *Argiope catenulata* |
| 4. | Lycosidae | Funnel Web Spider | *Hippasa holmerae* |
| 5. | Sparassidae | Brown Huntsman | *Sparassidae sp* |
| 6. | Thelyphonida | Whip scorpions | *Thelyphonus doriae hosei* |
| 7. | Phyrinidae | Tailess Whipscorpion | *Heterophynus longicornis* |
| 8. | Scolopendridae | Megarian banded centipede | *Scolopendra cingulata* |

| Sl.No. | Family Name | Comman Name | *Species Name* |
|---|---|---|---|
| 9. | Lithobidae | Common banded centipede | *Lithobius variegates* |
| 10. | Scorpionidae | Gaint forest scorpions | *Heterometrus ubicki* |

(***Source: Alexander(2013)***

**Table 4: List of Butterfly Species recorded in and around the Ousteri lake**

| S.No | Name of the Butterfly Species | S.No | Name of the Butterfly Species |
|---|---|---|---|
| 1 | Common Jezebel | 26 | Common Leopard |
| 2 | Chocolate Pansy | 27 | Common Wanderer |
| 3 | Angled Castor | 28 | Rice Swift |
| 4 | Danaid Eggfly | 29 | Common Grass Dart |
| 5 | Striped Tiger | 30 | Common Grass Yellow |
| 6 | Common Evening Brown | 31 | Zebra Blue |
| 7 | Blue Mormon | 32 | Common Cerulean |
| 8 | Plain Tiger | 33 | Banded Blue Pierrot |
| 9 | Small Grass Yellow | 34 | Common Sergeant |
| 10 | Common Castor | 35 | Tiny Grass Blue |
| 11 | Crimson Rose | 36 | Crimson Tip |
| 12 | Lime Butterfly | 37 | Common Jay |
| 13 | Dark Blue Tiger | 38 | Common Bush Brown |
| 14 | Common Crow | 39 | Great Orange Tip |
| 15 | Common Rose | 40 | Yellow Orange Tip |
| 16 | Glassy Tiger | 41 | Dark Cerulean |
| 17 | Lemon Pansy | 42 | Plains Cupid |
| 18 | Tawny Coster | 43 | African Babul Blue |
| 19 | Psyche | 44 | Southern Birdwing |
| 20 | Common Pierrot | 45 | Small Orange Tip |
| 21 | Common Gull | 46 | Chestnut Bob |
| 22 | Common Sailer | 47 | Peacock Pansy |
| 23 | Mottled Emigrant | 48 | Tailed Jay |
| 24 | Common Mormon | 49 | Great Eggfly |

(***Source: SACON report, 2011)***

**Table 5 : List of Amphibian species recorded in and around Ousteri Lake**

| S.No | Family | Common Name | Scientific Name | IUCN Status |
|---|---|---|---|---|
| 1 | Bufonidae | Common Indian Toad | *Duttaphrynus melanostictus* | VU |
| 2 | Dicroglossidae | Water Skipper or Skipper Frog | *Euphlyctis cyanophlyctis* | LRnt |
| 3 | Dicroglossidae | Indian Pond or Green Frog | *Euphlyctis hexadactylus* | - |
| 4 | Dicroglossidae | Cricket Frog | *Fejervarya mudduraja* | - |
| 5 | Dicroglossidae | Indian Bull Frog | *Hoplobatrachus tigerinus* | - |
| 6 | Dicroglossidae | Indian Burrowing Frog | *Sphaerotheca breviceps* | - |
| 7 | Microhylidae | Ornate Narrow-mouthed Frog | *Microhyla ornate* | LRnt |
| 8 | Microhylidae | Narrow-mouthed Frog | *Ramanella* sp. | - |
| 9 | Microhylidae | Lesser or Marbled Balloon Frog | *Uperodon systoma* | LRnt/N |
| 10 | Rhacophoridae | Chunam or Common Tree Frog | *Polypedates maculates* | LRlc |

VU-Vulnerable; LRlc-Low risk-least concern; LRnt-Low Risk-near threatened; EN-Endangered; Ex-Exotic species.

**(*Source: SACON report, 2011*)**

**Table – 6: List of Reptile species recorded in and around Ousteri Lake**

| Sl.No | Common name | Scientific name | Conservation status |
|---|---|---|---|
| **Turtles** | | | |
| 1 | Indian Starred Tortoise | *Geochelone elegans* | VU |
| 2 | Indian Black Turtle | *Melanochelys trijuga* | LR |
| 3 | Indian Flapshell Turtle* | *Lissemys punctata* | LR |
| **Lizards** | | | |
| 1 | Snake Skink | *Lygosoma punctatus* | LR |
| 2 | Common Supple Skink | *Eutropis macularius* | LR |

| Sl.No | Common name | Scientific name | Conservation status |
|---|---|---|---|
| 3 | Common Brahminy Skink | *Eutropis carinata* | LR |
| 4 | Termite Hill Gecko | *Hemidactylus triedrus* | LR |
| 5 | Southern House Gecko | *Hemidactylus frenatus* | LR |
| 6 | Bark Gecko | *Hemidactylus leschnaulti* | LR |
| 7 | Fan-throated Lizard | *Sitana ponticeriana* | LR |
| 8 | Common Garden Lizard | *Calotes versicolor* | LR |
| 9 | Indian Chameleon | *Chamaeleon zeylanicus* | VU |
| 10 | Indian Monitor Lizard | *Varanus bengalensis* | VU |
| **Snakes** | | | |
| 11 | Brahminy Worm Snake | *Ramphotyplops braminus* | LR |
| 12 | Common Sand Boa | *Gongylophis conicus* | LR |
| 13 | Red Sand Boa | *Eryx johnii* | LR |
| 14 | Indian Rock Python | *Python molurus molurus* | EN |
| 15 | Indian Bronze Back | *Dendrelaphis tristis* | LR |
| 16 | Common Vine snake | *Ahaetulla nasuta* | LR |
| 17 | Striped-keelback | *Amphiesma stolata* | LR |
| 18 | Checkered Keelback | *Xenochrophis piscator* | LR |
| 19 | Common Cat Snake | *Boiga trigonota* | LR |
| 20 | Indian Wolf Snake | *Lycodon aulicus* | LR |
| 21 | Indian Kukri | *Oligodon arnensis* | LR |
| 22 | Indian Rat Snake | *Ptyas mucosa* | LR |
| 23 | Spectacled Cobra* | *Naja naja* | LR |
| 24 | Common Krait* | *Bungarus caeruleus* | LR |
| 25 | Russell's Viper* | *Daboia russelii* | LR |
| 26 | Saw -scaled Viper* | *Echis carinatus* | LR |

* Venomous species

**VU-Vulnerable; LRlc-Low risk-least concern; LRnt-Low Risk-near threatened; EN-Endangered;Ex-Exotic species.**

**(*Source: SACON report, 2011*)**

**Table – 7 : List of bird species recorded in and around Ousteri Lake**

| Sl. No. | Family | Common name | Scientific name | Habitat | Status | IUCN status |
|---|---|---|---|---|---|---|
| 1 | Podicipedidae | Little Grebe | *Tachybaptus ruficollis* | A | R | LC |
| 2 | Pelicanidae | Great White Pelican | *Pelecanus onocrotalus* | A | M | - |
| 3 | | Spot-billed Pelican | *Pelecanus philippensis* | A | R | NT |
| 4 | Phalacrocoracidae | Little Cormorant | *Phalacrocorax niger* | A | R | LC |
| 5 | | Indian Cormorant | *Phalacrocorax fuscicollis* | A | R | - |
| 6 | | Great Cormorant | *Phalacrocorax carbo* | A | R | - |
| 7 | | Darter | *Anhinga melanogaster* | A | R | NT |
| 8 | Ardeidae | Grey Heron | *Ardea cinerea* | A | R | - |
| 9 | | Indian Pond Heron | *Ardeola grayii* | A | R | - |
| 10 | | Little Heron | *Butorides striata* | A | R | - |
| 11 | | Purple Heron | *Ardea purpurea* | A | R | - |
| 12 | | Black-crowned Night Heron | *Nycticorax nycticorax* | A | R | - |
| 13 | | Greater Egret | *Casmerodius albus* | A | R | - |
| 14 | | Intermediate Egret | *Mesophoyx intermedia* | A | R | - |
| 15 | | Little Egret | *Egretta garzetta* | A | R | - |
| 16 | | Cattle Egret | *Bubulcus ibis* | A | R | - |
| 17 | | Great Bittern | *Botaurus stellaris* | A | M | - |
| 18 | | Black Bittern | *Dupetor flavicollis* | A | R | - |
| 19 | Ciconiidae | Painted Stork | *Mycteria leucocephala* | A | R | - |
| 20 | | Asian Openbill | *Anastomus oscitans* | A | R | - |
| 21 | | Woolly-necked Stork | *Ciconia episcopus* | A | R | - |
| 22 | Threskiornithidae | Black Headed Ibis | *Threskiornis melanocephalus* | A | R | NT |
| 23 | | Black Ibis | *Pseudibis papillosa* | A | R | - |
| 24 | | Eurasian Spoonbill | *Platalea leucorodia* | A | R | NT |
| 25 | Phoenicopteridae | Greater Flamingo | *Phoenicopterus ruber* | A | M | NT |
| 26 | | Lesser Flamingo | *Phoenicopterus minor* | A | M | NT |
| 27 | Anatidae | Common Poachard | *Aythya ferina* | A | M | - |
| 28 | | Cotton Pygmy-Goose | *Nettapus coromandelianus* | A | R | - |
| 29 | | Eurasian Wigeon | *Anas penelope* | A | M | - |
| 30 | | Common Teal | *Anas crecca* | A | M | - |
| 31 | | Gargany Teal | *Anas querquedula* | A | M | - |
| 32 | | Mallard | *Anas platyrhynchos* | A | M | - |
| 33 | | Northern Pintail | *Anas acuta* | A | M | - |
| 34 | | Northern Shoveler | *Anas clypeata* | A | M | - |
| 35 | | Spot-billed Duck | *Anas poecilorhyncha* | A | R | - |
| 36 | | Unidentified Duck | *Anas* sp. | A | M | - |

| Sl. No. | Family | Common name | Scientific name | Habitat | Status | IUCN status |
|---|---|---|---|---|---|---|
| 37 | Accipitridae | Besra | *Accipiter virgatus* | T | M | - |
| 38 | | Shikra | *Accipiter badius* | T | M | - |
| 39 | | Black Eagle | *Ictinaetus malayensis* | T | R | - |
| 40 | | Crested Serpent Eagle | *Spilornis cheela* | T | R | - |
| 41 | | White-bellied Sea Eagle | *Haliaeetus leucogaster* | A | R | EN |
| 42 | | Black Kite | *Milvus migrans* | T | R | NT |
| 43 | | Black-shouldered Kite | *Elanus caeruleus* | T | R | - |
| 44 | | Brahminy Kite | *Haliastur indus* | T | R | - |
| 45 | | Eurasian Marsh Harrier | *Circus aeruginosus* | A | M | - |
| 46 | | Pallid Harrier | *Circus macrourus* | T | M | NT |
| 47 | | Pied Harrier | *Circus melanoleucos* | T | M | - |
| 48 | | Osprey | *Pandion haliaetus* | T | M | - |
| 49 | Falconidae | Common Kestrel | *Falco tinnunculus* | T | R | - |
| 50 | Phasianidae | Grey Francolin | *Francolinus pondicerianus* | T | R | - |
| 51 | | Indian Peafowl | *Pavo cristatus* | T | R | - |
| 52 | Rallidae | Common Coot | *Fulica atra* | A | R | - |
| 53 | | Common Moorhen | *Gallinula chloropus* | A | R | - |
| 54 | | Purple Swamphen | *Porphyrio porphyrio* | A | R | - |
| 55 | | White-breasted Waterhen | *Amaurornis phoenicurus* | A | R | - |
| 56 | Jacanidae | Bronze-winged Jacana | *Metopidius indicus* | A | R | - |
| 57 | | Pheasant Tailed Jacana | *Hydrophasianus chirurgus* | A | R | - |
| 58 | Charadriidae | Grey-headed Lapwing | *Vanellus cinereus* | A | M | - |
| 59 | | Red-wattled Lapwing | *Vanellus indicus* | A | R | - |
| 60 | | Yellow-wattled Lapwing | *Vanellus malabaricus* | A | R | - |
| 61 | | Grey Plover | *Pluvialis squatarola* | A | M | - |
| 62 | | Little Ringed Plover | *Charadrius dubius* | A | M | - |
| 63 | | Common Redshank | *Tringa totanus* | A | M | - |
| 64 | | Marsh Sandpiper | *Actitis hypoleucos* | A | M | - |
| 65 | | Green Sandpiper | *Tringa ochropus* | A | M | - |
| 66 | | Wood Sandpiper | *Tringa glorioles* | A | M | - |
| 67 | Regurvirostridae | Black-winged Stilt | *Himantopus himantopus* | A | R | - |
| 68 | Laridae | Black-bellied Tern | *Sterna acuticauda* | A | M | NT |
| 69 | | Black-naped Tern | *Sterna sumatrana* | A | M | - |
| 70 | | Common Tern | *Sterna hirundo* | A | M | - |
| 71 | | River Tern | *Sterna aurantia* | A | R | - |
| 72 | | Whiskered Tern | *Chlidonias hybridus* | A | M | - |
| 73 | | White-winged Tern | *Chlidonias niger* | A | M | - |

| Sl. No. | Family | Common name | Scientific name | Habitat | Status | IUCN status |
|---|---|---|---|---|---|---|
| 74 | Pteroclididae | Dunlin | *Calidris alpina* | A | M | - |
| 75 | | Broad Billed Sandpiper | *Limicola falcinellus* | A | M | - |
| 76 | | Curlew Sandpiper | *Calidris ferruginea* | A | M | - |
| 77 | | Spoon Billed Sandpiper | *Eurynorhynchus pygmeus* | A | M | CE |
| 78 | | Ruff | *Philomachus pugnax* | A | M | - |
| 79 | | Little Stint | *Calidris minuta* | A | M | - |
| 80 | | Common Snipe | *Gallinago gallinago* | A | M | - |
| 81 | Columbidae | Rock Pigeon | *Columba livia* | T | R | - |
| 82 | | Laughing Dove | *Streptopelia senegalensis* | T | R | - |
| 83 | | Red Collared Dove | *Streptopelia tranquebarica* | T | R | - |
| 84 | | Spotted Dove | *Streptopelia chinensis* | T | R | - |
| 85 | Psittacidae | Rose-ringed Parakeet | *Psittacula krameri* | T | R | - |
| 86 | Cuculidae | Chestnut-winged Cuckoo | *Clamator coromandus* | T | M | - |
| 87 | | Common Hawk Cuckoo | *Hierococcyx varius* | T | R | - |
| 88 | | Drongo Cuckoo | *Surniculus lugubris* | T | R | - |
| 89 | | Pied-crested Cuckoo | *Clamator jacobinus* | T | R | - |
| 90 | | Asian Koel | *Eudynamys scolopacea* | T | R | - |
| 91 | | Blue-faced Malkoha | *Phaenicophaeus viridirostris* | T | R | - |
| 92 | | Greater Coucal | *Centropus sinensis* | T | R | - |
| 93 | | Lesser Coucal | *Centropus bengalensis* | T | R | - |
| 94 | Strigidae | Barn Owl | *Tyto alba* | T | R | - |
| 95 | | Spotted Owlet | *Athene brama* | T | R | - |
| 96 | Caprimulgidae | Indian Nightjar | *Caprimulgus asiaticus* | T | R | - |
| 97 | Apodidae | Asian Palm Swift | *Cypsiurus balasiensis* | T | R | - |
| 98 | | Crested Tree-swift | *Hemiprocne coronata* | T | R | - |
| 99 | | House Swift | *Apus affinis* | T | R | - |
| 100 | Alcedinidae | Black-capped Kingfisher | *Halcyon pileata* | A | R | - |
| 101 | | Common Kingfisher | *Alcedo atthis* | A | R | - |
| 102 | | Pied Kingfisher | *Ceryle rudis* | A | R | - |
| 103 | | Stork-billed Kingfisher | *Halcyon capensis* | A | R | - |
| 104 | | White-breasted Kingfisher | *Halcyon smyrnensis* | A | R | - |
| 105 | Meropidae | Blue-tailed Bee-eater | *Merops philippinus* | T | R | - |

| Sl. No. | Family | Common name | Scientific name | Habitat | Status | IUCN status |
|---|---|---|---|---|---|---|
| 106 | | Chestnut-headed Bee-eater | *Merops leschenaulti* | T | R | - |
| 107 | | Green Bee-eater | *Merops orientalis* | T | R | - |
| 108 | Coraciidae | Indian Roller | *Coracias benghalensis* | T | R | - |
| 109 | Upupidae | Common Hoopoe | *Upupa epops* | T | R | - |
| 110 | Capitonidae | Coppersmith Barbet | *Megalaima haemacephala* | T | R | - |
| 111 | | White-cheeked Barbet | *Megalaima viridis* | T | R | - |
| 112 | Picidae | Black-rumped Flameback | *Dinopium benghalense* | T | R | - |
| 113 | | Common Flameback | *Dinopium javanense* | T | R | - |
| 114 | Pittidae | Indian Pitta | *Pitta brachyura* | T | R | - |
| 115 | Alaudidae | Ashy-crowned Sparrow Lark | *Eremopterix griseus* | T | R | - |
| 116 | | Rufous-winged Bushlark | *Mirafra assamica* | T | R | - |
| 117 | Hirundindae | Barn Swallow | *Hirundo rustica* | T | M | - |
| 118 | | Pacific Swallow | *Hirundo tahitica* | T | R | - |
| 119 | | Red-rumped Swallow | *Hirundo daurica* | T | R | - |
| 120 | Laniidae | Bay-backed Shrike | *Lanius vittatus* | T | R | - |
| 121 | | Southern Grey Shrike | *Lanius meidionalis* | T | R | - |
| 122 | Oriolidae | Black-hooded Oriole | *Oriolus xanthornus* | T | R | - |
| 123 | | Eurasian Golden Oriole | *Oriolus oriolus* | T | R | - |
| 124 | Dicruridae | Ashy Drongo | *Dicrurus leucophaeus* | T | M | - |
| 125 | | Black Drongo | *Dicrurus macrocercus* | T | R | - |
| 126 | | White-bellied Drongo | *Dicrurus caerulescens* | T | R | - |
| 127 | Artamidae | Ashy Wood Swallow | *Artamus fuscus* | T | R | - |
| 128 | Sturnidae | Brahminy Starling | *Sturnus pagodarum* | T | R | - |
| 129 | | Common Myna | *Acridotheres tristis* | T | R | - |
| 130 | | Rosy Starling | *Sturnus roseus* | T | M | - |
| 131 | Corvidae | House Crow | *Corvus splendens* | T | R | - |
| 132 | | Jungle Crow | *Corvus macrorhynchos* | T | R | - |
| 133 | | Rufous Treepie | *Dendrocitta vagabunda* | T | R | - |
| 134 | Campephagidae | Common Wood Shrike | *Tephrodornis pondicerianus* | T | R | - |
| 135 | Irenidae | Common Iora | *Aegithina tiphia* | T | R | - |
| 136 | Pycnonotidae | Red-vented Bulbul | *Pycnonotus cafer* | T | R | - |
| 137 | | White-browed Bulbul | *Pycnonotus luteolus* | T | R | - |
| 138 | Muscicapidae | Jungle Babbler | *Turdoides striatus* | T | R | - |
| 139 | | White-headed Babbler | *Turdoides affinis* | T | R | - |

| Sl. No. | Family | Common name | Scientific name | Habitat | Status | IUCN status |
|---|---|---|---|---|---|---|
| 140 | | Tawny-bellied Babbler | *Dumetia hyperythra* | T | R | - |
| 141 | | Paradise flycatcher | *Terpsiphone paradisi* | T | R | - |
| 142 | | White-browed Fantail | *Rhipidura aureola* | T | R | - |
| 143 | | Blyth's Reed Warbler | *Acrocephalus dumetorum* | T | M | - |
| 144 | | Greenish Warbler | *Phylloscopus trochiloides* | T | M | - |
| 145 | | Common Tailorbird | *Orthotomus atrogularis* | T | R | - |
| 146 | | Pied Buschat | *Saxicola caprata* | T | R | - |
| 147 | | Indian Robin | *Saxicoloides fulicata* | T | R | - |
| 148 | | Oriental Magpie Robin | *Copsychus saularis* | T | R | - |
| 149 | | Paddyfield Pipit | *Anthus rufulus* | T | R | - |
| 150 | | Ashy Prinia | *Prinia socialis* | T | R | - |
| 151 | | Franklin's Prinia | *Prinia hodgsonii* | T | M | - |
| 152 | | Jungle Prinia | *Prinia sylvatica* | T | R | - |
| 153 | | Plain Prinia | *Prinia inornata* | T | R | - |
| 154 | Motacillidae | Grey Wagtail | *Motacilla cinerea* | A | M | - |
| 155 | | White-browed Wagtail | *Motacilla maderaspatensis* | A | R | - |
| 156 | | Yellow Wagtail | *Motacilla flava* | A | M | - |
| 157 | Dicaeidae | Thick-billed Flowerpecker | *Dicaeum agile* | T | R | - |
| 158 | | Tickell's Flowerpecker | *Dicaeum erythrorynchos* | T | R | - |
| 159 | Nectariniidae | Loten's Sunbird | *Nectarinia lotenia* | T | R | - |
| 160 | | Purple Sunbird | *Nectarinia asiatica* | T | R | - |
| 161 | | Purple-rumped Sunbird | *Nectarinia zeylonica* | T | R | - |
| 162 | Ploceidae | House Sparrow | *Passer domesticus* | T | R | - |
| 163 | | Baya Weaver | *Ploceus philippinus* | T | R | - |
| 164 | Estrildinae | Black-headed Munia | *Lonchura malacca* | T | R | - |
| 165 | | Scaly-breasted Munia | *Lonchura punctulata* | T | R | - |
| 166 | | Indian Silverbill | *Lonchura malabarica* | T | R | - |

**Where- A-Aquatic; T-Terrestrial; M-Migratory; R-Resident; CE-Critically Endangered; EN-Endangered; NT-Near Threatened;**

**S-I-Schedule I; S-IV- Schedule IV. (*Source: SACON report, 2011)***

## Table – 7: List of Mammals recorded from Ousteri Lake

| Sl. No. | Common Name | Scientific Name | status | status | Schedule |
|---|---|---|---|---|---|
| 1 | Spotted deer | *Axis axis* | - | LRlc | IV |
| 2 | Jackal | *Canis aureus* | - | LRlc | I |
| 3 | Jungle cat | *Fellis chaus* | - | - | - |

| Sl. No. | Common Name | Scientific Name | status | status | Schedule |
|---|---|---|---|---|---|
| 4 | Common mongoose | *Herpestes edwardsii* | - | L Rlc | - |
| 5 | Black naped hare | *Lepus nigricollis* | - | LRlc | - |
| 6 | Bonnet macaque | *Macaca radiata* | Southern India | - | II |
| 7 | Indian porcupine | *Hystrix indica* | - | LRnt | IV |
| 8 | Bandicoot rat | *Bandicota indica* | - | LRlc | V |
| 9 | Three-striped palm squirrel | *Funambulus palmarum* | - | LRlc | - |
| 10 | Indian pangolin | *Manis crassicaudata* | - | LRlc | - |
| 11 | Asian Palm Civet | *Paradoxurus hermaphroditus* | - | LRlc | II |
| 12 | Mice | *Mus* sp. | - | - | - |
| 13 | Short-nosed Fruit Bat | *Cynopterus brachyotis* | - | - | - |
| 14 | Flying fox | *Pteropus giganteus* | - | - | - |

**VU-Vulnerable; LRlc-Low risk-least concern; LRnt-Low Risk-near threatened; EN-Endangered; Ex-Exotic species.**

(***Source: SACON report, 2011)***

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# Trees of Chennai Parks

**P. Sudhakar**

Chennai is one of the mega cities in India with less green cover, but one can find few patches of greenery in Chennai like The Guindy National Park, IIT Madras, Theosophical society Adyar, and the Madras Christian College which are in the southern end of the city. Parks in Chennai play a pivotal role in providing green cover in the city. There are about 270 parks maintained by the corporation of Chennai.

An analysis of the data on the flora among 30 parks of Chennai indicates that the species are distributed with a varied frequency. A number of plants are restricted to one or two parks in their occurrence. Many of the trees are also of rare occurrence in the entire flora of Chennai and its neighbourhood (Livingstone & Henry, 1994). They include *Ailanthus excelsa*, *Barringtonia acutangula, Berrya cordifolia, Caesalpinia ferrea, Citrus limon, Clusia rosea, Corypha macropoda, Crateva adansonii* ssp. *odora*, *Eucalyptus torelliana, Guaicum officinale, Hura crepitans, Magnolia champaca, Putranjiva roxburghii, Saraca asoca and Strychnos nux-vomica.* These trees arouse interest due to their form, flowers, rarity and uses.

## Trees of Rare Occurrence

Some of the rare trees of parks seem to have been a part of natural landscape and can be called remnants of past vegetation. *Corypha macropoda* is a rare and endangered species that is restricted to the Coromandel coast and the Andaman and Nicobar islands (Basu and Chakraverty, 1994). This tree is considered sacred. This species has become very rare in Chennai today. Occurrence of this species in Panagal Park not only adds interest to the landscape but is also of conservation importance. *Caesalpinia ferrea* is a species of rare occurrence and its auto-grafting phenomenon along with aesthetic patterns of bark calls for attention. *Barringtonia acutangula*, a semi-aquatic tree is located in three parks, all of which are adjacent to water bodies, though at present these parks are distanced from the water bodies. Both Natesan Park and Nageswara Rao Park were originally lakes which were eventually filled and converted into parks. Both these parks harbour *Barringtonia acutangula* as well as *Borassus flabellifer* as remnant species.

**Trees of Rare Occurrence**

| S.No. | Name of the Trees | No. of Parks in which recorded |
|---|---|---|
| 1 | *Corypha macropoda* | 1 |
| 2 | *Clusia rosea* | 1 |
| 3 | *Eucalyptus torelliana* | 1 |
| 4 | *Hura crepitans* | 1 |

| S.No. | Name of the Trees | No. of Parks in which recorded |
|---|---|---|
| 5 | *Strychnos nux-vomica* | 1 |
| 6 | *Adansonia digitata* | 1 |
| 7 | *Citrus limon* | 1 |
| 8 | *Guaiacum officinale* | 1 |
| 9 | *Artobotrys hexapetalus* | 2 |
| 10 | *Berrya cordifolia* | 2 |
| 11 | *Caesalpinia ferrea* | 2 |
| 12 | *Saraca asoca* | 2 |
| 13 | *Crateva adansonii ssp. odora* | 2 |
| 14 | *Magnolia champaca* | 2 |
| 15 | *Melia azadirach* | 2 |
| 16 | *Ailanthus excelsa* | 2 |
| 17 | *Borassus flabellifer* | 3 |
| 18 | *Dalbergia sissoo* | 3 |
| 19 | *Barringtonia acutangula* | 3 |
| 20 | *Acacia leucophloea* | 3 |
| 21 | *Putranjiva roxburghii* | 3 |
| 22 | *Manilkara zapota* | 3 |
| 23 | *Premna latifolia* | 4 |
| 24 | *Acacia nilotica* | 4 |
| 25 | *Phyllanthus acidus* | 4 |

## Trees of Common Occurrence

A number of trees are common to two thirds of the parks studied. They include both ornamental and other species. Many of these trees are also the commonest trees of Chennai (Sudhakar, 1991; Narasimhan & Pauline, 2010). They include *Azadirachta indica*, *Cassia fistula*, *Delonix regia*, *Ficus benjamina*, *Guazuma ulmifolia*, *Millingtonia hortensis*, *Peltophorum pterocarpum*, *Polyalthia longifolia*, *Pisonia alba*, *Pongamia pinnata*, *Samanea saman*, *Tabebuia rosea*, *Terminalia catappa*, *Thespesia populnea* and *Vitex negundo*. The majority of these trees are well stocked in the nurseries of forest department and other commercial horticultural establishments. Hence distribution and planting of these trees is cheaper and convenient for

landscapers as well as other promoters of parks and gardens. This explains the abundance of these trees in many of the parks. The entire Chennai flora is dominated by four or five trees, namely, *Delonix regia*, *Polyalthia longifolia*, *Peltophorum pterocarpum, Samanea saman* and *Terminalia catappa.* Apart from the easy availability of planting material, the high survival rate of these trees is another reason for their preference and spread. Many of these species are quite hardy, salt and drought tolerant as well as they can withstand cyclones. *Delonix regia* is an exception.

The Corporation of Chennai should set up an arboretum in Chennai and can also protect some of the rare trees found in Chennai.

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# Flowering Trees of Tropical Forests


## M. Kumaravelu


Flowering trees such as the Flame of the forest, *Cassia fistula* and *Glyricidia* are the commonly found flowering trees in the dry deciduous forests of the Nilgiri Biosphere Reserve.

### Flame of the Forest – Butea frondosa:

The Flame of the forest is an indigenous tree species of India. It is a small to medium sized deciduous tree. The bright, flaming scarlet-orange flowers, shaped like the beak of a parrot, are charming and add color to the jungles. The fully bloomed tree without leaves can be seen between March and May. The entire canopy of the tree looks like a flame. Hence, the name Flame of the forests. This tree, which easily germinates

through seeds, is also suitable for avenue plantation in the country. The flame of the forest tree plays a vital role in plant diversity. Birds and lungores are fond of eating the seeds of this tree. The color of the flower attracts many species of bees and insects also.

## Cassia fistula

This stunted tree is commonly known as the golden shower tree and is widespread in dry deciduous forests. During March and April, the entire tree is covered with yellow flowers with no signs of leaves. This tree is native to South Asia, being found all over India, Pakistan, Sri Lanka and Myanmar. Cassia fistula is the state flower of Kerala. During the Malayalam New Year, all over Kerala, people decorate their houses with this "Sarakondrai" flower and also use them for drawing rangoli (pookolam). Thus, this flower gets a kind of spiritual touch during the summer.

The Cassia fistula is also used for medicinal purposes. The flower of this tree is used for treating constipation, ulcer, and piles and for the de-worming. It is generally believed that the fruits of this tree help in purifying the blood. Many Ayurvedic medicines contain the essence of the fruit and flowers which enhances its value.

This beautiful yellow flower called *Cassia fistula* attracts bees and birds at large. During the flowering season (March to May) it adds more aesthetic value to the forests as well. This tree can be easily propagated and planted in countryside parks.

## Gliricidia Sepium

Gliricidia sepium is native to Central America; and is also found all over the dry deciduous forests of the Indian sub-continent. Similar to *Cassia fistula* and Flame of forest, this tree also blooms in summer. The faint purple color flower starts blooming from February of every year. During summer, we can find only the flower and seeds with no leaves at all.

The flowers of this tree attract bees and insects. In the traditional farming system, farmers grow Gliricidia Sepium at the edges of farm lands. Since the leaves are used as green manure, they help fixing nitrogen in the soil. It is interesting to note that farmers believe that the seeds of *Gliricidia sepium* can be used to kill rats.

Each and every native plant species helps directly in the faunal diversity. Small shrubs and herbs provide fodder to herbivores and seeds, and fruits are food for the birds and small mammals. Besides, the ground birds like the babbler and the common and jungle myna construct nests on the shrubs and herbs. Flowering trees provide nectar and honey for the bees and insects. These flowering plants have and bio-aesthetic value which can be promoted in the country side, even while we plan for industries and agriculture zones. This could add aesthetic value as well as to control pollution. In addition, promoting flowering trees will help in reducing the heat waves and to retain and improve the ground water level. A number of flowering trees and shrubs emit fragrance at night, and rainy days. These trees can be planted in the residential areas also to make the areas colorful and fragrant.

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# Significance of Totemism among the Tribes of India

**M. Amirthalingam**

The term totem is of Ojibwe (North American) origin. A totem can be defined as being an object or symbol representing animals or plants that serve as an emblem of a group of people such as a family, clan, group, lineage or tribe that serves as the link to their ancestry or mythic past (Merriam, 2004). Totemism denotes a mystical or ritual relationship among members of a specific social group and a species of animals or plants. However, totemistic beliefs are not restricted to Native American and aboriginal people in North America. They are also widely prevalent among the people of Africa, Arabia, Asia, Australia, Eastern and Western Europe and the Arctic polar region.

The term totemism also has a non-traditional connotation. A person who is not a member of a tribal group or clan but adopting a personal spirit or animal helper can also be brought under the definition of totem. This practice was common during the New Age movement and the mythopoetic men's movement.

Totemism implies respect for and prohibition against the killing and eating of the totemic animals or plants. Underlying this practice is the belief that the members of the group are descendants from a common totemic ancestor and thus are related. Such a group may adopt the group symbol of unity which also becomes the protector of the group. These totems hark back to a mythical past during which a mystical relationship existed between the tribe and the totemic symbol. The group that observes totemism is called the totemic group. Each totemic group is clearly differentiated from the other groups by its own unique totemic symbol.

Totemism can also be defined as a complex of varied ideas and ways of behavior based on a world view drawn from nature (Dagba, et.al., 2013). The totemic group has ideological, mystical, emotional, reverential and genealogical relationship with the totems. It is necessary to differentiate between group and individual totemism (Encyclopaedia Britannica).

There are various ways of viewing the totem for they are considered as a companion, protector or helper. It can also become an object of awe and fear. Sometimes special names and emblems are used to refer to the totem. There is a specific ban on killing and eating the totem animal. Certain totemistic rituals are always followed. A common method of depicting the totem is to erect a totem pole upon which the figure of the totem is carved or painted.

In India, totemism is most widely practiced among the tribal groups. The Santhals are an example of a totemic group which is named after plants and animals. The Kamar tribes have totemic groups named after Netam (tortoise), Sori (a jungle creeper), Wagh Sori (tiger), Nag Sori (snake) and Kunjam (goat). Among the Todas of the Nilgiris the buffalo is the totemic animal. The Toda's economy, culture, morality and naturally their religious life revolves around the totemic animal (Rivers 1906). In Maharashtra, the villages are generally farmed by a biradari or kinship group and even today we can find examples of the clan name usually after a totem like Magar, Landage, Vaji and More.

Another example that can be cited from Maharashtra is that of the Koliya tribe. There is a clear reference in the Jatakas to the Koliyas having the Kol tree (Indian jujube) as the clan totem (Kosambi, 1985, p.23). The same word also means spider and fisherman. Prehistoric fishing camps have been unearthed in Maharashtra and the Koliya caste still continues to fish as an occupation.

According to Kosambi (1964), in Maharashtra, the pipal is the totemic tree of the Pimpleys. A later Vedic Brahmin clan too is named as "Paippalada" named after the pipal tree.
The Kadambas who ruled over present day Karnataka sometime during the 4th and 5th centuries A.D. derived their clan totem from the kadamba tree. In fact, the kadamba tree is still worshipped as a totem by the Gaadas and other tribes of the Western Ghats (Kosambi, 1985, p.37).

Madhya Pradesh in India is the home of many totemic groups such as the Gond, Bheel, Kol, Aurand, Kammar and Saharia. The members of these tribes are mostly illiterate and very poor. Their main economic activity is the collection of wild plants from the forests. The staple food of the Saharia consists of sorghum (*Sorghum vulgare*) maize (*Zea mays*) or sometimes wheat (*Triticum* spp.), which they eat with salt and some leafy vegetables. Some of the taboos that these tribes observe are no marriages between the members of the same clan. They do not even eat the plant to which their clan name belongs.

The Umariya clan is associated with the Umar tree (*Ficus recemosa*), Peepar Barodiya is associated with the Pipal tree (*Ficus religiosa*), the Dhanik clan is associated with the *Dho* plant (*Anogerssas latifolia*), the Semariya clan is associated with *Semal* plant ( *Salmalia indica*), Samria clan is associated with *San* (*Crotolana jucea*), the Salaiya clan is associated with *Salai* ( *Boswellia serrata*)

and Jhilmalia clan is associated with Siris (*Albizzia lebbeck*). Some clans do not eat the flesh of the totem animal. Some Munda tribes of Bihar state are named after plants (Gupta, 1981).

The Sahyadri hills are the home of the Katkaris, a poor poverty stricken forest tribe. They speak a corrupt form of Marathi intermixed with Gujarati words. They live chiefly on roots and herbs and eat flesh. They eke out their living by working as catechu-makers or as daily wage labourers or as gatherers of fire wood. They worship gods such as Chaide and Mhasoba. They also pay obeisance to bhuts and pishachs (ghosts and demons). The community does not have any priest and the tribals themselves perform the marriage ceremonies (*http://archive.is/TgDvc*).

The Mandla Kols of Central India have a number of totemic sects or clans. The Bargaiyan are named after a village called Bargaon, but they connect their name with the *bar* or banyan tree and revere it. At their weddings, a branch of this tree is laid on the roof of the marriage shed and the food is cooked on a fire made of the wood of the banyan and served to all the relatives of the sect on its leaves (Russell and Lai, 1995).

According the folklore of the Saharia tribe of Central India, a marriage party once took shelter under a pipal tree because it was raining. Within a short time the branches and leaves of the pipal tree arranged themselves closely to save the marriage party from the heavy showers. Since this incident, they have been worshipping the pipal tree. It is a totemic tree of the Barodia clan of Central India (Mandal, 1998).

Till today, the bilva tree is the totemic deity of the guardians of the eastern Indian forests, the Santhal tribals (Patnaik, 1993). From ancient times, *vilvam* has been a totemic tree for *Saivaites*. It is always associated with Lord Shiva. It is also called Shiva's Tree, tall, stern, austere with dark leaves, and the trifoliate leaf which symbolizes the three eyes of Shiva. It is said that offerings of water sprinkled with these leaves at any shrine will always remain fresh.

The Mahobia group, whose name is undoubtedly derived from the town of Mahoba, has adopted the mahua tree as their totem, and digging a small hole in the ground they place in it a little water and the liquor made from mahua flowers, and worship it (Crooke, 1926).

According to Verrier Elwin, the Dumariyan clan worships the cluster fig (*Udumbara*) tree for the gift of a child (Gupta, 1991). The Chandan clans of central India worship the sandalwood tree and never harm it.

Even in mainstream Hinduism we can find examples of totemic manifestation. Among the Hindu pantheon of gods the vahana is the mount or vehicle of the god or goddess. For example, the vehicle of Brahma is the swan. It has been argued by some authorities that the worship of the humped bull in pre-Aryan times is evidence of prehistoric worship of the proto-Shiva (Kosambi, 1985, p.18). And finally, the existence of Brahmin gotras with names like Kaushika (from kusha grass) and Bharadwaja (skylark, a bird) means that even traditional Vedic Hinduism was not immune from totemism.

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# Conservation of Marine Faunal Communities in India

**R. Sabesh**

## Introduction

India has a coastline of about 7500 kilometres and nearly twenty five crore people live within fifty kilometres of the coast. The coastal zone is also endowed with a very wide range of ecosystems like mangroves, coral reefs, sea grasses, salt marshes, sand dunes, estuaries, lagoons, etc., The protection of coastal regions has assumed greater importance in recent years due to the ever increasing human population, urbanization and accelerated developmental activities, mainly the anthropogenic activities like dumping of hazardous wastes and letting untreated sewerage and industrial waste into the oceans. This causes tremendous pressure on this fragile ecosystem and affects the life of marine flora and fauna. Invasive species and disease vectors with

high dispersal potential also pose greater global threats to marine biodiversity. Understanding the connectivity is critical both for the designing of the marine reserve networks to protect biodiversity and for the development of conservation strategies to protect species associated with degrading and fragmenting seascapes. This article explores the possibilities of the implications for evaluating threats to marine biodiversity as well as different management options for minimizing such threats.

## Marine faunal diversity in India

The coastal areas of India experiences tropical climate and has a diverse geological and geomorphologic set up which favours a multitude of coastal and offshore marine ecosystems. These costal ecosystems not only protect the coast from the natural disasters but also provide livelihood security to nearly one quarter of the Indian population.

The Indian coast has diverse coastal flora and fauna and some of them are endemic to certain areas. The islands of Andaman & Nicobar, Lakshadweep and the Sunderbans are some of the hot spots where such endemic flora and fauna are found.

India has vast marine bio-resources and is the third largest producer of fishes in the world. About 2,182 species of fishes are found in Indian waters which includes 327 fresh water species listed in IUCN threat categories and 192 endemic fishes (India's fourth National Report to the Convention on Biodiversity). The total fish diversity in the Indian waters is 2,546 species belonging to 969 genera, 254 families and 40 orders.

Various mammals that are present in the Indian waters are also on the endangered list. Out of 120 species of marine mammals occurring worldwide, 25 species of marine mammals belonging to the order Cetacea and Sirenia are reported from Indian waters. Sea cow, Dugong occurs near the shore waters of the Gulf of Mannar, Gulf of Kachchh and the Andaman and Nicobar Islands. Dolphins and whales live or breed in tropical waters.

The euphotic zone of the sea (about 200 m depth) is teeming with phytoplankton, zooplankton, copepods, eggs, larvae of fishes, jellyfishes, molluscs, pelagic fishes, turtles and mammals.

A total of 208 species of Protozoan, Foraminifera, Tintinnid, Dinoflagellate, Sponges, Cnidarian, Hydrozoa, Siphanophores, Polychaetes Crustacea, Copepoda have been reported from India.

Among the four major reef areas of India, the Andaman and Nicobar Islands are found to be very rich in species diversity. The Lakshadweep Islands have more number of species than the Gulf of Mannar. In India, so far only 44 species have been reported and very little attention has been paid to deepwater corals.

For details of faunal diversity please refer to the table-1. The conservation of these faunal resources will help in the sustainability of coastal fishery and thereby ensure livelihood of the coastal communities.

## TABLE-1 ESTIMATED FAUNAL DIVERSITY IN INDIA

| Taxonomic Group | World species | Indian species | % in India |
|---|---|---|---|
| **PROTISTA** | | | |
| Protozoa | 31250 | 2577 | 8.24 |
| Total (Protista) | 31250 | 2577 | 8.24 |
| **ANIMALIA** | | | |
| Mesozoa | 71 | 10 | 14.08 |
| Porifera | 4562 | 486 | 10.65 |
| Cnidaria | 9916 | 842 | 8.49 |
| Ctenophora | 100 | 12 | 12 |
| Platyhelminthes | 17500 | 1622 | 9.27 |
| Nemertinea | 600 | | |
| Rotifera | 2500 | 330 | 13.2 |
| Gastrotricha | 3000 | 100 | 3.33 |
| Kinorhyncha | 100 | 10 | 10 |
| Nematoda | 30000 | 2850 | 9.5 |
| Nematomorpha | 250 | | |
| Acanthocephala | 800 | 229 | 28.62 |
| Sipuncula | 145 | 35 | 24.14 |
| Mollusca | 66535 | 5070 | 7.62 |
| Echiura | 127 | 43 | 33.86 |
| Annelida | 12700 | 840 | 6.61 |
| Onychophora | 100 | 1 | 1 |
| Arthropoda | 987949 | 68389 | 6.9 |
| Crustacea | 35534 | 2934 | 8.26 |
| Insecta | 853000 | 53400 | 6.83 |
| Arachnida | 73440 | | 7.9 |
| Pycnogonida | 600 | | 2.67 |
| Pauropoda | 360 | | |
| Chilopoda | 3000 | 100 | 3.33 |
| Diplopoda | 7500 | 162 | 2.16 |
| Symphyla | 120 | 4 | 3.33 |
| Merostomata | 4 | 2 | 50 |
| Phoronida | 11 | 3 | 27.27 |
| Bryozoa (Ectoprocta) | 4000 | 200 | 5 |
| Endoprocta | 60 | 10 | 16.66 |
| Brachiopoda | 300 | 3 | 1 |
| Pogonophora | 80 | | |
| Praipulida | 8 | | |
| Pentastomida | 70 | | |
| Chaetognatha | 111 | 30 | 27.02 |
| Tardigrada | 514 | 30 | 5.83 |
| Echinodermata | 6223 | 765 | 12.29 |

| Taxonomic Group | World species | Indian species | % in India |
|---|---|---|---|
| Hemichordata | 120 | 12 | 10 |
| Chordata | 48451 | 4952 | 10.22 |
| Protochordata (Cephalochordata+Urochordata) | 2106 | 119 | 5.65 |
| Pisces | 21723 | 2546 | 11.72 |
| Amphibia | 5150 | 209 | 4.06 |
| Reptilia | 5817 | 456 | 7.84 |
| Aves | 9026 | 1232 | 13.66 |
| Mammalia | 4629 | 390 | 8.42 |
| **Total (Animalia)** | **1196903** | **868741** | **7.25** |
| **Grand Total (Protosticta+Animalia)** | **1228153** | **871318** | **7.09** |

*Source: Animal Discovery 2011*

## Issues of Marine and Coastal Environment

Several ecosystems like coral reefs, mangroves, estuaries etc., have witnessed high species faunal diversity. Historical evidences reveal that the marine ecosystems at present are a cause for concern. In India, the issue of loss of marine biodiversity emerged two and half decades ago. Unlike the larger mammals and birds smaller marine organisms like zoo plankton and several other smaller invertebrates rarely appear on the endangered/extinct list. Although the fossil record is evident of such extinctions, the ever increasing human population is exerting a tremendous influence on the oceans, thus fundamentally changing their biological diversity and threatening a critical part of the Earth's life support system.

The majority of human activities threaten marine biodiversity, including coastal development, destruction of marine habitats, introduction of invasive species, overfishing, dumping of agricultural waste products, pesticides, hydrocarbons, toxic industrial wastes etc.

Excessive fishing and selective fishing are threats for sustaining biodiversity. Oceanic intake of anthropogenic carbon dioxide is altering the seawater chemistry and is affecting the marine biota. Elevated partial pressure of carbon-di-oxide levels is causing calcium carbonate saturation in many regions. The ability of marine animals, most importantly Pteropod, Mollusks, Foraminifera and some benthic invertebrates to produce calcareous skeletal structures is directly affected by seawater. $CO_2$ influences the physiology of marine organisms as well through acid-base imbalance and reduced oxygen transport capacity.

Several coastal related issues call for international cooperation and some of these were discussed in the seventh session of UN Commission of Sustainable Development (CSD) with respect to

1. Imposing a ban on the use of persistent organic pollutants (POPs) such as DDT

2. Transfer of the expertise and technology to the developing countries like India in order to popularize eco-friendly insecticides and pesticides.

Coastal management strategies also need to consider the socio-economic and cultural aspects of the coastal population, besides environmental issues.

## Marine pollution Control initiatives

We should recognize the ecological, human and economic significance of the coastal areas and the resources that already exist. In an effort to reduce marine pollution, the direct dumping of pollutants such as toxic chemicals, untreated sewerage, and garbage directly into the ocean has been banned across the world since 1972. The problem does not stop there since many of the particles are microscopic; they stick to the tiny particles of food which are eaten by the filter feeding planktons. Several fishes along the food chain start eating such planktons, then larger and larger species of fish eat those fishes, until the pollution ends up with us when we consume such sea food.

In order to protect and conserve the coastal environment, the Ministry of Environment & Forests has issued the Coastal Regulation Zone Notification dated 19.2.1991 under the Environment (Protection) Act, 1986. This notification regulates all developmental activities in the Coastal Regulation Zone area. The CRZ policy, the goals of biodiversity conservation and local people's livelihood security need to be placed at the centre stage of all decision making pertaining to infrastructure development or economic considerations of revenue generation.

## Conclusion

Even though air pollution and water pollution originate on the land it eventually reaches the sea water. Both scientists and policymakers have to focus on marine pollution and strategies to safeguard marine biodiversity. A healthier marine environment needs integrated policy approaches, which involve scientific disciplines to address the complexity of the interaction between the social and natural systems. Our goal should not be just conservation, but also enhancement of the living and nonliving resources of the coastal zone. We should rehabilitate all damaged mangrove wetlands and involve the local youth in preserving them. The next decades will be an important time in the evolution of the international law of the sea. We need to have lot of creative thinking and changes in our life style in order to have pollution free oceans, thereby safe guarding marine biodiversity. The global scientific and political community should show deep commitment and respond effectively to all international treaties and conventions. Partnerships and cooperation in different sectors would further strengthen all such national and international marine biodiversity conservation initiatives. Let us hope that the Cop-11 and other international treaties will provide us internationally acceptable customized and comprehensive solutions to conserve our invaluable marine biodiversity.

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# Micro Plastic: Ocean of Plastic Debris Endangering Life

**U.Thinavukkarasu**

An innocent act of washing your face with exfoliating cream may end up adding plastic debris to the water bodies and oceans. It is shocking to know that many of our personal care products use micro plastic beads as abrasive agents in exfoliating cosmetic products. The list of products is long -ranging from exfoliating soaps, facial cleansers, shower gel, instant-whitening creams shampoos, eyeliners, lip gloss, deodorant and sun block sticks to many other personal care cosmetic products which may also contain plastic particles.

It is even more shocking that even tooth pastes use plastic micro beads as abrasive agents. An unwitting victim may wash down in the drains and pollute the precious water resources. Scientific studies have shown that these micro-plastic particles come back to humans in the form of micro-plastic ingested sea food.

The problem of plastic pollution in the marine environment was reported in the 1970s and it was initially thought to harm marine animals. Now in the 2000s, it has assumed a greater magnitude and shape, thanks to our consumeristic culture and indiscriminate misuse of plastic products. Recently microplastic pollution is attracting the attention of the scientific community around the world, for persistent organic pollutant laden microplastic and poisoning of the food productivity base of oceans.

## Plastic

Modern Plastic, a scientific innovation of the twentieth century has many advantages if it is appropriately used. Basically, a synthetic polymer derived from petroleum (crude oil) it is mismanaged and mounting plastic wastes are creating a problem for the biosphere and life.

The Central Pollution Control Board, Government of India, defines plastics by quoting references such as

"*non-biodegradable, synthetic polymers derived primarily from petro-fossil feedstock and made-up of long chain hydrocarbons with additives and can be moulded into finished products" (excluding compostable plastic or polymer confirming IS/ISO 17088:2008)*

The global demand for plastic is around 245 million tones. India consumes about 8 million tones of plastic every year (2008). One third of global production of plastic resins is used for creating packaging materials especially for consumer products. Most of plastic packaging, which roughly accounts for 40% of the plastic production, ends up as plastic waste without any scientific management intervention. In India, approximately around 5.6 million tones of plastic waste are generated every year. The worrisome part of the affair is that most of the plastic waste generated in the world finds its way to the oceans through sewers, rivers and other water bodies.

Classes of plastics that are commonly encountered in the marine environment.

| Plastic Class | | Specific Gravity | Percentage production[#] | Products and typical origin |
|---|---|---|---|---|
| Low-density polyethylene | LDPE LLDPE | 0.91–0.93 | 21% | Plastic bags, six-pack rings, bottles, netting, drinking straws |
| High-density polyethylene | HDPE | 0.94 | 17% | Milk and juice jugs |
| Polypropylene | PP | 0.85–0.83 | 24% | Rope, bottle caps, netting |
| Polystyrene | PS | 1.05 | 6% | Plastic utensils, food containers |
| Foamed Polystyrene | | | | Floats, bait boxes, foam cups |
| Nylon | PA | | <3% | Netting and traps |
| Thermoplastic Polyester | PET | 1.37 | 7% | Plastic beverage bottles |
| Poly(vinyl chloride) | PVC | 1.38 | 19% | Plastic film, bottles, cups |
| Cellulose Acetate | CA | | | Cigarette filters |

[#] Fraction of the global plastics production in 2007 after (Brien, 2007).

*-Source: Micro Plastic in the Marine Environment,Anthony L.Andrady, Marine Pollution Bulletin 62 (2011) 1596-1605*

## Microplastic

Scientists involved in research say that micro-plastics are plastic particles which are smaller than 1mm in size, where as some others suggest that plastic particles lesser than 5mm in size are considered as micro-plastic. Whether it is 1mm or 5mm, the tiny bit or sub microscopic size of plastic is considered as micro-plastic.

## Source of Micro-plastic

The source of micro plastic may be direct from consumer products like micro beads in personal care products or it may be through disintegration, embrittlment, microcraking of larger plastic (macro plastic) waste materials into micro plastic pollutants.

Micro plastic beads are primarily made of Polyethylene (PE) and Polypropylene (PP). However, with the growth of industrial and cosmetic innovations, other plastic resin types such as Polyethylene Terephthalate (PET), Polymethyl methacrylate (PMMA) and Nylon are used in making plastic micro beads. The size and shape of the beads vary based on the requirements. It generally ranges from 0.1mm to 0.5mm in size.

The disintegration of larger plastic materials may happen due to thermal action or wave currents. Use and throw plastics, carry bangs, plastics used for packaging are the main sources of plastic debris created through domestic usage,

tourism, recreation, lifestyle and industrial activities.

The micro plastic source is divided in to two major sources, namely Primary micro plastics and Secondary micro plastics.

**Primary Micro plastics** are produced directly as micro plastic particles either for direct or indirect use. The example for direct use of micro plastics is abrasive agents in industrial products and scrub/ screen materials in personal care products. The example for indirect use of micro plastics is that it is used as precursors for consumer products.

**Secondary Micro plastics** are those micro sized (>1/>5 mm) plastic materials resulting from break down or fragmentation of larger plastic waste materials or debris especially in water bodies or in oceans due to mechanical, thermal or chemical force. This also includes shed synthetic textile fibers resulting from washing, which are almost less than 1mm in size and constitute a major micro- plastic pollutant in sewerage. There are instances in recent times where scientists have recorded even 1.6 µ.m. diameter plastic micro particle in the oceans.

## Micro plastic in personal care products

All over the world and especially in westernized nations, consumer products including personal care products contain 'specially produced micro plastic' in various sizes and shapes. They are used in cosmetics as exfoliants or "scrubbers". Patenting of micro plastic scrubbers in the 1980s in cosmetics promoted the use of micro-plastic under various names such as 'micro-beads' or micro-exfoliates.

Natural alternatives like Coco-bean, apricot shells, oatmeal, ground almond and many such homemade recipes are also available as readymade products. Preferring the natural alternatives to plastic micro-beads is the way out for this growing micro-plastic contamination.

## Plastic Debris in Oceans

With the global population touching seven billion people, throwing plastic everyday and creating monuments of plastic debris around world as their testimony to 'wasteful' lifestyle, the problem of micro plastic contaminants in the oceans, seas, gyres, bays, back waters, rivers, lakes and finally to our food plates will grow in leaps and bounds. The discovery of 'Great Pacific Garbage Patch' in 1997 by Captain Charles Moore brought the 'floating plastic debris' in ocean gyres to lime light. Now, marine scientists and oceanographers are revealing that five such plastic debris gyres are associated with ocean currents around the world.

## Micro plastic fragments as seen here at 10X magnification


"Microbeads"- "polyethylene" as an ingredient and Competing products which contain sustainable alternatives

**Picture Source:** http://5gyres.org/media/5_Gyres_Position_Paper_on_Microplastics.

## Impacts of micro plastics in the environment

The modern society of the world has created an 'Ocean of Floating Plastic Debris' as its hallmark. The growing population, consumerism, throwaway culture, intensifying environmental challenges will further spread the plastic menace beyond imaginations. Embrittled macro plastic debris and 'created micro plastic beads' has a great impact on the aquatic and marine biota. Marine biologists have reported ingestion of micro plastic among Zooplanktons, sea cucumbers, mussels, oysters, lobsters, fish and birds.

In the 1960s, plastic fragments were first identified in the guts of sea birds. Around 44% of marine bird species are known to ingest plastic pieces. There are even records of horrifying instances of 'black-footed albatross feeding plastics granules' to its chicks.

To add further, owing to the proliferation of micro plastic, the sea water is being contaminated with residual chemicals and persistent organic pollutants (POPs). The POPs that occur universally in sea water at very low concentrations are picked up by microplastics through partitioning. The hydrophobicity of POPs promotes a higher level of concentration in microplastic particles.

In a nutshell, microplastics act as a carrier for other dangerous pollutants like DDT & PCBs. When toxin-laden micro-plastics are ingested by marine organisms, it creates a food web ladder to 'bio magnification' of lethal toxins in the marine biota to higher trophic levels, including human beings.

Next time, when you toss a plastic carry bag outside or wash your face down in the drain with exfoliate soap, stop refrain and save yourselves.

New York state seeks to become the first in the nation to ban plastic microbeads commonly found in cosmetics after the tiny plastic beads have been found accumulating at "alarmingly high levels" in New York waterways.

Microbeads are commonly used as an abrasive in over 100 products, including facial scrubs, soaps, shampoo and toothpaste. The Microbead-Free Waters Act, which was introduced Tuesday, would prohibit the production, manufacture, distribution and sale in New York of any beauty products, containing plastic particles less than five millimeters in size.....

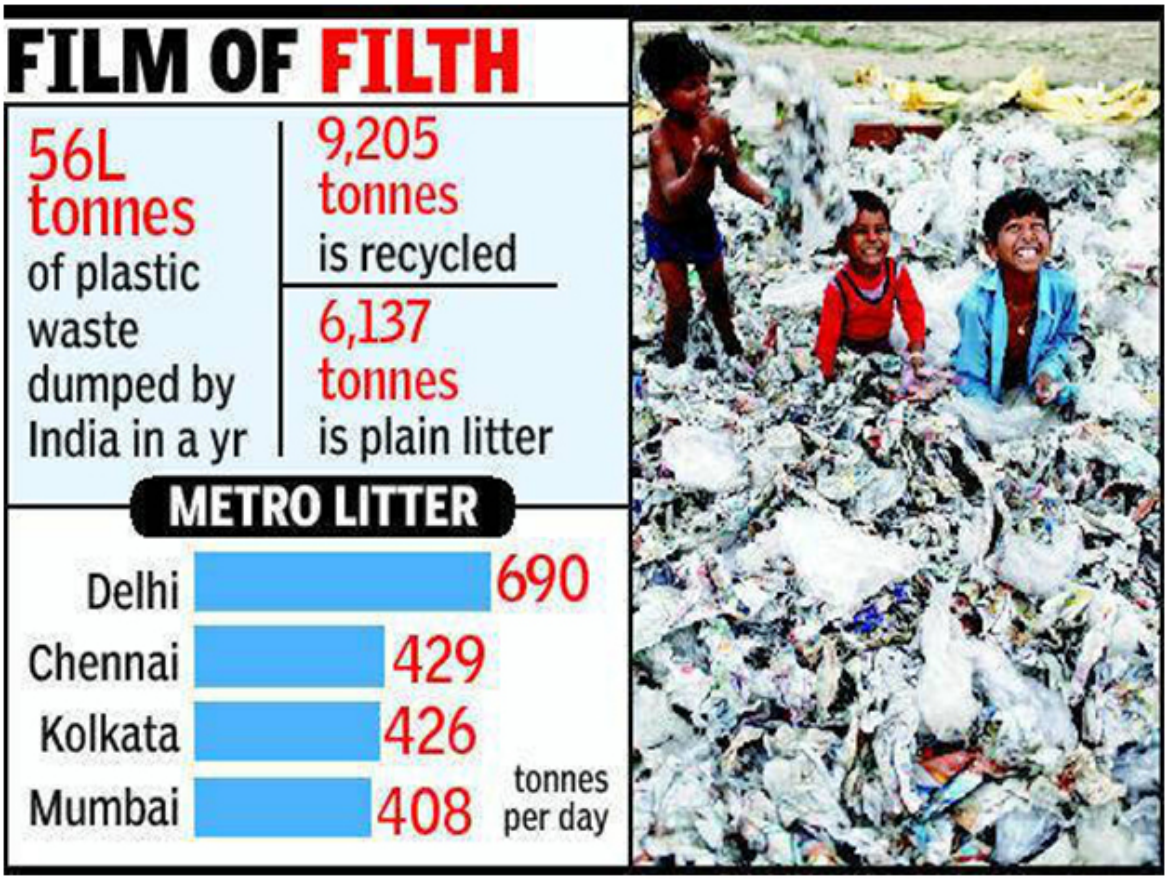
.....The proposed legislation comes after cosmetics companies including Procter & Gamble, Unilever, Johnson & Johnson, and Colgate-Palmolive have already committed to phasing out the use of microbeads in their products.

-**CBS News, *February 11, 2014.***

*"India's retail beauty and cosmetics industry, currently estimated at $950 million, is likely to almost treble to $2.68 billion by 2020, experts said.*

Annual growth in the Indian beauty and cosmetics markets is estimated to remain in the range of 15-20 per cent in the coming years, twice as fast as that of the US and European markets".

**- The Times of India, December 24, 2013**




**Source: The Times of India, April 4, 2013**

We are sitting on a plastic time bomb," - Supreme Court

"We are sitting on a plastic time bomb," the Supreme Court said on Wednesday after the Central Pollution Control Board (CPCB) informed it that India generates 56lakhtonnes of plastic waste annually, with Delhi accounting for a staggering 689.5 tonnes a day.

"Total plastic waste which is collected and recycled in the country is estimated to be 9,205 tonnes per day (approximately 60% of total plastic waste) and 6,137 tonnes remain uncollected and littered," the CPCB said.

**- The Times of India, April 4, 2013**

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# Present Scenario of Municipal Solid Waste Dumping Yards in Chennai

**R.Sindhu**

Municipal Solid Waste (MSW) is generally termed as "**unwanted or undesired"** material. According to the Municipal Solid Wastes (Management and Handling), Rules 1999 **"Municipal Solid Waste"** includes commercial and residential wastes generated in a municipal or notified area in either solid or semi-solid form excluding industrial hazardous wastes but including treated bio-medical wastes. Municipal Solid Waste in India is generally littered on roadsides and disposed in an unscientific manner without considering the harmful effects of wastes on the environment and human health. The waste is dumped in the outskirts of the cities in low lying areas with no compliance of regulations. The collected municipal solid wastes are openly dumped in Kodungaiyur and Perungudi dumping yards.

| **Location** | **Kodungaiyur** |
|---|---|
| Extent acres | Area around 200 |
| Life expectancy | Upto 2015 |
| Daily Waste disposed | 2100 to 2300 M.T |
| Location | Perungudi |
| Extent acres | Area around 200 |
| Life expectancy | Upto 2015 |
| Daily waste disposed | 2200 tons to 2400 MT |

(*Source: www.chennaicorporation.gov.in/departments/solid-waste-management/index.htm*)

Everyday 4500 MT of garbage is collected and removed from Chennai city. The dumped waste contains organic, inorganic and inert material like debris in mixed form.

## PHYSICAL AND CHEMICAL CHARACTERISTICS OF WASTE

| | |
|---|---|
| **Food waste** | **8.00 %** |
| **Green waste** | **32.25 %** |
| **Timber(wood)** | **6.99 %** |
| **Consumable plastic** | **5.86 %** |
| **Industrial Plastic** | **1.18 %** |
| **Steel & Material** | **0.03 %** |
| **Rags & Textiles** | **3.14 %** |
| **Paper** | **6.45 %** |
| **Rubber & Leather** | **1.45 %** |
| **Inerts** | **34.65 %** |

### CHEMICAL CHARACTERISTICS

| | |
|---|---|
| **Moisture Content** | **27.60 %** |
| **PH Value** | **7.68** |
| **Organic Content** | **39.06 %** |
| **Carbon content** | **21.53 %** |
| **Nitrogen Content** | **0.73 %** |
| **Phosphorous $P_2O_5$** | **0.63 %** |
| **Potassium $K_2O$** | **0.63 %** |

## Effects of wastes on environment and human health

Biodegradable waste, such as food waste, generally undergoes anaerobic degradation in a dumpsite environment. Leachate is a liquid produced when water (due to rainfall) percolates through waste undergoing decomposition. It contains dissolved and suspended materials that if not properly controlled and treated, may pass through the soil and contaminate groundwater as well as surface water. The decomposition of the waste also brings about the generation of gases, mainly methane (about 50-65%) and carbon dioxide (about 35-45%). As methane is formed, it builds up pressure and then begins to move through the soil. Methane is lighter than air and is highly flammable. It is released to the atmosphere and greatly contributes to global warming as it has approximately 21 times the global warming potential of carbon dioxide. If open burning of solid waste is practiced (usually, to reduce the volume of the waste), it results in the emission of toxic substances to the air from the burning of plastics and other materials. The toxic fumes can cause chronic respiratory and other diseases, and it increase the concentration of air pollutants such as nitrogen oxides (NOx), sulfur oxides (SOx), heavy metals (mercury, lead, chromium, cadmium, etc.), dioxins and furans, and particulate matter.

## Solid waste management methods

- Waste minimization methods
- Reduce, Recycle and Reuse
- Waste Treatment like bioremediation, phtoremediation, compost etc.
- Landfill disposal
- Implement of policy and regulations
- General awareness about waste segregation and effects of waste on the environment and human health.

## Conclusion

At present, there are only limited waste management methods to upgrade or to replace the waste and dumpsites. The solid waste managers should discover new management techniques to attempt to modernize open dumping practices.

## Source:

1. www.chennaicorporation.gov.in/departments/solid-waste-management/index.htm
2. http://dste.puducherry.gov.in/envisnew/books&reports2.pdf

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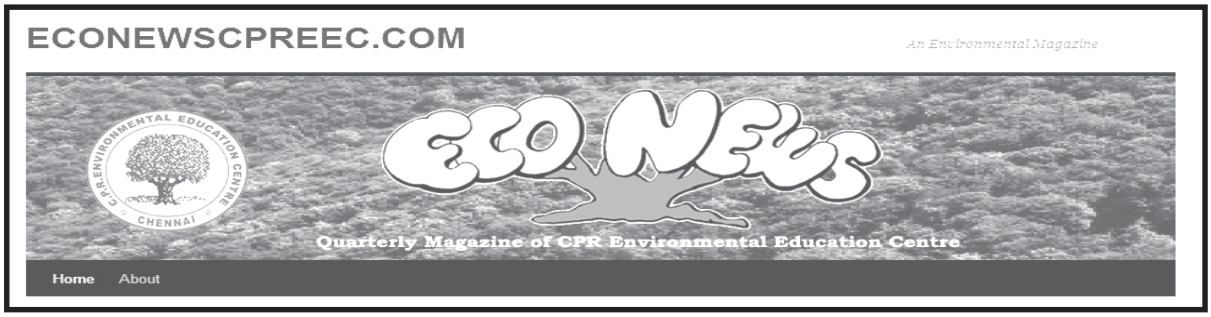



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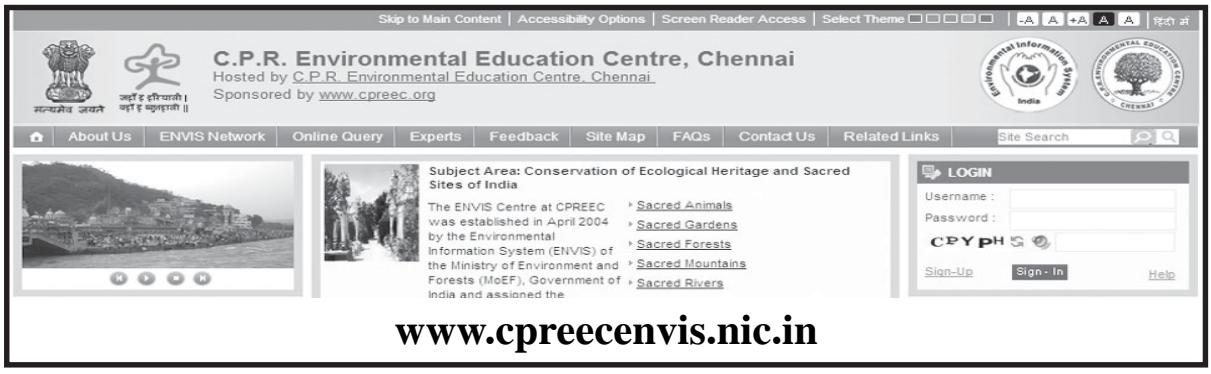


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