Study of Ecology and Biodiversity of Parsada and Gidhva Wetlands, Dist. Bemetara and Palaudi and Chicha Wetlands, Patan, Dist. Durg

Submitted to

Chhattisgarh State Biodiversity Board
Raipur, Chhattisgarh

by

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SUMMARY

Chhattisgarh is the state of wetlands. Some of them have potential to provide habitat to aquatic birds and potential to attract migratory birds. Wetlands of Dudhwa and Parsada Distt. Bemetara, and Palaudi and Chicha in Patan, Distt. Durg, have been observed to attract the migratory birds in large number and variety. Major objectives of presently proposed study will be:

- To evaluate the water quality and prepare water health card and water health index for regular monitoring of the proposed wetlands.
- To determine biodiversity of wetlands for: Planktons, Macrophytes, Amphibia and Fishes.
- To identify the threats to the wetlands and recommend their mitigation measures.

These studies will give a clear picture of the status for physico-chemical and biological characters with their desirable (permissible) limits. The water health card will help the stakeholders to assess and maintain the water quality in future. This will help to recognize the wetland as a Ramsar site.

The Ramsar site:

None of wetland, so far, in the state of Chhattisgarh is included in the list of Ramsar site. Most important criteria for inclusion in Ramsar site is the biodiversity with fortunate detection of rare, endangered or threatened species. Thus, total biodiversity of a wetland, evaluated, will make the wetland a strong candidate for inclusion in the list of Ramsar site.

Major outcome of the study will be:

1. Water health card.
2. Biodiversity of the wetlands.
3. Threats and their mitigation

Tenure of the project: 15 months

Total cost of the project: 11,10,000=00

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INTRODUCTION

Chhattisgarh state is famous for the large number of ponds. Total 7711 wetlands have been mapped at 1:50,000 scale in the state. In addition, 27823 wetlands (<2.25 ha) have also been identified and delineated. Total wetland area estimated for Chhattisgarh state is 3,37,966 ha that is around 2.51% of the state geographic area (13519400 Ha). Every village of the state is adorned with atleast one or two ponds. Along with being used for Nistar, most of these wetlands are very rich in biodiversity. A vast variety of fishes are found in the ponds of the state, which attracts the large number of birds including the migratory birds. In the last few years, the visits of migratory birds in Chhattisgarh state is increased manifolds in different areas of the state. Parsada wetland, Gidhwa pond, Dist. Bemetara and Balaudi and Chicha, wetland, Patan, District Durg are the best examples of the paradise of a large number and variety of these migratory birds. Quality of water and their biodiversity, determines to a large extent, the migratory birds. To attract and protect these migratory, local aquatic and other birds and to provide them a favorable environment for their breeding and growth, Chhattisgarh Government should mark these areas as bird protected areas. The selected wetlands require the preparation of water quality index, water health index and water health card.

Currently attempts are being made to get recognized a water body, from different geographical regions, as a **Ramsar site**. There are several criteria for inclusion of a water body as a Ramsar site, most of these are based on Biodiversity wealth of the water body.

Water Quality Index (WQI)

Water Quality Index (WQI) is a single number which can be calculated easily and used for overall description of the quality of water bodies used for different purposes. A water quality index provides a single number (like a grade) that expresses overall water quality at a certain location and time based on several water quality parameters. The objective of an index is to turn complex water quality data into information that is understandable and useable by the public.

WQI is a dimensionless number that combines multiple water-quality factors into a single number by normalizing values to subjective rating curves (Miller et al. 1986). Factors to be included in WQI model could vary depending upon the designated water uses and local preferences.

Water quality is intrinsically connected to human health, food production, gender equality, reduction of poverty, ecosystem livelihoods, economic development, and social growth in our communities. It is also one of the major problems in water resource planning and management.

Water quality is usually classified into biological, physical, and chemical parameters, and there are several parameters for each category. The evaluation of these three categories, based on parameters through field monitoring of water sampling, provides essential information for identifying trends, a wider range of knowledge to water resource authorities, and future planning recommendations.

The water quality index (WQI) is considered a mathematical tool that significantly minimizes the complex water quality data sets and provides a single classifying value that describes the water quality status of water bodies or degree of pollution. Furthermore, WQI is a single dimensionless number that describes the overview of the overall water quality status in a simple way by aggregating the measurements of selected parameters such as pH, nitrate, dissolved oxygen (DO), heavy metal.

The WHO guidelines divide water quality parameters into two categories:

i. Health guidelines, which take into account chemical and radiological constituents that have the potential to directly adversely affect human health; and
ii. Acceptability guidelines, which include parameters that may not have any direct health effects but result in objectionable taste or odour in the water.

Water Health Index (WHI)

The Freshwater Health Index assesses the status and trends of benefits that people receive from freshwater ecosystems, including clean water, fish and recreational uses. It provides links

between governance, stakeholders, their impacts on ecosystems and the consequences for ecosystem services.

The FHI scores watersheds on a scale of 1-100 across three dimensions: the "vitality" of freshwater ecosystems, whether people are getting the water services they need and the level of coordination among the people who govern water use.

The Freshwater Health Index can help users identify vulnerabilities or opportunities within a basin as well as potential impacts from climate change, land use change and infrastructure development. By exploring tradeoffs (an act of balancing between two opposing situations, qualities or things, both of which you want and need), decision makers can make better choices that balance the sustainability of water resources with social equity. The FHI allows resource managers, engineers, policy makers and other stakeholders to evaluate scenarios, understand tradeoffs, prioritize interventions and communicate basin health with a broad audience by:

- Transforming data into commonly scaled indicators (on a 0-100 scale), providing a baseline diagnosis of a basin's health.
- Tracking freshwater health over time through an iterative process between scientists, end-users and other stakeholders for a result that is salient, credible and useful.
- Evaluating potential impacts from climate change, land-cover change, population growth and water allocation decisions.

The Freshwater Health Index focuses on three main components:

Ecosystem Vitality: The integrity and functioning of the ecosystem itself.

Ecosystem Services: The benefits to people provided by a freshwater ecosystem.

Governance & Stakeholders: The structures and processes by which people make decisions related to water resources.

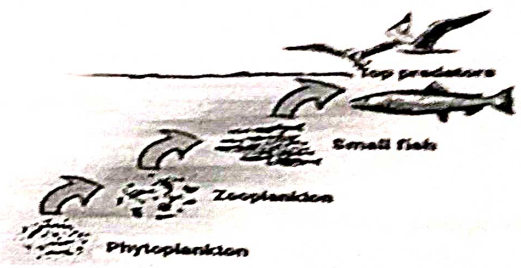
Each of these components is assessed with a suite of measurable indicators that are aggregated into an index. Evaluation of the indicators requires hydrologic and water allocation models, ecosystem service models, valuation techniques and stakeholder surveys.

Aquatic ecosystem health indicators can be broadly divided into four categories:

- Physico-chemical indicators
- Biological indicators
- Habitat indicators
- Flow indicators

Food Chain, Biodiversity and Birds:

Birds occupy the top carnivore level. Existence of top carnivores depends upon the entire food chain from primary producers (planktons and macrophytes) to secondary producers (zooplankton, insects, molluscs and small fishes) to tertiary producers (amphibian and larger fishes) followed by the birds at the top carnivore level. The variety and density of birds in these ponds clearly indicate their direct relation with the absence of sewage pollution, non-sewage eutrophication and biodiversity in the ponds. Gidhwa, Parsada and Chicha ponds have very high biodiversity, attracting and supporting a verygood variety and density of birds. The Palaudi pond, although free from sewage pollution, is more an oligotrophic rather than an eutrophic pond, poor in biodiversity supports lesser variety and density of birds.



Thus it becomes clear that to maintain a good variety and density of birds, it is essential to investigate and maintain a good biodiversity and density of biodiversity elements.

A Ramsar site

The Ramsar Convention on Wetlands defines wetlands as "areas of marsh, fen, peat and 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."

The nine criteria for identifying Wetlands of International Importance

Criterion 1: A wetland should be considered internationally important if it contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.

Criterion 2: A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities.

Criterion 3: A wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.

Criterion 4: A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.

Criterion 5: A wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds.

Criterion 6: A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird.

Criterion 7: A wetland should be considered internationally important if it supports a significant proportion of indigenous fish subspecies, species or families, life-history stages, species interactions and/or populations that are representative of wetland benefits and/or values and thereby contributes to global biological diversity.

Criterion 8: A wetland should be considered internationally important if it is an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend.

Criterion 9: A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of wetland-dependent non-avian animal species.

Cluster of wetlands

In some cases, it may be more meaningful to list a cluster of wetlands as one Ramsar site where the wetlands are:

- Component parts of a hydrologically linked system (e.g. a system of groundwater-fed wetlands along a spring line, or karst and subterranean wetland systems).
- Linked in use by a common population of an animal species (e.g. a group of alternative roost or feeding areas used by one population of waterbirds).
- Formerly geographically continuous before being separated by human activity
- Otherwise ecologically interdependent (e.g. sites forming part of a distinct wetland district/ Landscape with a common developmental history and/or supporting discrete species populations).
- Found in arid or semi-arid zones, where complexes of dispersed wetlands can both individually and collectively be of very great importance both for biological diversity and human populations.

The above account makes it clear that to get included in Ramsar site the initial requirement is to investigate the total biodiversity of the wetland.

The major component of wetland biodiversity includes the planktons, macrophytes, amphibians and fishes.

Planktons:

Planktons are the microscopic organisms classified as phytoplankton and zooplankton. Planktons form the starting point of food chain.

Macrophytes

A macrophyte is a plant that grows in or near water and is either emergent, submergent, or floating in lakes and rivers. Provide cover for fish and substrate for aquatic invertebrates. Macrophytes are primary producers, producing oxygen and provide food for some fish and other wildlife. Macrophytes respond to a wide variety of environmental conditions. The depth, density, diversity and types of macrophytes present in a system are indicators of waterbody health. Where submerged aquatic macrophytes are abundant, they can have a heavy influence on habitat structure, fishability, recreational use and nutrient dynamics.

Amphibians

Amphibians form the link between planktons and birds. They are food items of many of the aquatic birds.

Fishes

Fishes alone contribute about 2,546 species. Fishes are essential and most important componentof aquatic food chain. Fish communities, and specific species, are excellent indicators of biological and ecological integrity due to their continuous exposure to water conditions. Fishes display an array of biotic responses, such as changes in growth, distribution and abundance related to water pollution, critical habitat degradation. Therefore are key elements of ecosystem monitoring programs.

Threats to ponds:

Ponds are exposed to several types of threats including:

1. **Natural:** Silt and suspended particles coming with water from catchment area.

2. **Anthropogenic (Human related):** Fertilizers and pesticides from surrounding cultivated fields. Detergents through bathing and washing of cloth. Fecal matter through open air feacation around the water bodies.

To maintain the wetlands to attract the migratory birds and keep informed the stakeholders about the quality status and threats to the wetlands following objectives are proposed:

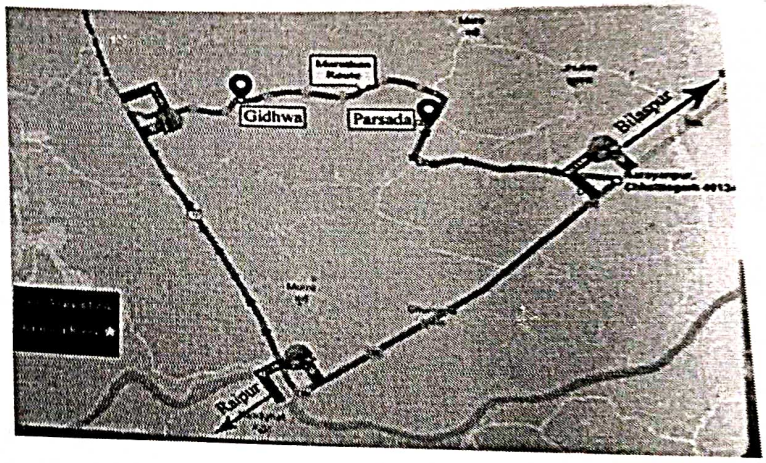
OBJECTIVES:

- To evaluate the water quality and prepare water health card and water health index for regular monitoring of the proposed wetlands.
- To determine biodiversity of wetlands for: Planktons, Macrophytes, Amphibia and Fishes.
- To identify the threats to the wetlands and recommend their mitigation measures.

STUDY AREA AND SITES

In the present study the ponds in following areas will be selected for their limnological studies and fish faunal diversity:

1. Wetlands in Gidhwa, Parsadavillages, Dist. Bemetara
2. Wetlands in Palaudi, Chicha villages,Patan, Dist. Durg



Approach road to Gidhwa-Parsada

Gidhwa-Parsada wetland

These are typical rural wetland surrounded by paddy cultivation fields. They are free from sewage pollution but receive inputs from the cultivated fields including nutrients like

nitrogen and phosphorus and pesticides and herbicides. These are shallow but perennial water bodies. These have clear water supporting good to heavy growth of submerged to emergent macrophytes.

Palaudi wetland:

It is actually a dammed lake. It is in general a oligotrophic pond, supporting very little biodiversity. Besharam (*Ipomoea carnea*) is the major and extensively growing macrophyte.

Chicha wetland:

It is a also a typical rural aquatic body, free from sewage pollution but highly eutrophic due to input of nutrients from the surrounding cultivated fields. It supports a thick growth of macrophytes like the Gidhwa, Parsada wetland.

MATERIALS AND METHODS

I. Collection of water Sample:

Water samples will be collected bi-monthly in plastic cans. Samples for dissolved oxygen determination will be collected in BOD bottles and will be fixed at the time of collection. All the samples will be transported to the laboratory immediately after collection for analysis for their physico-chemical characters, as soon as possible.

II. Analysis for Physico-Chemical Parameters:

Analysis will be made following Standard Methods (APHA-AWWA-WPCF)

a. **Colour:** by simple observation

b. **Odor:** by smelling

c. **Temperature:** will be measured with the help of a Celcius thermometer up to 0.1^0C accuracy.

d. **Turbidity:** by turbidity meter.

e. **pH:** will be measured with the help of a digital pH meter.

f. **Conductivity:** will be measured with the help of a digital conductivity meter.

g. **Alkalinity (mgl^{-1}as $CaCO_3$):** will be determined in three forms as phenolphthalein, methyl orange and total alkalinity by titrimetric methods.

h. **Free Carbon Dioxide ($F.CO_2$)** will be determined by titrimetric method.

i. **Dissolved Oxygen (DO)** will be determined by alkali-azide modification method.

j. **Chloride (Cl^-):** Chloride content will be determined by Argentometric method.

k. **Hardness:** Hardness will be determined only as calcium hardness by EDTA titrimetric method.

l. **Sulfate:** Sulfate will be determined by Barium chloride method.

m. **Total Phosphorus:** Total phosphorus will be determined as phosphate by Vanado-molybdophosphoric acid method.

n. **Nitrate-Nitrogen:** Nitrate-nitrogen will be determined by phenoldisulphonic acid method.

III: Collection and identification of Phyto and Zooplanktons:

In generalphyo and zooplanktons are sensitive to preservation. With preservation either they are killed or lose their characters like colour etc., hence will be observed in living condition. For observing them in living condition the water sample will be brought to the laboratory and observed for phyto and zooplankton, in their living condition, as early as possible.

IV. Macrophytes:

Macrophytes will be photographed in their habitat, also will be photographed after taking them out of water.

Collection, Preservation and Identification of Amphibians and Fishes:-

Amphibians and Fishes will be collected with the help of local fisher man. Collected specimens will be preserved in 5% formol solution (40% formaldehyde and 5% glycerol preservative) in different plastic boxes with proper coding.

After collection from all stations, specimenswill be scrutinized by morphological features.Will be identified with the help of keys and reference books. If required some specimens may be sent to the authorities for identification.

All identified specimens will be photographed with their hierarchical position.

IV. Statistical analysis of Data: Diversity index, Diversity richness, correlation and significance of the data will be enumerated with the use of proper statistical formula.

Expected outcome of the proposed work:

1. Water health card.
2. Biodiversity of the wetlands.
3. Threats identified and their mitigation

TIMELINE OF THE PROPOSED WORK

Time (In month)	Procurement of chemicals and Instruments	Sample Collection and analysis	Data Analysis	Project Report Writing
0 -3	+			
4 -6	+	+		
7 - 9		+	+	
10 - 12		+	+	
13 – 15		+	+	+

BUDGET

SN	Head	Ist Year (In Rs.)	IInd Year (In Rs.)	Total (In Rs.)
1.	PROJECT CONSULTANT (01) Honorarium @ Rs 50,000/ annum	50,000	30,000	80,000
2.	JRF (01) Salary@ 20,000/month	2,40,000	60,000	3,00,000
3.	**Instruments**			
	a. Nikon P 1000 Camera	70,000		70,000
	b. Trinocular Research Microscope with image capture system	1,50,000		1,50,000
	c. Portable Water Analyser Field Kit	80,000		80,000
4.	Travel	80,000	20,000	1,00,000
5.	Chemicals	1,20,000		1,20,000
6.	Glass wares	80,000		80,000
7.	Miscellaneous	1,00,000	30,000	1,30,000
	GRAND TOTAL	**11,10,000**		

Total: Eleven lakhs ten thousand only.

Justification for Instruments:

1. **Portable Water Analyser Field Kit:** This will be required to record Temperature, pH, TDS and conductivity of the pond water at the place of sampling because these parameters get changed with time. Therefore, it is necessary to measure these parameters at the time and place of sampling.
2. **Trinocular Research Microscope with image capture system:** This is required to observed and identify the phytoplankton, zooplankton and fishes.
3. **DSLR Camera:** This will be required to make digital documentation of the ponds and fishes.

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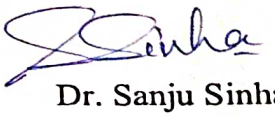
Project Investigator



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