

SURVEY OF THE RIVERS IN PUNE CITY
BASED ON ECOLOGICAL FACTORS IN ORDER
TO PREPARE AN ECO-DEVELOPMENT PLAN
TO IMPROVE THE RIVER-FRONTS OF PUNE

BY

PRAKASH GOLE

ECOLOGICAL SOCIETY

1983

ACKNOWLEDGEMENTS

This study would have remained incomplete without the kind assistance given by the following individuals:

Shri Kirad of Kirloskar Consultants Limited for chemical analysis of water samples,

Dr. Godbole of Vidnyan-Vardhini for bacteriological analysis of water samples,

Dr. Vartak of Vidnyan-Vardhini for identification of botanical specimens,

Dr. Miss Sane of Garware College also for the same,

Dr. Bhagwat & Justice Patwardhan also for the same,

Shri Ketkar & Shri Joshi of Museum of Arthropoda for identification of aquatic animal specimens,

Dr. Rajguru of Deccan College for explaining the geology of river-basins,

Shri V. Sardesai of School of Architecture for a discussion of town-planning aspects, and

Mrs. Swati Gole of S. P. College for a discussion of the geography of river-basins.

The author wishes to thank all of them.

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CHAPTER I

PHYSICAL FEATURES OF THE RIVER COURSES

The Mutha river enters Pune Corporation limits near Vitthalwadi. From a deepish pool near Hingne the river rolls over an outcrop of rock to enter a shallow depression at Vitthalwadi. Here the river is flanked by a broad platform of basalt on its right bank. The swollen stream that rushes over this platform every monsoon has etched pot-holes over it which remain filled with water for more than two months after the rainy season. Further to the east the platform ends abruptly at an escarpment whose upper level probably marks the base-line where once the stream flowed in ages beyond memory.

It is on this upper terrace that the temple of Shiva stands. An impressive Banyan (Ficus bengalensis) tree marks the place from where one can descend to the basalt platform by way of steps made of stone. A lesser temple stands on the rocky platform. Pot-holes around it provide sustenance not only to aquatic organisms but water for the priest for his daily Pooja!. At present water that percolates from the Mutha Right Bank Canal at the foot of Panchgao-Parvati hills, flows down in a sizeable stream that cascades down the escarpment in a substantial waterfall to meet the river.

The left bank of the river near Vitthalwadi is not rocky but holds fertile soil cover. It is actually the inner side of the river's meander which holds deposition of soil brought

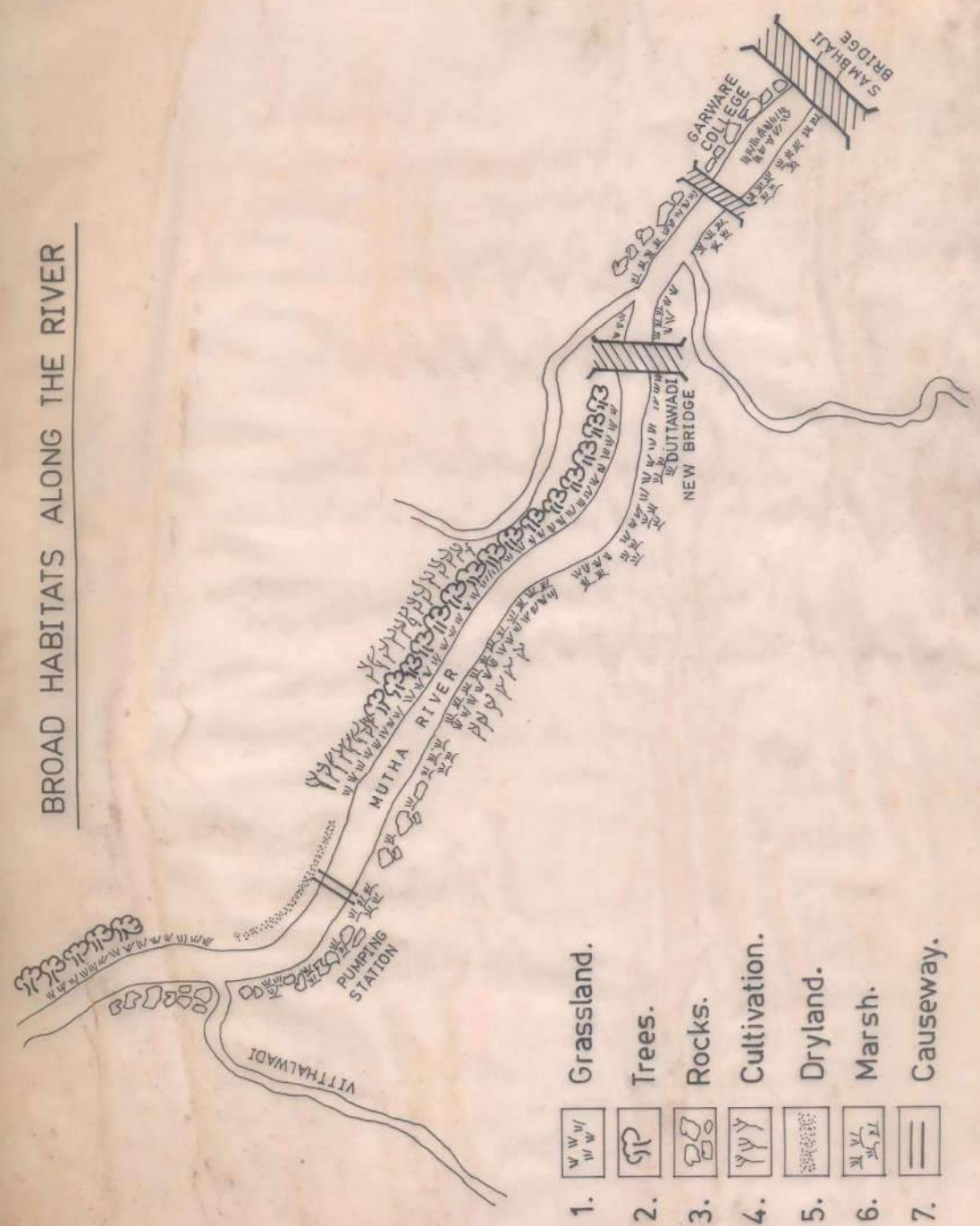
by it, while the outer edge which lies on the right bank shows greater erosion. A number of trees and farms growing fruit and vegetables and sugarcane border the river on the left bank (west side). A narrow strip of grass runs along the river but beyond the farms the land is open and desolate with a few stunted bushes for a stretch of about 200 meters. Probably as nobody looks after it, this strip of about 200 m. x 400 m. remains neglected.

Once over the rocky outcrop the stream at Vitthalwadi flows sluggishly (240 meters per hour), eddying softly over submerged rocks and lapping against small inlets in basalt which at places are sufficiently broad to make sheltered coves and bays.

About half a kilometer downstream, a small bund impounds the river creating a pool with a depth of about a meter. Immediately after the Panshet calamity water used to be pumped up from this pool and released in the Right Bank Canal to be taken to settling tanks for purification. This is now discontinued. But the bund, by impounding water, has created a ford downstream where people can easily cross the river once the monsoon floods recede. Here the shingle bed is now exposed and a number of low islands irregular in shape, poke their heads above the water level.

The rocky platform which is more or less unbroken at Vitthalwadi, is much disjointed and broken downstream with the result that marshy depressions are formed between slabs of

BROAD HABITATS ALONG THE RIVER



1. Grassland.
2. Trees.
3. Rocks.
4. Cultivation.
5. Dryland.
6. Marsh.
7. Causeway.

FIG. NO. 1.

rock on the right bank. Turf and not rock lines the edge on the left bank and the ground slopes upward gently. Cultivation of sugarcane, banana and certain other fruits trees cover the upper slope. Further downstream a number of trees have taken root on the slope just above the water level.

The escarpment which is distinctly visible at Vitthalwadi, continues beyond the bund where residential blocks now line its edge. The eastern end of the bund has an outlet through which water is released into the river-bed below. It gushes out on to the rocks and then rushes by the shingle bed. It then flows gently through islands and bays.

The cultivation and trees that occupy the slopes on the left bank, the wild, marshy and rocky portion that lines the edge of water on the right bank, impart this place and a little further downstream, the appearance of a wild park. It is worth preserving this aspect.

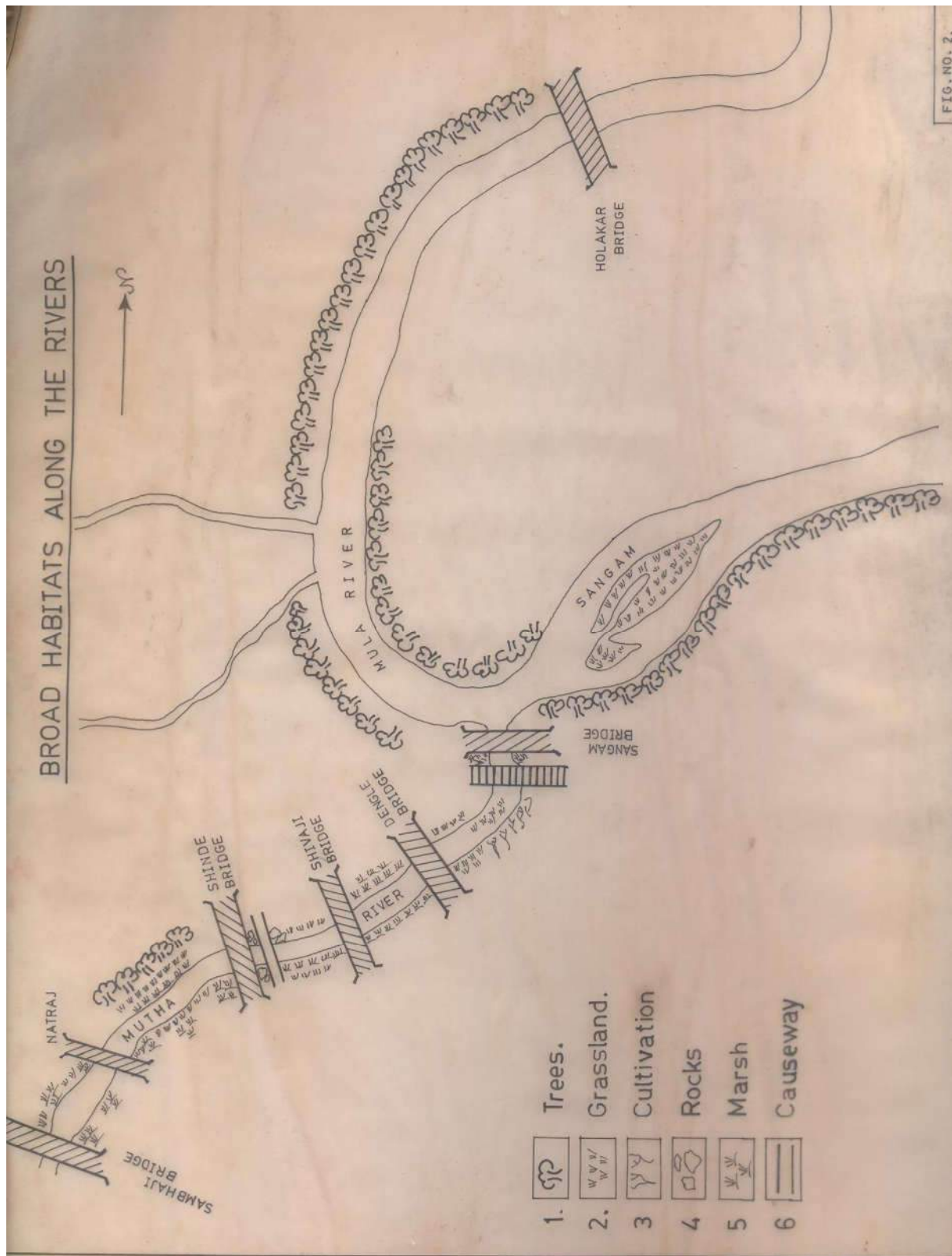
Beyond the residential blocks on the right bank are the brick kilns. There are no buildings approaching the river basin here and some trees and cultivation still embellish the upper slopes. The lower slope is covered with grass and below the river flows through islands and little outcrops of rocks. A few centimeters above the water level, opposite the brick kilns on the left bank, a number of palm trees (Shindi) cover the slopes. The place also deserves special mention for the variety of bird life found here and this aspect needs to be preserved also.

A new bridge is coming up across the river to connect Dattawadi with the left bank. Site of this bridge at present marks the point where the river enters the densely populated areas of the city. The river makes a turn to the right near the new bridge and now the outer edge of the meander lies on the left bank and the inner on the right. Consequently rocks are exposed on the left bank while the right bank is marshy and shows deposition of soil.

A short distance beyond the bridge the first overflow from city's drains pours into the river. Onwards these overflows increase in number and volume and by the time the river reaches Sangam bridge, the water is saturated with sewage.

Between the site of the new bridge and the causeway behind Garware College, the upper portion of the slope on the right bank is occupied by residential buildings which converge on the junction between the river and the Ambil Odha. The rocky plateau on the left bank is similarly occupied by hutments. The right bank slope is steeper than the one on the left bank where grassy outliers reach the river flow. Further downstream on the left bank more rocks are exposed though moist soil near the flow of the river shows a lush growth of grass. Below the Vaikunth cremation ground a strip of marsh borders the river.

Immediately beyond the causeway the course of the river is divided in the middle by an island which was obviously created by deposition of silt. The island is mostly covered



by sedges and at places shingle is exposed. Skirting the island the river flows in two narrow channels which unite in a broad pool below Sambhaji bridge. Onwards the river used to flow between two low embankment walls built especially to keep the broad patches of turf on both sides free of water-logging. The Panshet flood devastated the embankment, scattered rocks and other debris, destroyed the turf and created depressions here and there where water collects during every monsoon. These stagnant pools become breeding grounds for mosquitoes.

Though residential buildings line the edge of the basin here, the width of the basin itself (more than 150 meters), leaves wide open spaces along the river right upto Shivaji bridge. Between Omkareshwar causeway and Shivaji bridge there used to be a swimming pool and gardens lining the basin on the left bank; these were swept away in 1961. Since then no attempts were made to improve these devastated areas.

Beyond Shivaji bridge the high wall of the road encroaches on the right bank. There is also a parallel road on the left bank but below it stretch the ruins of old structures. A strip of fertile land by the side of the river is cultivated.

There is also a strip of cultivation on the right bank between Dengle bridge and Sangam bridge. The Nagzari joins the river between these two bridges, just beyond the cultivation. The flow of the river in this stretch is again divided by islands that rise out of the water once the flood recedes. The islands are level and have good short turf.

Beyond Sangam bridge the right bank is lined with trees from private buildings. On the left the flow is again divided by an island called 'Naikache Bet'. There are no residential blocks close to the river on the left bank.

Beyond Fitzgerald bridge the rocks are again exposed as the flow of the twin rivers (The Mula-Mutha) is impounded below Parnakuti hill. The right bank is low and marshy and the left higher and rocky. As the water level here has considerably gone down due to the impoundment, a number of islands can be seen midstream. This area which was the end-point of our enquiry, constitutes the Mula-Mutha Bird Sanctuary.

Both the banks of the Mula between Holkar bridge and Sangam are more or less green, though residential buildings have started coming up beyond Engineering College on the right bank. As much of the area along the banks is owned either by Central or State Governments, the open aspect of the banks is likely to be preserved in near future. Beyond Holkar bridge a thick carpet of Water Hyacinth (*Eichhornia crassipes*) covers the entire water surface and no movement in the river is possible. The investigation could not be continued beyond Holkar bridge.

BROAD HABITATS ALONG THE RIVERS

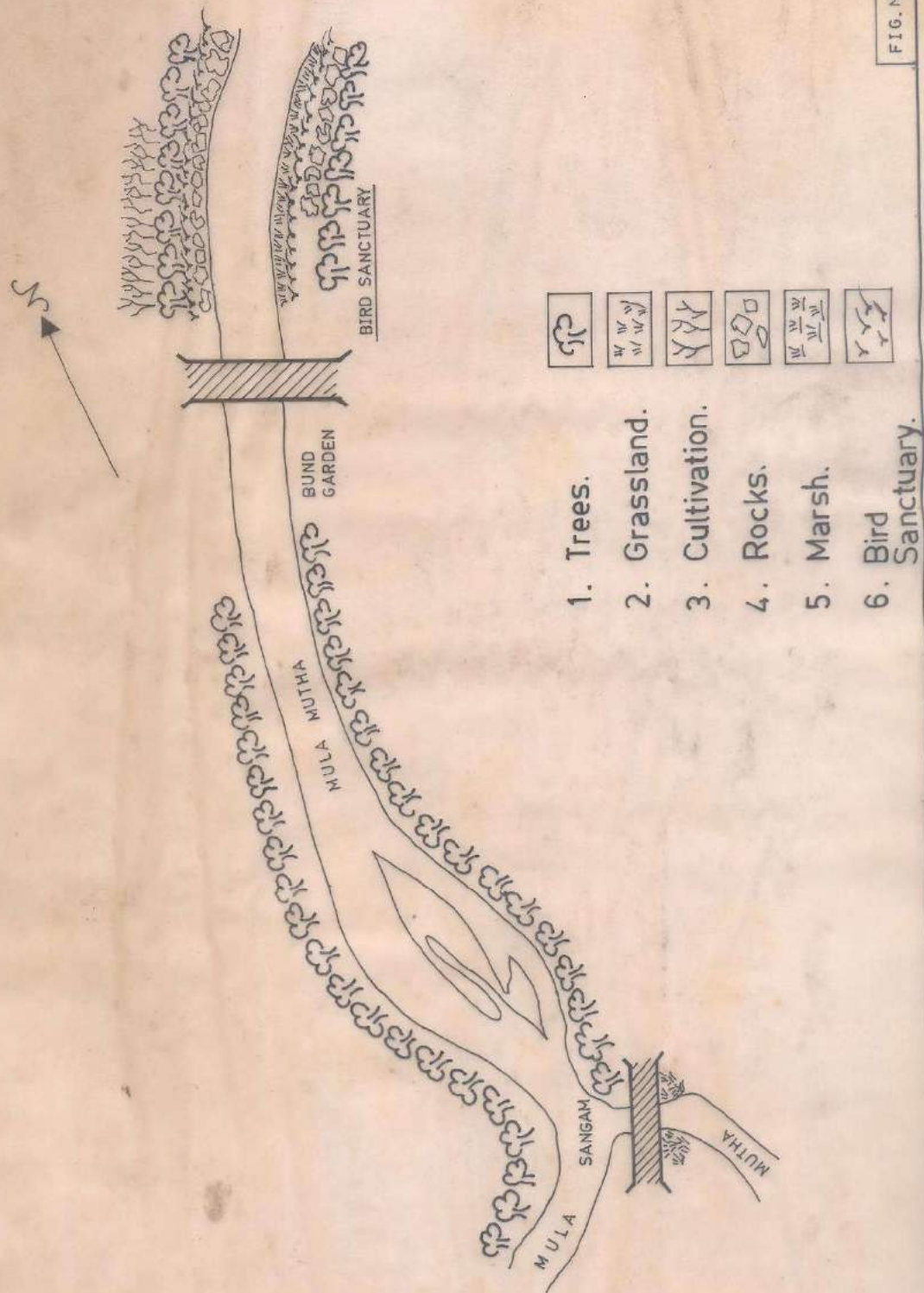


FIG. NO. 3.

CHAPTER II

THE QUALITY OF RIVER WATERS

To examine the quality of water in the rivers, five litre samples were collected from the following points:

- 1) About 50 meters upstream of Vitthalwadi
- 2) Below old pumping station
- 3) Upstream of causeway behind Garware College
- 4) In Ambil Odha just before it meets the river
- 5) Near the causeway behind Natraj theatre
- 6) Below Omkareshwar temple
- 7) Between Shivaji bridge and Dengle bridge
- 8) In the Mula upstream of Engineering College Boat Club
- 9) Below Sudarshan Chemical Industry
- 10) From left bank in the Bird Sanctuary area
- 11) Mid-stream in Bird Sanctuary

For bacteriological analysis 250 cc samples were also collected from the same places.

A five-litre sample and a 250 cc sample were also collected from Khadakwasla reservoir to compare its quality with that of the river-water.

Table No.2 sets out the results of chemical analysis and Table No.3 those of bacteriological analysis.

It will be seen from Table 2 that even at the point where the Mutha enters the city limits, the turbidity index and the proportion of solid matter are high (near Vitthalwadi). This is probably due to the fact that population has increased and areas near river-banks are increasingly being settled upstream of Vitthalwadi. The BOD is however, lower near Vitthalwadi than the BOD in the reservoir. As the river advances from Vitthalwadi to Sangam the proportion of solids, dissolved solids, COD, BOD and chlorides goes on increasing which indicates that the river is receiving higher and higher loads of organic matter. This is due to the increase in the number of drains that flow into the river and to a lesser extent to the discharge of industrial effluents as the river passes through densely populated areas of the city. The proportion of dissolved oxygen varies between 1.20 and 5.20 ppm. Predictably the oxygen content is high in Khadakwasla reservoir, but it declines sharply near Vitthalwadi. At Garware causeway, near Omkareshwar temple and between Shivaji bridge and Dingle bridge the water showed high proportion of dissolved oxygen. This is rather surprising as the organic content and consequently the BOD and COD are quite high at these places. The high oxygen content is probably due to turbulence.

The sample from Ambil Odha was collected to enable us to compare the quality of its water with that of the river. The stream showed a very high concentration of organic matter. The proportion of solids, COD, BOD, and chlorides was considerably

higher in the Odha than in the river. This indicates that the stream brings in a large load of faecal matter to the river. This is substantiated by bacteriological analysis. It is also worth noting that the samples from the Mula river and from the Mula-Mutha showed a high concentration of pollution and compare favourably with the Odha! As the joint stream is impounded near Bund Garden the settling action in the reservoir thus created, probably leads to a reduction in turbidity and total solids by the time the flow reaches Bird Sanctuary area.

Table No. 3 shows the results of the MPN count. Predictably the analysis shows an increasing concentration of organisms per 100 ml.s as the river flows from Vitthalwadi to Sangam bridge. The concentration is seen to be the highest in samples collected below Shivaji bridge and in Bird Sanctuary. The conspicuous rise in coliform MPN indicates faecal pollution. This makes the water highly dangerous to human beings. In such waters occurrence of intestinal pathogens cannot be ruled out. If such water enters the human system, diseases of intestine, liver and digestive system in general, are likely to result. In such waters it is also dangerous to wash clothes and utensils for fear of infection which may result in diseases of skin. According to knowledgeable medical practitioners the number of cases of intestinal and skin infections are on the increase in Pune. Jaundice and other forms of hepatitis are becoming endemic. These together with the increase in mosquito menace in the city clearly pose a serious threat to the health of citizens of Pune.

Dr. Godbole of Vidnyan-Vardhini who examined the water coming to the settling tanks from the Right Bank Canal also found high degree of bacterial and viral contamination of water in the canal. He is of the opinion that purification of water by the action of chlorine may reduce bacterial contamination but not the viral one. It thus appears that both the sources of water that enter city limits pose a great threat to the health of Pune's citizens.

**Table 2 : Ecological Survey of Rivers in Pune City : Quality of water
Chemical Analysis of Water Samples Collected at Different Places on the Rivers**

Count of	No. of collecting stations along the Mutha, the Mula and the Mula-Mutha									
	1	2	3	4	5	6	7	8	9	10
Turbidity (ppm)	07	16	06	12	11	09	14	11	08	15
Total solids (mg/litre)	108	120	100	168	184	200	252	322	190	334
Dissolved solids (mg/l)	108	108	100	148	167	191	246	218	180	292
COD	10	4	24	25	21	5	78	70	19	150
BOD	3	1	7	7	6	2	30	22	7	40
Dissolved oxygen	4.20	1.40	4.60	4.20	5.20	4.30	2.90	2.40	1.30	3
Nitrates (N2O5)	-	-	-	-	-	-	-	-	-	2
Nitrites (N2O3)	-	-	-	-	-	-	-	-	-	-
Chlorides (Cl)	14	8	21	21	21	28	35	42	49.5	35
<u>Names of Stations</u>										

1 = Khadakwasla Reservoir; 2 = Vitthalwadi upstream; 3 = Opp. Pumping Station;
4 = Upstream of Garware College Causeway; 5 = Near Shinde bridge;
6 = Upstream of Shiwaji bridge; 7 = Downstream of Holkar bridge (on the Mula)
8 = Downstream of Sangam bridge (on the Mula-Mutha); 9 = In Bird Sanctuary;
10 = In Ambli Odha

Table 3 : Ecological Survey of the Rivers in Pune City :
Quantity of Water

Bacteriological Analysis of Water Samples
Collected at Different Points along the
River

Point of collection	Date	Count per 100 ml.s
1. Upstream of Vitthalwadi	22.3.83	1.4×10^6
2. Opposite old pumping station	25.3.83	2.0×10^5
3. Below Garware College causeway	22.3.83	2.5×10^6
4. Near Natraj causeway	22.3.83	1.3×10^7
5. Below Omkareshwar temple	22.3.83	1.3×10^7
6. Below Shivaji bridge	22.3.83	3.5×10^6
7. Below the Sangam	6.4.83	1.0×10^5
8. In the Mula river	6.4.83	1.0×10^5
9. In Bird Sanctuary	24.3.83	3.5×10^7

CHAPTER III
VEGETATION OF THE RIVER-BED

In a period of six months covered by this enquiry, i.e. October 1982 to March 1983, it was not possible to study all the seasonal changes that occur in plant-life in the course of a year. In 1954-55 Dr. V. D. Vartak had done exactly this and has recorded about 400 species of plants in the river-bed. Naturally it contained a number of ephemerals. During the period covered in the present enquiry, 156 plants were recorded. Their distribution according to broad types of habitat is as follows:

Aquatic Plants	: 12
Partly Submerged Plants	: 30
Plants Growing In Marshy Places	: 79
Plants Growing Along Drains & Effluents	: 51
Plants Growing In Rock Crevices	: 26
Plants From Dry Places	: 55
Plants Common To All Habitats	: 18

While most of the plants recorded now were also recorded by Dr. Vartak in 1954-55, the present collection contains a few plants like Eichhornia crassipes not recorded before. Let us now consider the plants according to the type of habitat in which they were found.

Aquatic Habitat : Hydrilla verticillata, Lemna gibba, and Ceratophyllum demersum were found to be growing in water everywhere in the river-course. Water hyacinth or Eichhornia crassipes was seen everywhere except in the area between Vitthalwadi and pumping station and was rather uncommon between pumping station and brick kilns. It becomes progressively common after that point.

Vallisneria spirallis was seen everywhere except the portion between pumping station and Dattawadi bridge. Two species of Potamogeton viz. crispus and indicus were found between Vitthalwadi and Dattawadi bridge but not elsewhere. Ottelia alismoides was recorded from Garware College causeway and Bird Sanctuary. The floating plant Spirodela polyrhiza was seen everywhere except near Dattawadi bridge. Pistia stratiotes was seen at a few places between Sambhaji bridge and Bird Sanctuary.

Marshy Habitat : Common plants from habitat include Polygonum glabrum, Cyperus pangorei, Cynodon dactylon, Alternanthera sessilis, Commelina sp., Ammania baccifera, Jussiaea suffruticosa and Cryptocoryne retrospiralis.

Laurentia longiflora was observed in marshy places only near Vitthalwadi temple. Verbascum coromandelianum was recorded from Vitthalwadi to Dattawadi bridge and again in Bird Sanctuary. It was found growing in wet places in between rocks and also on shingle islands. Hygrophila auriculata was found to be numerous near Garware College causeway, Bird

Sanctuary and to a lesser extent near pumping station. Asclepias curassavica was seen to occur everywhere except the area near Sangam bridge. Bacopa monnieri was observed everywhere except between Omkareshwar temple and Sangam bridge.

All Ipomoea species were generally seen growing in marshy places. Ipomoea carnea was seen everywhere; Ipomoea nil was noticed only near Omkareshwar temple. Ipomoea muricata was observed everywhere; Ipomoea palmata was observed near Vitthalwadi and again near Dattawadi bridge and Garware College causeway, and also Shivaji bridge to Sangam bridge. Portulaca oleracea and Exacum pedunculatum were seen only in Bird Sanctuary; Elipta erecta and Phyla nodiflora were also observed in Bird Sanctuary and between Vitthalwadi and Dattawadi bridge. Marselia was observed everywhere except between brick kilns and Dattawadi bridge. It was found to be growing particularly well in Bird Sanctuary area. Also Rorripa indica was noticed in Bird Sanctuary and between Vitthalwadi and pumping station. Homonia riparia was noticed near Vitthalwadi and again between Sambhaji bridge and Omkareshwar temple. Crotollaria palcida was observed only between pumping station to brick kilns and again from Dattawadi bridge to Garware College causeway.

Partly Submerged Plants : These plants include plants growing at the edges of rivers as well as those growing along drains and other effluents flowing into the river. Cryptocoryne retrospirallis, Euphorbia hirta, Xanthium strumarium, Ammania baccifera, Commelina sp., Parthenium hysterophorus, Cyperus

pangorei, Polygonum glabrum, Asclepias curassavica, Hygrophila auriculata were commonly found in this habitat.

Typha angustata was seen near drains between Dattawadi bridge and Garware College causeway, between Sambhaji bridge and Omkareshwar temple, and in Bird Sanctuary. Jussiaea suffruticosa was seen along effluents between Vitthalwadi and Dattawadi bridge. Crinum defixum was likewise noticed along drains between Omkareshwar temple and Shivaji bridge. Bacopa monnieri, Phyllanthus niruri, Ricinus communis, and Ipomoea palmata were the other plants found growing along drains and effluents. The last mentioned was seen growing on rick cliffs near Vitthalwadi from where water cascades to meet the river.

Rocky Habitat : Plants growing in rock crevices and between gaps in rocks were found to be mostly grasses. Cynodon dactylon, Cyperus pangorei, Alternanthera sessilis, Commelina sp., Lantana camara, Parthenium hysterophorus and Acacia arabica were found also to be common in these places, growing mostly on soil deposited there.

On wet rocks near puddles red patches of Rotalla tenuis were observed in Bird Sanctuary and between Vitthalwadi and brick kilns. Here, in rock crevices and on wet rocks was seen Canscora diffusa.

Dry-land Habitat : Grasslands and trees marked this habitat. Acacia arabica, Ficus bengalensis, F. religiosa, F. glomerata, Albizia lebbeck, Azadiracta indica, Salmalia malbarica were some of the trees that were seen to line the

river-banks. Cynodon dactylon, Alternanthera sessilis, and Lantana camara were seen on grassy patches. Phoenix sylvestris, Tamarindus indica, Cocos nucifera, Musa paradisiaca, Delonix regia and Michelia champaka were also recorded along the banks. A number of trees are now planted in the Bird Sanctuary area. These include Erythrina, Bauhinia, Cassia, Gliricidia sp.s etc.

Association of Plants and Other Organisms : Association of insects and birds with plants was recorded along the river.

- 1) Dragonflies were observed mostly on Cyperus sp. in marshy places and grasslands.
- 2) Small insects like damsel flies were seen to favour Cryptocoryne retrospirallis.
- 3) Egrets and Pond herons were observed standing on Eichhornia crassipes
- 4) Little Grebes were nesting near the mass of plants like Hydrilla verticillata.
- 5) Birds like Common Myna and Large Grey Babbler were observed perching on Kirganelia reticulata.
- 6) Grey partridge was found perching on Acacia arabica.
- 7) Egrets were found perching repeatedly on Acacia arabica near Vitthalwadi and Ficus religiosa near Sambhaji bridge.
- 8) Redvented Bulbuls, Common and Brahminy Mynas and Crimson-breasted Barbets were seen on the flowers of Salmalia malbarica.
- 9) Red munias were noticed feeding on the seed of Polygonum glabrum.

Ecological Survey of the Rivers in Pune City

List of Plants Recorded from the Mutha River-bed

Family Ranunculaceae

Clematis triloba

Family Menispermaceae

Tinospora cordifolia
(Wild)

Family Papaveraceae

Argemone mexicana

Family Crucifereae

Rorripa indica

Raphanus sativum

Brassica juncea

Family Capparidaceae

Cleome viscosa

Gynandropsis
pentaphylla

Family Portulacaceae

Portulaca oleracea

Family Malvaceae

Sida rhombifolia

Sida acuta Burm.

Abutilon indicum

Sida spinosa*

Sida cordifolia*

Sida sp.

Family Bombacaceae

Salmaia malbarica

Family Tiliaceae

Grewia tiliaefolia

Corchorus olitorius

Corchorus fascicularis

Corchorus aestuans

Family Solanaceae

Solanum xanthocarpum

Datura metel

Family Scrophulariaceae

Verbascum coromandelianum

Bacopa monnieri

Veronica anagallis

Family Lentibulariaceae

Sub Family Bignoniaceae

Tecoma stans

Family Acanthaceae

Hygrophila auriculata*

Dipteracanthus prostratus

Barlenia prionitis

Justicia betonica

Ruellia tuberosa*

Family Verbenaceae

Lantana camera
Phyla nodiflora
Vitex nigundo
Lantana indica*
Clerodendron iner.

Family Labiatae

Ocimum americanum
Ocimum gratissimum
Ocimum sanctum
Pogostemon parviflorus
Pogostemon parviflorus*
Salvia plebia
Hyptis suaveolens
Salvia officianalis*
Salvia coccinea*
Ocimum basilicum*

Family Nyctaginaceae

Boerhaaria diffusa

Family Amaranthaceae

Amaranthus spinosus
Amaranthus paniculatus
Achyranthus aspara
Pupalia lappacea
Alternanthera sessilis
Amaranthus polygamus*
Amaranthus teunifoliaus*

Family Chenopodiaceae

Chenopodium ambrosiodes

Family Plygonaceae

Polygonum glabrum

Family Santalaceae

Santalum album

Family Euphorbiaceae

Euphorbia hirta
Euphorbia geniculata
Phyllantus niruri
Kirganelia reticulata
Jatropha curcus
Croton sparsiflorus*
Chrozophora rottleri
Acalypha indica
Homonia riparia
Ricinus communis
Euphorbia nerifolia*

Family Moraceae

Ficus religiosa
Ficus glomerata
Ficus bengalensis

Family Ceratophyllaceae

Ceratophyllum demersum

Family Hydrocharitaceae

Hydrilla verticillata

Vallisneria spiralis

Ottelia alismoides

Family Orchidaceae

Zeuxine sulcata*

Family Scitamineae

Musa paradisiaca

Family Amaryllidaceae

Crinum defixum

Agave americana*

Family Commelinaceae

Commelina sp.

Family Oxalidaceae

Oxalis coronculata

Family Rutaceae

Feronia limonia

Family Meliaceae

Azadiracta indica

Family Rhamnaceae

Zizipus jujuba

Family Sapindaceae

Sapindus trifoliatus

Family Fabaceae

Heylandia latebrosa

Crotolaria striata

Psoralea corylifolia

Lathyrus aphaca

Ponagamia pinnata

Family Caesalpinaceae

Caesalpinia pulcherrima

Cassia tora

Delonix regia

Tamarindus indica

Caesalpinia crista

Family Mimosaceae

Acacia arabica

Albizzia lebeck

Pithecolobium dulce

Mimosa pudica*

Family Lythraceae

Ammania baccifera

Rotala tenuis

Family Onagraceae

Jussiaea suffruticosa

Family Cucurbitaceae

Cucurbita maxima

Family Cactaceae

Opuntia elatior

Cereus sp.

Family Molluginaceae

Mollugo lotoides

Family Rubiaceae

Morinda tinctoria

Family Compositae

Vernonia cinerea

Ageratum conyzoides

Blumea oxydonta

Gnaphalium luteo-album

Pulicaria wightiana

Xanthium strumarium

Tridax procumbens

Parthenium hysterophorus

*Cyathocline lysata**

Family Campanulaceae

Laurentia longiflora

Family Apocynaceae

*Allwanda cathatica**

Family Asclepidaceae

Calotropis gigantea

Asclepias curassarica

Family Getinaceae

Exacum pedunculatum

Canscora diffusa

Family Boraginaceae

Heliotropium indicum

Family Convolvulaceae

Convolvulus arvensis

Ipomoea muricata

Ipomoea aquatica

Ipomoea obscura

Ipomoea palmata

Argyreia nervosa

Cuscuta reflexa

Ipomoea sp.

*Ipomoea nil**

*Ipomoea carnea**

Family Palmae

Phoenix sylvestris

Cocos nucifera

Typha angustata

Family Araceae

Cryptocoryne retrospirallis

*Pistia stratiotes**

Family Lemnaceae

*Lemna gibba**

Family Naidaceae

Potamogeton indicus

Potamogeton crispus

*Potamogeton perfoliatus**

Family Eriocaulaceae

Sub-Family Cyperaceae

Cyperus defformisus
Cyperus pangorei
Cyperus globosus
Kyllinga brarifolia*
Fimbristylis bis-
umbellata*
Eleocharis capitata
Schoenoplectus
mucranotus*

Family Gramineae

Echinochloa colona
Eragrostis uniloides
Cynodon dactylon
Chloris barbata
Chrysopogon montanus
Setaria glauca
Bothriicola sp
Bulbostylis

Family Pontadariaceae

Eichhornia crassipes*

* Denotes plants that were not recorded in 1954-55.

CHAPTER IV

THE RIVERSIDE FAUNA

In October 1982 when this survey began at Vitthalwadi, the temperature ranged between 15°C and 34°C . The temperature of the water in the river Mutha averaged between 27°C and 31°C . The monsoon was below normal that year, though heavy showers in September narrowed the deficit to a certain extent.

The stream that appeared clear and colourless when it flowed over the rocky outcrop above Vitthalwadi, revealed its character once it entered the shallow depression below the temple. The water became greyish-brown in colour and turned murky in more sheltered places. Though we have no index of turbidity for October, in January 1983 the water showed a turbidity of 16 ppm.

The pot-holes on the rocky platform were still filled with water. In October it appeared that the puddles provided optimum conditions for the growth of algae and minute aquatic organisms on which prospered tadpoles and tiny fish. We could not investigate the bottom of the depression to examine the flora and fauna harboured by the stream. But the water's edge and also the puddles harboured aquatic organisms such as shrimps, catfishes and frogs in various stages of growth. Molluscs were also collected. Puddles that contained water from a few to over 30 cm.s in depth, showed mosquito larvae,

small fish, frogs and chironomous larvae.

At some places pot-holes join together to form water channels. Mosses and algal growth were evident where water dripped from the escarpment and where it travelled slowly through nooks and crevices. Dipteran flies, spiders and crickets were found in abundance along the rills inviting such birds as Large Pied and Grey Wagtails, while Little Egrets searched for insects and fish on larger flows, particularly the one below the waterfall.

The fauna of this place was surveyed again in January & March 1983. Little change was noticed in animal life then. The weather was still cold in January when water temperatures varied between 22° and 25°C. In March the weather warmed up and the water temperature rose correspondingly and varied between 25° and 29°C. In January some pot-holes still retained water and appeared to have become the cess-pools for breeding mosquitoes. Small fish were also abundant. A few tadpoles and chironomous larvae were also collected there. At the water's edge water bugs, molluscs and beetles were collected. In March the puddles went dry but little change was noticed in the fauna collected at the water's edge. By the end of March profuse algal growth covered much of the surface of water in the depression below the temple.

On the left bank we examined the grasses and sedges for the presence of organisms. Long-horned grasshopper, Lady-bird beetles and dragon-flies were collected on the vegetation that

grew along the edge of the river-flow.

Our second point of collection was below the small bund, along the shingle bed and in puddles on the right bank of the river near the old pumping station. Probably because of the impoundment of water by the small bund which resulted in some settling action, the turbidity index of water was lower than the one near Vitthalwadi. The proportion of dissolved solids in water was also less. The bio-oxygen demand was however, higher and the proportion of dissolved oxygen lower.

This place appeared to harbour a good number of fish and is consequently a favourite with fishermen. The fish was however, of a small size. The catches that we examined showed that the size of fish was bigger in October than the fish that were caught in January. Small crabs were also noticed here in October. The organisms that were collected near the water's edge were similar to those collected at Vitthalwadi. Vegetation at the water's edge was also examined. In October caterpillars were noticed on the Lily, while dragonflies, damsel flies and crickets were collected from the vegetation at the edges.

Collection of small organisms was made at regular intervals at the river's edges all along the stretch from Vitthalwadi to Sangam bridge and also in the Bird Sanctuary area. Shrimps, catfishes, tadpoles, water bugs and beetles, water skaters, water scorpion etc. were found commonly at the edges practically at every point. In October a high concentration of chironomous larvae was noticed at the place where the Ambil Odha meets the

Mutha river. A number of Blackwinged Stilts were feeding at this place. In January and March a high concentration of small fish was noticed at this place. The stilts were again present in a great assemblage. The Bird Sanctuary area also showed a high concentration of chironomous larvae in water. Beside the Natraj causeway rat-tailed maggots were collected. All these organisms are tolerant of low oxygen content, to that extent they reflect that the quality of water is unsatisfactory.

It appears that the high organic content of the river water makes it possible for a number of small aquatic organisms to survive and to breed successfully. Most of them appear to be hardy enough to survive in an oxygen-deficient medium. The abundance of minute aquatic organisms makes it easier for the fish to multiply which in turn attracts higher forms of insects which prey on small fish, as well as birds who prey on insects as well as fish.

CHAPTER V

BIRD LIFE OF THE RIVERS

During the period of the enquiry 71 species of birds were recorded on the rivers. The list of recorded species is given at the end of the chapter. The list includes 23 migratory and 48 resident species. Their distribution according to habitats is as follows:

Deep-water habitat	:	6
Shallow-water habitat	:	9
Marshy habitat	:	16
Dry-land habitat	:	24
River-side trees	:	5
Birds in flight	:	11
Total		<u>71</u>

From time to time counts of species and individuals were carried out at various places along the rivers. On 24th February, excepting Bird Sanctuary, a count of all species & individuals was carried out on the river Mutha. The count in Bird Sanctuary was carried out on 3rd March.

On 24th February 37 species were noted on the river with a total of 1806 individuals. In this stretch of about 6.5 km.s. this gives a density of 277 birds per kilometer.

This does not include arboreal birds seen on trees by the river-side. In the Bird Sanctuary 1490 individuals belonging to 42 species were recorded on 3rd March. This 1.5 km. stretch thus gives a density of 993 birds per kilometer.

As will be seen from the graphs there are some definite places where birds were seen to be concentrated. These three places according to the number of birds found there are: (1) the stretch between pumping station to Dattawadi bridge, (2) the stretch between this bridge to Garware College causeway and (3) the stretch between the broken causeway behind PMT bus terminus in Deccan Gymkhana and Omkareshwar temple. The Bird Sanctuary is of course, in a class by itself.

Figure No. 5 shows the birds at different places along the river according to the type of habitat they generally occupied. As will be seen from the graph, the number of birds seen along the edges of the river was the highest followed by the number seen in deepish water. The number of species seen along the edges was 15 while those seen in deepish water were 7. Some of the species like Blackwinged Stilt were common to both these habitats. In the Bird Sanctuary the number of species seen along the edges was 17 while in deepish water the number was 12. While counting these numbers such species as House and Jungle Crow, Common Myna, Pariah Kite, Gull-billed Tern and Little Brown Dove are not included. Certain species like Pond Heron, Intermediate Egret, Blackwinged Stilt were seen mid-stream where the water was shallow. Species like

DISTRIBUTION OF BIRDS ALONG THE RIVER

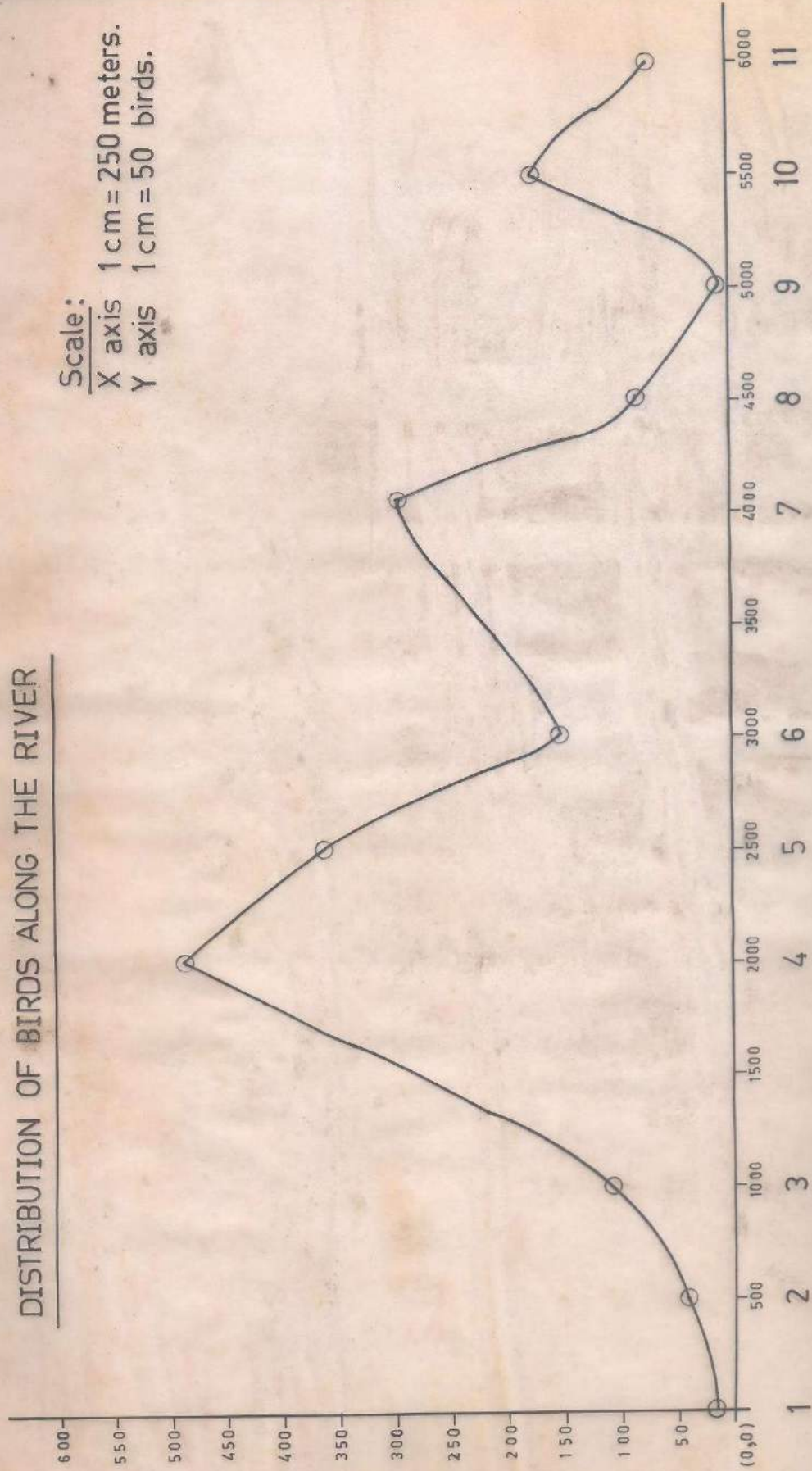
Scale:

X axis

1 cm = 250 meters.

Y axis

1 cm = 50 birds.

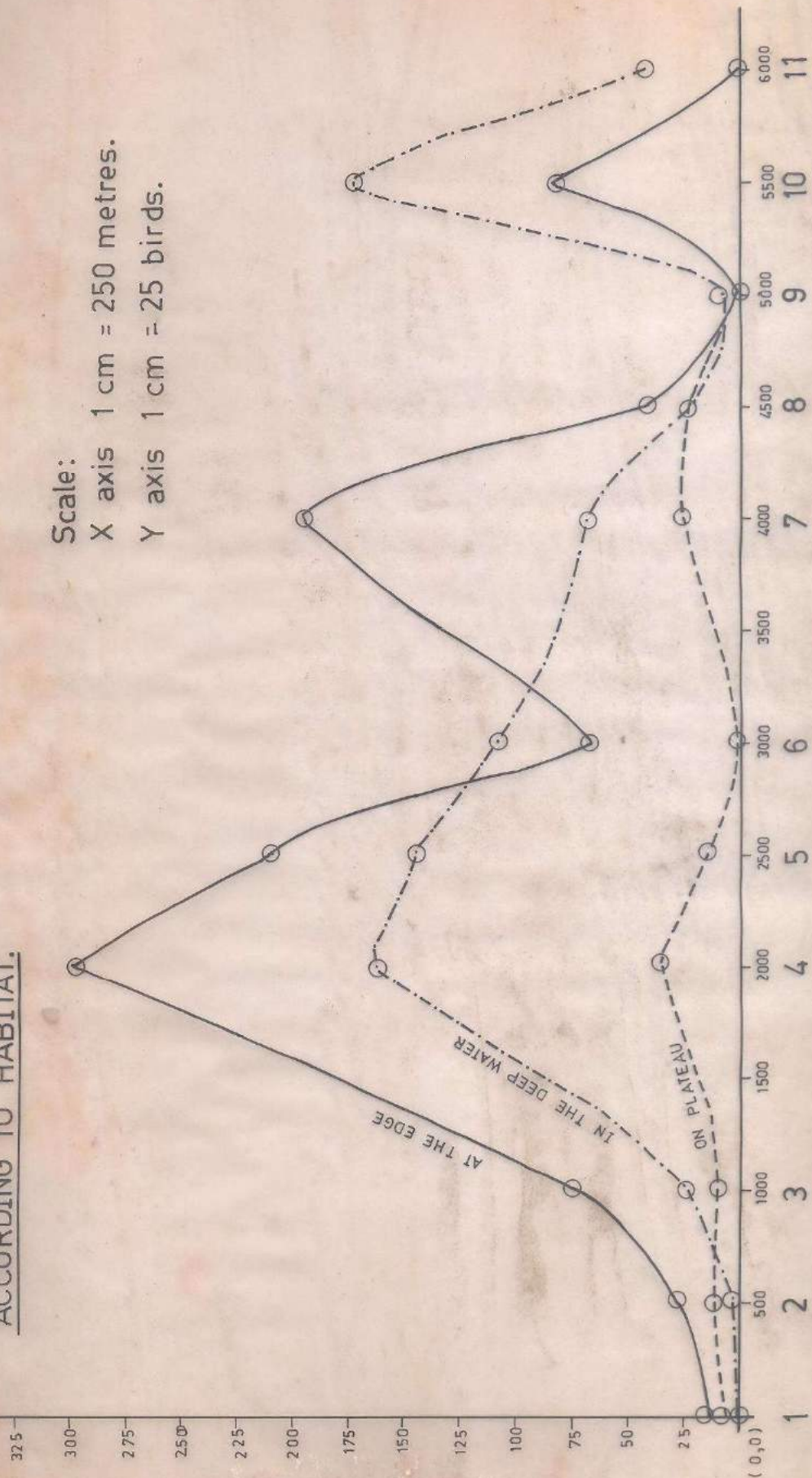


Yellow Wagtail and Pheasant-tailed jacana were mainly seen on floating vegetation such as Eichhornia crassipes.

The quality of water where birds were seen to concentrate, was also examined. As is shown in the chapter on water-quality, the river takes on an increasing load of organic pollution as it flows from Vitthalwadi onwards. It will now be interesting to see if any change in the composition of bird species in different months on the stretch between pumping station and Dattawadi, near Garware causeway and from Sambhaji bridge to Omkareshwar temple can be detected. Table No. 4 gives this information. The table shows that in the first two stretches the numbers of egrets, stilts, dabchiks and gull-billed terns are low; while these birds become more numerous from Garware College causeway to Omkareshwar temple. We have recorded in greater detail the distribution of these species between January and April. Table No. 5 shows their distribution along the entire river course. From this it is clear that these birds are fewer where the quality of water is better and drains do not overflow into the river. Their numbers progressively increase as the quality of water deteriorates and its organic content goes up. It appears that these birds have adopted the role of scavengers along the river course. Special mention should be made of Black-winged Stilt. These were found to be concentrated, at places in very large numbers, where streams loaded with faecal matter and drains flow into the river. To a lesser extent this can be said to be true of the three species of egrets also. Gull-billed terns were also seen to patronise such places and to dive repeatedly to pick up floating organisms.

DISTRIBUTION OF BIRDS ALONG THE RIVER ACCORDING TO HABITAT.

Scale:
X axis 1 cm = 250 metres.
Y axis 1 cm = 25 birds.



Birds Recorded Along the River Courses : October 1982 to April 1983

1. Podiceps ruficollis	Little Grebe
2. Phalacrocorax niger	Little Cormorant
3. Ardea cineria	Grey Heron
4. Ardeola grayii	Pond Heron
5. Ardea purpurea	Purple Heron
6. Egretta garzeta	Little Egret
7. Egretta intermedia	Median Egret
8. Bubulcus ibis	Cattle Egret
9. Anastomus oscitans	Openbilled Stork
10. Threskiornis melanocephala	White Ibis
11. Anas clypeata	Shoveller
12. Anas acuta	Pintail
13. Anas querquedula	Garganey Teal
14. Elanus caeruleus	Blackwinged Kite
15. Milvus migrans govinda	Pariah Kite
16. Circus aeruginosus	Marsh Harrier
17. Francolinus pondicerianus	Grey Partridge
18. Gallinula chloropus	Indian Moorhen
19. Porphyrio porphyrio	Purple Moorhen
20. Fulica atra	Coot
21. Hydrophasianus chirurgus	Pheasant-tailed Jacana
22. Vanellus indicus	Red-wattled Lapwing

Contd...

23. <i>Charadrius dubius</i>	Little Ringed Plover
24. <i>Tringa nebularia</i>	Greenshank
25. <i>Tringa ochropus</i>	Green Sandpiper
26. <i>Tringa glareola</i>	Spotted Sandpiper
27. <i>Tringa hypoleucos</i>	Common Sandpiper
28. <i>Capella gallinago</i>	Common Snipe
29. <i>Calidris minutus</i>	Little Stint
30. <i>Philomachus pugnax</i>	Ruff
31. <i>Himantopus himantopus</i>	Blackwinged Stilt
32. <i>Gelochelidon nilotica</i>	Gull-billed Tern
33. <i>Columba livia</i>	Blue Rock Pigeon
34. <i>Streptopelia senegalensis</i>	Little Brown Dove
35. <i>Psittacula krameri</i>	Roseringed Parakeet
36. <i>Eudynamis scolopacea</i>	Koel
37. <i>Centropus sinensis</i>	Crow-pheasant
38. <i>Cypsiurus parvus</i>	Palm Swift
39. <i>Apus affinis</i>	House Swift
40. <i>Upupa epops</i>	Hoopoe
41. <i>Ceryle rudis</i>	Pied Kingfisher
42. <i>Alcedo atthis</i>	Small Blue Kingfisher
43. <i>Halcyon smyrnensis</i>	White-brested Kingfisher
44. <i>Merops orientalis</i>	Common Green Bee-eater
45. <i>Megalaima haemacephala</i>	Coppersmith
46. <i>Eremopterix grisea</i>	Black-bellied Finchlark
47. <i>Ammomanes phoenicurus</i>	Rufous-tailed Finchlark

Contd...

DISTRIBUTION OF BIRDS
IN THE BIRD SANCTUARY

Scale:

X axis 1 cm = 150 meters.

Y axis 1 cm = 50 birds.

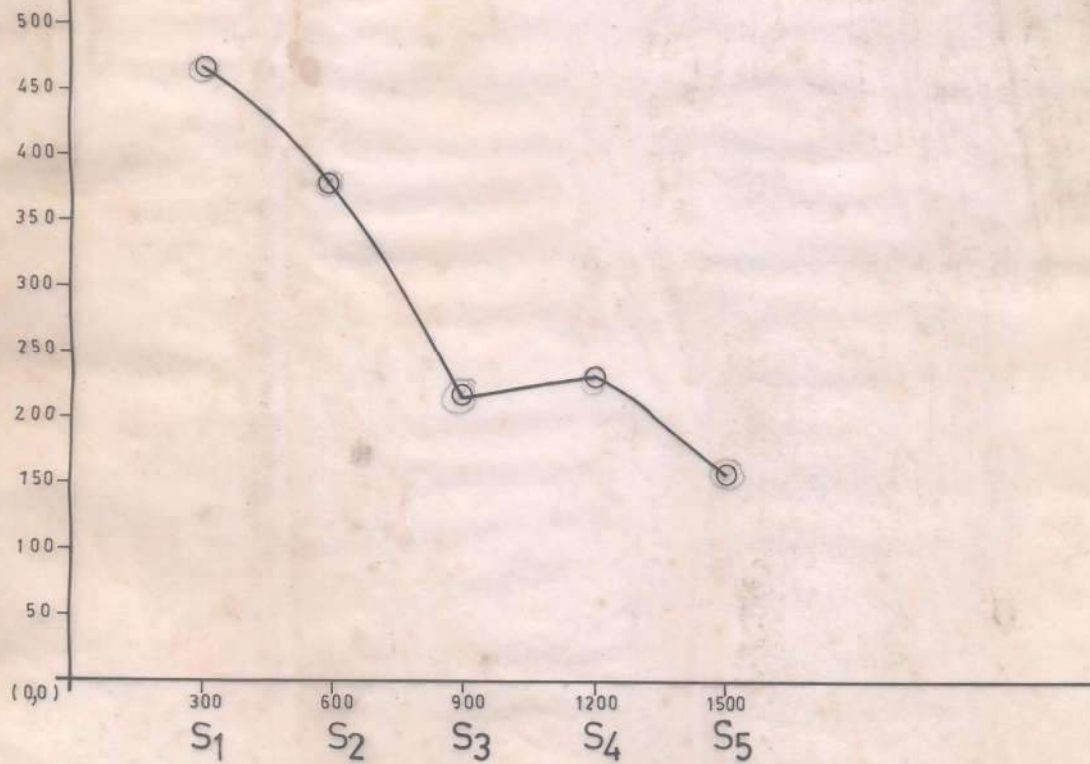


FIG.NO. 6.

48. <i>Hirundo rustica</i>	Eastern Swallow
49. <i>Hirundo smithii</i>	Wire-tailed Swallow
50. <i>Hirundo daurica</i>	Red-rumped Swallow
51. <i>Lanius schach</i>	Rufous-backed Shrike
52. <i>Dicrurus adsimilis</i>	Black Drongo
53. <i>Sturnus pagodarum</i>	Brahminy Myna
54. <i>Acridotheres tristis</i>	Indian Myna
55. <i>Corvus splendens</i>	House Crow
56. <i>Corvus macrorhynchos</i>	Jungle Crow
57. <i>Pericrocotus cinnamomeus</i>	Small Minivet
58. <i>Pycnonotus cafer</i>	Redvented Bulbul
59. <i>Turdoides malcolmi</i>	Large Grey Babbler
60. <i>Sylvia curruca</i>	Lesser Whitethroat
61. <i>Saxicoloides fulicata</i>	Indian Robin
62. <i>Monticola solitarius</i>	Blue Rock Thrush
63. <i>Saxicola torquata</i>	Stone-chat
64. <i>Motacilla flava</i>	Yellow wagtail
65. <i>Motacilla citreola</i>	Yellow-headed Wagtail
66. <i>Motacilla alba</i>	White Wagtail
67. <i>Motacilla maderaspatensis</i>	Large Pied Wagtail
68. <i>Passer domesticus</i>	House Sparrow
69. <i>Estrilda amandava</i>	Red Munia
70. <i>Lonchura malabarica</i>	White-throated Munia
71. <i>Lonchura punctulata</i>	Spotted Munia

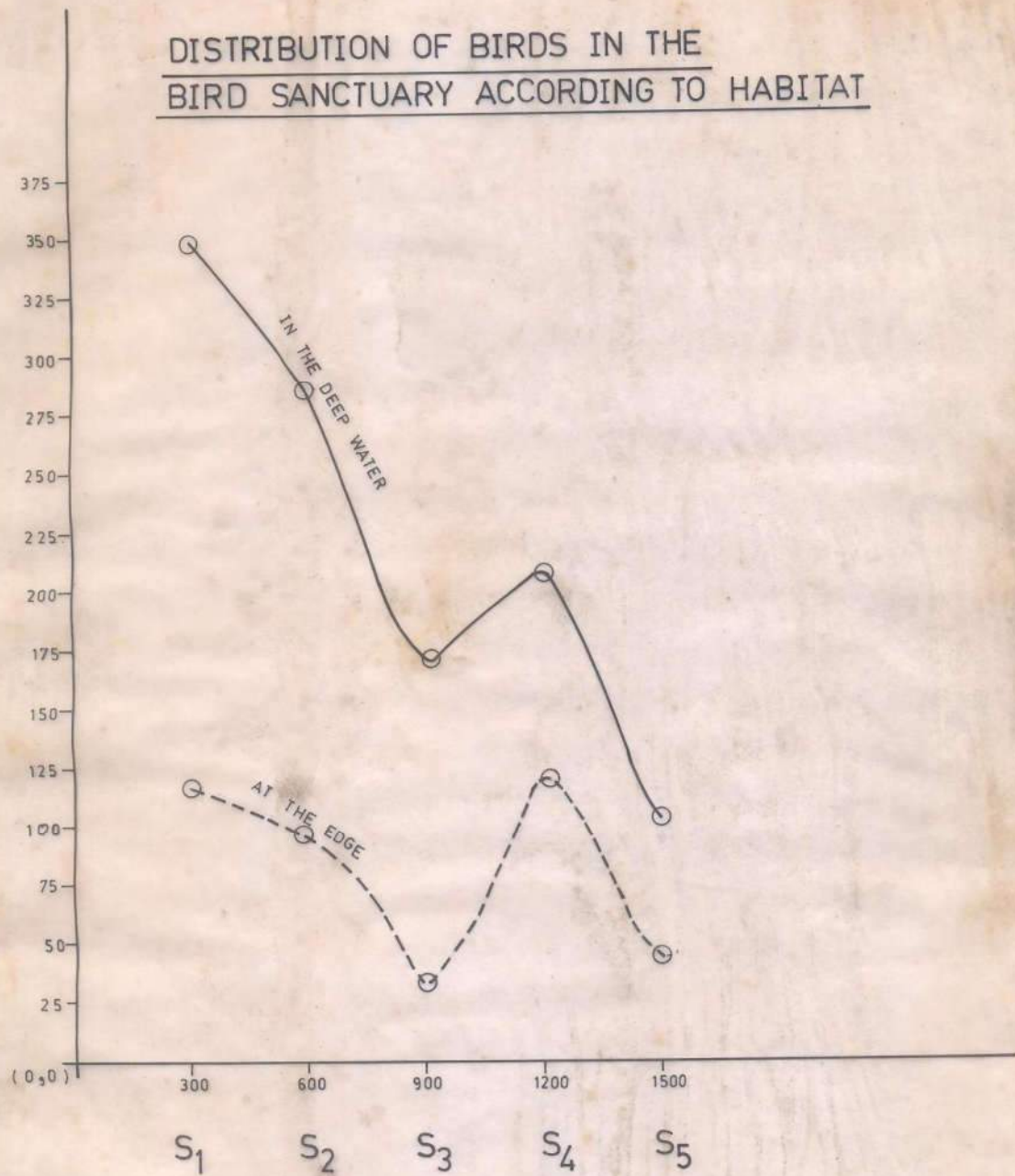


FIG.NO. 7.

Table 4 : Ecological Survey of the Rivers in Pune City
Distribution of Birds Commonly seen along the Mutha at Selected Places

Name of the Species	Old Pumping Station to Dattawadi Bridge			
	January	February	March	April
1. Little Cormorant	F	F	F	F
2. Egrets	F	C	C	VC
3. Pond Herons	F	C	C	VC
4. Shoveller	-	-	-	-
5. Little Grebe	F	F	C	C
6. Pintail	-	-	-	-
7. Garganey Teal	-	-	-	-
8. Coot	-	-	-	-
9. Redwattled Lapwing	F	F	F	F
10. Blackwinged Stilt	F	C	C	C
11. Gullbilled Tern	F	F	F	F
12. Green Bee-eater	C	C	C	C
13. Pied Kingfisher	F	F	F	F
14. Small Blue Kingfisher	F	F	F	F
15. White-breasted Kingfisher	F	F	F	F
16. Yellow Wagtail	C	C	C	C
17. Large Pied Wagtail	F	F	F	F
18. Munias	C	C	C	C

F = Few, upto 10; C = Common, 11 to 40; VC = Very Common, 41 to 70; A =

ed Places

Names of the Places							
Garware College Causeway to Sangam				Bird Sanctuary			
January	February	March	April	January	February	March	April
F	F	F	F	F	F	F	F
C	C	VC	VC	A	A	A	A
F	C	C	C	VC	VC	VC	VC
-	-	-	-	F	F	F	F
C	F	C	VC	C	A	A	A
-	-	-	-	A	A	-	-
-	-	-	-	VC	A	A	A
-	-	-	-	F	F	F	F
F	F	F	F	F	F	F	F
A	A	A	A	A	A	A	C
F	F	F	F	C	A	VC	C
F	F	F	F	C	C	C	C
F	F	F	F	F	F	F	F
F	F	F	F	F	F	F	F
F	F	F	F	F	F	F	F
F	F	F	F	VC	VC	VC	VC
F	F	F	F	F	F	F	F
-	-	-	-	C	C	C	C

; A = Abundant, 71 and above.

Table 5 : Ecological Survey of the Rivers in Pune City
Distribution of More Numerous Birds along the Mutha River

Name of Species	Names of Places											
	Vitthalwadi				Pumping Station				Dattawadi Bridge			
	Jan	Feb	Mar	Apr	Jan	Feb	Mar	Apr	Jan	Feb	Mar	Apr
1. Egrets	C	F	F	F	F	C	C	VC	C	C	C	C
2. Pond Herons	F	F	F	F	F	C	C	VC	F	C	C	C
3. Little Grebe	F	F	-	-	F	F	C	C	C	VC	VC	C
4. Blackwinged Stilt	F	F	F	F	F	C	C	C	A	A	A	VC
5. Gull-billed Tern	F	F	F	F	F	F	F	F	F	F	F	F
Name of Species	Names of Places											
	Garware Causeway				Sambhaji Bridge				Omkareshwar			
	Jan	Feb	Mar	Apr	Jan	Feb	Mar	Apr	Jan	Feb	Mar	Apr
1. Egrets	C	C	VC	VC	VC	C	VC	C	C	C	C	C
2. Pond Herons	F	C	C	C	C	C	C	C	C	C	C	C
3. Little Grebe	C	F	C	VC	F	F	-	-	C	C	C	C
4. Blackwinged Stilt	A	A	A	A	VC	A	VC	C	C	A	C	C
5. Gull-billed Tern	F	F	F	F	F	-	-	-	F	F	-	-

Name of Species	Names of Places											
	Shivaji Bridge				Dengle Bridge to Sangam Bridge				Bird Sanctuary			
	Jan	Feb	Mar	Apr	Jan	Feb	Mar	Apr	Jan	Feb	Mar	Apr
1. Egrets	F	F	F	F	C	VC	VC	C	A	A	A	A
2. Pond Herons	F	F	F	F	C	C	C	C	VC	VC	VC	VC
3. Little Grebe	F	F	F	F	F	F	F	F	C	A	A	A
4. Blackwinged Stilt	F	F	-	-	VC	VC	VC	C	A	A	A	C
5. Gull-billed Tern	F	F	F	-	C	C	F	F	C	A	VC	C

F = Few, 1 to 10; C = Common, 11 to 30; VC = Very Common, 31 to 70;

A = Abundant, 71 & above

CHAPTER VI

HUMAN ACTIVITIES ALONG THE RIVERS

Human activities along the river should be viewed from angles such as whether the environs of the rivers provide any conveniences and services to citizens; whether the activities contribute to maintenance or destruction of river-environment; and whether they serve certain additional interests such as aesthetic or welfare considerations.

The rivers no longer provide drinking water to citizens of Pune; but water for washing clothes and utensils, cattle and vehicles and even for bathing is still provided by the rivers. At present water supply being inadequate to a number of people, especially from hutments, people come to the rivers for washing wherever it is convenient to approach water. Vitthalwadi, Garware Causeway, Omkareshwar and Natraj causeway, the Sangam, the Bird Sanctuary area provide such convenient points. However, as was said in Chapter II, washing clothes and utensils means undertaking a grave risk of skin and intestinal infections. The same applies to bathing even with greater force. It is most agonising to reflect on the conditions of people living in areas downstream of Pune City when one considers the load of foul matter that the city puts in the rivers and thereby spreads the risk of disease and illhealth

beyond its limits. A number of people come to defecate in the environs of the rivers. Unless better facilities are provided on a larger scale in the hutment areas, it is very difficult to regulate this activity and to that extent all the schemes suggested for the improvement of the river-front will come to nothing.

The rivers appear no longer to provide remunerative fishing. Fishing is carried on mainly during and immediately after the monsoon. The quality of fish probably deteriorates rapidly thereafter. The fishermen whom we met during the survey were seen to fish between old pumping station and Garware causeway. They reported that fish of smaller size and belonging to 3 or 4 varieties (all catfishes) could be found in the river. No one can now make an year-round living by fishing in the rivers.

Vehicles like trucks and three-wheelers are brought to the river for washing near Dattawadi bridge on left bank, and near Garware college causeway and Omkareshwar causeway on the right bank. Cattle are brought for washing near the pumping station, Garware College, Natraj and Omkareshwar causeways. From the point of view of maintenance of habitats and beautification of river-front, it is necessary that these activities are carried on in a regulated fashion.

From the point of view of better health and hygiene it is necessary to stop the overflow of drains going into the rivers. If this is done the quality of water and of fish will

improve. Then not only traditional fishermen but also sophisticated anglers can enjoy fishing in the river. To improve the quality of water it is necessary that vehicles & cattle are not brought to the river indiscriminately. Special facilities can be provided at one or two points for these activities.

The basin of the river Mutha is quite broad and the actual post-monsoon flow of the river occupies only a small middle portion of it. If the flow is suitably channelled and trained, wide open spaces will be available on both sides. Before the Panshet disaster, there used to be good grasslands along the river in some parts. These were devastated and pock-marked and now mostly used for defecation, cattle-grazing and even for some nefarious activities. These open spaces are available on the left bank between Dattawadi bridge and Garware College causeway and between Sambhaji bridge and Dengle bridge on both the banks. These can be improved to provide amenities and recreational facilities to citizens.

From Dattawadi bridge onwards residential buildings have encroached upon the open spaces on the river-side at many points. There appear to be no room left for uniformity of structural design of the riverside buildings. Very tall buildings disturb the sky line and obstruct the free flow of fresh air from the river basin. Functional uniformity is also lacking. The only way left is to maintain and aesthetically use the remaining open spaces.

At some places however, greenery still dominates the landscape, especially between Vitthalwadi and Garware College causeway, on the left bank. The stretch between Sangam and Bird Sanctuary on the Mula-Mutha and most of the river course between Engineering College and Holkar bridge on the Mula are still green. It is necessary to see that no structures come up in these areas along the river as most of them now come under the Green Belt proposed in the new Pune Metropolitan Development Plan. Human activities in these areas, insignificant at present, need to be regulated in view of the future.

Several bridges span the river at various points. There are also causeways that go under flood-water during monsoons. But most of these are in the old, congested areas in the city. People cross the river at certain points where the flow is very shallow. One such very busy point is near the pumping station, between Vitthalwadi and Navsahyadri and other housing societies. Fortunately a low bund exists here across the river which can be made into a causeway without much expense. It will be a great convenience to people living in the areas settled only recently.

CHAPTER VII

IMPROVEMENT OF THE RIVER-FRONTS

Improving the Quality of River-water : From the foregoing it is clear that to improve the quality of water it is necessary to stop the overflow of drains and to some extent of industrial effluents flowing into the river. It will be beneficial not only to citizens of Pune but also to people living downstream.

It is reliably learnt that the PMC engineers are considering a scheme which has this objective. The salient features of this scheme are as follows:

- 1) Collect the overflow of drains in pipes of suitable diameters.
- 2) Carry the overflow in pipe-lines laid on both the banks.
- 3) Release the flow below the Sangam into the rivers again.

These pipelines will cover the area from Garware causeway to the Sangam. However, this will only transfer the pollution from the middle part of the city to the outlying areas. These pipelines which are to be laid on both the banks will be carried under raised platforms on both the banks. It is proposed that the middle 250' portion of the river basin

will be levelled and the river channel deepened. Beyond this portion a retaining wall of a height of 3 meters will be built. The drainage pipes will travel beyond the wall and the portion beyond the wall and upto the edge of the basin will be raised and levelled. The raised platforms will be kept open to be used as pathways by pedestrians and cyclists.

This scheme is basically sound and has the merit of being low-cost. However, the pollution from the river is not eliminated.

An alternative should therefore, be proposed. It is better if the overflows from drains and effluents are led into small settling-cum-purification plants located on the periphery of the river basin all along the river. The treated water coming out of these plants may be led into the pipes which are to be laid on both the banks. From these pipes the treated water may be released at selected points for municipal gardens, tree planting or even riverside private gardens for a fee.

Actually the PMC has built a small-scale settling plant which cannot function properly due to some technical hitches. These can be easily rectified. It may be suggested that a settling plant for every 10,000 population or some other convenient unit may be provided. The cost of these settling plants may be around Rs. 4 lacs each. If 25 plants are provided on both banks, it will involve an expenditure of one crore rupees. The PMC has already worked out the cost of laying

ECOLOGICAL STUDY OF THE RIVERS IN PUNE CITY

Sector No.1 to 3.

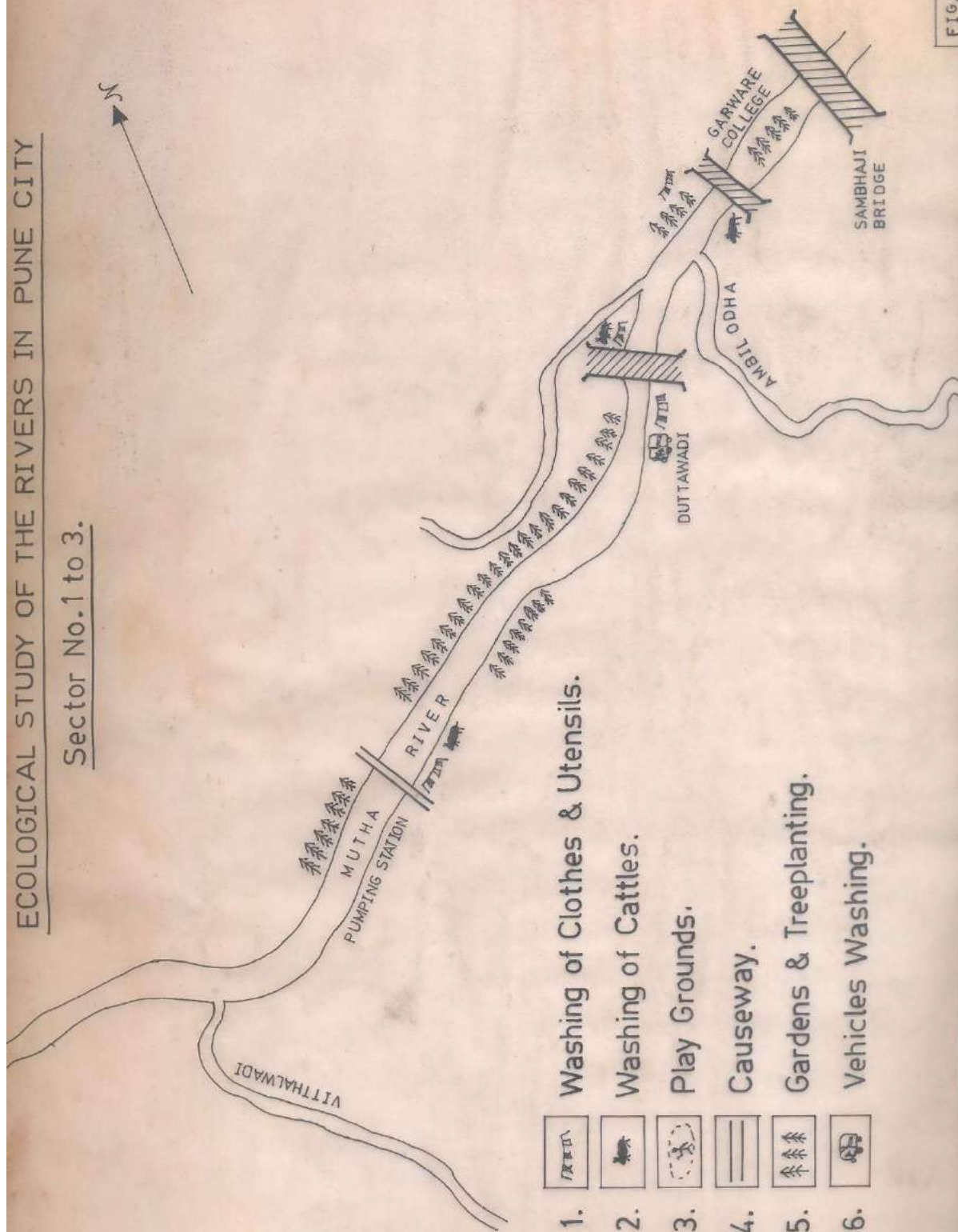


FIG.NO. 8.

pipelines on both the banks. If treated water is taken out from the pipes for trees and gardens, it will effect a net saving in drinking water supply of the city and the Corporation may even earn a modest income by selling water to citizens who have their gardens along the river. Such system is prevalent in New Delhi. This scheme will obviate the necessity of releasing the sewage downstream, in the river.

Improving the River Channel : The flow of river from Vitthalwadi to Dattawadi is slow and the channel broad. Beyond the causeway behind Garware College however, the channel is very much broken, divided and irregular. Immediately after the causeway the river flows into two channels which meet below Sambhaji bridge, creating a substantial island in between the two channels. These channels can be deepened to a uniform depth of 3 meters to take the load of flood-waters and the soil so excavated heaped on the island in the middle. Trees can be planted on the island in the middle, giving it a wild, beautiful look. Beyond Sambhaji bridge the river will flow in the channel which is being designed by municipal engineers. This regulated channel should be extended right upto Dengle bridge. Beyond this the river has a wide basin with a narrow but long island in between. This island is level and has a short turf. It is a fair-weather island and even today children use it as a playground. This use should be continued.

Improving Facilities along the River : As narrated in the chapter on human activities, facilities will have to be

provided to people for washing clothes, utensils, cattle and vehicles. These activities, especially washing cattle and vehicles, will have to be properly regulated so that they are not carried on indiscriminately. It is suggested that facilities for washing clothes and utensils should be provided at the following points:

- 1) Below pumping station on right bank
- 2) Near Dattawadi bridge on left bank
- 3) Below Dattawadi on right bank
- 4) Near Garware College causeway on left bank
- 5) Near Natraj causeway on left bank
- 6) Below Omkareshwar temple on both banks
- 7) Below Dengle bridge on left bank.

For washing cattle the points should be:

- 1) Near Dattawadi bridge on left bank
- 2) Near Garware College causeway on right bank
- 3) Downstream of Omkareshwar causeway on right bank
- 4) Below Dengle bridge on left bank.

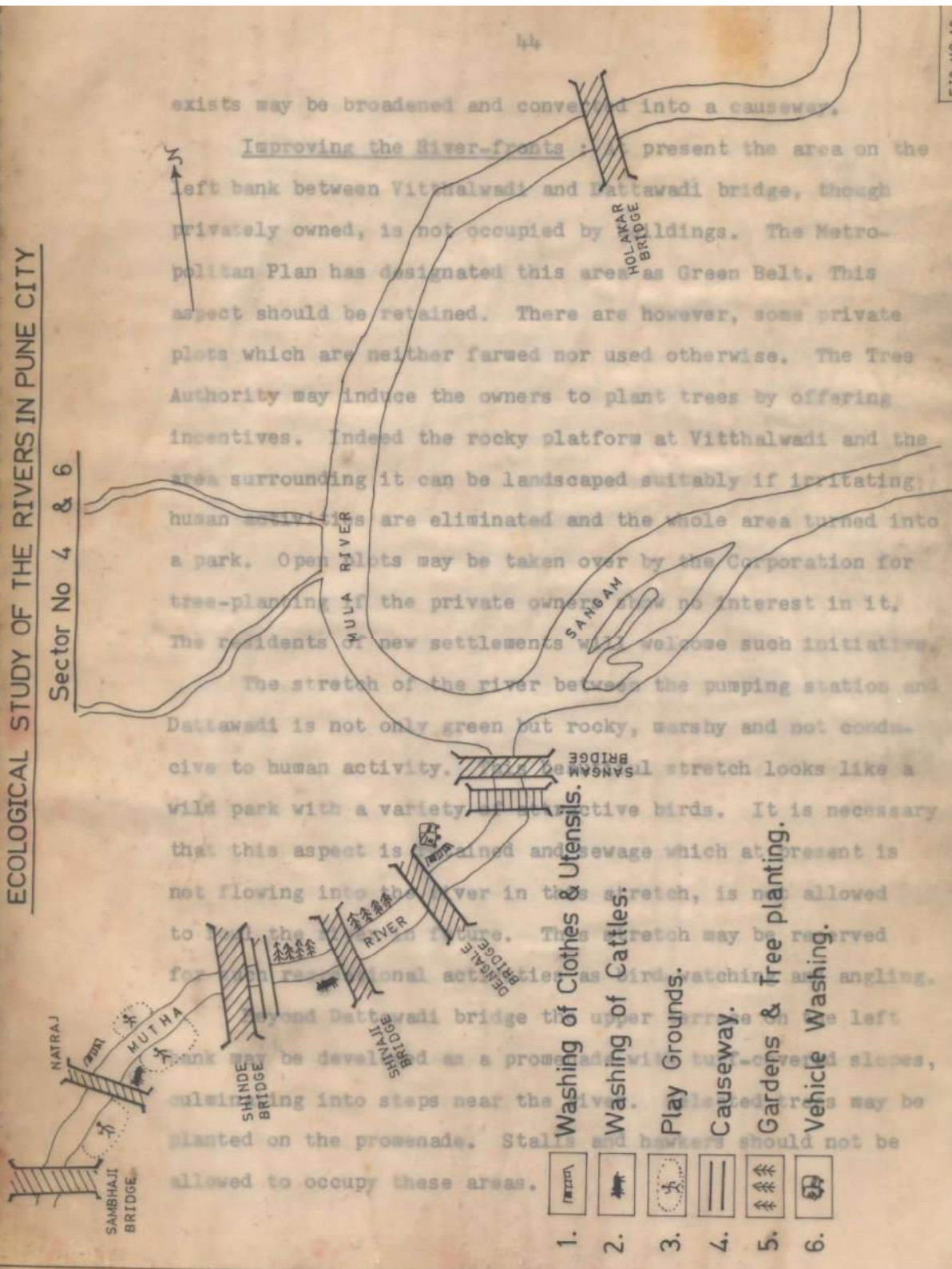
For washing vehicles the points should be:

- 1) Below Dattawadi on right bank
- 2) Below Dengle bridge on left bank

It is also suggested that a causeway should be provided near the pumping station for the convenience of the residents of new settlements in that region. The bund which already

ECOLOGICAL STUDY OF THE RIVERS IN PUNE CITY

Sector No 4 & 6



exists may be broadened and converted into a causeway.

Improving the River-fronts : At present the area on the left bank between Vitthalwadi and Dattawadi bridge, though privately owned, is not occupied by buildings. The Metropolitan Plan has designated this area as Green Belt. This aspect should be retained. There are however, some private plots which are neither farmed nor used otherwise. The Tree Authority may induce the owners to plant trees by offering incentives. Indeed the rocky platform at Vitthalwadi and the area surrounding it can be landscaped suitably if irritating human activities are eliminated and the whole area turned into a park. Open plots may be taken over by the Corporation for tree-planting if the private owners show no interest in it. The residents of new settlements will welcome such initiative.

The stretch of the river between the pumping station and Dattawadi is not only green but rocky, marshy and not conducive to human activity. This beautiful stretch looks like a wild park with a variety of attractive birds. It is necessary that this aspect is retained and sewage which at present is not flowing into the river in this stretch, is not allowed to foul the river in future. This stretch may be reserved for such recreational activities as bird-watching and angling.

Beyond Dattawadi bridge the upper terrace on the left bank may be developed as a promenade with turf-covered slopes, culminating into steps near the river. Selected trees may be planted on the promenade. Stalls and hawkers should not be allowed to occupy these areas.

The open spaces on both sides of the river between Sambhaji bridge and Shinde bridge will be covered by raised platforms on both sides of the river channel. These level platforms should be given over to municipal and other schools for use as playgrounds. The PMC can even earn some income by renting the space out to schools who should be asked to maintain the space clean and healthy. It is possible that for a few days of the year this space may be submerged but this in no way should interfere with school activities as in any case during monsoon playgrounds are not much in use.

Along the Omkareshwar causeway on the right bank exists an old patch of shingle bed which if kept clean and tidy, can be used by citizens for sitting out. No washing of clothes, cattle and vehicles should be allowed here. On the left bank there is no reason why the gardens which at one time used to embellish the river-front, should not be relocated. The raised platforms that will be built on both the banks here, can be used for laying out these gardens. Trees may be planted on the left bank between Shivaji bridge and Dengle bridge on these raised platforms leaving space for facilities for washing.

These measures if implemented, will radically transform the river-front of the city, both aesthetically and functionally.

Fortunately the Mutha river flows from west to east through the city and provides a corridor for fresh air that blows from hills to the west and south-west. Through this

corridor the fresh and cool winds enter and circulate in the densely populated areas much to the relief of the residents. Tall buildings along the river-front interfere with the free flow of fresh air. Also broad roads along the river, while they may relieve traffic congestion in some parts, may give rise to air pollution if heavy vehicular traffic is allowed on such roads. The fumes generated by vehicles will be blown into the city's congested areas by the winds blowing from west and further foul the atmosphere there. It is therefore, advisable to avoid heavy traffic on roads proposed to be built at the edge of the river basin and allow the winds to flow freely.

The developments need not involve colossal expenditure. There is a move in the PMC to allocate 10 lacs of rupees annually for developmental works in each ward. It is suggested that the entire river course may be divided into following wards:

- 1) Vitthalwadi to Dattawadi bridge
- 2) Dattawadi bridge to Sambhaji bridge
- 3) Sambhaji bridge to Shinde bridge
- 4) Shinde bridge to Shivaji bridge
- 5) Shivaji bridge to Sangam.

If rupees 10 lacs are allocated annually to each such 'ward' this modest sum will, within a few years, transform the river-fronts of Pune.