BEFORE THE NATIONAL GREEN TRIBUNAL,
SOUTHERN ZONE, CHENNAI

(Under Section 18 (1)) read with Section 14 of National Green Tribunal Act, 2010)

Application No.153/2016 (SZ)

In the matter of

1. PARYAVARANA PARIRAKSHANA SANGHAM
   Through its President Mr.Y.Krishnamurthy,
   Sompeta, Srikakulam District,
   Andhra Pradesh.
2. E.A.S.Sarma
   14-40-4/1, Gokhale Road,
   Maharanipeta,
   Visakhapatnam – 530002

... Applicants

Versus

1. UNION OF INDIA
   Through Secretary
   Ministry of Environment & Forest
   ParyavaranBhawan, CGO Complex,
   Lodhi Road,
   New Delhi – 110 003

2. CENTRAL WETLANDS REGULATORY AUTHORITY,
   Through its Chairman
   Ministry of Environment and Forests
   And Climate Change,
   Indira ParayavaranBhawan,
   Jorbagh Road, Aliguni,
   New Delhi.

3. STATE OF ANDHRA PRADESH,
   Through its Chief Secretary,
   Government of Andhra Pradesh,
   Secretariat, Hyderabad – 500 022.

4. M/s NCC Ltd.
   (formerly known asNagarjuna Construction Company Ltd).
   Nagarjuna Hills, Punjagutta,
   Hyderabad, Andhra Pradesh.

   (Now at NCC House,
   Madhapur,
   Hyderabad)

   Also at:-

   M/S NAGARJUNA CONSTRUCTION COMPANY LTD.
   Project office at: - Sompeta Town,
   Sompeta Mandal, District, Srikakulam,
   Andhra Pradesh
   Rep by its G.M-Admin & Co-ordination,
   Sri.Badari Narayana N.

... Respondents

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Dated at Chennai on this the 15th day of April 2021.

COUNSEL FOR RESPONDENT -4

1

WETLANDS OF SRIKAKULAM DISTRICT

AN ECOLOGICAL STATUS SURVEY

Final Report

Submitted to

The Ministry of Environment and Forests, Government of India

By

Mathew K Sebastian, P R Arun, T Arthi, M Murugesan & P A Azeez

Sálim Ali Centre for Ornithology and Natural History
Coimbatore - 641108

July 2012

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Glossary, symbols and abbreviations

AP	=	Andhra Pradesh
CADA	=	Catchment Area Development Authority
FGD	=	Focussed Group Discussions
ft	=	feet
GoAP	=	Government of Andhra Pradesh
GoI	=	Government of India
Ha	=	hectare
IMC	=	Indian Major Carps
m	=	meters
MoEF	=	Ministry of Environment & Forests, Government of India
PRA	=	Participatory Rural Appraisal

Acknowledgements

The present study entitled 'Ecological Status Survey of the Wetlands of Srikakulam District, Andhra Pradesh' was carried out by Salim Ali Centre for Ornithology and Natural History with the support of Ministry of Environment and Forests, Government of India. We are grateful to the Ministry for entrusting the study to SACON and extending financial assistance for the same.

During the course of our field work, we have received support from various organizations and individuals. We are thankful to Mr. Mohammad Thayyab, District Forest Officer, Srikakulam district for providing valuable information about the flora and fauna.

Departments of Fisheries and Irrigation play a vital role in maintaining and using the wetland resources for the benefit of the rural community. We acknowledge the valuable assistance rendered by P Koteswara Rao, Deputy Director of Fisheries, Srikakulam district; Mr. P Sudhakara Rao, Deputy Superintending Engineer, Vamsadhara project, Srikakulam, and Mr. Suganakara Rao Sambagi, Executive Engineer, Department of Irrigation. Mr. Sreedhar, Deputy Director, District Industries Centre, Srikakulam was a valuable source of information regarding the industries and related aspects of Srikakulam district.

The officials of various Non Governmental Organizations such as Paryavaran Samrakshana Samiti, Sompeta and Sanjeevani Paryavarana Samrakshana Sangam, Srikakulam, assisted us in reaching the far corners of Sompeta and Naupada wetlands. The officials and members of Fishermen Cooperative Societies have also rendered valuable assistance in carrying out the survey. We express our deep sense of gratitude to all of them.

We are indebted to the members of the rural community in different parts of the Srikakulam district in sparing their valuable time participating in the discussions and answering our questions. We are thankful to the people of Gollakandi village for actively participating in the Participatory Rural Appraisal exercise.

We are grateful to Mr K A Nishad, Research Scholar, SACON for preparing the satellite images of the wetlands.

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Executive Summary

The district Srikakulam (18^0 20' to $19^{0'}$-$10^{1'}$N latitudes and 83^0 05' to 84^0 90', E longitudes) is the most north-eastern and second smallest district in Andhra Pradesh. Spreading over 5837 Km^2 of area, it shares boarders with Odisha state in the north, Vizhinagaram district of A P in the west and south. On its east lies the Bay of Bengal. It is divided into 38 Mandals under three Revenue Divisions viz. Srikakulam, Palakonda and Tekkali.

In view of the large number of wetlands in the district, of which many are under serious threat, the Union Ministry of Environment and Forests (MoEF) entrusted SACON with the present study on the 'ecological status of the wetlands of Srikakulam district'. Although initially envisaged as a short-term, three months, project, considering the number and diversity of wetlands, the study was extended to six months.

The district can be distinctively divided into three zones namely i) the hills, ii) the midland plains, and iii) the coastal plains. Most of the wetlands are seen in the coastal plains, followed by the midland plains.

The rivers, Vamsadhara, Nagavalli, Mahendratanaya and Bahuda flow through the district. The river Vamsadhara, originating in the Eastern Ghats of Odisha state, enters the Srikakulam district in Bhamini Mandal and flows into the Bay of Bengal near Kalingapatanam. The river Nagavalli and its tributary Suvarnamukhi originate in the Eastern Ghats and joins the Bay of Bengal at Kallepalli near the Srikakulam town. The smaller rivers Mahendratanaya and Bahuda drain the northern parts, a narrow stretch of land between the Eastern Ghats and the sea, in the district.

The district is industrially backward. The people in the district depend largely on agriculture for a living. Though the main crop is paddy, millets, horse grams and red grams are also raised. Vegetable/fruits such as Cabbage, Cauliflower, Tomato,

Papaya, Jack Fruit, Cashew, Lemon, and Guava are also cultivated. Jute is also widely cultivated to serve the local industries.

Pisciculture is practiced in most of the wetlands. Traditional inland fishermen depend upon these wetlands for their livelihood. Wetlands in the district provide a number of ecosystem services such as water for irrigation and fish culture, habitat for wildlife, grazing field for livestock, and as a source for fodder, materials for making traditional gadgets for people's day to day uses, edible and medicinal plants. The role of these wetlands in recycling nutrients and arresting of sedimentation and controlling floods remains undervalued.

The coastal plains are blessed with numerous wetlands of different sizes and characteristics, of which 'Beelas' are of ecologically and economically important (Beelas, in the vernacular, are back waters, a wetland system fed by flood waters or a network of streams/channels and connected to the sea through a creek/channel). Four major large wetland complexes, namely Naupada, Sompeta, Ichapuram and Poondi are situated in the coastal plains in the district. In addition there are hundreds of small and medium, seasonal and perennial wetlands of diverse nature.

Sompeta Beela, a complex of three separate but connected water bodies of which two are brackish and the other fresh water, with its surrounding flood plains is a wetland complex with an approximate area of 800 hectares. It is an important habitat of 121 bird species and 493 plant species. Many bird species seen here fall under IUCN Red List. Around 100,000 people belonging to 30 villages around the wetland depend upon the wetland complex for various purposes, deriving ecosystem goods and services. During the dry season drained out portions of the wetland is used for grazing by thousands of cattle and wild boars. Around thousand families belonging to the traditional fisher communities fully depend upon the wetland for their sustenance. Around 2000 hectares of paddy (two crops) and 300 hectares of vegetable and horticultural crops are irrigated directly drawing water from the beela.

Naupada swamps is another large wetland complex which falls in the Tekkali division of the district. The Naupada swamps consists of vast stretches of perennially and seasonally water logged areas, salt pans, and the Tekkali creek through which it connects to the sea. As per the revenue records the total wetland area, excluding the creek, is approximately 2800 hectares. During monsoon, fed by numerous water channels, vast stretches of this wetland is inundated. Thus, Naupada swamps perform invaluable ecosystem services of flood and siltation control, and enhancing the recharge of ground water in hundreds of villages in its environs.

It is an important foraging ground for Pelicans and Painted Storks from the Telineelapuram Important Bird Area (IBA), just 4 Km away. Our rapid survey found 145 bird species here, out of which 13 species belong to the IUCN Red List. Two thirty six plant species were also listed from the swamp area. One thousand fishers depend upon the wetland on a regular basis eking out a living. This wetland also provides numerous wetland services to lakhs of people in the surrounding villages.

Poondi wetland, a backwater one, has a water-spread of about 200 ha and vast stretches of salt pans and aquaculture farms in the adjoining areas. Ichapuram wetland spreads across the Srikakulam and the Ganjam district of Odisha state. Apart from providing habitats for several species, this wetland and adjacent hundreds of acres of salt pans and aquaculture farms provide livelihood for thousands of households.

All the above mentioned wetlands are extensively used for fishing, traditional fisher communities (viz. Kaviti, Behra and Kandra) holding the rights. These communities use tralatitious gears and techniques for fishing in a sustainable way. Adept only in these traditional skills their survival is inextricably linked to the survival of the wetlands. Same is the case of several invaluable and wild species living in / on the wetlands.

In addition to the abovementioned major coastal wetland complexes hundreds of wetlands of different sizes and characteristics are seen in the coastal plains of the district. Most of the wetlands, despite pressures from intentional and unintentional anthropogenic and other pressures, harbour valuable floral and faunal biodiversity. These wetlands provide several known crucial ecosystem services such as water for irrigation, fishing, grazing land for thousands of cattle during lean period, fodder, edible and medicinal plants, roofing and thatching materials, and several unaccounted services such as moderating local climate and offering haven for several known and unknown species. Regulating services such as flood control, sediment retention, ground water replenishment, and water purification contribute to the very maintenance and survival of the ecology of the entire region, which however remains largely unrecognised, neither studied nor documented.

Both the Important Bird Areas (IBA) in the district, Telineelapuram and Telkunchi are in the coastal areas of Srikakulam. While Telineelapuram harbours more than 150 Spot billed Pelicans and 200 Painted Storks, Telkunchi sustains thousands of Open Bills and many other birds.

The coast of Srikakulam district is the second largest breeding site after Odisha coast for the endangered Olive Ridley Turtles. Their preferred breeding grounds are the river mouths and adjoining areas. Olive Ridley Turtles travel from the sea south of Sri Lanka to the coasts of Odisha, passing through Tamil Nadu and Andhra coastal waters during the breeding season. Therefore to ensure the survival of Olive Ridleys , it is imperative that the coasts and coastal waters are kept devoid of constructions that will change the coastal setting and ambience.

The midland plains in the district are also rich in wetlands of varying sizes harbouring valuable biodiversity and providing various ecosystem services. Many of these wetlands are connected to rivers Mahendratanaya, Vamsadhara or Nagavalli. A number of these perennial wetlands are foraging grounds for several

conservationally important bird species such as Spot billed Pelican and Painted Storks.

Madduvalasa reservoir created by a dam in the Swarnamukhi river, which is a tributary of Nagavalli, is important for people of the district. It also supports very important biodiversity; both floral and faunal. Apart from many other birds, species such as Darter, large flocks of Tufted Duck showing some morphological variance, was observed here.

The integrity of most of the wetlands is under threat due to various pressures, some of which are universal and some particular to the district. Due to the well developed transportation links such as the Chennai-Calcutta National Highway and the broad-gauge railway line passing through the coastal areas, and easy access to the sea for building Jetties, transportation of construction materials and raw materials for industries is cost effective. Proposals for setting up two Super Thermal Power Plants (STPPs), one at Sompeta and another one at Bhavanapadu, a part of the Naupada swamps, are in advanced stage. Despite intense opposition from the local communities, NGOs, Environmentalists and Scientists, permission was granted for both the proposals. However, both places have seen 3 human casualties each while protesting against the projects, forcing the authorities to suspend permission for the projects till further studies are taken up on the ecological status of all the wetlands of Srikakulam district (order dated 14 July 2010 by National Environment Appellate Authority).

The changes in the natural landscape settings, alteration in natural flow regimes, construction of roads, transportation of construction and raw materials and release of thousands of tons of pollutants to the environment during the operation of the STPPs will cause irreparable damage to the coastal ecosystem imperilling not only the rich biodiversity but also the wellbeing of lakhs of inhabitants of the coastal area who depend upon the wetlands directly and indirectly and would effectively marginalise them. The impact of the jetties proposed to be built for bringing in fuel /

coal for the STPPs and the release of thousands of gallons of water to the sea during the STPP operation on the breeding migration of the Olive Ridley Turtles as of now is little known.

Bhavanapadu wetland is an important foraging ground for the Spot billed Pelicans and Painted Storks of the Telineelapuram Heronry. Any qualitative / quantitative changes in the Bhavanapadu wetland will adversely affect the survival of these 'Near-threatened' birds.

Our exploratory surveys employing participatory tools among the adjoining villages indicate a strong possibility of the existence of the critically endangered Pink Headed Duck during November to January in the core area of Sompeta wetland. Any changes in the wetland complex will deny an opportunity to take up further enquiries in this regard and perchance if this 'critically endangered' species is confirmed as present there it will lead to an irremediable loss.

It is disheartening to note that water from none of the wetlands is used for drinking indicating the deterioration of the water quality. The major threats generally faced by the wetlands of the district are pollution caused by agricultural runoff, wide usage of wetlands for curing the jute bark, dumping of solid wastes especially in urban and semi urban wetlands, sewage discharge, encroachment, open defecation on the banks of wetlands which leads to increased microbial and organic load. Poaching of birds is widespread in the wetlands. Cleaning and modification of wetlands, without appropriate supervision, under the MNREGA programme is also wiping out plant biodiversity from many of the wetlands and possibly associated animal species.

As of now consequences of Industrial pollution is explicitly seen only in the Pyedibhimavaram area, bordering the Visakhapatnam district, hardly five kilometers away from the coast. Most of the effluents here flow to the sea through a wetland near the industrial area. Effluents from M/s Nagarjuna Agrichem Ltd manufacturing agrochemicals including fungicides and pesticides apparently play havoc with the

ecology of the nearby wetlands and ecosystems and deprives the local inhabitants' of safe drinking water and water for irrigation.

The wetlands and its environs of Srikakulam district provide habitats for 236 bird species and 662 plant species. Information on other taxa is scanty. As noted above several birds falling under 'Near threatened', 'Vulnerable' and 'Endangered' IUCN categories and Schedule- I of IWPA-1972 are seen in the wetlands and its environs.

The 'Beelas' as made out are not inconsequential water bodies in the coastal plains and should be protected from any violations of their integrity as they are ecologically sensitive and important, habitats for diverse biodiversity including several species under various categories of threat, and to ensure environmental, food and water security for lakhs of people. The plans for setting up the Super Thermal Power Plants in those wetlands should be re-examined.

Lakhs of people depend upon the various ecosystem goods and services provided by the coastal wetlands for their survival. There are 83 marine fisher's habitations apart from the hundreds of settlements of local farmers, traditional pisci-culturists, workers in the numerous salt pans and inland fishers in the coastal area. The water and food security of the coastal plains depend upon the wetlands to a great extent. Therefore, no activity that will threaten the integrity of the wetlands should be allowed.

Srikakulam coast is the second largest endangered Olive Ridley nesting site in India. This species prefer river mouths for breeding. Therefore, special protective measures have to be devised and executed in the coastal belt. The coastal waters of Andhra Pradesh being an important pathway for migrating Olive Ridley turtles in search of their nesting sites, construction of Jetties near the Srikakulam coast and also the release of effluents to the sea should not be allowed.

To conserve the breeding sites of the Olive Ridley Turtles, 'Interest Groups' involving the stakeholders have to be formed and awareness campaigns and other steps needed for achieving the objective should be taken up.

Since, our survey using PRA tools surmises the presence of the endangered Pink Headed Duck, which has not been sighted in the country for more than half a century, in the core area of the Sompeta wetland, pending its confirmation, immediate steps should be taken up to protect the habitat from any disturbance and investigations should be taken up right away to ascertain the presence of the bird.

Both Naupada swamps and Sompeta wetland are rich and distinctive ecosystems. However, scientific documentation on these wetlands is grossly inadequate and therefore it is imperative that a multidisciplinary research programme is taken up on these wetlands and a comprehensive management plan prepared. Considering their apparent ecological values steps should be initiated to declare both the wetlands as Ramsar sites.

Jute cultivation and processing is an important economic activity in the district. Appropriate methods that will not spoil the wetlands may be devised and executed for curing jute. Construction of special cement water tanks may be considered for the purpose.

The present survey indicates that many fishermen indulge in poaching birds and other wild life, maybe being unaware of the importance of such species. Awareness programmes have to be initiated to address this issue. Programmes with stakeholder participation should also be formulated that would help in this and protect such wetlands.

Under the Mahatma Gandhi National Employment Guarantee Programme cleaning and expansion work has been taken up in many wetlands which lead to the removal of plant biodiversity which in turn impact the bird and other animal biodiversity.

Measures to sustain the biodiversity of the wetland have to be devised and implemented while carrying out such works using MNREGP funds.

Wetlands should not be used as dump yards for wastes of any kind, municipal, industrial, commercial or domestic. Industrial effluents should not be allowed to be discharged into the wetlands even after treatment. Rules and regulations pertaining to Solid Waste Management and wetland management should be strictly enforced.

In brief, it is suggested that all the wetlands (including interconnected wetland complexes such as coastal wetlands of Sompeta) in the district with more than 500 ha should be identified and protected alongwith wetlands that are ecologically sensitive,though they are less than 500 ha, and important which are major wildlife habitats, areas of outstanding natural beauty or historical or heritage areas and the areas rich in genetic diversity as stipulated in the National Wetland (Conservation & Management) Rules-2010. They should not be allowed to be converted for any other purpose. It is also suggested that firm attempts should be made, especially for the four major wetland complexes in the coastal plains, to document their ecological and conservational values, the ecological goods and services form these and to conserve them. A strategy to use them wisely in sustainable manner should be formulated and executed, perhaps by a system such as ecodevelopment committees.

1 INTRODUCTION

1.1 BACKGROUND

The Union Ministry of Environment and Forests (MoEF) entrusted SACON with the present short-term study on the wetlands of Srikakulam district of Andhra Pradesh (AP). Srikakulam is the second smallest district of the state with an area of 5837 Km^2, having more than 8,000 wetlands of different sizes and characteristics. Although initially envisaged as a short-term, three months project, considering the large number and diversity of wetlands of the district, the study was extended to six months to do justice to the task of representative sample data collection.

1.2 STUDY AREA

The district Srikakulam, situated between 18^0 20' and 19^0, 10'N latitudes and 83^0 05' and 84^0 50' E longitudes, is the north eastern most one in AP state. The district is divided into 38 Mandals under three Revenue Divisions viz. Srikakulam, Palakonda and Tekkali. The district shares boarders with Odisha state in the north, Vizhinagaram district of AP in the south while Bay of Bengal lies along the east. In the district the altitude varies from sea level to to above 1100 m above msl in the hills.

The district receives an annual average rainfall of 1162.5 mm.

The district can be distinctively divided, based on the terrain and geomorphology, into three zones namely i) the Hills, ii) the Midland plains and iii) the Coastal plains. Most of the wetlands are seen in the coastal plains followed by the midland plains. The coastal plains harbour major four large wetlands namely, Naupada, Sompeta, Ichapuram and Poondi.

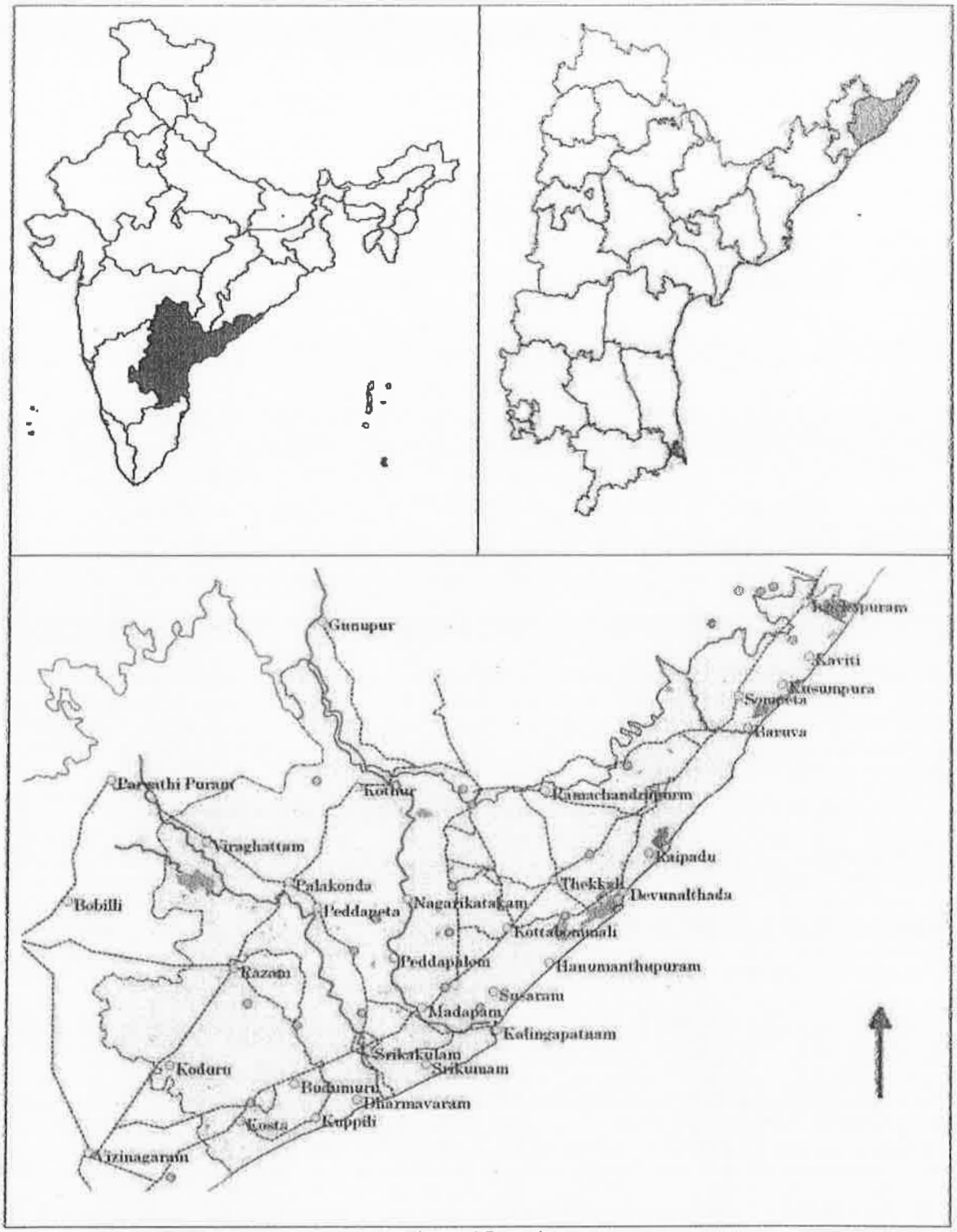


Figure 1 Location map

Apart from these major wetland complexes, there are hundreds of small and medium, seasonal and perennial wetlands in the coastal area. The major rivers of the district, Nagavalli, Mahendratanaya and Vamsadhara drain into Bay of Bengal. The river Vamsadhara originating in the Eastern Ghats of Odisha state enters Srikakulam district in Bhamini Mandal and finally flows into the Bay of Bengal near Kalingapatanam. The river Nagavalli and its tributary, Swarnamukhi originate in the Eastern Ghats and joins the Bay of Bengal at Kallepalli near Srikakulam town. Other smaller rivers such as Mahendratanaya and Bahuda drain into the northern parts, a narrow stretch of land between the Eastern Ghats and the sea.

Table 1 Mandals under the three divisions in Srikakulam District

Palakonda Division	Tekkali Division	Srikakulam Division
1. Veeraghattam	1. Palasa	1. Sarubujjili
2. Seethampetta	2. Mandasa	2. Ganguvarisigadam
3. Bhamini	3. Kanchili	3. Amadalvalasa
4. Kothuru	4. Ichapuram	4. Narasannapeta
5. Pathapatnam	5. Kaviti	5. Polaki
6. Meliaputti	6. Sompeta	6. Gara
7. Palakonda	7. Vajarapukothuru	7. Srikakulam
8. Heeramandalam	8. Nandigam	8. Ponduru
9. Vangara	9. Tekkali	9. Laveru
10. Regidiamadalavalasa	10. Santhabommali	10. Ranastalam
11. Lakshminarsupeta	11. Kotabommali	11. Etcheria
12. Sarvakota	12. Jalumuru	
13. Burja		
14. Santhakaviti		
15. Rajam		

The Coastal Plains: Coastal plains are highly productive fertile area harbouring different types of ecosystems. Extensive sand bars / mounds are seen near Kallepalli, Srikakulam, Kalingapatnam, Bhavanapadu, Vajrapukotturu, and Baruva; along the estuaries of the river Nagavalli near Kallepalli, river Vamsadhara near Kalingapatnam and the river Mahendratanaya near Baruva. Under the agro-forestry programme of the state forest department, private entrepreneurs have converted vast coastal stretches into cashew plantations providing green cover to the entire coast.

The Plains: The midland plains lie within the network of semi-perennial rivers like Vamsadhara, Nagavalli, Bahuda, Mahendratanaya, and their tributaries. In the plains there is little forest. The areas being highly fertile are under permanent agriculture or horticultural crops.

The Hills: The hilly region, lying in the north and west of the district, forming part of the Eastern Ghats, is characterised with highly undulating terrain. This terrain covers parts of Palakonda, Pathapatnam and areas of Mandasa, Sompeta in the north-west and northern part of the district. About 1/3rd of the total area of the district is hilly.

The Eastern Ghats run, roughly parallel to the sea from the north-east to the south-west. Some prominent hills in this range in the district are given below. These hill ranges with their isolated hills show a distinct north – west, south east trend.

Table 2 Prominent hills in the district

S.No.	Name	Altitude (m)
1	Himagiri	1120
2	Darabanda	950
3	Rangavalasa	950
4	Chintaleguda	900
5	Burnakonda	812
6	Anitkonda	684
7	Palakonda	650

Source: Draft Working plan 2011, DFO Srikakulam

1.2.1 Geology, Rocks and Soil

The Srikakulam district geomorphologically is characterised by rocks of Archaean ages comprising of Granites and Charnockites, which have intruded into the highly folded and metamorphosed sedimentary rocks, represented by Khondalite series. The district forms a part of the stable peninsula, where these are overlaid with recent age laterite and alluvial soils.

1.2.2 Demography

As per 2001 census, the population of Srikakulam district is 25,37,593; females 50.3% and males 49.7%. For the district the decennial growth rate for 1991 to 2001 is

9.33%, as against 14.44% for the whole state of AP. The district population density is 435 persons per km^2 as against the state average 277. Scheduled caste and scheduled tribe population in the district is 2,29,609 (9.05%) and 1,51,249 (5.96%) respectively. The literacy rate is 67.19% for males and 43.68% among females. The urban population is 2,78,659 (10.98%) as against the 27.35% for the whole state.

1.2.3 LAND UTILIZATION

During the year 2009-10 the cultivable land was 3,56,654 ha, 61.10% of the total geographical area of the district. Net area sown represents 2,84,644 ha accounting for 48.76% of the total. Forest area in the district during 2009-10 is 68641 ha; 11.76% of the total geographical area.

1.2.4 AGRICULTURE

The role of agriculture, which is mostly rain fed, in the district economy is very significant. The agricultural practices in the plains and hills vary. Tribals following primitive method of agriculture are predominant in the hilly terrains. They practice *'Konda-podu'*, a mode of traditional hill cultivation. Though main crop is paddy; millets, horse grams and red grams are also raised. Vegetable/fruits such as Cabbage, Cauliflower, Tomato, Papaya, Jack Fruit, Cashew, Lemon, Guava etc, are also cultivated by the tribals near their dwellings. The yield from the agri-horticultural activities is just sufficient to meet their domestic consumption only. The tribals collect Non Timber Forest Produce (NTFP) such as Tamarind and Adda leaves (*Bauhinia sp*) and sell them to Girijan Co-operative society which provides them additional income.

Agriculture in the plains is practiced on the modern lines using improved seeds, fertilizers, pesticides etc. The main Kharif crop is Meshta Jute (*Hibiscus cannabinus)* which is cultivated extensively in Palakonda, Amadalavalasa, and Rajam Mandals. The product is largely utilised by the Jute mills at Amadalavalasa and Singupuram in the district, while the surplus is sent to Calcutta.

The most important wet crop is paddy, intensively cultivated in the plains. Cultivation of coconut and cashew in coastal areas and, mango in the plains is very profitable. Casuarina (*Casuarina equisetifolia*) is also raised in small plots chiefly to meet their domestic fuel requirement and also as a source of income.

1.2.5 Irrigation

Thre are several major (Table 3) and minor (Appendix 9) irrigation projects in the district, catering to the agriculture needs of the area. There are several ongoing irrigation projects in the district with vast expanses of water storage and channel systems. These irrigation / channels augment the number of wetlands in and around.

Table 3 Major irrigation schemes and area irrigated (2009-10)

Sl.No.	Project	Registered Ayacut (Ha)
1.	Vamsadhara Stage-1	60012
2.	Vamsadhara Stage-II	18212
3.	Thottapppally Barrage	30485
4.	Narayanapuram Project	15001
5.	Paidigam Project	2021
6.	Thottappally Regulator	12837
7.	Madduvalalsa	9996
8.	Bahuda Barrage	2096
9.	Vonigadda Reservoir	80
	Total	**150740**

Source: Report of Executive Engineer, I & CAD, Irrigation, Srikakulam (2011)

1.2.6 Fisheries

Inland fishing based on *'Beela's* and tanks are a major source of income for the fishing communities. The traditional fishers, mostly migrants from Odisha, belonging to Scheduled Castes/Scheduled Tribes hold the fishing rights in these water bodies. The ownership of the tanks is vested with Gram Panchayats or Fisheries Department and these tanks are leased to the Fishermen Cooperative Societies.

Table 4 Inland Fish Production (2009-10)

Sl. No.	Fish species	Quantity (M.T.)	Value (lakhs)
1	Barbus	540	135
2	Indian Major Carps	4958	3222

Sl. No.	Fish species	Quantity (M.T.)	Value (lakhs)
3	Cat Fishes	145	43
4	Common Carps	-	-
5	Murrel	344	275
6	Mullets	128	51
7	Prawn	514	514
8	Miscellaneous	978	293
	Total	7607	4533

Source: RC No. Mapping/2012, Report by Dy Director of Fisheries, Srikakulam

1.2.7 INDUSTRIES

Jute is the major Kharif crop and Jute Mills are the industrial backbone of the district. As per the District Industries Centre statistics, in 2009-10 there are 24 large and medium scale industries in the district.

	Industrial unit	Product	Capacity	Investment Rs. in lakhs	Employment
1	M/s Amadalavalasa Coop. Sugars, Amadalavalasa	Sugar	1000 TPD	300.00	709
2	M/s Mahadeo Jute mills Ltd., Rajam	Jute twine Yarn	5500 TPA	300.00	358
3	M/s Vamsadhara Paper Mills Ltd., Madapam	Kraft paper	16500 TPA	1109.46	397
4	M/s Dr. Reddy Laboratories Ltd. IDA, Pydibheemavaram (Ranasthalam)	Bulk drugs	2250 TPA	1287.34	91
5	M/s Smart Chem Industries Ltd., Ponnada village, (Etcherla Mandal)	Ammonium, Nitrate & Nitric acid	16500 TPA	5315.00	262
6	M/s Midwest Iron & Steel Co. Ltd., Dusi RS Amadalavalasa	Pig Iron	1,50,000 TPA	4000.00	252
7	M/s Samkrg Pistons Ltd., Varisam village Ranasthalam (M)	Piston rings	150 lakh nos	4000.00	180
8	M/s Varalaxmi Jute Twine Mills Ltd., Rajam	Jute Twine Yarn	7250 TPA	816.00	235
9	M/s Stilbene Chemicals, Ltd., IDA, Pydibheemavaram Ranasthalam	Dye intermediates	500 TPA	4218.00	278
10	M/s Chem. Agro Inds. Ltd., Arinam Akkivalasa vill. Etcherla Mandal.	Monochrotophos	500 TPA	4218.00	108
11	M/s GMR Technologies &Inds. Ltd. Ravivalasa vill Tekkali Mandal	Ferro Chrome	500 TPA	3000.00	245
12	M/s Saritha Synthetics Ltd., Rajam	Texturised yarn	1257 TPA	1692.00	190
13	Sri Laxmi Srinivasa Jute Jutetwine mills	Twine Yarn	4300 TPA	300.00	270

	Ltd., Rajam				
14	Emergy Pharma Ltd., Ravivalasa (V) Ranasthalam ,	Folic acid	5500 TPA	700.00	240
15	Sri Vasavi Steel Mills Ltd., Rajam	MSCTD bars and rounds	5760 TPA	420.00	224
16	M/s Samkrg Pistons Ltd., Arinam akkivalasa Etcherla Mandal	Pistons	10 lakh	655.00	321
17	Mid-West Iron & Steel Portland & Co. Ltd. Dusi RS. Amadalavalasa Mandal	Slag Cement	51,000 MTS		13
18	M/s Saritha Synthetics Polyester Grey Ltd., (Looms division) Challavanipeta vill Gara Mandal	cloth Metres	22,51,300	300.00	300,0026
19	M/s GMR Technologies (Sugar division Sankili vill, Regidi(M))	Sugar and 16 MW power	2500 TPD	8903.82	650
20	M/s Shiva Sagar Chemicals Ltd., Akkurada vill	Paper & Kraft Paper	75,000 TPA	900.00	148
21	M/s GMR Vasavi Inds, Ltd., Bantupalli vill, Ranasthalam Mandal	BEER	5000 K. Litres	2300.00	150
22	M/s Sri Shiridi Sai Laxmi Venkateswara Jute mills (P) Ltd, Fine yearn Gunabhadra vill, Kotturu(M)	Jute twine	1500 TPA	223.00	141
23	M/s Varam Power Projects(P) Ltd., Chilakapalem vill Etcherla (M)	Power generation	6 MW	2400.00	75
24	M/s Andhra Organics IDA, Pydibheemavaram	Bulk Drugs		2007.00	100

Source: District Industries Centre, Srikakulam

1.2.8 FLORA AND FAUNA

Currently the forests in the district are largely mixed dry deciduous forests which are secondary in origin. Constant adverse biotic factors particularly, recurring annual forest fires, grazing and *'podu'* cultivation are some of the factors which led to the present degraded condition of the forests. Based on the Champion & Seth's revised classification of forests of India (1968) the following types of forests existed in the district.

Southern tropical moist mixed deciduous forests: These are high forests, generally 20 m and above, with relatively negligible number of evergreen elements in the upper canopy. Evergreen habit is more pronounced in the lower storey. Bamboo under growth is generally absent, but when present constitutes the second storey.

Epiphytes and climbers are plenty. Altitude is 610 m and above and average rainfall is 1020 mm and above. The trees in the top storey are leafless for a short period either in winter or early summer. Most of these trees flower during summer.

This type occurs in localized small patches in valleys and near perennial streams at a fairly high altitude where the conditions are favourable. They are found in parts of Burnakonda and Antikonda block of Palakonda range. This type of forest extends over 2600 ha.

Northern Tropical Dry Deciduous Forests-Sal Type: The distribution of Sal (*Shorea robusta)* is restricted owing to the relatively narrow limits of locally conducive factors suitable for it. The soils in this type of forests, which is absent or thin on the ridges, vary from deep ferruginous sandy loams to clay and lime, leading to stunted growth of sal. The tree height here is 20 to 25 m, density 0.6 to 0.8, canopy fairly closed, and with under growth. Altitude is between 350 to 600 m, and rainfall above 1,000 mm.

Sal is found in the northern most part of the district bordering Odisha state, in areas lying between the rivers Vamsadhara and Nagavalli and their tributaries as they enter AP. Confined to the Palakonda Range, Sal forests are spread over about 20 ha.

Southern Tropical Dry Mixed Deciduous Forests: The upper canopy in this forest types is rather open, uneven and not very dense, formed by a mixture of deciduous trees. Most of these trees also occur in moist deciduous forests, attaining a satisfactory growth there. The height of dry deciduous forests in this division is generally 10 to 15 m. The species is much less in number than other types of forests and a few tend to predominate in any selected area for the soil peculiarities or human interference. The lower canopies also consist of deciduous species here and there. Semi-ever green scrubs when present are confined to moist sheltered pockets. Bamboos are present. Due to open canopy enough light gets down

permitting grass growth. Annual fire and other biotic factors eventually result in the development of dry scrub and eventually leading to savannah type.

Rainfall is between 600 m and 1000 mm. Soils are impoverished, organic matter and topsoil being practically absent and the area, of these forests spread over 26,000 ha.

Dry Deciduous scrub: This is a degradation stage of dry deciduous mixed forest conditioned by heavy grazing, fires and removals. The adverse biotic factors overrule the favourable climate and keep these forests in a degraded stage preventing improvement /progression of the vegetation. Canopy height never exceeds 6 m and is open with the presence of Bamboo. Many of the shrubs here are unpalatable (*Holarrhena antidysenterica, Dodonaea viscose* etc) to cattle or thorny (*Randia, Carissa*). These forests are characterized by the presence of relatively high percentage of thorny species, and thin grass occurring throughout. The soils here are impoverished, eroded, gullied, bouldery and rocky, and rainfall below 1,000 mm.

Dry Evergreen Forests: These forests are mostly open, irregular with an average height of 6 m and less. Preponderance of thorny species is conspicuous. This type of forest occurs in the eroded slopes, surface being gravelly with almost no soil subject to heavy biotic interference. This forest occurs in Bejji and Asokam blocks of Pathapatnam range spreading over 16,800 ha.

Beach Forests: This type of forests is distributed all along the coast wherever a fair width of sandy beach occurs. The soil is sea-sand often blown and accumulating low-dunes with adequate lime from shell-fragments but poor in other mineral nutrients. These forests extend over 5820 ha. Species seen here are very few; *Casuarina equisetifolia, Ipomea biloba, Spinifex squarrosus, Pandanus odoratissimum*a and climbers like *Chinopodum* near the estuaries.

1.2.9 Forest Fauna

The forests shelter fairly good wildlife, including Leopard, Sambar, Spotted Deer, Wild Boar, Sloth Bear, and several other species. Local migratory birds such as Open

Bill Stork, Painted Stork, and Pelican are regular in the district. In recent years wildlife is improving because of the protection of forests under participatory management.

1.2.10 WETLANDS

Wetlands are the ecotones or transitional zones between permanently aquatic and terrestrial ecosystems. Ramsar Convention has defined wetlands as "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters".

Wetlands are increasingly coming under pressure due to the fast growing human population, its needs and its associatory changes such as rapid urbanization, industrial and urban pollution, solid and liquid waste dumping, changing land use patterns, diverting and manipulating hydrological regimes and their wanton destruction for setting up various other structures and industries. Wetlands are important feeding and breeding grounds for wild life and the destruction/decline of the same leads to loss of biodiversity. Wetlands are also valuable repositories of plant / animal genetic pools.

A substantial chunk of rural population, in India and elsewhere, depend upon wetlands for various means of their livelihoods such as agriculture, irrigation, fisheries, medicinal and edible wild plants, fodder, and materials for thatch and for preparation of various key utility items. The decline in the wetlands, while directly impacting the very existence of the ecosystem, make ecological refugees of the ecosystem people depending on the wetlands for their life needs.

1.2.11 RAMSAR CLASSIFICATION OF WETLAND TYPES

As per the Ramsar Convention the Wetlands are classified into 42 subtypes under three major categories, namely marine/ coastal wetlands, inland wetlands and human made wetlands (Appendix 1).

1.2.12 Ecosystem services from Wetlands

The values of the wetlands are increasingly being acknowledged all over the world as a result of the ever increasing awareness about the role they have been playing in the development of civilisations and over all welfare of the humanity by ensuring water security and food security and several other services being derived from them. As earlier, wetlands no more are considered as wastelands. It has been estimated that wetlands provide US $4.88 trillion yr^{-1} as ecosystem services. These ecosystem services include flood regulation, water supply, water quality maintenance, facilitating pollination, biological control, food production, and others. According to Costanza et al., (1997) wetlands are 75% more valuable in terms of ecosystem services than lakes and rivers, 15 times more valuable than forests, and 64 times more valuable than grassland or rangelands (Bruland, 2008).

As noted above the wetlands offer a variety of services to human kind, numerous other species and to the environment. Some of the well known such services, grouped into different types, are briefed below.

Basic categories of Ecosystem Services (Millennium Ecosystem Assessment, 2005)
Provisioning Services: supply a large variety of ecosystem goods and other services for human consumption, ranging from food and raw materials to energy resources and genetic material.
Regulating Services: regulate essential ecological processes and life support systems through bio-geochemical cycles and other biospheric processes. These include things like climate regulation, disturbance moderation and waste treatment.
Cultural Services: provide an essential 'reference function' and contribute to the maintenance of human health and well being by providing spiritual fulfilment, historic integrity, recreation and aesthetics.
Supporting Services: provide a range of services that are necessary for the production of the other three service categories. These include nutrient cycling, soil formation and soil retention.

1.2.13 THREATS TO THE WETLANDS

Urbanisation: Ever increasing demand for space for residential, infrastructure, commercial and recreation activities are adding pressure on wetlands. Already the wetlands are fast disappearing for various such reasons.

Pollution: Dumping solid wastes and discharge of liquid waste and industrial effluents, toxic chemicals from industries and households are destroying the wetlands.

Industrialisation: More and more wetlands are being diverted for setting up industries flouting wetland conservation rules and guidelines.

Agriculture: Booming requirement for new areas for cultivation makes wetlands very prone for diversion.

Deforestation: Extensive land use changes in the catchment and deforestation is leading to heavy siltation of wetlands and changes in the water regime.

Climate change: Coastal wetlands are under threat from sea level rise as a consequence of global warming. Erratic changes in the pattern of precipitation increase in ambient temperature, frequent floods and droughts pose serious threats to the hydrological regime and biodiversity of wetlands.

Weeds: Exotic species like Salvinia and Water Hyacinth invade wetlands, dominate the macrophytes and choke them and curtail the growth of the planktonic forms eventually leading to the death of the wetlands.

Salinisation: Depletion in the water table due to overexploitation of ground water leads to reduction of wetland size as well as increase in salinity.

1.2.14 WETLANDS IN INDIA

According to Ministry of Environment and Forests (1990) there are 67,429 wetlands in India above 100 ha in size covering a total area of 4.1 million ha.These wetlands

are distributed in varied eco-geo-climatic zones from the Himalayas to the Peninsular India. Wetlands, of which 70% is rice-paddies, occupy 18.4% of India's geographical area. The diversity of Indian wetlands is fascinating. It ranges from the high altitude wetlands of the Himalayas, saline and temporary wetlands of the arid and semi arid regions, coastal wetlands such as mangroves, low tide areas, swamps, lagoons, backwaters, estuaries, and coral reefs. In addition to the natural wetlands there are thousands of manmade wetlands constructed for various purposes such as irrigation, drinking water, electricity generation and flood control. Out of the 4.1 million ha of wetlands in our country (excluding irrigated agricultural lands, rivers and streams) 1.5 million ha are natural and 2.6 million ha are manmade. India has 6750 Km^2 of coastal wetlands (National Wetlands conservation programme-guidelines for conservation and management of wetlands, MoEF, 2009). Twenty percent of national biodiversity is supported by wetlands (Prasad et al., 2002).

1.2.15 INITIATIVES FOR WETLAND CONSERVATION

Until the wetland rules-2010 came into force (Annexure- 4) there was no exclusive laws to protect wetlands. Earlier, wetland protection fell into the ambit of many other Acts enacted from time to time and policies adopted for environmental protection and biodiversity conservation. Thus, wetlands, except those select ones, were not under much legal protection in the country, and practically wetlands were considered as wastelands, meant for reclamation.

Wetlands conservation in India is indirectly influenced by an array of policy and legislative measures (Parikh & Parikh 1999). Some of the key legislations are given in the table below

Table 5 Relevant legislations pertaining to wetland conservation

Name of the Legislation	Year
The Indian Fisheries Act	1897
The Indian Forest Act	1927
Wildlife (Protection) Act	1972

Water (Prevention and Control of Pollution) Act	1974
Territorial Water, Continental Shelf, Exclusive Economic Zone and other Marine Zones Act	1976
Water (Prevention and Control of Pollution) Act	1977
Maritime Zone of India (Regulation and fishing by foreign vessels) Act	1980
Forest (Conservation act)	1980
Environmental (Protection) Act	1986
Coastal Zone Regulation Notification	1991 & 2011
Wildlife (Protection) Amendment Act	1991
National Conservation Strategy and Policy Statement on Environment and Development	1992
National Policy and Macro level Action Strategy on Biodiversity	1999
EIA Notification	2006
Wetland (Conservation and Management) rules	2010

1.2.15.1 National Wetlands Conservation Programme

The Government of India has been implementing the National Wetlands Conservation Programme (NWCP) in close collaboration with the State/UT Governments since the year 1985-86. Under the programme, 115 wetlands have been identified till now by the ministry which require urgent conservation and management interventions. The aim of the programme is the conservation of wetlands so as to prevent their further degradation, ensuring their wise use for the benefit of local communities and overall conservation of biodiversity.

India is one of the early signatories to the Ramsar Convention on Wetlands and the Convention of Biological Diversity.

1.2.16 WETLANDS OF ANDHRA PRADESH

AP is bestowed with thousands of wetlands which fall under different categories. The available data indicates that 1.33% of the land area in AP is covered by wetlands of the size 56.25 ha and above (SAC, 1998) and the number of such wetlands is estimated to be 1493. However, the number of wetlands below 56.25 ha occupies the lion's share of wetlands in the state. The wetlands of the size of 2 ha and above in nine out of the 23 districts are in areas that are ecologically sensitive and

important, such as, national parks, marine parks, sanctuaries, reserved forests, wildlife habitats, mangroves, corals, coral reefs, areas of outstanding natural beauty or historical or heritage areas and the areas rich in genetic diversity.

Low rainfall districts have maximum number of wetlands because of the new water harvesting structures built for irrigation and fisheries (SACON, 2004). The number of tanks used for fisheries alone comes to 74000 in the state (Draft Report, CADA, Irrigation Department, Government of AP (Undated)). There has been a steady increase in the number of wetlands in the coastal districts due to the expansion of aquaculture.

1.2.17 WETLANDS IN THE DISTRICT

The Srikakulam district abounds in wetlands both natural and manmade. The number of wetlands, small to large ones, is more than 8000. Though the wetlands are distributed more or less evenly in the district, the coastal wetlands are ecologically and economically more sensitive and came into focus for various reasons.

1.2.17.1 Coastal wetlands of Srikakulam district

The coastal plains consist of a strip of land, 10 to 15 Km in width, all along the 198 Km sea coast from Ichapuram of KandivalasaGedda. The Coastal plains are characterized by Beelas (Back waters, a typical wetland system which is fed by flood waters through a vast network of small streams/channels and connected to the sea through a creek/channel) and sandy dunes. The two major Beelas in the district are Sompeta and Bhavanapadu swamps. While Sompeta swamp is situated near to the Sompeta town in the northern part of the district, Bhavanapadu lies near Tekkali town in the central part of the district. Major Corporates were eyeing the coastal areas of Srikakulam district for setting up Thermal Power Plants due to various reasons such as the availability of water, and transportation facilities in the form of NH-5 from Chennai to Calcutta and the broad-gauge railway line from Chennai to

Calcutta. Proximity to the sea facilitates building jetties for transportation of coal and other materials and also for drawing sea water as coolant or for other uses and for discharge of effluents.

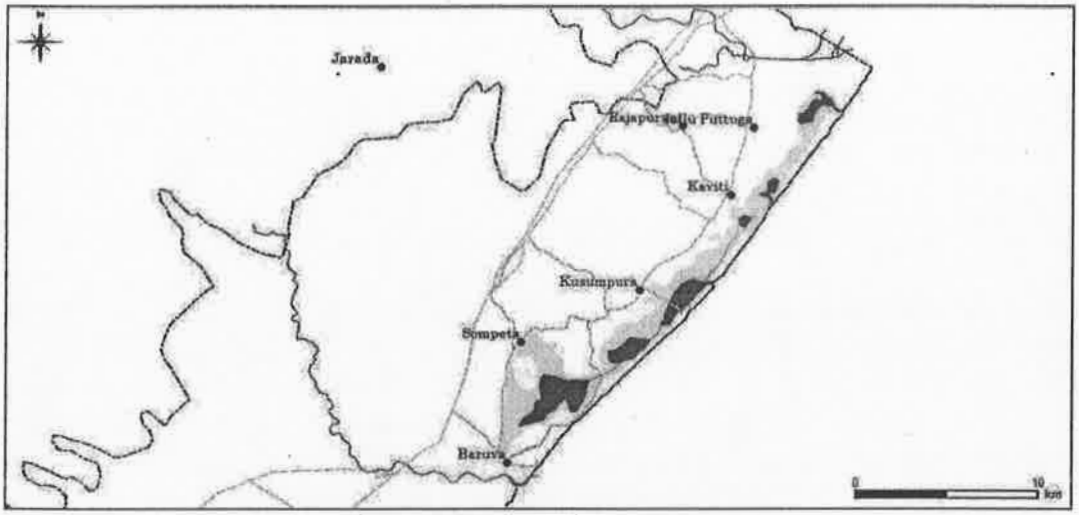


Figure 2 Coastal wetlands- Sompeta

1.2.17.2 Proposal for Thermal Power Plant at Sompeta

Nagarjuna Construction Company Ltd (NCC) has proposed to construct a coal based 2640 MW (4x660 MW) Thermal Power Plant (TPP) at Gollakandi and Baruva villages of the Sompeta mandal and procured 2423.599 acres of land from government and private parties.

The TPP is proposed in the Sompeta Beela, a low lying swamp with several microhabitats and several taxa of animals and plants. Three adjacent Beelas form the Sompeta wetland complex. The 'Pedda Beela' is connected to the two other Beelas; the second one known as the 'Chinna Beela' and the third 'Tampara'. The third one eventually joins the sea. The wetland complex is nearly 4000 acres and 20 Km long covering parts of Baruva in Sompeta mandal and Kapaasguddi in Kaviti mandal. It is a wetland which is to be conserved under various State and Central government policies and international treatises such as Ramsar Convention and the Wetland Rules-2010 notified by the Ministry of Environment and Forests, GoI.

Of the 1882 acres handed over to NCC, 1200 acres is in the Beela. The area is highly fertile. Thirty two villages with a population of around 3 lakhs depend upon the Beela for various purposes, for water for irrigation, fisheries, fodder, thatching materials, medicinal plants and several edible plants. Apart from the direct ecosystem goods and services provided by the Beela to thousands of people, regulatory ecosystem services such as maintaining the hydrological regime of a large area which is vital for maintaining the ground water table supporting the agriculture, acting as a carbon sink and maintaining air quality, soil nutrient maintenance etc are invaluable. The core area of the Pedda Beela is a major habitat for migratory and other birds, giving shelter to 122 bird species several of them falling under IUCN categories that require conservation actions.

1.2.17.3 Social issues at Sompeta

Local people have resented the establishment of the proposed project from the very beginning though the company could purchase few hundreds of acres of land directly from the local farmers. Environmental NGOs under the leadership Environmental Paryavaran Samrakshana Samiti spearheaded the agitation by the locals against the setting up of the power project in the area. On the 14 July 2010, NCC attempted levelling the land allocated to them although they were yet to receive the mandatory 'Consent for Establishment' from the AP Pollution Control Board (E A S Sarma, 2010). The action provoked the local public leading to violence in which three people were shot dead and many others including scribes and police personnel got injured.

After hearing the project proponent and the opposing parties on 13 May 2010 and on the request of M/s NCC and the appellants, the Environment Appellate Authority and Dr. S. Kaul, an expert on wetlands, visited the Sompeta wetlands during 28th to 30th May 2010 and heard the views of various stake holders. The authority again heard the views of the opposing parties on 6^{th,} 13th and 14th July 2010. Based on these exercises, the Appellate Authority concluded inter alia that:

"-This is a typical land of great ecological importance and a source of water for nearby villagers upon which three lift irrigation projects of the Government depend. The report of various committees including the EAC is misleading. The EAC was also carried away by these reports and reversed its decision of 32st meeting held on 13th and 14th of October 2008.

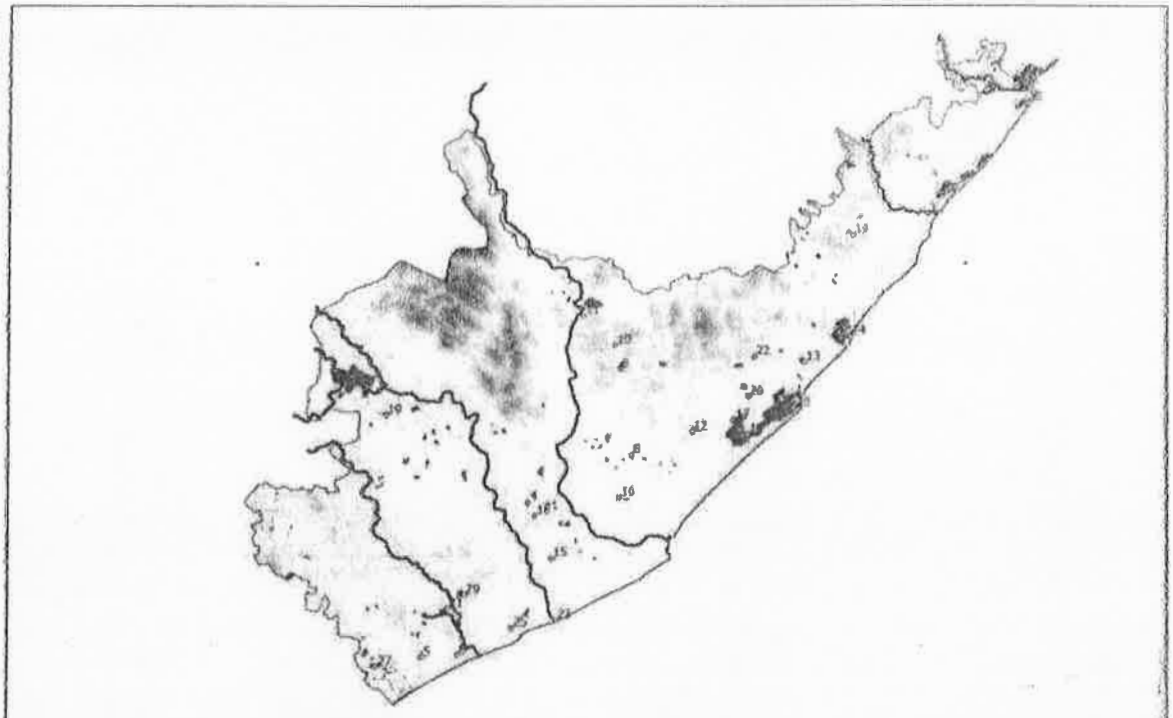
- There was overwhelming opposition from the people of the area against this project which is valid.

-It is relevant here to mention that the four corners of the project site were shown to the authority and the expert by the Revenue Divisional Authority accompanied by his surveyor and the authority has no doubt that the area is a typical wetland of great ecological significance and despite no law prohibiting its use for Power plant, does not permit its use for the proposed power plant."

Accordingly the Environmental Clearance for setting up the power plant was quashed. The authority also gave a directive to the MoEF, to undertake a survey of all wetlands of Srikakulam district for their ecological sensitiveness as soon as possible pending which no project should be cleared in such locations (National Environment Appellate Authority order dated 14 July 2010).

1.3 OBJECTIVES OF THE PRESENT STUDY

- assess the biodiversity of the wetlands in the Srikakulam district
- assess the ecosystem services provided by the wetlands of Srikakulam district and its implications on the livelihood of the people depending on the wetlands, and
- assess the ecological status and the major threats of the wetlands in the district



° Wetland areas visited by the team

1	Naupada Swamps	16	Rajalu Cheruvu
2	Sompeta	17	Vaddidhandra Kaaricheruvu
3	Mahendratanaya swamps	18	Chintada Cheruvu
4	Kuddiram sagaram	19	Arisadu wetlands
5	Lanka Cheruvu	20	Bhavanapadu Creek area
6	Cheri Cheruvu	21	Dhyal Cheruvu (Dhevunivalu)
7	Madduvalasa Reservoir	22	Narasapuram Peddha Cheruvu
8	Narayanavalasa	23	Nagavalli River Mouth
9	Mettucheruvu	24	Poondi Back waters
10	Thamarai Cheruvu	25	Marandupada Cheruvu
11	Rajakaru Cheruvu	26	Telineelapuram Wetland
12	Kottabommali Cheruvu	27	Pydibhimavaram Cheruvu
13	Pathatekkali	28	Dunkuru wetlands
14	Damodar Sagaram	29	Narayana sagaram
15	Peddhapadu Cheruvu		

Figure 3 Wetlands visited during the present study

1.4 METHODOLOGY

Wetlands of the district were located using Survey of India Topo Sheets and Google Earth Maps, and field surveys were planned and executed accordingly. Care was

taken to visit all the mandals of the district and important wetlands in each mandal to collect as much primary data as possible, within our time and logistic constraints.

Before embarking upon the field trips extensive survey of literature was conducted collecting maximum information available. Government departments such as Irrigation, Forest, Fisheries and District Industries Centre were valuable sources of information. NGO's, industrialists, public and other knowledgeable people were also helpful in this regard.

Since the coastal wetlands such as Sompeta and Bhavanapadu were found to be the major wetland complexes supporting large human population and are apparently rich in biodiversity, special attention was given to these wetlands in terms of time and effort (Figure 2).

Stratified random sampling strategy was adopted for sampling the wetlands ensuring representation from diverse geographical areas as well as the wetlands under varying disturbance regimes. All the large wetlands of the districts, especially the ones with more than 500 acres of ayacut area, were surveyed. Wetlands of lesser size classes were also visited on a rapid survey mode and sample data collected. As per the original schedules the study period was only three months. However, while proceeding with the preliminary investigations it was found the duration need to be extended at least to six months.

1.4.1 Biodiversity assessment

Biodiversity surveys were carried out in the Srikakulam district during October 2011 to March 2012. At first, a pilot survey was carried out in the entire district, followed by more detailed surveys to document birds, plants and butterflies. Socio-economic sample surveys was also conducted among the local public residing around the wetlands to find out their dependency on the wetlands, their knowledge about the locally available species of birds and other animals using a custom made

questionnaire. Secondary information was also collected from the concerned departments, organizations and from published research articles and reports.

1.4.1.1 Documentation of flora

The plants occurring in the study area were enumerated by random walk. Reports from previous floral studies were also used for the purpose. Taxonomic identification of the species was done referring to the flora of Hooker (1872-97), Gamble (1957) and Mathew (1996, 1999). Unidentified plant specimens were collected and preserved in 10% formaldehyde for identification by experts at the Botanical Survey of India, Southern Circle (MH), Coimbatore. Nomenclature used in this report is based on the Flora of Tamil Nadu Series 1: Analysis vols. 1-3 (1983-1989).

1.4.1.2 Documentation of fauna

Various groups of animals found in the study area were recorded by both direct and indirect methods. Different sampling techniques were applied to record different faunal groups in the study area. Animals recorded include butterflies, fishes, amphibians, reptiles, birds and mammals. The following sampling techniques were used for the study of various fauna during the present study period as given in the Table

Table 6. Sampling techniques used for the faunal study

Taxa	Sampling techniques
Butterflies	Random walk, opportunistic observations
Amphibians	Visual encounter survey (search)
Reptiles	Visual encounter survey (search)
Birds	Random walk, opportunistic observations
Mammals	Tracks and signs, and visual encounter survey

1.4.1.2.1 Avifauna

The survey covered major wetlands in the area, extending to their adjacent / immediate catchments. The birdlife in the study area were documented by direct observations, random walks and opportunistic encounters following Bibby et al., (1992). Observations were made over a period of 6 months, from October, 2011 to

March, 2012 with three intensive surveys. Bird survey was conducted, when birds are most active during day, from (07.00 to 11.00 hrs) and from (16.00 to 19.00) hrs. However, opportunistic observations were also made during other timings, and species recorded during these observations are included in the checklist. Based on the visibility, the observations on both the sides of the viewer on a field path were recorded with the help of 7 x 35 and 10 x 50 m field binoculars (Nikon). Indirect observations, signs and vocalisations, were also recorded. Birds seen were recorded with habitat type, season and frequency of occurrence. Identification manuals and filed guides by Ali & Ripley (1989), Kazmierczak (2000) and Grimmett et al., (2001) were used during the survey. Standardized common and scientific names of the birds following Grimmett et al., (1998 & 2001); Manakadan and Pittie (2001) were adopted. The birds were categorized as Resident (R), Migratory (M), Aquatic (A) and Terrestrial (T) as per Grimmett et al., (2001). All the bird species recorded during the present study were tabulated giving their recent scientific name, family, IUCN status & legal status if any. Abundances of the recorded species were documented based on the total sightings during the study period as common (more than 10 sightings); fairly common (6-10 sightings), uncommon (3-5 sightings), and rare (1-2 sightings).

1.4.1.2.2 Butterflies

The butterflies in and around the wetlands were documented by direct observations, random walk and opportunistic observations, during morning (07:00 to 11:00 hrs) and evenings (16:00 to 19:00 hrs), as our earlier surveys have shown this timing as ideal in the area to see maximum butterfly activity. Butterflies were looked for 5m distance on either side of the path. Gunathilagaraj et al., (1998), Kunte (2000) and Kehimkar (2008) were referred to identify the Butterflies and Larson (1987a, b, c; 1988) was referred for scientific nomenclature. Abundance of each butterfly species was graded, based on the total sightings during the study period, as common (more than 10 sightings during the study period), fairly common (6-10 sightings), uncommon (3-5 sightings), and rare (1-2 sightings).

1.4.1.2.3 Herpetofauna

Visual Encounter Survey (VES, search) was followed for the survey of the herpetofauna (amphibians and reptiles) in the wetland and its environs were conducted following during the survey for amphibians and reptiles. VES is a method one in which field personnel walk through an area or habitat for a prescribed time period systematically searching for animals. This is an appropriate technique for inventory and monitoring studies. During the search leaf litter, fallen logs, trees (bark, buttress, root and holes), shrubs, boulders, rocks and rock crevices were examined. The identification of herpetofauna was done with the help of Boulenger (1890), Daniel and Sekar (1989), Daniel (1963 & 1975), Daniel (1992), Daniels (1997 a, b & c), Daniels (2005), Das (2002), Whitaker and Captain (2004).

1.4.1.2.4 Mammals

Both direct and indirect methods were applied to get an overall view on mammals present in the area. For survey of mammals, tracks and signs, and visual encounter survey were used during the present survey period. Species were also identified by indirect evidences such as pug marks, calls, signs and scats (Bang et al., 1972; Burnham et al., 1980 and Heyer et al., 1994). Mammals were identified following Menon (2003).

1.4.2 QUESTIONNAIRE SURVEY AND FOCUSSED GROUP DISCUSSIONS

A customized questionnaire was prepared to obtain information about the socio-economic state of the villagers around major wetlands and their dependency, awareness and suggestions for improving the status of wetland. The questionnaire survey among the stakeholders helped in collecting information on the ecological history, people's understanding about the ecosystem services provided by the wetland, their dependence on the wetland and their perceptions about the wetlands in their neighbourhoods. Data on several socio-economic parameters were collected

at village level and household level wherever possible (mainly in inland fisher's colonies), by using open and close-ended questionnaires.

Focus Group Discussions (FGD) were conducted with members of the stakeholder communities participating to collect information on the history of the wetland, recent changes in utilization of the wetlands and their general understanding about various other aspects related to wetlands and local environment.

1.4.3 Participatory Rural Appraisals

Participatory Rural Appraisal (PRA) tools were employed on a limited scale to collect data on various ecological aspects in a participatory way. A preliminary resource map of Sompeta wetland was also worked out through this exercise.

In order to ascertain the presence and absence of the migratory bird species, a novel methodology namely Participatory Biodiversity Appraisal (PBA) tool was tried which generated very interesting information. As part of the methodology, the stake holders for whom the wetlands are integral parts of their day to day life and survival were shown pictures of 10 species of birds which are common and not so common to that particular area. If the person could identify all the birds correctly by their local names it was concluded that he is qualified enough to recognize other migratory /rare birds which is likely to be found in that area.

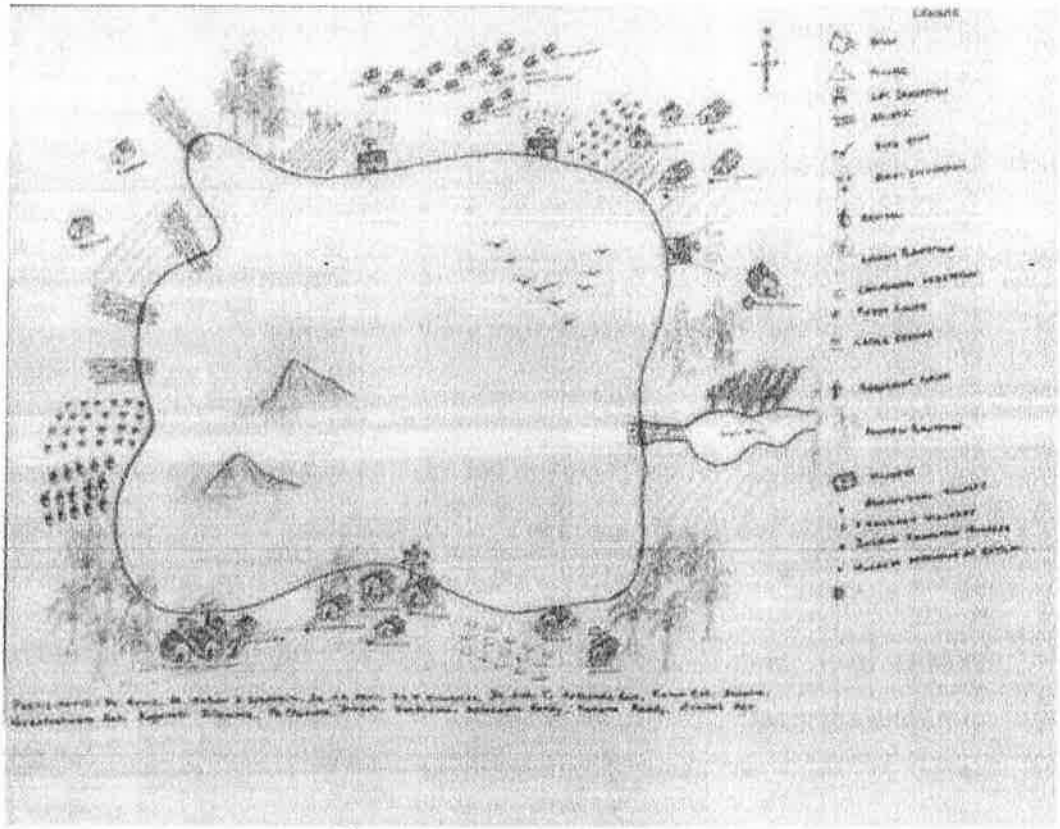


Figure 4 Resource map of Sompeta

2 OBSERVATIONS

2.1 FLORA

2.1.1 FLORAL ANALYSIS

In total 662 plant species belonging to 406 genera spreading over 111 families were documented (Appendix 2) Among them, herbaceous plants were dominant (245 species, 37%) followed by trees (182 species, 28%), shrubs/under-shrubs (77 species, 12%), grasses (74 species, 11%) excluding *Bambusa arundinacea*, which is included under trees due to its arborescent nature), stragglers (47 species, 7%) and climbers (36 species, 6%, Figure 5).

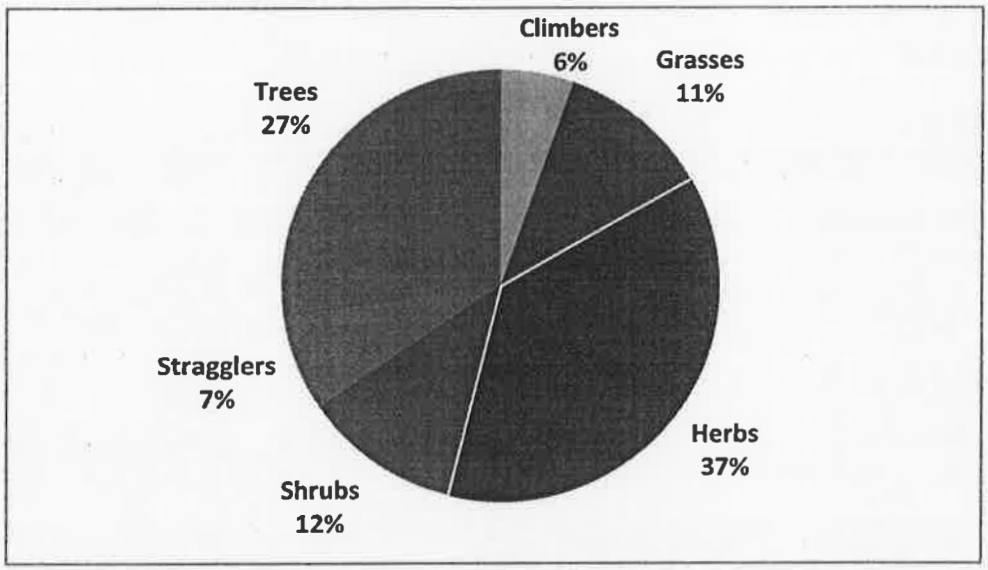


Figure 5 Habit-wise representation of plant species in the present study area

2.1.2 DOMINANT FAMILIES

Of the 111 families of plants recorded in the study area, Poaceae represented by 75 species, was the most dominant one. Other notable families are Fabaceae (44 species), Euphorbiaceae (34 species), Asteraceae (32 species) and Malvaceae (23 species, Figure-6).

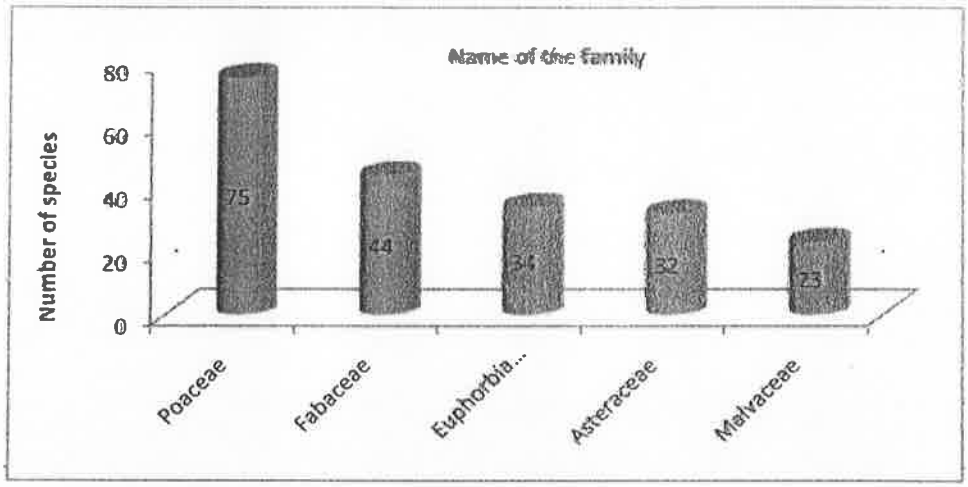


Figure 6 Major plant families

2.1.3 Dominant genera

Among the 406 genera recorded from the study area, the genus Acacia is the dominant with 10 species, next was Ficus and Fimbristylis with 9 species each, Eragrostis with 8 species, Cyperus, Euphorbia, Ipomoea and Phyllanthus each with 7 species and Hibiscus, Indigofera, Panicum, Senna and Sida with 6 species each (Figure-7).

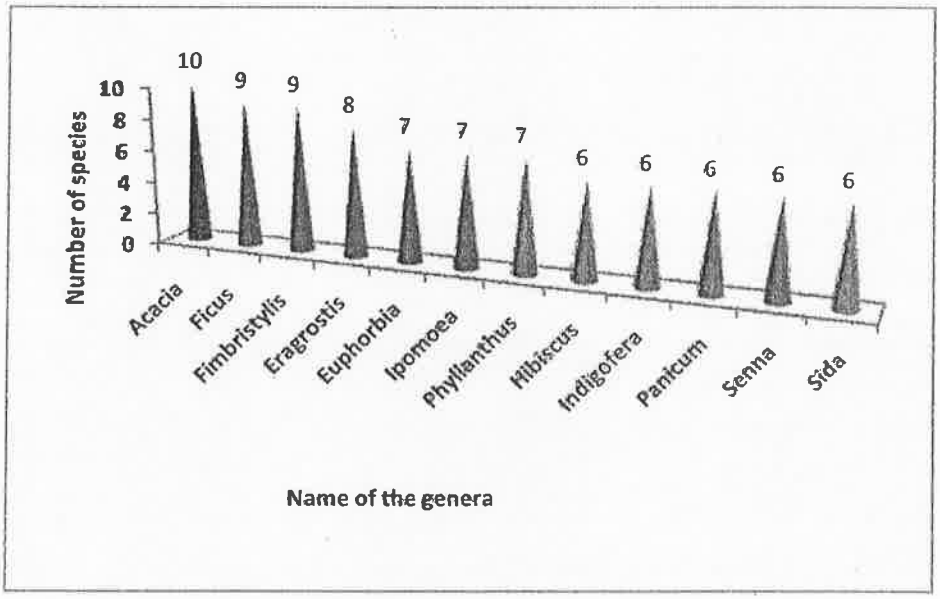


Figure 7 Dominant genera in the study area

2.2 FAUNA

2.2.1 AVIFAUNA

In total 236 bird species belonging to 147 genera, over 56 families and 17 orders were recorded (Appendix-2). This included 179 species that were directly observed and rest 57 species were based on various secondary information. Of the 236 bird species, 107 species were aquatic, 129 species terrestrial, 177 species resident, and 59 species migratory (both winter and summer visitors,).

Species *Aythya baeri* (Bear's Pochard) reported from the district fall under "Endangered" category, while *Amandava formosa* (Green Avadavat) and *Haliaeetus leucoryphus* (Palla's Fish Eagle), *Grus antigone* (Sarus Crane) and *Leptoptilos javanicus* (Lesser Adjutant) fall under "Vulnerable" category (IUCN, 2010). The species *Anhinga melanogaster* (Darter), *Numenius arquata* (Eurasian Curlew), *Pelecanus philippensis* (Spot-billed Pelican), *Threskiornis melanocephalus* (Black-headed Ibis), *Mycteria leucocephala* (Painted Stork), *Platalea leucorodia* (Eurasian Spoonbill), *Sterna acuticauda* (Black-bellied Tern), *Limnodromus semipalmatus* (Asian Dowitcher), *Ichthyophagia ichthyaetus* (Greater Grey-headed Fish Eagle), *Ephippiorhynchus asiaticus* (Black-necked Stork), *Aythya nyroca* (White Eye Pochard) and *Circus macrourus* (Pallid Harrier), coming under Near Threatened category (IUCN, 2007) were also recorded.

Birds such as *Pavo cristatus* (Indian Peafowl), *Pandion haliaetus* (Osprey), *Platalea leucorodia* (Eurasian Spoonbill), *Haliaeetus leucogaster* (White-bellied Sea Eagle) and *Circus macrourus* (Pallid Harrier) recorded in the study fall under Schedule-I of the Indian Wildlife Protection Act (IWPA, 1972).Among the wetland birds, Asian Openbill (*Anastomus oscitans*), Black-winged Stilt (*Himantopus himantopus*), Bronze-winged Jacana (*Metopidius indicus*), Common Poachard (*Aythya ferina*), Cattle Egret (*Bubulcus ibis*), Lesser Whistling Duck (*Dendrocygna javanica*), Little Cormorant (*Phalacrocorax niger*), Little Egret (*Egretta garzetta*), Cotton Pygmy Goose (*Nettapus*

coromandelianus), Indian Pond Heron (*Ardeola grayii*), Northern Shovelor (*Anas clypeata*), Northern Pintail (*Anas acuta*), Painted Stork (*Mycteria leucocephala*), Spot-billed Pelican (*Pelecanus philippensis*) and Eurasian Wigeon (*Anas penelope*), Tufted Duck (*Aythya fuligula*) were common and abundant Amongst the terrestrial birds, Asian Pied Starling (*Sturnus contra*), Asian Palm Swift (*Cypsiurus balasiensis*), Eurasian Collared Dove (*Streptopelia decaocta*), White-headed Babbler (*Turdoides affinis*), Common Myna (*Acridotheres tristis*), Jungle Crow (*Corvus macrorhynchos*), Black Drongo (*Dicrurus macrocercus*), House Crow (*Corvus splendens*), Red-vented Bulbul (*Pycnonotus cafer*), Spotted Dove (*Streptopelia chinensis*), White-browed bulbul (*Pycnonotus luteolus*) and Blue-tailed Bee-eater (*Merops philippinus*) were very commonly seen in the study area.

Bird species such as Barn Swallow (*Hirundo rustica*), Black-crowned Sparrow Lark (*Eremopterix nigriceps*), Crested Treeswift (*Hemiprocne coronata*), Eurasian Golden Oriole (*Oriolus oriolus*), Jack Snipe (*Lymnocryptes minimus*), Indian Pitta (*Pitta brachyura*), Yellow Bittern (*Ixobrychus sinensis*), Grey-headed Lapwing (*Vanellus cinereus*), Small Minivet (*Pericrocotus cinnamomeus*), Pied Harrier (*Circus melanoleucos*), Long-tailed Shrike (*Lanius schach*), Large Cuckooshrike (*Coracina macei*) and Lesser-crested Tern (*Sterna bengalensis*) were spotted, but rarely.

Great Crested Grebe (*Podiceps cristatus*), Eurasian Sparrowhawk, (*Accipiter nisus*), Eurasian Spoonbill (*Platalea leucorodia*), Osprey (*Pandion haliaetus*), Besra (*Accipiter virgatus*), Green Avadavat (*Amandava formosa*), Orange-headed Thrush (*Zoothera citrina*), Plum-headed Parakeet (*Psittacula cyanocephala*), Red-crested Pochard (*Rhodonessa rufina*) and Palla's Fish Eagle (*Haliaeetus leucoryphus*) were sighted only twice or thrice during the entire study period.

Among the 17 orders of birds recorded, Passeriformes is the dominant 69 species (29.2%) of the total followed by Charadriiformes (44 species, 18.6%), Ciconiiformes (23 species, 9.7%), Anseriformes (19 species, 8.1%) and Falconiformes (18 species, 7.6%). The order Caprimulgiformes is the least represented by single species (Table-

6). Of the 56 families the family Scolopacidae is the dominant represented with 28 species (11.86%). The other notable avian families include Anatidae (19 species, 8.05%), Accipitridae (15 species, 6.36%), Ardeidae (12 species, 5.08%) and Cuculidae and Rallidae represented with 8 species each (3.39%, Table-7).

Table 7 Order-wise representation of birds recorded during the study

Sl. No.	Avain order	Species	% representation
1.	Anseriformes	19	8.1
2.	Apodiformes	4	1.7
3.	Caprimulgiformes	1	0.4
4.	Charadriiformes	44	18.6
5.	Ciconiiformes	23	9.7
6.	Columbiformes	6	2.5
7.	Coraciiformes	12	5.1
8.	Cuculiformes	8	3.4
9.	Falconiformes	18	7.6
10.	Galliformes	4	1.7
11.	Gruiformes	10	4.2
12.	Passeriformes	69	29.2
13.	Pelecaniformes	5	2.1
14.	Piciformes	4	1.7
15.	Podicipediformes	2	0.8
16.	Psittaciformes	3	1.3
17.	Strigiformes	4	1.7

Table 8 Family-wise representation of birds recorded during the study

Sl. No.	Avian family	Species	% representation
1.	Accipitridae	15	6.36
2.	Alaudidae	6	2.54
3.	Alcedinidae	6	2.54
4.	Anatidae	19	8.05
5.	Anhingidae	1	0.42
6.	Apodidae	3	1.27
7.	Ardeidae	12	5.08
8.	Bucerotidae	1	0.42
9.	Campephagidae	4	1.69
10.	Capitonidae	2	0.85
11.	Caprimulgidae	1	0.42

Sl. No.	Avian family	Species	% representation
12.	Charadriidae	5	2.12
13.	Ciconiidae	6	2.54
14.	Columbidae	6	2.54
15.	Coraciidae	1	0.42
16.	Corvidae	3	1.27
17.	Cuculidae	8	3.39
18.	Dicaeidae	2	0.85
19.	Dicruridae	4	1.69
20.	Estrildidae	5	2.12
21.	Falconidae	2	0.85
22.	Gruidae	2	0.85
23.	Hemiprocnidae	1	0.42
24.	Hirundinidae	3	1.27
25.	Irenidae	3	1.27
26.	Jacanidae	2	0.85
27.	Laniidae	3	1.27
28.	Laridae	7	2.97
29.	Meropidae	3	1.27
30.	Motacillidae	5	2.12
31.	Nectariniidae	3	1.27
32.	Oriolidae	2	0.85
33.	Pandionidae	1	0.42
34.	Passerinae	1	0.42
35.	Pelecanidae	1	0.42
36.	Phalacrocoracidae	3	1.27
37.	Phasianidae	4	1.69
38.	Phoenicopteridae	1	0.42
39.	Picidae	2	0.85
40.	Pittidae	1	0.42
41.	Ploceinae	2	0.85
42.	Podicipedidae	2	0.85
43.	Psittacidae	3	1.27
44.	Pycnonotidae	2	0.85
45.	Rallidae	8	3.39
46.	Recurvirostridae	1	0.42
47.	Scolopacidae	28	11.86
48.	Strigidae	3	1.27
49.	Sturnidae	5	2.12
50.	Sylviinae	5	2.12

Sl. No.	Avian family	Species	% representation
51.	Threskiornithidae	4	1.69
52.	Timaliinae	3	1.27
53.	Turdinae	7	2.97
54.	Tytonidae	1	0.42
55.	Upupidae	1	0.42
56.	Burhinidae	1	0.42

In the study area insectivorous birds represented by 96 species dominated, followed by omnivores (50 species), piscivores (32 species), predators (23 species), granivores (14 species) and frugivores (12 species, Figure-8).

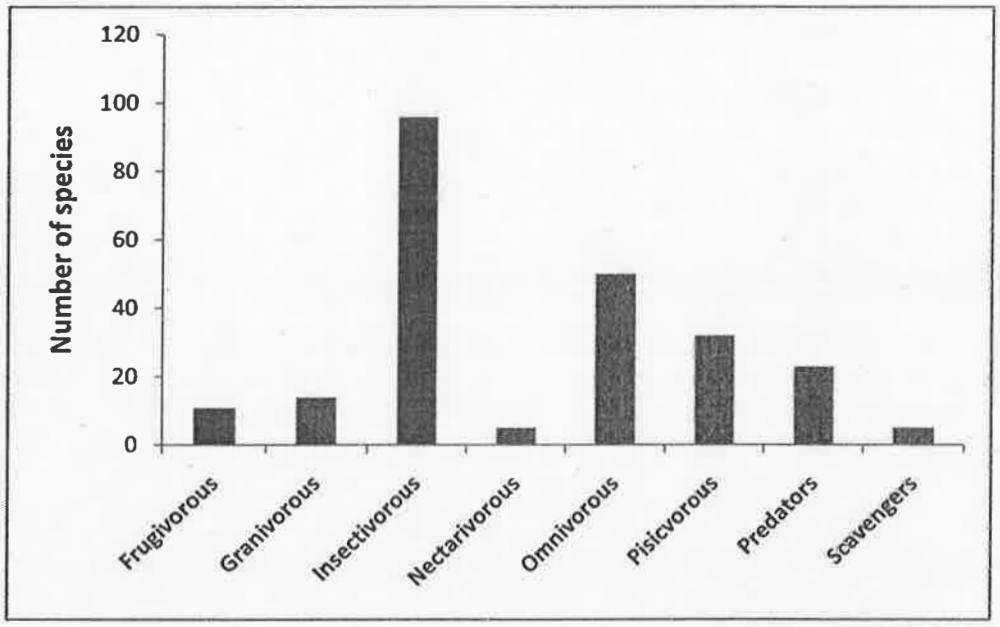


Figure 8 Feeding guild representations of birds in the area

2.2.2 Butterflies

In total 83 butterfly species belonging to 57 genera extending over 5 families were recorded (Table-8). Nymphalidae with 31 species (37%) forms the dominant family. This was followed by Pieridae with 17 species (21%) and Lycaenidae with 13 species (16%), Papilionidae with 12 species (14%). The least number of butterfly species were found to be belonging to the family Hesperiidae with 10 species (12%, Table-8).

Table 9 List of butterflies recorded in the present study area

No.	Common name	Scientific name	IWPA status	Abundance
		Family: Papilionidae		
1.	Common Bluebottle	*Graphium sarpedon*		F
2.	Spot Swordtail	*Graphium nomius*		F
3.	Common Mime	*Chilasa clytia*	Schd. I	R
4.	Paris Peacock	*Papilio paris*		R
5.	Blue Mormon	*Papilio polymnestor*		C
6.	Common Jay	*Graphium doson*		O
7.	Common Mormon	*Papilio polytes*		C
8.	Common Rose	*Pachliopta aristolochiae*		R
9.	Crimson Rose	*Pachliopta hector*	Schd. I	C
10.	Lime Butterfly	*Papilio demoleus*		A
11.	Southern Birdwing	*Troides minos*	Endemic to PI	R
12.	Tailed Jay	*Graphium agamemnon*		O
		Family: Pieridae		
13.	Common Emigrant	*Catopsilia pomona*		A
14.	Common Jezebel	*Delias eucharis*		C
15.	Common Grass yellow	*Eurema hecabe*		C
16.	Common Gull	*Cepora nerissa*	Schd. II	F
17.	Common Wanderer	*Pareronia valeria*		F
18.	Small Salmon Arab	*Colotis amata*		R
19.	Crimson Tip	*Colotis danae*		O
20.	Great Orange Tip	*Hebomoea glaucippe*		C
21.	Mottled Emigrant	*Catopsilia pyranthe*		C
22.	Psyche	*Leptosia nina*		R
23.	Small Grass Yellow	*Eurema brigitta*		A
24.	Spotless Grass Yellow	*Eurema laeta*		R
25.	Small Orange Tip	*Colotis etrida*		O
26.	Plain Orange Tip	*Colotis eucharis*		R
27.	White Orange Tip	*Ixias marianne*		R
28.	Yellow Orange Tip	*Ixias pyrene*		A
29.	Pioneer	*Belenois aurota*		O
		Family: Nymphalidae		
30.	Angled Castor	*Ariadne ariadne*		O
31.	Baronet	*Euthalia nais*		O
32.	Blue Tiger	*Tirumala limniace*		C
33.	Black Rajah	Charaxes solon		R
34.	Common Nawab	*Polyura athamas*		O
35.	Chocolate Pansy	*Precis iphita*		A

No.	Common name	Scientific name	IWPA status	Abundance
36.	Common Palmfly	*Elymnias hypermnestra*		O
37.	Common Bush Brown	*Mycalesis perseus*		C
38.	Common Castor	*Ariadne merione*		A
39.	Common Baron	*Euthalia aconthea*		F
40.	Common Crow	*Euploca core*	Schd. IV	A
41.	Common Evening Brown	*Melanitis leda*		F
42.	Common Leopard	*Phalanta phalantha*		C
43.	Common Sailer	*Neptis hylas*		C
44.	Common Sergeant	*Athyma perius*		F
45.	Common Lascar	*Pantoporia hordonia*		O
46.	Danaid Eggfly	*Hypolimnas misippus*	Schd. I	F
47.	Dark Blue Tiger	*Tirumala septentrionis*		C
48.	Double-branded Crow	*Euploca sylvester*		R
49.	Glassy Tiger	*Parantica aglea*		C
50.	Joker	*Byblia ilithyia*		R
51.	Painted Lady	*Vanessa cardui*		R
52.	Great Eggfly	*Hypolimnas bolina*		R
53.	Blue Pansy	*Junonia orithiya*		R
54.	Grey Pansy	*Junonia atlites*		A
55.	Lemon Pansy	*Junonia lemonias*		A
56.	Peacock Pansy	*Junonia almana*		R
57.	Plain Tiger	*Danaus chrysippus*		A
58.	Striped Tiger	*Danaus genutia*		A
59.	Tawny Caster	*Acraea violae*		R
60.	Yellow Pansy	*Junonia hierta*		R
		Family: Lycaenidae		
61.	Common Cerulean	*Jamides celeno*		A
62.	Common Pierrot	*Castalius rosimon*	Schd-I	A
63.	Angled Pierrot	*Caleta caleta*		F
64.	Banded Blue Pierrot	*Discolampa ethion*		C
65.	Common Silverline	*Spindasis vulcanus*		O
66.	Dark Cerulean	*Jamides bochus*		R
67.	Tiny Grass Blue	*Zizula hylax*		C
68.	Dark Grass Blue	*Zizeeria karsandra*		R
69.	Grass Jewel	*Freyeria trochylus*		O
70.	Red Pierrot	*Talicada nyseus*		R
71.	Zebra Blue	*Lepotes plinius*		R
72.	Gram Blue	*Euchrysops cnejus*		C
73.	Plains Cupid	*Chilades pandava*		R
		Family: Hesperiidae		

No.	Common name	Scientific name	IWPA status	Abundance
74.	Brown Awl	*Badamia exclamationis*		C
75.	Bush Hopper	*Ampittia dioscorides*		F
76.	Common Banded Owl	*Hasora chromus*		F
77.	Common Grass Dart	*Taractrocera maevius*		A
78.	Pale Palm Dart	*Telicota colon*		R
79.	Dark Palm Dart	*Telicota ancilla*		O
80.	Indian Palm Bob	*Suastus gremius*		R
81.	Indian Skipper	*Spialia galba*		F
82.	Rice Swift	*Borbo cinnara*		O
83.	Common Redeye	*Matapa aria*		O

Where: A-Abundant; C-Common; F-Fairly common; O-Occasional; R-Rare; IWPA-Indian Wildlife Protection Act; Schd-Schedule; PI-Peninsular India

Table 10 Composition butterfly assemblage recorded during the present study

Family	Number of species with %	Number of genera with %
Papilionidae	12 (14%)	5 (9%)
Pieridae	17 (21%)	10 (18%)
Nymphalidae	31 (37%)	21 (37%)
Lycaenidae	13 (16%)	12 (20%)
Hesperiidae	10 (12%)	9 (16%)
Total	83	57

Butterflies such as Plain Tiger, Striped Tiger, Blue Tiger, Chocolate Pansy, Common Rose, Crimson Rose, Grey Pansy, Common Jezebel, Plain Tiger, Common Crow, Lime Butterfly, White Orange Tip, Crimson Tip and Common Grass Yellow, were common in the study area. Blue Mormon, Tailed Jay, Paris Peacock, Peacock Pansy, Common Mime, Small Salmon Arab, Tailed Jay, Black Rajah, Joker and Blue Pansy were found rare. Six species namely Common Baron, Common Silverline, Spot Swordtail, Southern Birdwing, Common Lascar and Common Redeye were seen not more than twice during the entire study period with less than six individuals each.

Four species namely Common Mime, Crimson Rose, Danaid Eggfly and Common Pierrot are protected under Schedule - I of Indian Wildlife Protection Act 1972. Common Gull is included under Schedule – II and Common Crow under Schedule - IV. While Blue Mormon, Double-branded Crow and Crimson Rose are distributed only in

Indian subcontinent and Sri Lanka, Southern Birdwing is endemic to Peninsular India (Kehimkar, 2008). Based on the abundance of butterfly species in the study area 24 species fall under the category 'rare'. 17 species are common, 15 occasional, 10 abundant and 11 fairly common.

2.2.3 HERPETOFAUNA

A total of 10 species of Amphibians and 33 species of reptiles were recorded during the survey period (Table 11 & Table 12). Among the 33 species of reptiles 3 were turtles, 13 were lizards and 17 were snakes.

Table 11.Amphibians recorded in and around the wetlands of Srikakulam District.

#	Family	English 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*	DD
4	Dicroglossidae	Cricket Frog	*Fejervarya mudduraja*	-
5	Dicroglossidae	Indian Bull Frog	*Hoplobatrachus tigerinus*	-
6	Dicroglossidae	Indian Burrowing Frog	*Sphaerotheca breviceps*	DD
7	Microhylidae	Ornate Narrow-mouthed Frog	*Microhyla ornata*	LRnt
8	Microhylidae	Narrow-mouthed Frog	*Ramanella* sp.	-
9	Microhylidae	Lesser/Marbled Balloon Frog	*Uperodon systoma*	LRnt/N
10	Rhacophoridae	Common Tree Frog	*Polypedates maculatus*	LRic

Table 12 Reptiles recorded in and around the wetlands of Srikakulam District

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
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	Forest calotes	*Calotes rouxi*	LR

10	Indian Chameleon	*Chamaeleon zeylanicus*	VU
11	Indian Monitor Lizard	*Varanus bengalensis*	VU
12	South Indian Rock Agama	*Psammophilus dorsalis*	LR
13	Common Rat Lizard	*Ptylas mucosus*	LR
Snakes			
1	Brahminy Worm Snake	*Ramphotyplops braminus*	LR
2	Common Sand Boa	*Gongylophis conicus*	LR
3	Red Sand Boa	*Eryx johnii*	LR
4	Indian Rock Python	*Python molurus molurus*	EN
5	Indian Bronze Back	*Dendrelaphis tristis*	LR
6	Common Vine snake	*Ahaetulla nasuta*	LR
7	Striped-keelback	*Amphiesma stolata*	LR
8	Checkered Keelback	*Xenochrophis piscator*	LR
9	Common Cat Snake	*Boiga trigonota*	LR
10	Indian Wolf Snake	*Lycodon aulicus*	LR
11	Indian Kukri	*Oligodon arnensis*	LR
12	Indian Rat Snake	*Ptyas mucosa*	LR
13	Spectacled Cobra*	*Naja naja*	LR
14	Common Krait*	*Bungarus caeruleus*	LR
15	Banded Krait*	*Bungarus fasciidiscuputus*	LR
16	Russell's Viper*	*Daboia russelii*	LR
17	Saw -scaled Viper*	*Echis carinatus*	LR

* Venomous species

2.2.4 MAMMALS

A total of 16 species of mammals were recorded in the study area (Table 13).

Table 13. Mammals recorded from the study area

Sl. No.	Common Name	Scientific Name	IUCN status	Legal Status
1	Spotted deer	*Axis axis*	LR\Lc	IV
2	Jackal	*Canis aureus*	LR\Lc	I
3	Indian fox	*Vulpes benghalensis*	LR\Lc	II
4	Jungle cat	*Felis chaus*	Lc	-
5	Common mongoose	*Herpestes edwardsii*	L R\Lc	-
6	Black naped hare	*Lepus nigricollis*	LR\Lc	-
7	Rhesus macaque	*Macaca mullata*	Lc	II
8	Indian porcupine	*Hystrix indica*	LR\Nt	IV
9	Bandicoot rat	*Bandicota indica*	LR\Lc	V
10	Three-striped palm squirrel	*Funambulus palmarum*	LR\Lc	-
11	Indian pangolin	*Manis crassicaudata*	LR\Lc	-
12	Asian Palm Civet	*Paradoxurus hermaphroditus*	LR\Lc	II

13	Common langur	*Presbytis entellus*	LR\Lc	II
14	Wild boar	*Sus scrofa*	Lc	III
15	Short-nosed Fruit Bat	*Cynopterus brachyotis*	Lc	-
16	Flying fox	*Pteropus giganteus*	Lc	-

3 Major Wetlands

Thirty four major wetlands were surveyed taking care that representative sampling was done covering all the geographical areas of the district. Since the coastal plains have several major wetlands of ecological and economic importance, more wetlands were selected for detailed study from that area.

The area calculated from the satellite image may vary from the actual area depending upon the month of the satellite imagery; i.e. if the satellite imagery is during monsoon the area of the wetland will be more whereas during dry period the area will shrink.

3.1 NAUPADA SWAMPS

Location	Division	Mandal	Latitude	Longitude	Type of wetland
Naupada	Tekkali	Santhabommali	18^0 31' 0.24" N	84^0 15' 40.88" E	Natural

3.1.1 LOCATION AND CHARACTERISTICS

Naupada swamps covers Santhabommali, Kotabommali and Tekkali mandals of Srikakulam district. In the revenue records the extent of wetlands shown as swamps is 7414 acres or approximately 30 Km^2. However the Naupada wetlands are larger than that since it is a complex of wetlands consisting of swamps, mud and salt meadows and creek. It is a transitional zone between terrestrial and marine ecosystem and many permanent shallow marine waters on the coastal lines

adjoining the Naupada wetland being integral part of the wetland complex, the area much higher and this wetland is the only remaining wetland of this type on the entire east coast.

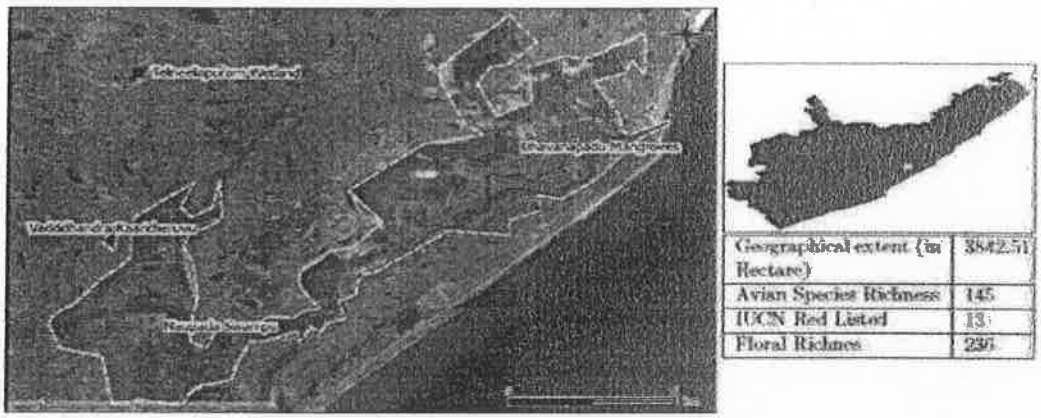


Figure 9 Satellite image of Naupada swamps

3.1.2 ECOSYSTEM SERVICES PROVIDED BY NAUPADA WETLAND

3.1.2.1 Regulatory Services

Numerous streams and water channels drains water into the wetland which is discharged into the sea through the Tekkali creek. Most of these water flow-ways are linked to the river Vamsadhara. During monsoon the entire wetland complex receives the flood waters spreading it over thousands of acres. The mixing of the floodwaters with the sea water which intrudes through the Tekkali results in a unique water regime which has implications on the biodiversity and livelihood of thousands of inhabitants in more than 30 villages around the wetland. The floodwaters polluted by industries and agricultural pesticides and fertilisers get more or less purified and released into the Tekkali creek generating an appropriate environment for the survival of biodiversity. The Naupada wetlands play a vital role in erosion control and sediment restoration. It also plays an invaluable role in controlling the salinisation of both water and soil.

3.1.2.2 Provisioning Services

Wildlife Habitat

Data collected by a rapid survey and data from literature shows that Naupada wetland is habitat for at least 145 birds and 236 plants. Telineelapuram which is designated as an "Important Bird Area' is part of the Naupada wetland complex.

Naupada wetland harbours large number of migratory birds such as Bar-headed Goose, Shoveller, Spot-billed Pelican, Grey Pelican, Sarus Crane, Common Teal, Cotton teal, Common Pochard etc. Many of these species are observed even during non migratory season in parts of the wetland where there is sufficient water. As per the IUCN categories, there is one 'Endangered' species, ten 'Near Threatened' species and two 'Vulnerable' species present in the wetland. Among the Near Threatened, Pallied Harrier is also a Schedule –I animal according to the Indian Wild Life (Protection Act) 1972. The Monitor Lizard, another Schedule- I animal is also present in the wetland. SACON has reported 7147 birds belonging to just 20 species from the Naupada swamps (Vijayan et al., 2004). The wetland is an important haven and crucial foraging ground for thousands of birds throughout the year. It is the major foraging ground for more than 150 Spot Billed Pelicans and 250 Painted Storks of Telineelapuram. The filling and alterations in the Naupada swamps will seriously curtail food sources for these numerous bird species in the area.

As per the Environmental Impact Assessment Report prepared by M/s BS Envi-Tech (P) Ltd, this wetland is also habitat of Common mongoose, hare, Indian Fox, Jackal, Palm Squirrel, Porcupine, Rhesus Macaque, Wild Boar, Banded Krait, Chameleon, Cobra, Common Green Lizard, Common Rat Snake. Forest Calotes, Indian Pond Terrain Tortoise, Krait and Monitor Lizard which is a Schedule-I animal as per IWLP-1972.

Water supply

During monsoons more than 8000 acres of the wetland is submerged by the flood waters which gradually drains out through the Tekkali Creek further into the sea. However, in winter and summer substantial quanity of water is retained in the wetland. As noted above, Naupada wetland sustains the ground water table of more than 30 nearby villages thus making provision for water for irrigation, drinking, for industries etc.

Fisheries

Fishing rights here are leased out to M/s Jagannath Inland Fishermen Cooperative Society, Vaddithandra which have 539 members. In fact, the number of families depending upon fishing for their livelihood is around 1000 as a lot of non members in the cooperative society are also engaged in fishing. Females of the fishing families are engaged in marketing fish catches in the nearby areas. Vaddithandra is an exclusive fishers' village. Only members of the '*Kendra*' community do fishing in the Naupada wetlands. Since this indigenous group of Odisha origin is engaged in fishing for generations they lack any other skills for a living. According to the fishermen, Tiger Prawn, White Prawn and Giant Fresh Water Prawn (Scampy) are abundant in the wetland since water quality is ideal for their growth. They also state that around 35 species of fishes are available from the wetland, which indicate the richness of fish diversity.

Agriculture and animal husbandry

Villages surrounding the wetlands, more than 30 in number, are lush green with paddy crops and coconut groves. Majority of the population depend upon agriculture and allied activities. Most of the farmers raise two crops of paddy. Cattle rearing, pig farming and poultry farming are common practices in these areas.

Plant biomass resources

The wetland is a source of several medicinal and edible plants collected by the locals. During winter and summer when the water recedes, thousands of cattle graze in the wetlands. The wetland is a source for raw materials for making mats, an important source of income for the locals. Materials for thatching the roofs, building houses, and making tools and crafts are also sourced from these wetlands.

Table 14 Birds recorded in Naupada swamps and its surroundings

No.	English name	Scientific name	IUCN/IWPA status**
1.	Ashy Drongo	*Dicrurus leucophaeus*	
2.	Ashy-crowned Sparrow Lark	*Eremopterix griseus*	
3.	Asian Koel	*Eudynamys scolopacea*	
4.	Asian Openbill	*Anastomus oscitans*	
5.	Asian Palm Swift	*Cypsiurus balasiensis*	
6.	Asian Pied Starling	*Sturnus contra*	
7.	Bay-backed Shrike	*Lanius vittatus*	
8.	Black Drongo	*Dicrurus macrocercus*	
9.	Black Kite	*Milvus migrans*	
10.	Black-bellied Tern	*Sterna acuticauda*	NT
11.	Black-crowned Sparrow Lark	*Eremopterix nigriceps*	
12.	Black-headed Ibis	*Threskiornis melanocephalus*	NT
13.	Black-shouldered Kite	*Elanus caeruleus*	
14.	Black-winged Stilt	*Himantopus himantopus*	
15.	Blue-tailed Bee-eater	*Merops philippinus*	
16.	Brahminy Kite	*Haliastur indus*	
17.	Brahminy Starling	*Sturnus pagodarum*	
18.	Bronze-winged Jacana	*Metopidius indicus*	
19.	Common Coot	*Fulica atra*	
20.	Common Greenshank	*Tringa nebularia*	
21.	Common Kingfisher	*Alcedo atthis*	
22.	Common Moorhen	*Gallinula chloropus*	
23.	Common Myna	*Acridotheres tristis*	
24.	Common Poachard	*Aythya farina*	
25.	Common Redshank	*Tringa totanus*	
26.	Common Ringed Plover	*Charadrius hiaticula*	
27.	Common Sandpiper	*Actitis hypoleucos*	
28.	Common Teal	*Anas crecca*	
29.	Cotton Pygmy-Goose	*Nettapus coromandelianus*	
30.	Darter	*Anhinga melanogaster*	NT

No.	English name	Scientific name	IUCN/IWPA status**
31.	Eurasian Curlew	*Numenius arquata*	NT
32.	Eurasian Marsh Harrier	*Circus aeruginosus*	
33.	Eurasian Wigeon	*Anas Penelope*	
34.	Fulvous Whistling Duck	*Dendrocygna bicolor*	
35.	Gargany Teal	*Anas querquedula*	
36.	Great Cormorant	*Phalacrocorax carbo*	
37.	Greater Coucal	*Centropus sinensis*	
38.	Greater Egret	*Casmerodius albus*	
39.	Green Avadavat	*Amandava formosa*	VU
40.	Grey Heron	*Ardea cinerea*	
41.	House Crow	*Corvus splendens*	
42.	House Swift	*Apus affinis*	
43.	Indian Cormorant	*Phalacrocorax fuscicollis*	
44.	Indian Pond Heron	*Ardeola grayii*	
45.	Indian Robin	*Saxicoloides fulicata*	
46.	Indian Roller	*Coracias benghalensis*	
47.	Indian Silverbill	*Lonchura malabarica*	
48.	Intermediate Egret	*Mesophoyx intermedia*	
49.	Jungle Crow	*Corvus macrorhynchos*	
50.	Kentish Plover	*Charadrius alexandrinus*	
51.	Laughing Dove	*Streptopelia senegalensis*	
52.	Lesser Whistling Duck	*Dendrocygna javanica*	
53.	Little Cormorant	*Phalacrocorax niger*	
54.	Little Egret	*Egretta garzetta*	
55.	Little Grebe	*Tachybaptus ruficollis*	
56.	Little Ringed Plover	*Charadrius dubius*	
57.	Marsh Sandpiper	*Tringa stagnatilis*	
58.	Northern Pintail	*Anas acuta*	
59.	Northern Shoveler	*Anas clypeata*	
60.	Painted Stork	*Mycteria leucocephala*	NT
61.	Pallid Harrier	*Circus macrourus*	NT & Sch.1
62.	Pheasant Tailed Jacana	*Hydrophasianus chirurgus*	
63.	Pied Avocet	*Recurvirostra avosetta*	
64.	Pied Harrier	*Circus melanoleucos*	
65.	Pied Kingfisher	*Ceryle rudis*	
66.	Pintail Snipe	*Gallinago stenura*	
67.	Purple Heron	*Ardea purpurea*	
68.	Purple Sunbird	*Nectarinia asiatica*	
69.	Purple Swamphen	*Porphyrio porphyrio*	
70.	Purple-rumped Sunbird	*Nectarinia zeylonica*	
71.	Red Avadavat	*Amandava amandava*	
72.	Red Collared Dove	*Streptopelia tranquebarica*	

No.	English name	Scientific name	IUCN/WPA status**
73.	Red-wattled Lapwing	*Vanellus indicus*	
74.	River Lapwing	*Vanellus duvaucalii*	
75.	River Tern	*Sterna aurantia*	
76.	Rose-ringed Parakeet	*Psittacula krameri*	
77.	Rosy Starling	*Sturnus roseus*	
78.	Small Green Bee-eater	*Merops orientalis*	
79.	Spot-billed Pelican	*Pelecanus philippensis*	NT
80.	Spotted Dove	*Streptopelia chinensis*	
81.	Spotted Redshank	*Tringa erythropus*	
82.	White-breasted Kingfisher	*Halcyon smyrnensis*	
83.	White-breasted Waterhen	*Amaurornis phoenicurus*	
84.	White-headed Babbler	*Turdoides affinis*	
85.	Yellow-wattled Lapwing	*Vanellus malabaricus*	
86.	*Spotted owlet	*Athene brama*	
87.	*Barn Owl	*Tyto alba*	
88.	*Black-headed Gull	*Larus ridibundus*	
89.	*Ruddy Turnstone	*Arenaria interpres*	
90.	*Black-bellied Plover	*Pluvialis squatarola*	
91.	*Ruddy Shelduck	*Tadorna ferruginea*	
92.	*Grey Plover	*Pluvialis squatarola*	
93.	*Pacific Golden Plover	*Pluvialis fulva*	
94.	*Asian Dowitcher	*Limnodromus semipalmatus*	NT
95.	*Black-tailed Godwit	*Limosa limosa*	
96.	*Bar-tailed Godwit	*Limosa lapponica*	
97.	*Gadwall	*Anas strepera*	
98.	*Bar-headed Goose	*Anser indicus*	
99.	*Comb Duck	*Sarkidiornis melanotos*	
100.	*Greater Flamingo	*Phoenicopterus roses*	
101.	*Sarus Crane	*Grus antigone*	VU
102.	*Woolly-necked Stork	*Ciconia episcopus*	
103.	*White Eye Pochard	*Aythya nyroca*	NT
104.	*Bear's Poachard	*Aythya baeri*	END
105.	*Ferruginous Duck	*Aythya nyroca*	
106.	*Blue-breasted Banded Rail	*Rallus striatus*	
107.	*Ballions Crake	*Porzana pusilla*	
108.	*Brown Crake	*Amaluromis akool*	
109.	*Wood Snipe	*Gallnago nemoricola*	
110.	*Bush lark	*Mirafra assamica*	
111.	*Rufous Tailed Finch Lark	*Ammomanes phoenicurus*	
112.	*Common crested lark	*Galerida cristata*	
113.	*Small Sky Lark	*Alauda gulgula*	
114.	*Peregrine Falcon	*Falco peregrinus*	

No.	English name	Scientific name	IUCN/IWPA status**
115.	*Plaintive Cuckoo	*Cacomantis merulinus*	
116.	*Indian Blue Robin	*Luscinia brunnea*	
117.	*White-rumped Needletail	*Zoonavena sylvatica*	
118.	*Kentish Plover	*Charadrius alexandrinus*	
119.	*Lesser Sand Plover	*Charadrius mongolus*	
120.	*Greater Sand Plover	*Charadrius leschenaultii*	
121.	*Dunlin	*Calidris alpine*	
122.	*Temminck's Stint	*Calidris temminckii*	
123.	*Green Sandpiper	*Tringa ochropus*	
124.	*Wood Sandpiper	*Tringa glariola*	
125.	*Black Crowned Night Heron	*Nycticorax nycticorax*	
126.	*Great Crested Grebe	*Podiceps cristatus*	
127.	*Tufted Duck	*Aythya fuligula*	
128.	*Black-headed Cuckoo-shrike	*Coracina melanoptera*	
129.	*Common Babbler	*Turdoides caudatus*	
130.	*Common Crane	*Grus grus*	
131.	*Blue-winged Leafbird	*Chloropsis cochinchinsis*	
132.	*Golden-fronted Leafbird	*Chloropsis aurifrons*	
133.	*Greater Racket-tailed Drongo	*Dicrurus pardiseus*	
134.	*Indian Cuckoo	*Cuculus micropterus*	
135.	*Jungle Babbler	*Turdoides striatus*	
136.	*Jungle Owlet	*Glaucidium radiatum*	
137.	*Eurasian Thick-knee	*Burhinus oedicnemus*	
138.	*Grey-headed Fish Eagle	*Ichthyophagia ichthyaetus*	NT
139.	*Grey Junglefowl	*Gallus sonneratii*	
140.	*Grey Francolin	*Francolinus pondicerianus*	
141.	*Brown-Caped Pygmy Woodpecker	*Dendrocopos nanus*	
142.	*Egyptian Vulture	*Neophron percnopterus*	
143.	*Short-toed Snake Eagle	*Circaetus gallicus*	
144.	*Streaked Weaver	*Ploceus manyar*	
145.	*Water Cock	*Gallicrex cinerea*	

* Secondary information, **NT- Near Threatened; VU-Vulnerable; END-Endangered; IWPA Sch.1- Schedule I as per Indian Wildlife Protection Act, 1972

Table 15 Plants recorded in Naupada swamps and its sorroundings

No.	Plant species	Family
1.	*Acalypha indica* L.	Euphorbiaceae
2.	*Aeluropus lagopoides* (Linn.) Trin. ex Thw.	Poaceae

No.	Plant species	Family
3.	*Alternanthera paronychioides* A. St.-Hilaire	Amaranthaceae
4.	*Alternanthera pungens* Kunth	Amaranthaceae
5.	*Alternanthera sessilis* (L.) R.Br. ex DC.	Amaranthaceae
6.	*Alternanthera tenella* Colla.	Amaranthaceae
7.	*Amaranthus viridis* L.	Amaranthaceae
8.	*Ammannia baccifera* Linn.	Lythraceae
9.	*Anisomeles indica* (L.) Kuntze	Lamiaceae
10.	*Anisomeles malabarica* (L.) R. Br. ex Sims.	Lamiaceae
11.	*Aponogeton natans* (L.) Engl. & K.Krause	Aponogetonaceae
12.	*Argemone mexicana* L.	Papaveraceae
13.	*Aristida adscensionis* L.	Poaceae
14.	*Aristida funiculata* Trin & Rupr.	Poaceae
15.	*Aristida hystrix* L.	Poaceae
16.	*Aristida setacea* Retz.	Poaceae
17.	*Artemesia vulgaris* L.	Asteraceae
18.	*Arundo donax* L.	Poaceae
19.	*Asclepias curassavica* L.	Asclepiadaceae
20.	*Bacopa monnieri* (L.) Pennell	Scrophulariaceae
21.	*Barleria prionitis* L.\	Acanthaceae
22.	*Barringtonia racemosa* (L.) Spreng.	Lecythidaceae
23.	*Bergia ammannioides* Roxb.	Elatinaceae
24.	*Bidens pilosa* L.	Asteraceae
25.	*Biophytum reinwardtii* (Zucc.) Klotzsch.	Oxalidaceae
26.	*Blumea lacera* (Burm.f) DC.	Asteraceae
27.	*Blumea mollis* (D.Don) Merr.	Asteraceae
28.	*Bothriochloa bladhii* (Retz.) S. T. Blake	Poaceae
29.	*Bothriochloa pertusa* (L.) A. Camus	Poaceae
30.	*Brachiaria ramosa* (L.) Stapf	Poaceae
31.	*Bulbostylis barbata* (Rottb.) C.B. Clarke	Cyperaceae
32.	*Caesalpinia bonduc* (L.) Roxb.	Caesalpiniaceae
33.	*Cenchrus ciliaris* L.	Poaceae
34.	*Chloris barbata* Sw.	Poaceae
35.	*Cleome monophylla* L.	Capparidaceae
36.	*Clerodendrum inerme* (L.) Gaertn.	Verbenaceae
37.	*Clerodendrum phlomidis* L.f.	Verbenaceae
38.	*Coccinia grandis* (L.) Voigt	Cucurbitaceae
39.	*Coldenia procumbens* Linn.	Boraginaceae

No.	Plant species	Family
40.	*Colocasia esculenta* (L.) Schott	Araceae
41.	*Commelina benghalensis* L.	Commelinaceae
42.	*Commelina longifolia* Lam.	Commelinaceae
43.	*Corchorus aestuans* L.	Tiliaceae
44.	*Cynodon dactylon* (L.) Pers.	Poaceae
45.	*Cyperus articulatus* L.	Cyperaceae
46.	*Cyperus difformis* L.	Cyperaceae
47.	*Cyperus exaltatus* Retz.	Cyperaceae
48.	*Cyperus halpan* L.	Cyperaceae
49.	*Cyperus iria* L.	Cyperaceae
50.	*Cyperus pangorei* Rottb.	Cyperaceae
51.	*Cyperus rotundus* L.	Cyperaceae
52.	*Dactyloctenium aegyptium* (L.) Willd.	Poaceae
53.	*Dactyloctenium aristatum* Link.	Poaceae
54.	*Datura metal* L.	Solanaceae
55.	*Desmostachya bipinnata* (L.) Stapf	Poaceae
56.	*Dicanthium annulatum* (Forsk.) Stapf.	Poaceae
57.	*Digera muricata* (L.) Mart.	Amaranthaceae
58.	*Digitaria bicornis* (Lam.) Roem. & Schult.	Poaceae
59.	*Dinebra retroflexa* (Vahl) Panzer	Poaceae
60.	*Diospyros buxifolia* (Blume) Hiern	Ebenaceae
61.	*Diospyros melanoxylon* Roxb.	Ebenaceae
62.	*Echinochloa colona* (L.) Link	Poaceae
63.	*Echinops echinatus* Roxb.	Asteraceae
64.	*Eclipta prostrata* (L.) L.	Asteraceae
65.	*Eichhornia crassipes* (Mart.) Solms-Laub.	Pontederiaceae
66.	*Eleusine indica* (L.) Gaertn.	Poaceae
67.	*Emilia sonchifolia* (L.) DC.	Asteraceae
68.	*Enicostema axillare* (Lam.) Raynal	Gentianaceae
69.	*Eragrostis maderaspatana* Bor	Poaceae
70.	*Eragrostis minor* Host	Poaceae
71.	*Eragrostis nigra* Nees ex Steud.	Poaceae
72.	*Eragrostis nutans* (Retz.) Nees ex Steud.	Poaceae
73.	*Eragrostis unioloides* (Retz.) Nees ex Steud.	Poaceae
74.	*Eremopogon foveolatus* (Del.) Stapf.	Poaceae
75.	*Euphorbia rosea* Retz.	Euphorbiaceae
76.	*Euphorbia thymifolia* L.	Euphorbiaceae

No.	Plant species	Family
77.	*Evolvulus alsinoides* (L.) L.	Convolvulaceae
78.	*Evolvulus nummularius* (L.) L.	Convolvulaceae
79.	*Fimbristylis aestivalis* (Retz.) Vahl.	Cyperaceae
80.	*Fimbristylis argentea* (Rottb.) Vahl.	Cyperaceae
81.	*Fimbristylis bisumbellata* (Forssk.) Bubani	Cyperaceae
82.	*Fimbristylis complanata* (Retz.) Link.	Cyperaceae
83.	*Fimbristylis dichotoma* (L.) Vahl.	Cyperaceae
84.	*Fimbristylis falcata* (Vahl.) Kunth.	Cyperaceae
85.	*Fimbristylis miliacea* (L.) Vahl.	Cyperaceae
86.	*Fimbristylis ovata* (Burm. F.) Kern.	Cyperaceae
87.	*Fimbristylis tetragona* R.Br.	Cyperaceae
88.	*Giseckia pharnaceoides* L.	Aizoaceae
89.	*Gnaphalium luteo-album* L.	Asteraceae
90.	*Gnaphalium polycaulon* Pers.	Asteraceae
91.	*Gomphrena serrata* L.	Amaranthaceae
92.	*Grangea maderaspatana* (L.) Poir.	Asteraceae
93.	*Hedyotis biflora* (L.) Lam.	Rubiaceae
94.	*Hedyotis corymbosa* (L.) Lam.	Rubiaceae
95.	*Heliotropium curasavicum* L.	Boraginaceae
96.	*Heliotropium indicum* L.	Boraginaceae
97.	*Heteropogon contortus* (L.) P.Beauv	Poaceae
98.	*Hydrilla verticillata* (L. f.) Royle	Hydrocharitaceae
99.	*Hygrophila auriculata* (Schum) Heine	Acanthaceae
100.	*Hyptis suaveolens* (L.) Poit.	Lamiaceae
101.	*Imperata cylindrica* (L.) Beauv.	Poaceae
102.	*Indigofera linifolia* (L.f.) Retz.	Fabaceae
103.	*Indigofera linnaei* Ali	Fabaceae
104.	*Indoneesiella echioides* (L) Nees.	Acanthaceae
105.	*Ipomoea aquatica* Forssk.	Convolvulaceae
106.	*Ipomoea biloba* Forssk.	Convolvulaceae
107.	*Ipomoea carnea* Jacq.	Convolvulaceae
108.	*Ischaemum indicum* (Houtt.) Merr. var. *indicum*	Poaceae
109.	**Iseilema anthephoroides* Hack.	Poaceae
110.	*Iseilema laxum* Hack.	Poaceae
111.	**Jatropha tanjorensis* Ellis & Saroja	Euphorbiaceae
112.	*Kyllingia nemoralis* (J. R. & G. Forst.) Dandy ex Hutchinson & Dalziel	Cyperaceae

No.	Plant species	Family
113.	*Lagascea mollis* Cav.	Asteraceae
114.	*Lantana wightiana* Wallich ex Gamble	Verbenaceae
115.	*Lemna minor* L.	Lemnaceae
116.	*Lindernia antipoda* (L.) Alston	Scrophulariaceae
117.	*Lindernia crustacea* (L.) F.v.Muell.	Scrophulariaceae
118.	*Lindernia hyssopioides* (L.) Haines	Scrophulariaceae
119.	*Ludwigia adscendens* (L.) H. Hara	Onagraceae
120.	*Ludwigia perennis* L.	Onagraceae
121.	*Ludwigia peruviana* (L.) Hara	Onagraceae
122.	*Manisuris myuros* L.	Poaceae
123.	*Merremia hastata* (Hallier f.) Ooststr.	Convolvulaceae
124.	*Merremia tridentata* (L.) Hall.f.	Convolvulaceae
125.	*Mollugo cerviana* (L.) Ser.	Aizoaceae
126.	*Monochoria hastata* (L.) Solms-Laub.	Pontideriaceae
127.	*Monochoria vaginalis* (Burm. F.) Presl	Pontideriaceae
128.	*Najas minor* All.	Najadaceae
129.	*Nelumbo nucifera* Gaertn.	Nymphaeaceae
130.	*Nothosaerva brachiata* (L.) Wight	Amaranthaceae
131.	*Nymphaea nouchali* Burm. f.	Nymphaeaceae
132.	*Nymphaea pubescens* Willd.	Nymphaeaceae
133.	*Nymphaea rubra* Roxb. ex Salisb.	Nymphaeaceae
134.	*Nymphoides indicum* (L.) Kuntze	Menyanthaceae
135.	*Ophiuros exaltatus* (Linnaeus) Kuntze	Poaceae
136.	*Oropetium thomaeum* (Linn.f.) Trin.	Poaceae
137.	*Ottelia alismoides* (L.) Pers.	Hydrocharitaceae
138.	*Oxalis corniculata* L.	Oxalidaceae
139.	*Oxystelma esculentum* R. Br.	Asclepiadaceae
140.	*Pandanus odoratissimus* L.f.	Pandanaceae
141.	*Panicum miliaceum* L.	Poaceae
142.	*Panicum paludosum* Roxb.	Poaceae
143.	*Panicum repens* L.	Poaceae
144.	*Panicum trypheron* Schult.	Poaceae
145.	*Parthenium hysterophorus* L.	Asteraceae
146.	*Paspalidium flavidum* (Retz.) A. Camus.	Poaceae
147.	*Paspalum scrobiculatum* L.	Poaceae
148.	*Passiflora foetida* L.	Passifloraceae
149.	*Pavonia odorata* Willd.	Malvaceae

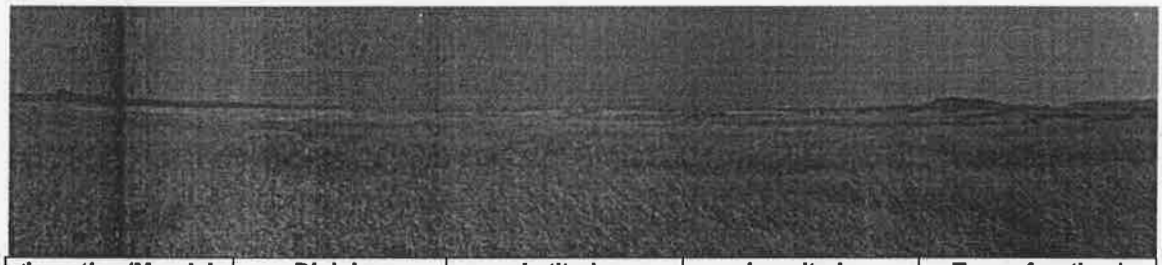
No.	Plant species	Family
150.	*Pavonia procumbens* (Wall ex Wight & Arn.) Walp.	Malvaceae
151.	*Pavonia zeylanica* (L.) Cav.	Malvaceae
152.	*Pedalium murex* L.	Pedaliaceae
153.	*Peristrophe bicalyculata* (Forssk.) Brummitt.	Acanthaceae
154.	*Phoenix loureirii* Kunth.	Arecaceae
155.	*Phragmites karka* Trin. ex Steud.	Poaceae
156.	*Phyla nodiflora* (L.) E. Greene	Verbenaceae
157.	*Phyllanthus amarus* Schum. & Thonn.	Euphorbiaceae
158.	*Phyllanthus maderaspatensis* L.	Euphorbiaceae
159.	**Phyllanthus rotundifolius* Klein ex Willd.	Euphorbiaceae
160.	*Phyllanthus urinaria* L.	Euphorbiaceae
161.	*Physalis minima* Linn.	Solanaceae
162.	*Pistia stratiotes* L.	Araceae
163.	*Plecospermum spinosum* Trec.	Moraceae
164.	*Polycarpaea corymbosa* (L.) Lam.	Caryophyllaceae
165.	*Polygonum barbatum* (L.) H.Hara var. *barbatum*	Polygonaceae
166.	*Polygonum glabrum* Willdenow	Polygonaceae
167.	*Polygonum hydropiper* L.	Polygonaceae
168.	*Polygonum plebeium* R. Br.	Polygonaceae
169.	*Polygonum* sp.	Polygonaceae
170.	*Portulaca oleracea* L.	Portulacaceae
171.	*Portulaca quadrifida* L.	Portulacaceae
172.	*Psilotrichum elliotii* Baker & Clarke	Amaranthaceae
173.	*Pycreus globosus* (All.) Reichenb.	Cyperaceae
174.	*Rhynchosia minima* (L.) DC.	Fabaceae
175.	*Rivea hypocrateriformis* (Desr.) Choisy	Convolvulaceae
176.	*Ruellia patula* Jacq.	Acanthaceae
177.	*Ruellia tuberosa* L.	Acanthaceae
178.	*Saccharum spontaneum* Linn.	Poaceae
179.	*Sacciolepis indica* (L.) Chase	Poaceae
180.	*Salicornia brachiata* Miq.	Chenopodiaceae
181.	*Salvinia molesta* D.Mitch.	Salviniaceae
182.	*Scirpus articulatus* Linn.	Cyperaceae
183.	*Scleria lithosperma* (L.) Sw.	Cyperaceae
184.	*Scoparia dulcis* L.	Scrophulariaceae
185.	*Sebastiania chamaelea* (L.) Muell.-Arg.	Euphorbiaceae
186.	*Sehima nervosum* (Rottl.) Stapf.	Poaceae

No.	Plant species	Family
187.	*Senna hirsuta* (L.) Irwin & Barneby	Caesalpiniaceae
188.	*Senna italica* Mill.	Caesalpiniaceae
189.	*Senna occidentalis* (L.) Link	Caesalpiniaceae
190.	*Senna tora* (L.) Roxb.	Caesalpiniaceae
191.	*Setaria italica* (L.) P. Beauv	Poaceae
192.	*Sida acuta* Burm.f.	Malvaceae
193.	*Sida cordata* (Burm. f.) Borss.	Malvaceae
194.	*Solanum surattense* Burm. f.	Solanaceae
195.	*Solanum trilobatum* L.	Solanaceae
196.	*Solena amplexicaulis* (Lam.) Gandhi	Cucurbitaceae
197.	*Sonchus oleraceus* L.	Asteraceae
198.	*Spermacoce hispida* L.	Rubiaceae
199.	*Spermacoce ocymoides* Burm.f.	Rubiaceae
200.	*Sphaeranthus indicus* Linn.	Asteraceae
201.	*Spilanthes calva* DC.	Asteraceae
202.	*Spilanthes uliginosa* Sw.	Asteraceae
203.	*Sporobolus coromandelianus* (Retz.) Kunth	Poaceae
204.	*Sporobolus indicus* (L.) R.Br.	Poaceae
205.	*Sporobolus spicatus* (Vahl.) Kunth	Poaceae
206.	*Sporobolus wallichii* Munro ex Trimen	Poaceae
207.	*Stemodia viscosa* Roxb.	Scrophulariaceae
208.	*Striga asiatica* (L.) Kuntze	Scrophulariaceae
209.	*Suaeda fruticosa* Forssk. ex J.F. Gmelin	Chenopodiaceae
210.	*Suaeda nudiflora* (Willd) Moq.	Chenopodiaceae
211.	*Synedrella nodiflora* (L.) Gaertn.	Asteraceae
212.	*Tephrosia purpurea* (L.) Pers.	Fabaceae
213.	*Tephrosia villosa* (L.) Pers.	Fabaceae
214.	*Tinospora cordifolia* (Willd.) Miers ex Hook. f. & Thoms.	Menispermaceae
215.	*Tragia involucrata* L.	Euphorbiaceae
216.	*Tragia plukenetii* R. Smith	Euphorbiaceae
217.	*Trianthema triquetra* Rottl.	Aizoaceae
218.	*Tribulus lanuginosis* L.	Zygophyllaceae
219.	*Trichodesma indicum* (L.) R. Br.	Boraginaceae
220.	*Tridax procumbens* L.	Asteraceae
221.	*Triumfetta pentandra* A. Rich	Tiliaceae
222.	*Triumfetta rotundifolia* Lam.	Tiliaceae
223.	*Turnera subulata* Smith	Turneraceae

No.	Plant species	Family
224.	*Typha angustifolia* L.	Typhaceae
225.	*Urena lobata* L. subsp. Lobata	Malvaceae
226.	*Vallisneria spiralis* L.	Hydrocharitaceae
227.	*Vernonia cinerea* (L.) Less.	Asteraceae
228.	*Vetiveria zizanioides* (L.) Nash.	Poaceae
229.	*Vigna trilobata* (L.) Verdc.	Fabaceae
230.	*Vitex leucoxylon* L.f.	Verbenaceae
231.	*Waltheria indica* L.	Sterculiaceae
232.	*Wedelia chinensis* (Osbeck) Merr.	Asteraceae
233.	*Xanthium indicum* Koen.	Asteraceae
234.	*Zornia diphylla* (L.)	Fabaceae
235.	*Zornia gibbosa* Span.	Fabaceae
236.	*Zoysia matrella* (L.) Merr.	Poaceae

*species endmic to Peninsular India

3.2 SOMPETA



Location/Mandal	Division	Latitude	Longitude	Type of wetland
Sompeta	Tekkali	18° 56' 14.73" N	84° 35' 24.50" E	Natural

Sompeta wetland is locally known as '*Beela*'. Beela is a low lying swamp/marsh area with a unique habitat for rich biodiversity with a distinctive hydrological regime. There are three distinct water bodies of varying size and characteristics in the Sompeta wetland complex. The first one is known as '*Pedda Beela*' which is linked to two other Beelas know as the '*Chinna Beela* (Mankkiapuram Beela) and *Tampara* which is eventually connected to sea near Idduvanipalem. An anicut of height 0.843 m distinguishes the Pedda Beela and Chinna Beela. The Anicut has a sluiceway that allows water to flow from the Pedda Beela to the Chinna Beela and not vice versa. This helps to prevent intrusion of salt water to the Pedda Beela enabling it to maintain fresh water characteristics.

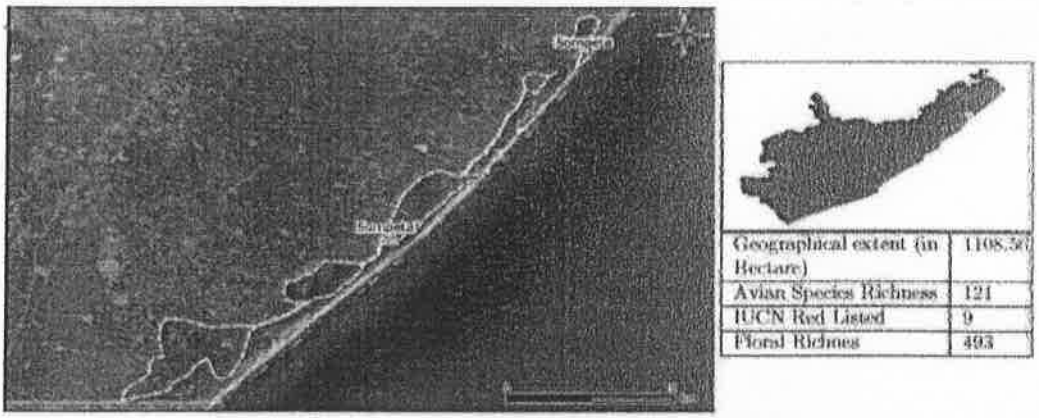


Figure 10 Satellite image of Sompeta wetland complex

The Sompeta wetland complex spreads over nearly 1600 ha acres starting from Baruva in Sompeta mandal to Kapaasuguddi in Kaviti mandal, approximately 20 Km, with varying widths. It falls within Rishikudda, Gollagandi, Baruvapeta and Benkili villages. It consists of marshes, mud flats, permanent shallow marine waters, marine sub tidal aquatic beds, coastal brackish/saline lagoons, seasonal/intermittent freshwater marshes/pools, permanent freshwater spreads, fish-culture ponds, irrigated lands etc.

3.2.1 CHARACTERISTICS OF THE WETLAND

Sompeta wetland is fed by Mukundasagaram Pydigam reservoir and numerous channels and small streams from the river Mahendaratanaya. Considerable flood waters also reach it during the monsoon. The area gets about 1200 mm rainfall annually, most of it during the south western season of June to September. In summer, the upper reaches of the wetland get dried up whereas its middle portion remains inundated and marshy.

3.2.2 ECOSYSTEM SERVICES

3.2.2.1 Regulatory services

During monsoon the entire Sompeta wetland complex gets inundated by flood waters. This flood waters keep the wetlands replenished with water and nutrients; even in extreme summer all the three beelas never dry up completely. These

wetlands help in controlling flood in the surrounding areas which are rather thickly populated. It also sponges the flood and storm waters gradually releasing it in lean months. Sediments are retained within the wetland and the thick vegetation which persists in the wetland traps sediments and control soil erosion.

3.2.2.2 Provisioning services

Wildlife Habitat and rare species

The wetland is a habitat for 491 plant species and 121 bird species that includes migratory species. In fact, 74% of the plants and 52% birds found in the whole of Srikakulam district are seen in the Sompeta wetland and its environs. The hillock, about 25 acre, in the wetland shelters a wide variety of wild life such as wild boars, several species of snakes and bats.

Pink-headed Duck is a shy and secretive bird, even possibly nocturnal (Eames 2008, http://www.birdlife.org/datazone/speciesfactsheet.php?id=468), inhabiting secluded and overgrown still-water pools, marshes and swamps in lowland forest and tall grasslands, where there are lot of hiding places particularly areas subject to seasonal inundation. Both male and female of the species are 41–43 cm in size, long-billed with long necks and peaked heads. The male has a pink bill, head and neck while the female has a pale pinkish head and neck with a paler bill. The black of the body extends as a narrow strip on the front of the neck.

The Pink-headed Duck is a species not reported from the country for more than half a century. Its known distribution range includes northern Burma, north-eastern India, and central Nepal. Some, and possibly all, populations show local seasonal movements, resulting in scattered historical records as far as from Punjab, Maharashtra and AP in India. The species was relentlessly hunted in the 19th and first half of 20th century for its skin which was prized as curios though its meat was less preferred. Indiscriminate hunting coupled with loss of habitat led to the fast disappearance of this bird from all known places of report.

Pink-headed Duck was last observed in the wild in 1949. Though amenable to live in captivity for a long time it failed to breed in captivity and in 1944 the last bird in the captivity died. As there have been some local reports of the sighting of this bird in Northern Burma, this bird has been categorised as 'Critically Endangered' instead of extinct. It is assumed that a small population of around 50 birds may exist in Northern Burma which is yet to be explored fully. The elusive search of Pink-headed Duck is still moves on.

Our research team visited Sompeta wetland in October 2011 and January 2012; the first visit being a reconnaissance survey. During the first visit in order to obtain a preliminary idea about the presence of various birds in the wetland, photographs of several species were shown to many villagers who were intimately related to the wetlands. Along with the photographs of bird species already confirmed from those wetlands many villagers firmly reiterated, after seeing the photograph of Pink-headed Duck, that the bird is available in the area during November to December end and sometimes up to January.

Due to compelling reasons we could not visit the wetland during possible season. Therefore, we decided to adopt 'Participatory Biodiversity Appraisal' methodology to ascertain the veracity of the information obtained during the previous visit. The core area of the 'Peddabeela' of Sompeta wetland is inundated with water even in extreme summer (approximately 50 ha) with a thick growth of grass and sedge spp. (*Typha angustifolia, Cyperus exaltatus,* and *Scirpus articulates*,) and *Ipomoea carnea* which are more than 5 ft high having enough hiding places. As per the available literature, Pink-headed Ducks prefer similar habitats. The approach to the core area is very marshy and even cattle avoid these areas and hence little disturbed. Only fishermen go to the core area, approachable only by dugout canoes, for fishing.

Since these fishers have been doing fishing in these areas for generations they are very familiar with the biodiversity, the hydro-period and the habitats of the area. Therefore, it was decided to conduct the exercise of Participatory Biodiversity

Appraisal (PBA) with the fishermen. Photographs of 10 species of birds were selected, 4 common species in the area, 4 uncommon and 2 which were not reported from the area. Showing the photographs, fishermen were asked to indicate the presence and absence of each species in the wetland and their local name. All the fishermen (n=15) except two could correctly identify the birds that were present there and their local name, and could tell which species were absent correctly. Thereafter they were shown the photograph of the Pink-headed Duck. All the fishermen except 2 stated that the bird is available during November to January in the wetland. Therefore, the existence of the bird in the Sompeta wetland is a strong possibility.

Water supply

Our PRA exercise brought out the information that 33 villages with an approximate population of 90000 reside within 3 Km radius of the wetland. While 11 villages are exclusively engaged in agriculture, 8 villages are occupied by the marine fishers, and 4 villages are engaged in fishing along with cultivation. One village, Manikkapuram is engaged fully in inland 'Beela' fishing. Seventeen villages are engaged in farming along with rearing of the cattle. In two villages some of the households earn their livelihood from making mats whereas spinning coir was taken up as an occupation by some households in two villages.

Due to the "Beela' the ground water table is always high. In fact the Beela is vital for supporting the water needs of the Paddy cultivated in approximately 5000 acres (two crops). The area around the Beela is very fertile. In and around the Beela there is lush green coconut groves interspersed with areca nut trees. This area is also known for its vegetables. A food mile analysis in the nearby areas indicated that except potatoes all other food materials are locally produced. Three lift irrigation schemes which cater to 750 acres of agriculture are operated in the area. Water could be sourced without any interruption from the wells located in the wetland to pump to upstream areas.

Fisheries

The inhabitants of the Manikkapuram village of the Kaviti mandal depend exclusively upon the Beelas for fishing. The residents here are traditional fishers belonging to Behera community of Odisha origin. Here, around 400 families are engaged in subsistence fishing (Appendix 6). All members in the family are engaged in fishing related activities by some means. While the menfolk involve in capture fisheries, the womenfolk market the fishes locally earning extra income for the family. Traditional gears made of plant materials are used for fishing. The residents spent their free time in mending their fishing gears. The Fishers here are organised into cooperative societies patronised by the Department of Fisheries and the wetlands are leased out to these societies every year.

Fodder

Farmers in seventeen villages falling within the 3 Km from the wetland are chiefly into agriculture and rearing cattle. Hundreds of cattle graze in the wetland during dry season. The villagers harvest fodder from the wetland for stall feeding. Thousands of cattle are reared in homesteads.

Materials for roofing and mats

The wetland is a rich source of raw material, such as *Scirpus* sp., to make mats. It is an income source crucial to hundreds of people. The material is also used for thatching and roofing.

Medicinal and Edible plants

Sompeta wetland and its environs are habitat for 495 plant species out of which many have medicinal properties and many edible. Local people depend on these plants as remedy for many of their maladies and also collect tubers and fruits for consumption.

Conservation priorities

As noted earlier, Sompeta wetland is a complex wetland. Whereas Pedda Beela consists of about 50 ha of permanently inundated area with typical aquatic macrophytes, and surrounded by marshy area covered by grass and sedge species. Throughout the monsoon (for almost six months) these areas remain submerged. Surrounding the 'Pedda Beela' is hundreds of acres of lush paddy fields which yield two crops. Hundreds of acres of coconut plantations are also sustained by high water table maintained by the 'Pedda beela'. Numerous seasonal channels and streams feed 'Pedda Beela' during rainy season. The altitude of Pedda Beela is just two meters above sea level. Pedda Beela harbours significant faunal and floral biodiversity.

The other two 'Beelas' are fed by the water from the Pedda Beela and have a water regime which may have wider implications in terms of the water table, water quality and sustenance of the biodiversity of the surrounding areas.

Table 16 Birds recorded in Sompeta wetlands and its environs

Sl. No.	English name	Scientific name	Status
1.	Alexandrine Parakeet	*Psittacula eupatria*	
2.	Ashy Drongo	*Dicrurus leucophaeus*	
3.	Ashy Prinia	*Prinia socialis*	
4.	Ashy-crowned Sparrow Lark	*Eremopterix griseus*	
5.	Asian Koel	*Eudynamys scolopacea*	
6.	Asian Openbill	*Anastomus oscitans*	
7.	Asian Palm Swift	*Cypsiurus balasiensis*	
8.	Asian Pied Starling	*Sturnus contra*	
9.	Baya Weaver	*Ploceus philippinus*	
10.	Bay-backed Shrike	*Lanius vittatus*	
11.	Black Bittern	*Dupetor flavicollis*	
12.	Black Drongo	*Dicrurus macrocercus*	
13.	Black Kite	*Milvus migrans*	
14.	Black-crowned Night Heron	*Nycticorax nycticorax*	
15.	Black-headed Ibis	*Threskiornis melanocephalus*	NT
16.	Black-shouldered Kite	*Elanus caeruleus*	
17.	Black-winged Stilt	*Himantopus himantopus*	

Sl. No.	English name	Scientific name	Status
18.	Blue-eared Kingfisher	*Alcedo meninting*	
19.	Blue-tailed Bee-eater	*Merops philippinus*	
20.	Brahminy Kite	*Haliastur Indus*	
21.	Brahminy Starling	*Sturnus pagodarum*	
22.	Bronze-winged Jacana	*Metopidius indicus*	
23.	Cattle Egret	*Bubulcus ibis*	
24.	Cinnamon Bittern	*Ixobrychus cinnamomeus*	
25.	Common Coot	*Fulica atra*	
26.	Common Hoopoe	*Upupa epops*	
27.	Common Kingfisher	*Alcedo atthis*	
28.	Common Moorhen	*Gallinula chloropus*	
29.	Common Myna	*Acridotheres tristis*	
30.	Common Poachard	*Aythya ferina*	
31.	Common Sandpiper	*Actitis hypoleucos*	
32.	Common Teal	*Anas crecca*	
33.	Cotton Pygmy-Goose	*Nettapus coromandelianus*	
34.	Darter	*Anhinga melanogaster*	NT
35.	Eurasian Collared Dove	*Streptopelia decaocta*	
36.	Eurasian Marsh Harrier	*Circus aeruginosus*	
37.	Eurasian Spoonbill	*Platalea leucorodia*	NT & Sch. I
38.	Eurasian Wigeon	*Anas penelope*	
39.	Fulvous Whistling Duck	*Dendrocygna bicolor*	
40.	Gargany Teal	*Anas querquedula*	
41.	Great Cormorant	*Phalacrocorax carbo*	
42.	Greater Coucal	*Centropus sinensis*	
43.	Greater Egret	*Casmerodius albus*	
44.	Green Sandpiper	*Tringa ochropus*	
45.	Grey Francolin	*Francolinus pondicerianus*	
46.	Grey Heron	*Ardea cinerea*	
47.	House Crow	*Corvus splendens*	
48.	House Sparrow	*Passer domesticus*	
49.	Indian Cormorant	*Phalacrocorax fuscicollis*	
50.	Indian Grey Hornbill	*Ocyceros birostris*	
51.	Indian Peafowl	*Pavo cristatus*	Sch. I
52.	Indian Pond Heron	*Ardeola grayii*	
53.	Indian Robin	*Saxicoloides fulicata*	
54.	Indian Roller	*Coracias benghalensis*	
55.	Indian Silverbill	*Lonchura malabarica*	
56.	Intermediate Egret	*Mesophoyx intermedia*	

Sl. No.	English name	Scientific name	Status
57.	Jungle Babbler	*Turdoides striatus*	
58.	Jungle Crow	*Corvus macrorhynchos*	
59.	Jungle Myna	*Acridotheres fuscus*	
60.	Laughing Dove	*Streptopelia senegalensis*	
61.	Lesser Coucal	*Centropus bengalensis*	
62.	Little Cormorant	*Phalacrocorax niger*	
63.	Little Egret	*Egretta garzetta*	
64.	Little Grebe	*Tachybaptus ruficollis*	
65.	Little Heron	*Butorides striata*	
66.	Little Ringed Plover	*Charadrius dubius*	
67.	Marsh Sandpiper	*Tringa stagnatilis*	
68.	Northern Pintail	*Anas acuta*	
69.	Northern Shoveler	*Anas clypeata*	
70.	Oriental Magpie Robin	*Copsychus saularis*	
71.	Paddyfield Pipit	*Anthus rufulus*	
72.	Painted Stork	*Mycteria leucocephala*	NT
73.	Pallid Harrier	*Circus macrourus*	NT & Sch I
74.	Pheasant Tailed Jacana	*Hydrophasianus chirurgus*	
75.	Pied Harrier	*Circus melanoleucos*	
76.	Pied Kingfisher	*Ceryle rudis*	
77.	Pintail Snipe	*Gallinago stenura*	
78.	Purple Heron	*Ardea purpurea*	
79.	Purple Swamphen	*Porphyrio porphyrio*	
80.	Purple-rumped Sunbird	*Nectarinia zeylonica*	
81.	Red Avadavat	*Amandava amandava*	
82.	Red Collared Dove	*Streptopelia tranquebarica*	
83.	Red-crested Pochard	*Rhodonessa rufina*	
84.	Red-vented Bulbul	*Pycnonotus cafer*	
85.	Red-wattled Lapwing	*Vanellus indicus*	
86.	River Lapwing	*Vanellus duvaucalii*	
87.	River Tern	*Sterna aurantia*	
88.	Rock Pigeon	*Columba livia*	
89.	Rose-ringed Parakeet	*Psittacula krameri*	
90.	Rosy Starling	*Sturnus roseus*	
91.	Rufous Treepie	*Dendrocitta vagabunda*	
92.	Shikra	*Accipiter badius*	
93.	Small Green Bee-eater	*Merops orientalis*	
94.	Spot-billed Duck	*Anas poecilorhyncha*	
95.	Spot-billed Pelican	*Pelecanus philippensis*	NT

Sl. No.	English name	Scientific name	Status
96.	Spotted Dove	*Streptopelia chinensis*	
97.	White-bellied Drongo	*Dicrurus caerulescens*	
98.	White-breasted Kingfisher	*Halcyon smyrnensis*	
99.	White-breasted Waterhen	*Amaurornis phoenicurus*	
100.	White-browed Bulbul	*Pycnonotus luteolus*	
101.	White-browed Wagtail	*Motacilla maderaspatensis*	
102.	White-headed Babbler	*Turdoides affinis*	
103.	Yellow Bittern	*Ixobrychus sinensis*	
104.	Yellow Wagtail	*Motacilla flava*	
105.	Yellow-wattled Lapwing	*Vanellus malabaricus*	
106.	Brown-headed Barbet	*Megalaima zeylanica*	
107.	*White Stork	*Ciconia ciconia*	
108.	*Black-necked Stork	*Ephippiorhynchus asiaticus*	NT
109.	*Lesser Adjudant	*Leptoptilos javanicus*	VU
110.	*Black Ibis	*Pseudibis papillosa*	
111.	*Glossy Ibis	*Plegadis falcinellus*	
112.	*White-eyed Buzzard	*Butastur teesa*	
113.	*Greater Grey-headed Fish Eagle	*Ichthyophagia ichthyaetus*	NT
114.	*Egyptian Vulture	*Neophron percnopterus*	
115.	*Short-toed Snake Eagle	*Circaetus gallicus*	
116.	*Grey Junglefowl	*Gallus sonneratii*	
117.	*Grey Francolin	*Francolinus pondicerianus*	
118.	*Common Babbler	*Turdoides caudatus*	
119.	*Common Crane	*Grus grus*	
120.	*Indian Cuckoo	*Cuculus micropterus*	
121.	*Jungle Owlet	*Glaucidium radiatum*	

*** included based on secondary information;** NT- Near Threatened; VU-Vulnerable (IUCN status); Sch.1- Schedule I as per Indian Wildlife Protection Act, 1972

Table 17 Plants recorded in Sompeta wetlands and its environs

No.	Plant Species	Family
1.	*Abrus precatorius* L.	Fabaceae
2.	*Abutilon hirtum* (Lam.) Sweet	Malvaceae
3.	*Abutilon indicum* (L.) Sweet	Malvaceae
4.	*Acacia auriculiformis* A. Cunn ex Benth.	Mimosaceae
5.	*Acacia leucophloea* (Roxb.) Willd.	Mimosaceae
6.	*Acacia nilotica* (L.) Willd. ex Del.	Mimosaceae
7.	*Acacia torta* (Roxb.) Craib	Mimosaceae
8.	*Acalypha brachystachya* Hornem.	Euphorbiaceae

No.	Plant Species	Family
9.	*Acalypha indica* L.	Euphorbiaceae
10.	*Acalypha paniculata* Willd.	Euphorbiaceae
11.	*Acanthospermum hispidum* DC.	Asteraceae
12.	*Achyranthes aspera* L.	Amaranthaceae
13.	*Aeluropus lagopoides* (Linn.) Trin. ex Thw.	Poaceae
14.	*Aerva sanguinolenta* (L.) Blume	Amaranthaceae
15.	*Aeschynomene aspera* L.	Fabaceae
16.	*Ailanthus excelsa* Roxb.	Simaroubaceae
17.	*Alangium salviifolium* (L.f.) Wang.	Alangiaceae
18.	*Albizia amara* (Roxb.) Boivin	Mimosaceae
19.	*Albizia lebbeck* (L.) Willd.	Mimosaceae
20.	*Albizia saman* (Jacq.) F.v. Muell.	Mimosaceae
21.	*Allophylus serratus* Kurz.	Sapindaceae
22.	*Aloe vera* (L.) Burm.f.	Aloeaceae
23.	*Alstonia scholaris* (L.) R.Br.	Apocynaceae
24.	*Alternanthera paronychioides* A. St.-Hilaire	Amaranthaceae
25.	*Alternanthera pungens* Kunth	Amaranthaceae
26.	*Alternanthera sessilis* (L.) R.Br. ex DC.	Amaranthaceae
27.	*Alternanthera tenella* Colla.	Amaranthaceae
28.	*Alysicarpus longifolius* Wight & Arn.	Fabaceae
29.	*Alysicarpus monilifer* (L.) DC.	Fabaceae
30.	*Alysicarpus rugosus* DC.	Fabaceae
31.	*Amaranthus spinosus* L.	Amaranthaceae
32.	*Amaranthus viridis* L.	Amaranthaceae
33.	*Ammannia baccifera* Linn.	Lythraceae
34.	*Amorphophallus paeoniifolius* (Dennst.) Nicolson	Araceae
35.	*Ampelocissus latifolia* (Roxb.) Planch.	Vitaceae
36.	*Ampelocissus tomentosa* (Heyne ex Roth) Planch.	Vitaceae
37.	*Anacardium occidentale* L.	Anacardiaceae
38.	*Andrographis alata* (Vahl) Nees	Acanthaceae
39.	*Andrographis paniculata* (Burm.f.) Wall. ex Nees	Acanthaceae
40.	*Andropogon pumilus* Roxb.	Poaceae
41.	*Anisochilus carnosus* (L.f.) wall.	Lamiaceae
42.	*Anisochilus scaber* Benth.	Lamiaceae
43.	*Anisomeles indica* (L.) Kuntze	Lamiaceae
44.	*Anisomeles malabarica* (L.) R. Br. ex Sims.	Lamiaceae
45.	*Anogeissus acuminata* (Roxb. ex DC.) Guill. & Perr.	Combretaceae
46.	*Aponogeton natans* (L.) Engl. & K.Krause	Aponogetonaceae
47.	*Arachis hypogaea* L.	Fabaceae

No.	Plant Species	Family
48.	*Argemone mexicana* L.	Papaveraceae
49.	*Argyreia cuneata* (Willd.) Ker-Gawl.	Convolvulaceae
50.	*Argyreia elliptica* (Roth) Choisy	Convolvulaceae
51.	*Aristida adscensionis* L.	Poaceae
52.	*Aristida funiculata* Trin & Rupr.	Poaceae
53.	*Aristida hystrix* L.	Poaceae
54.	*Aristida setacea* Retz.	Poaceae
55.	*Aristolochia bracteolata* Lam.	Aristolochiaceae
56.	*Aristolochia indica* L.	Aristolochiaceae
57.	*Artemesia vulgaris* L.	Asteraceae
58.	*Arundo donax* L.	Poaceae
59.	*Asclepias curassavica* L.	Asclepiadaceae
60.	*Asparagus racemosus* Willd.	Asparagaceae
61.	**Asystasia dalzelliana* Sant.	Acanthaceae
62.	*Atalantia monophylla* (L.) Corr. Serr.	Rutaceae
63.	*Atalantia racemosa* Wight & Arn.	Rutaceae
64.	*Atylosia scarabaeoides* (L.) Benth.	Fabaceae
65.	*Azadirachta indica* A. Juss.	Meliaceae
66.	*Azima tetracantha* Lam.	Salvadoraceae
67.	*Bacopa monnieri* (L.) Pennell	Scrophulariaceae
68.	*Balanites aegyptiaca* (L.) Del.	Balanitaceae
69.	*Bambusa bambos* Voss	Poaceae
70.	**Barleria acuminata* Wight ex Nees.	Acanthaceae
71.	*Barleria buxifolia* L.	Acanthaceae
72.	*Barleria cristata* L.	Acanthaceae
73.	*Barleria mysorensis* Roth.	Acanthaceae
74.	*Barleria prionitis* L.	Acanthaceae
75.	*Barringtonia racemosa* (L.) Spreng.	Lecythidaceae
76.	*Basella rubra* L.	Chenopodiaceae
77.	*Bassia latifolia* Roxb.	Sapotaceae
78.	*Benkara malabarica* (Lam.) Tirvengadum	Rubiaceae
79.	*Bergia ammannioides* Roxb.	Elatinaceae
80.	*Bidens pilosa* L.	Asteraceae
81.	*Biophytum reinwardtii* (Zucc.) Klotzsch.	Oxalidaceae
82.	*Blainvillea acmella* (L.) Philipson	Asteraceae
83.	*Blepharis maderaspatensis* (L.) Heyne ex Roth	Acanthaceae
84.	*Blepharis repens* (Vahl) Roth	Acanthaceae
85.	*Blumea lacera* (Burm.f) DC.	Asteraceae
86.	*Blumea mollis* (D.Don) Merr.	Asteraceae

No.	Plant Species	Family
87.	*Boerhavia diffusa* L.	Nyctaginaceae
88.	*Boerhavia erecta* L.	Nyctaginaceae
89.	*Bombax ceiba* L.	Bombacaceae
90.	*Borassus flabellifer* L.	Arecaceae
91.	*Bothriochloa bladhii* (Retz.) S. T. Blake	Poaceae
92.	*Bothriochloa pertusa* (L.) A. Camus	Poaceae
93.	*Brachiaria ramosa* (L.) Stapf	Poaceae
94.	*Brachiaria remota* (Retz.) Haines	Poaceae
95.	*Breynia retusa* (Dennst.) Alston	Euphorbiaceae
96.	*Breynia vitis-idaea* (Burm.f.) Fischer	Euphorbiaceae
97.	*Bulbostylis barbata* (Rottb.) C.B. Clarke	Cyperaceae
98.	*Bulbostylis densa* (Wall. ex Roxb.) Hand.-Mazz.	Cyperaceae
99.	*Butea monosperma* (Lam.) Taub.	Fabaceae
100.	*Cadaba fruticosa* (L.) Druce	Capparidaceae
101.	*Caesalpinia bonduc* (L.) Roxb.	Caesalpiniaceae
102.	*Caesalpinia* sp.	Caesalpiniaceae
103.	*Calophyllum inophyllum* L.	Clusiaceae
104.	*Calotropis gigantea* (L.) R.Br.	Apocynaceae
105.	*Calotropis procera* (Ait.) R.Br.	Apocynaceae
106.	*Canavalia cathartica* Thouars	Fabaceae
107.	*Cardiospermum halicacabum* L.	Sapindaceae
108.	*Carissa carandas* L.	Apocynaceae
109.	*Carissa inermis* Vahl	Apocynaceae
110.	*Carissa spinarum* L.	Apocynaceae
111.	*Carmona retusa* (Vahl) Masam.	Boraginaceae
112.	*Casearia tomentosa* Roxb.	Flacourtiaceae
113.	*Cassia fistula* L.	Caesalpiniaceae
114.	*Cassia obtusa* L.	Caesalpiniaceae
115.	*Cassia siamea* Lam.	Caesalpiniaceae
116.	*Cayratia pedata* (Lam.) Juss. ex Gagnep.	Vitaceae
117.	*Cayratia trifolia* (L.) Domin.	Vitaceae
118.	*Celastrus paniculatus* Willd.	Celastraceae
119.	*Celosia polygonoides* Retz.	Amaranthaceae
120.	*Cenchrus barbatus* Schumach.	Poaceae
121.	*Cenchrus ciliaris* L.	Poaceae
122.	*Cenchrus setigera* Vahl.	Poaceae
123.	*Centella asiatica* (L.) Urban	Apiaceae
124.	*Cereus pterogonus* Lem.	Cactaceae
125.	*Chloris barbata* Sw.	Poaceae

No.	Plant Species	Family
126.	*Chloris dolichostachya* Lagasca	Poaceae
127.	*Chloris tenella Koen.* ex Roxb.	Poaceae
128.	*Chloroxylon swietenia* DC.	Rutaceae
129.	*Chromolaena odorata* (L.) King & Robinson	Asteraceae
130.	*Cipadessa baccifera* (Roth) Miq.	Meliaceae
131.	*Cissampelos pareira* L.	Menispermaceae
132.	*Cissus quadrangularis* L.	Vitaceae
133.	*Cissus repanda* Vahl.	Vitaceae
134.	*Cleome aspera* Koen ex. DC.	Capparidaceae
135.	*Cleome monophylla* L.	Capparidaceae
136.	*Cleome viscosa* L.	Capparidaceae
137.	*Clerodendrum inerme* (L.) Gaertn.	Verbenaceae
138.	*Clerodendrum infortunatum* L.	Verbenaceae
139.	*Clerodendrum phlomidis* L.f.	Verbenaceae
140.	*Clitoria ternatea* L.	Fabaceae
141.	*Coccinia grandis* (L.) Voigt	Cucurbitaceae
142.	*Cocculus hirsutus* (L.) Diels	Menispermaceae
143.	*Cocculus pendulus* (Forst.) Diels	Menispermaceae
144.	*Coldenia procumbens* Linn.	Boraginaceae
145.	*Colocasia esculenta* (L.) Schott	Araceae
146.	*Combretum albidum* G. Don	Combretaceae
147.	*Commelina benghalensis* L.	Commelinaceae
148.	*Commelina clavata* Clarke	Commelinaceae
149.	*Commelina longifolia* Lam.	Commelinaceae
150.	*Conyza leucantha* (D.Don) Ludlow & Raven	Asteraceae
151.	*Corchorus aestuans* L.	Tiliaceae
152.	*Corchorus tridens* L.	Tiliaceae
153.	*Corchorus trilocularis* L.	Tiliaceae
154.	*Costus speciosus* (Koen.) J. E. Smith	Costaceae
155.	*Crotalaria evolvuloides* Wight ex Wight & Arn.	Fabaceae
156.	*Crotalaria juncea* L.	Fabaceae
157.	*Crotalaria mysorensis* Roth.	Fabaceae
158.	*Crotalaria pallida* Dryand. var. *obovata* (G.Don) Polhill	Fabaceae
159.	*Croton bonplandianum* Baill.	Euphorbiaceae
160.	*Cuscuta reflexa* Roxb.	Convolvulaceae
161.	*Cyanotis tuberosa* (Roxb.) Schultes & Schultes	Commelinaceae
162.	*Cynodon dactylon* (L.) Pers.	Poaceae
163.	*Cynoglossum zeylanicum* (Vahl ex Hornem.) Thunb. ex Lehm.	Boraginaceae

No.	Plant Species	Family
164.	*Cyperus articulatus* L.	Cyperaceae
165.	*Cyperus difformis* L.	Cyperaceae
166.	*Cyperus exaltatus* Retz.	Cyperaceae
167.	*Cyperus halpan* L.	Cyperaceae
168.	*Cyperus iria* L.	Cyperaceae
169.	*Cyperus pangorei* Rottb.	Cyperaceae
170.	*Cyperus rotundus* L.	Cyperaceae
171.	*Dactyloctenium aegyptium* (L.) Willd.	Poaceae
172.	*Dactyloctenium aristatum* Link.	Poaceae
173.	*Datura innoxia* Mill.	Solanaceae
174.	*Datura metal* L.	Solanaceae
175.	*Desmostachya bipinnata* (L.) Stapf	Poaceae
176.	*Dicanthium annulatum* (Forsk.) Stapf.	Poaceae
177.	*Dichrostachys cinerea* (L.) Wight & Arn.	Mimosaceae
178.	*Dicoma tomentosa* Cass.	Asteraceae
179.	*Digera muricata* (L.) Mart.	Amaranthaceae
180.	*Digitaria bicornis* (Lam.) Roem. & Schult.	Poaceae
181.	*Dinebra retroflexa* (Vahl) Panzer	Poaceae
182.	*Diospyros buxifolia* (Blume) Hiern	Ebenaceae
183.	*Diplocyclos palmatus* (L.) Jeffrey	Cucurbitaceae
184.	*Echinochloa colona* (L.) Link	Poaceae
185.	*Echinops echinatus* Roxb.	Asteraceae
186.	*Eclipta prostrata* (L.) L.	Asteraceae
187.	*Eichhornia crassipes* (Mart.) Solms-Laub.	Pontederiaceae
188.	*Eleusine indica* (L.) Gaertn.	Poaceae
189.	*Elytraria acaulis* (L.f.) Lindau.	Acanthaceae
190.	*Embelia ribes* Burm.f.	Myrisinaceae
191.	*Emilia sonchifolia* (L.) DC.	Asteraceae
192.	*Enicostema axillare* (Lam.) Raynal	Gentianaceae
193.	*Eragrostiella bifaria* (Vahl)	Poaceae
194.	*Eragrostis maderaspatana* Bor	Poaceae
195.	*Eragrostis minor* Host	Poaceae
196.	*Eragrostis nigra* Nees ex Steud.	Poaceae
197.	*Eragrostis nutans* (Retz.) Nees ex Steud.	Poaceae
198.	*Eragrostis pilosa* P. Beauv	Poaceae
199.	*Eragrostis* sp.	Poaceae
200.	*Eragrostis unioloides* (Retz.) Nees ex Steud.	Poaceae
201.	*Eragrostis viscosa* (Retz.) Trin.	Poaceae
202.	*Eremopogon foveolatus* (Del.) Stapf.	Poaceae

No.	Plant Species	Family
203.	*Euphorbia hirta* L.	Euphorbiaceae
204.	*Euphorbia rosea* Retz.	Euphorbiaceae
205.	*Euphorbia thymifolia* L.	Euphorbiaceae
206.	*Euphorbia tirucalli* L.	Euphorbiaceae
207.	*Evolvulus alsinoides* (L.) L.	Convolvulaceae
208.	*Evolvulus nummularius* (L.) L.	Convolvulaceae
209.	*Fimbristylis aestivalis* (Retz.) Vahl.	Cyperaceae
210.	*Fimbristylis argentea* (Rottb.) Vahl.	Cyperaceae
211.	*Fimbristylis bisumbellata* (Forssk.) Bubani	Cyperaceae
212.	*Fimbristylis complanata* (Retz.) Link.	Cyperaceae
213.	*Fimbristylis dichotoma* (L.) Vahl.	Cyperaceae
214.	*Fimbristylis falcata* (Vahl.) Kunth.	Cyperaceae
215.	*Fimbristylis miliacea* (L.) Vahl.	Cyperaceae
216.	*Fimbristylis ovata* (Burm. F.) Kern.	Cyperaceae
217.	*Fimbristylis tetragona* R.Br.	Cyperaceae
218.	*Flacourtia indica* (Burm.f.) Merr.	Flacourtiaceae
219.	*Giseckia pharnaceoides* L.	Aizoaceae
220.	*Glinus lotoides* Linnaeus	Aizoaceae
221.	*Gloriosa superba* L.	Colchicaceae
222.	*Glycosmis mauritiana* (Lam.) Tanaka	Rutaceae
223.	*Glycosmis pentaphylla* (Retz.) DC.	Rutaceae
224.	*Glycyrrhiza glabra* L.	Fabaceae
225.	*Gmelina arborea* Roxb.	Verbenaceae
226.	*Gmelina asiatica* L.	Verbenaceae
227.	*Gnaphalium luteo-album* L.	Asteraceae
228.	*Gnaphalium polycaulon* Pers.	Asteraceae
229.	*Gomphrena serrata* L.	Amaranthaceae
230.	*Grangea maderaspatana* (L.) Poir.	Asteraceae
231.	*Grewia hirsuta* Vahl.	Tiliaceae
232.	*Grewia tiliifolia* Vahl.	Tiliaceae
233.	*Grewia villosa* Willd.	Tiliaceae
234.	*Gymnema sylvestre* R. Br.	Asclepiadaceae
235.	*Hedyotis biflora* (L.) Lam.	Rubiaceae
236.	*Hedyotis corymbosa* (L.) Lam.	Rubiaceae
237.	*Helicteres isora* L.	Sterculiaceae
238.	*Heliotropium curasavicum* L.	Boraginaceae
239.	*Hemidesmus indicus* (L.) R. Br.	Asclepiadaceae
240.	*Heteropogon contortus* (L.) P.Beauv	Poaceae
241.	*Hibiscus micranthus* L.f.	Malvaceae

No.	Plant Species	Family
242.	*Holarrhena pubescens* (Buch. - Ham) Wall. ex G. Don	Apocynaceae
243.	*Holoptelea integrifolia* (Roxb.) Planch.	Ulmaceae
244.	*Hugonia mystax* L.	Linaceae
245.	*Hybanthus enneaspermus* (L.) F. Muell.	Violaceae
246.	*Hydrilla verticillata* (L. f.) Royle	Hydrocharitaceae
247.	*Hygrophila auriculata* (Schum) Heine	Acanthaceae
248.	*Hyptis suaveolens* (L.) Poit.	Lamiaceae
249.	*Ichnocarpus frutescens* (L.) R.Br.	Asclepiadaceae
250.	*Imperata cylindrica* (L.) Beauv.	Poaceae
251.	*Indigofera caerulea* Roxb.	Fabaceae
252.	*Indigofera linifolia* (L.f.) Retz.	Fabaceae
253.	*Indigofera linnaei* Ali	Fabaceae
254.	*Indigofera sp.*	Fabaceae
255.	*Indigofera trifoliata* L.	Fabaceae
256.	*Indigofera trita* L.f.	Fabaceae
257.	*Indoneesiella echioides* (L) Nees.	Acanthaceae
258.	*Ipomoea alba* L.	Convolvulaceae
259.	*Ipomoea aquatica* Forssk.	Convolvulaceae
260.	*Ipomoea biloba* Forssk.	Convolvulaceae
261.	*Ipomoea carnea* Jacq.	Convolvulaceae
262.	*Ipomoea hederifolia* L.	Convolvulaceae
263.	*Ipomoea pes-tigridis* L.	Convolvulaceae
264.	*Ipomoea staphylina* Roem. & Schultes	Convolvulaceae
265.	*Ischaemum indicum* (Houtt.) Merr. var. *depressum* (Scribn. & J.G. Sm.) Rydb	Poaceae
266.	*Ischaemum indicum* (Houtt.) Merr. var. *indicum*	Poaceae
267.	**Iseilema anthephoroides* Hack.	Poaceae
268.	*Iseilema laxum* Hack.	Poaceae
269.	*Ixora arborea* Roxb. ex Sm.	Rubiaceae
270.	*Jatropha curcas* L.	Euphorbiaceae
271.	*Jatropha gossypifolia* L.	Euphorbiaceae
272.	**Jatropha tanjorensis* Ellis & Saroja	Euphorbiaceae
273.	*Justicia adhatoda* L.	Acanthaceae
274.	*Justicia betonica* Linn.	Acanthaceae
275.	*Justicia gendarussa* Burm.f.	Acanthaceae
276.	*Justicia* sp.	Acanthaceae
277.	*Kedrostis foetidissima* (Jacq.) Cogn.	Cucurbitaceae
278.	*Kleinia grandiflora* (Wall. ex DC.) Rani	Asteraceae
279.	*Kyllingia nemoralis* (J. R. & G. Forst.) Dandy ex	Cyperaceae

No.	Plant Species	Family
	Hutchinson & Dalziel	
280.	*Lagascea mollis* Cav.	Asteraceae
281.	*Lemna minor* L.	Lemnaceae
282.	*Leonotis nepetiifolia* (L.) R. Br.	Lamiaceae
283.	*Leptadenia reticulata* Wight & Arn.	Asclepiadaceae
284.	*Lindernia antipoda* (L.) Alston	Scrophulariaceae
285.	*Lindernia crustacea* (L.) F.v.Muell.	Scrophulariaceae
286.	*Lindernia hyssopioides* (L.) Haines	Scrophulariaceae
287.	*Lindernia parviflora* (Roxb.) Haines	Scrophulariaceae
288.	*Ludwigia adscendens* (L.) H. Hara	Onagraceae
289.	*Ludwigia perennis* L.	Onagraceae
290.	*Ludwigia peruviana* (L.) Hara	Onagraceae
291.	*Madhuca longifolia* (J.Konig) J.F.Macbr.	Sapotaceae
292.	*Malvastrum coromandelianum* (L.) Garcke	Malvaceae
293.	*Manisuris myuros* L.	Poaceae
294.	*Martynia annua* L.	Asteraceae
295.	*Maytenus emarginata* (Willd.) Ding Hou	Celastraceae
296.	*Maytenus heyneana* (Roth) Raju & Babu	Celastraceae
297.	*Memecylon edule* Roxb.	Melastomataceae
298.	*Memecylon umbellatum* Burm.f.	Melastomataceae
299.	*Merremia hastata* (Hallier f.) Ooststr.	Convolvulaceae
300.	*Merremia tridentata* (L.) Hall.f.	Convolvulaceae
301.	*Mikania cordata* (Burm. f.) Robinson	Asteraceae
302.	*Millingtonia hortensis* L.f.	Bignoniaceae
303.	*Mimosa hamata* Willd.	Mimosaceae
304.	*Mitragyna parvifolia* (Roxb.) Korth.	Rubiaceae
305.	*Mollugo cerviana* (L.) Ser.	Aizoaceae
306.	*Mollugo disticha* Ser.	Aizoaceae
307.	*Mollugo nudicaulis* Lam.	Aizoaceae
308.	*Mollugo pentaphylla* L.	Aizoaceae
309.	*Monochoria hastata* (L.) Solms-Laub.	Pontideriaceae
310.	*Monochoria vaginalis* (Burm. F.) Presl	Pontideriaceae
311.	*Morinda pubescens* J.E. Smith.	Rubiaceae
312.	*Mucuna monosperma* DC.	Fabaceae
313.	*Mucuna pruriens* (L.) DC.	Fabaceae
314.	*Mukia maderaspatana* (L.) M. Roem.	Cucurbitaceae
315.	*Murraya paniculata* (L.) Jack	Rutaceae
316.	*Najas indica* (Willd.) Cham.	Najadaceae
317.	*Najas marina* L.	Najadaceae

No.	Plant Species	Family
318.	*Najas minor* All.	Najadaceae
319.	*Nelumbo nucifera* Gaertn.	Nymphaeaceae
320.	*Neonotonia wightii* (Wight & Arn.) J.A. Lackey	Fabaceae
321.	*Nothosaerva brachiata* (L.) Wight	Amaranthaceae
322.	*Nymphaea nouchali* Burm. f.	Nymphaeaceae
323.	*Nymphaea pubescens* Willd.	Nymphaeaceae
324.	*Nymphaea rubra* Roxb. ex Salisb.	Nymphaeaceae
325.	*Nymphoides indicum* (L.) Kuntze	Menyanthaceae
326.	*Ocimum canum* Sims.	Lamiaceae
327.	*Oldenlandia umbellata* L.	Rubiaceae
328.	*Ophiuros exaltatus* (Linnaeus) Kuntze	Poaceae
329.	*Oplismenus compositus* (L.) P. Beauv.	Poaceae
330.	*Oropetium thomaeum* (Linn.f.) Trin.	Poaceae
331.	*Ottelia alismoides* (L.) Pers.	Hydrocharitaceae
332.	*Oxalis corniculata* L.	Oxalidaceae
333.	*Oxystelma esculentum* R. Br.	Asclepiadaceae
334.	*Pandanus odoratissimus* L.f.	Pandanaceae
335.	*Panicum miliaceum* L.	Poaceae
336.	*Panicum notatum* Retz.	Poaceae
337.	*Panicum paludosum* Roxb.	Poaceae
338.	*Panicum psilopodium* Trin.	Poaceae
339.	*Panicum repens* L.	Poaceae
340.	*Panicum trypheron* Schult.	Poaceae
341.	*Parthenium hysterophorus* L.	Asteraceae
342.	*Paspalidium flavidum* (Retz.) A. Camus.	Poaceae
343.	*Paspalum scrobiculatum* L.	Poaceae
344.	*Passiflora foetida* L.	Passifloraceae
345.	*Pavetta indica* L.	Rubiaceae
346.	*Pavetta tomentosa* Roxb. ex J.E. Smith	Rubiaceae
347.	*Pavonia odorata* Willd.	Malvaceae
348.	*Pavonia procumbens* (Wall ex Wight & Arn.) Walp.	Malvaceae
349.	*Pavonia zeylanica* (L.) Cav.	Malvaceae
350.	*Pedalium murex* L.	Pedaliaceae
351.	*Pennisetum americanum* (L.) R.Br.	Poaceae
352.	*Pentatropis microphylla* L.	Asclepiadaceae
353.	*Pergularia daemia* (Forrsk.) Chiov.	Asclepiadaceae
354.	*Peristrophe bicalyculata* (Forssk.) Brummitt.	Acanthaceae
355.	*Phoenix loureirii* Kunth.	Arecaceae
356.	*Phoenix sylvestris* (L.) Roxb.	Arecaceae

No.	Plant Species	Family
357.	*Phragmites karka* Trin. ex Steud.	Poaceae
358.	*Phyla nodiflora* (L.) E. Greene	Verbenaceae
359.	*Phyllanthus amarus* Schum. & Thonn.	Euphorbiaceae
360.	*Phyllanthus emblica* L.	Euphorbiaceae
361.	*Phyllanthus maderaspatensis* L.	Euphorbiaceae
362.	*Phyllanthus polyphyllus* L.	Euphorbiaceae
363.	*Phyllanthus reticulatus* Poir.	Euphorbiaceae
364.	**Phyllanthus rotundifolius* Klein ex Willd.	Euphorbiaceae
365.	*Phyllanthus urinaria* L.	Euphorbiaceae
366.	*Physalis minima* Linn.	Solanaceae
367.	*Pistia stratiotes* L.	Araceae
368.	*Plecospermum spinosum* Trec.	Moraceae
369.	*Polyalthia cerasoides* (Roxb.) Bedd.	Annonaceae
370.	*Polyalthia suberosa* (Roxb.) Thw.	Annonaceae
371.	*Polycarpaea corymbosa* (L.) Lam.	Caryophyllaceae
372.	*Polygonum barbatum* (L.) H.Hara var. *barbatum*	Polygonaceae
373.	*Polygonum glabrum* Willdenow	Polygonaceae
374.	*Polygonum hydropiper* L.	Polygonaceae
375.	*Polygonum plebeium* R. Br.	Polygonaceae
376.	*Polygonum* sp.	Polygonaceae
377.	*Pongamia pinnata* (L.) Pierre	Fabaceae
378.	*Portulaca oleracea* L.	Portulacaceae
379.	*Portulaca quadrifida* L.	Portulacaceae
380.	*Potamogeton nodosus* Poiret	Potamogetonaceae
381.	*Premna tomentosa* L.	Verbenaceae
382.	*Pseudarthria viscida* (L) Wight & Arn.	Fabaceae
383.	*Psilotrichum elliotii* Baker & Clarke	Amaranthaceae
384.	*Pulicaria wightiana* C.B. Clarke	Asteraceae
385.	*Pupalia lappacea* (L.) Juss.	Amaranthaceae
386.	*Pycreus globosus* (All.) Reichenb.	Cyperaceae
387.	*Randia dumetorum* (Retz.) Poiret.	Rubiaceae
388.	*Rauwolfia serpentina* (L.) Benth. ex Kurz.	Apocynaceae
389.	*Rhynchosia densiflora* (Roth) DC.	Fabaceae
390.	*Rhynchosia minima* (L.) DC.	Fabaceae
391.	*Rivea hypocrateriformis* (Desr.) Choisy	Convolvulaceae
392.	*Rottboellia cochinchinensis* (Lour.) Clayton	Poaceae
393.	*Ruellia tuberosa* L.	Acanthaceae
394.	*Saccharum spontaneum* Linn.	Poaceae
395.	*Sacciolepis indica* (L.) Chase	Poaceae

No.	Plant Species	Family
396.	*Salacia chinensis* L.	Hippocratiaceae
397.	*Salicornia brachiata* Miq.	Chenopodiaceae
398.	*Salvinia molesta* D.Mitch.	Salviniaceae
399.	*Sansevieria roxburghiana* Schultes & Schultes	Dracaenaceae
400.	*Sapindus emarginatus* Vahl.	Sapindaceae
401.	*Scirpus articulatus* Linn.	Cyperaceae
402.	*Scleria lithosperma* (L.) Sw.	Cyperaceae
403.	*Scoparia dulcis* L.	Scrophulariaceae
404.	*Scutia myrtina* (Burm. f.) Kurz.	Rhamnaceae
405.	*Sebastiania chamaelea* (L.) Muell.-Arg.	Euphorbiaceae
406.	*Sehima nervosum* (Rottl.) Stapf.	Poaceae
407.	*Sehima sulcatum* (Hack.) A. Camus	Poaceae
408.	*Senna alata* (L.) Roxb.	Caesalpiniaceae
409.	*Senna auriculata* (L.) Roxb.	Caesalpiniaceae
410.	*Senna hirsuta* (L.) Irwin & Barneby	Caesalpiniaceae
411.	*Senna italica* Mill.	Caesalpiniaceae
412.	*Senna occidentalis* (L.) Link	Caesalpiniaceae
413.	*Senna tora* (L.) Roxb.	Caesalpiniaceae
414.	*Sesbania bispinosa* (Jacq.) W. F. Wight	Fabaceae
415.	*Sesuvium portulacastrum* (L.) L.	Aizoaceae
416.	*Setaria italica* (L.) P. Beauv	Poaceae
417.	*Sida acuta* Burm.f.	Malvaceae
418.	*Sida cordata* (Burm. f.) Borss.	Malvaceae
419.	*Sida cordifolia* L.	Malvaceae
420.	*Sida rhombifolia* L. var. *retusa* (L.) Borss.	Malvaceae
421.	*Sida rhombifolia* L. var. *rhombifolia*	Malvaceae
422.	*Sida spinosa* Linn.	Malvaceae
423.	*Solanum surattense* Burm. f.	Solanaceae
424.	*Solanum trilobatum* L.	Solanaceae
425.	*Solena amplexicaulis* (Lam.) Gandhi	Cucurbitaceae
426.	*Sonchus oleraceus* L.	Asteraceae
427.	*Spermacoce hispida* L.	Rubiaceae
428.	*Spermacoce ocymoides* Burm.f.	Rubiaceae
429.	*Sphaeranthus indicus* Linn.	Asteraceae
430.	*Spilanthes calva* DC.	Asteraceae
431.	*Spilanthes uliginosa* Sw.	Asteraceae
432.	*Spinifex littoreus* (Burm.f.) Merr.	Poaceae
433.	*Sporobolus coromandelianus* (Retz.) Kunth	Poaceae
434.	*Sporobolus indicus* (L.) R.Br.	Poaceae

No.	Plant Species	Family
435.	*Sporobolus spicatus* (Vahl.) Kunth	Poaceae
436.	*Sporobolus wallichii* Munro ex Trimen	Poaceae
437.	*Stemodia viscosa* Roxb.	Scrophulariaceae
438.	*Streblus asper* Lour.	Moraceae
439.	*Striga asiatica* (L.) Kuntze	Scrophulariaceae
440.	*Strychnos nux-vomica* L.	Loganiaceae
441.	*Suaeda fruticosa* Forssk. ex J.F. Gmelin	Chenopodiaceae
442.	*Suaeda nudiflora* (Willd) Moq.	Chenopodiaceae
443.	*Suregada lanceolata* (Willd.) Kuntze	Euphorbiaceae
444.	*Synedrella nodiflora* (L.) Gaertn.	Asteraceae
445.	*Syzygium cumini* (L.) Skeels	Myrtaceae
446.	*Tamarindus indica* L.	Caesalpiniaceae
447.	*Taraxacum officinale* F.H.Wigg	Asteraceae
448.	*Tarenna asiatica* (L.) Kuntze ex K. Schum.	Rubiaceae
449.	*Tecoma stans* (L.) Kunth	Bignoniaceae
450.	*Tectona grandis* L.f.	Verbenaceae
451.	*Tephrosia purpurea* (L.) Pers.	Fabaceae
452.	*Tephrosia villosa* (L.) Pers.	Fabaceae
453.	*Terminalia arjuna* (Roxb.) Wight & Arn.	Myrtaceae
454.	*Terminalia catappa* L.	Myrtaceae
455.	*Themeda triandra* Forssk.	Poaceae
456.	*Thespesia populnea* (L.) Soland ex Correa	Malvaceae
457.	*Thevetia peruviana* K.Schum	Apocynaceae
458.	*Tinospora cordifolia* (Willd.) Miers ex Hook. f. & Thoms.	Menispermaceae
459.	*Tragia involucrata* L.	Euphorbiaceae
460.	*Tragia plukenetii* R. Smith	Euphorbiaceae
461.	*Trewia nudiflora* L.	Euphorbiaceae
462.	*Trewia polycarpa* Benth.	Euphorbiaceae
463.	*Trianthema triquetra* Rottl.	Aizoaceae
464.	*Tribulus lanuginosis* L.	Zygophyllaceae
465.	*Tribulus terrestris* L.	Zygophyllaceae
466.	*Trichodesma indicum* (L.) R. Br.	Boraginaceae
467.	*Tridax procumbens* L.	Asteraceae
468.	*Triumfetta pentandra* A. Rich	Tiliaceae
469.	*Triumfetta rhomboidea* Jacq.	Tiliaceae
470.	*Triumfetta rotundifolia* Lam.	Tiliaceae
471.	*Turnera subulata* Smith	Turneraceae
472.	*Typha angustifolia* L.	Typhaceae

No.	Plant Species	Family
473.	*Urena lobata* L. subsp. *Lobata*	Malvaceae
474.	*Urena lobata* L. subsp. *sinuata* (L.) Borss.	Malvaceae
475.	*Vallisneria spiralis* L.	Hydrocharitaceae
476.	*Vernonia cinerea* (L.) Less.	Asteraceae
477.	*Vetiveria zizanioides* (L.) Nash.	Poaceae
478.	*Vigna trilobata* (L.) Verdc.	Fabaceae
479.	*Vitex altissima* L.f.	Verbenaceae
480.	*Vitex leucoxylon* L.f.	Verbenaceae
481.	*Vitex negundo* L. var. *negundo*	Verbenaceae
482.	*Vitex negundo* L. var. *purpurascens* Sivar. & Moldenke	Verbenaceae
483.	*Waltheria indica* L.	Sterculiaceae
484.	*Wedelia chinensis* (Osbeck) Merr.	Asteraceae
485.	*Wrightia tinctoria* (Roxb.) R.Br.	Apocynaceae
486.	*Xanthium indicum* Koen.	Asteraceae
487.	*Youngia japonica* (L.) DC.	Asteraceae
488.	*Ziziphus mauritiana* Lam.	Rhamnaceae
489.	*Ziziphus nummularia* (Burm.f.) Wight & Arn.	Rhamnaceae
490.	*Ziziphus oenoplia* (L.) Mill.	Rhamnaceae
491.	*Zornia diphylla* (L.)	Fabaceae
492.	*Zornia gibbosa* Span.	Fabaceae
493.	*Zoysia matrella* (L.) Merr.	Poaceae

Where: * Endemic plants to Peninsular India

3.3 MAHENDRATANAYA RIVER MOUTH

Location	Division	Mandal	Latitude	Longitude	Type of wetland
Damodarapuram	Tekkali	Sompeta	18⁰ 52' 39.61" N	84⁰ 34' 52.08" E	Natural

The river Mahendratanaya originates in the Eastern Ghats in the Gajapati district of Odisha state. It flows through Mandasa and Sompeta mandals of Srikakulam district and joins the Bay of Bengal at Damodarapuram. Our rapid survey indicated that the area is rich in biodiversity. Forty nine bird species, which included one scheduled species (IWPA 1972), one vulnerable and 4 Near Threatened species (IUCN 2012???), were recorded. Out of the 145 plant species recorded one was endemic to Peninsular India.

Figure 11 Satellite image of Mahendratanaya River mouth

Local fishers are engaged in both inland and marine fishing. Inland fishermen report about the declining catches and fish diversity affecting their livelihoods. The river mouth is a nesting site for the Olive Ridley turtles.

3.4 KUDDIRAM SAGARAM

Location	Division	Mandal	Latitude	Longitude	Type of wetland
Kuddiram	Srikakulam	Amadalavalasa	180 24' 28.68" N	830 53' 13.47" E	Natural

Kuddiram Sagaram is a large natural wetland with about 80 ha water spread supporting several species of birds. Of the 45 bird species recorded here 4 belonged to Near Threatened category. Poaching is a major threat to the birds here, with professional poachers from outside the village being into the business.

Thirty three plant species were recorded from the environs of the wetland. Apart from supporting a rich biodiversity, water from this wetland is used for irrigation. Approximately 100 agricultural families depend on this wetland for irrigation cultivating around 100 ha of land. The main crops cultivated are paddy and pulses. Fishermen belonging to Neyla community do seasonal fishing in this wetland. During the dry season the wetland is a grazing land for cattle. Around 50 families are engaged in rearing cattle.

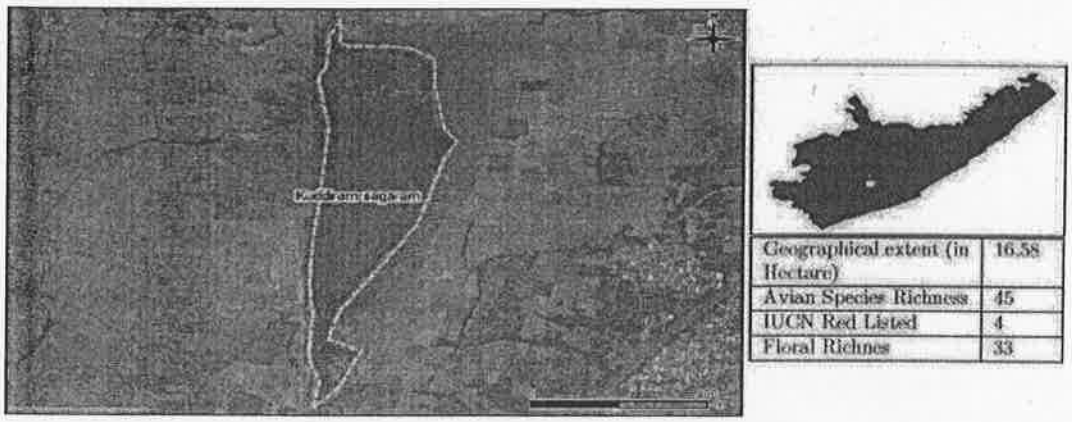


Figure 12 Satellite image of Kuddiram sagaram

3.5 LANKA CHERUVU

Location	Division	Mandal	Latitude	Longitude	Type of wetland
Peddaraopalle	Srikakulam	Laveru	18° 10' 38.19" N	83° 48' 22.79" E	Natural

It is a large seasonal, natural but modified wetland with a water spread area of 120 ha during monsoon. It provides various ecosystem services; water for irrigation, washing, fisheries, bathing, etc. 5 villages around with an approximate population of 7000 people depend on the wetland for their various needs. Villagers depend upon bore wells for drinking water which apparently is being recharged mainly by the wetland. Around 120 ha of agriculture is directly irrigated by this wetland. Majority of the inhabitants of the surrounding villages are engaged in agriculture and related activities.

Geographical extent (in Hectare)	26.97
Avian Species Richness	30
IUCN Red Listed	-
Floral Richness	34

Figure 13 Satellite image of Lanka Cherivu

Sixteen families are engaged in fishing during season. During off season they are engaged in agriculture related activities. In dry season the wetland is extensively grazed since around 60% of the people keep cattle. Poaching of birds by outsiders is a major threat here. Solid waste is indiscriminately dumped in the wetland. People are apprehensive that once the proposed Nuclear Power plant at Kovvada, which is just 5 Km away, is established it will have detrimental impacts on the wetland.

3.6 CHERI CHERUVU

Location	Division	Mandal	Latitude	Longitude	Type of wetland
Patha Sundarapalam	Srikakulam	Etcherla	18° 10' 38.30" N	83° 48' 22.71" E	Natural

Twenty three bird species and 18 plant species were reported from the environs of Cheri Cheruvu during our rapid survey. Seven villages, with about 2000 people, in the surroundings depend upon the wetland for various purposes such as irrigation, cattle grazing during dry season, washing of cloths etc. The surrounding areas are very fertile supporting a variety of crops such as paddy, groundnut, plantains and several vegetables. The tank is also leased out to fishers on a yearly basis. The villagers are well aware about the role of the wetland in sustaining their agricultural crops. According to the villagers the wetland is free from poaching of birds.

Figure 14 Satellite imagery of Cheri Cherivu

3.7 MADDUVALASA RESERVOIR

Location	Division	Mandal	Latitude	Longitude	Type of Wetland
Madduvalasa	Palakonda	Vangara	18⁰ 10' 38.19" N	83⁰ 48' 22.79" E	artificial

Madduvalasa reservoir is the major man made wetland, constructed on the rivers Vegavati and Swarnamukhi, in the hilly area of the district. Its construction was completed in 2002. It is in the Vangara Mandal of Palakonda Division. Madduvalasa dam and its immediate environs are habitats for rich biodiversity. Our rapid survey revealed 58 bird and 71 plant species here. Among the birds Black bellied Tern, Darter and Painted Stork are 'Near Threatened' ones and White bellied sea Eagle falls under Schedule-I of IWPA. A large flock of adult Tufted Ducks without the prominent tufts (apparently a morphological anomaly) was recorded from this reservoir. Among the 71 plant species reported, *Pterospermum xylocarpum* is endemic to Peninsular India. Poaching of birds is a major threat faced here.

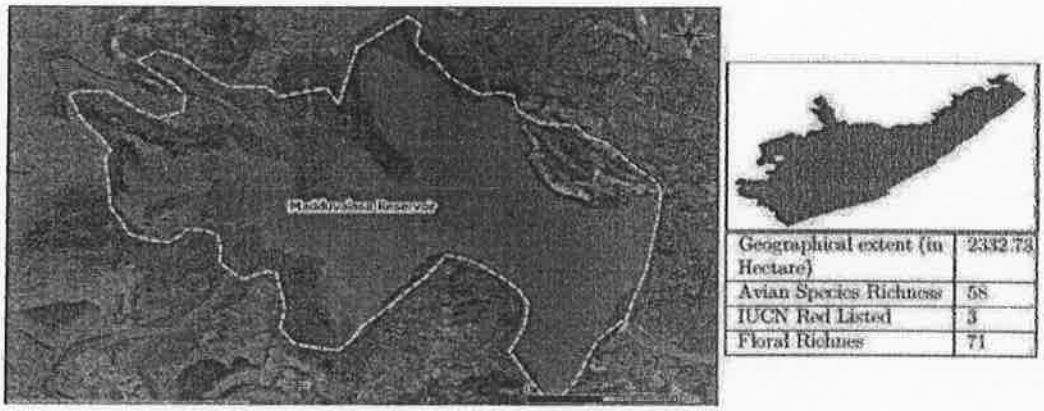


Figure 15 Satellite image of Madduvalasa reservoir

3.8 NARAYANAVALASA

Location	Division	Mandal	Latitude	Longitude	Type of wetland
Narayanavalasa	Tekkali	Kottabommali	18° 28' 57.60" N	84° 3' 45.52" E	Natural, Modified

It is a seasonal, natural wetland but modified later, which retains water only for 3-4 months. Around 20 ha of agriculture, belonging to 2 villages, mainly paddy is supported by this wetland. This wetland is extensively used by cattle for grazing. Washing of vehicles in the wetland seen frequently pollutes the water and needs to be avoided.

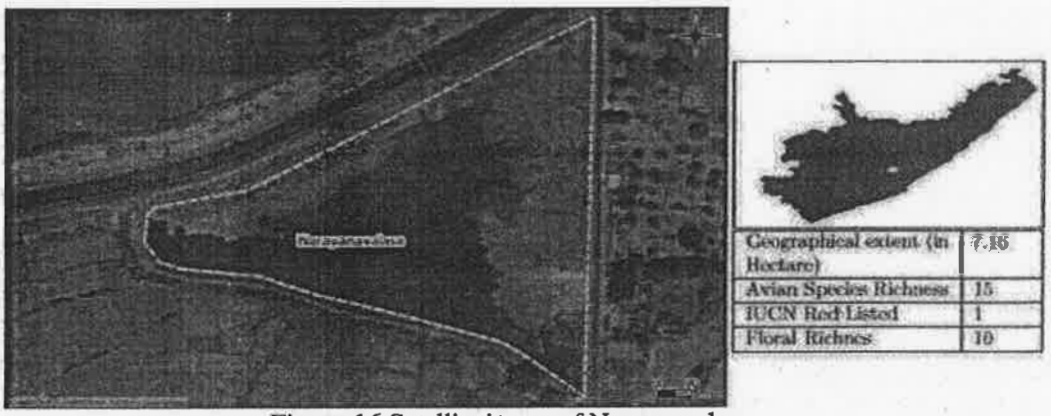


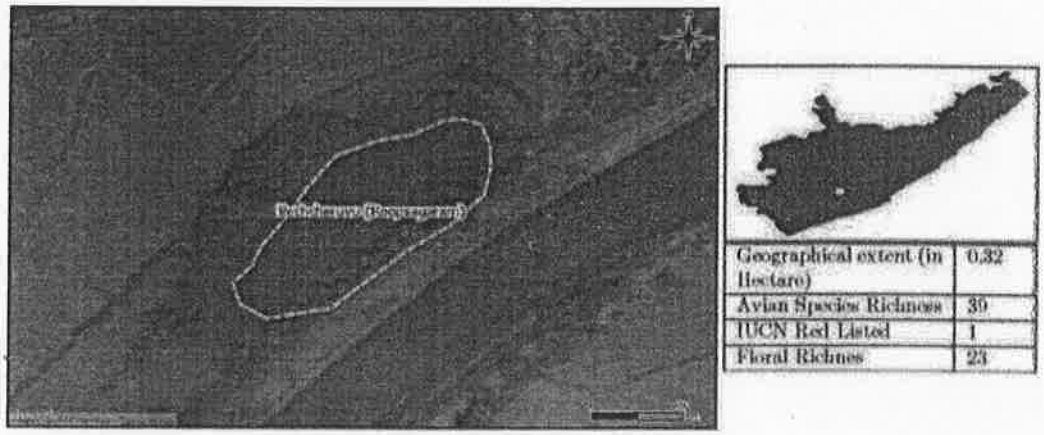
Figure 16 Satellite image of Naraynavalasa

Only 15 species of birds could be located during our survey, perhaps being dry season. Darter, a 'Near Threatened' species, was seen here. Villagers report that migratory ducks visit the wetland during season. They also indicated that poaching is a serious threat to the birds here.

3.9 PECHCHERUVU (ROOPSAGARAM)

Location/Mandal	Division	Latitude	Longitude	Type of wetland
Jalumuru	Tekkali	18⁰ 30' 53.72" N	84⁰ 2' 6.64" E	Natural

It is a tank with 6 acres of water spread area. It harbours 39 bird species which includes Darter, a Near Threatened species, and 23 plant species. Being fed by the river Vamsadhara through canals it is a perennial wetland performing various ecosystem services to around 500 families in the surrounding villages. Paddy is extensively cultivated in the nearby areas irrigated by the water from this wetland. Thirty fisher families make a living exclusively by fishing in the wetland which is leased out to them by the Fisheries Department. Poaching is a major threat to the bird biodiversity of this wetland.



Geographical extent (in Hectare)	0.32
Avian Species Richness	39
IUCN Red Listed	1
Floral Richnes	23

Figure 17 Satellite image of Pechcheruvu

3.10 METTUCHERUVU

Location	Division	Latitude	Longitude	Type of wetland
Saravakota	Palakonda	180 37' 25.79" N	840 02' 40.0" E	Natural

Mettucheruvu is a large wetland with 200 acres of water spread during monsoon. During the survey 30 bird species including Black Bellied Tern, a Near Threatened species, and six plant species were recorded. It provides a variety of ecosystem services, irrigation being the major one. Hundreds of hectares of paddy, chillies and pulses are irrigated by the water. One hundred fishing families depend upon the wetland for part time fishing.

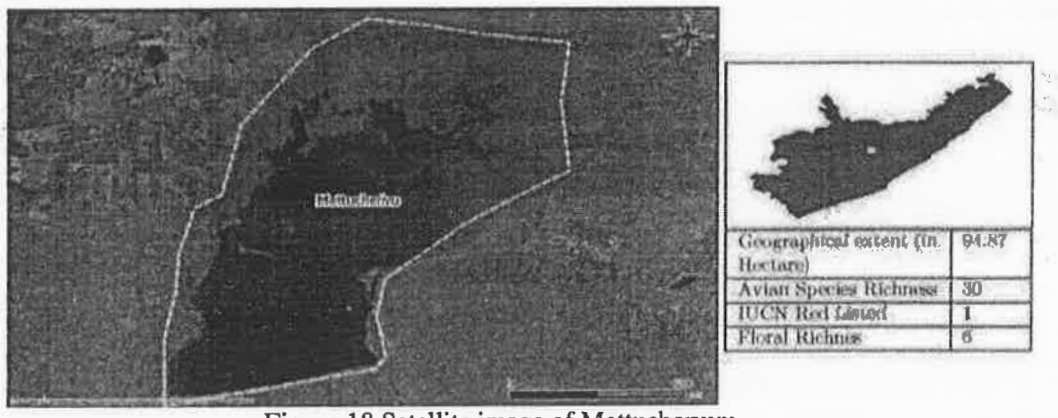
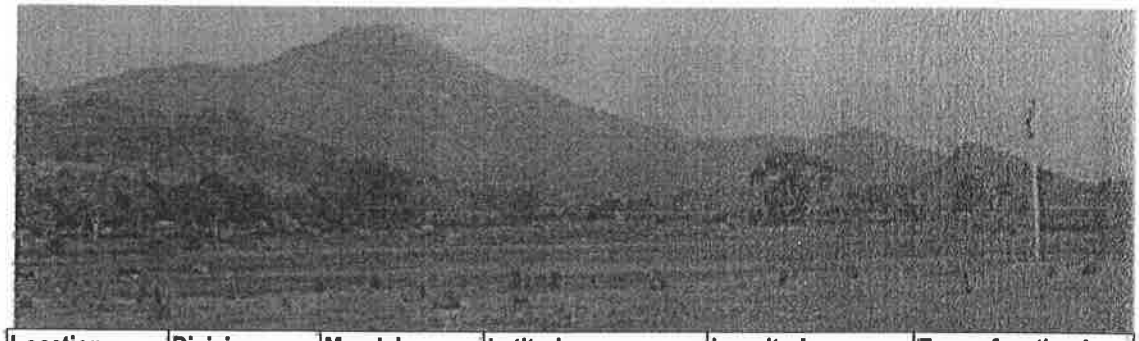


Figure 18 Satellite image of Mettucheruvu

3.11 THAMARAI CHERUVU



Location	Division	Mandal	Latitude	Longitude	Type of wetland
Saravakota	Palakonda	Saravakota	18⁰ 39' 42.41" N	84⁰ 02' 3.82" E	Natural

Natural, but seasonal, wetland with 20 ha of water spread area is an important habitat for 'Near Threatened' birds like Painted Stork, Spot Billed Pelican, Pallied Harrier and Indian Pea Fowl. The last two falls under the Schedule –I of Indian Wildlife Protection Act. The wetland harbours 21 species of birds and 14 plant species. Water is used for irrigation. During dry season wetland is a grazing ground for cattle.

Figure 19 Satellite image of Thamarai cheruvu

3.12 RAJAKARU CHERUVU

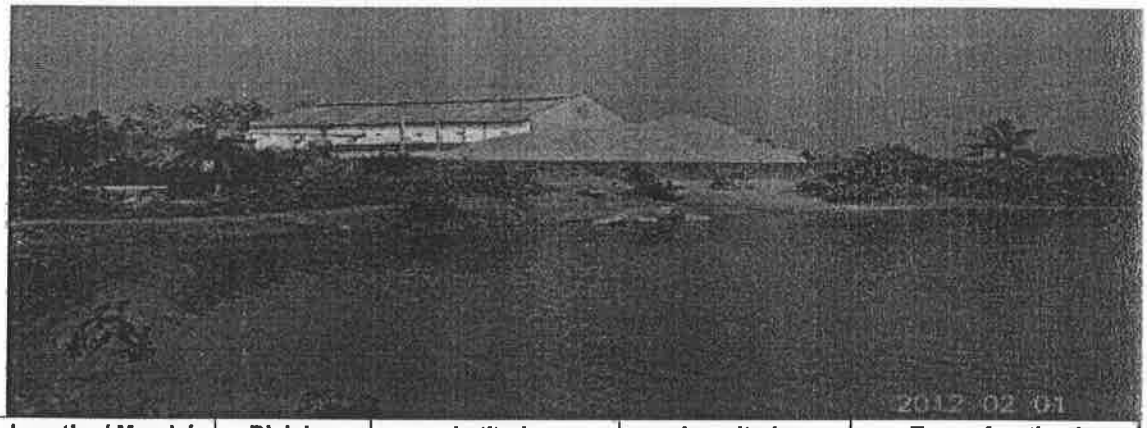
Location	Division	Mandal	Latitude	Longitude	Type of wetland
Tungatampara	Palakonda	Hiramandalam	18° 37' 25.79" N	84° 02' 40.0" E	Natural

Rajakaru Cheruvu, a natural wetland, has 60 ha of water spread area during monsoon. During the survey 49 bird species were recorded which included Painted Stork, a Near Threatened species, and 21 plant species. During dry months the wetland is replenished with water from the river Vamsadhara through a canal. Because of this 100 agricultural families depend on the wetland for irrigation. Around 120 to 200 ha of land is irrigated. Paddy and pulses are the major crops in the area. During extreme dry season wetland is used for grazing for cattle on which many families depend upon for a living. The wetland is also leased out to fishermen society for fishing.

Geographical extent (in Hectare)	19.43
Avian Species Richness	49
IUCN Red Listed	2
Floral Richnes	21

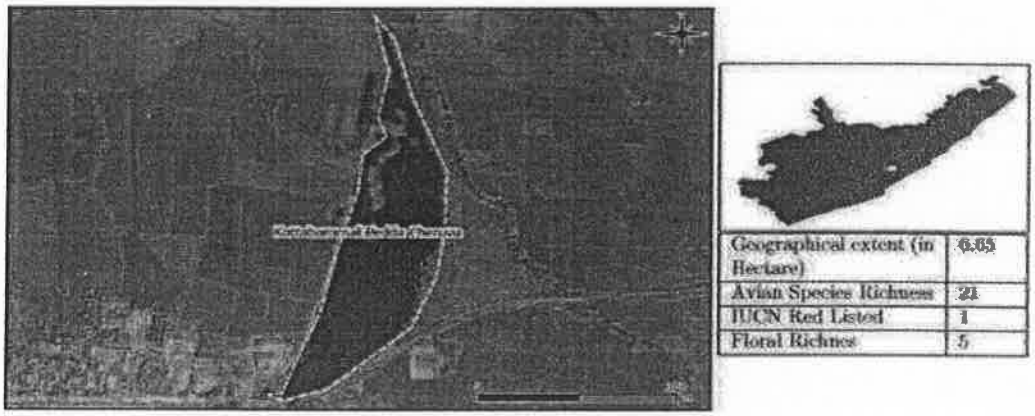
Figure 20 Satellite image of Rajakaru Cheruvu

3.13 KOTABOMMALI PEDDA CHERUVU



Location/ Mandal	Division	Latitude	Longitude	Type of wetland
Kotabommal	Tekkali	18⁰ 31' 13.27" N	84⁰ 09' 56.30" E	Natural

It is a natural, urban wetland with about 8 ha of water spread area, fed by rainwater. Twenty one species of birds were recorded which includes Darter, a Near Threatened species, during the period of our survey. Plant diversity recorded was very poor with only 5 species.



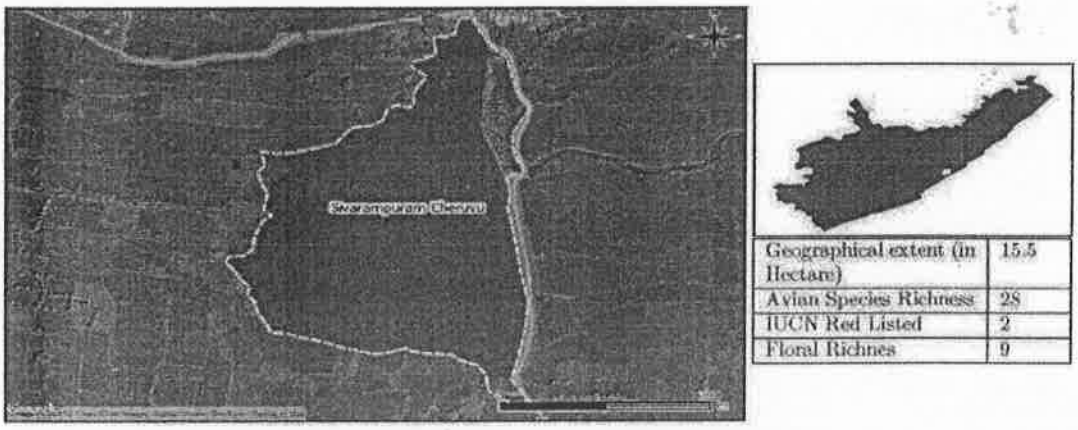
Geographical extent (in Hectare)	6.05
Avian Species Richness	21
IUCN Red Listed	1
Floral Richnes	5

Figure 21 Satellite image of Kotabommali Pedda cheruvu

3.14 SIVARAMPURAM CHERUVU

Location/Mandal	Division	Latitude	Longitude	Type of wetland
Santhabommali	Tekkali	18⁰ 32' 32.71" N	84⁰ 12' 49.99" E	Natural

This wetland has a water spread area of 16 ha, harbouring 28 species of birds. Darter was the only IUCN category listed bird among them. During our visit only 9 plant species were reported. The wetland helps in irrigating more than 200 hundred acres of agricultural land. The main crops are paddy, pulses, sunflower and chillies. Seven villages around the wetland depend on it for some purpose. Fishing rights are leased to fishermen cooperative society comprising of 50-60 members. They do annual stocking of Indian Major Carps. The major threat faced by the wetland is poaching by outsiders.



Geographical extent (in Hectare)	15.5
Avian Species Richness	28
IUCN Red Listed	2
Floral Richnes	9

Figure 22 Satellite image of Sivaramapuram Cheruvu

3.15 PATHATEKKALI PEDDA CHERUVU

Location	Division	Mandal	Latitude	Longitude	Type of wetland
Pathatekkali	Tekkali	Vajrapukoturu	18⁰ 38' 02.71" N	84⁰ 21' 39.35" E	Natural

In monsoon this wetland has a water spread area of 28 ha. It is also fed by a canal from the river Vamsadhara. Twenty nine birds and 19 plant species were recorded from this wetland. Some interesting bird species were Tufted Duck, Little Grebe, Great Crested Grebe and Indian Open Bill. Water is used for irrigation. Paddy is the main crop in the nearby areas. Fishing by Fishermen Cooperative Society members is a major activity in the wetland.

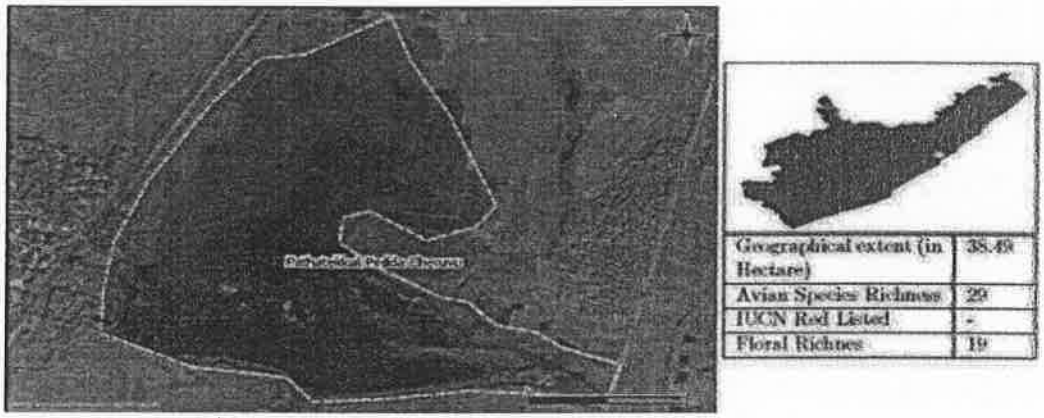
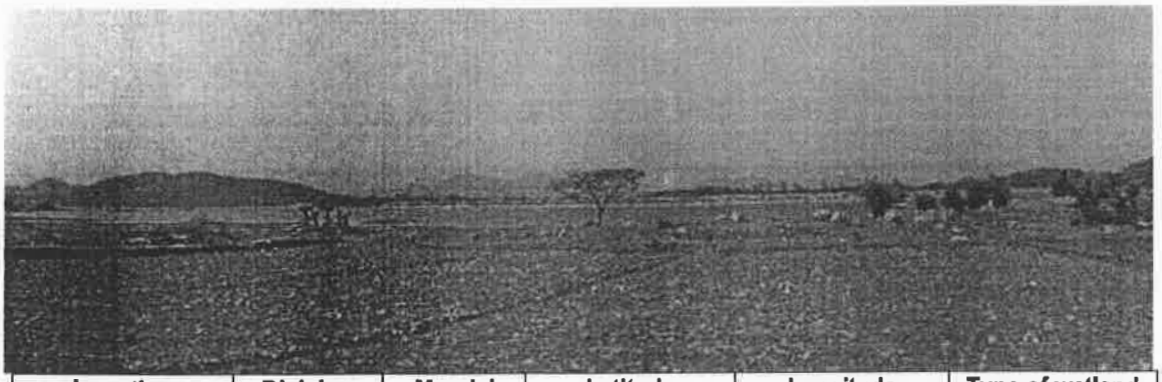


Figure 23 Satellite image of Pathatekkali Pedda cheruvu

3.16 DAMODAR SAGARAM



Location	Division	Mandal	Latitude	Longitude	Type of wetland
Mahadevupuram	Tekkali	Palasa	18⁰ 50' 22.49" N	84⁰ 26' 39.15" E	Artificial

It is a large wetland with an area of 100 acres with rich biodiversity. It is a natural wetland, later modified. Among the 16 bird species reported two species fall under IUCN categories among which Darter is a 'Near threatened' species, Palla's Fish eagle is Vulnerable and White Bellied Sea Eagle is a Schedule-1 bird. Only 16 plant species were recorded in the wetlands during the survey. Of this *Jatropha tanjorensis* is endemic to Peninsular India.

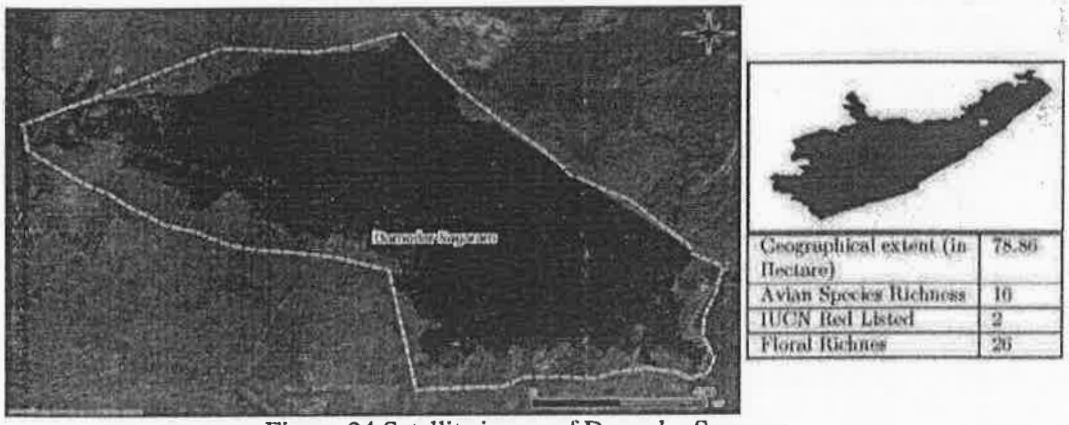


Figure 24 Satellite image of Damodar Sagaram

Water from the wetland is used for irrigating large areas of paddy and vegetable cultivation. Fishermen Cooperative Society members are engaged in fishing. They stock fingerlings at the onset of monsoon.

3.17 PEDDHAPADU CHERUVU

Location	Division/ Mandal	Latitude	Longitude	Type of wetland
Peddhapadu	Srikakulam	18⁰ 18′ 55.08″ N	83⁰ 55′ 38.30″ E	Natural

Peddapadu Cheruvu is an important wetland near Srikakulam town with a water spread of nearly 36 acres. It is a natural wetland being replenished by water from the river Nagavalli by a channel making it a perennial one. It is rich in biodiversity with 41 species of birds among which Painted Stork is a Near Threatened one. Forty seven species of plants were recorded from the immediate environs of the wetland.

Approximately 100 farmers draw water from the wetland to irrigate 120 acres of land. Paddy and vegetables are major crops cultivated. Fishing Cooperative Society members take the wetland on lease for fishing. Fingerlings of IMCs are stocked during monsoon.

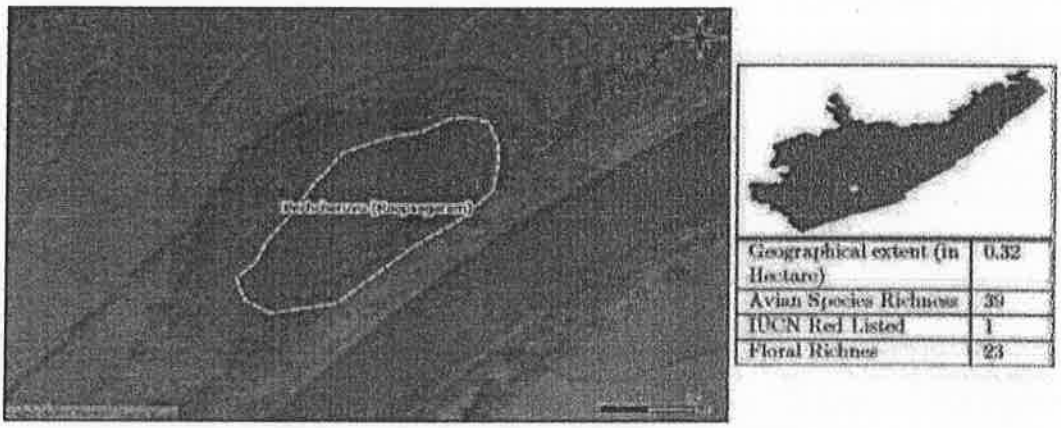


Figure 25 Satellite image of Peddhapadu cheruvu

The wetland is under threat from effluents released from a nearby factory and also from a milk processing unit.

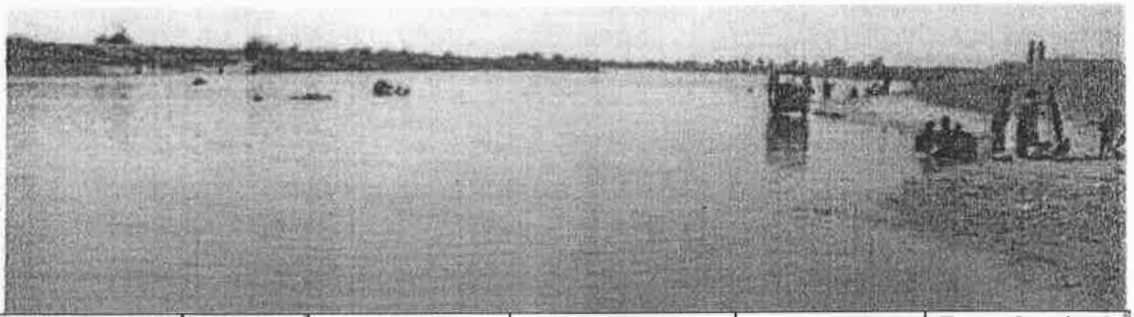
3.18 RAJALU CHERUVU

Location/Mandal	Division	Latitude	Longitude	Type of wetland
Narasannapeta	Srikakulam	18⁰ 24' 48.63" N	84⁰ 02' 30.61" E	Natural

It is an urban wetland in the Narasannapeta town. It is a degraded natural wetland. It is a dumping place for solid wastes and effluents from the town. People report that till two years ago there was fishing in the wetland. Water is not used for irrigation. Biodiversity is poor with only 6 species of birds and 11 species of plants. Now the wetland has been divided into two by a bund and one half is kept free from solid wastes dumping and pollution. People use this half for washing clothes.

Figure 26 Satellite image of Rajalu Cheruvu

3.19 VADDITHANDRA KAARICHERUVU



Location	Division	Mandal	Latitude	Longitude	Type of wetland
Vaddithandra	Tekkali	Santhabommali	18⁰ 32' 24.52" N	84⁰ 14' 16.86"	Natural

It is a perennial, natural wetland near to Naupada swamps with an area of 40 acres. It harbours 32 bird species. It is a foraging area for Spot Billed Pelican, Black Headed Ibis, of which Painted Stork is Near Threatened species. Nineteen plant species were reported from the wetland. Water from the wetland is used for irrigating 100 acres of paddy. Fifty fisher families, who are organised as a cooperative society, depend upon the wetland for their livelihood.

Geographical extent (in Hectare)	12.11
Avian Species Richness	32
IUCN Red Listed	3
Floral Richnes	19

Figure 27 Satellite image of Vaddithandra Kaaricheruvu

The proposed Super Thermal Power Plant by East Coast Energy Ltd is perceived as a threat by the local villagers to the wetland.

3.20 NARAYANPURAM RESERVOIR

Location	Division	Mandal	Latitude	Longitude	Type of wetland
Labham	Palakonda	Burja	18⁰ 29′ 12.81″ N	83⁰ 48′ 34.75″ E	Natural

This reservoir is a rich habitat for 48 bird species of which Black Bellied Tern and Darter fall under the Near Threatened category. Twenty two plant species were also reported form the reservoir area. Narayanapuram reservoir is a source for irrigating hundreds of acres of agriculture. Through channels it replenishes water for several wetlands in the adjoining areas.

Figure 28 Satellite image of Narayanapuram reservoir

3.21 CHINTADA CHERUVU

Location	Division/ Mandal	Latitude	Longitude	Type of wetland
Chintada	Srikakulam	180 23' 04.44" N	830 53' 52.71" E	Artificial

It is an artificial wetland, water being drawn from the Getta barrage through canals, making it a perennial one. It has an approximate area of 40 ha. It supports 33 species of birds which include Darter and Painted Stork, both categorised as 'Near Threatened' ones and thirty eight plant species were also reported.

The wetland is a source of irrigation for large areas. Paddy, pulses and vegetables are extensively cultivated. Part of the wetland is used by animals for grazing. Many families depend upon cattle for their living. Several fishers also elk out a living by fishing here during season and in off season they are engaged as agricultural labourers. The people in the immediate villagers are poor and ready to leave their present occupation to take industrial jobs.

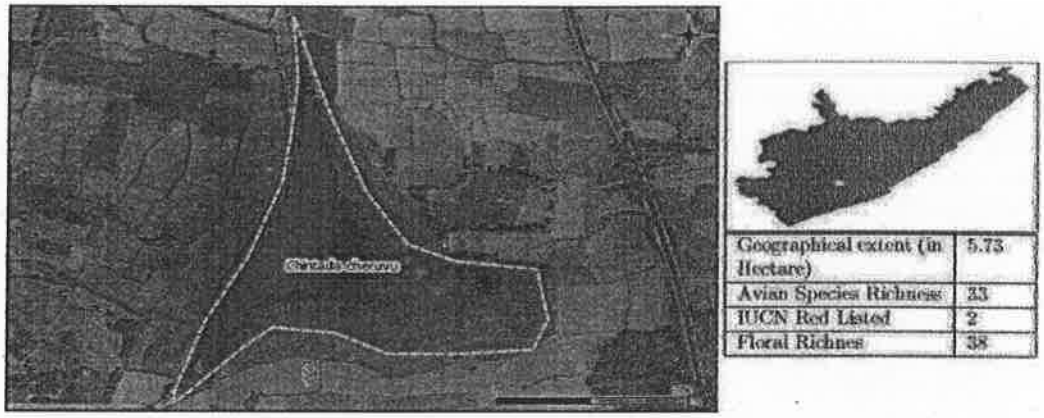


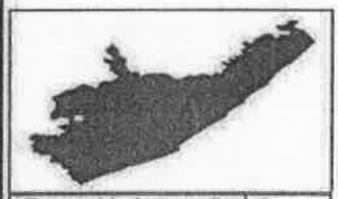
Figure 29 Satellite image of Chintada Cherivu

3.22 CHITTADI CHERUVU (ARISADU WETLAND)

Location	Division	Mandal	Latitude	Longitude	Type of wetland
Arisadu	Palakonda	Vangara	18⁰ 32' 55.23" N	83⁰ 38' 41.33" E	Natural/ Modified

It is a natural wetland fed by rain water sheltering rich biodiversity. Seventy two bird species were recorded. This includes 'Near Threatened' Darter and Painted Stork, Green Avadavat that falls under Vulnerable category and Indian Pea Fowl, a schedule – I species. Thirty three plant species are also available in the environs of the wetland.

Around 20 ha of agriculture, mainly paddy and sugarcane is supported by the wetland. Ten fisher families live by fishing in the wetland. It is partially used for grazing by cattle.



Geographical extent (in Hectare)	2
Avian Species Richness	72
IUCN Red Listed	3
Floral Richnes	33

Figure 30 Satellite image of Chittadi Cheruvu (Arisadu wetland)

3.23 BHAVANAPADU CREEK AREA

Location	Division	Mandal	Latitude	Longitude	Type of wetland
Bhavanapdu	Tekkali	Santhabommali	18⁰ 33' 35.08" N	84⁰ 20' 35.56" E	Natural

The Bhavanapadu Creek mouth is an ecosystem harbouring rich and vulnerable species. The bird biodiversity is quite rich. Black Bellied Tern, Black Headed Ibis and Eurasian Curlew are the 'Near Threatened' and Eurasian Open Bill and Pallied Harrier are 'Near Threatened' and Schedule –I bird species and White Bellied Sea Eagle is the Schedule-I bird found here among the 27 birds recorded during our rapid survey. Seventeen plant species are seen here at the time of our survey. A patch of mangrove is also coming up near to the fishing harbour.

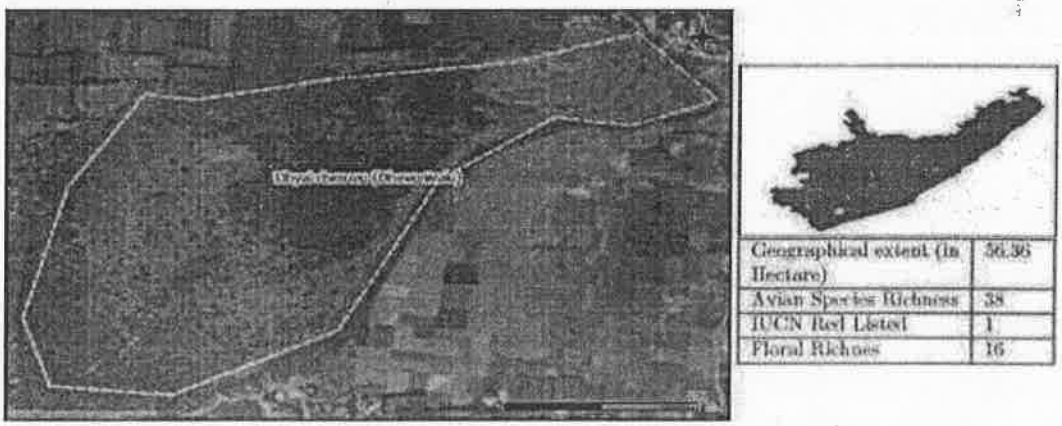
Figure 31 Satellite image of Bhavanapadu Creek area

3.24 DHAYAL CHERUVU (DHEVUNIVALU)

Location	Division	Mandal	Latitude	Longitude	Type of wetland
Bejupuram	Srikakulam	Laveru	18⁰ 13' 57.75" N	83⁰ 44' 56.95" E	Natural

Dhayal Cheruvu is a large seasonal, modified wetland, water being drawn from canals from the river Nagavalli which is retained only for six months. Its water spread area is 200 hasupporting more than 200 acres of agriculture, mainly paddy, for one season. Twenty fisher families organised as cooperative societies do fishing during season after releasing fingerlings at the onset of monsoon. Cattle graze in the wetland during off season.

A 'Vulnerable' species, Green Avadavat is among the 32 species of birds recorded here. Sixteen plant species were also seen here.



Geographical extent (in Hectare)	56.36
Avian Species Richness	38
IUCN Red Listed	1
Floral Richness	16

Figure 32 Satellite image of Dhayal Cheruvu

3.25 NARASAPURAM PEDDHA CHERUVU

Location	Division	Mandal	Latitude	Longitude	Type of wetland
Narasapuram	Tekkali	Nandigam	18° 38' 36.93" N	84° 16' 22.59" E	Natural

It is a natural, modified wetland with 53 acres of area. Black Headed Ibis, a Near Threatened species, was among the 34 bird species reported from there. Nineteen plant species are also seen here. It supports more than 100 acres of agricultural land for a single crop of paddy. Ten fisher families do fishing after taking fishing rights in auction.

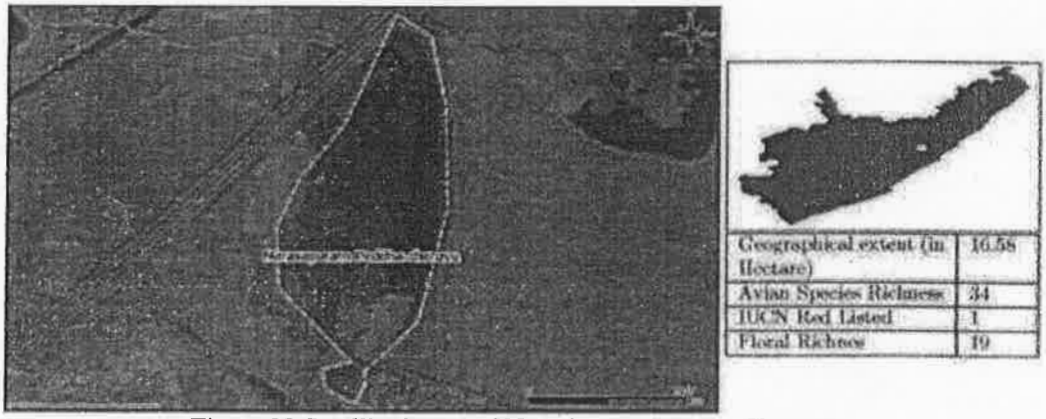


Figure 33 Satellite image of Narasipuram Peddha Cheruvu

3.26 NAGAVALLI RIVER MOUTH

Location	Division	Mandal	Latitude	Longitude	Type of wetland
Kallepalli	Srikakulam	Srikakulam & Etcherla	18⁰ 12' 40.78"	83⁰ 56' 40.12"	Natural

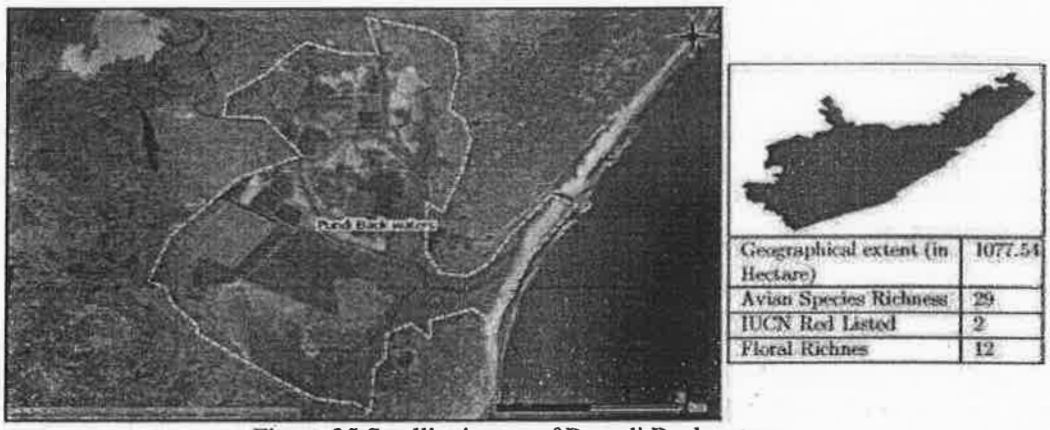
Nagavalli River Mouth and its surrounding environs is an ecologically sensitive area. These areas are nesting grounds of the endangered Olive Ridley Turtles. It is also a habitat for IUCN listed birds. White Bellied Sea Eagle, a Schedule-1 bird, Eurasian Spoon Bill, a 'Near Threatened' and Schedule-I species and Eurasian Curlew, a 'Near Threatened' one were among the 47 birds recorded during our rapid survey. 44 plant species were also seen. This area is thickly populated by both marine and freshwater fisherfolk.

Figure 34 Satellite image of Nagavalli River mouth

3.27 POONDI BACK WATERS

Location	Division	Mandal	Latitude	Longitude	Type of wetland
Nuvalarevu	Tekkali	Vajrapukotturu	18⁰ 40' 34.28" N	84⁰ 26' 18.81" E	Natural

Poondi wetland complex consists of Poondi backwaters, adjacent salt pans and several aquaculture farms. The total area is approximately 800 acres. During our rapid survey at the backwater mouth, 29 bird species which included Black Bellied Tern and Black Headed Ibis, both 'Near threatened' species were reported.



Geographical extent (in Hectare)	1077.54
Avian Species Richness	29
IUCN Red Listed	2
Floral Richnes	12

Figure 35 Satellite image of Poondi Backwaters

Poondi wetland complex is a very fertile and productive area supporting both biodiversity and human habitations. There are a number of marine fisher habitations. This wetland supports large areas of agriculture crops; mainly paddy and coconut.

The beaches of this area are potential nesting grounds for the Olive Ridley turtles.

3.28 MARANDUPADA CHERUVU

Location	Division	Mandal	Latitude	Longitude	Type of wetland
Dharmavaram	Srikakulam	Etcherla	18⁰ 20' 11.27" N	83⁰ 85' 92.54" E	Natural

It is a natural wetland with an approximate area of 36 ha. It harbours 38 species of birds which includes 3 'Near Threatened' birds viz. Painted Stork, Spot Billed Pelican and Darter. Nineteen plant species were recorded in the wetland during our survey. It is an extensive grazing land for cattle from the nearby villages and also supplies fodder for the villagers. Fishery resources and water for irrigation are the other major ecosystem services provided by the wetland.

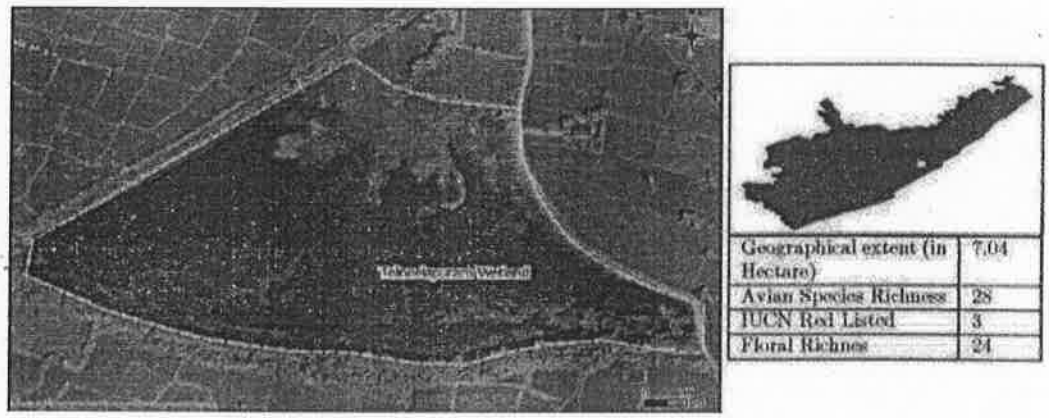
Figure 36 Satellite image of Marandupada cheruvu

3.29 TELINEELAPURAM WETLAND

Location	Division/ Mandal	Latitude	Longitude	Type of wetland
Telineeliapuram	Tekkali	18⁰ 34' 36.55" N	84⁰ 15' 46.35" E	Natural

This is one among the many wetlands near the Telineelapuram heronry and is a foraging ground for the Pelicans and Painted Storks thus playing a major role for the sustainability of the bird population in the heronry. Twenty eight bird species which include 3 'Near Threatened' birds viz. Darter, Painted Stork and Spot Billed Pelican were recorded from the wetland. Twenty four plant species were also recorded.

Water for irrigation, grazing land for cattle and fisheries resources are the major ecosystem services provided by the wetland.



Geographical extent (in Hectare)	7.04
Avian Species Richness	28
IUCN Red Listed	3
Floral Richnes	24

Figure 37 Satellite image of Telineelapuram wetland

3.30 NALLA CHERUVU (PYDIBHIMAVARAM)

Location	Division	Mandal	Latitude	Longitude	Type of wetland
Pydibhimavaram	Srikakulam	Ranastalam	18⁰ 08′ 18.62″ N	83⁰ 37′ 44.99″ E	Natural

This is one of the numerous natural wetlands which exist in the southern part of the Srikakulam district. Pyidibhimavaram is the major industrial area in the district. Arobindo Lab is a major industry operating adjacent to the wetland. However, no effluents are seen released into this wetland. Nalla Cheruvu is a seasonal wetland of 6 ha supporting 16 half single crop paddy cultivation in the nearby areas. Fingerlings of Indian Major Carps (IMC) are stocked in the wetland at the beginning of monsoon by the fishermen society and fishing is done at the end of monsoon.

Fourteen bird species and 15 plant species were recorded from the wetland during our survey.

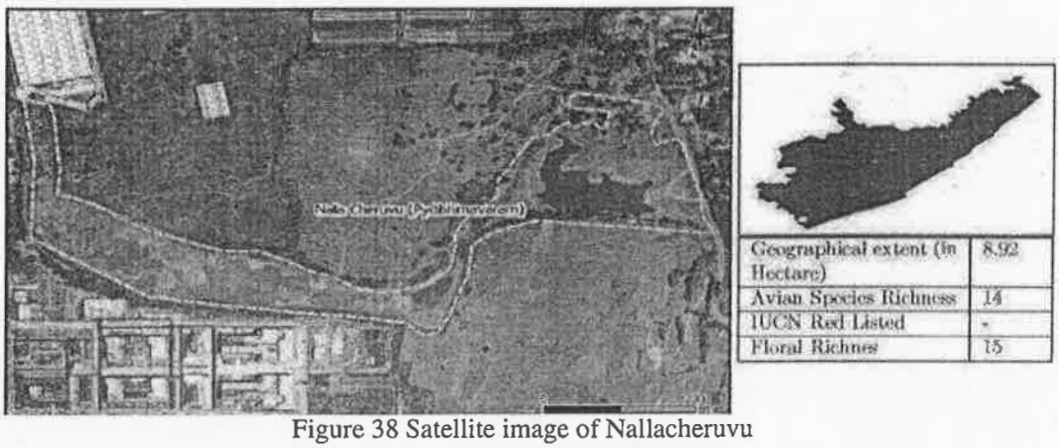


Figure 38 Satellite image of Nallacheruvu

3.31 DUNKURU WETLANDS

Location	Division	Mandal	Latitude	Longitude	Type of wetland
Dunkuru	Tekkali	Ichapuram	19⁰ 03' 19.08" N	84⁰ 44' 23.78" E	Natural

It is an important seasonal wetland land with an area of 60 ha situated near to the Ichapuram wetland complex. Thirty nine bird species were recorded from the area. This included Black Headed Ibis and Painted Stork which are 'Near Threatened', Eurasian Spoon Bill, which is 'Near Threatened' and Schedule-I species, Palla's Fish Eagle, a 'Vulnerable' species and White Bellied Sea eagle, a Schedule-1 species. Flora consists of 32 species which included *Iseilma anthphoroides*, an endemic species to Peninsular India.

The surrounding areas of the wetland are very fertile and water from the tank is used for irrigating around 400 ha of paddy, pulses and other cereals. Around hundred farmers depend on the wetland for their agriculture. The wetland is a major grazing field for cattle during dry season. Poaching of birds is a threat in the wetland.

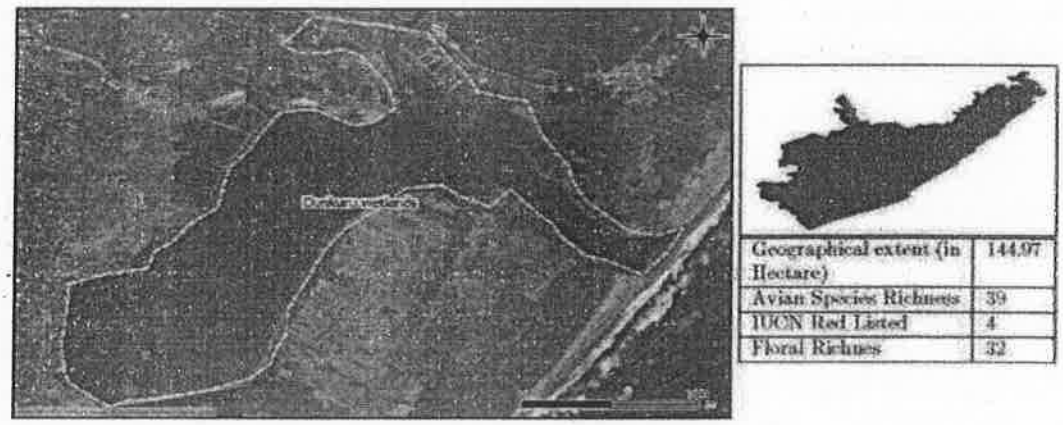
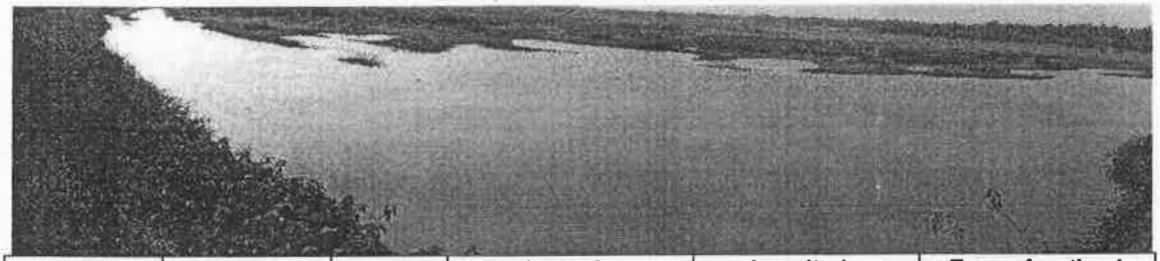


Figure 39 Satellite image of Dunkuru wetlands

3.32 NARAYANA SAGARAM



Location	Division	Mandal	Latitude	Longitude	Type of wetland
Budumuru	Srikakulam	Laveru	18⁰ 15' 17.89" N	83⁰ 46' 37.56" E	Natural/ Modified

It is a seasonal, natural wetland, modified later, spread over 300 ha. Thirty four bird species and 25 plant species were recorded form the wetland area. More than 1000 farmers depend upon this wetland for irrigation. Paddy and pulses are the major crops. During season fingerlings are stocked and fishing cooperative society members are engaged in fishing. In dry season the wetland is a major grazing field for cattle.

Figure 40 Satellite image of Narayana Sagaram

3.33 ICHAPURAM WETLANDS

Location/Mandal	Division	Latitude	Longitude	Type of wetland
Ichapuram	Tekkali Ichapuram	18⁰ 15' 17.89" N	83⁰ 46' 37.56" E	Natural

This important perennial wetland complex is situated partly in Srikakulam district and partly in the Ganjam district of Odisha. Hundreds of acres of Salt pans and aquaculture farms spread across this wetland. Nevertheless it has got rich biodiversity. During our rapid survey 54 bird species and 231 plant species were recorded. Black Bellied tern, Black Headed Ibis, Eurasian Curlew, and Painted Stork 'Near Threatened' species, Palla's Fish Eagle which is 'Vulnerable' and Osprey and Pallid Harrier Schedule-1 species were found in the wetland. Poaching birds is rampant here. *Phyllanthus rotundifilia*, an endemic species to Peninsular India was also reported from the wetland.

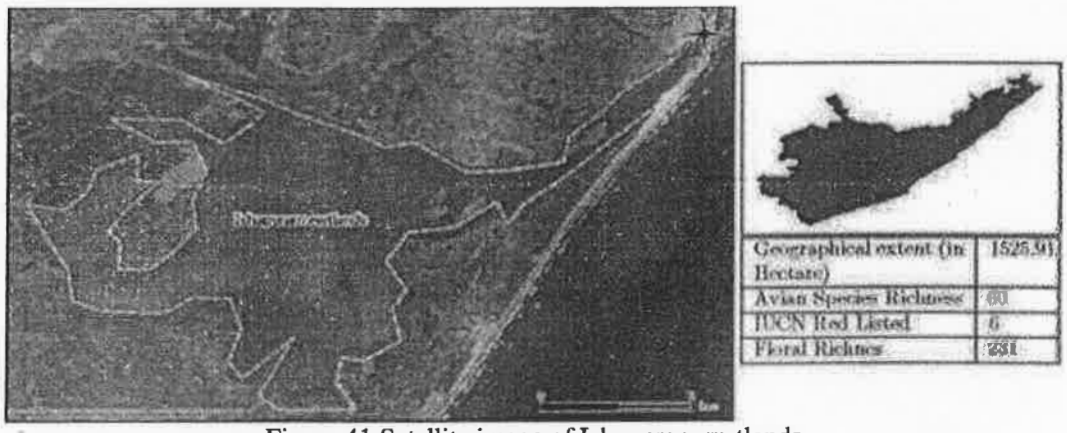
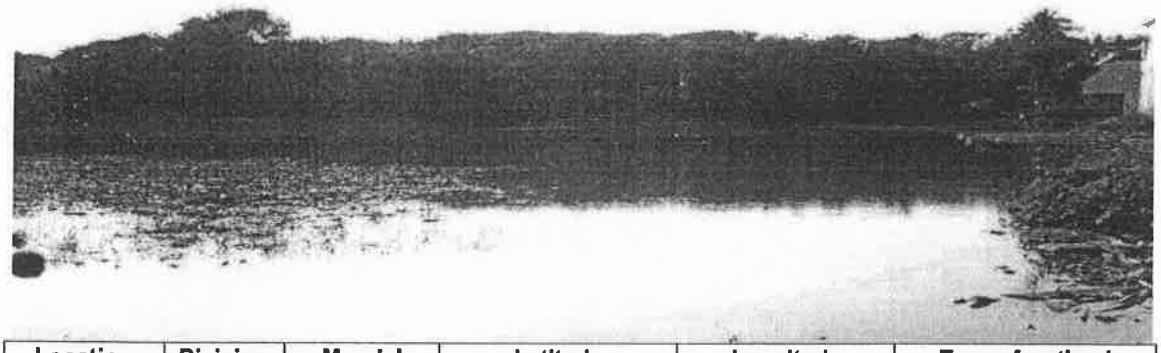


Figure 41 Satellite image of Ichapuram wetlands

3.34 TELIKUNJI WETLANDS



Location	Division	Mandal	Latitude	Longitude	Type of wetland
Telikunji	Tekkali	Ichapuram	18⁰ 15' 17.89" N	83⁰ 46' 37.56" E	Natural and modified

Telikunji wetland is designated as an Important Bird Area. It harbours thousands Open Bills along with several other species. During our survey we recorded 18 bird species which included Painted Stork, a 'Near Threatened' species. It is harbouring a rich plant biodiversity with 132 species, which included *Jatropha tanjorensis,* an endemic species to Peninsular India.

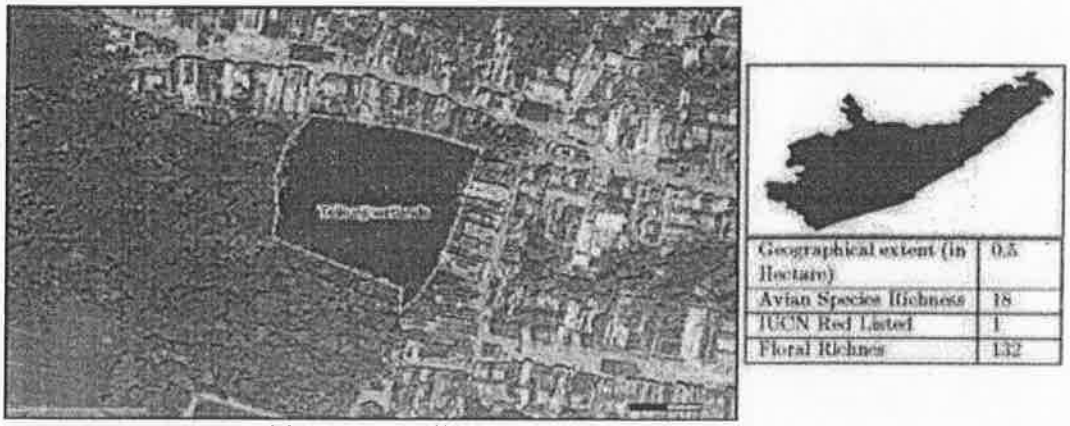


Figure 42 Satellite image of Thelikunji wetland

4 DISCUSSION

4.1 COASTAL WETLANDS

Coastal wetlands are the most valuable, productive and critically threatened wetlands in the world. They are a critical interface between the terrestrial and marine environments and are ideally positioned to reduce impacts from land-based sources. There are various types of coastal wetlands including riparian wetlands, tidal freshwater marshes, tidal salt marshes, and mangroves. While many coastal nations have developed coastal-zone management policies and legislation, degradation and losses of coastal wetlands continue due to altered hydrology, increased sediment and nutrient loading, urban development, agriculture, and aquaculture (Bruland, 2008)

The coastal land at the continental margin accounts for less than 5% of the Earth's land area, yet 17% of the earth's human population lives within this zone (*http://qui.unep-wcmc.org/MA/Index.cfml*). Furthermore, approximately 4 billion people live within 60 Km of the world's coastlines (Kennish, 2002). In fact, 27% of the earth's human population lives within 50 Km distance from an estuary. Coastal population densities have been estimated to be 100 people per square kilometer compared to only 38 people per square kilometer in inland areas (Agardy & Alder, 2005).

4.2 COASTAL BELT OF SRIKAKULAM- A BIODIVERSITY HUB

The coastal plains consist of 10-15 Km strip of land all along the seacoast of 193 Km starting from Itchapuram to Kandivalasagedda. The major rivers of the district, namely the Nagavalli drains into Bay of Bengal near Kallepalli, the Vamsadhara near Kalingapatnam and the Mahendratanaya near Baruva creating estuaries.

The Coastal Plains all along the seacoast are characterized by Beelas (in vernacular) or backwaters, typical wetland systems fed by flood waters through a vast network

of small streams/channels and connected to the sea via a creek/channel marked by sandy dunes. The two major Beelas of the district are Sompeta swamp and Bhavanapadu swamp. Sompeta swamp is situated in the northern part of the district and Bhavanapadu lies near to Tekkali town in the central part of the district. The Poondi wetland complex, extending to about 320 ha acres with more than 200 acres of back water area and adjacent salt pans and aquaculture fields, is a major wetland near Vajrapukkotturu in Nandigam mandal. Ichapuram wetland, into which the river Bahuda drains, is partly situated in the extreme north of the Srikakulam district and partly in the Odisha state.

Apart from the above major wetlands there are hundreds of wetlands with fresh water, most of them being perennial, and providing habitat for important varied biodiversity. Some such wetlands surveyed are Dunkuru, Narasipuram Peddacheruvu, Pathatekkali, Telineelapuram, Kotabommali, Sivarampuram, Narayanapuram, Mettucheruvu, Lanka and Kuddiram Cheruvu.

As discussed above coastal plains are highly productive with similar but varied ecosystem characteristics. Sand bars / mounds can be seen near Kallepalli, Srikakulam, kalingapatnam, Bhavanapadu, Vajrapukotturu, Baruva etc., along the estuaries of the rivers Nagavalli near Kallepalli, Vamsadhara near kalingapatnam and Mahendratanaya near Baruva. During our survey 662 plant species were recorded from the entire district. The Sompeta wetland and its environs alone harbour 491 plant species which is 74.17% of the total plants recorded in the district. Excluding Sompeta the other coastal wetlands of the district is a habitat for 422 plant species which is 63.75% of the total plant species recorded in the district. Two hundred and thirty six bird species were recorded from the entire district and 190 species were from the coastal areas.

4.3 SOMPETA WETLAND COMPLEX – THE NEED FOR CONSERVATION

4.3.1 BIODIVERSITY VALUES

4.3.1.1 Important Bird Habitats

The Sompeta wetland and its environs is habitat to 122 bird species, of which 11 species fall under IUCN Red List. Black Headed Ibis, Darter, Eurasian Spoon Bill, Painted Stork, Pallid Harrier, Spot Billed Pelican, Black Necked Stork and Greater Grey Headed Fish Eagle seen here belong to 'Near Threatened' categories by IUCN. Among these, Eurasian Spoon Bill and Pallid Harrier fall under Schedule –I of the Indian Wildlife Protection Act. Lesser Adjutant is a 'Vulnerable' species found here.

As mentioned in the site inspection report by the committee formed by the MoEF, Go I, in October every year thousands of birds, locally known as '*Kondamkodi and Nathagotta*' said to be coming from Siberia and Australia visit the wetland and stay there up to 5-6 months. The Beela is used as a resting and feeding habitat. This is an important migrant route and passage migrant place (Report of the site inspection committee, MoEF, 2010).

4.3.1.2 A potential habitat for Pink Headed Duck

As mentioned earlier, circumstantial evidences point to the possibility of the 'Critically Endangered' Pink Headed Duck occurring in the core area of the Pedda Beela in the Sompeta Wetland complex. As per literature stray populations of this bird were reported from Maharashtra and AP earlier. As the core area of the Pedda Beela is inundated throughout the year and with tall vegetation, extensive efforts will have to be taken in order to ascertain the presence of Pink Headed Duck during migratory season.

4.3.1.3 An area of great floristic wealth

Our three rapid surveys conducted during the months of October 2011 and February-March 2012 revealed the presence of 491 plant species in the Sompeta

wetland area which indicate the floristic wealth of this area. Out of these 491 plants 206 plants are with medicinal properties, 15 plants edible and 10 plants are edible possessing medicinal properties. *Jatropha tanjorensis reported from* here is endemic to Coromandel costs of peninsular India. Apart from this, following plants viz., *Asystasia dalzelliana, Barleria acuminata, Iseilema anthephorodes* and *Phyllanthus rotundifolius* are endemic to Indian subcontinent. Further surveys during different seasons may establish the presence of many other species.

Apart from the rich bird and plant biodiversity, it is a habitat for several important butterfly species. Because of the complex nature of the ecosystem, a detailed survey is required and that certainly would reveal the presence of several more vertebrate and invertebrate species.

4.3.1.4 Ecosystem Services of the Wetland

Numerous seasonal channels and streams feed 'Pedda Beela' during rainy season. The other two 'Beelas' are fed by the water from the Pedda Beela, with a typical water regime which have wider implications in terms of the water table, water quality and sustenance of the biodiversity of the surrounding areas.

Around 2000 ha of rice cultivation (two crops) is supported by these beelas. Three lift irrigations projects, each covering an ayacut of 80 ha, is maintained by the water directly drawn from the Beela even during the extreme summer. Mostly vegetables are cultivated using the water from the lift irrigations. There are hundreds of acres of lush coconut and arecanut groves surrounding the Beela providing crucial income for the survival of local inhabitants.

Manikkapuram in the Kanchili Mandal is an exclusive fishing village of Behra community, having their origin in Odisha. Around 800 traditional fishermen form this village and Kaviti Mandal fish in the wetland throughout the year for their sustenance. Apart from providing them income, the catches are locally sold which is a valuable source for comparatively cheap animal protein for the local people. The

fisher households earn additional income, from marketing the fish in the local market by their womenfolk.

The wetlands act as a huge grazing ground for cattle during dry season. Almost all the families surrounding the wetland keep cattle as an additional source of income. The wetland is also a valuable source of medicinal plants and several edible plants which are extensively consumed by the local people. Many villagers depend on the wetland plants for preparation of mats which is the only source of their income.

Our Participatory Rural Appraisal exercise revealed that out of the 33 villages in the periphery of the wetland 17 villages are involved in agriculture, and 16 villages are engaged in cattle rearing along with agriculture. There are 9 fishing villages where some of the villagers also hold agricultural land. One village mostly depend upon coir spinning along with agriculture whereas two villages are engaged in mat preparation along with agriculture.

Our study indicate that the 969.44 ha of land acquired by M/s Nagaurjuna Construction Company for setting up the proposed 4x660 MW Coal Based Thermal Power Plant, except the 10 ha of Pamalumetta highland, forms part of the Sompetta wetland complex (refer to Map). Setting up the proposed plant will have irreversible negative impact on the wetland system. The change in the water regime because of the diversion of the water inlets and the flood waters by blocking the natural flow by the construction of the plant will permanently alter the characteristics of the wetland leading to the loss of biodiversity of plants, birds and several other taxa.

Each bird species occupies a niche for itself, and if that is disturbed it will lead to the loss of the species from this area. At present the core area of the Pedda beela is relatively undisturbed except by random activities of the traditional fishermen.

The construction work involving the movement of man, machinery and materials for the establishment of the thermal power plant will play havoc with the natural setup of the area. After the operationalisation of the plant, it is possible that its emissions

would bring down the environmental quality of the area, and the massive physical interventions will impact the agriculture, and over all environmental health and ecosystem dynamics of the area.

The ash pond where thousands of tons of fly ash will be deposited will pollute the water, although use of modern technology may help reducing the levels. The changes which will happen by design and as a natural consequence of setting up the power plant will impact the beelas which in turn affecting the capture fisheries which has been the chief livelihood of generations of local fishers. Since these fishermen lack any other skill to earn a livelihood, their survival will be in peril.

2000 ha of paddy with 2 crops will suffer by the change in the hydrological regime of the wetland and its surroundings. Apart from the paddy cultivation thousands of acres of coconut farms and 750 acres of vegetable cultivation which depend on the three lift irrigation schemes will face severe threat hitting the livelihood of around 3 lakh people in 33 villages. In effect the physical and operational interventions due to the establishment of the power plant would alter the natural system drastically in the coming years. In the process several species, known and unknown, is likely to disappear from the two areas, several crucial ecosystem services will be seriously undermined affecting the environmental security.

4.3.2 NAUPADA SWAMPS

4.3.2.1 Biodiversity

A comprehensive biodiversity survey is yet to be conducted in the Naupada swamp areas, in spite of several projects being implemented there. Our rapid survey reveals that both faunal and floral biodiversity is quite high in the swamp area.

4.3.2.2 Faunal Biodiversity

Data collected from the present study period and from the various secondary sources indicates that Naupada wetland harbours 145 birds. Naupada wetland is

visited by large number of migratory birds such as Bar-headed Goose, Shoveller, Spot-billed Pelican, Grey Pelican, Sarus Crane, Common Teal, Cotton Teal and Common Pochard. Many of these species are observed even during non migratory season in parts of the wetland where there is sufficient water. As per the IUCN categories, there is one 'Endangered' species, ten 'Near Threatened' species and two 'Vulnerable' species present in the wetland. Among the 'Near Threatened' Pallied Harrier is also a Schedule -I species as per the Indian Wild Life (Protection Act) 1972. The Monitor Lizard, another Schedule- I animal is also present in the wetland. SACON has reported 7147 birds belonging to just 20 species from the Naupada swamps (Vijayan et al, 2004). The wetland is a foraging ground for thousands of birds during all the seasons. It is the major foraging ground for more than 150 Spot Billed Pelicans and 250 Painted Storks nesting in the Telineelapuram, an Important Bird Area.

As per the Environmental Impact Assessment Report prepared by M/s B.S. Envi-Tech (P) Ltd, this wetland is also a habitat for several mammals, snakes and other reptiles many of which fall under Schedule-I as per the IWLP-1972.

4.3.2.3 Plant biodiversity

Our rapid survey revealed that there are 236 plant species in the Naupada wetland area. *Jatropha tanjoriensis,* an endemic species to Peninsular India is present.

4.3.2.4 Ecosystem services provided by the wetland

Though the extent of wetlands shown as swamps in the revenue records is 2965.60 ha or approximately 30 square kilometres, extent of the Naupada wetland is much higher since it is a complex of wetlands consisting of marshes, swamps, mud and salt meadows and a creek. The Tekkali creek itself has an approximate water spread area of 1000 ha. The approximate area of the wetland complex may be more than 4800 ha which include the vast salt pans found in the area. While considering that there are many permanent shallow marine waters on the coastal lines adjoining the

Naupada wetland, the area of this complex will be much higher. It is the only remaining wetland of this type on the entire east coast.

During monsoon the entire area gets flooded and the water gradually drains into the Tekkali creek debouched into the sea. The flooding helps in the recharging of the ground water table in a larger area, apart from bringing in huge quantity of nutrients. Large areas remain inundated even after monsoon which is being mixed with the sea water through the creek in the marshes which generate a unique hydrological regime in the wetland complex. This unique hydrological regime supports a vast and dynamic biodiversity not only in the immediate wetland area but also its environs.

The canals from the river Vamsadhara and other numerous drains flowing into the wetland brings in a large quantity of sediments which is being retained by the large wetland area thus maintaining the health of the Tekkali creek. The nutrients being brought in by flood waters play a major role in maintaining the fertility of a vast area. But for the wetlands a lot more sedimentation will take place in the Tekkali creek and valuable nutrients will be lost.

During migratory season it is a habitat for tens of thousands birds since the food is abundant. As per the information provided by the local fishermen 36 species of fishes breed and grow in the wetland. This is the foraging ground for the Pelicans and Painted Storks of the Telineelapuram Heronry.

Around 5000 fishers depend on the wetland for their livelihood. Apart from the fishers involved directly in fishing, the womenfolk of the fishermen community are marketing the fish, thus earning valuable additional income. Vaddithandra is an exclusive fisher community village who are still engaged in traditional fishing employing traditional fishing gears and methods.

Thousands of people depend on the wetland for plant biomass as medicinal plants, edible plants, fodder, materials for thatching and preparation of mats etc. Thousands of cattle graze on the wetland during dry season.

4.3.2.5 Need for the conservation of the wetland

M/s East Coast Energy Pvt Ltd has partially established a 2640 MW Coal based Thermal power Project in an area which falls under Kakarapalli, Vaddithandra, Antlavaram, Kotapadu, Akasalakkavaram and Pothinadupeta villages in Santhabommali mandal of Tekkali Division of Srikakulam district. 820 ha is allotted for the purpose. Of this, as per the company sources 200 acres will be left free of any alterations.

Our field survey indicates that the area occupied by M/s ECEPL is part of the wetland complex (see map-). According to the company sources, 400 ha acres is earmarked for filling and raising for the power plant block, ash pond and auxiliary structures. Of these, 160 ha acres will be filled and raised to build the main power plant, coal handling area, infrastructure and internal roads. Of the 250 acres acquired for making drainage facilities 70 ha has been used for forming the drainage / garland channel to drain out the flood waters during monsoon to the creek.

4.3.3 Possible adverse impacts of the proposed Thermal Power Plant Project

4.3.3.1 Adverse changes in the ecosystem

As mentioned earlier the marshland and the Naupada swamps are formed by the natural process of the mixing of the water drained out by the Tekkali creek and the flood waters reaching the area through a network of canals originating from the river Vamsadhara and numerous drainage channels. The filling or raising the area would alter the natural land characteristics and flow pattern that will consequently disturb the structure and dynamics of the hydrological / ecological system and processes happening there. It is also likely that it will lead to uncontrolled floods, inundation pattern and cycles and submersion of about 30000 acres of land in the nearby

villages during rainy season. The natural hydrologic regime and the life strategy of animal and plant species are inextricably interconnected and the changes in the former would lead to disappearance of several species from the area.

4.3.3.2 Impact on biodiversity

The regular grounds for the birds to forage and for other activities will be lost because of the resultant changes. Since the wetland is apparently the main foraging ground for the Pelicans and Painted Storks of Telineelapuram, the very existence of such heronries may be doubtful.

4.3.3.3 Decline in soil and water quality

The locals expressed their apprehension that in lean season back flow of marine water through the garland canal by the M/s ECEPL for diverting the flood waters to Tekkali creek would adversely impact the soil and water quality, and benthic and other water dependent and aquatic organisms. The natural process the sediment retention, nutrient cycling, and self purification process and assimilation capacity of the swamp area will be disturbed.

4.3.3.4 Impact on livelihood avenues

The surrounding areas are lush green farm lands cultivating paddy and coconut in thousands of acres which contributes to the prosperity of the area. Increased and uncontrolled flooding during monsoon season, decline in soil and water quality and changes in the hydrological regime is likely to lead to decline in agriculture.

The southern side of the land acquired by the M/s ECEPL has been traditionally used by the fishers for hundreds of years. The adverse impacts on the wetland will lead to the decline in the diversity of fish fauna, fall in the quantum of fish catches and also the number of fish eating birds and other animals.

4.3.3.5 Status of other coastal wetlands surveyed

Dunkur, Poondi wetland complex, Narsipuram Peddacheruvu, Padhatekkali, Telineelpuram, Kottabommali, Sivarampuram, Narayanapuram, Mettucheruvu, Lanka Cheruvu and Kuddiram Cheruvu, Ichapuram, and the river mouths of Nagavalli, Vamsadhara and Mahendratanaya are other coastal wetlands surveyed during present study. Excluding Sompeta wetland, 422 plant species were recorded from the coastal wetlands and environs compared to 662 plant species recorded from the entire district. Out of the 236 bird species recorded from the district, 190 were from the coastal belt alone.

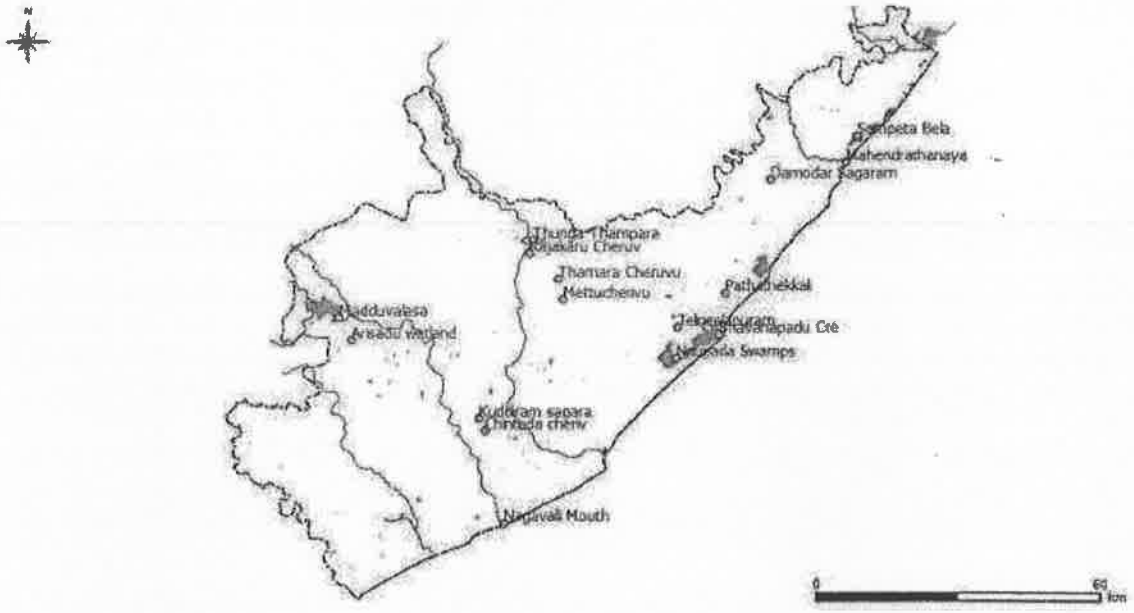


Figure 43 Some of the ecologically important wetland areas

Spot billed pelican, Painted Stork, Sarus Crane, White eyed Pochard, Bear's Pochard, Grey Headed Fish Eagle, Darter, Eurasian Spoon Bill, pallid Harrier, Black necked Stork, Lesser Adjutant, Greater rey headed Fish Eagle, Black bellied Tern, Black Headed Ibis, Eurasian Curlew, Palla's Sea Eagle, and White bellied sea Eagle were the birds fall in the IUCN Red data List reported from the entire district and all of them are from the coastal belt. The possibility of the existence of Pink Headed Duck in the Sompeta wetland makes entire coastal belt a biodiversity hot spot.

4.3.3.6 Srikakulam Coast-an important Olive Ridley nesting site

Odisha coast is the site of largest congregations of Olive Ridley turtles (*Lepidochelys olivacea)* for nesting. More than a lakh Olive Ridley turtles congregate at Gahirmatha in the Odisha coast. After the Gahirmatha, coastal AP has the largest nesting sites for Olive Ridleys in India. Beaches of Srikakulam district from Ichapuram north to the Nagavalli river mouth in the south are grounds for this turtle's nesting. Bahuda-Vamsadhara-Nagavalli belt are major nesting sites for the species in Srikakulam district. Eight hundred and thirty five nesting sites were reported in 2001 from this belt. Olive Ridleys prefer river mouths for nesting (Tripathy et al., 2001).

The coastal waters of AP are an important pathway for Olive Ridley migrating from the south of Srilanka towards the Odisha coast, with the onset of winter, from September. Usually these animals move at a depth of 5 to 30 m at 5-10 Km off the coast (Mishra, et al., 2011).

Both the proposed Super Thermal Power Plants by M/s NCC Ltd and M/s ECEPL Ltd propose to construct Jetties in the Bay of Bengal for transportation of machineries and coal. Once the plants are established and operational, they would also discharge millions of litres of thermally or otherwise polluted water into the sea, which would impact the biodiversity especially species such as Olive Ridley.

4.3.3.7 Coastal Areas-livelihood for millions

All coastal areas are thickly populated and the major towns of the district Viz., Srikakulam, Narasannapeta, Tekkali, Palasa, Sompeta and Ichapuram are situated in this belt. Fishers (both inland and marine) and agrarian communities, thickly populated and interspersed, inhabit the coastal belt from south to north of the district (Annexure-6). There are 104 villages of fishermen communities. These communities have been living in these areas for hundreds of years. Any major industrialization will jeopardize their means of livelihood since they vitally depend upon ecosystem services for their living. Fishing and associated activities are also an

important vocation for many others. Fish is exported from Srikakulam district to different parts of the country. There are 54 marine fish landing centres (Annexure-5), 47 fish drying platforms, 41 shore shelters and 11 shore sheds (Annexure- 7,8) along the district coast.

4.3.4 WETLANDS OF THE PLAINS AND HILLY AREAS

4.3.4.1 Madduvalasa Reservoir

Madduvalasa is the major reservoir, in the Vangara Mandal of Palakonda Division, built in 2002 on the course of rivers Vegavati and Swarnamukhi. Having water round the year, the reservoir has developed as a habitat for diverse animals and plants. During our rapid survey 18 bird species were identified from the environs of the reservoir. It was interesting to note a large flock of Tufted Ducks with morphological variations such as Ducks with rudimentary tuft or without any tuft. 76 species of plants were identified from the areas near the reservoir. Being in an isolated location, the birds here are subject to poaching with the connivance of the fishers fishing in the reservoir.

Plains of the district abound in wetlands of different sizes and characteristics, and performing different types of ecosystem services. The wetlands in the plains, similar to the wetlands of the coastal areas, play a major role in the well being of the people and also in sustaining the biodiversity, especially the bird population. Most wetlands in the plains are foraging grounds for many important bird species. Thus, scattered populations of 'Near Threatened' species such as Painted Stork, Spot Billed Pelican, Darter and Pallied Harrier could be spotted in several wetlands such as Thamarai Cheruvu in Sarvakota Mandal of Palakonda Division. Painted Stork was also seen spotted in Peddapadu Cheruvu of Srikakulam mandal, Black Bellied Tern was seen in Mettucheruvu of Sarvakota Mandal, Black Bellied Tern and Darter in Narayanapuram Cheruvu in Burja Mandal in Palakonda Division. Chittadi Cheruvu in Vangara Mandal of Palakonda Division was a habitat for Green Avadavat, a 'Vulnerable' species. Chittadi Cheruvu was habitat for 72 bird species, Narayanapuram Cheruvu gives

shelter to 48 bird species, Rajakaru Cheruvu was habitat for 49 bird species, and 21 bird species were found in Thamarai Cheruvu in Sarvakota Mandal of Palakonda Division. All these wetlands were habitat for a number of plant species also.

Most of the wetlands perform the dual function of providing water for agriculture, mostly for a season when rain water is the only source sustaining the wetland, and for two crops when wetland is served by canals from rivers or barrages. Since the district is receiving only 1200 mm rainfall annually, that also from heavy rainfall concentrated in a few days, the process of water harvesting through these wetlands is vital in sustaining the rural economy and ensuring environmental security.

Most of these wetlands are grazing fields for cattle and sheep during dry season. Cattle are a major source of additional income for the rural people. Wetlands provide other services such as providing water for other uses and as a source of fodder for cattle.

4.3.5 WETLANDS UNDER THREAT

Most of the wetland ecosystems of Srikakulam are under severe pressure posed by multiple threats. The major threats are given below.

4.3.5.1 Industrialisation

As discussed earlier major coastal wetlands are under threat form large industries. The small and medium wetlands are also facing threats of different types.

Agricultural run off

About 10-15 years ago, people report that, the water was of potable quality in most of the wetlands. It is painful to note that none of the wetlands visited during the present survey has potable water. Currently people depend upon bore wells for drinking water. Heavy usages of chemical fertilizers and pesticides for agriculture, dumping wastes and open defecation are the main reasons for the deterioration of the water quality.

Industrial pollution

Srikakulam is an industrially backward district. Most industries are concentrated in Pyedibhimavaram, located in the boarder of Visakhapatnam and Srikakulam districts, of which M/s Arobindo Pharma and M/s Dr. Reddy's Lab are the major ones. These industries release their effluents to the nearby rivulets which carry the effluent to the Bay of Bengal. Mercifully the nearby wetlands looks as if not under serious direct threat, perhaps the effluents are better treated, the quanity is relatively low or the self-purification capacity of the system is not overwhelmed or not poisoned by the quanity and quality of the pollutants. However, the wetlands near the M/s Nagarjuna Agrochem Ltd in Akkivalasa village of Etcherla Mandal in Srikakulam district could not survive. They have released their deleterious effluents to the wetland which was a source of various ecosystem services for more than 1000 households. Today the whole area stinks of chemicals and the health of people and animals are affected and nearby agricultural lands have become barren.

Likewise the Eenadu Paper Factory and a nearby milk processing unit release effluents to the Peddapadu Cheruvu near the Srikakulam town. This wetland is a habitat for Painted Storks and thousands of other birds. Nearby inhabitants and fishers complain that the water quality has gone down and they are not getting the yield as they used to get earlier.

Curing of Jute

The industrial sector in the district is dominated by Jute based industries since Jute is a major crop cultivated in the district. Umpteen number of wetlands are used for curing Jute which pollutes the water making it unfit for other purposes. It would be advisable that a study of impact of the process on ecosystems is conducted and alternate ways of curing the plant is developed.

Eutrophication

Many wetlands are facing eutrophication due to heavy nutrient load from domestic and municipal effulents, agricultural runoff, open defecation, industrial pollution and curing Jute.

Dumping solid wastes

Most of the urban and semi urban wetlands are being used for dumping solid wastes and are facing permanent destruction.

Domination of weeds and single species growth

Many wetlands are dominated by the growth of weeds which negatively impact the plant diversity there. Similarly there is an overgrowth of species like *Vetivera zizanoides* in many wetlands. While these types of growth are favorable for many bird species, it is unfavourable to several other ones.

Excessive grazing

Srikakulam district boasts of a substantial population of cattle and sheep as most of the agricultural households rear cattle as an additional source of income. Wetlands during dry season are extensively grazed as well as used for harvesting fodder which is detrimental to the plant biodiversity which in turn impact the faunal diversity.

Cleaning and Expansion of wetlands under MNREGA

Biodiversity is indiscriminately removed while taking up cleaning and expansion programme in several wetlands which adversely impact the biodiversity of the wetlands.

Poaching

Poaching of birds is rampant in all the wetlands mostly by the fishermen or with their connivance by others. Many traditional fishermen are also known hunting turtles. At

the current rate of reported poaching the survival of birds and other wild fauna associated with wetlands are in peril.

Conflict of interests for water between irrigation and fishing

While the farmers require the water released promptly for their seasonal crops, the fishers would like to retain water for a longer time to enable the fishes to grow larger. Retaining the water for a longer duration will help the resident and migratory birds also. However, this conflict of interest between the stakeholder groups continues without any proper solution.

5 Conclusions and Recommendations

- Srikakulam district is rich in wetlands, with many major wetlands located along the coastal plains. In hilly regions the wetlands are mostly man-made.
- The coastal wetlands of Srikakulam present a complex inter-connected wetland system that needs to be conserved in its entirety to preserve the functional linkages between these wetlands and to sustain the invaluable ecosystem services.
- The wetlands of Srikakulam district provide habitats for 236 bird species and 662 plant species. Information on other taxa remains almost absent.
- Several bird species falling under the 'Near Threatened', 'Vulnerable' and 'Endangered' IUCN categories and Schedule- I of IWPA-1972 are seen in the wetlands and its surroundings.
- Documentation of other taxa associated with the wetlands in the district is very scarce and it needs to be done at the earliest.
- The wetlands in the district face various types of threats. Diversion for industrial use is a major and serious one.
- Rampant poaching of wild birds is a major threat to the birds of the area.
- The wetlands serve several ecosystem services such as water for irrigation, ground water recharging, water for other human uses, support several species

of fauna and flora, fishery, control of salt water intrusion, pollution abatement etc.

- A large number of people get their livelihood from fishing and other weland goods.
- The coastal wetlands should be protected as they are ecologically sensitive, habitats for rich biodiversity that includes several IUCN redlisted species, and to ensure ecological security and sustainability.
- Lakhs of people depend upon the various ecosystem services provided by the coastal wetlands. For their survival, therefore no activity which will threaten the integrity of these wetlands should be allowed.
- Srikakulam coast is the second largest nesting site of Olive Ridley turtles in India. These species prefer areas close to river mouths for breeding. Therefore special protective measures have to be devised and executed in the coastal belt of Srikakulam.
- It has been established that coastal waters of AP is an important pathway for Olive Ridley turtles migrating from south of Srilanka to Odisha in search of their breeding and nesting sites. Therefore construction of Jetties in the Bay of Bengal near the Srikakulam coast and also the release of effluents to the sea should not be allowed.
- For protection of the breeding sites of the Olive Ridley Turtles 'Interest Groups' involving all the stakeholders need to be formed and substantial awareness campaigns and strict enforcement of relevant laws and regulations should be ensured.
- The core area of the Sompeta wetland is a suspected habitat of the endangered Pink Headed Duck, which has not been sighted in the country for more than half a century. However, since its presence is indicated during our attempts using PRA tools, immediate steps should be taken to protect the habitat from any disturbance and investigations should be taken up right away to ascertain the presence of the bird. Nevertheless, pending confirmation of its presence /

absence in the area, protection should be given immediately to the area so that the chance of survival of this singular bird is not jeopardized by unscrupulous actions.

- Both Naupada swamps and Sompeta wetland are rich and distinctive ecosystems. However, scientific documentation on these wetlands is sparse and grossly inadequate. Therefore, it is imperative that a multidisciplinary research programme is taken up on these wetlands and a comprehensive management plan is prepared. Looking at their apparent ecological values efforts should be initiated to declare both the wetlands as Ramsar sites.
- A comprehensive survey of the wetlands of Srikakulam district should be conducted and all the wetlands with more than 500 ha area should be identified and the same should not be allowed to be converted for any other purpose as stipulated in the national Wetland Rules-2010.
- As the present survey has indicated that many smaller wetlands also harbor substantial biodiversity, provide habitats at times for several species of conservation importance and are ecologically sensitive and valuable. Such wetlands should be identified and protected as per the stipulations of Wetlands (Conservation & Management) Rules-2010. A strategy for sustainably and wisely using them whilst ensuring their entire ecosystem structure, functions and services should be identified and executed.
- Jute cultivation and processing, being an important economic activity in the district appropriate methods that will not spoil the wetlands may be executed for curing jute. Cement water tanks should be considered for curing of Jute.
- The present survey indicates that many fishermen indulge in poaching of birds and other wild life wherever available. They are unaware of the importance of such species. Awareness programmes have to be initiated to address this issue. Programmes with stakeholder participation should be formulated to protect such wetlands.

- Many wetlands have the potential for development as recreation centres and nature educational avenues. Such wetlands should be identified and developed.
- Under the Mahatma Gandhi National Employment Guarantee Programme cleaning and expansion work has been taken up in many wetlands which lead to the complete removal of plant biodiversity which in turn impact the bird and other animal biodiversity. Measures to sustain the biodiversity of the wetland have to be devised and implemented while carrying out such works, perhaps using MNERGP funds.
- Wetlands should not be used as dump yards for wastes of any kind, municipal, industrial, commercial or domestic. Industrial effluents should not be allowed to be discharged into the wetlands even after treatment.
- Awareness programmes should be taken up for educating people about the harmful effects of open defecation, such as contamination of drinking water and its health implications and sufficient toilets may be provided.

In brief, it is suggested that all the wetlands in the district with more than 500 ha should be identified and protected alongwith the wetlands that are ecologically sensitive and important which are major wildlife habitats, areas of of outstanding natural beauty or historical or heritage areas and the areas rich in genetic diversity as stipulated in the National Wetland (Conservation & Management) Rules-2010. They should not be allowed to be converted for any other purpose. It is also suggested that firm attempts should be made, especially for the four major wetland complexes in the coastal plains, to document their ecological and conservational values, the ecological goods and services form these and to conserve them.

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Appendix 1 Ramsar classification of wetlands

	Marine/Coastal Wetlands
A	Permanent shallow marine waters in most cases less than six metres deep at low tide; includes sea bays and straits.
B	Marine sub tidal aquatic beds; includes kelp beds, sea-grass beds, and tropical marine meadows.
C	Coral reefs.
D	Rocky marine shores; includes rocky offshore islands, sea cliffs.
E	Sand, shingle or pebble shores; includes sand bars, spits and sandy islets; includes dune systems and humid dune slacks.
F	Estuarine waters; permanent water of estuaries and estuarine systems of deltas.
G	Intertidal mud, sand or salt flats.
H	Intertidal marshes; includes salt marshes, salt meadows, saltings, raised salt marshes; includes tidal brackish and freshwater marshes.
I	Intertidal forested wetlands; includes mangrove swamps, nipah swamps and tidal freshwater swamp forests.
J	Coastal brackish/saline lagoons; brackish to saline lagoons with at least one relatively narrow connection to the sea.
K	Coastal freshwater lagoons; includes freshwater delta lagoons.
Zk(a)	Karst and other subterranean hydrological systems, marine/coastal
	Inland Wetlands
L	Permanent inland deltas.
M	Permanent rivers/streams/creeks; includes waterfalls.
N	Seasonal/intermittent/irregular rivers/streams/creeks.
O	Permanent freshwater lakes (over 8 ha); includes large oxbow lakes.
P	Seasonal/intermittent freshwater lakes (over 8 ha); includes floodplain lakes.
Q	Permanent saline/brackish/alkaline lakes.
R	Seasonal/intermittent saline/brackish/alkaline lakes and flats.
Sp	Permanent saline/brackish/alkaline marshes/pools.
Ss	Seasonal/intermittent saline/brackish/alkaline marshes/pools.
Tp	Permanent freshwater marshes/pools; ponds (below 8 ha), marshes and swamps on inorganic soils; with emergent vegetation water-logged for at least most of the growing season.
Ts	Seasonal/intermittent freshwater marshes/pools on inorganic soils; includes sloughs, potholes, seasonally flooded meadows, sedge marshes.
U	Non-forested peat lands; includes shrub or open bogs, swamps, fens.
Va	Alpine wetlands; includes alpine meadows, temporary waters from snowmelt.
Vt	Tundra wetlands; includes tundra pools, temporary waters from snowmelt.
W	Shrub-dominated wetlands; shrub swamps, shrub-dominated freshwater marshes, shrub carr, alder thicket on inorganic soils.
Xf	Freshwater, tree-dominated wetlands; includes freshwater swamp forests, seasonally flooded forests, wooded swamps on inorganic soils.
X	Forested peat lands; peat swamp forests.
Y	Freshwater springs; oases.

	Marine/Coastal Wetlands
Za	Geothermal wetlands
Zb	Karst and other subterranean hydrological systems, inland
	Human-made wetlands
1	Aquaculture (e.g., fish/shrimp) ponds
2	Ponds; includes farm ponds, stock ponds, small tanks; (generally below 8 ha).
3	Irrigated land; includes irrigation channels and rice fields:
4	Seasonally flooded agricultural land (including intensively managed or grazed wet meadow or pasture).
5	Salt exploitation sites; salt pans, salines, etc.
6	Water storage areas; reservoirs/barrages/dams/impoundments (generally over 8 ha).
7	Excavations; gravel/brick/clay pits; borrow pits, mining pools.
8	Wastewater treatment areas; sewage farms, settling ponds, oxidation basins, etc.
9	Canals and drainage channels, ditches.
Zk(c)	Karst and other subterranean hydrological systems, human-made

Source: www.ramsar.org

Appendix 2 Plants recorded from the study area

Sl. No.	Species	Family	Habit	Habitat	Type
1.	*Abelmoschus esculentus* (L.) Moench	Malvaceae	Shrub	Terrestrial	Cultivated
2.	*Abrus precatorius* L.	Fabaceae	Straggler	Terrestrial	Wild
3.	*Abutilon hirtum* (Lam.) Sweet	Malvaceae	Shrub	Terrestrial	Wild
4.	*Abutilon indicum* (L.) Sweet	Malvaceae	Shrub	Terrestrial	Wild
5.	*Acacia auriculiformis* A. Cunn ex Benth.	Mimosaceae	Tree	Terrestrial	Exotic
6.	*Acacia caesia* (L.) Willd.	Mimosaceae	Straggler	Terrestrial	Wild
7.	*Acacia catechu* (L.f.) Willd.	Mimosaceae	Tree	Terrestrial	Wild
8.	*Acacia chundra* (Roxb. ex Rottl.) Willd.	Mimosaceae	Tree	Terrestrial	Wild
9.	*Acacia farnesiana* (L.) Willd.	Mimosaceae	Tree	Terrestrial	Wild
10.	*Acacia holosericea* A.Cunn.	Mimosaceae	Tree	Terrestrial	Planted
11.	*Acacia leucophloea* (Roxb.) Willd.	Mimosaceae	Tree	Terrestrial	Wild
12.	*Acacia nilotica* (L.) Willd. ex Del.	Mimosaceae	Tree	Terrestrial	Wild
13.	*Acacia sinuata* (Lour.) Merr.	Mimosaceae	Tree	Terrestrial	Wild
14.	*Acacia torta* (Roxb.) Craib	Mimosaceae	Straggler	Terrestrial	Wild
15.	*Acalypha brachystachya* Hornem.	Euphorbiaceae	Herb	Terrestrial	Wild
16.	*Acalypha fruticosa* Forssk.	Euphorbiaceae	Shrub	Terrestrial	Wild
17.	*Acalypha indica* L.	Euphorbiaceae	Herb	Terrestrial	Wild
18.	*Acalypha paniculata* Willd.	Euphorbiaceae	Herb	Terrestrial	Wild
19.	*Acanthospermum hispidum* DC.	Asteraceae	Herb	Terrestrial	Wild
20.	*Acanthus ilicifolius* Linn.	Acanthaceae	Herb	Semi-aquatic	Wild
21.	*Achras sapota* Linn.	Sapotaceae	Tree	Terrestrial	Cultivated
22.	*Achyranthes aspera* L.	Amaranthaceae	Herb	Terrestrial	Wild
23.	*Acorus calamus* L	Zingiberaceae	Herb	Terrestrial	Cultivated

Sl. No.	Species	Family	Habit	Habitat	Type
24.	*Adansonia digitata* L.	Bombacaceae	Tree	Terrestrial	Wild
25.	*Aegle marmelos* (L.) Correa	Rutaceae	Tree	Terrestrial	Wild
26.	*Aeluropus lagopoides* (Linn.) Trin. ex Thw.	Poaceae	Grass	Semi-aquatic	Wild
27.	*Aerides ringens* (Lindl.) C.E.C.Fischer	Orchidaceae	Herb	Epiphytic	Wild
28.	*Aerva lanata* (L.) Juss. ex Schultes	Amaranthaceae	Herb	Terrestrial	wild
29.	*Aerva persica* (Burm.f.) Merr.	Amaranthaceae	Herb	Terrestrial	wild
30.	*Aerva sanguinolenta* (L.) Blume	Amaranthaceae	Herb	Terrestrial	Wild
31.	*Aeschynomene aspera* L.	Fabaceae	Herb	Terrestrial	Wild
32.	*Aglaia elaeagnoidea* (Juss.) Benth.	Meliaceae	Tree	Terrestrial	Wild
33.	*Ailanthus excelsa* Roxb.	Simaroubaceae	Tree	Terrestrial	Wild
34.	*Alangium salviifolium* (L.f.) Wang.	Alangiaceae	Tree	Terrestrial	Wild
35.	*Albizia amara* (Roxb.) Boivin	Mimosaceae	Tree	Terrestrial	Wild
36.	*Albizia lebbeck* (L.) Willd.	Mimosaceae	Tree	Terrestrial	Wild
37.	*Albizia saman* (Jacq.) F.v. Muell.	Mimosaceae	Tree	Terrestrial	Planted
38.	*Allophylus serratus* Kurz.	Sapindaceae	Tree	Terrestrial	Wild
39.	*Aloe vera* (L.) Burm.f.	Aloeaceae	Herb	Terrestrial	Wild
40.	*Alstonia scholaris* (L.) R.Br.	Apocynaceae	Tree	Terrestrial	Cultivated
41.	*Alstonia venenata* R.Br.	Apocynaceae	Tree	Terrestrial	Wild
42.	*Alternanthera paronychioides* A. St.-Hilaire	Amaranthaceae	Herb	Terrestrial	Wild
43.	*Alternanthera pungens* Kunth	Amaranthaceae	Herb	Terrestrial	Wild
44.	*Alternanthera sessilis* (L.) R.Br. ex DC.	Amaranthaceae	Herb	Aquatic	Wild
45.	*Alternanthera tenella* Colla.	Amaranthaceae	Herb	Semi-aquatic	Wild
46.	*Alysicarpus longifolius* Wight & Arn.	Fabaceae	Herb	Terrestrial	Wild
47.	*Alysicarpus monilifer* (L.) DC.	Fabaceae	Herb	Terrestrial	Wild
48.	*Alysicarpus rugosus* DC.	Fabaceae	Herb	Terrestrial	Wild

Sl. No.	Species	Family	Habit	Habitat	Type
49.	*Amaranthus spinosus* L.	Amaranthaceae	Herb	Terrestrial	Wild
50.	*Amaranthus viridis* L.	Amaranthaceae	Herb	Terrestrial	Wild
51.	*Ammannia baccifera* Linn.	Lythraceae	Herb	Semi-aquatic	Wild
52.	*Amorphophallus paeoniifolius* (Dennst.) Nicolson	Araceae	Herb	Marshy	Wild
53.	*Ampelocissus latifolia* (Roxb.) Planch.	Vitaceae	Climber	Terrestrial	Wild
54.	*Ampelocissus tomentosa* (Heyne ex Roth) Planch.	Vitaceae	Climber	Terrestrial	Wild
55.	*Anacardium occidentale* L.	Anacardiaceae	Tree	Terrestrial	Planted
56.	*Andrographis alata* (Vahl) Nees	Acanthaceae	Herb	Terrestrial	Wild
57.	*Andrographis paniculata* (Burm.f.) Wall. ex Nees	Acanthaceae	Herb	Terrestrial	Wild
58.	*Andropogon pumilus* Roxb.	Poaceae	Grass	Terrestrial	Wild
59.	*Anisochilus carnosus* (L.f.) wall.	Lamiaceae	Shrub	Terrestrial	Wild
60.	*Anisochilus scaber* Benth.	Lamiaceae	Shrub	Terrestrial	Wild
61.	*Anisomeles indica* (L.) Kuntze	Lamiaceae	Herb	Terrestrial	Wild
62.	*Anisomeles malabarica* (L.) R. Br. ex Sims.	Lamiaceae	Herb	Terrestrial	Wild
63.	*Annona reticulata* L.	Annonaceae	Tree	Terrestrial	Planted
64.	*Annona squamosa* L.	Annonaceae	Tree	Terrestrial	Cultivated
65.	*Anogeissus acuminata* (Roxb. ex DC.) Guill. & Perr.	Combretaceae	Tree	Terrestrial	Wild
66.	*Anogeissus latifolia* (Roxb. Ex DC.) Wall ex Guill. & Perr.	Combretaceae	Tree	Terrestrial	Wild
67.	*Anthocephalus cadamba* (Roxb.) Miq.	Rubiaceae	Tree	Terrestrial	Cultivated
68.	*Aponogeton natans* (L.) Engl. & K.Krause	Aponogetonaceae	Herb	Aquatic	Wild
69.	*Arachis hypogaea* L.	Fabaceae	Herb	Terrestrial	Cultivated
70.	*Araucaria cunninghamii* Aiton ex D.Don	Araucariaceae	Tree	Terrestrial	Ornamental
71.	*Ardisia solanacea*Roxb.	Myrisinaceae	Tree	Marshy	Wild
72.	*Argemone mexicana* L.	Papaveraceae	Herb	Terrestrial	Exotic
73.	*Argyreia cuneata* (Willd.) Ker-Gawl.	Convolvulaceae	Straggler	Terrestrial	Wild

Sl. No.	Species	Family	Habit	Habitat	Type
74.	*Argyreia elliptica* (Roth) Choisy	Convolvulaceae	Straggler	Terrestrial	Wild
75.	*Argyreia hirsuta* Wight & Arn.	Convolvulaceae	Straggler	Terrestrial	Wild
76.	*Argyreia nervosa* (Burm.f.) Boj.	Convolvulaceae	Straggler	Terrestrial	Wild
77.	*Argyreia setosa* (Roxb.) Choisy	Convolvulaceae	Straggler	Terrestrial	Wild
78.	*Aristida adscensionis* L.	Poaceae	Grass	Terrestrial	Wild
79.	*Aristida funiculata* Trin & Rupr.	Poaceae	Grass	Terrestrial	Wild
80.	*Aristida hystrix* L.	Poaceae	Grass	Terrestrial	Wild
81.	*Aristida setacea* Retz.	Poaceae	Grass	Terrestrial	Wild
82.	*Aristolochia bracteolata* Lam.	Aristolochiaceae	Straggler	Terrestrial	Wild
83.	*Aristolochia indica* L.	Aristolochiaceae	Climber	Terrestrial	Wild
84.	*Artabotrys hexapetalus* (L. f.) Bhandari	Annonaceae	Straggler	Terrestrial	Cultivated
85.	*Artemesia vulgaris* L.	Asteraceae	Herb	Terrestrial	Cultivated
86.	*Arundo donax* L.	Poaceae	Shrub	Marshy	Wild
87.	*Asclepias curassavica* L.	Asclepiadaceae	Herb	Marshy	Wild
88.	*Asparagus racemosus* Willd.	Asparagaceae	Straggler	Terrestrial	Wild
89.	*Asystasia dalzelliana* Sant.	Acanthaceae	Shrub	Terrestrial	Wild
90.	*Asystasia gangetica* (L.) T. And.	Acanthaceae	Shrub	Terrestrial	Wild
91.	*Atalantia monophylla* (L.) Corr. Serr.	Rutaceae	Tree	Terrestrial	Wild
92.	*Atalantia racemosa* Wight & Arn.	Rutaceae	Tree	Terrestrial	Wild
93.	*Atylosia scarabaeoides* (L.) Benth.	Fabaceae	Herb	Terrestrial	Wild
94.	*Avicennia marina* (Forsk.) Vierh.	Avicenniaceae	Tree	Marshy	Wild
95.	*Avicennia officinalis* L.	Avicenniaceae	Tree	Marshy	Wild
96.	*Azadirachta indica* A. Juss.	Meliaceae	Tree	Terrestrial	Wild
97.	*Azima tetracantha* Lam.	Salvadoraceae	Shrub	Terrestrial	Wild
98.	*Bacopa monnieri* (L.) Pennell	Scrophulariaceae	Herb	Aquatic	Wild

Sl. No.	Species	Family	Habit	Habitat	Type
99.	*Balanites aegyptiaca* (L.) Del.	Balanitaceae	Tree	Terrestrial	Wild
100.	*Bambusa bambos* Voss	Poaceae	Tree	Terrestrial	Wild
101.	*Barleria acuminata* Wight ex Nees.	Acanthaceae	Undershrub	Terrestrial	Wild
102.	*Barleria buxifolia* L.	Acanthaceae	Herb	Terrestrial	Wild
103.	*Barleria cristata* L.	Acanthaceae	Herb	Terrestrial	Planted
104.	*Barleria mysorensis* Roth.	Acanthaceae	Herb	Terrestrial	Wild
105.	*Barleria prionitis* L.	Acanthaceae	Herb	Terrestrial	Wild
106.	*Barringtonia racemosa* (L.) Spreng.	Lecythidaceae	Tree	Terrestrial	Wild
107.	*Basella rubra* L.	Chenopodiaceae	Climber	Terrestrial	Cultivated
108.	*Bassia latifolia* Roxb.	Sapotaceae	Tree	Terrestrial	Wild
109.	*Bauhinia purpurea* L.	Caesalpiniaceae	Tree	Terrestrial	Cultivated
110.	*Bauhinia racemosa* Lam.	Caesalpiniaceae	Tree	Terrestrial	Wild
111.	*Benkara malabarica* (Lam.) Tirvengadum	Rubiaceae	Shrub	Terrestrial	Wild
112.	*Bergia ammannioides* Roxb.	Elatinaceae	Herb	Aquatic	Wild
113.	*Bidens pilosa* L.	Asteraceae	Herb	Terrestrial	Wild
114.	*Biophytum reinwardtii* (Zucc.) Klotzsch.	Oxalidaceae	Herb	Terrestrial	Wild
115.	*Blainvillea acmella* (L.) Philipson	Asteraceae	Herb	Terrestrial	Wild
116.	*Blepharis maderaspatensis* (L.) Heyne ex Roth	Acanthaceae	Herb	Terrestrial	Wild
117.	*Blepharis repens* (Vahl) Roth	Acanthaceae	Herb	Terrestrial	Wild
118.	*Blumea lacera* (Burm.f) DC.	Asteraceae	Herb	Terrestrial	Wild
119.	*Blumea mollis* (D.Don) Merr.	Asteraceae	Herb	Terrestrial	Wild
120.	*Boerhavia diffusa* L.	Nyctaginaceae	Herb	Terrestrial	Wild
121.	*Boerhavia erecta* L.	Nyctaginaceae	Herb	Terrestrial	Wild
122.	*Bombax ceiba* L.	Bombacaceae	Tree	Terrestrial	Wild
123.	*Borassus flabellifer* L.	Arecaceae	Tree	Terrestrial	Wild

Sl. No.	Species	Family	Habit	Habitat	Type
124.	*Bothriochloa bladhii* (Retz.) S. T. Blake	Poaceae	Grass	Terrestrial	Wild
125.	*Bothriochloa pertusa* (L.) A. Camus	Poaceae	Grass	Terrestrial	Wild
126.	*Brachiaria ramosa* (L.) Stapf	Poaceae	Grass	Terrestrial	Wild
127.	*Brachiaria remota* (Retz.) Haines	Poaceae	Grass	Terrestrial	Wild
128.	*Breynia retusa* (Dennst.) Alston	Euphorbiaceae	Shrub	Terrestrial	Wild
129.	*Breynia vitis-idaea* (Burm.f.) Fischer	Euphorbiaceae	Shrub	Terrestrial	Wild
130.	*Bridelia crenulata* Roxb.	Euphorbiaceae	Tree	Terrestrial	Wild
131.	*Buchanania axillaris* (Desr.) Ramam.	Anacardiaceae	Tree	Terrestrial	Wild
132.	*Buchanania lanzan* Spreng.	Anacardiaceae	Tree	Terrestrial	Wild
133.	*Bulbostylis barbata* (Rottb.) C.B. Clarke	Cyperaceae	Herb	Terrestrial	Wild
134.	*Bulbostylis densa* (Wall. ex Roxb.) Hand.-Mazz.	Cyperaceae	Herb	Terrestrial	Wild
135.	*Butea monosperma* (Lam.) Taub.	Fabaceae	Tree	Terrestrial	Wild
136.	*Cadaba fruticosa* (L.) Druce	Capparidaceae	Straggler	Terrestrial	Wild
137.	*Caesalpinia bonduc* (L.) Roxb.	Caesalpiniaceae	Straggler	Terrestrial	Wild
138.	*Caesalpinia sp.*	Caesalpiniaceae	Shrub	Terrestrial	Wild
139.	*Calophyllum inophyllum* L.	Clusiaceae	Tree	Terrestrial	Wild
140.	*Calotropis gigantea* (L.) R.Br.	Apocynaceae	Shrub	Terrestrial	Wild
141.	*Calotropis procera* (Ait.) R.Br.	Apocynaceae	Shrub	Terrestrial	Wild
142.	*Canavalia cathartica* Thouars	Fabaceae	Straggler	Terrestrial	Wild
143.	*Canna indica* L.	Cannaceae	Herb	Terrestrial	Planted
144.	*Cansjera rheedii* Gmel.	Opeliaceae	Straggler	Terrestrial	Wild
145.	*Capparis decidua* (Forssk.) Edgew.	Capparidaceae	Tree	Terrestrial	Wild
146.	*Capparis grandis* L.	Capparidaceae	Tree	Terrestrial	Wild
147.	*Capparis sepiaria* L.	Capparidaceae	Straggler	Terrestrial	Wild
148.	*Capparis zeylanica* L.	Capparidaceae	Straggler	Terrestrial	Wild

Sl. No.	Species	Family	Habit	Habitat	Type
149.	*Caralluma adscendens* Wight	Asclepiadaceae	Herb	Terrestrial	Wild
150.	*Cardiospermum halicacabum* L.	Sapindaceae	Climber	Terrestrial	Wild
151.	*Carissa carandas* L.	Apocynaceae	Straggler	Terrestrial	Wild
152.	*Carissa inermis* Vahl	Apocynaceae	Straggler	Terrestrial	Wild
153.	*Carissa spinarum* L.	Apocynaceae	Straggler	Terrestrial	Wild
154.	*Carmona retusa* (Vahl) Masam.	Boraginaceae	Shrub	Terrestrial	Wild
155.	*Caryota urens* L.	Arecaceae	Tree	Terrestrial	Wild
156.	*Casearia tomentosa* Roxb.	Flacourtiaceae	Tree	Terrestrial	Wild
157.	*Casearia wyanadensis* Bedd.	Flacourtiaceae	Tree	Terrestrial	Wild
158.	*Cassia fistula* L.	Caesalpiniaceae	Tree	Terrestrial	Wild
159.	*Cassia obtusa* L.	Caesalpiniaceae	Tree	Terrestrial	Wild
160.	*Cassia siamea* Lam.	Caesalpiniaceae	Tree	Terrestrial	Wild
161.	*Casuarina equisetifolia* L.	Casuarinaceae	Tree	Terrestrial	Planted
162.	*Cayratia pedata* (Lam.) Juss. ex Gagnep.	Vitaceae	Climber	Terrestrial	Wild
163.	*Cayratia trifolia* (L.) Domin.	Vitaceae	Climber	Terrestrial	Wild
164.	*Ceiba pentandra* (L.) Gaertn.	Bombacaceae	Tree	Terrestrial	Wild
165.	*Celastrus paniculatus* Willd.	Celastraceae	Straggler	Terrestrial	Wild
166.	*Celosia argentea* L.	Amaranthaceae	Herb	Terrestrial	Wild
167.	*Celosia polygonoides* Retz.	Amaranthaceae	Herb	Terrestrial	Wild
168.	*Cenchrus barbatus* Schumach.	Poaceae	Grass	Terrestrial	Wild
169.	*Cenchrus ciliaris* L.	Poaceae	Grass	Terrestrial	Wild
170.	*Cenchrus setigera* Vahl.	Poaceae	Grass	Terrestrial	Wild
171.	*Centella asiatica* (L.) Urban	Apiaceae	Herb	Semi-aquatic	Wild
172.	*Cereus pterogonus* Lem.	Cactaceae	Tree	Terrestrial	Wild
173.	*Chloris barbata* Sw.	Poaceae	Grass	Terrestrial	Wild

Sl. No.	Species	Family	Habit	Habitat	Type
174.	*Chloris dolichostachya* Lagasca	Poaceae	Grass	Terrestrial	Wild
175.	*Chloris tenella* Koen. ex Roxb.	Poaceae	Grass	Terrestrial	Wild
176.	*Chloroxylon swietenia* DC.	Rutaceae	Tree	Terrestrial	Wild
177.	*Chromolaena odorata* (L.) King & Robinson	Asteraceae	Shrub	Terrestrial	Exotic
178.	*Chrysopogon aciculatus (Retz.) Trin.*	Poaceae	Grass	Terrestrial	Wild
179.	*Chrysopogon asper* (Heyne ex Hook. f.) Blatter & Mc Can	Poaceae	Grass	Terrestrial	Wild
180.	*Cipadessa baccifera* (Roth) Miq.	Meliaceae	Shrub	Terrestrial	Wild
181.	*Cissampelos pareira* L.	Menispermaceae	Climber	Terrestrial	Wild
182.	*Cissus quadrangularis* L.	Vitaceae	Climber	Terrestrial	Wild
183.	*Cissus repanda* Vahl.	Vitaceae	Climber	Terrestrial	Wild
184.	*Cleome aspera* Koen ex. DC.	Capparidaceae	Herb	Terrestrial	Wild
185.	*Cleome monophylla* L.	Capparidaceae	Herb	Terrestrial	Wild
186.	*Cleome viscosa* L.	Capparidaceae	Herb	Terrestrial	Wild
187.	*Clerodendrum inerme* (L.) Gaertn.	Verbenaceae	Straggler	Terrestrial	Wild
188.	*Clerodendrum infortunatum* L.	Verbenaceae	Shrub	Terrestrial	Wild
189.	*Clerodendrum phlomidis* L.f.	Verbenaceae	Shrub	Terrestrial	Wild
190.	*Clitoria ternatea* L.	Fabaceae	Climber	Terrestrial	Wild
191.	*Coccinia grandis* (L.) Voigt	Cucurbitaceae	Climber	Terrestrial	Wild
192.	*Cocculus hirsutus* (L.) Diels	Menispermaceae	Climber	Terrestrial	Wild
193.	*Cocculus pendulus* (Forst.) Diels	Menispermaceae	Straggler	Terrestrial	Wild
194.	*Cochlospermum religiosum* (L.) Alston	Cochlospermaceae	Tree	Terrestrial	Wild
195.	*Coldenia procumbens* Linn.	Boraginaceae	Herb	Terrestrial	Wild
196.	*Colocasia esculenta* (L.) Schott	Araceae	Herb	Aquatic	Wild
197.	*Combretum albidum* G. Don	Combretaceae	Straggler	Terrestrial	Wild
198.	*Commelina benghalensis* L.	Commelinaceae	Herb	Terrestrial	Wild

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Sl. No.	Species	Family	Habit	Habitat	Type
199.	*Commelina clavata* Clarke	Commelinaceae	Herb	Terrestrial	Wild
200.	*Commelina longifolia* Lam.	Commelinaceae	Herb	Terrestrial	Wild
201.	*Commiphora berryi* (Arn.) Engler	Burseraceae	Tree	Terrestrial	Wild
202.	*Commiphora caudata* (Wight & Arn.) Engler	Burseraceae	Tree	Terrestrial	Wild
203.	*Convolvulus arvensis* L.	Convolvulaceae	Climber	Terrestrial	Wild
204.	*Conyza leucantha* (D.Don) Ludlow & Raven	Asteraceae	Herb	Terrestrial	Wild
205.	*Corchorus aestuans* L.	Tiliaceae	Herb	Terrestrial	Wild
206.	*Corchorus tridens* L.	Tiliaceae	Herb	Terrestrial	Wild
207.	*Corchorus trilocularis* L.	Tiliaceae	Herb	Terrestrial	Wild
208.	*Cordia dichotoma* G. Forst.	Boraginaceae	Tree	Terrestrial	Wild
209.	*Cordia domestica* Roth	Boraginaceae	Tree	Terrestrial	Wild
210.	*Cordia myxa* L.	Boraginaceae	Tree	Terrestrial	Wild
211.	*Cordia sebestena* L.	Boraginaceae	Tree	Terrestrial	Ornamental
212.	*Costus speciosus* (Koen.) J. E. Smith	Costaceae	Herb	Terrestrial	Planted
213.	*Couroupita guianensis* Aubl.	Lecythidaceae	Tree	Terrestrial	Ornamental
214.	*Crotalaria evolvuloides* Wight ex Wight & Arn.	Fabaceae	Herb	Terrestrial	Wild
215.	*Crotalaria juncea* L.	Fabaceae	Shrub	Terrestrial	Wild
216.	*Crotalaria mysorensis* Roth.	Fabaceae	Herb	Terrestrial	Wild
217.	*Crotalaria pallida* Dryand. var. *obovata* (G.Don) Polhill	Fabaceae	Herb	Terrestrial	Wild
218.	*Croton bonplandianum* Baill.	Euphorbiaceae	Herb	Terrestrial	Wild
219.	*Cryptolepis buchananii* Roem. & Schult.	Asclepiadaceae	Straggler	Terrestrial	Wild
220.	*Cryptolepis grandiflora* Wight	Asclepiadaceae	Straggler	Terrestrial	Wild
221.	*Curculigo orchioides* Gaertn	Hypoxidaceae	Herb	Terrestrial	Wild
222.	*Cuscuta reflexa* Roxb.	Convolvulaceae	Climber	Terrestrial	Wild
223.	*Cyanotis tuberosa* (Roxb.) Schultes & Schultes	Commelinaceae	Herb	Terrestrial	Wild

Sl. No.	Species	Family	Habit	Habitat	Type
224.	*Cycas circinalis* L.	Cycadaceae	Tree	Terrestrial	Ornamental
225.	*Cynodon dactylon* (L.) Pers.	Poaceae	Grass	Terrestrial	Wild
226.	*Cynoglossum zeylanicum* (Vahl ex Hornem.) Thunb. ex Lehm.	Boraginaceae	Herb	Terrestrial	Wild
227.	*Cyperus articulatus* L.	Cyperaceae	Herb	Aquatic	Wild
228.	*Cyperus difformis* L.	Cyperaceae	Herb	Semi-aquatic	Wild
229.	*Cyperus exaltatus* Retz.	Cyperaceae	Herb	Aquatic	Wild
230.	*Cyperus halpan* L.	Cyperaceae	Herb	Semi-aquatic	Wild
231.	*Cyperus iria* L.	Cyperaceae	Herb	Semi-aquatic	Wild
232.	*Cyperus pangorei* Rottb.	Cyperaceae	Herb	Semi-aquatic	Wild
233.	*Cyperus rotundus* L.	Cyperaceae	Herb	Terrestrial	Wild
234.	*Dactyloctenium aegyptium* (L.) Willd.	Poaceae	Grass	Terrestrial	Wild
235.	*Dactyloctenium aristatum* Link.	Poaceae	Grass	Terrestrial	Wild
236.	*Dalbergia sissoo* Roxb.	Fabaceae	Tree	Terrestrial	Planted
237.	*Datura innoxia* Mill.	Solanaceae	Shrub	Terrestrial	Wild
238.	*Datura metal* L.	Solanaceae	Shrub	Terrestrial	Wild
239.	*Delonix elata* (L.) Gamble	Caesalpiniaceae	Tree	Terrestrial	Wild
240.	*Delonix regia* (Boj. ex Hook) Rafin.	Caesalpiniaceae	Tree	Terrestrial	Wild
241.	*Derris scandens* (Roxb.) Benth	Fabaceae	Straggler	Terrestrial	Wild
242.	*Desmostachya bipinnata* (L.) Stapf	Poaceae	Grass	Terrestrial	Wild
243.	*Dicanthium annulatum* (Forsk.) Stapf.	Poaceae	Grass	Terrestrial	Wild
244.	*Dichrostachys cinerea* (L.) Wight & Arn.	Mimosaceae	Shrub	Terrestrial	Wild
245.	*Dicoma tomentosa* Cass.	Asteraceae	Herb	Terrestrial	Wild
246.	*Digera muricata* (L.) Mart.	Amaranthaceae	Herb	Terrestrial	Wild
247.	*Digitaria bicornis* (Lam.) Roem. & Schult.	Poaceae	Grass	Terrestrial	Wild

Sl. No.	Species	Family	Habit	Habitat	Type
248.	*Dillenia indica* L.	Dilleniaceae	Tree	Terrestrial	Planted
249.	*Dinebra retroflexa* (Vahl) Panzer	Poaceae	Grass	Terrestrial	Wild
250.	*Diospyros buxifolia* (Blume) Hiern	Ebenaceae	Tree	Terrestrial	Wild
251.	*Diospyros chloroxylon* Roxb.	Ebenaceae	Tree	Terrestrial	Wild
252.	*Diospyros malabarica* (Desr.) Kostel.	Ebenaceae	Tree	Terrestrial	Wild
253.	*Diospyros melanoxylon* Roxb.	Ebenaceae	Tree	Terrestrial	Wild
254.	*Diplocyclos palmatus* (L.) Jeffrey	Cucurbitaceae	Climber	Terrestrial	Wild
255.	*Dodonaea viscosa* (L.) Jacq.	Sapindaceae	Shrub	Terrestrial	Wild
256.	*Echinochloa colona* (L.) Link	Poaceae	Grass	Semi-aquatic	Wild
257.	Echinochloa crus-gulli (L.) P. Beauv.	Poaceae	Grass	Semi-aquatic	Wild
258.	*Echinops echinatus* Roxb.	Asteraceae	Herb	Terrestrial	Wild
259.	*Eclipta prostrata* (L.) L.	Asteraceae	Herb	Semi-aquatic	Wild
260.	*Eichhornia crassipes* (Mart.) Solms-Laub.	Pontederiaceae	Herb	Aquatic	Wild
261.	*Eleusine indica* (L.) Gaertn.	Poaceae	Grass	Terrestrial	Wild
262.	*Elytraria acaulis* (L.f.) Lindau.	Acanthaceae	Herb	Terrestrial	Wild
263.	*Embelia ribes* Burm.f.	Myrisinaceae	Straggler	Terrestrial	Wild
264.	*Emilia sonchifolia* (L.) DC.	Asteraceae	Herb	Terrestrial	Wild
265.	*Enicostema axillare* (Lam.) Raynal	Gentianaceae	Herb	Terrestrial	Wild
266.	*Eragrostiella bifaria* (Vahl)	Poaceae	Grass	Terrestrial	Wild
267.	*Eragrostis maderaspatana* Bor	Poaceae	Grass	Terrestrial	Wild
268.	*Eragrostis minor* Host	Poaceae	Grass	Terrestrial	Wild
269.	*Eragrostis nigra* Nees ex Steud.	Poaceae	Grass	Terrestrial	Wild
270.	*Eragrostis nutans* (Retz.) Nees ex Steud.	Poaceae	Grass	Terrestrial	Wild
271.	*Eragrostis pilosa* P. Beauv	Poaceae	Grass	Terrestrial	Wild
272.	*Eragrostis* sp.	Poaceae	Grass	Terrestrial	Wild

Sl. No.	Species	Family	Habit	Habitat	Type
273.	*Eragrostis unioloides* (Retz.) Nees ex Steud.	Poaceae	Grass	Terrestrial	Wild
274.	*Eragrostis viscosa* (Retz.) Trin.	Poaceae	Grass	Terrestrial	Wild
275.	*Eremopogon foveolatus* (Del.) Stapf.	Poaceae	Grass	Terrestrial	Wild
276.	*Erythrina stricta* Roxb.	Fabaceae	Tree	Terrestrial	Planted
277.	*Erythroxylum monogynum* Roxb.	Erythroxylaceae	Tree	Terrestrial	Wild
278.	*Euphorbia geniculata* Ortega	Euphorbiaceae	Herb	Terrestrial	Wild
279.	*Euphorbia hirta* L.	Euphorbiaceae	Herb	Terrestrial	Wild
280.	*Euphorbia nivulia* L.	Euphorbiaceae	Shrub	Terrestrial	Wild
281.	*Euphorbia rosea* Retz.	Euphorbiaceae	Herb	Terrestrial	Wild
282.	*Euphorbia thymifolia* L.	Euphorbiaceae	Herb	Terrestrial	Wild
283.	*Euphorbia tirucalli* L.	Euphorbiaceae	Tree	Terrestrial	Wild
284.	*Euphorbia trigona* Mill.	Euphorbiaceae	Tree	Terrestrial	Wild
285.	*Evolvulus alsinoides* (L.) L.	Convolvulaceae	Herb	Terrestrial	Wild
286.	*Evolvulus nummularius* (L.) L.	Convolvulaceae	Herb	Terrestrial	Wild
287.	*Exocoecaria agallocha* Linn.	Euphorbiaceae	Tree	Aquatic	Wild
288.	*Ficus amplissima* J.E. Smith	Moraceae	Tree	Terrestrial	Wild
289.	*Ficus benghalensis* L.	Moraceae	Tree	Terrestrial	Wild
290.	*Ficus hispida* L.f.	Moraceae	Tree	Terrestrial	Wild
291.	*Ficus microcarpa* var. *microcarpa* L.f.	Moraceae	Tree	Terrestrial	Wild
292.	*Ficus microcarpa* var. *retusa* L.f.	Moraceae	Tree	Terrestrial	Wild
293.	*Ficus racemosa* L.	Moraceae	Tree	Terrestrial	Wild
294.	*Ficus religiosa* L.	Moraceae	Tree	Terrestrial	Wild
295.	*Ficus tinctoria* Forst.f.	Moraceae	Tree	Terrestrial	Wild
296.	*Ficus virens* Ait.	Moraceae	Tree	Terrestrial	Wild
297.	*Filicium decipiens* (Wight & Arn.) Thw.	Sapindaceae	Tree	Terrestrial	Wild

Sl. No.	Species	Family	Habit	Habitat	Type
298.	*Fimbristylis aestivalis* (Retz.) Vahl.	Cyperaceae	Herb	Terrestrial	Wild
299.	*Fimbristylis argentea* (Rottb.) Vahl.	Cyperaceae	Herb	Aquatic	Wild
300.	*Fimbristylis bisumbellata* (Forssk.) Bubani	Cyperaceae	Herb	Semi-aquatic	Wild
301.	*Fimbristylis complanata* (Retz.) Link.	Cyperaceae	Herb	Semi-aquatic	Wild
302.	*Fimbristylis dichotoma* (L.) Vahl.	Cyperaceae	Herb	Semi-aquatic	Wild
303.	*Fimbristylis falcata* (Vahl.) Kunth.	Cyperaceae	Herb	Terrestrial	Wild
304.	*Fimbristylis miliacea* (L.) Vahl.	Cyperaceae	Herb	Semi-aquatic	Wild
305.	*Fimbristylis ovata* (Burm. F.) Kern.	Cyperaceae	Herb	Terrestrial	Wild
306.	*Fimbristylis tetragona* R.Br.	Cyperaceae	Herb	Semi-aquatic	Wild
307.	*Flacourtia indica* (Burm.f.) Merr.	Flacourtiaceae	Tree	Terrestrial	Wild
308.	*Flacourtia ramontchi* L'Herit.	Flacourtiaceae	Tree	Terrestrial	Wild
309.	*Flueggea leucopyrus* Willd.	Euphorbiaceae	Shrub	Terrestrial	Wild
310.	*Flueggea virosa* (Willd.) Baill.	Euphorbiaceae	Shrub	Terrestrial	Wild
311.	*Galactia villosa* Wight & Arn.	Fabaceae	Straggler	Terrestrial	Wild
312.	*Gardenia latifolia* Ait.	Rubiaceae	Tree	Terrestrial	Wild
313.	*Giseckia pharnaceoides* L.	Aizoaceae	Herb	Terrestrial	Wild
314.	*Glinus lotoides* Linnaeus	Aizoaceae	Herb	Terrestrial	Wild
315.	*Gliricidia sepium* (Jacq.) Kunth ex Walp.	Fabaceae	Tree	Terrestrial	Exotic
316.	*Gloriosa superba* L.	Colchicaceae	Herb	Terrestrial	Wild
317.	*Glycosmis mauritiana* (Lam.) Tanaka	Rutaceae	Shrub	Terrestrial	Wild
318.	*Glycosmis pentaphylla* (Retz.) DC.	Rutaceae	Shrub	Terrestrial	Wild
319.	*Glycyrrhiza glabra* L.	Fabaceae	Straggler	Terrestrial	Wild
320.	*Gmelina arborea* Roxb.	Verbenaceae	Tree	Terrestrial	Wild
321.	*Gmelina asiatica* L.	Verbenaceae	Shrub	Terrestrial	Wild
322.	*Gnaphalium luteo-album* L.	Asteraceae	Herb	Terrestrial	Wild

Sl. No.	Species	Family	Habit	Habitat	Type
323.	*Gnaphalium polycaulon* Pers.	Asteraceae	Herb	Terrestrial	Wild
324.	*Gomphrena serrata* L.	Amaranthaceae	Herb	Terrestrial	Wild
325.	*Grangea maderaspatana* (L.) Poir.	Asteraceae	Herb	Terrestrial	Wild
326.	*Grewia hirsuta* Vahl.	Tiliaceae	Shrub	Terrestrial	Wild
327.	*Grewia tiliifolia* Vahl.	Tiliaceae	Tree	Terrestrial	Wild
328.	*Grewia villosa* Willd.	Tiliaceae	Shrub	Terrestrial	Wild
329.	*Guazuma ulmifolia* Lam.	Sterculiaceae	Tree	Terrestrial	Planted
330.	*Gymnema sylvestre* R. Br.	Asclepiadaceae	Straggler	Terrestrial	Wild
331.	*Hedyotis biflora* (L.) Lam.	Rubiaceae	Herb	Terrestrial	Wild
332.	*Hedyotis corymbosa* (L.) Lam.	Rubiaceae	Herb	Terrestrial	Wild
333.	*Helicteres isora* L.	Sterculiaceae	Shrub	Terrestrial	Wild
334.	*Heliotropium curasavicum* L.	Boraginaceae	Herb	Terrestrial	Wild
335.	*Heliotropium indicum* L.	Boraginaceae	Herb	Terrestrial	Wild
336.	*Hemidesmus indicus* (L.) R. Br.	Asclepiadaceae	Climber	Terrestrial	Wild
337.	*Heteropogon contortus* (L.) P.Beauv	Poaceae	Grass	Terrestrial	Wild
338.	*Hibiscus cannabinus* L.	Malvaceae	Shrub	Terrestrial	Planted
339.	*Hibiscus micranthus* L.f.	Malvaceae	Herb	Terrestrial	Wild
340.	*Hibiscus rosa-sinensis* Linn.	Malvaceae	Tree	Terrestrial	Planted
341.	*Hibiscus subdariffa* L.	Malvaceae	Shrub	Terrestrial	Planted
342.	*Hibiscus tiliaceus* L.	Malvaceae	Tree	Terrestrial	Wild
343.	*Hibiscus vitifolius* L.	Malvaceae	Shrub	Terrestrial	Wild
344.	*Holarrhena pubescens* (Buch. - Ham) Wall. ex G. Don	Apocynaceae	Shrub	Terrestrial	Wild
345.	*Holoptelea integrifolia* (Roxb.) Planch.	Ulmaceae	Tree	Terrestrial	Wild
346.	*Hugonia mystax* L.	Linaceae	Straggler	Terrestrial	Wild
347.	*Hybanthus enneaspermus* (L.) F. Muell.	Violaceae	Herb	Terrestrial	Wild

Sl. No.	Species	Family	Habit	Habitat	Type
348.	*Hydrilla verticillata* (L. f.) Royle	Hydrocharitaceae	Herb	Aquatic	Wild
349.	*Hygrophila auriculata* (Schum) Heine	Acanthaceae	Herb	Marshy	Wild
350.	*Hyptis suaveolens* (L.) Poit.	Lamiaceae	Herb	Terrestrial	Wild
351.	*Ichnocarpus frutescens* (L.) R.Br.	Asclepiadaceae	Climber	Terrestrial	Wild
352.	*Imperata cylindrica* (L.) Beauv.	Poaceae	Grass	Terrestrial	Wild
353.	*Indigofera caerulea* Roxb.	Fabaceae	Herb	Terrestrial	Wild
354.	*Indigofera linifolia* (L.f.) Retz.	Fabaceae	Herb	Terrestrial	Wild
355.	*Indigofera linnaei* Ali	Fabaceae	Herb	Terrestrial	Wild
356.	*Indigofera* sp.	Fabaceae	Herb	Terrestrial	Wild
357.	*Indigofera trifoliata* L.	Fabaceae	Herb	Terrestrial	Wild
358.	*Indigofera trita* L.f.	Fabaceae	Shrub	Terrestrial	Wild
359.	*Indoneesiella echioides* (L) Nees.	Acanthaceae	Herb	Terrestrial	Wild
360.	*Ipomoea alba* L.	Convolvulaceae	Climber	Terrestrial	Wild
361.	*Ipomoea aquatica* Forssk.	Convolvulaceae	Climber	Aquatic	Wild
362.	*Ipomoea biloba* Forssk.	Convolvulaceae	Climber	Marshy	Wild
363.	*Ipomoea carnea* Jacq.	Convolvulaceae	Shrub	Aquatic	Wild
364.	*Ipomoea hederifolia* L.	Convolvulaceae	Climber	Terrestrial	Wild
365.	*Ipomoea pes-tigridis* L.	Convolvulaceae	Climber	Terrestrial	Wild
366.	*Ipomoea staphylina* Roem. & Schultes	Convolvulaceae	Climber	Terrestrial	Wild
367.	*Ischaemum indicum* (Houtt.) Merr. var. *depressum* (Scribn. & J.G. Sm.) Rydb	Poaceae	Grass	Terrestrial	Wild
368.	*Ischaemum indicum* (Houtt.) Merr. var. *indicum*	Poaceae	Grass	Terrestrial	Wild
369.	*Iseilema anthephoroides* Hack.	Poaceae	Grass	Terrestrial	Wild
370.	*Iseilema laxum* Hack.	Poaceae	Grass	Terrestrial	Wild
371.	*Ixora arborea* Roxb. ex Sm.	Rubiaceae	Tree	Terrestrial	Wild

Sl. No.	Species	Family	Habit	Habitat	Type
372.	*Jacaranda mimosifolia* D.Don.	Bignoniaceae	Tree	Terrestrial	Ornamental
373.	*Jasminum auriculatum* Vahl	Oleaceae	Straggler	Terrestrial	Wild
374.	*Jatropha curcas* L.	Euphorbiaceae	Shrub	Terrestrial	Planted
375.	*Jatropha gossypifolia* L.	Euphorbiaceae	Shrub	Terrestrial	Wild
376.	*Jatropha tanjorensis* Ellis & Saroja	Euphorbiaceae	Shrub	Terrestrial	Wild
377.	*Justicia adhatoda* L.	Acanthaceae	Shrub	Terrestrial	Ornamental
378.	*Justicia betonica* Linn.	Acanthaceae	Shrub	Terrestrial	Wild
379.	*Justicia gendarussa* Burm.f.	Acanthaceae	Shrub	Terrestrial	Cultivated
380.	*Justicia* sp.	Acanthaceae	Herb	Terrestrial	Wild
381.	*Kedrostis foetidissima* (Jacq.) Cogn.	Cucurbitaceae	Climber	Terrestrial	Wild
382.	*Kigelia pinnata* (Jacq.) DC.	Bignoniaceae	Tree	Terrestrial	Planted
383.	*Kleinhovia hospita* L.	Sterculiaceae	Tree	Terrestrial	Planted
384.	*Kleinia grandiflora* (Wall. ex DC.) Rani	Asteraceae	Shrub	Terrestrial	Wild
385.	*Kyllingia nemoralis* (J. R. & G. Forst.) Dandy ex Hutchinson & Dalziel	Cyperaceae	Herb	Marshy	Wild
386.	*Lagascea mollis* Cav.	Asteraceae	Herb	Terrestrial	Wild
387.	*Lagerstroemia reginae* Roxb.	Lythraceae	Tree	Terrestrial	Ornamental
388.	*Lantana camara* L.	Verbenaceae	Shrub	Terrestrial	Exotic
389.	*Lantana wightiana* Wallich ex Gamble	Verbenaceae	Undershrub	Terrestrial	Wild
390.	*Lawsonia inermis* L.	Lythraceae	Shrub	Terrestrial	Planted
391.	*Lemna minor* L.	Lemnaceae	Herb	Aquatic	Wild
392.	*Leonotis nepetiifolia* (L.) R. Br.	Lamiaceae	Herb	Terrestrial	Wild
393.	*Lepisanthes tetraphylla* (Vahl.) Radlk.	Sapindaceae	Tree	Terrestrial	Wild
394.	*Leptadenia reticulata* Wight & Arn.	Asclepiadaceae	Climber	Terrestrial	Wild
395.	*Leucaena leucocephala* (L.) Gills	Mimosaceae	Tree	Terrestrial	Exotic

Sl. No.	Species	Family	Habit	Habitat	Type
396.	*Limonia acidissima* L.	Rutaceae	Tree	Terrestrial	Planted
397.	*Lindernia antipoda* (L.) Alston	Scrophulariaceae	Herb	Aquatic	Wild
398.	*Lindernia crustacea* (L.) F.v.Muell.	Scrophulariaceae	Herb	Aquatic	Wild
399.	*Lindernia hyssopioides* (L.) Haines	Scrophulariaceae	Herb	Aquatic	Wild
400.	*Lindernia parviflora* (Roxb.) Haines	Scrophulariaceae	Herb	Aquatic	Wild
401.	*Ludwigia adscendens* (L.) H. Hara	Onagraceae	Herb	Aquatic	Wild
402.	*Ludwigia perennis* L.	Onagraceae	Herb	Aquatic	Wild
403.	*Ludwigia peruviana* (L.) Hara	Onagraceae	Herb	Semi-aquatic	Wild
404.	*Madhuca longifolia* (J.Konig) J.F.Macbr.	Sapotaceae	Tree	Terrestrial	Wild
405.	*Malva* sp.	Malvaceae	Shrub	Aquatic	Exotic
406.	*Malvastrum coromandelianum* (L.) Garcke	Malvaceae	Herb	Terrestrial	Wild
407.	*Mangifera indica* L.	Anacardiaceae	Tree	Terrestrial	Planted
408.	*Manilkara hexandra* (Roxb.) Dubard	Sapotaceae	Tree	Terrestrial	Wild
409.	*Manisuris myuros* L.	Poaceae	Grass	Terrestrial	Wild
410.	*Markhamia stipulata* Seem.	Bignoniaceae	Tree	Terrestrial	Ornamental
411.	*Martynia annua* L.	Asteraceae	Herb	Terrestrial	Wild
412.	*Maytenus emarginata* (Willd.) Ding Hou	Celastraceae	Straggler	Terrestrial	Wild
413.	*Maytenus heyneana* (Roth) Raju & Babu	Celastraceae	Straggler	Terrestrial	Wild
414.	*Melia azedarach* L.	Meliaceae	Tree	Terrestrial	Ornamental
415.	*Memecylon edule* Roxb.	Melastomataceae	Tree	Terrestrial	Wild
416.	*Memecylon umbellatum* Burm.f.	Melastomataceae	Tree	Terrestrial	Wild
417.	*Merremia hastata* (Hallier f.) Ooststr.	Convolvulaceae	Herb	Terrestrial	Wild
418.	*Merremia tridentata* (L.) Hall.f.	Convolvulaceae	Herb	Terrestrial	Wild
419.	*Mikania cordata* (Burm. f.) Robinson	Asteraceae	Climber	Marshy	Wild
420.	*Millingtonia hortensis* L.f.	Bignoniaceae	Tree	Terrestrial	Ornamental

Sl. No.	Species	Family	Habit	Habitat	Type
421.	*Mimosa hamata* Willd.	Mimosaceae	Shrub	Terrestrial	Wild
422.	*Mimusops elengi* L.	Sapotaceae	Tree	Terrestrial	Ornamental
423.	*Mitragyna parvifolia* (Roxb.) Korth.	Rubiaceae	Tree	Terrestrial	Wild
424.	*Mollugo cerviana* (L.) Ser.	Aizoaceae	Herb	Terrestrial	Wild
425.	*Mollugo disticha* Ser.	Aizoaceae	Herb	Terrestrial	Wild
426.	*Mollugo nudicaulis* Lam.	Aizoaceae	Herb	Terrestrial	Wild
427.	*Mollugo pentaphylla* L.	Aizoaceae	Herb	Terrestrial	Wild
428.	*Momordica dioica* Roxb. ex. Willd.	Cucurbitaceae	Climber	Terrestrial	Wild
429.	*Monochoria hastata* (L.) Solms-Laub.	Pontederiaceae	Herb	Aquatic	Wild
430.	*Monochoria vaginalis* (Burm. F.) Presl	Pontederiaceae	Herb	Aquatic	Wild
431.	*Morinda pubescens* J.E. Smith.	Rubiaceae	Tree	Terrestrial	Wild
432.	*Moringa concanensis* Nimmo ex Dalz. & Gibs.	Moringaceae	Tree	Terrestrial	Wild
433.	*Moringa oleifera* Lam.	Moringaceae	Tree	Terrestrial	Cultivated
434.	*Mucuna monosperma* DC.	Fabaceae	Straggler	Terrestrial	Wild
435.	*Mucuna pruriens* (L.) DC.	Fabaceae	Shrub	Terrestrial	Wild
436.	*Mukia maderaspatana* (L.) M. Roem.	Cucurbitaceae	Climber	Terrestrial	Wild
437.	*Murraya koenigii* (L.) Spreng.	Rutaceae	Tree	Terrestrial	Planted
438.	*Murraya paniculata* (L.) Jack	Rutaceae	Shrub	Terrestrial	Ornamental
439.	*Musa parasidiaca* L.	Musaceae	Tree	Terrestrial	Planted
440.	*Najas indica* (Willd.) Cham.	Najadaceae	Herb	Aquatic	Wild
441.	*Najas marina* L.	Najadaceae	Herb	Aquatic	Wild
442.	*Najas minor* All.	Najadaceae	Herb	Aquatic	Wild
443.	*Naringi crenulata* (Roxb.) Nicolson	Rutaceae	Tree	Terrestrial	Wild
444.	*Nelumbo nucifera* Gaertn.	Nymphaeaceae	Herb	Aquatic	Wild
445.	*Neonotonia wightii* (Wight & Arn.) J.A. Lackey	Fabaceae	Straggler	Terrestrial	Wild

Sl. No.	Species	Family	Habit	Habitat	Type
446.	*Nothosaerva brachiata* (L.) Wight	Amaranthaceae	Herb	Terrestrial	Wild
447.	*Nyctanthes arbor-tristis* L.	Oleaceae	Tree	Terrestrial	Ornamental
448.	*Nymphaea nouchali* Burm. f.	Nymphaeaceae	Herb	Aquatic	Wild
449.	*Nymphaea pubescens* Willd.	Nymphaeaceae	Herb	Aquatic	Wild
450.	*Nymphaea rubra* Roxb. ex Salisb.	Nymphaeaceae	Herb	Aquatic	Wild
451.	*Nymphoides indicum* (L.) Kuntze	Menyanthaceae	Herb	Aquatic	Wild
452.	*Ocimum canum* Sims.	Lamiaceae	Herb	Terrestrial	Wild
453.	*Oldenlandia umbellata* L.	Rubiaceae	Herb	Terrestrial	Wild
454.	*Ophiuros exaltatus* (Linnaeus) Kuntze	Poaceae	Grass	Terrestrial	Wild
455.	*Oplismenus compositus* (L.) P. Beauv.	Poaceae	Grass	Terrestrial	Wild
456.	*Opuntia stricta* (Haw.) Haw.	Cactaceae	Shrub	Terrestrial	Wild
457.	*Oropetium thomaeum* (Linn.f.) Trin.	Poaceae	Grass	Terrestrial	Wild
458.	*Ottelia alismoides* (L.) Pers.	Hydrocharitaceae	Herb	Aquatic	Wild
459.	*Oxalis corniculata* L.	Oxalidaceae	Herb	Terrestrial	Wild
460.	*Oxystelma esculentum* R. Br.	Asclepiadaceae	Climber	Marshy	Wild
461.	*Pandanus odoratissimus* L.f.	Pandanaceae	Tree	Aquatic	Wild
462.	*Panicum miliaceum* L.	Poaceae	Grass	Terrestrial	Wild
463.	*Panicum notatum* Retz.	Poaceae	Grass	Terrestrial	Wild
464.	*Panicum paludosum* Roxb.	Poaceae	Grass	Terrestrial	Wild
465.	*Panicum psilopodium* Trin.	Poaceae	Grass	Terrestrial	Wild
466.	*Panicum repens* L.	Poaceae	Grass	Terrestrial	Wild
467.	*Panicum trypheron* Schult.	Poaceae	Grass	Semi-aquatic	Wild
468.	*Parkia biglandulosa* Wight Arn.	Mimosaceae	Tree	Terrestrial	Ornamental
469.	*Parkinsonia aculeata* L.	Fabaceae	Tree	Semi-aquatic	Wild
470.	*Parthenium hysterophorus* L.	Asteraceae	Herb	Terrestrial	Exotic

Sl. No.	Species	Family	Habit	Habitat	Type
471.	*Paspalidium flavidum* (Retz.) A. Camus.	Poaceae	Grass	Semi-aquatic	Wild
472.	*Paspalum scrobiculatum* L.	Poaceae	Grass	Semi-aquatic	Wild
473.	Passiflora edulis Sims	Passifloraceae	Climber	Terrestrial	Cultivated
474.	*Passiflora foetida* L.	Passifloraceae	Climber	Terrestrial	Wild
475.	*Pavetta indica* L.	Rubiaceae	Shrub	Terrestrial	Wild
476.	*Pavetta tomentosa* Roxb. ex J.E. Smith	Rubiaceae	Shrub	Terrestrial	Wild
477.	*Pavonia odorata* Willd.	Malvaceae	Herb	Terrestrial	Wild
478.	*Pavonia procumbens* (Wall ex Wight & Arn.) Walp.	Malvaceae	Herb	Terrestrial	Wild
479.	*Pavonia zeylanica* (L.) Cav.	Malvaceae	Herb	Terrestrial	Wild
480.	*Pedalium murex* L.	Pedaliaceae	Herb	Terrestrial	Wild
481.	*Peltophorum pterocarpum* (DC.)	Caesalpiniaceae	Tree	Terrestrial	Planted
482.	*Pennisetum americanum* (L.) R.Br.	Poaceae	Grass	Terrestrial	Cultivated
483.	*Pennisetum purpureum* Schum	Poaceae	Grass	Terrestrial	Planted
484.	*Pentatropis microphylla* L.	Asclepiadaceae	Climber	Terrestrial	Wild
485.	*Pergularia daemia* (Forrsk.) Chiov.	Asclepiadaceae	Climber	Terrestrial	Wild
486.	*Peristrophe bicalyculata* (Forssk.) Brummitt.	Acanthaceae	Herb	Terrestrial	Wild
487.	*Phoenix loureirii* Kunth.	Arecaceae	Shrub	Terrestrial	Wild
488.	*Phoenix sylvestris* (L.) Roxb.	Arecaceae	Tree	Terrestrial	Planted
489.	*Phragmites karka* Trin. ex Steud.	Poaceae	Grass	Semi-aquatic	Wild
490.	*Phyla nodiflora* (L.) E. Greene	Verbenaceae	Herb	Aquatic	Wild
491.	*Phyllanthus amarus* Schum. & Thonn.	Euphorbiaceae	Herb	Terrestrial	Wild
492.	*Phyllanthus emblica* L.	Euphorbiaceae	Tree	Terrestrial	Planted
493.	*Phyllanthus maderaspatensis* L.	Euphorbiaceae	Herb	Terrestrial	Wild
494.	*Phyllanthus polyphyllus* L.	Euphorbiaceae	Shrub	Terrestrial	Wild
495.	*Phyllanthus reticulatus* Poir.	Euphorbiaceae	Shrub	Terrestrial	Wild

Sl. No.	Species	Family	Habit	Habitat	Type
496.	*Phyllanthus rotundifolius* Klein ex Willd.	Euphorbiaceae	Herb	Terrestrial	Wild
497.	*Phyllanthus urinaria* L.	Euphorbiaceae	Herb	Terrestrial	Wild
498.	*Physalis minima* Linn.	Solanaceae	Herb	Terrestrial	Wild
499.	*Pisonia aculeata* L.	Nyctaginaceae	Tree	Terrestrial	Ornamental
500.	*Pistia stratiotes* L.	Araceae	Herb	Aquatic	Wild
501.	*Pithecellobium dulce* (Roxb.) Benth.	Mimosaceae	Tree	Terrestrial	Planted
502.	*Plecospermum spinosum* Trec.	Moraceae	Straggler	Terrestrial	Wild
503.	*Plumeria acuminata* Ait.	Apocynaceae	Tree	Terrestrial	Ornamental
504.	*Plumeria alba* L.	Apocynaceae	Tree	Terrestrial	Ornamental
505.	*Plumeria rubra* L.	Apocynaceae	Tree	Terrestrial	Ornamental
506.	*Polyalthia cerasoides* (Roxb.) Bedd.	Annonaceae	Tree	Terrestrial	Wild
507.	*Polyalthia longifolia* (Sonner.) Thw.	Annonaceae	Tree	Terrestrial	Ornamental
508.	*Polyalthia suberosa* (Roxb.) Thw.	Annonaceae	Tree	Terrestrial	Wild
509.	*Polycarpaea corymbosa* (L.) Lam.	Caryophyllaceae	Herb	Terrestrial	Wild
510.	*Polygonum barbatum*(L.) H.Hara var. *barbatum*	Polygonaceae	Shrub	Aquatic	Wild
511.	*Polygonum glabrum* Willdenow	Polygonaceae	Shrub	Aquatic	Wild
512.	*Polygonum hydropiper* L.	Polygonaceae	Shrub	Aquatic	Wild
513.	*Polygonum plebeium* R. Br.	Polygonaceae	Herb	Marshy	Wild
514.	*Polygonum* sp.	Polygonaceae	Straggler	Marshy	Wild
515.	*Pongamia pinnata* (L.) Pierre	Fabaceae	Tree	Terrestrial	Wild
516.	*Portulaca oleracea* L.	Portulacaceae	Herb	Terrestrial	Wild
517.	*Portulaca quadrifida* L.	Portulacaceae	Herb	Terrestrial	Wild
518.	*Potamogeton nodosus* Poir.	Potamogetonaceae	Herb	Aquatic	Wild
519.	*Premna tomentosa* L.	Verbenaceae	Tree	Terrestrial	Wild
520.	*Prosopis cineraria* (L.) Druce	Mimosaceae	Tree	Terrestrial	Wild

Sl. No.	Species	Family	Habit	Habitat	Type
521.	*Prosopis juliflora* (Sw.) Dc.	Mimosaceae	Tree	Terrestrial	Exotic
522.	*Pseudarthria viscida* (L) Wight & Arn.	Fabaceae	Herb	Terrestrial	Wild
523.	*Psilotrichum elliotii* Baker & Clarke	Amaranthaceae	Herb	Terrestrial	Wild
524.	*Pterocarpus marsupium* Roxb.	Fabaceae	Tree	Terrestrial	Wild
525.	*Pterocarpus santalinus* L.	Fabaceae	Tree	Terrestrial	Wild
526.	*Pterolobium hexapetalum* (Roth.) Sant. & Wagh	Fabaceae	Straggler	Terrestrial	Wild
527.	*Pterospermum acerifolium* (L.) Willd.	Sterculiaceae	Tree	Terrestrial	Wild
528.	*Pterospermum xylocarpum* (Gaertn) S & W.	Sterculiaceae	Tree	Terrestrial	Wild
529.	*Pulicaria wightiana* C.B. Clarke	Asteraceae	Herb	Terrestrial	Wild
530.	*Punica granatum* L.	Punicaceae	Tree	Terrestrial	Planted
531.	*Pupalia lappacea* (L.) Juss.	Amaranthaceae	Herb	Terrestrial	Wild
532.	*Pycreus globosus* (All.) Reichenb.	Cyperaceae	Herb	Marshy	Wild
533.	*Randia brandisii* Gamble	Rubiaceae	Shrub	Terrestrial	Wild
534.	*Randia dumetorum* (Retz.) Poiret.	Rubiaceae	Shrub	Terrestrial	Wild
535.	*Randia parviflora* (Thunb.) Lam.	Rubiaceae	Shrub	Terrestrial	Wild
536.	*Rauwolfia serpentina* (L.) Benth. ex Kurz.	Apocynaceae	Herb	Terrestrial	Wild
537.	*Ravenala madagascarensis* Sonner	Musaceae	Tree	Terrestrial	Planted
538.	*Rhizophora apiculata* Blume	Rhizophoraceae	Tree	Marshy	Wild
539.	*Rhynchosia capitata* DC.	Fabaceae	Herb	Terrestrial	Wild
540.	*Rhynchosia densiflora* (Roth) DC.	Fabaceae	Herb	Terrestrial	Wild
541.	*Rhynchosia minima* (L.) DC.	Fabaceae	Herb	Terrestrial	Wild
542.	*Ricinus communis* L.	Euphorbiaceae	Tree	Terrestrial	Cultivated
543.	*Rivea hypocrateriformis* (Desr.) Choisy	Convolvulaceae	Straggler	Terrestrial	Wild
544.	*Rottboellia cochinchinensis* (Lour.) Clayton	Poaceae	Grass	Terrestrial	Wild
545.	*Ruellia patula* Jacq.	Acanthaceae	Herb	Terrestrial	Wild

Sl. No.	Species	Family	Habit	Habitat	Type
546.	*Ruellia tuberosa* L.	Acanthaceae	Herb	Terrestrial	Wild
547.	*Saccharum officinarum* L.	Poaceae	Grass	Terrestrial	Cultivated
548.	*Saccharum spontaneum* Linn.	Poaceae	Shrub	Aquatic	Wild
549.	*Sacciolepis indica* (L.) Chase	Poaceae	Grass	Marshy	Wild
550.	*Salacia chinensis* L.	Hippocratiaceae	Straggler	Terrestrial	Wild
551.	*Salicornia brachiata* Miq.	Chenopodiaceae	Shrub	Semi-aquatic	Wild
552.	*Salix tetrasperma* Roxb.	Salicaceae	Tree	Aquatic	Wild
553.	*Salvinia molesta* D.Mitch.	Salviniaceae	Herb	Aquatic	Wild
554.	*Sansevieria roxburghiana* Schultes & Schultes	Dracaenaceae	Herb	Terrestrial	Wild
555.	*Sapindus emarginatus* Vahl.	Sapindaceae	Tree	Terrestrial	Wild
556.	*Scirpus articulatus* Linn.	Cyperaceae	Herb	Aquatic	Wild
557.	*Scleria lithosperma* (L.) Sw.	Cyperaceae	Herb	Marshy	Wild
558.	*Scoparia dulcis* L.	Scrophulariaceae	Herb	Semi-aquatic	Wild
559.	*Scutia myrtina* (Burm. f.) Kurz.	Rhamnaceae	Straggler	Terrestrial	Wild
560.	*Sebastiania chamaelea* (L.) Muell.-Arg.	Euphorbiaceae	Herb	Terrestrial	Wild
561.	*Sehima nervosum* (Rottl.) Stapf.	Poaceae	Grass	Terrestrial	Wild
562.	*Sehima sulcatum* (Hack.) A. Camus	Poaceae	Grass	Terrestrial	Wild
563.	*Senna alata* (L.) Roxb.	Caesalpiniaceae	Shrub	Terrestrial	Ornamental
564.	*Senna auriculata* (L.) Roxb.	Caesalpiniaceae	Shrub	Terrestrial	Wild
565.	*Senna hirsuta* (L.) Irwin & Barneby	Caesalpiniaceae	Herb	Terrestrial	Wild
566.	*Senna italica* Mill.	Caesalpiniaceae	Herb	Terrestrial	Wild
567.	*Senna occidentalis* (L.) Link	Caesalpiniaceae	Herb	Terrestrial	Wild
568.	*Senna tora* (L.) Roxb.	Caesalpiniaceae	Herb	Terrestrial	Wild
569.	*Sesamum indicum* L.	Pedaliaceae	Shrub	Terrestrial	Cultivated
570.	*Sesbania bispinosa* (Jacq.) W. F. Wight	Fabaceae	Tree	Terrestrial	Wild

Sl. No.	Species	Family	Habit	Habitat	Type
571.	*Sesuvium portulacastrum* (L.) L.	Aizoaceae	Herb	Terrestrial	Wild
572.	*Setaria italica* (L.) P. Beauv	Poaceae	Grass	Terrestrial	Wild
573.	*Sida acuta* Burm.f.	Malvaceae	Herb	Terrestrial	Wild
574.	*Sida cordata* (Burm. f.) Borss.	Malvaceae	Herb	Terrestrial	Wild
575.	*Sida cordifolia* L.	Malvaceae	Herb	Terrestrial	Wild
576.	*Sida rhombifolia* L. var. *retusa* (L.) Borss.	Malvaceae	Herb	Terrestrial	Wild
577.	*Sida rhombifolia* L. var. *rhombifolia*	Malvaceae	Herb	Terrestrial	Wild
578.	*Sida spinosa* Linn.	Malvaceae	Herb	Terrestrial	Wild
579.	*Solanum surattense* Burm. f.	Solanaceae	Herb	Terrestrial	Wild
580.	*Solanum trilobatum* L.	Solanaceae	Straggler	Terrestrial	Wild
581.	*Solena amplexicaulis* (Lam.) Gandhi	Cucurbitaceae	Climber	Terrestrial	Wild
582.	*Sonchus oleraceus* L.	Asteraceae	Herb	Terrestrial	Wild
583.	*Sonneratia apetala* Buch. - Ham.	Sonneratiaceae	Tree	Marshy	Wild
584.	*Sorghum bicolor* (L.) Moench	Poaceae	Grass	Terrestrial	Cultivated
585.	*Spermacoce hispida* L.	Rubiaceae	Herb	Terrestrial	Wild
586.	*Spermacoce ocymoides* Burm.f.	Rubiaceae	Herb	Terrestrial	Wild
587.	*Sphaeranthus indicus* Linn.	Asteraceae	Herb	Terrestrial	Wild
588.	*Spilanthes calva* DC.	Asteraceae	Herb	Marshy	Wild
589.	*Spilanthes uliginosa* Sw.	Asteraceae	Herb	Marshy	Wild
590.	*Spinifex littoreus* (Burm.f.) Merr.	Poaceae	Grass	Terrestrial	Wild
591.	*Spondias pinnata* Kurz.	Anacardiaceae	Tree	Terrestrial	Planted
592.	*Sporobolus coromandelianus* (Retz.) Kunth	Poaceae	Grass	Terrestrial	Wild
593.	*Sporobolus indicus* (L.) R.Br.	Poaceae	Grass	Terrestrial	Wild
594.	*Sporobolus spicatus* (Vahl.) Kunth	Poaceae	Grass	Terrestrial	Wild
595.	*Sporobolus wallichii* Munro ex Trimen	Poaceae	Grass	Terrestrial	Wild

Sl. No.	Species	Family	Habit	Habitat	Type
596.	*Stemodia viscosa* Roxb.	Scrophulariaceae	Herb	Marshy	Wild
597.	*Sterculia foetida* Linn.	Sterculiaceae	Tree	Terrestrial	Ornamental
598.	*Streblus asper* Lour.	Moraceae	Tree	Terrestrial	Wild
599.	*Striga asiatica* (L.) Kuntze	Scrophulariaceae	Herb	Terrestrial	Wild
600.	*Strychnos nux-vomica* L.	Loganiaceae	Tree	Terrestrial	Wild
601.	*Strychnos potatorum* L.	Loganiaceae	Tree	Terrestrial	Wild
602.	*Suaeda fruticosa* Forssk. ex J.F. Gmelin	Chenopodiaceae	Herb	Semi-aquatic	Wild
603.	*Suaeda nudiflora* (Willd) Moq.	Chenopodiaceae	Herb	Semi-aquatic	Wild
604.	*Suregada lanceolata*(Willd.) Kuntze	Euphorbiaceae	Tree	Terrestrial	Wild
605.	*Swietenia macrophylla* King	Meliaceae	Tree	Terrestrial	Planted
606.	*Swietenia mahagoni* (L.) Jacq.	Meliaceae	Tree	Terrestrial	Planted
607.	*Synedrella nodiflora* (L.) Gaertn.	Asteraceae	Herb	Terrestrial	Wild
608.	*Syzygium cumini* (L.) Skeels	Myrtaceae	Tree	Terrestrial	Planted
609.	*Tabebuia arjentea* Britton	Bignoniaceae	Tree	Terrestrial	Planted
610.	*Tabebuia rosea* (Bertol.) DC.	Bignoniaceae	Tree	Terrestrial	Planted
611.	*Tabernaemontana divaricata* (L.) R.Br.	Apocynaceae	Shrub	Terrestrial	Planted
612.	*Tamarindus indica* L.	Caesalpiniaceae	Tree	Terrestrial	Planted
613.	*Taraxacum officinale* F.H.Wigg	Asteraceae	Herb	Terrestrial	Wild
614.	*Tarenna asiatica* (L.) Kuntze ex K. Schum.	Rubiaceae	Shrub	Terrestrial	Wild
615.	*Tecoma stans* (L.) Kunth	Bignoniaceae	Tree	Terrestrial	Ornamental
616.	*Tectona grandis* L.f.	Verbenaceae	Tree	Terrestrial	Wild
617.	*Tephrosia purpurea* (L.) Pers.	Fabaceae	Herb	Terrestrial	Wild
618.	*Tephrosia villosa* (L.) Pers.	Fabaceae	Herb	Terrestrial	Wild
619.	*Terminalia arjuna* (Roxb.) Wight & Arn.	Myrtaceae	Tree	Terrestrial	Planted
620.	*Terminalia catappa* L.	Myrtaceae	Tree	Terrestrial	Ornamental

Sl. No.	Species	Family	Habit	Habitat	Type
621.	*Themeda quadrivalvis* (L.) Kuntze	Poaceae	Grass	Terrestrial	Wild
622.	*Themeda triandra* Forssk.	Poaceae	Grass	Terrestrial	Wild
623.	*Thespesia populnea* (L.) Soland ex Correa	Malvaceae	Tree	Terrestrial	Wild
624.	*Thevetia peruviana* K.Schum	Apocynaceae	Tree	Terrestrial	Wild
625.	*Tinospora cordifolia* (Willd.) Miers ex Hook. f. & Thoms.	Menispermaceae	Climber	Terrestrial	Wild
626.	*Tragia involucrata* L.	Euphorbiaceae	Straggler	Terrestrial	Wild
627.	*Tragia plukenetii* R. Smith	Euphorbiaceae	Straggler	Terrestrial	Wild
628.	*Trewia nudiflora* L.	Euphorbiaceae	Tree	Marshy	Wild
629.	*Trewia polycarpa* Benth.	Euphorbiaceae	Tree	Marshy	Wild
630.	*Trianthema triquetra* Rottl.	Aizoaceae	Herb	Terrestrial	Wild
631.	*Tribulus lanuginosis* L.	Zygophyllaceae	Herb	Terrestrial	Wild
632.	*Tribulus terrestris* L.	Zygophyllaceae	Herb	Terrestrial	Wild
633.	*Trichodesma indicum* (L.) R. Br.	Boraginaceae	Herb	Terrestrial	Wild
634.	*Tridax procumbens* L.	Asteraceae	Herb	Terrestrial	Wild
635.	*Triumfetta pentandra* A. Rich	Tiliaceae	Herb	Terrestrial	Wild
636.	*Triumfetta rhomboidea* Jacq.	Tiliaceae	Herb	Terrestrial	Wild
637.	*Triumfetta rotundifolia* Lam.	Tiliaceae	Herb	Terrestrial	Wild
638.	*Turnera subulata* Smith	Turneraceae	Herb	Terrestrial	Exotic
639.	*Typha angustifolia* L.	Typhaceae	Shrub	Aquatic	Wild
640.	*Urena lobata* L. subsp. lobata	Malvaceae	Herb	Terrestrial	Wild
641.	*Urena lobata* L. subsp. sinuata (L.) Borss.	Malvaceae	Herb	Terrestrial	Wild
642.	*Vallisneria spiralis* L.	Hydrocharitaceae	Herb	Aquatic	Wild
643.	*Vanda tessellata* (Roxb.) G.Don.	Orchidaceae	Herb	Epiphytic	Wild
644.	*Vernonia cinerea* (L.) Less.	Asteraceae	Herb	Terrestrial	Wild
645.	*Vetiveria zizanioides* (L.) Nash.	Poaceae	Grass	Marshy	Wild

Sl. No.	Species	Family	Habit	Habitat	Type
646.	*Vigna trilobata* (L.) Verdc.	Fabaceae	Herb	Terrestrial	Wild
647.	*Vitex altissima* L.f.	Verbenaceae	Tree	Marshy	Wild
648.	*Vitex leucoxylon* L.f.	Verbenaceae	Tree	Marshy	Wild
649.	*Vitex negundo* L. var. *negundo*	Verbenaceae	Tree	Terrestrial	Wild
650.	*Vitex negundo* L. var. *purpurascens* Sivar. & Moldenke	Verbenaceae	Tree	Terrestrial	Wild
651.	*Waltheria indica* L.	Sterculiaceae	Herb	Terrestrial	Wild
652.	*Wedelia chinensis* (Osbeck) Merr.	Asteraceae	Herb	Terrestrial	Wild
653.	*Wrightia arborea* (Dennst.) Mabberley	Apocynaceae	Tree	Terrestrial	Wild
654.	*Wrightia tinctoria* (Roxb.) R.Br.	Apocynaceae	Tree	Terrestrial	Wild
655.	*Xanthium indicum* Koen.	Asteraceae	Herb	Terrestrial	Wild
656.	*Youngia japonica* (L.) DC.	Asteraceae	Herb	Terrestrial	Wild
657.	*Ziziphus mauritiana* Lam.	Rhamnaceae	Tree	Terrestrial	Wild
658.	*Ziziphus nummularia* (Burm.f.) Wight & Arn.	Rhamnaceae	Shrub	Terrestrial	Wild
659.	*Ziziphus oenoplia* (L.) Mill.	Rhamnaceae	Straggler	Terrestrial	Wild
660.	*Zornia diphylla* (L.)	Fabaceae	Herb	Terrestrial	Wild
661.	*Zornia gibbosa* Span.	Fabaceae	Herb	Terrestrial	Wild
662.	*Zoysia matrella* (L.) Merr.	Poaceae	Grass	Marshy	Wild

Appendix 3 Birds recorded

Sl. No.	Family	English name	Scientific name	Habitat	Status	IUCN status	Guild	IWPA
1.	Psittacidae	Alexandrine Parakeet	*Psittacula eupatria*	T	R	LC	FR	S IV
2.	Dicruridae	Ashy Drongo	*Dicrurus leucophaeus*	T	R	LC	IN	S IV
3.	Sylviinae	Ashy Prinia	*Prinia socialis*	T	R	LC	IN	S IV
4.	Alaudidae	Ashy-crowned Sparrow Lark	*Eremopterix griseus*	T	R	LC	IN	S IV
5.	Cuculidae	Asian Koel	*Eudynamys scolopacea*	T	R	LC	FR	S IV
6.	Ciconiidae	Asian Openbill	*Anastomus oscitans*	A	R	LC	PR	S IV
7.	Apodidae	Asian Palm Swift	*Cypsiurus balasiensis*	T	R	LC	IN	S IV
8.	Campephagidae	Asian Paradise-flycatcher	*Terpsiphone paradisi*	T	R	LC	IN	S IV
9.	Sturnidae	Asian Pied Starling	*Sturnus contra*	T	R	LC	OM	S IV
10.	Hirundinidae	Barn Swallow	*Hirundo rustica*	T	R	LC	IN	S IV
11.	Ploceinae	Baya Weaver	*Ploceus philippinus*	T	R	LC	GR	S IV
12.	Laniidae	Bay-backed Shrike	*Lanius vittatus*	T	R	LC	IN	S IV
13.	Accipitridae	Besra	*Accipiter virgatus*	T	R	LC	PR	S IV
14.	Ardeidae	Black Bittern	*Dupetor flavicollis*	A	R	LC	PI	S IV
15.	Ardeidae	Black Crowned Night Heron	*Nycticorax nycticorax*	A	R	LC	PI	S IV
16.	Dicruridae	Black Drongo	*Dicrurus macrocercus*	T	R	LC	IN	S IV
17.	Accipitridae	Black Kite	*Milvus migrans*	T	R	LC	SC	S IV
18.	Laridae	Black-bellied Tern	*Sterna acuticauda*	A	R	NT	PI	S IV
19.	Alcedinidae	Black-capped Kingfisher	*Halcyon pileata*	A	R	LC	PI	S IV
20.	Alaudidae	Black-crowned Sparrow Lark	*Eremopterix nigriceps*	T	R	LC	IN	S IV
21.	Laridae	Black-headed Gull	*Larus ridibundus*	A	WV	LC	PI	S IV
22.	Threskiornithidae	Black-headed Ibis	*Threskiornis melanocephalus*	A	R	NT	PR	S IV
23.	Estrildidae	Black-headed Munia	*Lonchura malacca*	T	R	LC	GR	S IV
24.	Oriolidae	Black-hooded Oriole	*Oriolus xanthornus*	T	R	LC	OM	S IV
25.	Accipitridae	Black-shouldered Kite	*Elanus caeruleus*	T	R	LC	PR	S IV
26.	Recurvirostridae	Black-winged Stilt	*Himantopus himantopus*	A	R	LC	IN	S IV
27.	Turdinae	Blue-capped Rock Thrush	*Monticola cinclorhynchus*	T	SV	LC	IN	S IV
28.	Alcedinidae	Blue-eared Kingfisher	*Alcedo meninting*	A	R	LC	PI	S IV

Sl. No.	Family	English name	Scientific name	Habitat	Status	IUCN status	Guild	IWPA
29.	Cuculidae	Blue-faced Malkoha	*Phaenicophaeus viridirostris*	T	R	LC	FR	S IV
30.	Meropidae	Blue-tailed Bee-eater	*Merops philippinus*	T	R	LC	IN	S IV
31.	Sylviinae	Blyth's Reed Warbler	*Acrocephalus dumetorum*	T	WV	LC	IN	S IV
32.	Accipitridae	Brahminy Kite	*Haliastur indus*	T	R	LC	SC	S IV
33.	Sturnidae	Brahminy Starling	*Sturnus pagodarum*	T	R	LC	OM	S IV
34.	Jacanidae	Bronze-winged Jacana	*Metopidius indicus*	A	R	LC	OM	S IV
35.	Laniidae	Brown Shrike	*Lanius cristatus*	T	WV	LC	IN	S IV
36.	Capitonidae	Brown-headed Barbet	*Megalaima zeylanica*	T	R	LC	FR	S IV
37.	Laridae	Brown-headed Gull	*Larus brunnicephalus*	A	WV	LC	PI	S IV
38.	Ardeidae	Cattle Egret	*Bubulcus ibis*	A	R	LC	IN	S IV
39.	Meropidae	Chestnut-headed Bee-eater	*Merops leschenaulti*	T	R	LC	IN	S IV
40.	Ardeidae	Cinnamon Bittern	*Ixobrychus cinnamomeus*	A	R	LC	PI	S IV
41.	Motacillidae	Citrine Wagtail	*Motacilla citreola*	T	WV	LC	IN	S IV
42.	Rallidae	Common Coot	*Fulica atra*	A	R	LC	OM	S IV
43.	Picidae	Common Flameback	*Dinopium javanense*	T	R	LC	IN	S IV
44.	Scolopacidae	Common Greenshank	*Tringa nebularia*	A	WV	LC	IN	S IV
45.	Cuculidae	Common Hawk Cuckoo	*Hierococcyx varius*	T	R	LC	IN	S IV
46.	Upupidae	Common Hoopoe	*Upupa epops*	T	SV	LC	IN	S IV
47.	Irenidae	Common Iora	*Aegithina tiphia*	T	R	LC	IN	S IV
48.	Falconidae	Common Kestrel	*Falco tinnunculus*	T	WV	LC	PR	S IV
49.	Alcedinidae	Common Kingfisher	*Alcedo atthis*	A	R	LC	PI	S IV
50.	Rallidae	Common Moorhen	*Gallinula chloropus*	A	R	LC	OM	S IV
51.	Sturnidae	Common Myna	*Acridotheres tristis*	T	R	LC	OM	S IV
52.	Anatidae	Common Poachard	*Aythya ferina*	A	WV	LC	OM	S IV
53.	Scolopacidae	Common Redshank	*Tringa totanus*	A	WV	LC	IN	S IV
54.	Charadriidae	Common Ringed Plover	*Charadrius hiaticula*	A	WV	LC	IN	S IV
55.	Scolopacidae	Common Sandpiper	*Actitis hypoleucos*	A	WV	LC	IN	S IV
56.	Scolopacidae	Common Snipe	*Gallinago gallinago*	A	R	LC	IN	S IV
57.	Sylviinae	Common Tailorbird	*Orthotomus atrogularis*	T	R	LC	IN	S IV

Sl. No.	Family	English name	Scientific name	Habitat	Status	IUCN status	Guild	IWPA
58.	Anatidae	Common Teal	*Anas crecca*	A	WV	LC	OM	S IV
59.	Capitonidae	Coppersmith Barbet	*Megalaima haemacephala*	T	R	LC	FR	S IV
60.	Anatidae	Cotton Pygmy-Goose	*Nettapus coromandelianus*	A	R	LC	OM	S IV
61.	Hemiprocnidae	Crested Treeswift	*Hemiprocne coronata*	T	R	LC	IN	S IV
62.	Scolopacidae	Curlew Sandpiper	*Calidris ferruginea*	A	WV	LC	IN	S IV
63.	Anhingidae	Darter	*Anhinga melanogaster*	A	R	NT	PI	S IV
64.	Columbidae	Eurasian Collared Dove	*Streptopelia decaocta*	T	R	LC	GR	S IV
65.	Scolopacidae	Eurasian Curlew	*Numenius arquata*	A	WV	NT	IN	S IV
66.	Strigidae	Eurasian Eagle Owl	*Bubo bubo*	T	R	LC	PR	S IV
67.	Oriolidae	Eurasian Golden Oriole	*Oriolus oriolus*	T	SV	LC	OM	S IV
68.	Accipitridae	Eurasian Marsh Harrier	*Circus aeruginosus*	T	WV	LC	PR	S IV
69.	Accipitridae	Eurasian Sparrowhawk	*Accipiter nisus*	T	R	LC	PR	S IV
70.	Threskiornithidae	Eurasian Spoonbill	*Platalea leucorodia*	A	R	NT	OM	S I
71.	Anatidae	Eurasian Wigeon	*Anas penelope*	A	WV	LC	OM	S IV
72.	Anatidae	Fulvous Whistling Duck	*Dendrocygna bicolor*	A	R	LC	OM	S IV
73.	Anatidae	Gargany Teal	*Anas querquedula*	A	WV	LC	OM	S IV
74.	Phalacrocoracidae	Great Cormorant	*Phalacrocorax carbo*	A	R	LC	PI	S IV
75.	Podicipedidae	Great Crested Grebe	*Podiceps cristatus*	A	WV	LC	PI	S IV
76.	Laridae	Great Crested Tern	*Sterna bergii*	A	R	LC	PI	S IV
77.	Cuculidae	Greater Coucal	*Centropus sinensis*	T	R	LC	IN	S IV
78.	Ardeidae	Greater Egret	*Casmerodius albus*	A	R	LC	IN	S IV
79.	Estrildidae	Green Avadavat	*Amandava formosa*	T	R	VU	GR	S IV
80.	Scolopacidae	Green Sandpiper	*Tringa ochropus*	A	WV	LC	IN	S IV
81.	Phasianidae	Grey Francolin	*Francolinus pondicerianus*	T	R	LC	OM	S IV
82.	Ardeidae	Grey Heron	*Ardea cinerea*	A	R	LC	PI	S IV
83.	Motacillidae	Grey Wagtail	*Motacilla cinerea*	T	WV	LC	IN	S IV
84.	Charadriidae	Grey-headed Lapwing	*Vanellus cinereus*	A	WV	LC	IN	S IV
85.	Corvidae	House Crow	*Corvus splendens*	T	R	LC	SC	S IV
86.	Passerinae	House Sparrow	*Passer domesticus*	T	R	LC	GR	S IV

Sl. No.	Family	English name	Scientific name	Habitat	Status	IUCN status	Guild	IWPA
87.	Apodidae	House Swift	*Apus affinis*	T	R	LC	IN	S IV
88.	Phalacrocoracidae	Indian Cormorant	*Phalacrocorax fuscicollis*	A	R	LC	PI	S IV
89.	Bucerotidae	Indian Grey Hornbill	*Ocyceros birostris*	T	R	LC	FR	S IV
90.	Caprimulgidae	Indian Nightjar	*Caprimulgus asiaticus*	T	R	LC	IN	S IV
91.	Phasianidae	Indian Peafowl	*Pavo cristatus*	T	R	LC	OM	S I
92.	Pittidae	Indian Pitta	*Pitta brachyura*	T	R	LC	IN	S IV
93.	Ardeidae	Indian Pond Heron	*Ardeola grayli*	A	R	LC	PI	S IV
94.	Turdinae	Indian Robin	*Saxicoloides fulicata*	T	R	LC	IN	S IV
95.	Coraciidae	Indian Roller	*Coracias benghalensis*	T	R	LC	IN	S IV
96.	Estrildidae	Indian Silverbill	*Lonchura malabarica*	T	R	LC	GR	S IV
97.	Ardeidae	Intermediate Egret	*Mesophoyx intermedia*	A	R	LC	IN	S IV
98.	Scolopacidae	Jack Snipe	*Lymnocryptes minimus*	A	WV	LC	IN	S IV
99.	Timaliinae	Jungle Babbler	*Turdoides striatus*	T	R	LC	IN	S IV
100.	Corvidae	Jungle Crow	*Corvus macrorhynchos*	T	R	LC	SC	S IV
101.	Sturnidae	Jungle Myna	*Acridotheres fuscus*	T	R	LC	OM	S IV
102.	Sylviinae	Jungle Prinia	*Prinia sylvatica*	T	R	LC	IN	S IV
103.	Scolopacidae	Kentish Plover	*Charadrius alexandrinus*	A	WV	LC	IN	S IV
104.	Campephagidae	Large Cuckooshrike	*Coracina macei*	T	R	LC	IN	S IV
105.	Turdinae	Large Grey Babbler	*Turdoides malcolmi*	T	R	LC	IN	S IV
106.	Columbidae	Laughing Dove	*Streptopelia senegalensis*	T	R	LC	GR	S IV
107.	Cuculidae	Lesser Coucal	*Centropus bengalensis*	T	R	LC	IN	S IV
108.	Anatidae	Lesser Whistling Duck	*Dendrocygna javanica*	A	R	LC	OM	S IV
109.	Laridae	Lesser-crested Tern	*Sterna bengalensis*	A	WV	LC	PI	S IV
110.	Phalacrocoracidae	Little Cormorant	*Phalacrocorax niger*	A	R	LC	PI	S IV
111.	Ardeidae	Little Egret	*Egretta garzetta*	A	R	LC	IN	S IV
112.	Podicipedidae	Little Grebe	*Tachybaptus ruficollis*	A	R	LC	PI	S IV
113.	Ardeidae	Little Heron	*Butorides striata*	A	R	LC	PI	S IV
114.	Scolopacidae	Little Ringed Plover	*Charadrius dubius*	A	R	LC	IN	S IV
115.	Scolopacidae	Little Stint	*Calidris minuta*	A	WV	LC	IN	S IV

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116.	Laniidae	Long-tailed Shrike	*Lanius schach*	T	R	LC	IN	S IV
117.	Nectariniidae	Loten's Sunbird	*Nectarinia lotenia*	T	R	LC	NE	S IV
118.	Scolopacidae	Marsh Sandpiper	*Tringa stagnatilis*	A	WV	LC	IN	S IV
119.	Anatidae	Northern Pintail	*Anas acuta*	A	WV	LC	OM	S IV
120.	Anatidae	Northern Shoveler	*Anas clypeata*	A	WV	LC	OM	S IV
121.	Turdinae	Orange-headed Thrush	*Zoothera citrina*	T	R	LC	IN	S IV
122.	Turdinae	Oriental Magpie Robin	*Copsychus saularis*	T	R	LC	IN	S IV
123.	Pandionidae	Osprey	*Pandion haliaetus*	T	WV	LC	PR	S I
124.	Motacillidae	Paddyfield Pipit	*Anthus rufulus*	T	R	LC	IN	S IV
125.	Ciconiidae	Painted Stork	*Mycteria leucocephala*	A	R	NT	PR	S IV
126.	Accipitridae	Palla's Fish Eagle	*Haliaeetus leucoryphus*	T	R	VU	PR	S IV
127.	Accipitridae	Pallid Harrier	*Circus macrourus*	T	WV	NT	PR	S IV
128.	Jacanidae	Pheasant Tailed Jacana	*Hydrophasianus chirurgus*	A	R	LC	OM	S IV
129.	Scolopacidae	Pied Avocet	*Recurvirostra avosetta*	A	WV	LC	IN	S IV
130.	Turdinae	Pied Bushchat	*Saxicola caprata*	T	R	LC	IN	S IV
131.	Cuculidae	Pied Cuckoo	*Clamator jacobinus*	T	R	LC	IN	S IV
132.	Accipitridae	Pied Harrier	*Circus melanoleucos*	T	R	LC	PR	S IV
133.	Alcedinidae	Pied Kingfisher	*Ceryle rudis*	A	R	LC	PI	S IV
134.	Scolopacidae	Pintail Snipe	*Gallinago stenura*	A	WV	LC	IN	S IV
135.	Sylviinae	Plain Prinia	*Prinia inornata*	T	R	LC	IN	S IV
136.	Psittacidae	Plum-headed Parakeet	*Psittacula cyanocephala*	T	R	LC	FR	S IV
137.	Ardeidae	Purple Heron	*Ardea purpurea*	A	R	LC	PI	S IV
138.	Nectariniidae	Purple Sunbird	*Nectarinia asiatica*	T	R	LC	NE	S IV
139.	Rallidae	Purple Swamphen	*Porphyrio porphyrio*	A	R	LC	OM	S IV
140.	Nectariniidae	Purple-rumped Sunbird	*Nectarinia zeylonica*	T	R	LC	NE	S IV
141.	Estrildidae	Red Avadavat	*Amandava amandava*	T	R	LC	GR	S IV
142.	Columbidae	Red Collared Dove	*Streptopelia tranquebarica*	T	R	LC	GR	S IV
143.	Anatidae	Red-crested Pochard	*Rhodonessa rufina*	A	WV	LC	OM	S IV
144.	Hirundinidae	Red-rumped Swallow	*Hirundo daurica*	T	R	LC	IN	S IV

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145.	Pycnonotidae	Red-vented Bulbul	*Pycnonotus cafer*	T	R	LC	FR	S IV
146.	Charadriidae	Red-wattled Lapwing	*Vanellus indicus*	A	R	LC	IN	S IV
147.	Charadriidae	River Lapwing	*Vanellus duvaucalii*	A	R	LC	IN	S IV
148.	Laridae	River Tern	*Sterna aurantia*	A	R	LC	PI	S IV
149.	Columbidae	Rock Pigeon	*Columba livia*	T	R	LC	GR	S IV
150.	Psittacidae	Rose-ringed Parakeet	*Psittacula krameri*	T	R	LC	FR	S IV
151.	Sturnidae	Rosy Starling	*Sturnus roseus*	T	WV	LC	FR	S IV
152.	Corvidae	Rufous Treepie	*Dendrocitta vagabunda*	T	R	LC	OM	S IV
153.	Estrildidae	Scaly-breasted Munia	*Lonchura punctulata*	T	R	LC	GR	S IV
154.	Accipitridae	Shikra	*Accipiter badius*	T	R	LC	PR	S IV
155.	Meropidae	Small Green Bee-eater	*Merops orientalis*	T	R/SV	LC	IN	S IV
156.	Campephagidae	Small Minivet	*Pericrocotus cinnamomeus*	T	R	LC	IN	S IV
157.	Anatidae	Spot-billed Duck	*Anas poecilorhyncha*	A	R	LC	OM	S IV
158.	Pelecanidae	Spot-billed Pelican	*Pelecanus philippensis*	A	R	NT	PI	S IV
159.	Columbidae	Spotted Dove	*Streptopelia chinensis*	T	R	LC	GR	S IV
160.	Strigidae	Spotted Owlet	*Athene brama*	T	R	LC	PR	S IV
161.	Scolopacidae	Spotted Redshank	*Tringa erythropus*	A	WV	LC	IN	S IV
162.	Alcedinidae	Stork-billed Kingfisher	*Halcyon capensis*	A	R	LC	PI	S IV
163.	Scolopacidae	Temminck's Stint	*Calidris temminckii*	A	WV	LC	IN	S IV
164.	Dicaeidae	Thick-billed Flowerpecker	*Dicaeum agile*	T	R	LC	NE	S IV
165.	Dicaeidae	Tickell's Flowerpecker	*Dicaeum erythrorynchos*	T	R	LC	NE	S IV
166.	Anatidae	Tufted Duck	*Aythya fuligula*	A	WV	LC	OM	S IV
167.	Scolopacidae	Whimbrel	*Numenius phaeopus*	A	WV	LC	IN	S IV
168.	Laridae	Whiskered Tern	*Chlidonias hybridus*	A	R	LC	PI	S IV
169.	Dicruridae	White-bellied Drongo	*Dicrurus caerulescens*	T	R	LC	IN	S IV
170.	Accipitridae	White-bellied Sea Eagle	*Haliaeetus leucogaster*	T	R	LC	PR	S I
171.	Alcedinidae	White-breasted Kingfisher	*Halcyon smyrnensis*	A	R	LC	PI	S IV
172.	Rallidae	White-breasted Waterhen	*Amaurornis phoenicurus*	A	R	LC	IN	S IV
173.	Pycnonotidae	White-browed Bulbul	*Pycnonotus luteolus*	T	R	LC	FR	S IV

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174.	Motacillidae	White-browed Wagtail	*Motacilla maderaspatensis*	T	R	LC	IN	S IV
175.	Timaliinae	White-headed Babbler	*Turdoides affinis*	T	R	LC	IN	S IV
176.	Hirundinidae	Wire-tailed Swallow	*Hirundo smithii*	T	R	LC	IN	S IV
177.	Scolopacidae	Wood Sandpiper	*Tringa glariola*	A	WV	LC	IN	S IV
178.	Ardeidae	Yellow Bittern	*Ixobrychus sinensis*	A	R	LC	PI	S IV
179.	Motacillidae	Yellow Wagtail	*Motacilla flava*	T	WV	LC	IN	S IV
180.	Charadriidae	Yellow-wattled Lapwing	*Vanellus malabaricus*	A	R	LC	IN	S IV
181.	Scolopacidae	*Lesser Sand Plover	*Charadrius mongolus*	A	R	LC	IN	S IV
182.	Scolopacidae	*Greater Sand Plover	*Charadrius leschenaultii*	A	WV	LC	IN	S IV
183.	Scolopacidae	*Dunlin	*Calidris alpina*	A	WV	LC	IN	S IV
184.	Scolopacidae	*Ruddy Turnstone	*Arenaria interpres*	A	WV	LC	IN	S IV
185.	Scolopacidae	*Grey Plover	*Pluvialis squatarola*	A	WV	LC	IN	S IV
186.	Scolopacidae	*Pacific Golden Plover	*Pluvialis fulva*	A	WV	LC	IN	S IV
187.	Scolopacidae	*Asian Dowitcher	*Limnodromus semipalmatus*	A	WV	NT	IN	S IV
188.	Scolopacidae	*Black-tailed Godwit	*Limosa limosa*	A	WV	LC	IN	S IV
189.	Scolopacidae	*Bar-tailed Godwit	*Limosa lapponica*	A	WV	LC	IN	S IV
190.	Anatidae	*Ruddy Shelduck	*Tadorna ferruginea*	A	WV	LC	OM	S IV
191.	Anatidae	*Gadwall	*Anas strepera*	A	WV	LC	OM	S IV
192.	Anatidae	*Bar-headed Goose	*Anser indicus*	A	WV	LC	OM	S IV
193.	Anatidae	*Comb Duck	*Sarkidiornis melanotos*	A	R	LC	OM	S IV
194.	Phoenicopteridae	*Greater Flamingo	*Phoenicopterus roses*	A	R/WV	LC	OM	S IV
195.	Gruidae	*Sarus Crane	*Grus antigone*	T	R	VU	OM	S IV
196.	Ciconiidae	*Woolly-necked Stork	*Ciconia episcopus*	A	R	LC	PR	S IV
197.	Anatidae	*White Eye Pochard	*Aythya nyroca*	A	WV	NT.	OM	S IV
198.	Anatidae	*Bear's Poachard	*Aythya baeri*	A	WV	EN	OM	S IV
199.	Anatidae	*Ferruginous Poachard	*Aythya nyroca*	A	WV	NT	OM	S IV
200.	Rallidae	*Blue-breasted Banded Rail	*Rallus striatus*	A	R	LC	OM	S IV
201.	Rallidae	*Ballions Crake	*Porzana pusilla*	A	WV	LC	OM	S IV
202.	Rallidae	*Brown Crake	*Amaluromis akool*	A	R	LC	OM	S IV

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203.	Scolopacidae	*Wood Snipe	*Gallnago nemoricola*	A	R	LC	IN	S IV
204.	Alaudidae	*Bush lark	*Mirafra assamica*	T	R	LC	IN	S IV
205.	Alaudidae	*Rufous Tailed Finch Lark	*Ammomanes phoenicurus*	T	R	LC	IN	S IV
206.	Alaudidae	*Common crested lark	*Galerida cristata*	T	R	LC	IN	S IV
207.	Alaudidae	*Small Sky Lark	*Alauda gulgula*	T	R/WV	LC	IN	S IV
208.	Tytonidae	*Barn Owl	*Tyto alba*	T	R	LC	PR	S IV
209.	Falconidae	*Peregrine Falcon	*Falco peregrinus*	T	R	LC	PR	S IV
210.	Cuculidae	*Plaintive Cuckoo	*Cacomantis merulinus*	T	R	LC	IN	S IV
211.	Turdinae	*Indian Blue Robin	*Luscinia brunnea*	T	R	LC	IN	S IV
212.	Apodidae	*White-rumped Needletail	*Zoonavena sylvatica*	T	R	LC	IN	S IV
213.	Campephagidae	*Black-headed Cuckoo-shrike	*Coracina melanoptera*	T	R	LC	OM	S IV
214.	Timaliinae	*Common Babbler	*Turdoides caudatus*	T	R	LC	OM	S IV
215.	Gruidae	*Common Crane	*Grus grus*	T	WV	LC	OM	S IV
216.	Irenidae	*Blue-winged Leafbird	*Chloropsis cochinchinsis*	T	R	LC	OM	S IV
217.	Irenidae	*Golden-fronted Leafbird	*Chloropsis aurifrons*	T	R	LC	OM	S IV
218.	Dicruridae	*Greater Racket-tailed Drongo	*Dicrurus pardiseus*	T	R	LC	IN	S IV
219.	Cuculidae	*Indian Cuckoo	*Cuculus micropterus*	T	R	LC	IN	S IV
220.	Strigidae	*Jungle Owlet	*Glaucidium radiatum*	T	R	LC	PR	S IV
221.	Burhinidae	*Eurasian Thick-knee	*Burhinus oedicnemus*	T	R	LC	OM	S IV
222.	Accipitridae	*Greater Grey-headed Fish Eagle	*Ichthyophagia ichthyaetus*	A	R	NT	PR	S IV
223.	Phasianidae	*Grey Junglefowl	*Gallus sonneratii*	T	R	LC	OM	S IV
224.	Phasianidae	*Grey Francolin	*Francolinus pondicerianus*	T	R	LC	OM	S IV
225.	Picidae	*Brown -Caped Pygmy Woodpecker	*Dendrocopos nanus*	T	R	LC	OM	S IV
226.	Accipitridae	*Egyptian Vulture	*Neophron percnopterus*	T	R	LC	SC	S IV
227.	Accipitridae	*Short-toed Snake Eagle	*Circaetus gallicus*	T	R	LC	PR	S IV
228.	Ploceinae	*Streaked Weaver	*Ploceus manyar*	T	R	LC	GR	S IV
229.	Rallidae	*Watercock	*Gallicrex cinerea*	A	R	LC	PI	S IV
230.	Ciconiidae	*White Stork	*Ciconia ciconia*	A	R/WV	LC	PI	S IV
231.	Ciconiidae	*Black-necked Stork	*Ephippiorhynchus asiaticus*	A	R	NT	PI	S IV

Sl. No.	Family	English name	Scientific name	Habitat	Status	IUCN status	Guild	IWPA
232.	Ciconiidae	*Lesser Adjudant	*Leptoptilos javanicus*	A	R	VU	PI	S IV
233.	Threskiornithidae	*Black Ibis	*Pseudibis papillosa*	A	R	LC	OM	S IV
234.	Threskiornithidae	*Glossy Ibis	*Plegadis falcinellus*	A	R/WV	LC	OM	S IV
235.	Accipitridae	*White-eyed Buzzard	*Butastur teesa*	T	R	LC	PR	S IV
236.	Columbidae	*Yellow-footed Green Piegeon	*Treron phoenicoptera*	T	R	LC	GR	S IV

Where: T-Terrestrial; W-water bird; R-Resident; WR-Widespread resident; WV-Winter visitor; SV-Summer visitor; WWV-Wisespread winter visitor; BR-Breading resident; LC-Least concern; VU-Vulnerable; EN-Endangered; NT-Near threatened; IN-Insectivorous; OM-Omnivorus; PR-Predators; FR-Frugivorous; PI-Piscivorous; GR-Granivorous; NE-Nectarivorous; SC-Scavengers; S I-Schedule I; S IV-Schedule IV; IWPA-Indian Wildlife Protection Act.

ANNEXURE 1

[TO BE PUBLISHED IN THE GAZETTE OF INDIA, PART II, SECTION 3, SUBSECTION (ii)]

GOVERNMENT OF INDIA

MIINSTRY OF ENVIRONMENT AND FORESTS

NOTIFICATION

New Delhi the ..... of November, 2010

G.S.R. --------- **WHEREAS** the wetlands, vital parts of the hydrological cycle, are highly productive, support exceptionally large biological diversity and provide a wide range of ecosystem services, such as waste assimilation, water purification, flood mitigation, erosion control, ground water recharge, microclimate regulation, aesthetic enhancement of the landscape while simultaneously supporting many significant recreational, social and cultural activities, besides being a part of the cultural heritage;

AND WHEREAS many wetlands are seriously threatened by reclamation through drainage and landfill, pollution (discharge of domestic and industrial effluents, disposal of solid wastes), hydrological alterations (water withdrawal and inflow changes) and over-exploitation of their natural resources resulting In loss of biodiversity and disruption in goods and services provided by wetlands;

AND WHEREAS India is a signatory to the Ramsar Convention for the conservation and wise use of wetlands, which includes in its ambit a wide variety of habitats, such as rivers and lakes, coastal lagoons, mangroves, peatlands, coral reefs, and numerous man-made wetlands, such as ponds, farm ponds, irrigated agricultural lands, sacred groves, salt pans, reservoirs, gravel pits, sewage farms, and canals;

AND WHEREAS the Central Government has identified certain wetlands for conservation and management under its conservation programme and provides financial and technical assistance to the State Governments and Union territory Administrations for various conservation activities through approval of the Management Action Plans;

AND WHEREAS the National Environment Policy, 2006 recognises the ecological services provided by wetlands and emphasizes the need to set up a regulatory mechanism consistent with the Ramsar Convention to maintain the ecological character of the identified wetlands and develop a national inventory of such wetlands;

NOW, THEREFORE, in exercise of the powers conferred by section 25, read with sub-section (1) and clause (v) of sub-section (2) and sub section (3) of section 3 of the Environment (Protection) Act, 1986 (29 of 1986), the Central Government hereby makes the following rules for conservation and management of wetlands, namely:-

1. Short title and commencement

1. These rules may be called the Wetlands (Conservation and Management) Rules,

2010.

2. They shall come into force on the date of their publication in the Official Gazette.

2. **Definitions-(1) In these rules, unless the context otherwise requires**

(a) "Act" means the Environment (Protection) Act, 1986 (29 of 1986);

(b) "Authority" means the Central Wetlands Regulatory Authority constituted under rule 5;

(c) "dredging" means an excavation activity or operation usually carried out at least partly underwater, in shallow sea or fresh water areas with the purpose of gathering up bottom sediments and disposing them off at a different location;

(d) "National Park" means an area declared, as National Park under section 35 or section 38, or deemed to be declared as a National Park under sub-section (3) of section 66, of the Wild Life (Protection) Act, 1972 (35 of 1972);

(e) "Ramsar Convention" means the Convention on Wetlands signed at Ramsar, Iran in 1971;

(f) "UNESCO" means the United Nations Educational Scientific and Cultural Organisation;

(g) "wetland" means an area or of marsh, fen, peatland or water; natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water, the depth of which at low tide does not exceed six meters and includes all inland waters such as lakes, reservoirs, tanks, backwaters, lagoon, creeks, estuaries and manmade wetland and the zone of direct influence on wetlands that is to say the drainage area or catchment region of the wetlands as determined by the authority but does not include main river channels, paddy fields and the coastal wetland covered under the notification of the Government of India in the Ministry of Environment and Forest, S.O. number 114 (E) dated the 19th February, 1991 published in the Gazette of India, Extraordinary, Part II, Section 3, Sub-section (ii) of dated the 20th February, 1991;

(h) "Wildlife sanctuary" means an area declared as a wildlife sanctuary under the provisions of Chapter IV of the Wildlife (Protection) Act, 1972 (35 of 1972) and shall include an area deemed to be sanctuary under sub section (4) of section 66, of the said Act.

The word and expressions used in these rules and not defined but defined in the Act, shall have the meaning respectively assigned to them in the Act.

3. Protected wetlands

Based on the significance of the functions performed by the wetlands for overall well being of the people and for determining the extent and level of regulation, the following wetlands shall be regulated under these rules, namely:-

i. wetlands categorised as Ramsar wetlands of International Importance under the

Ramsar Convention as specified in the Schedule.

ii. wetlands in areas that are ecologically sensitive and important, such as, national parks, marine parks, sanctuaries, reserved forests, wildlife habitats, mangroves, corals, coral reefs, areas of outstanding natural beauty or historical or heritage areas and the areas rich in genetic diversity;

iii. wetlands recognised as or lying within a UNESCO World Heritage Site;

iv. high altitude wetlands or high altitude wetland complexes at or above an elevation of two thousand five hundred metres with an area equal to or greater than five ha;

v. wetlands or wetland complexes below an elevation of two thousand five hundred metres with an area equal to or greater than five hundred ha.

vi. any other wetland as so identified by the Authority and thereafter notified by the Central Government under the provisions of the Act for the purposes of these rules.

4. Restrictions on activities within wetlands

(1). The following activities within the wetlands shall be prohibited, namely:-

(i) reclamation of wetlands;

(ii) setting up of new industries and expansion of existing industries;

(iii) manufacture or handling or storage or disposal of hazardous substances covered under the Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 notified vide S.O. number 966 (E) dated the 27th November, 1989 or the Rules for Manufacture, Use, Import, Export and Storage of Hazardous Micro-organisms/Genetically engineered organisms or cells notified vide GSR number 1037 (E) dated the 5th December, 1989 or the Hazardous Wastes (Management, Handling and Transboundry Movement) Rules, 2008 notified vide S.O. number 2265 (E), dated the 24th September, 2008;

(iv) solid waste dumping: provided that the existing practices, if any, existed before the commencement of these rules shall be phased out within a period not exceeding six months from the date of commencement of these rules;

(v) discharge of untreated wastes and effluents from industries, cities or towns and other human settlements: provided that the practices, if any, existed before the commencement of these rules shall be phased out within a period not exceeding one year from the date of commencement of these rules;

(vi) any construction of a permanent nature except for boat jetties within fifty metres from the mean high flood level observed in the past ten years calculated from the date of commencement of these rules.

(vii) any other activity likely to have an adverse impact on the ecosystem of the wetland to be specified in writing by the Authority constituted in accordance with these rules.

(2) The following activities shall not be undertaken without the prior approval of the State

Government within the wetlands, namely:-

i. withdrawal of water or the impoundment, diversion or interruption of water sources within the local catchment area of the wetland ecosystem;
ii. harvesting of living and non-living resources;
iii. grazing to the level that the basic nature and character of the biotic community is not adversely affected;
iv. treated effluent discharges from industries, cities or towns, human settlements and agricultural fields falling within the limits laid down by the Central Pollution Control Board or the State Pollution Control Committee, as the case may be;
v. plying of motorized boat, if it is not detrimental to the nature and character of the biotic community;
vi. dredging, only if the wetland is impacted by siltation;
vii. construction of boat jetties;
viii. activities within the zone of influence, as per the definition of wetlands, that may directly affect the ecological character of the wetland;
ix. facilities required for temporary use, such as pontoon bridges, that do not affect the ecological character of the wetland;
x. Aquaculture, agriculture and horticulture activities within the wetland;
xi. repair of existing buildings or infrastructure including reconstruction activities.
xii. any other activity to be identified by the Authority.

Not withstanding anything in sub-rule (1) or sub-rule (2), the Central Government may permit any of the prohibited activities or non-wetland use in the protected wetland on the recommendation of the Authority.
The State Government shall ensure that a detailed Environment Impact Assessment is carried out in accordance with the procedures specified in the notification of the Government of India in the Minister of Environment and Forests S.O. number 1533 (E) dated the September 14th, 2006 as amended from time to time.
No wetland shall be converted to non-wetland use unless the Central Government is satisfied on the recommendation of the Authority that it is expedient in the public interest and reasons justifying the decision are recorded.

5. Constitution of Central Wetlands Regulatory Authority

The Central Government, in exercise of the powers conferred by sub-section (3) of section 3 of the Environment (Protection) Act, 1986 (29 of 1986), hereby constitutes Central Wetlands Regulatory Authority consisting of the following Chairpersons and members for the purpose of these rules, namely: -

(a) Secretary, Ministry of Environment and Forests, Government of India - Chairperson;
(b) a representative (not below the rank of Joint Secretary) from Ministry of

Tourism, Government of India- Member ex-officio;

(c) a representative (not below the rank of Joint Secretary) from Ministry of Water Resources, Government of India -Member ex-officio;

(d) a representative (not below the rank of Joint Secretary) from Ministry of Agriculture, Government of India - Member ex-officio;

(e) a representative (not below the rank of Joint Secretary) from Ministry of Social Justice, Government of India- Member ex-officio;

(f) Chairman or his nominee, the Central Pollution Control Board,- Member ex-officio;

(g) Joint Secretary or Adviser, dealing with the wetland in the Ministry of Environment and Forests, Government of India, - member ex-officio;

(h) Dr. Asad R. Rahmani, Director, Bombay Natural History Society, Hornbill House, Salim Ali Chowk, Shaheed Bhagat Singh Road, Mumbai-400 023; Expert Ornithology -Member.

(i) Dr. M.R.D. Kunadangar, Darul Aloom Qasmia Lane, Botshah Mohalla, Lal Bazar, Srinagar, Kashmir ; Expert limnology- Member

(j) Dr. CK. Varshney, 88 Vaishali, Pitampura, New Delhi-110034; Expert Ecology- Member

(k) Dr E.J. James, Director, Water Institute, Karunya University, Coimbatore, Tamil Nadu ; Expert Hydrology- Member;

(l) Director or Additional Director or Joint Director dealing with the Wetland in the Ministry of Environment and Forests-Member Secretary.

The term of the Authority shall be three years effected from the date of publication of the notification referred to in sub-rule (1).

The Authority shall exercise the following powers and perform the following functions, namely:-

(i) appraise proposals for identification of new wetlands, projects or activities in consultations with the concerned local authorities;

(ii) identify and interface with the concerned local authorities to enforce the provisions contained under these rules and other laws for the time being in force;

(iii) grant clearances or identify in consultation with the local state government, the areas for the grant of clearance for regulated activities in the wetlands within their respective jurisdictions;

(iv) determine, in consultation with concerned local authority, the zone of direct influence of the wetlands;

(v) issue whatever directions, necessary for the conservation, preservation and wiseuse of wetlands to the State Governments.

(4) The Authority shall periodically review the list of wetlands and the details of prohibited and regulated activities under the rules.

(5) The Authority shall specify the threshold levels for activities to be regulated and the mode and methodology for undertaking activities in wetland.

6. Process for identification of wetlands under different categories

(1) Wetlands covered under item (i) of rule 3 specified under Schedule shall be the wetland to be regulated under these rules.

(2) The States Government shall prepare, within a period of one year from the commencement of these rules, 'Brief Document' identifying and classifying the wetlands within their respective territories in accordance with the criteria specified under Rule 3 and submit the same to Authority.

(3) The 'Brief Document' of each wetland for identification shall comprise of following information, namely:-

- i) broad geographic delineation of the wetland;
- ii) its zone of influence along with a map (accurate and to scale);
- iii) the size of the wetland;
- iv) account of pre-existing rights and privileges, consistent or not consistent with the ecological health of the wetland.

(4) The Authority, shall on receipt of the 'Brief document' under sub-rule(2), if consider it necessary refer in consultation with the State Government to a research institute or university having relevant multi-disciplinary expertise related to wetlands, to conduct a comprehensive survey of the wetland within a period of thirty days: provided that the institute or university to which the matter has been referred under sub-rule(4) shall submit a report within next ninety days from the date of such reference to Authority, which shall contain information with respect to the criteria specified under rule 3.

(5) The Authority shall, thereafter, arrive at a decision in consultation with the State Government, on the proposal, within a period of ninety days from the date of receipt of the report under sub-rule(4).

(6) The Central Government shall on the receipt of the recommendation of the Authority notify the area of wetlands as recommended by the Authority for public information inviting objections and suggestions from the general public likely to be affected to make representation to the Central Government within a period of sixty days;

(7) The Authority shall consider all the representations which the Central Government may receive under sub-rule (6) and submit its recommendation on the such representations to Central Government within a period of sixty days for final notification;

(8) The Central Government shall on receipt of the recommendations of the Authority under sub-rule (7) issue a final notification notifying therein the area of the wetland its category or classification to be regulated under these rules and display the said notification in public places in English and vernacular languages.

(10) The Authority may, *suo moto* or on application made to it, review any decision under these rules or issue direction for inclusion of wetland under these rule.

7. Overlapping provisions

(1) The wetlands within the protected areas of the National Parks and Wildlife Sanctuaries

shall be regulated by the provisions of Wildlife (Protection) Act, 1972 (35 of 1972).

(2) The wetlands within the protected or notified forest areas shall be regulated by the provisions of the Indian Forest Act, 1927(16 of 1972); the Forest (Conservation) Act, 1980(69 of 1980); and the Environment (Protection) Act, 1986(29 of 1986).

(3) The gaps in the regulation of wetlands within the protected and notified forest areas, if any, under the provisions of the Indian Forest Act, 1927; Wildlife (Protection) Act, 1972; and Forest (Conservation) Act, 1980; shall be plugged by invoking provisions of the Environment (Protection) Act, 1986.

(4) The wetlands situated outside the protected or notified forest areas referred to in sub rule(2) shall be regulated by the relevant provisions of the Environment (Protection) Act, 1986(29 of 1986)

8. Enforcement of regulated activities

(1) The identified activities for management and wise use of wetlands situated within the protected or notified forest areas referred to in sub rule (2) of rule 7 shall be regulated by the Forest Department of the State concerned.

(2) The identified activities for management and wise use of wetlands situated outside the protected or notified forest areas shall be regulated by the nodal Department or the relevant local state agencies to be designated by the State Government within a period of six months from the date of commencement of these rules.

9. Appeals against the decisions of Authority

Any person aggrieved by the decision of the Authority may prefer an appeal to the National Green Tribunal constituted under the National Green Tribunal Act, 2010(19 of 2010) with in a period of sixty days from the date of such decision: Provided the National Green Tribunal may entertain any appeal after the expiry of the said period of sixty days if it is satisfied that the appellant was prevented by sufficient cause from, filing the appeal in time.

THE SCHEDULE [see- rule 3(i)]

List of wetlands in India identified as Ramsar sites under Ramsar Convention on Wetland

Sl. No.	Name of the Wetland	State
1	Ashtamudi Wetland	Kerala
2	Bhitarkanika Mangroves	Odisha
3	Bhoj Wetland	Madhya Pradesh
4	Chilika Lake	Odisha
5	Deepor Beel	Assam
6	East Calcutta Wetlands	West Bengal
7	Harike Lake	Punjab
8	Kanjli	Punjab
9	Keoladeo National Park	Rajasthan

10	Kolleru Lake	Andhra Pradesh
11	Loktak Lake	Manipur
12	Point Calimere Wildlife and Bird Sanctuary	Tamil Nadu
13	Pong Dam Lake	Himachal Pradesh
14	Ropar	Punjab
15	Sambhar Lake	Rajasthan
16	Sasthamkotta Lake	Kerala
17	Tsomoriri	Jammu and Kashmir
18	Vembanad-Kol Wetland	Kerala
19	WularLake	Jammu and Kashmir
20	Chandratal	Himachal Pradesh
21	Renuka	Himachal Pradesh
22	Rudrasagar	Tripura
23	Uppai Ganga	Uttar Pradesh
24	Hokarsar (Hokera)	Jammu and Kashmir
25	Surinsar and Mansar (complex)	Jammu and Kashmir

[F.No. J-22012/3t/05-CS(W)]

(R. Mehta)
Adviser to the Government of India

Source: *http://moef.nic.in/downloads/public-information/Wetlands-Rules-2010.pdf*

Appendix 5 CMFRI identified fish landing centres in Srikakulam

Sl. No.		Mandal	Landing Centre
1	1	Ichapuram	Donkuru
2	1	Kaviti	Kapasakuddu
3	2		Chinnakarrivanipalem
4	3		Peddakarrivanipalem
5	4		Idduvanipalem
6	5		Kotha Calingapatnam
7	1	Sompeta	Isakalapalem
8	2		Ramayyapatnam
9	3		Gollagandi
10	4		Baruva kotturu
11	5		Battigalluru
12	6		Ekuvooru
13	1	Mandasa	Gedduru
14	2		M. Ganguvada
15	1	V.Kothuru	Gunupalli
16	2		Akkupalli
17	3		Dokulapadu
18	4		Chinnakotturu
19	5		Nuvvalarevu
20	6		Machineellapeta
21	7		Hukumpeta
22	8		Kambalarayudupeta
23	9		Kothapeta
24	10		Althada
25	1	Santhabommali	Bhavanapadu
26	2		M. Sunnapalli
27	3		Meghavaram
28	4		Maruvada
29	5		Geddalapadu
30	6		Kumunduvanipeta
31	7		Jagannadhapuram
32	8		Umilada
33	1	Polaki	Peddakoviripeta
34	2		Guppidipeta
35	3		Jogampeta
36	4		Kotharevu
37	5		Ampalam (Rajarampuram)
38	1	Gara	Bandaruvanipeta
39	2		Komaravanipeta
40	3		Moghadalapadu
41	4		Srikurmam Machilesam

Sl. No.		Mandal	Landing Centre
42	5		Balarampuram
43	1	Srikakulam	Kunduvanipeta
44	2		Pukkallapeta
45	1	Etcharla	Pathadibbalapalem
46	2		Kothadebbalapalem
47	3		Badevanipeta
48	4		Budagtlapalem
49	1	Ranasthalam	Kothamukkam
50	2		Jeerupalem
51	3		Allivalasa
52	4		Peddakovvada
53	5		Gurayyapeta
54	6		Donipeta

Source: *Report of Deputy Director, Fisheries, Srikakulam*

Appendix 6 Marine fishers' habitations in Srikakulam district

Sl No		Mandal		Village
1	1	Ichapuram	1	Donkuru
2	2	Kaviti	1	Kapasukuddi
3			2	Idduvanipalem
4			3	Ck palem
5			4	Battivanipalem
6			5	Kothapalem
7			6	Pk palem
8			7	K calingapatnam
9			8	Ontooru
10			9	Pukkallapalem
11	3	Sompeta	1	Isukalapalem
12			2	Ramayyapatnam
13			3	Gollagandi
14			4	B kotturu
15			5	Donkuluru
16			6	Battigalluru
17			7	Nadumuru
18			8	Ekkavuru
19			9	Erramukkam
20			10	Vadapalem
21	4	Mandasa	1	Bettalapadu
22			2	Geddaru
23			3	M ganguvada
24			4	Nolluru
25			5	Ratti
26	5	Vajrapukotturu	1	Manchineelapeta
27			2	Hukumpeta
28			3	Kambalaraidupeta
29			4	Kothapeta
30			5	Dokulapadu
31			6	Devunalthada
32			7	Akkupalli
33			8	Gunupalli
34			9	Nuvvalarevu
35			10	Chinna kotturu
36			11	Kidisingi
37			12	Vajrapukotturu
38	6	Santhabommali	1	Bhavanapadu
39			2	Kothapeta
40			3	Vadapeta

Sl No	Mandal	Village	
41		4	M sunnapalli
42		5	Geddalapadu
43		6	Suradavanipeta
44		7	Maruvada
45		8	D maruvada
46		9	Ch maruvada
47		10	Guddimeda peta
48		11	Yampallavanipeta
49		12	Chakkavanipeta
50		13	Pittavanipeta
51		14	Deepillivanipeta
52		15	Cheruvugattuvanipeta
53		16	Suradavanipeta
54		17	Karipeta
55		18	Pukkallavanipeta
56		19	Gorjanivanipeta
57		20	Kumuduvani peta
58		21	Jagannadhapuram
59		22	Umilada
60		23	Patha megavaram
61	7 Polaki	1	Guppidi peta
62		2	Ch koviripeta
63		3	Gullavanipeta
64		4	Pedda koviripeta
65		5	Rajaram puram
66		6	Jogampeta
67	8 Gara	1	Balarampuram
68		2	S matyalesam
69		3	Perlavanipeta
70		4	Mogadalapadu
71		5	Komaravanipeta
72		6	Bandaruvanipeta
73		7	K matyalesam
74	9 Srikakulam	1	Narasayyapeta
75		2	Pedda ganagallapeta
76		3	Chinna ganagallapeta
77		4	Khaji peta
78		5	Pukkallapeta
79		6	Kunduvanipeta
80		7	Mofus bandar
81		8	Jalaripeta
82	10 Etcherla	1	Bg palem

Sl No	Mandal		Village
83		2	D matyalesam
84		3	Rallapeta
85		4	K matyalesam
86		5	Sd palem
87		6	Pd palem
88		7	Kd palem
89		8	Ginnivanipeta
90		9	Musavanipeta
91		10	J koyyam
92		11	Bodelavanipea
93		12	J. Koyyam
94	11 Ranasthalam	1	Donipeta
95		2	Pothayyapeta
96		3	Gurrayyapeta
97		4	Cheekatipeta
98		5	Chinna kovvada
99		6	Kovvada
100		7	Athivalasa
101		8	Komaravanipeta
102		9	Kothamukkam
103		10	Teerupalem
104		11	Jagannadapuram

Source: *Report of Deputy Director, Fisheries, Srikakulam*

Appendix 7 Fish drying platforms in Srikakulam district

S. No.		Mandal	Village		Fish Drying Platforms
1	1	Ichapuram	1	Donkuru	1
2	2	Kaviti	1	Kasapakuddi	2
3			2	Kothapalame	1
4			3	Peddakarrivanipalem	1
5			4	Kotha Kalingapatnan	1
6	3	Sompeta	1	Ramayyapatnam	1
7			2	Battigalluru	2
8			3	Nadumuru	1
9			4	Ekavooru	1
10	4	Mandasa	1	Geddavooru	1
11			2	M. Ganguvada	1
12	5	Vajrapukotturu	1	Gunupalli	1
13			2	Thoturu	1
14			3	Akkupalli	1
15			4	Dokulapadu	1
16			5	Manchineellapeta	2
17			6	Hukumpeta	1
18			7	Kambalarayudupeta	2
19			8	Kothapeta	2
20	6	Santhabommali	1	Bhavanapadu	1
21			2	Pathameghavaram	1
22			3	Mastyalesam Maruvada	1
23			4	Dibbala Maruvada	1
24			5	Pittavanipeta	1
25	7	Polaki	1	Gullavanipeta	1
26			2	Jogampeta	1
27	8	Gara	1	Perlavanipeta	2

S. No.	Mandal	Village	Fish Drying Platforms
28		2 Mogadalapadu	1
29		3 Balarampuram	1
30	9 Srikakulam	1 Pukkallapeta	1
31		2 Khajipeta	1
32	10 Etcherla	1 Rallapeta	1
33		2 Jalarikoyyam	1
34		3 Badevanipeta	2
35		4 Budagatlapalem	1
36		5 Pathadibbalapalem	1
37	11 Ranasthalam	1 Donipeta	1
38		2 Kothamukkam	1
39		3 Komaravanipeta	1
40		4 Allivalasa	1
		Total:	**47**

Source: *Report of Deputy Director, Fisheries, Srikakulam*

Appendix 8 Shore sheds in Srikakulam district

S. No.		Mandal	Village	Shore Sheds
1	1	Kaviti	Kapasakuddi	1
2	2	Sompeta	Isakalapalem	1
3			Nadumuru	1
4	3	Vajrapukotturu	Manchineelapeta	1
5			D.Althada	1
6	4	S.Bommali	Geddalapadu	1
7	5	Polaki	Guppidipeta	1
8	6	Gara	S.Matsyalesam	1
9	7	Etcherla	D.Matsyalesam	1
10	8	Ranasthalam	Guruyyapeta	1
11			Allivalasa	1
			Total:	**11**

Source: *Report of Deputy Director, Fisheries, Srikakulam*

Appendix 9 Minor irrigation tanks (ayacut >100 Acres) of Srikakulam Irrigation division

S.No.	Constituency	Mandalam	No. of M.I.Tanks	Regd. Ayacut in Acres
1	Srikakulam	Srikakulam	4	539.16
		Gara	4	474.80
2	Amadalavalasa	Amadalavalasa	3	542.82
		Burja	7	1811.73
		L.N.Peta	14	2504.77
		Sarubujjili	13	2543.34
		Srikakulam	3	402.96
3	Palakonda	Santhakaviti	15	4232.13
4	Unukuru	Vangara	3	672.22
		Regidi	15	2647.97
		Rajam	27	4338.47
5	Pathapatnam	Meliaputti	11	2070.28
		Kotturu	3	394.26
		Pathapatnam	11	1725.61
		Saravakota	4	483.15
		Hiramandalam	7	1197.71
6	Kotturu	Kotturu	11	1926.53
		Bhamini	13	2245.51
7	Sompeta	Mandasa	6	1148.92
		Sompeta	11	2225.45
8	Tekkali	Palasa	8	1702.77
		Vajrapukotturu	2	257.24
9	Harischandapuram	Kotabommali	5	1187.71
		Jalumuru	5	713.09
10	Narasannapeta	Jalumuru	1	142.10
		Saravakota	6	2421.35
11	Cheepurupalli	G.Sigadam	24	4207.15
		Ponduru	3	471.44
			239	**45230.64**

Source: *Report of Executive Engineer, I&CAD, Irrigation Division, Srikakulam*

Appendix 10 Tank Details, Srikakulam

Sl. No.	Sub-Division	Mandal	Village	Tank name	Type of tank (M.I/ L.I. Schems/ Anicut/ Others)	Regd. Ayacut in Acres as per Dist. Gazettee	Irrigated ayacut in acres	Total catch ment area (Sq.Km)	Utilisable yield	Capacity of tank in M.Cft	Average Rainfall in MM
1	6	8	9	10	16	17	18	19	20	21	22
1	Tekkali	Nandlgam	Haridasupuram	Pedda tank	Rain fed	169.96	169.96	0.18	21.25	5.62	369.4
2	Tekkali	Nandigam	Madanapuram	Pedda tank	Rain fed	126.33	126.33	0.16	15.79	8.42	369.4
3	Tekkali	Nandigam	Sagaram peta	Padmanabha sagaram	Rain fed	352.77	352.77	22.32	44.09	23.51	369.4
4	Tekkali	Nandigam	Kaputemburu	Siddasagaram	Rain fed	182.01	182.01	0.12	22.75	12.13	369.4
5	Tekkali	Nandigam	Deenabandupuram	Patnaikuni tank	Rain fed	208.71	208.71	0.13	26.08	13.91	369.4
6	Tekkali	Nandigam	Nowgam-I	Ammagai tank	Rain fed	135.0	135.0	0.2	16.9	9.0	369.4
7	Tekkali	Nandigam	Nowgam-II	Banugai tank	Rain fed	103.07	103.07	0.96	12.89	6.87	369.4
8	Tekkali	Nandigam	Peddalowni palli	Racha tank	Rain fed	180.28	180.28	1.14	22.53	11.26	369.4
9	Tekkali	Nandigam	Turakala kota	Konda tank	Rain fed	105.2	105.2	0.92	13.15	7.51	369.4
10	Tekkali	Nandigam	Badagam	Tada tank	Rain fed	140	140	1.03	17.5	8.75	369.4
11	Tekkali	Pathapatnam	Temburu	Asarlasagaram	Rain fed	3162.88	3162.88	23.85	395.36	140.13	378
12	Tekkali	Tekkali	Polavaram	Nandasagaram	Rain fed	213.39	213.39	0.27	26.67	14.22	357.9
13	Tekkali	Tekkali	VRK Puram	Pedda tank	Rain fed	178.63	178.63	0.15	22.32	11.16	351.9
14	Sompeta	Kanchili	Binnala kotturu	Hetha tank	M.I	131.23	97.14	2.49	16.4	8.24	772
15	Sompeta	Kanchili	M.S.Palli	Boga tank	M.I	101.34	75.16	2.62	12.65	6.38	772
16	Sompeta	Kanchili	Kolluru	Kunchagai tank	M.I	160.3	118.56	2.91	20.1	9.8	772
17	Sompeta	Kanchili	Sasanam	Lodda Loddi Reservoir	M.I	343.1	256.36	4.29	42.8	18.6	772
18	Sompeta	Kanchili	Jalantrakota	Gangasagaram	M.I	202.98	152	--	26.5	13.59	772
19	Sompeta	Kanchili	Talatampara	Kodandam naidu tank	M.I	100.18	74.98	0.98	12.5	5.81	772
20	Sompeta	Kanchili	D.G.Puram	Govindasagaram	M.I	665.71	498.7	12.74	104.1	28.26	772
21	Sompeta	Kanchili	Mundala	Sunkili sagaram	M.I	619.5	462.07	32.34	77.4	29.12	772
22	Sompeta	Kanchila	Kuttuma	Hetha tank	M.I	166.1	122.9	3.6	20.8	10.67	772
23	Sompeta	Kanchila	Bogabani	Pedda tank	M.I	135.28	100.8	2.83	16.94	8.78	772
24	Sompeta	Kanchila	Buragam	Padmanabha sagara	M.I	233.93	173.59	4.47	30.9	13.86	772
25	Sompeta	Kanchila	Karthali	Rakasi tank	M.I	142.6	106.34	2.65	17.85	8.5	772
26	Sompeta	Kanchila	Keesari pada	Tallasagaram	M.I	247.23	184	4.47	30.9	14.5	772
27	Sompeta	Kanchila	Kolluru	Pedda tank	M.I	142.27	105.72	2.83	17.82	8.37	772
28	Sompeta	Kanchila	Yekkala	Voora tank	M.I	151.8	113.57	2.91	18.98	9.04	772
29	Sompeta	Kanchila	J.Narayanapuram	Patigundam tank	M.I	111.17	83.26	2.54	13.89	7.02	772
30	Sompeta	Kaviti	Karapadu	Voora tank	M.I	148.12	111.27	3.15	18.5	8.81	783
31	Sompeta	Kaviti	Karapadu	Kajugai	M.I	194.24	145.63	3.43	24.24	12.18	783
32	Sompeta	Kavitl	Rajapuram	Hathibandadi tank	M.I	132.19	99.09	2.65	16.55	8.37	783
33	Sompeta	Kaviti	Garlapdu	Bandirevughai tank	M.I	124.68	93.37	2.7	15.6	7.43	783
34	Sompeta	Kaviti	Nelavanka	Dukkapotenna tank	M.I	159.26	119.25	3.32	19.98	9.16	783
35	Sompeta	Itchapuram	Mandapalli	Bheemasamudram	M.I	213.97	160.13	4.12	26.8	12.64	815/ 32.11

Sl. No.	Sub-Division	Mandal	Village	Tank name	Type of tank (M.I/ L.I. Schems/ Anicut/ Others)	Regd. Ayacut in Acres as per Dist. Gazettee	Irrigated ayacut in acres	Total catch ment area (Sq.Km)	Utilisable yield	Capacity of tank in M.Cft	Average Rainfall in MM
36	Sompeta	Itchapuram	Mutchindra	Devalayam tank	M.I	132.44	98.99	2.85	16.58	7.68	815/ 32.11
37	Sompeta	Itchapuram	Bellupada	Siddi tank	M.I	350.62	264.68	8.11	43.95	20.67	815/ 32.11
38	Sompeta	Sompeta	Tallabhadra	Gangasagaram	M.I	197.23	197.23	2.5	24.65	11.74	--
39	Sompeta	Sompeta	Tallabhadra	Uondai tank	M.I	106.5	101	3.05	13.31	8.1	--
40	Sompeta	Sompeta	T.Sasanam	Gorakala gai tank	M.I	228.16	208	2.98	28.52	13.86	--
41	Sompeta	Sompeta	Pottangi	Jamili tank	M.I	234.48	200.48	3	29.31	13.46	--
42	Sompeta	Sompeta	Makannapuram	Chinthala tank	M.I	107.05	107.05	2.8	13.38	6.99	--
43	Sompeta	Sompeta	BRC puram	Chinna tank	M.I	206.29	190.54	5.2	25.78	12.94	--
44	Sompeta	Sompeta	Korlam	Dasari bedda	M.I	102.44	102.44	1.72	12.8	33.07	--
45	Sompeta	Sompeta	Korlam	Pedda tank	M.I	160.9	145	2.29	20.11	19.55	--
46	Sompeta	Sompeta	BRC puram	Pedda tank	M.I	648.34	608.24	3	77.29	69.02	--
47	Sompeta	Sompeta	Lakkavaram	Kari tank	M.I	113.93	102.05	3.4	14.24	7.28	--
48	Sompeta	Sompeta	Lakkavaram	Nalla tank	M.I	136.06	125.06	2.5	17	8.94	--
49	Sompeta	Sompeta	Gjinku bhadra	Neelakanta sagara	M.I	123.58	111.08	3.2	15.45	8.54	--
50	Sompeta	Sompeta	Palasapuram	Pedda tank	M.I	306.5	280.46	3	38.31	19.16	--
51	Sompeta	Kanchili	Buragam	Kurmasagaram	M.I	193.82	184.52	2.5	24.22	32.15	--
52	Sompeta	Kanchili	Sasanam	Rani sagaram	M.I	149.35	139	6.2	18.66	30.16	--
53	Sompeta	Mandasa	Devupuram	Damodara sagaram	M.I	199.31	199.31	5.99	24.91	15.84	--
54	Sompeta	Mandasa	Byrisaranga puram	Netapatruni tank	M.I	112.2	100.64	2.54	14.02	6.99	--
55	Sompeta	Mandasa	Byrisaranga puram	Pedda tank	M.I	150.64	120.28	3.99	18.83	10.24	--
56	Sompeta	Mandasa	Sondipudi	Kurmanna tank	M.I	101.5	101.5	2.84	12.64	6.94	--
57	Sompeta	Mandasa	Sondipudi	Godiabanda	M.I	116.06	102.4	2.24	14.5	8.4	--
58	Sompeta	Mandasa	VVR Puram	Malabanda	M.I	140.7	128.54	3.24	17.59	58	--

Appendix 11 Consolidated list of plants recorded in the visited wetlands and its environs

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Abrus precatorius	√																														√	√	
Abutilon hirtum	√	√				√	√					√		√	√		√			√	√				√	√					√	√	√
Abutilon indicum	√	√				√	√					√					√			√	√				√	√		√	√		√	√	√
Acacia caesia																																	
Acacia holosericea	√					√																											√
Acacia leucophloea	√	√																															
Acacia nilotica	√	√				√	√																√								√		
Acacia torta	√																																
Acalypha brachystachya	√	√																															
Acalypha fruticosa			√								√	√	√	√	√							√	√	√	√								
Acalypha indica	√	√	√				√																										
Acalypha paniculata	√	√																													√		
Acanthospermum hispidum	√	√																				√											√
Acanthus ilicifolius																√	√														√		√
Achyranthes aspera	√	√	√			√	√					√																			√		
Aegle marmelos																															√		
Aeluropus lagopoides	√	√																							√					√	√		
Aerva lanata		√				√	√					√					√														√	√	√
Aerva persica		√					√					√																			√		
Aerva sanguinolenta	√																																
Aeschynomene aspera	√																																
Ailanthus excelsa	√	√																															√
Alangium salviifolium	√	√			√																										√		
Albizia amara	√																																
Albizia lebbeck	√	√					√									√											√						
Albizia saman	√						√																										
Allophylus serratus	√		√																														
Aloe vera	√																																
Alstonia scholaris	√																																
Alternanthera paronychioides	√	√		√			√		√	√		√					√√			√		√	√	√	√						√	√	√
Alternanthera pungens	√	√		√			√					√								√				√	√	√	√				√		
Alternanthera sessilis	√	√		√			√					√				√	√			√											√	√	√
Alternanthera tenella	√	√		√			√		√	√	√	√					√			√			√	√	√	√	√	√	√		√	√	√

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Alysicarpus longifolius	√						√																								√		
Alysicarpus monilifer	√						√																								√		
Alysicarpus rugosus	√																																
Amaranthus spinosus	√						√					√				√	√														√		
Amaranthus viridis	√	√					√					√				√	√																
Ammannia baccifera	√	√		√	√							√				√	√		√	√													
Amorphophallus paeoniifolius	√																																
Ampelocissus latifolia	√																																
Ampelocissus tomentosa	√																																
Anacardium occidentale	√	√																													√		√
Andrographis alata	√																																
Andrographis paniculata	√		√																														
Andropogon pumilus	√																																
Anisochilus carnosus	√		√																														
Anisochilus scaber	√		√																														
Anisomeles indica	√	√	√	√	√	√	√		√	√		√				√	√				√		√	√	√	√	√				√	√	√
Anisomeles malabarica	√	√	√	√	√	√	√					√		√	√	√	√									√	√	√	√		√	√	√
Anogeissus acuminata	√		√								√								√		√										√	√	√
Aponogeton natans	√	√		√		√														√													
Arachis hypogaea	√																																
Argemone mexicana	√	√			√							√							√												√		
Argyreia cuneata	√																																
Argyreia elliptica	√																																
Ardisia littoralis																																	√
Aristida adscensionis	√	√					√					√		√	√		√	√			√	√				√	√		√	√	√		
Aristida funiculata	√	√					√					√		√			√				√	√					√		√	√	√	√	√
Aristida hystrix	√	√					√					√		√	√			√			√	√				√			√	√	√	√	√
Aristida setacea	√	√												√	√		√	√				√				√	√		√	√	√	√	√
Aristolochia bracteolata	√															√														√		√
Aristolochia indica	√		√																												√		
Artemesia vulgaris	√	√																															
Arundo donax	√		√	√	√		√					√	√	√	√	√	√			√				√	√			√	√	√			
Asclepias curassavica	√	√	√																														
Asparagus racemosus	√																																
Asystasia dalzelliana	√																																

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Atalantia monophylla	√		√																														
Atalantia racemosa	√		√																														
Atylosia scarabaeoides	√		√																														
Avicennia marina																						√											
Avicennia officinalis																						√											
Azadirachta indica	√																					√									√	√	√
Azima tetracantha	√																														√		
Bacopa monnieri	√	√	√	√		√			√	√						√		√	√	√	√		√	√		√	√	√	√				
Balanites aegyptiaca	√																														√	√	√
Bambusa bambos	√							√							√																		
Barleria acuminata	√																																
Barleria buxifolia	√						√					√			√	√		√	√			√	√	√	√			√	√		√		
Barleria cristata	√																																
Barleria mysorensis	√																																
Barleria prionitis	√	√																															
Barringtonia racemosa	√	√																															
Basella rubra	√																														√		
Bassia latifolia	√																														√		
Benkara malabarica	√																																
Bergia ammannioides	√	√		√																√													
Bidens pilosa	√	√																													√		
Biophytum reinwardtii	√	√				√	√	√	√				√	√		√	√		√	√		√	√								√		
Blainvillea acmella	√	√																													√	√	√
Blepharis maderaspatensis	√																																
Blepharis repens	√															√																	
Blumea lacera	√	√		√		√		√							√	√	√			√													
Blumea mollis	√	√																															
Boerhavia diffusa	√	√	√				√	√	√		√	√	√		√	√	√	√	√				√	√	√		√	√			√		
Boerhavia erecta	√																																
Bombax ceiba	√																																
Borassus flabellifer	√													√																			
Bothriochloa bladhii	√	√																															
Bothriochloa pertusa	√	√													√						√												
Brachiaria ramosa	√	√																													√		
Brachiaria remota	√					√		√	√		√	√	√		√	√	√	√		√	√		√	√	√								

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Breynia retusa	√																																
Breynia vitis-idaea	√																																
Bulbostylis barbata	√	√				√	√	√	√		√	√		√	√	√		√	√		√	√		√	√		√	√			√	√	√
Bulbostylis densa	√																																
Butea monosperma	√		√																														
Cadaba fruticosa	√																													√			
Caesalpinia bonduc	√																													√			
Caesalpinia sp	√																																
Calophyllum inophyllum	√																													√			
Calotropis gigantea	√				√	√						√	√			√	√					√	√							√	√	√
Calotropis procera	√																													√			
Canavalia cathartica	√		√																														
Capparis decidua	√	√						√	√							√	√						√	√						√	√	√
Capparis grandis																														√			
Capparis sepiaria																														√		√	
Capparis zeylanica																														√		√	
Caralluma adscendens			√																														
Cardiospermum halicacabum	√		√																											√	√	√	
Carissa carandas	√		√																														
Carissa inermis	√		√			√																											
Carissa spinarum	√		√																														
Carmona retusa	√														√															√			
Caryota urens															√																		
Casearia tomentosa	√																				√												
Casearia wyanadensis																					√												
Cassia fistula	√																															√	√
Cassia obtusa	√	√	√		√	√	√	√	√				√	√					√	√	√	√			√	√	√	√			√		
Cassia siamea	√																																
Cayratia pedata	√																																
Cayratia trifolia	√	√	√	√										√	√			√	√		√	√			√	√					√	√	√
Celastrus paniculatus	√																																
Celosia argentea																															√		
Celosia polygonoides	√	√	√					√	√	√	√	√	√	√				√	√					√	√						√	√	√
Cenchrus barbatus	√																																√
Cenchrus ciliaris	√	√																													√	√	√

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Cenchrus setigera	√																																
Centella asiatica	√																																
Cereus pterogonus	√																																
Chloris barbata	√	√	√	√	√	√		√	√	√	√	√		√	√		√	√	√	√		√	√		√	√	√		√		√	√	√
Chloris dolichostachya	√																																
Chloris tenella	√																																
Chloroxylon swietenia	√																																
Chromolaena odorata	√																						√								√	√	√
Chrysopogon aciculatus																					√												
Chrysopogon asper																					√												
Cipadessa baccifera	√																				√												
Cissampelos pareira	√							√																									
Cissus quadrangularis	√									√	√										√	√										√	√
Cissus repanda	√		√																														
Cleome aspera	√					√	√	√							√	√								√	√	√							
Cleome monophylla	√	√	√	√	√		√	√	√		√	√	√	√	√		√	√	√	√	√		√	√	√		√	√		√	√		
Cleome viscosa	√										√	√				√	√					√	√			√	√				√	√	√
Clerodendrum inerme	√	√																													√		
Clerodendrum infortunatum	√																																
Clerodendrum phlomidis	√	√																													√		√
Clitoria ternatea	√	√	√	√			√	√	√					√	√	√						√	√	√		√	√	√			√	√	√
Coccinia grandis	√	√																													√		
Cocculus hirsutus	√							√																							√		
Cocculus pendulus	√																																
Coldenia procumbens	√	√			√		√				√				√	√			√	√			√	√	√					√	√	√	√
Colocasia esculenta	√	√																√	√	√											√		
Combretum albidum	√																																
Commelina benghalensis	√	√				√	√	√	√					√	√				√	√	√					√	√				√		
Commelina clavata	√																																
Commelina longifolia	√	√																															
Commiphora berryi																															√		
Conyza leucantha	√			√																√													
Corchorus aestuans	√	√										√	√	√				√		√					√	√	√				√	√	√
Corchorus tridens	√				√	√	√										√	√			√	√	√								√		
Corchorus trilocularis	√									√	√	√																					

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Cordia sebestena																					√		√				√	√	√		√		
Costus speciosus	√																																
Crotalaria evolvuloides	√																																
Crotalaria juncea	√																														√		
Crotalaria mysorensis	√																																
Crotalaria pallidavar. obovata	√																																
Croton bonplandianum	√															√							√	√	√								
Cuscuta reflexa	√																														√		
Cyanotis tuberosa	√																																
Cynodon dactylon	√	√														√															√	√	√
Cynoglossum zeylanicum	√																																√
Cyperus articulatus	√	√				√	√	√			√							√	√						√						√		√
Cyperus difformis	√	√																√							√						√		√
Cyperus exaltatus	√	√	√								√							√							√			√					
Cyperus halpan	√	√																							√								√
Cyperus iria	√	√	√			√	√	√																	√						√		√
Cyperus pangorei	√	√																							√					√			
Cyperus rotundus	√	√	√							√						√								√	√					√	√	√	√
Dactyloctenium aegyptium	√	√		√	√	√				√		√	√		√		√	√			√	√	√		√					√	√	√	√
Dactyloctenium aristatum	√	√																							√					√	√		√
Datura innoxia	√					√	√		√			√	√	√		√	√		√				√	√		√							
Datura metal	√	√					√										√								√			√			√	√	√
Derris scandens																															√		√
Desmostachya bipinnata	√	√																													√		√
Dicanthium annulatum	√	√																													√		√
Dichrostachys cinerea	√																														√		√
Dicoma tomentosa	√																														√	√	√
Digera muricata	√	√					√	√	√	√	√	√	√			√	√			√	√	√	√	√									
Digitaria bicornis	√	√														√																	√
Dinebra retroflexa	√	√																							√								
Diospyros buxifolia	√	√																															
Diospyros melanoxylon		√													√																		
Diplocyclos palmatus	√																																
Dodonaea viscosa																															√	√	√
Echinochloa colona	√	√		√	√															√				√	√					√	√	√	√

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Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Echinochloa crista-galli				√	√															√					√							√	√
Echinops echinatus	√	√																													√	√	√
Eclipta prostrata	√	√														√		√	√												√	√	√
Eichhornia crassipes	√	√	√			√		√		√	√					√	√	√	√		√					√	√	√	√		√	√	√
Eleusine indica	√	√																															√
Elytraria acaulis	√																																
Embelia ribes	√																																
Emilia sonchifolia	√	√				√	√								√		√	√					√	√		√			√			√	
Enicostema axillare	√	√																															
Eragrostiella bifaria	√		√																														
Eragrostis maderaspatana	√	√																													√	√	√
Eragrostis minor	√	√																															√
Eragrostis nigra	√	√	√	√	√	√	√	√				√						√				√			√						√		
Eragrostis nutans	√	√																															
Eragrostis pilosa	√																																√
Eragrostis sp	√														√										√								
Eragrostis unioloides	√	√		√																√					√						√		√
Eragrostis viscosa	√	√	√	√					√	√				√	√	√	√		√			√									√		
Eremopogon foveolatus	√	√													√																		√
Euphorbia geniculata																																	√
Euphorbia hirta	√	√			√	√	√	√	√		√		√				√	√	√	√	√	√	√	√		√			√		√	√	√
Euphorbia nivulia				√								√							√	√											√		
Euphorbia rosea	√	√																													√		
Euphorbia thymifolia	√	√																													√		
Euphorbia tirucalli	√																														√	√	√
Euphorbia trigona																															√		
Evolvulus alsinoides	√	√																													√	√	√
Ficus benghalensis																√							√								√	√	√
Ficus microcarpa																															√	√	√
Ficus religiosa												√				√															√	√	√
Evolvulus nummularius	√	√																															
Excoecaria agallocha																						√											
Fimbristylis aestivalis	√	√	√	√							√	√													√					√	√	√	√
Fimbristylis argentea	√	√									√														√						√		√
Fimbristylis bisumbellata	√	√				√	√																		√						√	√	√

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Fimbristylis complanata	√	√									√	√						√							√						√		√
Fimbristylis dichotoma	√	√																				√			√						√		
Fimbristylis falcata	√	√					√																		√					√	√		√
Fimbristylis miliacea	√	√								√								√							√					√	√	√	
Fimbristylis ovata	√	√	√	√	√	√	√				√			√	√	√				√					√		√				√	√	√
Fimbristylis tetragona	√	√																							√					√	√		√
Fluggea leucopyrus	√	√																													√	√	√
Fluggea virosa	√	√																													√		
Flacourtia indica	√		√																														
Flacourtia ramontchi															√																		
Gardenia latifolia			√																														
Giseckia pharnaceoides	√	√					√					√	√	√	√					√											√	√	√
Glinus lotoides	√	√	√		√		√		√	√	√	√	√		√		√	√		√			√	√	√			√	√	√	√	√	√
Gloriosa superba	√																																
Glycosmis mauritiana	√																				√												
Glycosmis pentaphylla	√																				√												
Glycyrrhiza glabra	√																																
Gmelina arborea	√																																
Gmelina asiatica	√																														√		
Gnaphalium luteo-album	√	√		√								√	√							√											√		
Gnaphalium polycaulon	√	√		√	√															√													
Gomphrena serrata	√	√														√															√		
Grangea maderaspatana	√	√																						√	√			√	√	√	√	√	√
Grewia hirsuta	√		√																														
Grewia tiliifolia	√																																
Grewia villosa	√		√																														
Gymnema sylvestre	√		√																														
Hedyotis biflora	√	√																													√	√	√
Hedyotis corymbosa	√	√	√																												√		
Helicteres isora	√																				√												
Heliotropium curasavicum	√	√			√				√	√	√	√				√		√						√	√	√					√		√
Heliotropium indicum	√	√			√				√	√	√			√		√		√			√			√	√	√		√			√		√
Hemidesmus indicus	√																																
Heteropogon contortus	√	√		√	√	√		√	√		√	√	√					√	√	√	√	√	√		√			√		√			√
Hibiscus micranthus	√			√						√					√			√			√				√		√				√		

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Hibiscus tiliaceus																															√		
Hibiscus vitifolius																															√	√	√
Holarrhena pubescens	√		√																		√												
Holoptelea integrifolia	√																														√	√	√
Hugonia mystax	√																																
Hybanthus enneaspermus	√														√																		
Hydrilla verticillata	√	√				√		√		√	√					√																	√
Hygrophila auriculata	√	√						√					√	√	√			√	√												√	√	√
Hyptis suaveolens	√	√	√					√		√	√	√	√		√	√	√	√	√		√	√	√	√	√	√	√		√	√	√		√
Ichnocarpus frutescens	√																																
Imperata cylindrica	√	√	√		√	√	√	√	√		√		√	√	√			√	√		√			√	√			√		√	√		√
Indigofera caerulea	√																																
Indigofera linifolia	√	√																													√		
Indigofera linnaei	√	√					√	√	√	√	√						√	√				√	√	√							√	√	√
Indigofera sp.	√														√						√												
Indigofera trifoliata	√		√																														
Indigofera trita	√		√																														
Indoneesiella echioides	√	√									√								√			√			√			√			√	√	√
Ipomoea alba	√																																
Ipomoea aquatica	√	√						√	√	√	√			√		√		√	√		√	√		√	√	√	√	√	√	√	√	√	√
Ipomoea biloba	√	√																				√			√	√	√	√	√	√	√	√	√
Ipomoea carnea	√	√		√	√	√		√	√	√	√	√	√	√		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Ipomoea hederifolia	√																																
Ipomoea pes-tigridis	√																																
Ipomoea staphylina	√		√																												√	√	√
Ischaemum indicum var. *depressum*	√														√																		
*Ischaemum indicum*var. *indicum*	√	√																															
Iseilema anthephoroides	√	√																							√					√			√
Iseilema laxum	√	√																							√					√	√	√	√
Ixora arborea	√																																
Jatropha curcas	√																																
Jatropha gossypifolia	√	√			√			√	√			√	√	√	√	√	√				√	√				√	√				√	√	√
Jatropha tanjorensis	√	√													√										√						√	√	√

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Justicia adhatoda	√																																
Justicia betonica	√														√																		√
Justicia gendarussa	√														√																		√
Justicia sp.	√																																
Kedrostis foetidissima	√																																
Kleinia grandiflora	√																																
Kyllingia nemoralis	√	√																															
Lagascea mollis	√	√					√	√	√	√				√					√			√		√			√				√	√	√
Lantana camara											√																						√
Lantana wightiana		√														√																	
Lemna minor	√	√		√	√			√		√	√					√	√			√	√												
Leonotis nepetiifolia	√																														√		√
Leptadenia reticulata	√																																
Lindernia antipoda	√	√				√																											
Lindernia crustacea	√	√				√																											
Lindernia hyssopioides	√	√																															
Lindernia parviflora	√																																
Ludwigia adscendens	√	√	√											√	√			√															√
Ludwigia perennis	√	√	√											√	√																		√
Ludwigia peruviana	√	√																√	√														
Maba buxifolia															√																		
Madhuca longifolia	√																																
Malvastrum coromandelianum	√	√	√	√	√	√	√	√	√			√	√	√	√			√	√	√	√	√	√	√		√	√	√	√	√			√
Manisuris myuros	√	√																							√					√	√	√	√
Martynia annua	√																														√	√	√
Maytenus emarginata	√																																
Maytenus heyneana	√																																
Memecylon edule	√																																
Memecylon umbellatum	√																																
Merremia hastata	√	√																															
Merremia tridentata	√	√																															
Mikania cordata	√																														√	√	√
Millingtonia hortensis	√																																
Mimosa hamata	√																														√	√	√
Mitragyna parvifolia	√			√															√	√													

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Mollugo cerviana	√	√																															√
Mollugo disticha	√																																√
Mollugo nudicaulis	√																														√		√
Mollugo pentaphylla	√															√															√	√	√
Monochoria hastata	√	√																															
Monochoria vaginalis	√	√																			√												
Morinda pubescens	√																														√	√	√
Moringa concanensis			√																														
Moringa oleifera			√																														
Mucuna monosperma	√																																
Mucuna pruriens	√		√																														
Mukia maderaspatana	√																																
Murraya paniculata	√																																
Najas indica	√																																
Najas marina	√																																
Najas minor	√	√																															
Nelumbo nucifera	√							√		√				√													√	√					
Neonotonia wightii	√		√	√																													
Nothosaerva brachiata	√	√																		√											√	√	√
Nymphaea nouchali	√	√						√		√				√		√											√	√					
Nymphaea pubescens	√	√								√				√													√	√					
Nymphaea rubra	√	√						√																			√	√					
Nymphoides indicum	√	√		√	√			√		√	√			√		√		√		√							√	√					
Ocimum canum	√																														√		
Oldenlandia umbellata	√		√																												√	√	√
Ophiuros exaltatus	√	√																													√	√	√
Opuntia stricta																																	√
Oplismenus compositus	√																																
Oropetium thomaeum	√	√	√																												√	√	√
Ottelia alismoides	√	√		√	√	√		√		√						√				√							√	√					√
Oxalis corniculata	√	√														√															√	√	√
Oxystelma esculentum	√	√																			√					√	√	√	√		√	√	√
Pandanus odoratissimus	√	√											√	√		√			√	√	√	√		√	√	√	√	√	√	√	√	√	√
Panicum miliaceum	√	√																													√		√
Panicum notatum	√																																

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Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Panicum paludosum	√	√																															
Panicum psilopodium	√																														√		√
Panicum repens	√	√																															
Panicum trypheron	√	√	√	√						√	√		√	√				√	√	√				√	√					√	√	√	√
Parkinsonia aculeata																															√	√	√
Parthenium hysterophorus	√	√	√	√												√							√								√	√	√
Paspalidium flavidum	√	√	√	√	√													√		√											√	√	√
Paspalum scrobiculatum	√	√	√		√													√		√											√	√	√
Passiflora edulis																√																	
Passiflora foetida	√	√	√													√															√	√	√
Pavetta indica	√		√																														
Pavetta tomentosa	√		√																														
Pavonia odorata	√	√																													√		√
Pavonia procumbens	√	√																															
Pavonia zeylanica	√	√																													√	√	√
Pedalium murex	√	√					√																								√		√
Pennisetum americanum	√																																
Pennisetum purpureum				√																√													
Pentatropis microphylla	√																															√	√
Pergularia daemia	√																														√	√	√
Peristrophe bicalyculata	√	√																															
Phoenix loureirii	√	√												√		√	√						√								√	√	√
Phoenix sylvestris	√															√							√									√	√
Phragmites karka	√	√	√	√		√					√		√	√	√			√	√	√		√	√	√	√			√	√	√	√	√	√
Phyla nodiflora	√	√				√										√		√	√												√	√	√
Phyllanthus amarus	√	√																													√	√	√
Phyllanthus emblica	√																																√
Phyllanthus maderaspatensis	√	√																													√		√
Phyllanthus polyphyllus	√																																
Phyllanthus reticulatus	√																√																√
Phyllanthus rotundifolius	√	√				√																									√		√
Phyllanthus urinaria	√	√					√								√																√		
Physalis minima	√	√																													√		
Pistia stratiotes	√	√	√	√	√			√		√	√					√	√	√		√	√					√	√	√			√	√	√
Plecospermum spinosum	√	√																													√	√	√

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Polyalthia cerasoides	√																				√												
Polyalthia suberosa	√																																√
Polycarpaea corymbosa	√	√																															
Polygonum barbatu	√																																
Polygonum glabrum	√	√	√								√			√	√						√					√	√	√		√			√
Polygonum hydropiper	√	√	√								√			√	√						√			√	√	√	√	√	√	√			√
Polygonum plebeium	√	√																√	√				√	√	√					√			
Polygonum sp	√	√	√																														
Pongamia pinnata	√																																
Portulaca oleracea	√	√	√		√			√			√		√			√	√			√		√			√			√			√		
Portulaca quadrifida	√	√				√		√		√		√		√		√	√		√		√			√		√		√		√	√	√	√
Potamogeton nodosus	√																																
Premna tomentosa	√		√																														
Prosopis cineraria																															√		
Prosopis juliflora							√	√				√				√	√				√	√	√	√	√	√	√	√	√	√	√	√	√
Pseudarthria viscida	√		√																														
Psilotrichum elliotli	√	√	√																												√		√
Pterospermum xylocarpum			√																														
Pulicaria wightiana	√																														√	√	√
Pupalia lappacea	√																																
Pycreus globosus	√	√									√																						√
Randia brandisli			√																														
Randia dumetorum	√																																
Randia parviflora					√																												
Rauwolfia serpentina	√																																
Rhizophora apiculata																						√											
Rhynchosia densiflora	√																																
Rhynchosia minima	√	√			√			√				√					√					√			√			√	√		√		
Rivea hypocrateriformis	√	√				√					√							√		√				√		√		√	√		√		√
Rottboellia cochinchinensis	√																														√	√	√
Ruellia tuberosa	√	√		√	√			√				√				√			√				√			√	√	√	√	√		
Saccharum spontaneum	√	√	√																			√										√	√
Sacciolepis indica	√	√		√		√		√	√	√			√			√			√		√		√		√		√		√	√	√	√	√
Salacia chinensis	√																																
Salicornia brachiata	√	√																													√	√	√

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Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Salvinia molesta	√	√									√					√	√																
Sansevieria roxburghiana	√																																
Sapindus emarginatus	√																														√		√
Scirpus articulatus	√	√																													√	√	√
Scleria lithosperma	√	√																													√	√	√
Scoparia dulcis	√	√																													√	√	√
Scutia myrtina	√		√																														
Sebastiania chamaelea	√	√			√													√															
Sehima nervosum	√	√																													√		
Sehima sulcatum	√																																
Senna alata	√																																
Senna auriculata	√					√						√				√					√				√						√	√	√
Senna hirsuta	√	√																													√	√	√
Senna italica	√	√			√	√	√	√	√	√				√	√	√	√	√			√			√		√		√		√	√	√	√
Senna occidentalis	√	√	√	√	√	√	√					√	√	√	√	√	√	√	√		√	√	√	√	√	√	√				√	√	√
Senna tora	√	√		√	√	√	√	√	√	√			√	√	√	√	√	√	√	√				√	√	√	√	√			√	√	√
Sesbania bispinosa	√																																
Sesuvium portulacastrum	√																				√										√	√	√
Setaria italica	√	√	√	√	√	√	√	√	√	√	√	√	√	√			√	√	√	√	√	√	√	√	√		√	√					
Sida acuta	√	√	√	√	√	√	√	√	√	√	√	√	√	√			√	√	√	√	√	√	√	√	√		√	√			√	√	√
Sida cordata	√	√	√	√	√	√	√	√	√	√	√	√	√	√			√	√	√	√	√	√	√	√	√		√	√			√		
Sida cordifolia	√		√		√		√		√		√		√				√		√		√		√		√		√				√	√	√
Sida rhombifoliavar. retusa	√					√	√	√	√	√	√	√	√																				
Sida rhombifoliavar. rhombifolia	√							√	√							√	√																
Sida spinosa	√							√	√							√	√				√	√	√										
Solanum surattense	√	√			√			√	√							√	√	√													√	√	√
Solanum trilobatum	√	√						√								√																	
Solena amplexicaulis	√	√																															
Sonchus oleraceus	√	√																															
Sonneratia apetala																						√											
Spermacoce hispida	√	√																															
Spermacoce ocymoides	√	√																															
Sphaeranthus indicus	√	√			√			√	√	√	√	√	√			√		√		√	√		√	√	√			√	√	√	√	√	√
Spilanthes calva	√	√		√	√			√										√		√	√										√	√	√

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Spilanthes uliginosa	√	√			√			√										√															
Spinifex littoreus	√																					√			√						√		
Spondias pinnata																																	√
Sporobolus coromandelianus	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Sporobolus indicus	√	√	√			√	√	√	√	√	√	√	√	√		√	√	√	√	√			√	√	√				√	√			√
Sporobolus spicatus	√	√	√	√	√	√					√		√	√	√	√				√	√							√	√		√		
Sporobolus wallichii	√	√	√	√	√	√	√	√	√	√	√				√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√			
Stemodia viscosa	√	√		√		√														√											√		√
Sterculia foetida				√															√														
Streblus asper	√		√																														√
Striga asiatica	√	√																															
Strychnos nux-vomica	√																																
Suaeda fruticosa	√	√																				√									√	√	√
Suaeda nudiflora	√	√																				√									√		√
Suregada lanceolata	√																																
Synedrella nodiflora	√	√			√			√				√						√			√				√		√					√	√
Syzygium cumini	√																																
Tamarindus indica	√																																
Taraxacum officinale	√																																
Tarenna asiatica	√		√																														
Tecoma stans	√																																
Tectona grandis	√																																
Tephrosia purpurea	√	√		√	√	√	√	√		√	√				√			√				√				√			√		√	√	√
Tephrosia villosa	√	√			√	√	√	√	√		√		√		√		√		√	√			√	√		√		√			√	√	√
Terminalia arjuna	√																																
Terminalia catappa	√																																
Themeda triandra	√																																
Thespesia populnea	√																														√	√	√
Thevetia peruviana	√		√																														
Tinospora cordifolia	√	√	√																													√	√
Tragia involucrata	√	√	√		√	√	√	√	√			√				√			√		√				√			√		√	√	√
Tragia plukenetii	√	√	√		√			√		√	√		√					√		√			√			√					√	√	√
Trewia nudiflora	√																																
Trewia polycarpa	√																																
Trianthema triquetra	√	√																															

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Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Tribulus lanuginosis	√	√																															
Tribulus terrestris	√	√	√		√	√	√	√		√		√	√	√	√		√	√		√	√		√	√		√				√	√		√
Trichodesma indicum	√	√																													√	√	√
Tridax procumbens	√	√																													√	√	√
Triumfetta pentandra	√	√		√				√			√					√					√		√				√			√	√	√
Triumfetta rhomboidea	√						√						√								√				√			√					
Triumfetta rotundifolia	√	√	√							√					√						√					√							
Turnera subulata	√	√			√					√				√				√					√							√	√	√
Typha angustifolia	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√		√	√	√	√	√	√	√	√	√	√	√
Urena lobata	√	√		√				√								√								√							√	√	√
Urena lobata var. *sinuata*	√																√						√										
Vallisneria spiralis	√	√			√	√																											
Vernonia cinerea	√	√					√			√			√			√					√				√						√	√	√
Vetiveria zizanioides	√	√		√	√	√	√	√	√	√	√	√	√		√	√		√	√	√	√		√	√	√	√	√	√	√	√	√	√	√
Vigna trilobata	√	√			√																										√	√	√
Vitex altissima	√																																
Vitex leucoxylon	√	√			√																												
Vitex negundo var. *negundo*	√																																
Vitex negundo var. *purpurascens*	√																																
Waltheria indica	√	√			√		√			√				√		√	√	√		√		√		√			√		√		√	√	√
Wedelia chinensis	√	√																															
Wrightia tinctoria	√		√																		√												
Xanthium indicum	√	√		√		√			√				√					√					√			√		√			√	√	√
Youngia japonica	√																																
Ziziphus mauritiana	√																														√	√	√
Ziziphus nummularia	√																																
Ziziphus oenoplia	√		√		√																										√		
Zornia diphylla	√	√		√					√					√						√							√						
Zornia gibbosa	√	√					√											√							√								
Zoysia matrella	√	√	√	√	√				√		√				√					√	√	√	√	√	√						√	√	√

Where: 1-Sompeta; 2-Bhavanapadu and Naupada swamps; 3-Madduvalasa Reservoir; 4-Kuddiram Sagaram; 5-Lanka cherivu; 6-Cheri chrivu; 7-Narayana valasa; 8-Pechrivu; 9-Mettucherivu; 10-Thamarai cherivu; 11-Rajakaru cherivu; 12-Kottabommali; 13-Sivarampuram cherivu; 14-Pathathekkali; 15-Damodar sagaram; 16-Peddhapadu cherivu; 17-Rajulau cherivu; 18; Kaaricherivu; 19-Narayanpuram reservoir; 20-Chintada cherivu; 21-Arisadu; 22-Bhavanapadu creek area; 23-Devunivalu cherivu; 24-Narasapuram peddha cherivu; 25-Nagavalli river mouth; 26-Poundi back water;

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Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33

27-Marandupadu cherivu; 28_Telineelapuram wetland; 29-Nalla cherivu; 30-Dunkuru wetland; 31-Ichchapuram wetland; 32-Telikunji wetland; 33-Mahendrathanaiya river mouth.

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Appendix 12 Consolidated list of birds recorded during the present study in the wetlands of Srikakulam district and its environs

Common name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Alexandrine Parakeet		√			√				√			√	√			√		√		√	√				√							√	
Ashy Drongo	√	√		√	√	√	√	√				√	√	√	√	√		√		√	√	√	√		√		√	√	√	√	√	√	√
Ashy Prinia		√	√	√	√		√	√	√	√		√						√		√	√				√			√	√		√	√	√
Ashy-crowned Sparrow Lark	√	√			√		√			√		√			√			√		√				√	√	√	√		√		√	√	
Asian Koel	√	√			√					√		√				√		√		√	√	√						√	√				√
Asian Openbill	√	√	√	√	√	√	√	√	√	√	√	√	√		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Asian Palm Swift	√	√	√	√	√			√	√	√	√	√	√	√	√	√	√	√		√	√	√	√	√	√	√	√	√	√	√	√	√	√
Asian Pied Starling	√	√	√	√	√		√	√	√	√	√	√	√		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Baya Weaver		√									√	√			√	√	√	√		√	√			√	√		√		√	√	√	√	√
Bay-backed Shrike	√	√							√	√	√	√			√	√	√	√		√	√	√		√	√		√		√	√	√	√	√
Besra			√																												√	√	
Black Bittern		√								√														√									
Black Drongo	√	√		√				√			√		√		√	√		√		√	√	√			√	√			√	√	√	√	√
Black Kite	√	√	√	√		√	√	√		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√		√	√	√	√	√	√	√
Black-bellied Tern	√		√			√				√						√			√			√	√						√		√	√	
Black-crowned Night Heron		√																															
Black-crowned Sparrow Lark	√																																
Black-headed Gull																											√				√		
Black-headed Ibis	√	√						√		√					√				√		√	√	√				√		√			√	
Black-headed Munia				√				√		√	√					√		√		√	√	√							√			√	√
Black-shouldered Kite	√	√					√	√	√	√			√					√	√	√	√	√	√		√	√	√		√		√	√	
Black-winged Stilt	√	√			√				√	√					√	√		√	√			√					√		√		√	√	
Blue-eared Kingfisher		√	√				√	√					√			√	√	√			√	√	√	√	√						√	
Blue-faced Malkoha																				√													
Blue-tailed Bee-eater	√	√		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Brahminy Kite	√	√		√	√		√	√				√	√			√		√			√	√	√				√	√	√	√	√		
Brahminy Starling	√	√			√		√	√			√				√			√		√	√	√		√								√	
Bronze-winged Jacana								√			√		√	√			√	√			√	√							√			√	
Brown-headed Barbet	√	√	√		√		√											√															
Brown-headed Gull																											√						
Cattle Egret		√	√	√			√	√	√	√	√	√	√	√	√	√	√	√		√	√	√	√	√	√	√	√	√	√	√	√	√	√
Chestnut-headed Nee-eater				√														√															
Cinnamon Bittern		√																						√									

Common name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Citrine Wagtail						√																									√		
Common Coot	√	√			√			√		√	√							√				√		√	√							√	
Common Greenshank	√		√														√		√		√	√		√			√	√	√		√	√	
Common Hoopoe		√						√				√			√	√		√										√	√		√	√	√
Common Kingfisher	√	√	√	√	√		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Common Moorhen	√	√	√	√	√			√		√	√		√				√	√				√		√	√						√	
Common Myna	√	√	√	√	√		√	√	√	√	√	√	√	√	√	√	√	√		√	√	√	√	√	√	√	√	√	√	√	√	√	√
Common Poachard	√	√				√					√																				√		
Common Redshank	√					√													√			√	√	√			√	√	√		√		
Common Ringed Plover	√					√					√						√									√	√	√	√		√		√
Common Sandpiper	√	√	√	√		√				√	√		√		√	√	√	√	√	√	√	√	√	√		√	√	√	√		√	√	√
Common Snipe																√											√						
Common Tailorbird																		√		√	√	√		√	√			√	√			√	√
Common Teal	√	√											√																				
Coppersmith Barbet																√	√	√		√												√	
Cotton Pygmy-Goose	√	√			√			√			√		√									√										√	
Curlew Sandpiper																			√			√					√						
Darter	√	√	√		√				√	√	√	√				√	√	√		√				√	√						√	√	√
Eurasian Collared Dove		√		√		√		√	√	√	√	√		√	√	√	√	√	√	√	√	√			√	√	·	√	√	√	√		√
Eurasian Curlew	√																		√			√	√				√		√		√		
Eurasian Marsh Harrier	√	√																	√			√							√		√		
Eurasian Spoonbill		√																	√			√					√						
Eurasian Wigeon	√	√									√																						
Fulvous Whistling Duck	√	√						√					√											√	√		√						
Gargany Teal	√	√									√													√									
Great Cormorant	√	√	√					√			√				√	√	√		√		√	√	√	√	√				√		√	√	√
Greater Coucal	√	√			√	√		√			√	√				√	√	√		√		√							√				√
Greater Egret	√	√	√	√		√	√	√		√	√	√	√		√	√	√	√	√			√	√	√	√	√	√	√	√		√	√	√
Green Avadavat																		√		√													
Green Sandpiper	√	√																											√		√		
Grey Francolin		√																															
Grey Heron	√	√	√			√	√	√	√	√			√		√	√	√	√	√		√	√	√	√	√	√	√		√		√	√	√
Grey Wagtail			√			√	√								√	√	√	√			√							√				√	
House Crow	√	√		√			√	√	√	√		√	√	√		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
House Sparrow		√						√	√				√	√		√				√			√						√	√	√	√	√

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Common name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
House Swift	√		√					√	√	√		√	√	√		√		√	√	√	√		√	√	√		√	√	√	√	√	√	√
Indian Cormorant	√	√						√					√			√			√				√										
Indian Grey Hornbill		√	√				√	√					√			√	√	√		√	√			√	√			√	√	√		√	
Indian Peafowl		√					√	√					√		√	√	√	√		√									√	√		√	
Indian Pond Heron	√	√	√	√		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Indian Robin	√	√				√	√	√	√	√	√	√	√		√	√	√	√		√	√	√		√	√			√	√		√	√	√
Indian Roller	√	√			√		√	√	√	√	√		√	√	√	√	√	√		√	√	√			√	√		√	√	√	√	√	√
Indian Silverbill	√	√		√	√		√	√	√	√		√	√	√	√	√		√		√	√	√	√		√			√	√	√	√	√	√
Intermediate Egret	√	√			√	√		√	√				√			√		√	√			√							√		√		
Jack Snipe			√																								√						
Jungle Babbler		√																√														√	
Jungle Crow	√	√		√				√	√				√		√	√	√	√		√	√	√	√	√	√	√	√	√	√	√	√	√	
Jungle Myna		√						√					√					√														√	
Jungle Prinia								√				√						√				√							√			√	
Kentish Plover	√														√												√						
Large Grey Babbler					√																												
Laughing Dove	√	√		√	√					√			√		√			√		√	√	√			√			√	√		√	√	√
Lesser Coucal		√						√																									
Lesser-crested Tern																		√	√								√						
Lesser Whistling Duck	√							√					√														√						
Little Cormorant	√	√	√	√		√	√	√	√	√	√	√	√		√	√	√	√	√		√	√	√	√	√	√	√	√	√	√	√	√	
Little Egret	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Little Grebe	√	√	√		√	√		√		√	√	√					√							√	√		√				√	
Little Heron		√	√																√												√	
Little Ringed Plover	√	√	√			√						√	√		√	√	√		√		√	√	√	√			√		√	√	√	√	√
Little Stint			√																														
Loten's Sunbird																		√															
Marsh Sandpiper	√	√	√			√					√				√	√	√	√	√			√	√	√	√	√		√	√		√	√	√
Northern Pintail	√	√																															
Northern Shoveler	√	√																															
Orange-headed Thrush																		√															
Oriental Magpie Robun		√						√								√													√				
Osprey																													√		√		
Paddyfiled Pipit		√																											√		√	√	
Painted Stork	√	√	√			√	√	√			√		√		√	√	√	√				√		√	√		√		√	√	√	√	

Common name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Palla's Fish Eagle												√							√							√		√		√			
Pallid Harrier	√	√					√					√							√									√					
Pheasant Tailed Jacana	√	√	√				√	√		√			√				√	√													√		
Pied Avocet	√																																
Pied Buschat	√	√																√		√	√	√		√				√	√		√	√	
Pied Harrier	√	√	√			√	√		√	√	√	√	√	√		√	√	√	√			√	√				√		√				
Pied Kingfisher				√	√												√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Pintail Snipe	√	√	√			√																											
Plain Prinia				√						√								√		√	√							√	√		√		
Purple Heron	√	√	√		√		√	√	√		√		√		√	√	√	√	√		√	√	√	√	√		√	√	√		√	√	
Purple Sunbird	√							√												√												√	
Purple Swamphen	√	√	√		√			√			√		√					√														√	
Purple-rumped Sunbird	√	√			√			√								√	√	√				√			√				√		√	√	√
Red Avadavat	√	√			√													√		√													
Red Collared Dove	√	√						√		√					√	√	√	√														√	
Red-rumped Swallow																√		√											√		√	√	√
Red-vented Bulbul		√								√	√	√	√		√	√	√	√		√	√			√				√	√	√	√		
Red-wattled Lapwing	√	√	√		√	√		√		√	√	√	√		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
River Lapwing	√	√	√												√		√															√	
River Tern	√	√	√												√	√								√	√		√					√	
Rock Pigeon		√					√	√	√	√	√	√	√	√	√	√	√	√		√	√		√	√		√	√	√	√	√	√	√	√
Rose-ringed Parakeet	√	√			√		√	√	√			√	√		√	√	√	√		√	√	√		√		√		√	√	√	√	√	√
Rosy Starling	√	√			√			√					√		√	√		√		√													
Rufous Treepie		√	√					√								√	√	√		√						√		√	√		√	√	
Scaly-breasted Munia				√	√			√										√				√							√				
Shikra		√		√				√									√	√				√					√	√	√	√		√	√
Small Green Bee-eater	√	√	√					√	√			√	√	√		√	√	√		√	√	√	√	√	√	√	√		√	√	√	√	√
Small Minivet																		√															
Spot-billed Duck		√																						√	√								
Spot-billed Pelican	√	√	√				√								√									√	√						√	√	
Spotted Dove	√	√					√		√	√	√	√	√	√	√	√	√	√		√	√			√	√	√	√	√	√	√	√	√	√
Spotted Redshank	√					√																					√				√		
Whimbrel																			√			√	√								√		
Whiskered Tern								√																									
White-bellied Drongo		√		√																													

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Common name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
White-bellied Sea Eagle												√							√			√									√	√	
White-breasted Kingfisher	√	√	√		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
White-breasted Waterhen	√	√	√		√	√		√		√	√		√		√		√	√						√			√		√		√	√	√
White-browed Bulbul		√	√														√														√		
White-browed Wagtail		√														√										√						√	
White-headed Babbler	√	√					√	√				√			√	√		√						√		√		√	√	√			
Wire-tailed Swallow			√					√								√												√		√	√		
Yellow Bittern		√																√															
Yellow Wagtail		√				√									√	√								√				√	√				
Yellow-wattled Lapwing	√	√			√										√			√						√	√	√					√		
Brown-headed barbet		√																															
*Spotted owlet	√																																
*Barn Owl	√																																
*Black-headed Gull	√																																
*Ruddy Turnstone	√																																
*Black-bellied Plover	√																																
*Ruddy Shelduck	√																																
*Grey Plover	√																																
*Pacific Golden Plover	√																																
*Asian Dowitcher	√																																
*Black-tailed Godwit	√																																
*Bar-tailed Godwit	√																																
*Gadwall	√																																
*Bar-headed Goose	√																																
*Comb Duck	√																																
*Greater Flamingo	√																																
*Sarus Crane	√																																
*Woolly-necked Stork	√																																
*White Eye Pochard	√																																
*Bear's Poachard	√																																
*Ferruginous Duck	√																																
*Blue-breasted Banded Rail	√																																
*Ballions Crake	√																																
*Brown Crake	√																																
*Wood Snipe	√																																

Common name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
*Bush lark	√																																
*Rufous Tailed Finch Lark	√																																
*Common crested lark	√																																
*Small Sky Lark	√																																
*Peregrine Falcon	√																																
*Plaintive Cuckoo	√																																
*Indian Blue Robin	√																																
*White-rumped Needletail	√																																
*Kentish Plover	√																																
*Lesser Sand Plover	√																																
*Greater Sand Plover	√																																
*Dunlin	√																																
*Temminck's Stint	√																																
*Green Sandpiper	√																																
*Wood Sandpiper	√																																
*Black Crowned Night Heron	√																																
*Great Crested Grebe	√		√								√																						
*Tufted Duck	√										√																				√		
*Black-headed Cuckoo-shrike	√																																
*Common Babbler	√	√																															
*Common Crane	√	√																															
*Blue-winged Leafbird	√																																
*Golden-fronted Leafbird	√																																
*Greater Racket-tailed Drongo	√																																
*Indian Cuckoo	√	√																															
*Jungle Babbler	√																																
*Jungle Owlet	√	√																															
*Eurasian Thick-knee	√																																
*Grey-headed Fish Eagle	√																																
*Grey Junglefowl	√	√																															
*Grey Francolin	√	√																															
*Brown-Caped Pygmy Woodpecker	√																																
*Egyptian Vulture	√	√																															
*Short-toed Snake Eagle	√	√																															
*Streaked Weaver	√																																

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Common name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
*Water Cock	√																																
*White Stork		√																															
*Black-necked Stork		√																															
*Lesser Adjudant		√																															
*Black Ibis		√																															
*Glossy Ibis		√																															
*White-eyed Buzzard		√																															
*Greater Grey-headed Fish Eagle		√																															

Where: 1-Bhavanapadu and Naupada swamps; 2-Sompeta; 3-Kuddiram Sagaram; 4-Lanka cherivu;5-Pecherivu;6-Mettu Cherivu;7-Thamarai Cherivu;8-Rajakaru Cherivu;9-Kottabommali;10-Sivarampuram Cherivu;11-Pathathekkali;12-Damodar Sagarm;13-Peddhapadu Cherivu;14-Rajalu Cherivu;15-Kaaricherivu;16-Narayanapuram Reservoir;17-Chintdata;18-Arisadu;19-Bhavanapadu Creek area;20-Dhyal Cherivu;21-Narasapuram Pedda Cherivu;22-Nagavalli River mouth;23-Poundi back water;24-Marandupadu Cherivu;25-Telineelapuram wetland;26-Nalla Cherivu;27-Dunkuru wetland;28-Narayanasagaram;29-Ichchapuram wetland;30-Telikunchi wetland;31-Mahendrathanaya river mouth;32-Madduvalasa reservoir;33-Narayanavalasa;

Appendix 13 Summary Datasheet format

Date: ..... Data Sheet No: .....

Wetland Name: Place/village name: Lat:

Photo #: Post Office: Long:

WETLAND CHARACTERS

Natural / If Artificial, Age of WL:

Perennial/ If Seasonal, Dry Months:

Overflow? Yes / No

Isolated/ If Interconnected, Details:

.....

.....

WATER SOURCE FOR THE WETLAND:

Rain-fed/ Ground/ River .....

/ Canal ..... / .....

SIZE OF WETLAND (@ Max)

Area: ..... Ha. Depth: ..... m

Shape

Land-use Around wetland:

No. of Wells around: ..... Mean Depth .....

Contact Person Name & No if any

.....

.....

Water Quality Parameters:

Colour: ..... Odour: .....

Turbidity: .....

EC .....

pH .....

AS WATER SOURCE

For Drinking water	For Irrigation	For Industries	Bathing/washing	Other
Human /	Agriculture Area: ..... Ha	Type:	Human/ Livestock/	.....
Livestock/	Crops:	.....	Vehicle/	.....
Drinking water scheme:				
.....				

OTHER RESOURCES

Waste Dumping - Y/ N	Fishing	Fodder/ Grazing	Cultural	Other use.	As Bird/WL habitat
If Yes, by whome?	Sustenance/ Commercial	Cattle population	Religious/	.....	Sp:
Houses/ Industry/ Public/	Fish Species:	.....	Recreational/	.....	.....
Details:	.....		.....	.....	.....
.....	Annual catch :				Approx Nos: .....
.....	.....				Seasons: .....
.....	Fishing Season:				

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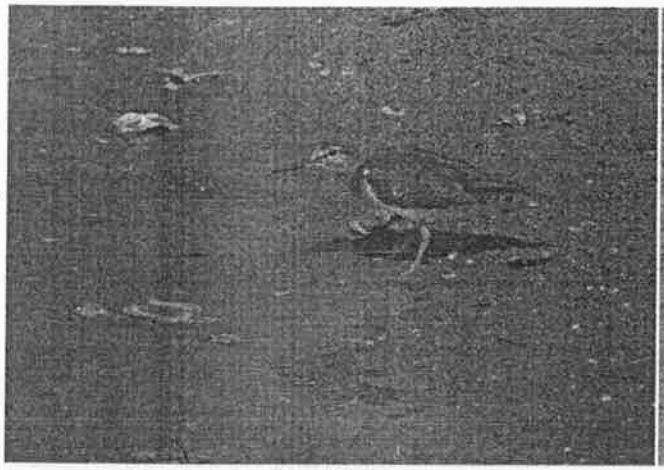
PLATE 1 Birds recorded from the study area



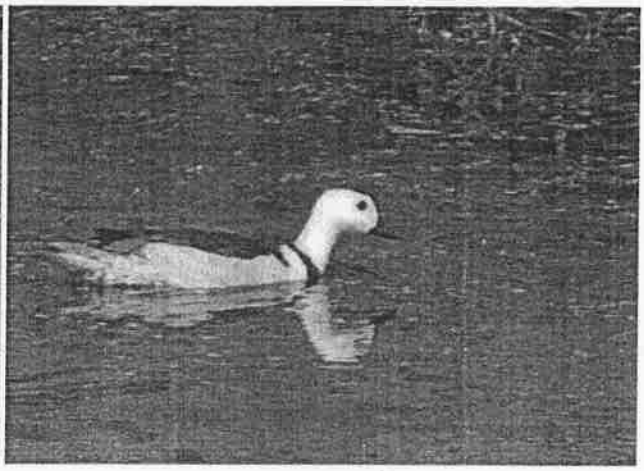
Sandpiper

Black-winged stilt

Spot-billed Pelican at Thelineelapuram

Painted storks at Thelineelapuram

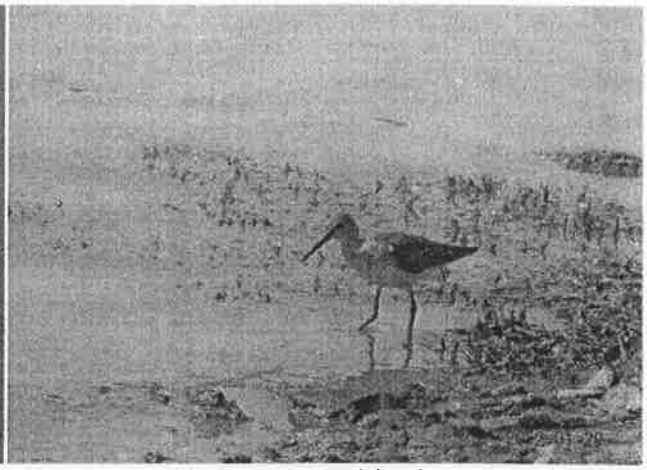
Fulvous Whistling duck



Cotton Teal

PLATE 2 Birds recorded from the study area

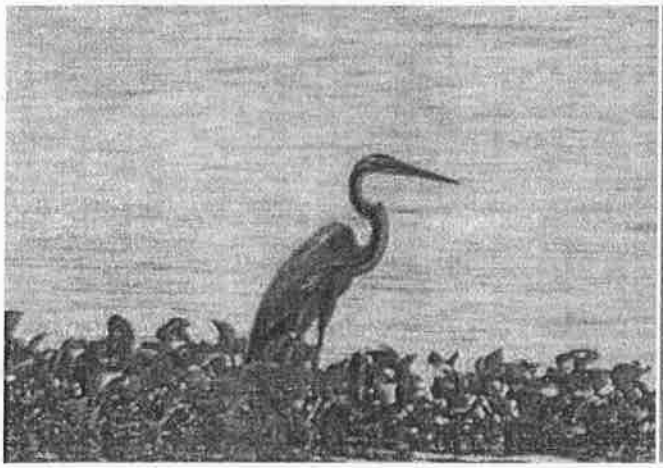
Little Ringed Plover



Common Redshank

Little Cormorant

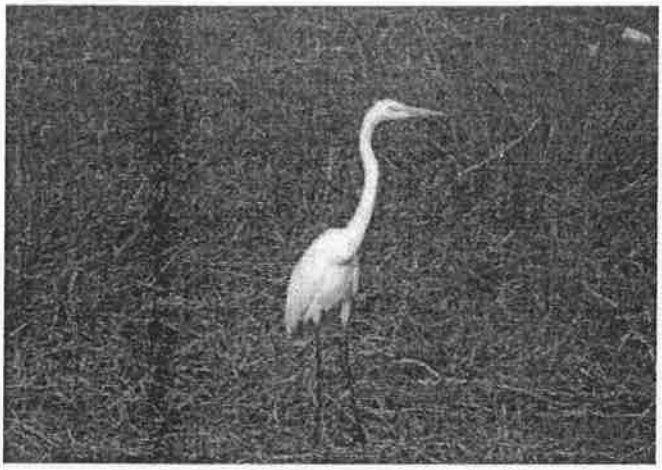
White-breasted Kingfisher



Purple Heron

Tufted Duck

PLATE 3 Birds recorded from the study area



Great Egret

Alexandrine parakeets

Indian Grey Hornbill

Purple Swamp Hen

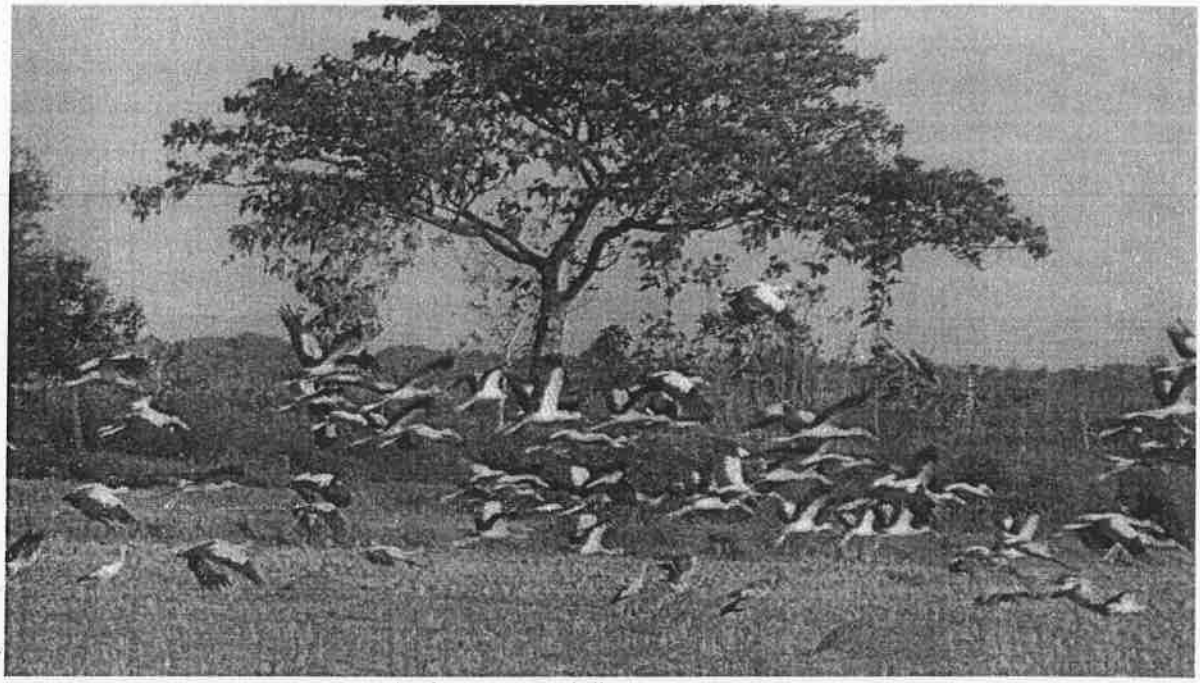
Blue-tailed Bee-eater *Merops philippinus javanicus*

Bronze-winged Jacana *Metopidius indicus*

PLATE 4 Birds recorded from the study area

Common Coot *Fulica atra atra*

White-bellied Sea eagle



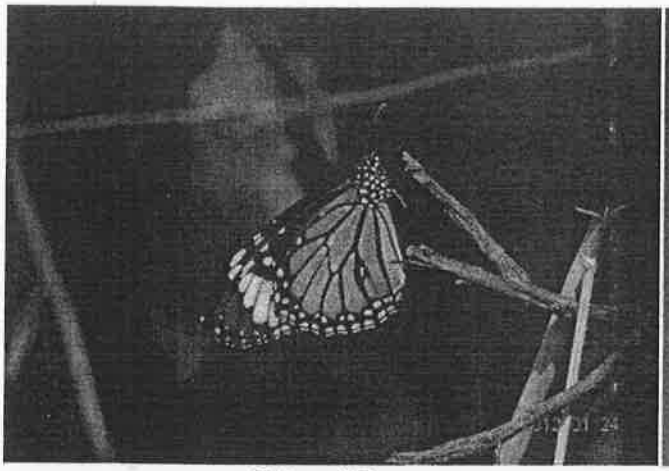
Flock of Asian Openbills, *Anastomus oscitans*

Brahminy kite

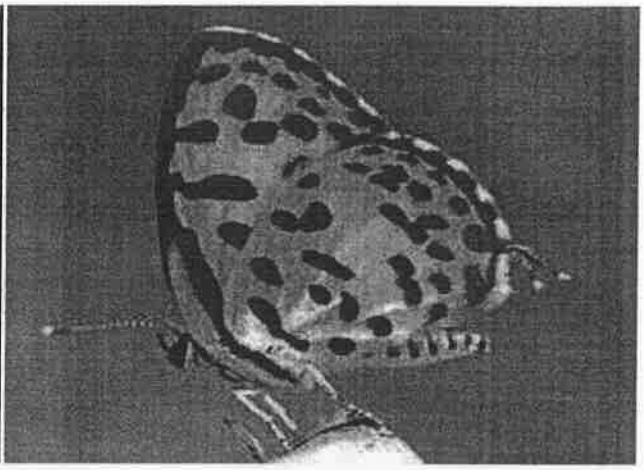
Red-wattled lapwing

Red Avadavat *Amandava amandava amandava amandava*

PLATE 5 Butterflies recorded from the area

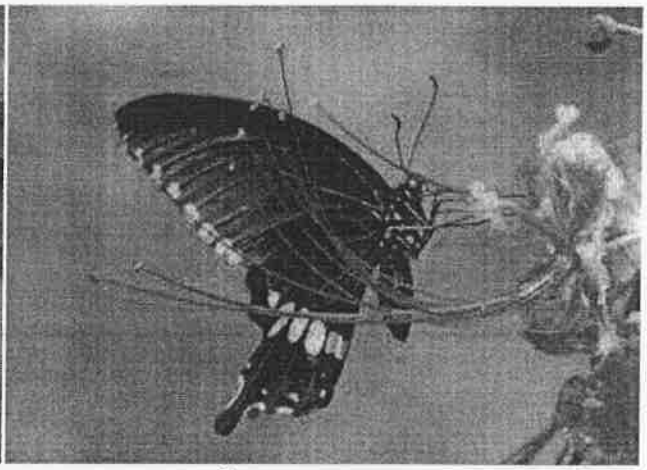


Stripped Tiger

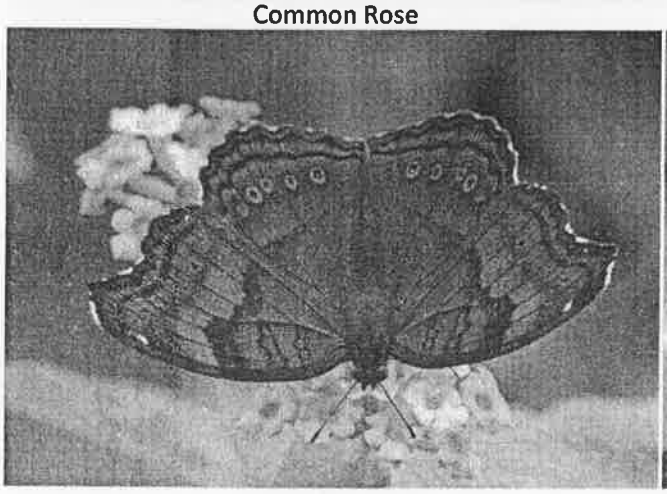


Common Pierrot

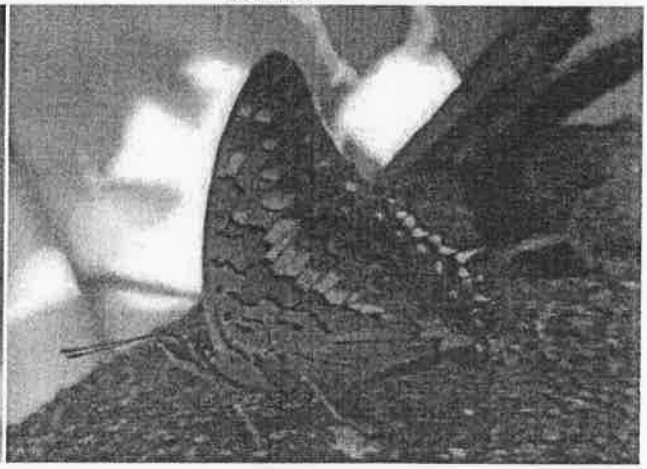
Common Rose



Common Mormon



Chocolate Pansy



Black Rajah

PLATE 6 Views of Bhavanapadu wetland

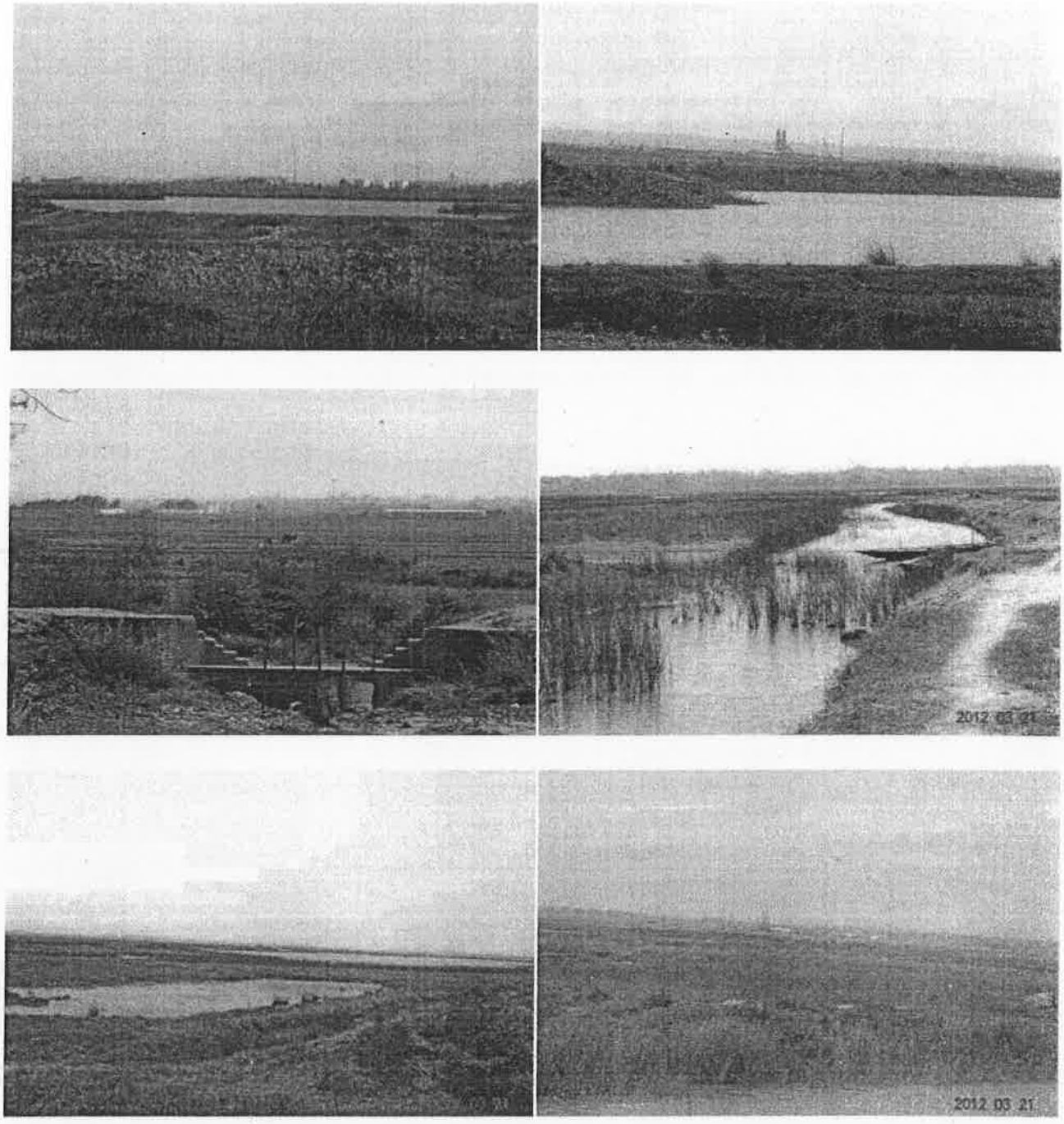
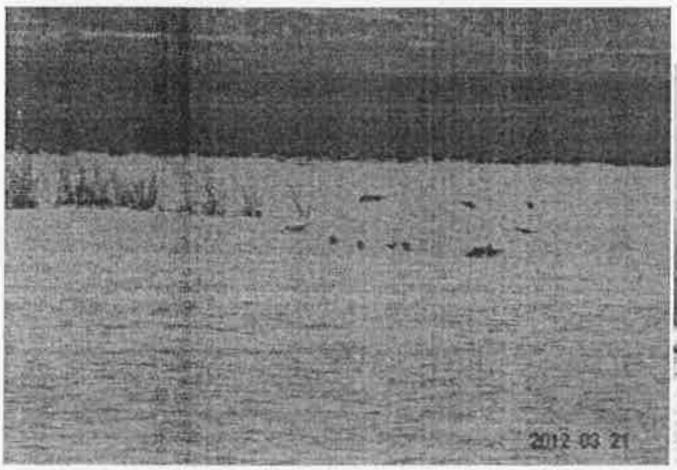


PLATE 7 Views of Bhavanapadu wetland

Fishermen shed at Bhavanapadu wetland

Fishing in Bhavanapadu



Avifaunal diversity at Bhavanapadu during March

PLATE 8 Views of Sompeta wetland

A view of Sompeta wetland during summer

Wild Boars grazing at Sompeta wetland

Water source within Sompeta wetland for lift irrigation

A flock of Rosy starlings at Sompeta

Irrigated rice field at Sompeta

Perennial marshy area of Sompeta wetland

PLATE 9 Field visit to Sompeta

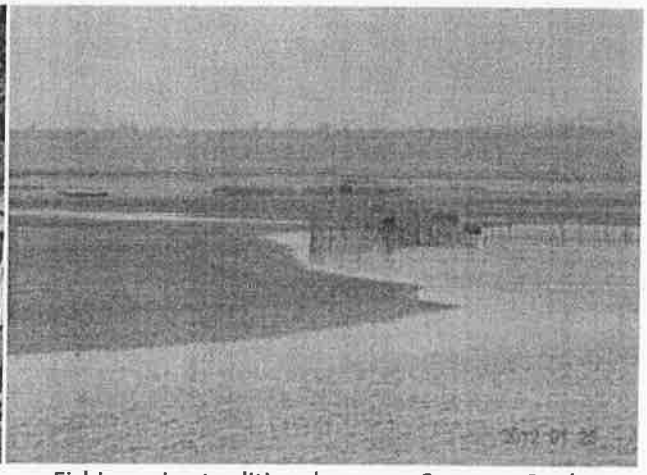
Focused Group Discussions at Sompeta

Resource mapping of Sompeta wetland and nearby areas

A freshwater fish vendor at Manikkiapuram

Manikkiapuram fisher village

Freshwater fishers of Manikkiapuram village



Fishing using traditional gears at Sompeta Beela

PLATE 10 Threats to the wetlands

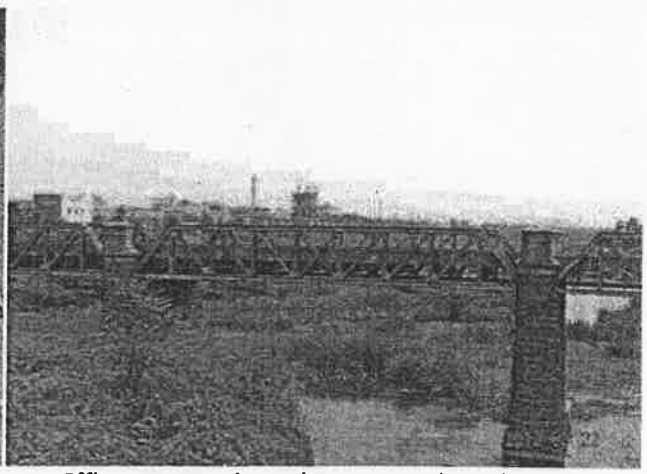
Jute curing in a wetland

Turtle poachers at Chintada lake

Wetlands are converted to Solid Waste dumps

Indiscriminate use of agrochemicals pollute wetlands

MNREGP at work-Biodiversity being wiped out



Effluents are released to streams by Industries

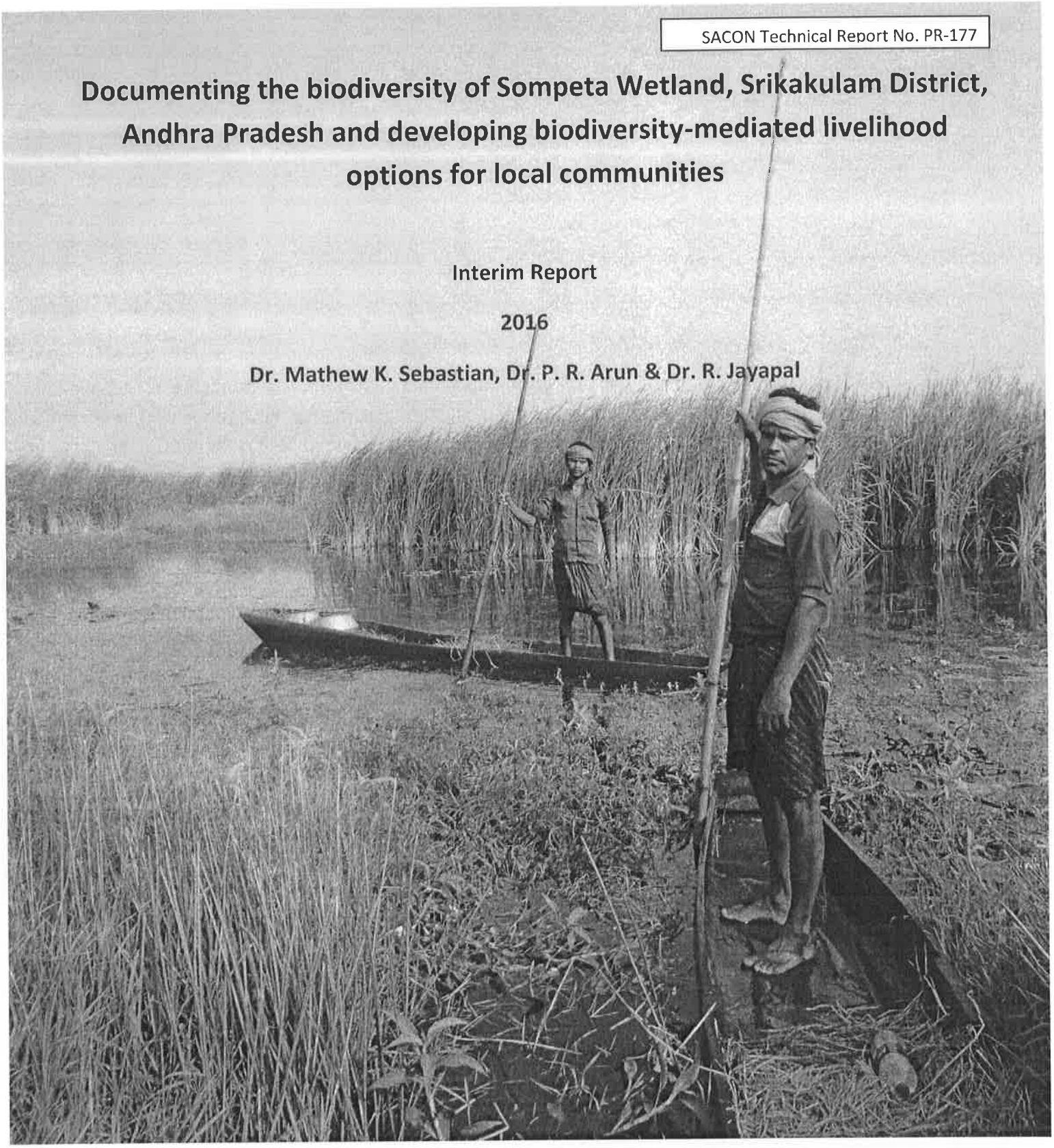
SACON Technical Report No. PR-177

Documenting the biodiversity of Sompeta Wetland, Srikakulam District, Andhra Pradesh and developing biodiversity-mediated livelihood options for local communities

Interim Report

2016

Dr. Mathew K. Sebastian, Dr. P. R. Arun & Dr. R. Jayapal



Sálim Ali Centre for Ornithology and Natural History
Anaikatty, Coimbatore – 641 108
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We express our heartfelt gratitude to the members of the local communities and their elders for extending wholehearted cooperation to provide information pertaining to our research topic.

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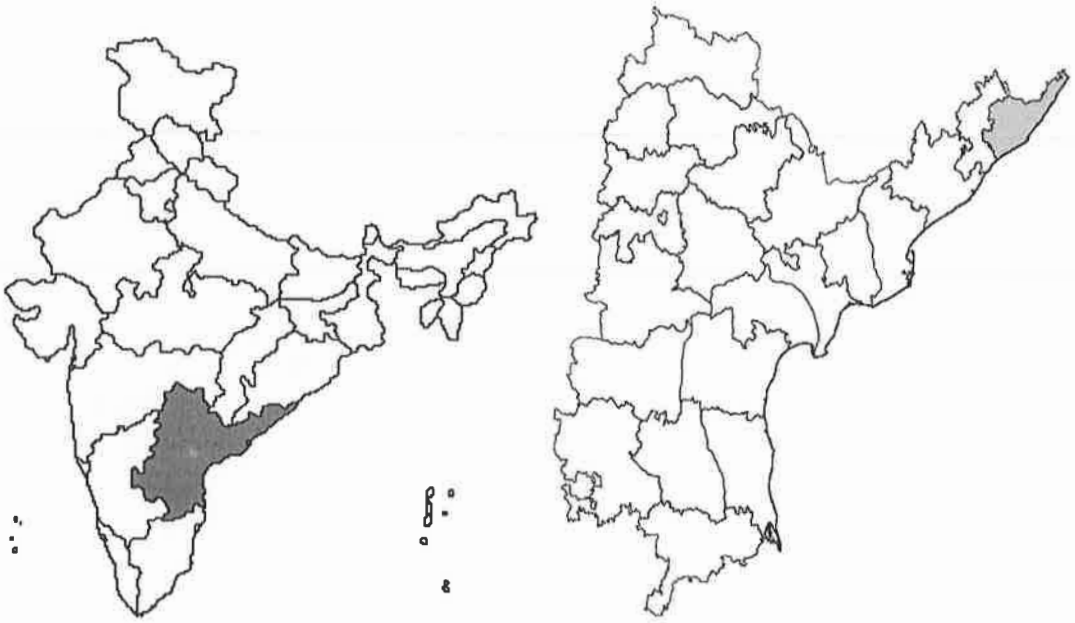
CONTENTS

Documenting the biodiversity of Sompeta Wetland, Srikakulam District, Andhra Pradesh and developing biodiversity-mediated livelihood options for local communities

1. Introduction

1.1. General features of Srikakulam district

The district Srikakulam, with an area of 5837 sq. km., situated between $18^0 20'$ and $19^0 10^1$'N latitudes and 83^0 05' and $84^0 90'$E longitudes, is the north eastern most one in Andhra Pradesh. The district is divided into 38 Mandals under three Revenue Divisions viz. Srikakulam, Palakonda and Tekkali. The district shares boarders with Orissa state in the north, Vizianagaram district of Andhra Pradesh in the south while Bay of Bengal lies in the east. In the district the altitude varies from a few meters above M.S.L. to above 1100 meters in the hills.



1.2 Population and literacy

In 2011, Srikakulam had population of 2,703,114 of which male and female were 1,341,738 and 1,361,376 respectively. In 2001 census, Srikakulam had a population of 2,537,593 of which males were 1,260,020 and remaining 1,277,573 were females. Population density is 463 people/sq. km. the sex ratio, 1015, is high as compared to all India average. The male literacy is 61.74 whereas the female literacy is only 55.31 (District Census Handbook, Srikakulam, 2011).

1.3 Geographical features

The district can be distinctively divided into three zones namely 1) the Hills, 2) the midland Plains and 3) the Coastal plains

1.3.1 The Coastal Plains

Coastal plains in the district are highly productive/ fertile area harbouring different types of ecosystems. Extensive sand bars / mounds are seen near Kallepalli, Srikakulam, Kalingapatnam, Bhavanapadu, Vajrapukotturu, and Baruva; along the estuaries of the river Nagavali near Kallepalli, river Vamsadhara near Kalingapatnam and the river Mahendratanaya near Baruva.

Most of the wetlands are seen in the coastal plains followed by the midland plains. The coastal plains harbour four major large wetlands namely, Naupada, Sompeta, Ichapuram and Poondi. Apart from these major wetland complexes, there are hundreds of small and medium, seasonal and perennial wetlands in the coastal area. The major rivers of the district, Nagavalli, Mahendratanya and Vamsadhara drains into Bay of Bengal. The river Vamsadhara originating in the Eastern Ghats of Orissa state enters Srikakulam district in Bhamini Mandal and finally flows into the Bay of Bengal near Kalingapatanam. The river Nagavalli and its tributary, Suvarnamukhi originate in the Eastern Ghats and. joins the Bay of Bengal at Kallepalli near Srikakulam town. Other smaller rivers such as Mahendratanaya and Bahuda drain into the northern parts, a narrow stretch of land between the Eastern Ghats and the sea.

1.3.2 The Plains

The midland plains lie within the network of semi–perennial rivers like Vamsadhara, Nagavali, Bahuda, Mahendratanaya, and their tributaries. In the plains there is little forest. The areas being highly fertile are under permanent agriculture or horticultural crops. The plains harbor a large number of small and medium wetlands.

1.3.3 The Hills

The hilly region, lying in the north and west of the district, forming part of the Eastern Ghats, is characterised with highly undulating terrain. This terrain covers parts of Palakonda, Pathapatnam and areas of Mandasa, Sompeta in the north-west and northern part of the district. About 1/3rd of the total area of the district is covered by the hills.

The Eastern Ghats run, roughly parallel to the sea from the north-east to the south-west.

1.4 Agriculture

Agriculture plays a major role in the economy of the district. The agricultural practices in the plains and hills vary. Tribals following primitive method of agriculture are predominant in the

hilly terrains. Though main crop is paddy; millets, horse grams and red grams are also raised. Vegetable/fruits such as Cabbage, Cauliflower, Tomato, Papaya, Jack Fruit, Cashew, Lemon, Guava etc, are also cultivated by the tribals near their dwellings.

The main Kharif crop is Meshta Jute (*Hibiscus cannabinus)* which is cultivated extensively in Palakonda, Amadalavalasa, and Rajam Mandals.

The most important wet crop is paddy, intensively cultivated in the plains. Cultivation of coconut and cashew in coastal areas and, mango in the plains is very profitable. Casuarina (*Casuarina equisetifolia*) is also raised in small plots mainly to meet their domestic fuel requirement and also as a source of income.

1.5 Irrigation

There are several irrigation projects in the district with vast expanses of water storage and channel systems. These irrigation / channels augment the number of wetlands in and around.

1.6 Fisheries

Inland fishing based on Beelas and tanks are a major source of income for the fishing communities. The traditional fishers, mostly migrants from Orissa, belonging to Scheduled Castes/Scheduled Tribes hold the fishing rights in these water bodies. The ownership of the tanks is vested with Grama Panchayats or Fisheries Department and these tanks are leased to the Fishermen Cooperative Societies.

1.7 Forests

Currently the forests in the district are largely mixed dry deciduous forests which are secondary in origin. Constant adverse biotic factors particularly, recurring annual forest fires, grazing and '*podu*' cultivation are some of the factors which led to the present degraded condition of the forests.

1.8 Coastal Wetlands

The coastal plains consist of a strip of land 10 to 15 Kms in width all along the sea coast with a length of 193 Kms starting from Itchapuram of Kandivalasa Gedda. All coastal areas are thickly populated and the major towns of the district Viz., Srikakulam, Narasannapeta, Tekkali, Palasa, Sompeta and Itchapuram are situated in this belt. Thickly populated villages of fishermen communities and other agricultural communities are interspersing the coastal area from south to north of the district.

The major rivers of the district viz. Nagavalli drains into Bay of Bengal near Kallepalli, Vamsadhara near Kalingapatnam and the river Mahendratanaya near Baruva creating estuaries.

The coastal plains all along the seacoast are characterized by 'Beelas' (Back – Waters/ a typical wetland system which is fed by flood waters through a vast network of small streams/channels and connected to the sea through a creek/channel) and sandy dunes. The two major Beelas of the district are Sompeta swamp and Bhawanapdu swamp. While Sompeta swamp is situated near to the Sompeta town in the northern part of the district, Bhawanapadu lies near to Tekkali town in the central part of the district.

The Poondi backwaters with more than 500 acres of water spread area is a major wetland near Vajrapukkotturu in Nandigam Mandal.

Ichapuram wetland is partly situated in the extreme north of the Srikakulam district and partly in the Odisha state.

The coastal plains are highly productive harbouring different types of ecosystems. The sand bunds / mounds can be seen near Kallepalli, Srikakulam, Kalingapatnam, Bhavanapadu, Vajrapukotturu, Baruva etc., along the estuaries of the river Nagavali near Kallepalli, river Vamsadhara near Kalingapatnam and the river Mahendratanaya near Baruva.

2. Objectives and Methodology

2.1 Objectives

- Survey and document the biodiversity of avifauna, butterflies and piscifauna of Sompeta Wetland
- Explore and suggest enhancement of sustainable livelihood options for the local stakeholders

2.2 Methodology

Birds: The wetland and the surrounding coastal landscape is being divided into subunits based on their unique habitat features. Birds are sampled from these habitats using standard methodologies like Point-count for woodland birds and vantage-point based total counts for water birds. In case of shy bird taxa like those frequenting reeds and marshes of the wetlands, area-search method is adopted to maximize our detection. At the end, a detailed bird-habitat matrix with annotations will be produced.

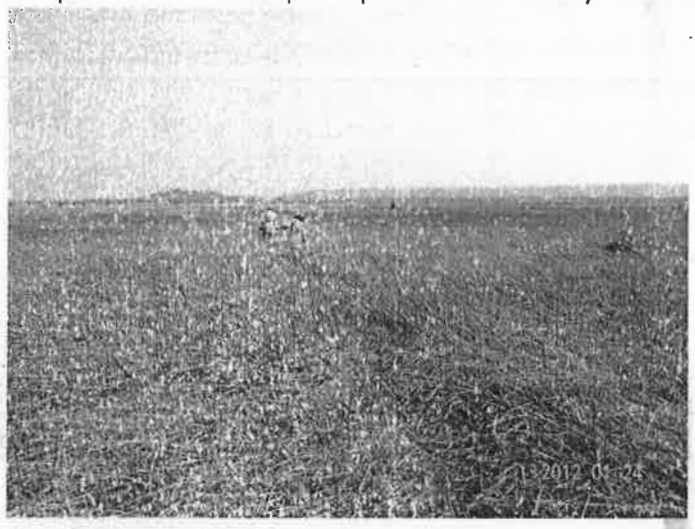
Butterflies: The same methods, as birds, are being followed for documenting the Lepidopteran fauna. Micro-habitats particularly identified on the basis of vegetation composition and structure, presence of larval plants, and vicinity to water bodies is being identified and sampling of butterflies conducted accordingly.

Enhancement of livelihood options: A detailed survey of the locally available resources and existing livelihood practices and options for the local people is being assessed by collecting information through participatory tools, questionnaires and focused and semi structured interviews. Enhancement of livelihood options is being formulated in a participatory way.

3. Sompeta Wetland

Sompeta wetland is situated in Sompeta Mandal of Tekkali Division. It is locally known as 'Beela'. Beela is a low lying swamp/marsh area with a unique habitat for rich biodiversity with a distinctive hydrological regime. There are three distinct water bodies of varying size and characterestics in the Sompeta wetland complex. The first one is known as '*Peddha Beela*' which is linked to two other Beelas known as the '*Chinna Beela* (Mankkiapuram Beela) and *Tampara* which is eventually connected to sea near Idduvanipalem. An anicut of height 0.843 m distinguishes the Peddha Beela and Chinna Beela. The Anicut has a sluiceway that allows water to flow from the Peddha Beela to the Chinna Beela and not vice versa. This helps to prevent intrusion of salt water to the Peddha Beela enabling it to maintain fresh water characteristics.

Sompeta wetland complex spreads over nearly 4000 acres starting from Baruva in Sompeta Mandal to Kapaasuguddi in Kaviti Mandal, an approximate length of 20 kms, with varying widths. It falls within Rishikudda, Goliagandi, Baruvapeta and Benkili villages of Sompeta Mandal. It consists of marshes, swamps, mud flats, permanent shallow marine waters, marine sub tidal aquatic beds, coastal brackish/saline lagoons, seasonal/intermittent freshwater marshes/pools, permanent freshwater lakes, , aquaculture ponds, irrigated lands etc.



Part of the Peddha Beela during summer

Sompeta wetland is fed by Mukundasagaram Pydigam reservoir and numerous water channels and small streams from the river Mahendaratanaya. Considerable flood waters also reach it during the monsoon. The area gets approximately 1200 mm rainfall annually, most of it during the south western season of June to September. summer where as middle portion of the wetland remains marshy even during summer.

3.1 Ecosystem Services provided by the Wetland

3.1.1 Regulatory services

3.1.1.1 Flood control

Srikakulam district receives around 1100 mm rainfall annually. The maximum rainfall happens during June to September and heavy rainfall occurs during few days bringing in flood waters from upstream inundating the low lying areas. During monsoon the entire Sompeta wetland complex gets inundated by flood waters. This flood water keep the wetlands replenished with water and nutrients and even in extreme summer all the three Beelas never dries up completely. These wetlands also help in controlling the flood in the surrounding areas which are thickly populated. It also sponges the flood and storm waters gradually releasing the water into the Beelas in lean months. Sediments are retained within the wetland and the thick vegetation which persists in the wetland controls soil erosion.

3.1.2 Provisioning services

3.1.2.1. Water regime

Numerous seasonal channels and streams feed 'Peddha Beela' during rainy season. The other two 'Beelas' are fed by the water from the Peddha Beela, with a typical water regime which have wider implications in terms of the water table, water quality and sustenance of the biodiversity of the surrounding areas.

Around 5000 acres of rice cultivation (two crops) is supported by these Beelas. Three lift irrigation projects, each covering an ayacut of 200 acres, is maintained by the water directly drawn from the Beela even during the extreme summer. Mostly vegetables are cultivated using the water from the lift irrigations. There are hundreds of acres of lush coconut and areca nut groves surrounding the Beela providing crucial income for the survival of local inhabitants.

Our PRA exercise brought out the information that 33 villages with an approximate population of 90000 reside within 3 km radius of the wetland. While 11 villages are exclusively engaged in agriculture, 8 villages are occupied by the marine fishers, and 4 villagers are engaged in fishing alongwith cultivation. One village, Manikkiapuram is engaged fully in inland 'Beela' fishing. Seventeen villages are engaged in farming alongwith rearing of the cattle. In two villages some of the households earn their livelihood from making mats where as spinning coir was taken up as an occupation by some households in two villages.

Due to the "Beela' the ground water table is always high. In fact the Beela is vital for supporting the water needs of the Paddy cultivated in the area. The area around the Beela is very fertile. In and around the Beelas there is lush green coconut groves interspersed with areca nut trees.

This area is also known for its vegetables. A food mile analysis in the nearby areas indicated that except potatoes all other food materials are locally produced. Three lift irrigation schemes which cater 750 acres of agriculture are operated in the area. Water could be sourced without any interruption from wells located in the wetland to pump to upstream areas.

3.1.2.2. Fisheries

The inhabitants of the Manikkapuram village of the Kaviti Mandal depend exclusively upon the Beelas for fishing. The residents here are traditional fishers belonging to fisher communities of Odisha origin. Here, around 400 families are engaged in subsistence fishing. All members in the family are engaged in fishing related activities by some means. While the men folk involve in capture fisheries, the womenfolk market the fishes locally earning extra income for the family. Traditional gears made of plant materials are used for fishing. The residents spent their free time in mending their fishing gears. The Fishers here are organised into cooperative societies Patronised by the Department of Fisheries and the wetlands are leased out to these societies every year.

Fishers with fish trap in Peddha Beela

3.1.2.3 Fodder

Beelas are important grazing fields

Farmers in seventeen villages falling within the 3 km from the wetland are mainly into agriculture and rearing cattle. Hundreds of the cattle graze in the wetland during dry season. The villagers harvest fodder from the wetland for stall feeding thousands of cattle reared in homesteads. The wetlands act as a huge grazing ground for cattle during dry season. Almost all the families surrounding the wetland keep cattle as an additional source of income.

3.1.2.4 Materials for roofing and mats

The wetlands a rich source of raw material, such as *Scirpus* sp., to make mats. It is an income source crucial to hundreds of people. The material is also used for thatching and roofing.

3.1.2.5 Medicinal and Edible plants

Sompeta wetland and its surroundings are habitat for 495 plant species out of which many have medicinal properties and many edible. Local people depend on these plants as remedy for many maladies and also collect tubers and fruits to eat.

4. Biodiversity and Conservation Priorities

4.1 Wildlife Habitat and rare species

The wetland is a habitat for 491 plant species and 121 bird species that includes migratory species. In fact Sompeta wetland and its environs give shelter to 74 % of the plants and 52 % birds found in the whole of Srikakulam district. A twenty five acre hillock within the wetland harbours a wide variety of wild life such as wild boars, several species of snakes and bats.

Wild boars roaming in Peddha Beela

4.2 A potential IBA site?

Sompeta wetland is one of the last remaining wetlands of Coromandel Coast that holds a significant key to the aquatic biodiversity of the peninsular India. Spread over 1,600 sq. km in area with 20 km long shoreline that ranges from 0.5 to 2 km in width, Sompeta wetland is a complex ecosystem with a multitude of aquatic habitats including freshwater marshes and pools, irrigated paddy fields, stream mouths, mud flats, coastal brackish/saline lagoons, and tidal backwaters. This variety in physical features gives rise to a spectacular diversity of aquatic flora and fauna. This wetland complex is also a lifeline to around one lakh people, living in 33 villages around the wetland, who are directly dependent on the waters for their sustenance. The local communities have been waging a vigorous campaign to protect the wetland as parts of it were to be 'reclaimed' for industrial development We surveyed the Sompeta wetland during 15-24 March, 2016 for a preliminary assessment of the floral and faunal diversity. During our short survey, we recorded 125 species of birds including 48 water birds and another 16 wetland-dependent

Oriental Pratincole

Bengal Bushlark_

avifauna. Interestingly, we documented presence of five species of globally Near-threatened birds, viz., Oriental Darter (*Anhinga melanogaster*), Eurasian Curlew (*Numenius arquata*), Black-headed Ibis (*Threskiornis melanocephalus*), Curlew Sandpiper (*Calidris ferruginea*), and Alexandrine Parakeet (*Psittacula eupatria*) in and around the Sompeta wetland. Other interesting observations include range extension of Bengal Bushlark (*Mirafra assamica*), which is otherwise distributed along the Indo-Gangetic plains east to Bengal and Brahmaputra floodplains, occurrence of a good population of Long-toed Stint (*Calidris subminuta*) – an uncommon winter visitor to India, and a large nesting colony of Black-breasted Weaver (*Ploceus benghalensis*) – a rare near-endemic species to India. Our survey also covered other taxa like plants, butterflies, dragonflies, fishes, herpetofauna, and mammals.

Long-toed Stint

We plan to do more extensive surveys in the coming days to complete our documentation of the biodiversity of Sompeta wetland, and we will recommend the wetland to be designated as an Important Bird and Biodiversity Area (IBA) if warranted.

4.3 Potential habitat for Pink Headed Duck

Pink-headed Duck is a shy and secretive bird, even potentially nocturnal, inhabiting secluded and overgrown still-water pools, marshes and swamps in lowland forest and tall grasslands, where there are lot of hiding places particularly areas subject to seasonal inundation. Both male and female of the species are 41–43 cm in size, long-billed with long necks and peaked heads. The male has a pink bill, head and neck while the female has a pale pinkish head and neck with a paler bill. The black of the body extends as a narrow strip on the front of the neck.

Pink Headed Duck from the wetlands of Srikakulam had been reported in the British Gazetteers. The Pink-headed Duck is a species not reported from the country for more than half a century. Its known distribution range includes northern Burma, north-eastern India, and central Nepal. Some, and possibly all, populations show local seasonal movements, resulting in scattered historical records as far as from Punjab, Maharashtra and Andhra Pradesh in India. The species was relentlessly hunted in the 19th and first half of 20th century for its skin which was prized as curios though its meat was less preferred. Indiscriminate hunting coupled with loss of habitat led to the fast disappearance of this bird from all known places of report.

Pink-headed Duck was last observed in the wild in 1949. Though amenable to live in captivity for a long time it failed to breed in captivity and in 1944 the last bird in the captivity died. As there have been some local reports of the sighting of this bird in Northern Burma, this bird has been categorised as 'Critically Endangered' instead of extinct. It is assumed that a small

population of around 50 birds may exist in Northern Burma which is yet to be explored fully. The elusive search of Pink-headed Duck is still in progress.

During our visits to Sompeta photographs of several species were shown to many villagers who were intimately connected to the wetlands. Alongwith the photographs of bird species already confirmed from those wetlands many villagers firmly reiterated, after seeing the photograph of Pink-headed Duck, that the bird was available during November to December end and sometimes upto January in the area around ten years back (Sebastian, et. al., 2012).

4.4 Conservation priorities

5000 acres of Paddy with 2 crops will suffer by the change in the hydrological regime of the wetland and its surroundings. Apart from the paddy cultivation thousands of acres of coconut farms and 750 acres of vegetable cultivation which depend on the three lift irrigation schemes will be in severe threat hitting the livelihood of around 3 lakh people in 33 villages. In effect the physical and operational interventions due to the establishment of any industrial activity would alter the natural system drastically in the coming years. In the process several species, known and unknown, is likely to disappear from the area, several crucial ecosystem services will be seriously undermined affecting the environmental security.

5. Profile of the immediate stakeholders of the wetland

5.1 Land Use Pattern

Table – 1 Land Use Pattern upto 10 km radius of the wetland (in ha)

Sl. No.	Particulars of land use	0 – 3 km	3 – 7 km	7 -10 km	0 – 10 km	Percentage
1.	Forest Land	0.00	0.00	3.10	3.10	0.003
2.	Land under cultivation					
	a) Irrigated Land	1789.89	1727.10	3376.23	7293.22	26.46
	b) Unirrigated Land	1532.51	3427.54	7498.35	12458.40	45.19
3.	Cultivable waste land	313.58	278.61	453.15	1045.34	3.79
4.	Area not available for cultivation	1585.02	2475.36	2710.31	6770.69	24.56
	Total Area	**5221.00**	**7908.61**	**14441.14**	**27570.75**	**100**

Data source: District Primary Statistics of Srikakulam District - 2001

The total area under cultivation within the 3 km radius is 3322.40 ha (irrigated – 1789.89, un irrigated -1532.51); within 3-7 km is 9225.45 ha (irrigated – 1727.10, un irrigated – 7498.35); 7-10 km is 10874.58 ha irrigated – 3376.23, un irrigated – 7498.35); 0-10 km 19751.62 ha

(irrigated – 7293.22, un irrigated – 12458.40). However the data shown above in the cultivable waste land is misleading as it contains wetlands also. As per the statistics 19751.62 ha cultivated land (irrigated and unirrigated) is in the 10 km radius of the wetland. The irrigated land is about 7293.22 ha l and the unirrigated area is about 12458.40 ha.

5.2 Agriculture and cropping pattern

Agriculture is the mainstay of the community and the economic well being is heavily dependent on the agriculture. There are mainly two cropping seasons which includes the first crop season during rainy season and the second season during the winter and early pre monsoon seasons. The major crops of the first season are paddy, sugarcane, groundnut, bajra, finger millet and jowar. Of the bajra, finger millet and jowar are grown in dry lands with low irrigation facility. The crop of second season include Bengal gram, green gram, gingili and vegetable crops like brinjal, tomato, bhindi and other leafy vegetables.

5.3 Population

5.3.1 Table – 2 Distribution of population

Sl. No.	Particulars	0-3 km	0 -10 km
1.	No. of households	6729	36007
2.	Male population	13242	74522
3.	Female population	14795	80585
4.	Total population	28217	155107
5.	Average household size	4.2	4.3
6.	% of males to the total population	46.92	48.05
7.	% females to the total population	52.43	51.95
8.	Average household size	4.2	4.3
9.	Sex ratio (no. Of females per 1000 males	1117	1081

Data source : District Primary Statistics of Srikakulam District. – 2001

5.4 Villages Covered for the present survey

Sompeta Mandal

1. Lakhavaram
2. Palasapuram
3. Zinkibhadra
4. Benkili
5. Rishigudda
6. Gollagandi
7. Baruva
8. Baruvpetta
9. Onturu

10. Ramayyapatanam

11. Iskalapalem

Kanchili Mandal

1. Ammavariputuga

2. Kuttuma

3. Kokkiliputtuga

4. Mandapalle

Kaviti Mandal

1. Manikkiyapuram

2. Baliaputtuga

3. Kusumapuram

4. Kapasaguddi

5. Borivanka

6.Kalingapatanam

5.5 Social Structure

The lion's share of the local community is agrarian belonging to the intermediary castes classified in the Backward Communities (BC) which is further classified into BC-A, BC-B, BC-C and BC-D depending upon their perceived backwardness. The forward communities are negligible in number. About 4.5% of the population belongs to Scheduled Tribes (ST) and about 6.60% belongs to Scheduled Caste (SC) communities. Thus approximately 11% of the population belongs to the socially weaker sections.

Majority of the villages display a multi-caste/multi-occupational social structure. The numerical strength of the Forward Caste (FC's) s is nominal whereas Backward Castes under different categories (BC-A, BC-B, BC-C, & BC-D) dominate the social composition. Most of the castes still stick to their traditional occupations whereas few castes (such as members belonging to the weaving community, sweet making community, carpentry, black smithy etc.) are veering away from their traditional occupation because of the job opportunities outside their locality.

5.5.1 Livelihood Assets of the Stakeholders surveyed (Based on the 'The Sustainable Livelihoods Approach', Kollmair, M and St. Gamper, 2002)

The Sustainable Livelihood Framework (SLF) forms the core of the Sustainable Livelihoods Approach and serves as an instrument for the investigation of poor people's livelihoods, whilst visualising the main factors of influence. To achieve the SLF model objectives a qualitative and participatory analysis at the local level has to be conducted in detail.

The livelihoods approach is focused heavily on people. Therefore an accurate and realistic understanding of people's strengths (here called "assets" or "capital") is crucial to analyse how their livelihood options can be enhanced by converting their assets into positive livelihood outcomes (Bebbington, 1999). People require a range of assets to achieve their self-defined goals, whereas no single capital endowment is sufficient to yield the desired outcomes on its

own. Since the importance of the single categories varies in association to the local context, the asset pentagon offers a tool to visualise these settings and to demonstrate dynamical changes over time through constantly shifting shapes of the pentagon

5.5.1.1 Natural Capital

Natural resource stocks from which **resource flows and services** (such as land, water, forests, air quality, erosion protection, biodiversity degree and rate of change, etc.) useful for livelihoods are derived are usually defined as Natural Capital. It is crucial for those who derive all or part of their livelihoods from natural resource-based activities (Ecosystem People), as it is often the case for the poor stakeholders, since a good air and water quality represents a basis for good health and other aspects of a livelihood.

The main Natural Capital commonly available to the local community is the Beela which is the main source for water for irrigation, drinking, grazing field for livestock, fodder, roofing and thatching materials, edible and medicinal plants etc. Apart from this the Beela plays a major role in maintaining the ecological and environmental balance which facilitates in maintaining air and water quality which is required for a healthy living.

The rich biodiversity of birds and plants add to the natural capital which is mentioned elsewhere in this report.

Only about 40% of the local stakeholders own their land which makes them vulnerable to poverty.

5.5.1.2 Physical Capital

Physical capital comprises the **basic infrastructure and producer goods** needed to support livelihoods such as affordable transport, secure shelter and buildings, adequate water supply and sanitation, clean, affordable energy and access to information. It is heartening to note that all the villagers own their own houses though only 50% houses are pucca. As is the common case, marginalized communities i.e. SC's and ST's and other landless people are the owner's of 'kaccha' houses. Almost hundred percentage of the households, in many cases more than one member, owns a mobile phone and ninety percent own a TV in their house rendering them accessible to information and communication facilities. In most of the village streets, drinking water is provided through pipeline; 60% households own a bicycle whereas 40% households own a two wheeler, either a Moped or a Motorcycle. However it is interesting to note that the number of Motor Cars owned is very less. Even in affluent villages like Ammavariputtuga and Lakhavaram there are few Motorcars. The maximum number of Motor Cars available in a village are 3-5. Being an agrarian community in many villages 2-3 tractors are found.

Other Physical Capital on commercial basis available in the villages are threshers, flour mills, rice mills, and coir making factories.

5.5.1.3 Human Capital

In the context of the SLF it is defined as follows: "Human capital represents the **skills, knowledge, ability to labour** and **good health** that together enable people to pursue different livelihood strategies and achieve their livelihood objectives" (DFID, 2000). It is a major and decisive factor in order to make use of any other type of assets. In many times valuation of Human Capital is a complex issue since assets like indigenous knowledge cannot be valued appropriately.

It is noteworthy in most of the villages from the available human capital is high. Villagers traditionally are skillful in their occupation such as agriculture, fishing, weaving, sweet making, preparation of mats, house construction etc. In Manikiyapuram village which is traditionally a fishing village, the family members prepare most of the fishing gears. Even children are adept in catching fishes. The people are capable of enduring long hours labour being an agrarian and fishing community.

Village evening fish market

Generally people are enjoying reasonable good health since government supported health care is reasonable available and accessible to them. The exception is that few villages which fall in the Uddanam area. Kusumapatanam, Kalingapatananm and parts of Baruva in the Uddanam area are inflicted by the rare Chronic Kidney Diseaase (CRD).

There is ample formally educated skill available in all the villages. The availability of few Junior and Senior, both in the private and government sector has facilitated hundreds of youth to become diploma holders, graduates, and Post Graduates. In all the villages there are Graduate and Post Graduate Engineers and MBA's available. Diploma and ITI certificate holders are exist in all disciplines. Apart from this there are informally skilled plumbers and electricians in each village to cater to the local needs. The unfortunate aspects are that only 50% of these skilled people are employed in formal or informal sector.

5.5.1.4 Social Capital

'In the context of the SLA, it is taken to mean the social resources upon which people draw in seeking for their livelihood outcomes, such **as networks and connectedness**, that increase

people's trust and ability to cooperate or **membership in more formalised groups** and their systems of rules, norms and sanctions.'

It is noteworthy that due to various factors, the social capital of the study area is quite high. Srikakulam district has a long history of many social movements. The agitation against the proposed Super Thermal Power Plants in which three people lost their lives and many got injured, have united people like never before.

The villages have many formal and informal organizations and institutions which is listed below.

5.5.1.4.1 Irrigation Committees – Under the auspices of the Department of Irrigation the Committee advises about the irrigation water usage formalities.

5.5.1.4.2 Self Help Groups (SHG's) – The most vibrant social groups, locally known as 'Dokras', in a village which are run by women. In few villages there are SHG's run by men also. In a large village like Baruva more than 100 SHG's exist whereas in small villages more than 20 SHG's exist. Each SHG consists of 10-15 members. The monthly subscription is usually Rs.50/- SHG's are active in microfinancing and takes care of the immediate and urgent financial needs of the villagers to a large extent.

5.5.1.4.3 Youth Clubs – Minimum one youth club is available in a village; some villages having more than one. Youth clubs are active in organizing social, cultural and sports activities.

5.5.1.4.4 Non Governmental Organisations – Few villages have NGO's focusing on particular social activities.

5.5.1.4.5 Temple Committees – These are formed to organize festivals and other programmes associated with temples. These committees are temporary and formed as and when required.

5.5.1.4.6 Institutions

5.5.1.4.6.1 Schools – depending on the size of the village there are government primary and secondary schools.

5.5.1.4.6.2 Panchayat and Village Office – All the villages have Panchayat and Village Office. Village Offices are usually functioning in the Panchayat Office. Villagers rank Panchayat and Village offices as the most important offices impacting their life.

5.5.1.4.6.3 Anganwadis – In all the villages there are Anganwadis, sometimes more than one.

5.5.1.4.6.4 Banks – Few villages have a bank branch.

4.5.1.4.6.5 Fishermen Societies - In Fishing villages, Fishermen Societies under the auspices of the Department of Fisheries.

5.5.1.4.6.6 Temples – Temples are ubiquitous in all the villages. Even in small villages there are minimum three temples; in large villages there are more than ten temples. Temples act as a binding force among the villagers.

5.5.1.5 Finance capital

"Financial capital" denotes the financial resources that people use to achieve their livelihood objectives and it comprises the important availability of cash or equivalent, that enables people to adopt different livelihood strategies. Two main sources of financial capital can be identified:

- **Available stocks** comprising cash, bank deposits or liquid assets such as livestock and jewellery, not having liabilities attached and usually independent on third parties.
- **Regular inflows of money** comprising labour income, pensions, or other transfers from the state, and remittances, which are mostly dependent on others and need to be reliable.

The financial capital of the villagers are precarious. Being an agrarian economy, the state and scope of agricultural crops determine the economic well being of the community. The major source of income of the land owning community is from coconut, paddy, vegetable cultivation and cashew which are all price sensitive. Labourers depend on the agricultural season for work opportunities and in the off season they migrate to states like Gujarat, Punjab and cities like Mumbai and Bengaluru. Even many farmers who own 1-2 acres of land also migrate for extra income. The migration is rampant so that sex ratio all the villages are favouring females. The wages are also not high locally.

Because of the depletion of the fish population in the Beela (mostly due to uncontrolled overfishing), inland fishers are struggling to survive. Since Srikakulam cost is not particularly known for fish productivity and because of over exploitation the income for marine fishers is also low. The ban on fishing from May 15th to July 15th every year adds to their vows. Many marine fishers also migrate to industrial canters for extra income.

Women folk equally contribute to the financial well being of the family in various ways. The fish catch of the men folk is marketed by women folk in the markets and vending it carrying on the heads from place to place which adds substantially to the family income. The vegetables are also marketed by the women.

Most importantly when the men are migrating to outside places, women tend the family assets like agriculture and cattle. Women from fishing communities also work as agricultural labourers.

6. Enhancing the livelihood options of the stakeholders

- To maintain the integrity of the wetland inorder to protect its biodiversity and also to maintain the ecosystem services derived from it.
- To derive maximum benefit out of the wetlands and its biodiversity, in a sustainable way, so that the stakeholders strive to protect the wetland

6.1 Measures to enhance the livelihood options

6.1.1. Development of Ecotourism

6.1.1.1 The scope

The natural setting of the wetland and its environs is ideal to become a thriving ecotourism centre. Even in extreme summer the core area is inundated by water suitable for boating by country boats. Having well developed conveyance facilities from different parts of the state and the country, the spot is easily accessible by rail, road and air. The three Beelas are unique in its characteristics and similar natural formations are not found anywhere else in the country. Different agricultural crops being cultivated in the surrounding areas can be developed for promoting farm tourism.

Peddha Beela in summer - A potential ecotourism attraction

The avifaunal biodiversity is astounding harbouring many rare and IUCN category birds. It is an important site for migratory birds from different parts of the world. It can be a destination for bird watchers and researchers.

The coastal stretch and beaches adjacent to the Beela also offer avenues for ecotourists. Experiencing village life of people of different vocations such as fishers, farmers in different settings would be enjoyable for the visitors.

6.1.1.2 Components of the Ecotourism

6.1.1.2.1 Bird watching: As mentioned elsewhere in this report, even during off season more than 120 bird species are available in the Beela and its environs which include rare and threatened birds. During the migratory season i.e. from September to February, thousands of birds reach Sompeta Beela from different parts of the world.

6.1.1.2.2 Boating: Even during extreme summer around 50 ha. of water spread area exists in the Peddha Beela which offers ample opportunities for boating in country boats in a calm and serene environment.

6.1.1.2.3 Angling: Chinna Beela can be developed as an angling site by stocking appropriate fish species such as Mahseer along with the native species in the Beela.

6.1.1.2.4 Experiencing **rural life and farm tourism:** A lot of foreign tourists and native urban tourists turning towards rural areas to experience rural life and local culinary. The villages in the immediate vicinity of the Beela offers perfect setting for farm tourism with the number of traditional houses and farms cultivating different types of crops. There are a number of festivals celebrated associated with temples in each village which will be exotic experience for the tourists.

6.1.1.3 Infrastructure needed to develop ecotourism

6.1.1.3.1 Ecofriendly cottages: Adequate accommodation will have to be made available by constructing ecofriendly cottages in locations which will not be inundated during monsoon.

6.1.1.3.2 Home stays: Local houses that are ready to convert themselves to home stay facility for tourists.

6.1.1.3.3 Boat bay: Facility for parking and embarking on boats will have to create at different spots in the Beela without altering the ambience.

6.1.1.3.4. Bird watching tower: A bird watching tower at an appropriate location can be constructed which will facilitate the visitors not only for bird watching but also to enjoy the natural scenic beauty.

Traditional houses can act as home stays for tourists

6.1.1.3.5. Catering facility for the tourists: adequate facility for providing food to the tourists should be created.

6.1.1.4 Employment opportunities

6.1.1.4.1 For local fishing community: Fishers can be trained to take the tourists for boating and bird watching since they are experts in handling country boats and familiar with the locations for bird watching.

6.1.1.4.2 For unemployed graduates: can be trained as guides for bird watching. They also should be trained in soft skills, proficiency in English and Hindi and also in dealing with domestic and foreign tourists.

6.1.1.4.5 Opportunities in the home stay sector: The local houses opting for converting themselves into home stays will be earning substantial income from this activity.

6.1.1.4.6 Other opportunities : Once the ecotourism is established and the number of tourists increase, ample income generating opportunities will be available by meeting the requirements of the tourists such as increased demand for local products such as vegetables, milk, fish and other items required on a day to day basis.

6.1.1.2 Establishment of Diary

6.1.1.2.1 Scope

A house hold cattle yard

Almost 50% of the households own cattle. Cattle population consists of local breed and hybrid breeds which are fed natural fodder. Most of the cattle graze on the grasslands of Beela. The quality of the milk is high as compared to the stall fed cattle. At present, a privately owned Dairy viz. Visakha diary operated from Visakhapatanam, has orgainised cattle owners as a cooperative and collects milk at Rs.20-22/litre. They market the milk at Visakhapatanam at a much higher price.

There is ample scope for organizing the milk producers as a separate cooperative society or registering a Producers Company. The collected milk can be processed at Sompeta itself by setting up a chilling plant. Since the milk is naturally produced it can be marketed as an organic product fetching much higher price. The income earned by milk producers can be substantially enhanced by this measure.

6.1.1.3 Establishment of a unit for making Coir based products

Fibre extracted from coconut husk

Coir rope making units exist in Sompeta and Kaviti Mandals. Coir products such as coir mats, coir brushes, coir ropes, coir mattresses do have increasing demand in domestic and international markets as they are ecofriendly. Coir Board of India provides training to entrepreneurs to manufacture

these products. The coir pith available during the process can be converted to organic manure which can be sold locally to organic farmers who are increasing day by day or can be exported.

Coconut farmers can be organized as Cooperative Society and manufacturing units can be set up.

6.1.1.4 Value added products from lotus tubers and stems

Lotus plants are profusely growing in the wetland impacting the ecological balance of the wetland. Unless the unlimited proliferation is controlled it will seriously alter the characteristics of the wetland.

Almost all the parts of the plant viz. root, young flower stalks, and seeds are delicacies and being employed in the cuisine.

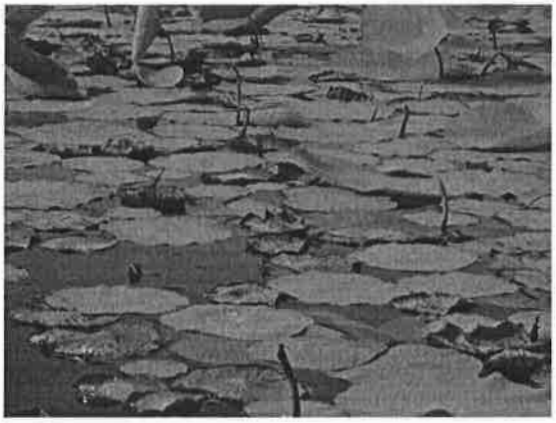
6.1.1.4.1 Uses of Lotus:-

- Lotus flowers, seeds, young leaves and rhizomes are all edible.
- The petals are sometimes used for decoration, while the large leaves are used as a wrap for food.
- Various parts of the sacred lotus are also used in traditional Asian herbal medicine.
- The tender seeds are munched in north-east India.
- The lotus stem is eaten almost in all parts of India, and pickled too.
- Young lotus stems are used as a salad ingredient in Vietnamese cuisine.
- The distinctive dried seed heads, which resemble the spout of watering cans, are widely sold throughout the World for decorative purposes and for dried flower arrangement.
- The rhizome is used as a vegetable in soups, deep-fried, stir-fried and braised dishes.
- Lotus rootlets are often pickled with rice vinegar, sugar, chili and garlic.
- The stamens can be dried and made into a scented herbal tea in Vietnam.
- The lotus seeds or nuts can be eaten raw or dried and popped like popcorn.
- In South Indian states, the lotus stem is sliced, marinated with salt to dry, and the dried slices are fried and used as a side dish.
- In Sri Lanka, the sliced lotus stem curry is a popular dish called as "Nelum Ala."

- A unique fabric from the lotus plant fibers is produced in Myanmar.
- The leaves are used as a flavouring agent and to wrap sweet and spicy mixtures (rice, meat, fruit etc.) for steaming (http://www.krishisewa.com/articles/production-technology/485-lotus.html)

6.1.1.4.2 Health benefits of Lotus root

- Lotus root is one of the moderate calorie root vegetables. 100 g root-stem provides about 74 calories. It is composed of several health benefiting phyto-nutrients, minerals, and vitamins.
- Lotus rhizome is very good source for dietary fiber; 100 g flesh provides 4.9 g or 13% of daily-requirement of fiber. Dietary fiber together with slow digesting complex carbohydrates in the lotus root help reduce blood cholesterol, sugar, body weight and constipation conditions.
- Fresh lotus root is one of the excellent sources of vitamin C. 100 g root provides 44 mg or 73% of daily-recommended values. Vitamin C is a powerful water soluble anti-oxidant. It is required for the collagen synthesis inside the human body. Collagen is the main structural protein inside the body, required for maintaining integrity of blood vessels, skin, organs, and bones. Regular consumption of foods rich in vitamin C helps the body protect from scurvy, develop resistance against viral infections, boosting of immunity, wound healing and to scavenge cancer causing harmful free radicals from the body.



Lotus plants are abundant in Peddha Beela

- In addition, the root contains moderate levels of some of valuable B-complex group of vitamins such as pyridoxine (vitamin B-6), folates, niacin, riboflavin, pantothenic acid, and thiamin. Pyridoxine (vitamin B-6) acts as a coenzyme in the neuro-chemical synthesis in the brain which influences mood. Adequate pyridoxine levels help control nervous irritability, headache, and tension. It also cuts heart-attack risk by controlling harmful homocysteine levels in the blood.
- Further, the root provides healthy amounts of some important minerals like copper, iron, zinc, magnesium, and manganese. Copper is a cofactor for many vital

enzymes, including *cytochrome c-oxidase* and *superoxide dismutase* (other minerals function as cofactors for this enzyme are manganese and zinc). Along with iron, it is also required in the production of red blood cells.

- Crunchy, neutral yet delicate flavor of root lotus is because of its optimum electrolyte balance. It composes agreeable ratio of sodium to potassium at the value 1:4. While sodium gives sweet taste to the root, potassium acts to counter negative effects of sodium by regulating heart rate and blood pressure (http://www.nutrition-and-you.com/lotus-root.html).

Local stakeholders can be trained in the processing of Lotus parts which can be marketed.

6.1.1.5 Value added products from Pandanus leaves

Pandanus plants

Pandanus odoratissimus is part of the Pandanceae family of plants, commonly referred to as screw pine. It is native to peninsular Southeast and South Asia and is one of the main wetland species of plants to be used to make handicraft products in this region. It is found in the back mangroves and has large prop roots and long, thin, spiny leaves. The leaves make a good fibre for weaving, as they are long, thick and durable.

Pandanus is an erect, evergreen, coarsely branched tree that looks like a large branched candlestick or holder. It can grow to a height of 15 m. Stems are hollow. Leaves are sword like, 1 to 2 m long and 4 to 7 cm wide, arranged spirally in three rows at the tips of the branches. In fully exposed leaves, the midrib is bent, and the upper third or so of the leaf hangs down, giving Pandanus plants their characteristic drooping appearance

Uses: It is an important component in the food security system of the Maldives and considered as the best source of food during famine and scarcity. Red portion of the ripe fruit is eaten raw. Juice, locally called as *baipainkandhi,* is extracted from the fruits by cutting them into small pieces, boiling them in water with sugar and then crushed and strained. Fruit is also used in various food preparations. It is cooked with rice and sugar to prepare a delicious traditional food called *kashiko bondibaiy*. A sweet soup, called *kashiko baypeen,* is prepared from the fruit. A sweet namely, *kashiko foa* is prepared by cooking pieces of fruits with sugar and wheat flour and sold in local market. Leaves, after thoroughly dried and prickles removed, are used to make a kind of soft mat called *santhi.* Prop root, locally called *aloho,* is used as a brush to paint boats.

Hollow stems were once used to build houses but now are widely used to construct *hargue*, a place where boats are hauled for repair. Stems, which are fibrous and very soft, are widely used in making *hulhuashi*, a resting platform commonly found nearby the beach (http://www.fao.org/docrep/010/ai387e/ai387e08.htm)

Pandanus can be used to make a variety of woven handicraft products including bags, boxes, baskets, mats and slippers. The sale of these products can be an important source of supplementary income for women's groups in coastal villages and can also encourage wetlands conservation.

To prepare the leaves for weaving the spines must first be removed and the leaves must be rolled out to dry in the sun. The dried leaves are then stripped into fine strands. Pandanus fibre can be coloured using chemical or natural dyes allowing a diversity of colourful patterns to be created to produce unique designs (http://mangroveactionproject.org/wp-content/uploads/2013/10/Pandanus-Handicrafts.pdf)

Pandanus mats were commonly used in many parts of our country, especially in Kerala, till a few decades back for various purposes such as sleeping, sitting, dining etc. After the advent of plastic mats Pandanus mats became unpopular. However, due to its ecofriendly nature and the increased awareness about the ill effects of plastic, Pandanaus mats have made a strong come back. Local stakeholders can be trained on all these aspects and cottage industries can be set up.

6.2 Feasibility of alternate livelihood options

An analysis of five types of sustainable capital of the stakeholders from where they derive the goods and services to improve the quality of lives indicate that the natural capital, social capital and human capital available in the community are high whereas their physical capital is moderate and financial capital is low. In order to lead a sustainable life all the capitals will have to be high. Since the first three capital mentioned above are high, the chances of improving the other two capitals viz. financial capital and physical capital is highly feasible.

The wise utilization of natural capital available i.e. the wetland its associated resources such as water, land, and biodiversity can be effectively utilized by the human capital available viz. the skill sets available with the community in the form of traditional skills coupled with educated human resource in various fields since their social capital is quite high.

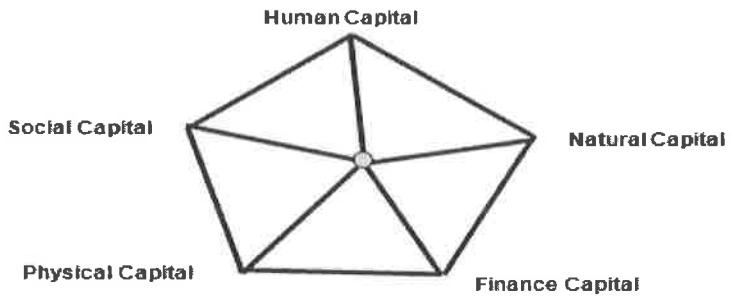


Figure -1 Asset Pentagon as the Core of Livelihood Base

6.2.2 Institutional Set Up required for executing the programmes

An effective and efficient institutional mechanism is required for the organization and implementation of the alternate livelihood options suggested. The programme will have several key components like formation of cooperative societies, awareness creation, training programmes, exposure visits, development of marketing network, developing infrastructure development, identification of appropriate funding agencies, preparation of Detailed Project Reports (DPR's) for funding, identification of beneficiaries etc.

Parayavaran Parirakshana Samiti (PPS) which has been active for the past many years in Sompeta taking up environmental issues has accumulated a lot of goodwill and acceptability among different stakeholders. PPS may form a separate wing for taking up the development activities and can hire specialists for initiating the above mentioned activities.

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BEFORE THE NATIONAL GREEN TRIBUNAL,
SOUTHERN ZONE, CHENNAI
(Under Section 18 (1)) read with Section 14 of National Green Tribunal Act, 2010)
Application No.153/2016 (SZ)

In the matter of

1. PARYAVARANA PARIRAKSHANA SANGHAM
   Through its President Mr.Y.Krishnamurthy,
   Sompeta, Srikakulam District,
   Andhra Pradesh.
2. E.A.S.Sarma
   14-40-4/1, Gokhale Road,
   Maharanipeta,
   Visakhapatnam – 530002.

... Applicants

Versus

1. UNION OF INDIA
   Through Secretary
   Ministry of Environment & Forest
   ParyavaranBhawan, CGO Complex,
   Lodhi Road,
   New Delhi – 110 003 and 4 others

Respondents

ADDITIONAL TYPED SET VOL. I FILED BY RESPONDENT-4

M/s L.G.SAHADEVAN1102/93
T-8, 4th FLOOR, SINGAPORE PLAZA,
164/337, LINGHI CHETTY STREET,
CHENNAI- 600 001: PH: 9841016152
COUNSEL FOR RESPONDENT-4
saha666@gmail.com