भारतीय वन्यजीव संस्थान
Wildlife Institute of India

No: AD/ESM/ J& K/2022-IV

Date: 29.12.2022

To

Principal Chief Conservator of Forest (Wildlife) & Chief Wildlife Warden
Government of Jammu & Kashmir
Office of the Chief Conservator of Forest (Wildlife)
Manda Hills (Near Ashoka Hotel), Jammu- 180005

Sub: Submission of final Management Plan of Mansar- Surinsar Wetland- reg.

Ref: Your letter dated WLP/Res/310-13, Dated: 30. 09. 2022

Sir,

With reference to the above mentioned letter a team of WII consisting of faculty and researcher visited your office dated 15.10.2022. As desired in the meeting, the comments pertaining to turtle population, outlet-inlet, fish hotspot mapping and budgetary detail are provided in this version of the management plan. A detail response to all the comments received during the meeting is enclosed as *Appendix- I* for your ready reference.

Thus, I request you to kindly go through the final version of the report and acceptance of the same at your end so that we can go ahead printing the document.

Thanking You.

Yours sincerely,

Jhala.

(Dr. Y.V. Jhala)
Dean, FWS

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Responses to CWLW comments and requirements stated on Surinsar Mansar Management plan draft against the meeting held at CWLW office on 15. 10.2022

QUERIES & CONCERNS	COMMENTS
Inclusion of Executive Summary	Incorporated; before Chapter 1
Simulation map of shallow areas after water reduction	Pg. 119 & 122
Emphasis and clarity on outlet locations	During the present survey done by WII researcher(2-8th November 2022) both the outlets (through which lake water moves out from lake) have been confirmed in the presence of Forest guards at both lakes and after incorporation of the GPS location collected from the site, the map prepared by WII shows the correct location of the 'only' existing outlets of both the lakes.
Incorporation of comments suggested by J&K WLPD 1. Phragmites should not be reintroduced 2. Removal of fish is necessary for the survival of floating and submerged aquatic vegetation **3. Recommendations for Biodiversity Heritage site** 4. Water quality parameters above permissible limits. **5. Inclusion/mention of bats in the management plan** 6. Reduction of water level to historic level for the revival of shallow banks	Incorporated in the following page no.- 1. Pg.- 100 2. Pg.- 87 & 104 3. **Pg.-158-159**. 4. Pg. 82. 5. **Pg. 100**. 6. Pg. 87.
Composite maps of Fish hotspots with the shallow area and built-ups	See Map 7 & 8 pg. no. 31-32
Type of animal-proof fencing	Mentioned in Pg. 96
Map showing turtle avoids basking where there is a large fish congregation	Mentioned in Pg. 115
SOP regarding Ex- Situ turtle hatchery	Mentioned in Pg. 123-124
Photographic mark-recapture and Total count to enumerate the number of softshell turtle	Mentioned in Pg. 113-115

Presence of Invasive turtle in the lake Mansar	Pg. 44
Inclusion of 10 years budget plan	Pg. 160-165

MANSAR-SURINSAR WETLAND



MANAGEMENT PLAN

2023-2034

DEPARTMENT OF WILDLIFE PROTECTION J&K GOVT.

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

Management plan preparation and population monitoring of turtles in Surinsar- Mansar Wetlands, Jammu and Kashmir

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Executed by: Wildlife Institute of India, Dehradun.

Funded By: Department of Wildlife Protection, Government of Jammu & Kashmir.

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We are thankful to all the forest guards, beat guards, associated staffs of both Surinsar and Mansar wetland who have immensely helped us during data collections. Thanks are also conveyed to the local residents of Mansar and Surinsar for being friendly, helpful and co-operative throughout the duration of this project.

We would also like to extend our thanks to Mr. Arup Das, GIS Head, Aaranyak, Guwahati for preparing maps essential for shaping this management plan. We also thank Public Health Laboratory of Jammu and Kashmir for helping us with analyzing the water samples.

Thanks are also due to the Director, Dean and Registrar Wildlife Institute of India for encouragement and support.

EXECUTIVE SUMMARY

The Surinsar Mansar wetlands are part of Surinsar Mansar Wildlife Sanctuary with total area of 97. 82 sq.kms, located in the confluences of three districts viz. Jammu, Udhampur and Samba of Jammu and Kashmir Union territory. Mansar lake is semi-oval shaped with an area 61.6 ha. Whereas n Surinsar Lake is approximately 30.6 ha. lies in the Northwest of Mansar lake is roughly oval shaped. These two wetlands are designated as Ramsar Wetlands for its important biodiversity, regional and mythological importance. These two wetlands are surrounded by thickly wooded mountain ranges and home to rich flora and fauna. These twin lakes have five important noteworthy softshell (*Nilssonia gangetica*, *Lissemys punctata*) and Three hardshell turtle species, approximately 10 native fish species and more than 80 avifaunal species out of which many are migratory. Surrounding mountains and lake habitats are home to many mammal species viz. Nilgai, Jackal, Indian barking deer, Leopard, Wild boar and large trees are also roosting habitats for flying fox / bats. The present management plan has been devised under the set of issues and current scenario that these twin lakes are facing as proposed and communicated by Jammu & Kashmir Wildlife Protection Department.

The present management plan has been compiled following the manual for planning wildlife management in wetlands. It comprises of 14 chapters in two different Parts. Part I of the management plan contains Chapter1- Introduction to the wetland, Chapter 2- Background information & attributes, Chapter 3- History of management & present practices and Chapter 4- The wetland area & the interface Land use situation. Chapter 5- Problems and Issues. Part II as Proposed Management comprises of Chapter6- Vision, Objectives and problems in achieving the objectives, Chapter 7- The Strategies; Chapter 8 – Habitat Management Strategies, Chapter-9- Turtle as keystone/ flagship/priority species management strategies is one of the main focus of the management plan; Chapter 10- Eco-Tourism, interpretation and Conservation Education, Chapter 11- Research, Monitoring & Training, Chapter 12- Organization and Administration , Chapter 13- Specific prescription on all three Ramsar site criteria and final Chapter 14- Budget. Last section contains several ANNEXURES and photo plates related to the management plan.

Among these, Chapter 8 & 9 mainly focuses on key management interventions pertaining to these two wetlands. Here we have discussed about problems related to turtle conservation and control of exotic fish population along with waste disposal management for revival of lake integrity. We have also produced approximate counts of softshell turtle population combining photographic mark recapture data with total counts of basking turtles through multiple rounds of Visual Encounter Surveys (VES) done at several period of time. Later in Chapter 8 we have discussed about ‘Key management strategies of early restoration of wetland integrity’ and in Chapter 9 we have discussed on various turtle monitoring protocols for long term purpose and issues and subsequent suggestions regarding lack of habitats and protection for turtle population.

PART I

THE WETLAND AREA: EXISTING SITUATION

Chapter 1

INTRODUCTION TO THE WETLAND



1.1 NAME, LOCATION, CONSTITUTION AND EXTENT

The Surinsar Mansar wetlands are part of Surinsar Mansar Wildlife Sanctuary, which is located in the confluences of three districts viz. Jammu, Udhampur and Samba of Jammu and Kashmir Union territory. and lies on the left side of the Sidhra-Surinsar-Mansar road. These two wetlands are near about 48-50 km east of Jammu city in Udhampur district and approximately 16 km away from each other. Surrounded by steep mountain slopes of lower Shivalik Himalayan hills these two lakes serve as one of the most cherished tourist destinations in Jammu and Kashmir, India (Sharma & Dua, 2017).

The sanctuary is spread over 97. 82 sq.kms and is roughly rectangular in shape. The area experiences the altitudinal range between 547 to 834 m. Above M.S.L. Mansar lake is semi-oval shaped with an area 61.6 ha. lies between 32◦46′11.25″ N and 75◦08′38.5″E with an elevation range of 635m-666m. Surinsar Lake (30.6 ha.) lies in the Northwest of Mansar lake is roughly oval shaped, geographically falls between 32◦46′11″N and 75◦02′31″ E and famous for the island which is situated at the center of the lake.

The sanctuary as well as wetland areas are under the control of Kathua Wildlife division of Department of Wildlife Protection, Jammu & Kashmir Government. The sanctuary was declared and notified by Govt. of Jammu and Kashmir under Jammu and Kashmir Wildlife Protection Act, 1978 (vide S.R.O. 138, Dated: 10 April, 1980, Appendix- 1). During the year 2005, these lakes were given the designation of Ramsar site (no: 1573) for the conservation of biodiversity, maintains the hydrological, environmental and ecological balance and the protection of natural lake water.

1.2 APPROACH AND ACCESS

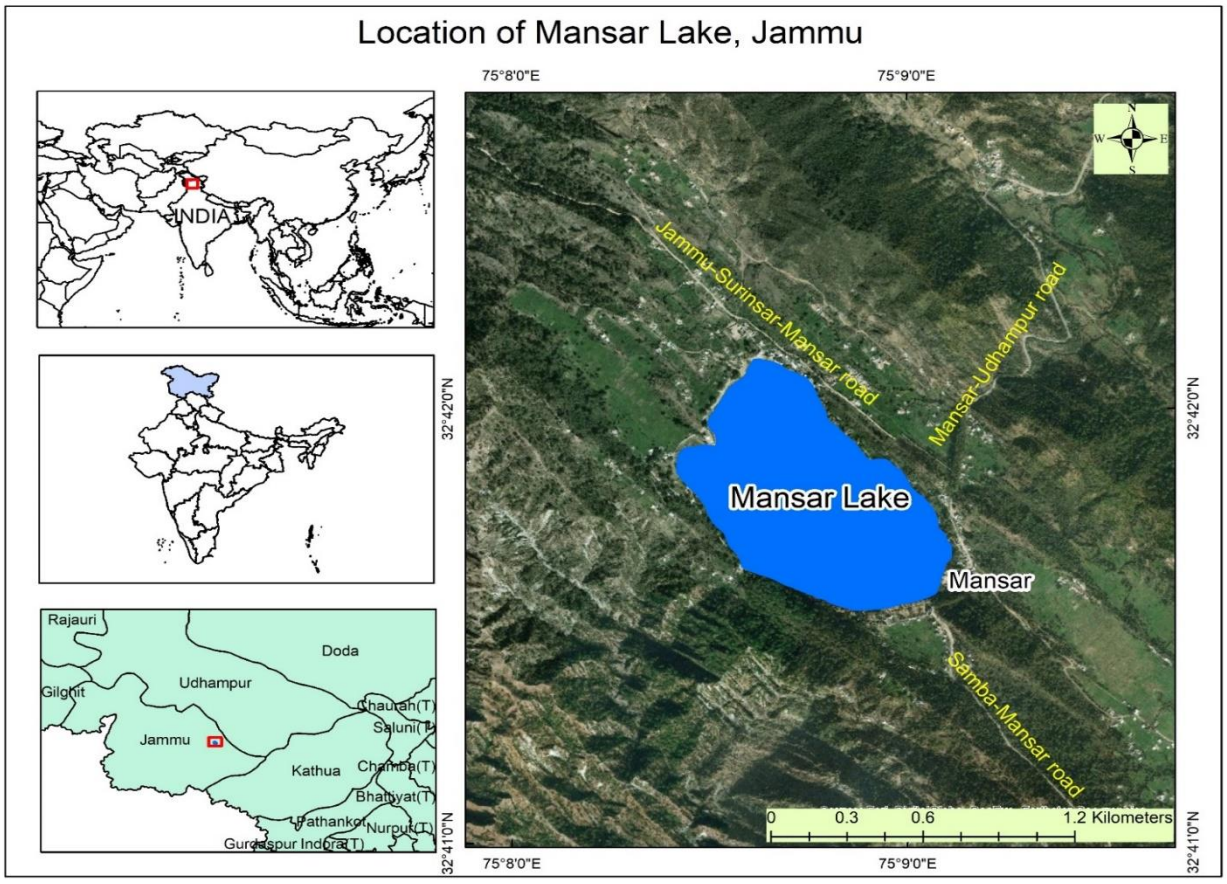
The Surinsar Mansar wetland is easily accessible through the Udhampur Samba road which connects from Jammu town. Mansar is 48 km south east of Jammu city and Surinsar is 16 km further north west from Mansar. The National Highway 44 (old numbering 1A) connects Jammu and Kashmir with other nearby states viz. Uttarakhand, Punjab, Haryana, Delhi etc. The nearest railway station is Samba (approx. 22 km) with regular train connections to major north Indian

State. The nearest Airport is Jammu airport which is 54.2 km from the lake location. A map showing the locations of Mansar and Surinsar lakes are shown in Map 1 & 2.

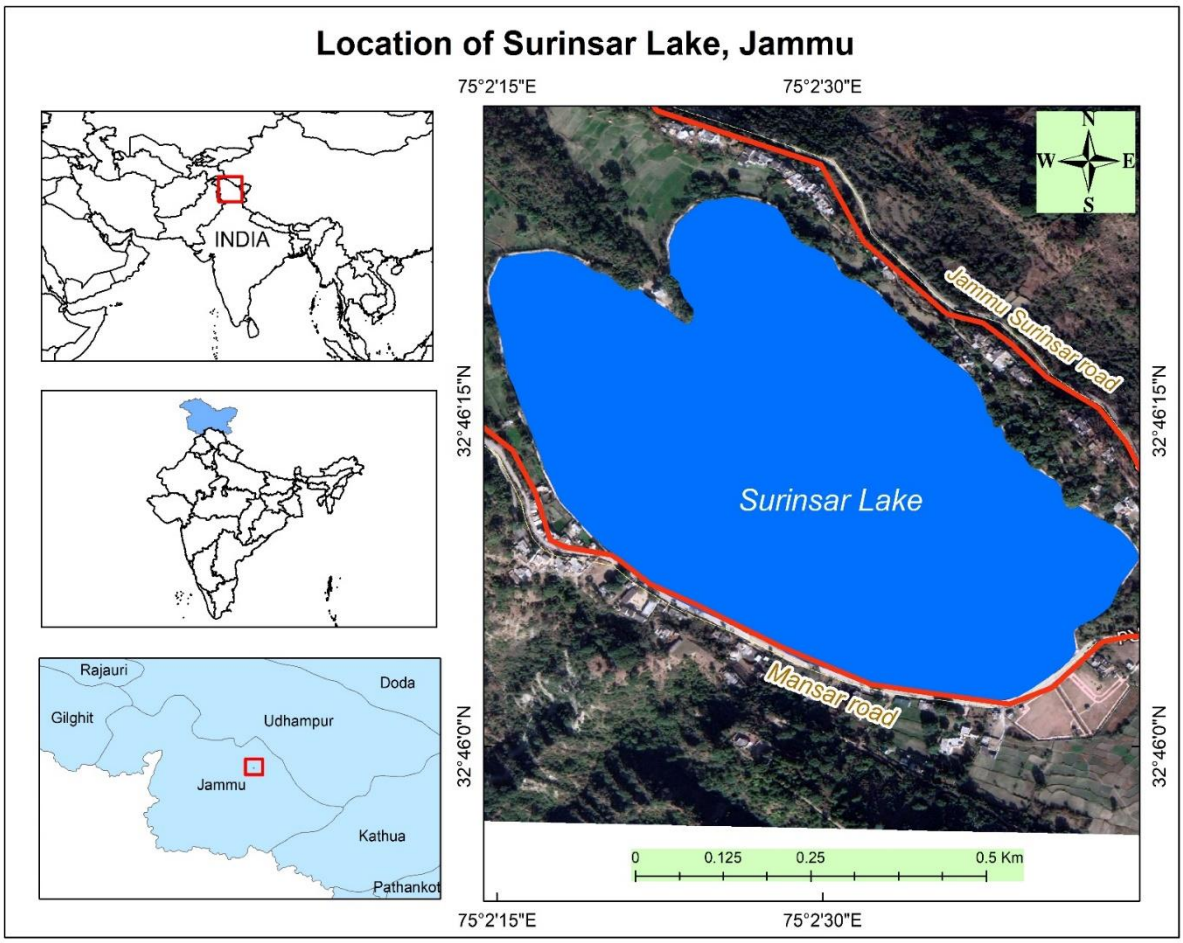
Box 1: **What is a wetland?**

According to the Ramsar Convention on Wetlands; "Wetlands are 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 cannot simply be described as just land or just water. They can actually be both at the same time, or seasonally aquatic, or terrestrial. According to Wetlands International, wetlands are: "Areas on which water covers the soil or if water is present either at or near the surface of that soil. Water can also be present within the root zone, all year or just during various periods of time of the year."



Map 1: Study Site and location of the Mansar Lake



Map 2: Study Site and location of the Surinsar Lake

1.3 LEGAL STATUS

The area of interest is under a reserve forest and after its identification as a potentially viable Wildlife area, it was agreed to notify it as a Wildlife Sanctuary under Government Order No: FST/20 OF 1981, dated: 04-04-1981. Presently the area is under the administrative and technical control of the Department of Wildlife Protection, Jammu and Kashmir which is protecting and propagating the life forms supported by the area with the help of scientific management practices.

1.4 STATEMENT OF SIGNIFICANCE/IMPORTANCE

These two wetlands play important role in supporting rich biodiversity and attract a variety of water and water associated birds like egrets, herons, lapwings, waterfowls etc. and other rare and endangered life forms (flora and fauna). In winters migratory birds flock around here in large numbers attracting bird watchers and tourist alike. Consequently, Mansar- Surinsar wetlands have their global, regional as well as local significance.

Global Significance

Due to the presence of high diversity of migratory birds Mansar and Surinsar wetlands were designated as Ramsar site in 2005 and claimed as 'Internationally important Wetland area'. These two sites support population of CITES and IUCN Red listed turtle species as well as one endemic and endangered medusa species i.e. *Mansariella lacustris* (Malhotra et al. 1976). Beside the above uniqueness these two lakes were considered to be important habitats for near about 50 species of fish fauna.

Regional significance

These two lakes are one of the major tourist attraction sites in Jammu region. Many visitors including bird-watchers, tourists, school and college students from outside and within the state visit these lakes for recreation as well as educational purpose. Owning to the geographical beauty and variety of floral and faunal assemblages around these lakes, these lakes have become preferred destination for nature enthusiasts.

Local Significance

These wetlands are socially and culturally very important with many temples around owing to its mythical origin from the Mahabharata period. Several religious rites and rituals are performed by devotees and local people around the year increase its socio-religious significance. Local people depend on these two water bodies for subsistence level activities like drinking water, irrigation for agriculture, washing and bathing etc. Being a vibrant tourist, birding and recreational spot, Surinsar –Mansar wetland has a potential of income generation for the local people.

Being a wetland it also performs a host of other ecological and environmental functions as well, which though not fully understood yet, are critical for the future wellbeing and existence of the wildlife and to humanity.

Box 2: Value of Wetlands

In every country and climatic zone, from the polar regions to the tropics, wetlands provide the basis for human survival and development. Wetlands include inland rivers, lakes and peat swamps, coastal lagoons, estuaries and reefs and human-made wetlands such as rice-fields. People and wetlands are interdependent: wetlands provide food and water, control floods, stabilize shorelines, mitigate climate change and are home to a wide range of biodiversity.

Despite their overwhelming values, wetlands are the most highly threatened ecosystems on the planet. Demand for their services is likely to intensify as human populations increase and development accelerates.

Chapter 2

BACKGROUND INFORMATION AND ATTRIBUTE



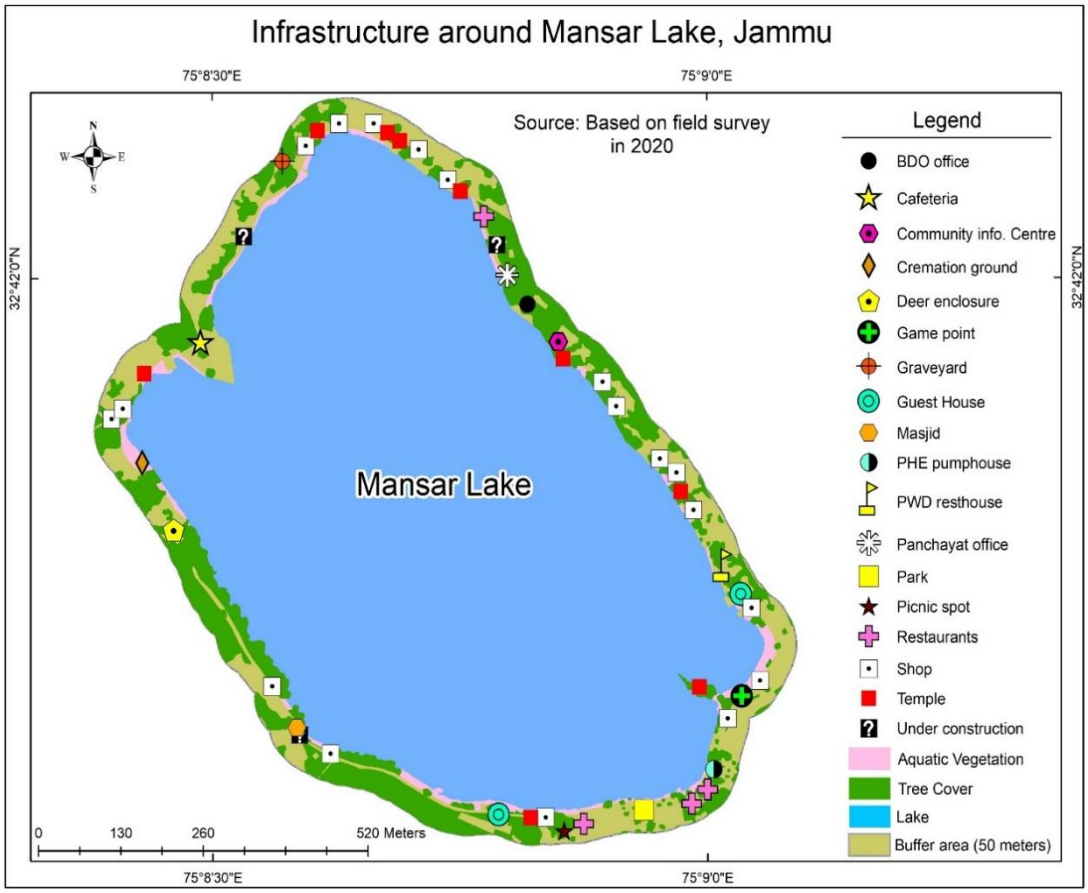
2.1 BIOGEOGRAPHIC ZONE AND WETLAND TYPES

These two wetland lie in semi-arid regions of Punjab plains and adjoining Jhelum basin forms a major catchment area. The biogeographic zones that these two wetlands come under is Semi-arid Punjab plains (4A) [Source: Rodgers et al. 2000].

According to Ramsar "Classification System of Wetland Types" (Resolution VII.11, page 24) Surinsar Mansar wetland qualifies the classification "**O**" i.e. Permanent freshwater lakes (over 8 ha) under '**Inland Wetland**' categories.

2.2 BOUNDARIES

Western flank of the Mansar lake basin has Masjid, Deer park, agricultural fields and settlements. Eastern boundary has a boating club, main entry to the park and Surinsar Mansar highway connecting Jammu. Northern flank contains Sheshnag temple, shops, settlements whereas at the southern flank there are mountains with forest covered area, eco-tourism hut of the forest department (vide Map 1, 3).



Map 3: Built up area around buffer area of Mansar

In Surinsar lake, towards the Northern boundary there are several crop lands houses as one moves to the north east there are few mandirs and adjacent human settlements. Southern boundary of the lake has a concrete road that connects Surinsar with Jammu & Katra and the connecting road from Mansar. South western part of the lake has a big park area, school and few shops and main boating ghat; while north western parts have stretches of agricultural fields. Western boundary has forested hills, forest department hut and few scattered settlements. Eastern boundary contains settlements, swampy areas, private lands (Vide Map 2,4).



Map 4: Built up area around buffer area of Surinsar

2.3 ALTITUDE/TERRAIN TYPES

Mansar and Surinsar lakes are situated at an elevation of around 605-650 m above sea level in lower Siwalik terrain. The physio geography of the region can be characterised by the presence of a plain area to the south of the Siwalik hills and Lesser Himalayan Mountains northwards up to the Pir Panjal range and is represented by an intricate mosaic of mountain ranges and hills characterised with river terraces, valleys and gorges (Mir, 2003). The terrain has minor undulations at areas, surrounded by several hills and consisting mainly of sandstone, mudstone and clay contents.

2.4 GEOLOGY, ROCK AND SOIL

Geologically, the Mansar Lake catchment is composed of fine-grained sandstone alternating with siltstone, mudstone and clay of the Lower Siwalik. Both the Mansar and Surinsar lakes are located at the crestal part of the WNW– NW to ESE–SE trending sub-horizontal anticlinorium. Associated with upright fold plunging 5° towards S52°E, the NNE–SSW trending faults have displaced the anti-clinorial axes at several places (Singh & Sharma, 1999) and are responsible for the fragile nature of the Lower Siwalik. These crushed rocks form the porous and permeable zone for recharge of the lakes. It consists of alternating layers of fine grained, hard and compact light gray sandstone, siltstone, mud, clay, calcareous and pebbly lenses. The soil is primarily shallow and immature. Alluvial soils having little clay content, poor in lime and nitrogenous content but rich in phosphates, potash and magnesia as well as stony and sandy soils are the chief soil types in the study area.

2.5 CATCHMENTS CHARACTERISTICS

A submerged spring source within the lakebed has been reported. Surrounding area has mango tree groves backed by pine trees on the hill slopes. The soil is primarily shallow and immature. Catchment comprises sandy conglomeratic soil with boulders and pebbles. The catchment area of Mansar is about 2000 ha. whereas in Surinsar it is approximately 1000 ha (Ramsar Information Sheet, 2005). Habitation and agricultural fields cover the northern and eastern parts of the lake catchment. The northwestern flank is mainly covered by farmland. The forest reserve on the western and southern parts of the catchment cover is mainly represented by *Mangifera indica*, *Ficus religiosa*, *Pinus roxburghii* and other subtropical-type plants, but the forest cover is scattered and degraded. Agricultural land is extensively used for paddy, wheat and maize production.

2.6 SEASONALITY

Climatically, the area is subtropical. The average annual rainfall is 1500 mm; the air temperature varies between 3°C (minimum) in winter and 43°C (maximum) during high summer, while the lake surface water temperature varies between 14°C (minimum) in January and 31°C (maximum) in July. The monsoon rains extend from July to September at times mid-October. The retreating monsoon starts in mid-September. The winter months (November- February) are usually dry with occasional rain in January.

2.7 HYDROLOGICAL FEATURES

2.7.1 Source of water

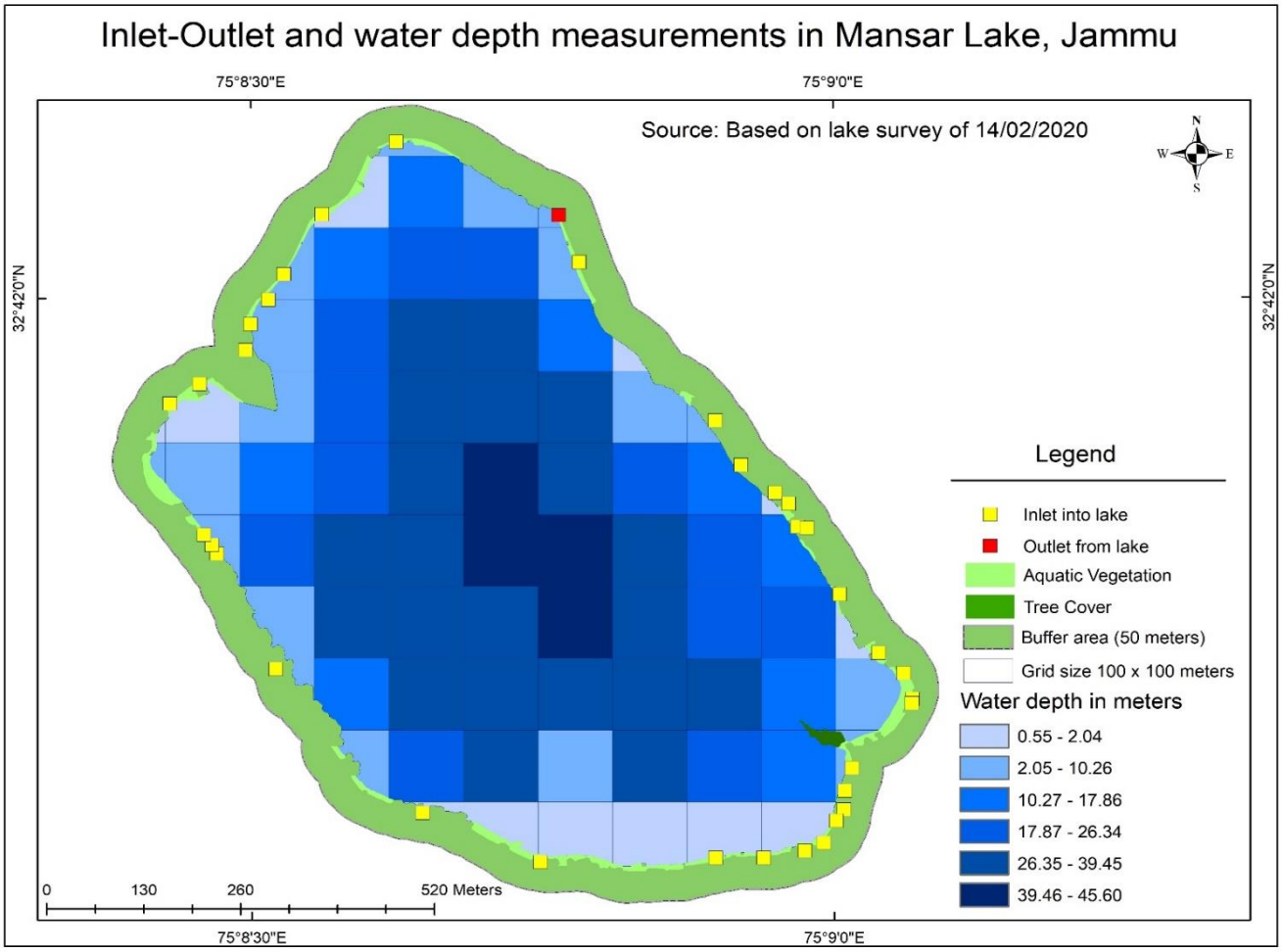
Major sources of water for these two lakes are from the catchments, which is primarily fed by rain and surface runoff and also partially by mineralized water through paddy fields. The lakes are said to have their own springs. It is also believed that these lakes owe their origin due to damming of the river which was flowing along the strike of the lower Siwalik range (Zutshi, 1985). One study also stated that the large amount of freshwater volume is mainly maintained by ground water as there are no major surface channels flowing into these lakes (Rai et al., 2002).

2.7.2 Total inflow and out flow

There is no well-defined surface inflow channel into the lake (Kumar et al., 2006). Excess water from the lake drains to a small tributary of the Tawi River through a piped outlet. An initial water balance of this lake indicated that the lake is also fed by groundwater (Goyal et al., 2002). The lake receives runoff from overland flow from the lake catchment area of 1.67×106 m^2.

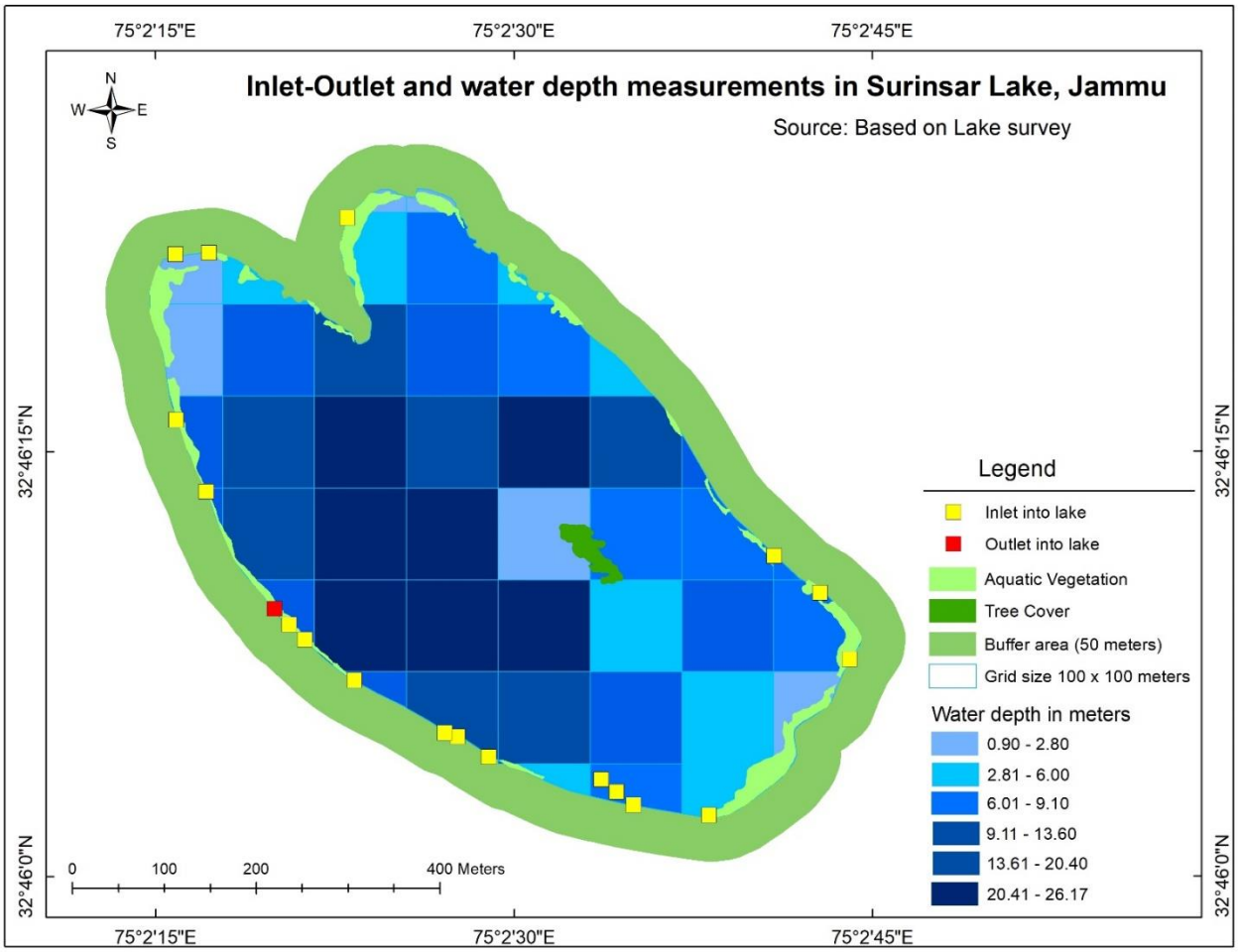
Mapping of Mansar lake demarcates 37 location points of inlet(s) and outlet during the field exercise (February'2020). Mansar lake receives water from agricultural fields, catchment runoff, restaurants, shops and household effluents year round through total 36 inlets marked as 'yellow square' in map 3, of which 19 are big inlets i.e. having large diameter or width (2-3m approx.).

There is a single outlet on the north-east bank of Mansar marked in 'red square' (See Map 5). The outlet opens directly into a seasonal drainage system "Mansar wali khad".



Map 5: Mansar depth profile & Inlet-Outlet system

A manually constructed outlet in Surinsar towards the west of the lake operates only when the water level crosses the maximum depth i.e. approximately 26 meter. There are total 19 inlets and single outlet in Surinsar (Vide Map or figure 6)



Map 6: Surinsar depth profile & Inlet-Outlet system

2.7.3 Bathymetry

Water Depth measurements of Mansar Surinsar wetland was done by systematic sampling using a hand held depth sounder and GPS 64s device. Fishnet tool has been used to generate grids over the lake area with the grid size of 100 x 100 m with centroid points having unique grid IDs. Using open source software “Base Camp " the grid layer and centroid layer has been uploaded in GPS 64s for easy visualization and navigation to reach the center of each grid to measure the water depth. Then each of these centroids were surveyed (17th Feb’2020- 22th Feb’2020) using a paddle boat and subsequent depth of the water inside every grids were measured using a depth finder sonar machine. For those grids that were falling at the edges were accessed on foot by walking along the bank, and depth of water with the location points of those regions were noted down separately. Then all those measurement data collected on the field were fed into grids as a range

of values of water depth according to their separate grid Id's and the following map was procured using IDW (Inverse Distance Weighting) interpolation method in Arc-GIS software.

We have also calculated approximate volume of water of Mansar & Surinsar lake by multiplying lake surface area with the average water depth measured during our field surveys.

The average water depth of Mansar was calculated around 17.17 meter, while the maximum value of water depth documented was 45.6 meter. The volume of water in Mansar lake during our study period was found to be around 10300489 M^3 (vide Map 5).

Water depth of Surinsar is lower than Mansar. The average depth of Surinsar is around 11.2 meter, while the maximum depth documented during current study was 26.7 meter (vide Map 6). The volume of Surinsar lake measured during our study period was approximately 277189.2 M^3.

2.7.4 Water requirements

There are two pumping stations installed nearby both lakes to supply water for drinking and other various purposes also known as PHE station. In Mansar lake the PHE is located at the south east corner of the lake. Every day the pumping station in Mansar pumps out 135-thousand-gallon water and distributes in 7 nearby villages. Out of this extracted water, 15-thousand-gallon water is released back into the lake as a result of filtration procedure. Filtration procedures happen in three large tanks where the extracted water from the lake passes through layers of sand beds, iron mesh, and then further gets filtered in chlorine and alum. In Surinsar the pumping station is installed at the South- west corner of the lake, which discharges around 60-thousand-gallon water per day. Water is used in households for drinking, bathing, washing; in shops, restaurants, agriculture fields etc. [See section 5.1.5]

2.7.5 Annual Water level changes – Changes in water regime

The Mansar lake water level varies within 1.5–2 m in a year. The water level here increases by 1-2 meter during monsoon. Whereas, in Surinsar the water level of the lake oscillates by 1.20m and touches its peak during monsoon. The margin of the lake is regular because DI value (Development of the shore line) is 1.28 to 1.29 (RIS, 2005 Surinsar Mansar wetland; Vide Appendix).

2.7.6 Physico-Chemical Characteristics/Water quality

In order to check the status of water quality in Mansar-Surinsar Wetland, water quality parameters were analyzed during pre and post lock down period. As pollution in water resources threatens the freshwater biodiversity and also the livelihood of the common people, selection of parameters for water testing depends upon its utility. Physical parameters such as pH, Temperature, TDS, Electrical Conductivity, Colour etc. are performed for testing its physical appearance and for its chemical characteristics, chemical parameters such as Total Alkalinity, Chloride, Nitrite, Salinity, Chlorophyll, Turbidity etc. were also analysed in Public Health Laboratory of J&K.

Water samples from five different sites were collected from Mansar lake (i.e. Site I, Site II, Site III, Site IV, Site V) and water samples from five different sites were collected from Surinsar lake (i.e. Site I, Site II, Site III, Site IV, Site V) for analyzing the physical and chemical parameters of the wetland (Table 2. 1).

Table 2.1: Sampling sites for water analysis

SITES	**DESCRIPTION**	
	MANSAR LAKE	**SURINSAR LAKE**
SITE I	Sheshnag temple	Main entry
SITE II	Boating site	opposite higher sec. School Surinsar
SITE III	opp. PHE department	Near lantana/mud bank opp. Agricultural field
SITE IV	Near masjid	shaded Bathing Ghat near Human settlement
SITE V	Hanuman Mandir , near Agricultural field	*Ipomea* patch catchment opp. Agricultural field

The sampling of the water samples was done using standard methodologies. The water samples were collected from different sites before lockdown on 30th of January 2020 and we got a unique opportunity to test the water quality devoid of prolong (6 months) restricted human activities due to COVID-19 lockdown. Five set of samples were collected during 4th of June 2020 early morning each in 5 L water containers which were rinsed with distilled water. All the samples were fixed by following standard protocols and stored at 40◦ c for further analysis. These samples were submitted

to the SPCB (J & K State Pollution Control Board) laboratory on the same day. Some parameters were performed on-site such as pH, Temperature, TDS, Electrical Conductivity using portable devices. Analysis of the rest of the parameters such as DO, BOD, Chloride, Total alkalinity, Suspended Impurities, Salinity, Chlorophyll, Turbidity, Nitrite was done in laboratory.

Results:

Temperature: The values show variation pattern in the temperature ranging between 13.3°C-14.2°C before lockdown i.e. during winter season and after lockdown i.e. summer season, variation pattern in the temperature ranges from 29.7°C – 33.3°C (Fig 2.1; Table 2.1 & 2.2).

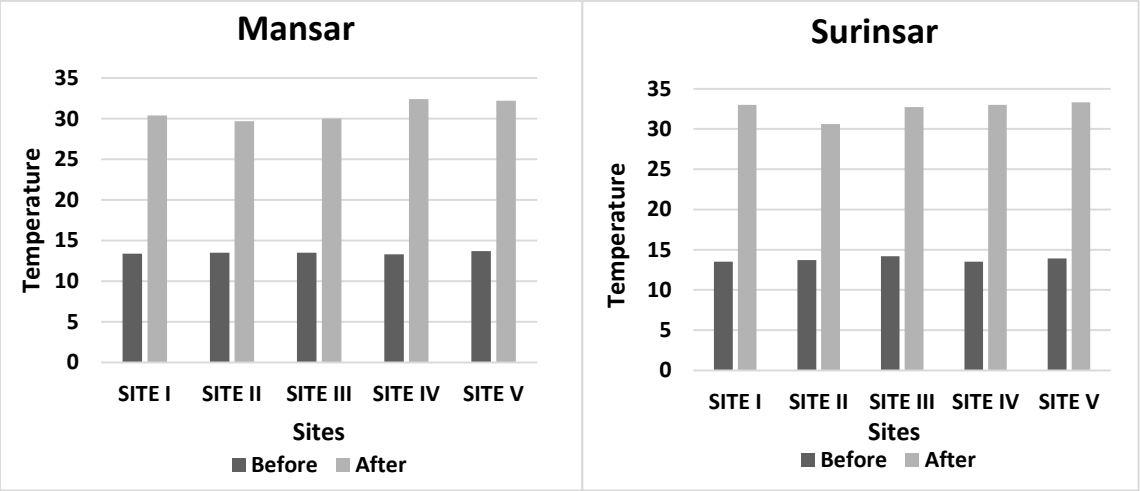


Fig 2.1: Water temperature (°c) at different sites of Mansar-Surinsar wetland

pH: Pure water should have pH equals to 7 which is considered as neutral (neither acidic nor basic). Water containing minerals and gases have pH of 6.5-8.5. The value of pH varied from 7.1 -7.43 before lockdown and 7.35-8.2 after lockdown (Table 2.2 &2.3; Fig 2.2) in both the lakes. The values of pH showed less variation. The pH value was within permissible limit.

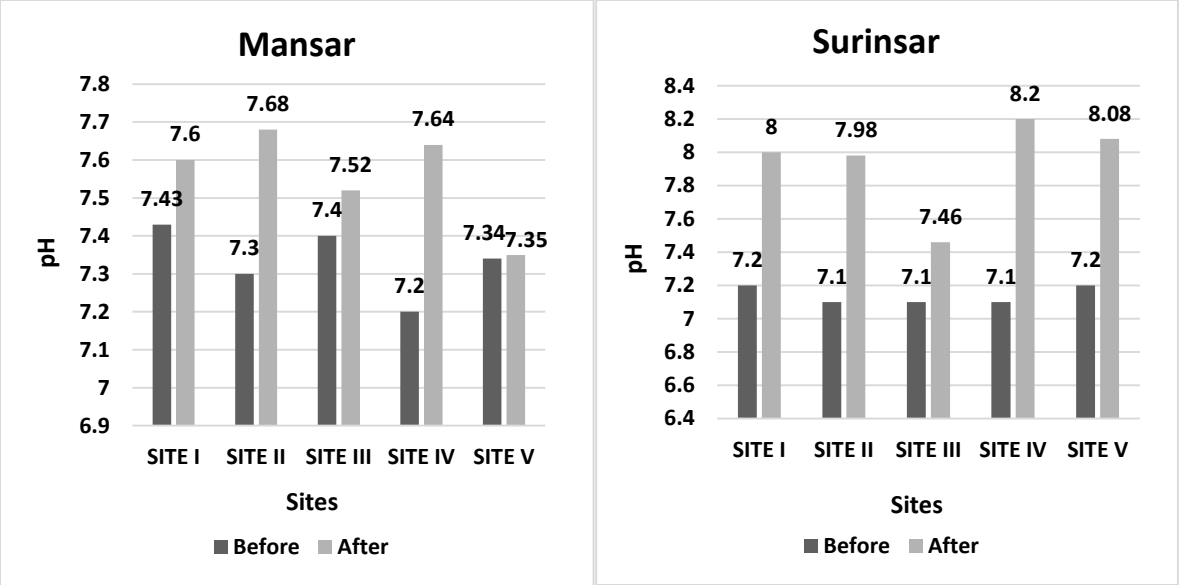


Fig 2.2: pH level of sampling sites of Mansar-Surinsar wetland

Total Dissolved Solid: TDS is directly related to the salinity and causes toxicity, shifts in biotic communities, effect the biodiversity and causes the acute- chronic effects at different life stages. Higher values of TDS were observed prior lockdown which shows higher concentration of nitrates, sulphates, chlorides carbonates of Ca and Mg due to the influx of agricultural runoff (Table 2.2 &2.3). The maximum value of Surinsar lake of TDS prior lockdown is at Site V i.e. 920ppm, whereas Mansar lake TDS value was within admissible range (Fig 2.3). According to the BIS specifications, the TDS should be less than 500 mg/l. According to CPCB, the maximum limit is 1500 mg/l which is suitable for aquatic biodiversity. Suitability of water for aquatic diversity decreases with the increase in the value of total dissolved solid.

Table 2.2: Physicochemical parameters of Mansar–Surinsar Wetland before lockdown.

Water quality parameters Mansar Lake					
SITES	**SITE I**	**SITE II**	**SITE III**	**SITE IV**	**SITE V**
pH	7.43	7.3	7.4	7.2	7.34
Temperature (°C)	13.4	13.5	13.5	13.3	13.7
Conductivity (µs/cm)	237	246	246	234	246
TDS (ppm)	160	380	260	460	180
Colour/odour	Not Agreeable	Not Agreeable	Not Agreeable	Not Agreeable	Not Agreeable
Suspended Impurities	Present	Present	Present	Present	Present
Chloride (mg/l)	21.27	48.58	31.91	31.91	31.91
Alkanity (mg/l)	150	154	137	137	180
Nitrite	Absent	Absent	Absent	Absent	Absent
Turbidity (NTU)	2	2	2	2	2
Salinity (ppt)	0.2	0.15	0.16	0.15	0.14
Chlorophyll (ppm)	0.12	0.11	0.13	0.1	0.2
DO (mg/l)	2.8	2.87	2.2	2.26	1.8
BOD (mg/l)	6.5	6.0	5.4	5.6	6.6
Water quality parameters Surinsar Lake					
SITES	**SITE I**	**SITE II**	**SITE III**	**SITE IV**	**SITE V**
pH	7.2	7.1	7.1	7.1	7.2
Temperature (°C)	13.5	13.7	14.2	13.5	13.9
Conductivity (µs/cm)	256	252	260	250	238
TDS (ppm)	260	220	260	320	920
Colour/odour	Not Agreeable	Not Agreeable	Not Agreeable	Not Agreeable	Not Agreeable
Suspended Impurities	Present	Present	Present	Present	Present
Chloride (mg/l)	31.91	32.62	39	28.36	31.91
Alkanity (mg/l)	146	138	151	132	162
Nitrite	Absent	Absent	Absent	Absent	Absent
Turbidity (NTU)	1	1	1	1	1
Salinity (ppt)	0.1	0.1	0.11	0.11	0.1
Chlorophyll (ppm)	0.09	0.08	0.09	0.09	0.12
DO (mg/l)	3.5	3.38	3.1	3.26	2.98
BOD (mg/l)	4.3	5.1	4.6	3.5	6.5

Table 2.3: Physicochemical parameters of Mansar–Surinsar Wetland during/after lockdown.

Water quality parameters Mansar Lake					
SITES	**SITE I**	**SITE II**	**SITE III**	**SITE IV**	**SITE V**
pH	7.6	7.68	7.52	7.64	7.35
Temperature (°C)	30.4	29.7	30	32.4	32.2
Conductivity (µs/cm)	198	220	222	222	218
TDS (ppm)	142	140	148	150	119
Colour/odour	Not Agreeable	Not Agreeable	Not Agreeable	Not Agreeable	Not Agreeable
Suspended Impurities	Present	Present	Present	Present	Present
Chloride (mg/l)	24.82	24.11	25.2	24.11	25.88
Alkanity(mg/l)	98	125	119	113	109
Nitrite	Absent	Absent	Absent	Absent	Absent
Turbidity (NTU)	1	2	1	1	1
Salinity (ppt)	0.11	0.1	0.1	0.1	0.1
Chlorophyll (ppm)	0.12	0.1	0.11	0.12	0.1
DO (mg/l)	5.6	6.2	7.9	7.7	8
BOD (mg/l)	3	3.1	1.2	0.3	1
Water quality parameters Surinsar Lake					
SITES	**SITE I**	**SITE II**	**SITE III**	**SITE IV**	**SITE V**
pH	8	7.98	7.46	8.2	8.08
Temperature (°C)	33	30.6	32.7	33	33.3
Conductivity (µs/cm)	177	177	180	130	173
TDS(ppm)	121	121	126	130	119
Colour/odour	Not Agreeable	Not Agreeable	Not Agreeable	Not Agreeable	Not Agreeable
Suspended Impurities	Present	Present	Present	Present	Present
Chloride (mg/l)	24.82	27.65	28.36	26.24	25.53
Alkanity (mg/l)	84	89	89	92	98
Nitrite	Absent	Absent	Absent	Absent	Absent
Turbidity (NTU)	1	1	1	1	1
Salinity (ppt)	0.08	0.08	0.08	0.08	0.08
Chlorophyll (ppm)	0.11	0.14	0.13	0.12	0.12
DO (mg/l)	8	6	7.8	6.5	6.2
BOD (mg/l)	0.9	4.2	1.2	1.5	4

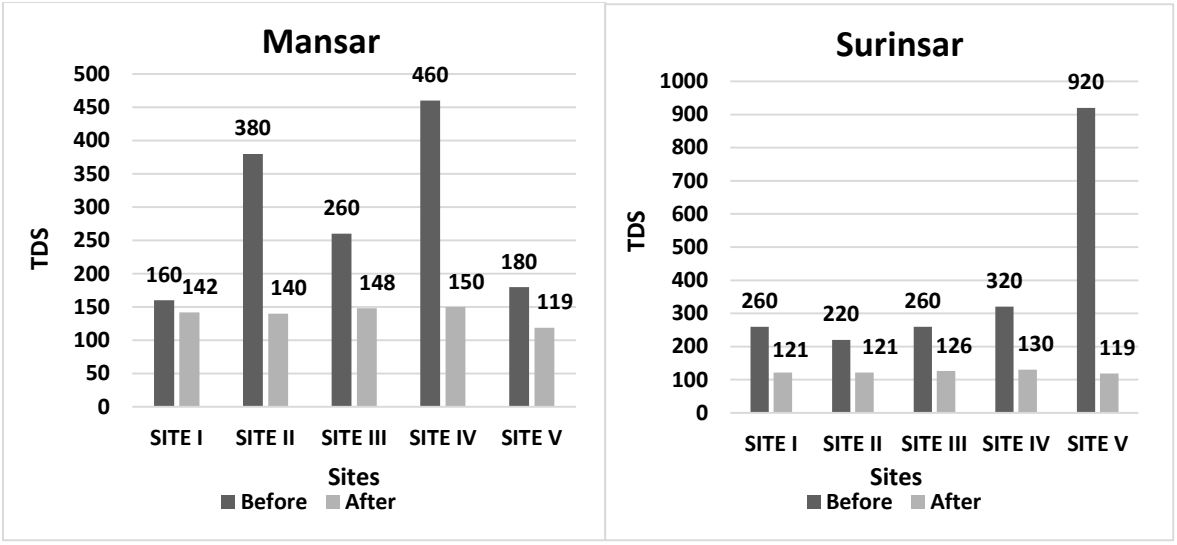


Fig 2.3: TDS (mg/l.) at different sites of Mansar-Surinsar wetland

Conductivity: It is a capacity of any aqueous solution to carry an electric current which is due to the presence of ions, their concentration and their motility. Electrical conductivity is mainly due to the presence of large amount of garbage, road runoff, plastics and other organic matter. According to CPCB, electrical conductivity of freshwater streams should not exceed 1000 us/cm at 25^{o} C, as this limit favor most of the aquatic life of the ecosystem. Higher the concentration of ions, higher is the conductivity and is an indicator of water pollution. The value of conductivity decreases post lockdown conditions (Fig 2.4).

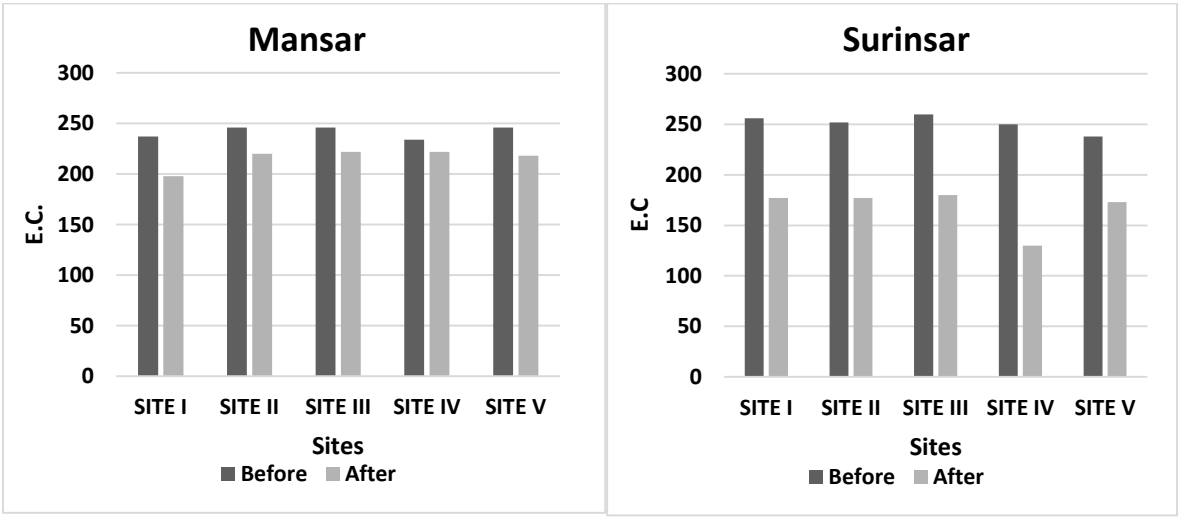


Fig 2.4: E.C (us/cm) at different sites of Mansar-Surinsar wetland

Chloride: Chloride is the inorganic compound found which is an important anion that helps in maintaining electro neutrality and osmolality in association with sodium. In freshwater lakes, chloride concentration should be less than 50mg/lt. Increased chloride concentration leads to the acidification of the streams, mobilize toxic materials, effects the mortality and reproduction of the aquatic biodiversity. In our present study, the values of chloride ranged between 21.27 mg/l. – 48.58 mg/l. for both the lakes which is within the permissible limit (Fig 2.5).

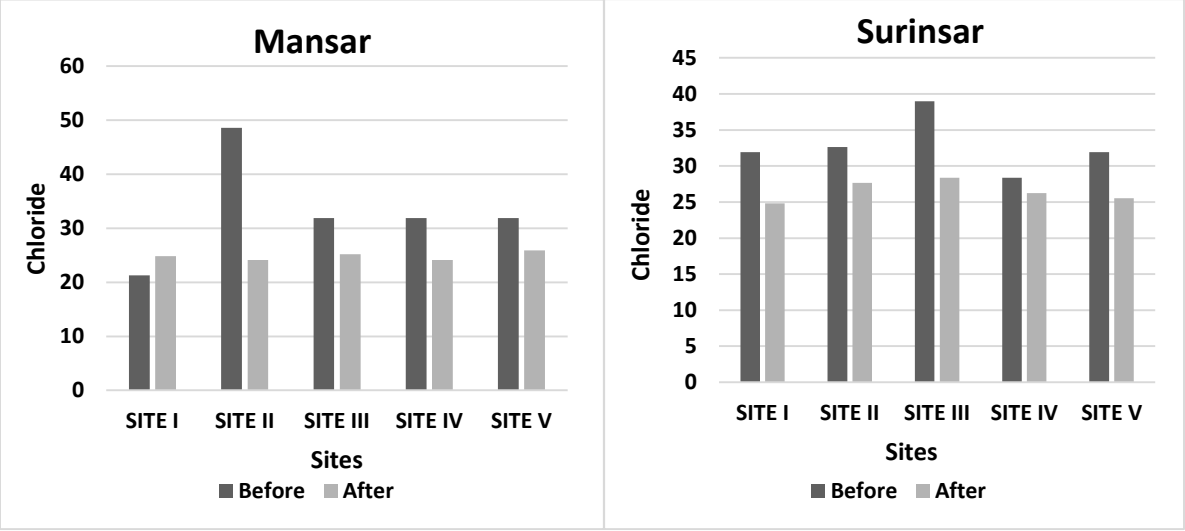


Fig 2.5: Chloride conc.(mg/l.) at different sites of Mansar-Surinsar wetland

Total Alkalinity: Alkalinity depends upon the hydroxides, carbonate and bicarbonate ions in the water sample. Other components that causes increase in alkalinity are phosphates and hydroxides. The value of alkalinity should not be greater than 200 mg/l in water bodies. If total alkalinity is too low, pH will be unstable. According to our study, the values of total alkalinity ranges between 132mg/l.-180mg/l. during pre-lockdown analysis. The highest value of total alkalinity is found at Site V (180mg/l.) in Mansar lake. The value of alkalinity of both the lakes ranges from 84mg/l-125mg/l. during lockdown analysis (Fig 2.6).

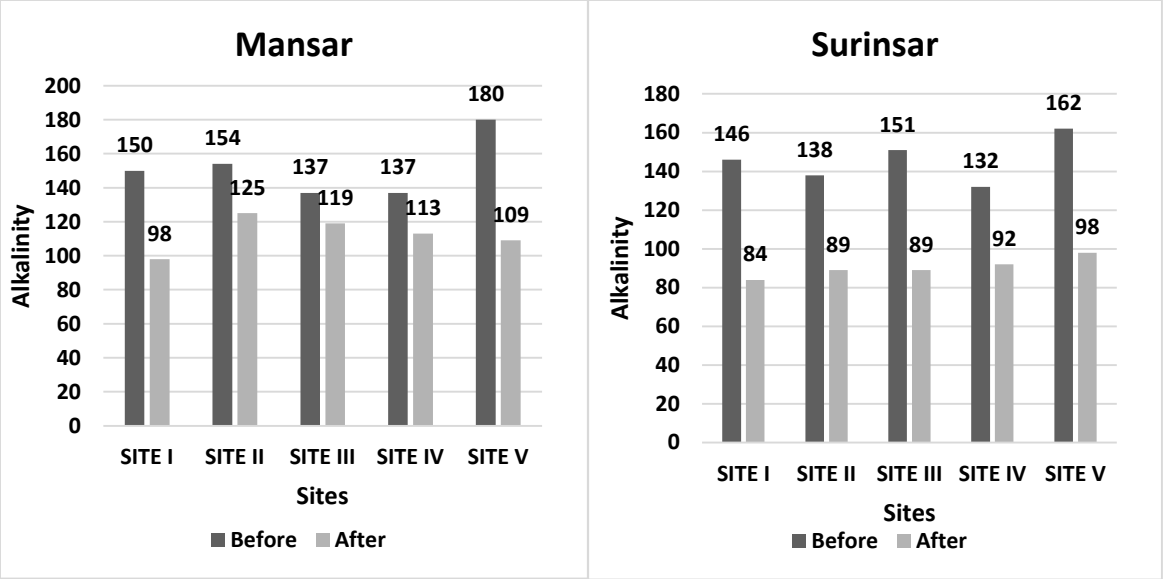


Fig 2.6: Total Alkalinity (mg/l.) of Mansar-Surinsar wetland

Turbidity: Turbidity effects the clarity of water, raises the water temperature, lower the DO level. It also determines the amount of water pollution present in the water bodies. Turbidity is an indicator of total suspended solid and erosion levels in water. Lead is an example of suspended solid present in water body. High concentration of suspended solid causes serious health problems in aquatic lives and humans also. The turbidity of freshwater suitable for aquatic species is ideally below 1 NTU and should not be more than 5NTU. In our present study, result shows that the Mansar lake has turbidity more than the preferred range (*i.e.* 2NTU) but Surinsar lake had turbidity of 1 NTU prior lockdown. Both the lakes have ideal values during the lockdown (Fig 2.7).

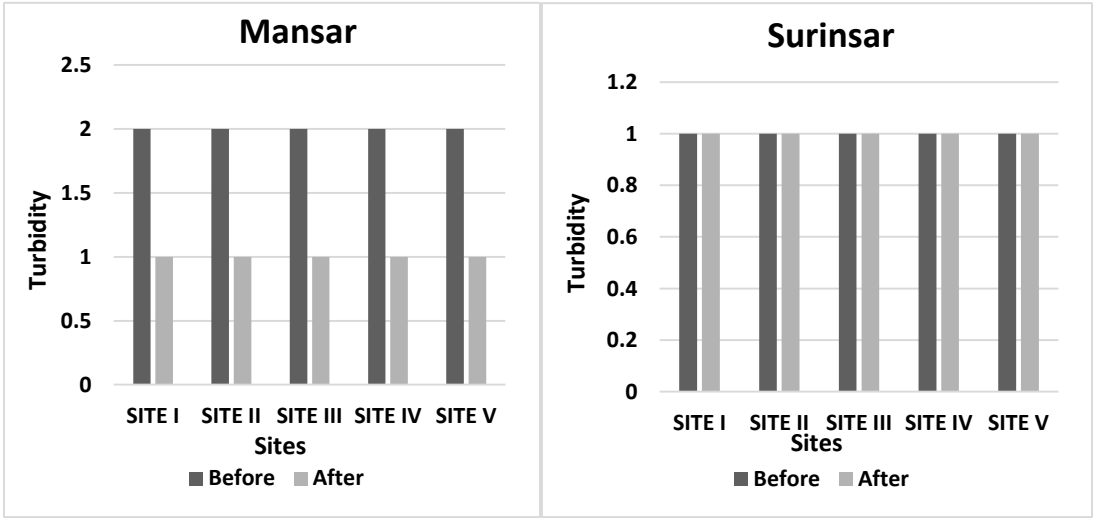


Fig 2.7: Turbidity at different sites of Mansar-Surinsar Wetland

Salinity: Salinity or Salt concentration has adverse effect on lake ecosystem. It can reduce diversity fitness through sub-lethal effects *e.g.* oxidative stress, delayed growth, reduced feeding efficiency and increase malformations. Various abiotic stressors and manipulated salinity resulted in ecological consequences, adversely change the performance of aquatic biodiversity. The salinity of freshwater lakes should below 0.5ppt and results show that values of salinity is between 0.08ppt -0.2ppt which is within the permissible limits (Fig 2.8; Table 2.2 & 2.3).

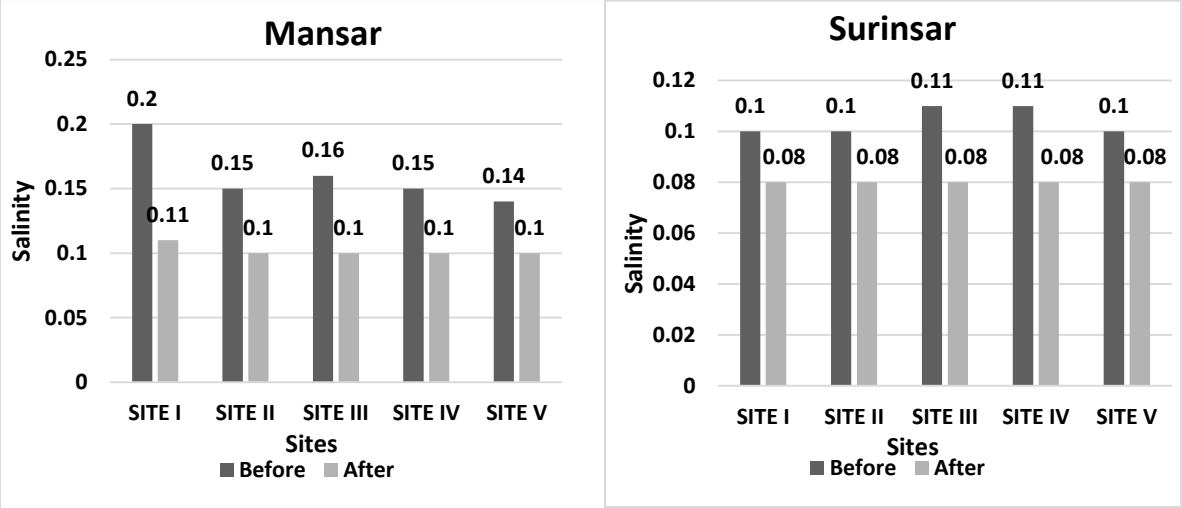


Fig 2.8: Salinity at different sites of Mansar-Surinsar Wetland

Chlorophyll: Chlorophyll is an indicator of algae growing in a water body. Although it is a natural component of the freshwater ecosystem but the excess of algae results in decrease in the level of the DO. Water with high levels of nutrients from fertilizers, septic systems, sewage treatment plants and urban runoff have high concentration of chlorophyll and excess amount of algae. Presence of high concentration of algae results in the formation of algal blooms, which are dangerous for the aquatic species because when the algae die, bacteria decompose them using all the oxygen present in the lake. According to the standard statistical classification of surface freshwater quality for the maintenance of aquatic life, the value of chlorophyll in freshwater ecosystem should not exceed 0.002ppm. In our study, before lockdown, value of chlorophyll varies from 0.08ppm-0.20ppm. Post lockdown, the water quality analysis shows the value ranges from 0.10-0.14ppm (Fig 2.9). In both the cases the margin of chlorophyll in these two lakes cross the ideal range.

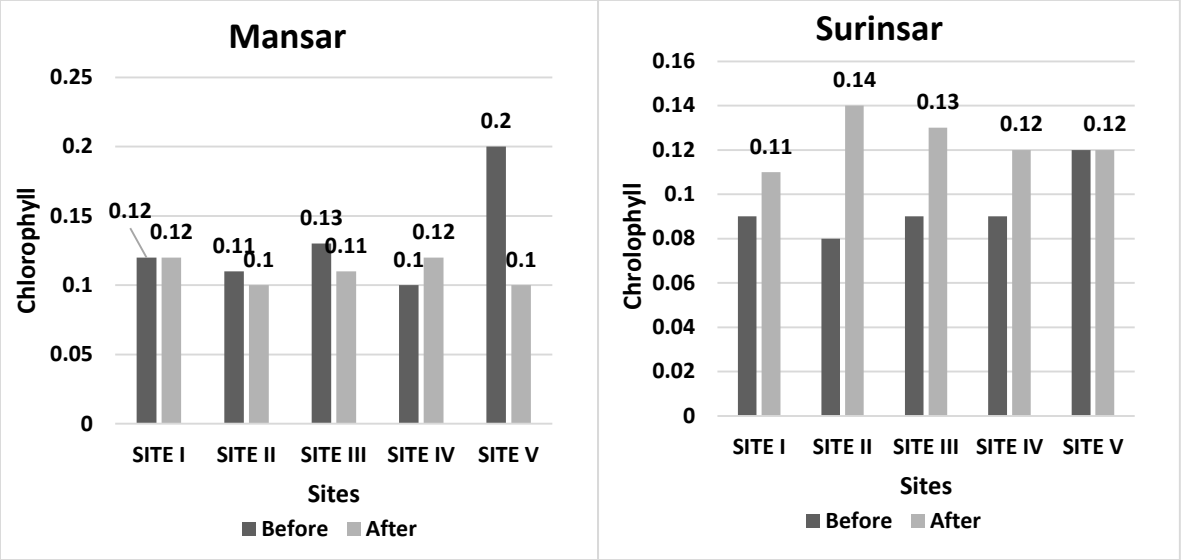


Fig 2.9: Chlorophyll(ppm) at different sites of Mansar-Surinsar Wetland

Dissolved Oxygen: DO is defined as the amount of gaseous oxygen dissolved in the water bodies. It is the most important component for aquatic species such as fishes and other aquatic species which requires dissolved oxygen for respiration. For the survival of fish, 4 mg /l or more of DO is required. Fishes go under stress, when the concentration of the DO in water falls below 4 mg /l. Greater the stress, if DO is lower in concentration. The value of DO varies between 1.8mg/lt. - 3.5mg/l. in Mansar-Surinsar Wetland before the lockdown. The lowest value of DO is at Site V of Mansar Lake (Fig 2.10 and Table 2.2) which is even too low to support the life. The value of DO reaches the preferable range *i.e.* 5mg/lt.- 8 mg/lt. during the lockdown (Table 2.3). The factors that affects DO include influx of agricultural runoff, temperature fluctuation, electrical conductivity, TDS and Chlorophyll.

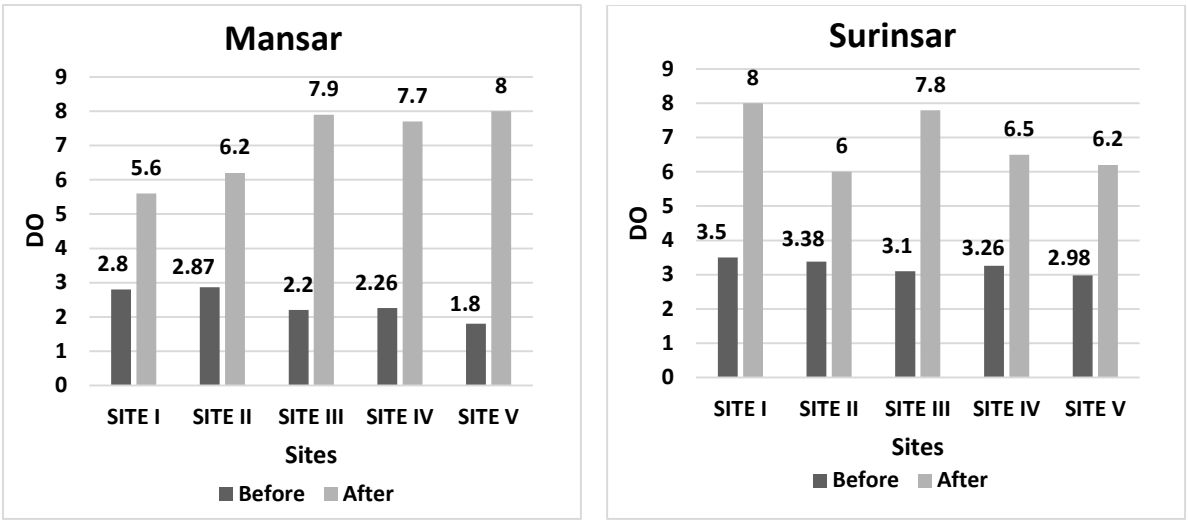


Fig 2.10: Dissolved Oxygen (mg/l.) at different sites of Mansar-Surinsar wetland.

<u>Biological Oxygen Demand</u>: BOD is defined as the amount of oxygen used by the micro-organisms for breaking down the decomposable organic matter present in water. BOD is an indicator of the organic pollution in the water bodies. Greater the amount of organic load in the water body, greater the value of the BOD. High value of BOD is due to the presence of the large amount of the Nitrates and Phosphates which causes algae to grow quickly and then die quickly. The unpolluted water typically has BOD less than 2mg/l. The study shows the values of the BOD between 3.5mg/l.- 6.6 mg/l. prior lockdown which are high enough than the preferred range but during lockdown it reaches between 0.9mg/l.- 3.1mg/l. almost within preferred range (Fig 2.11).

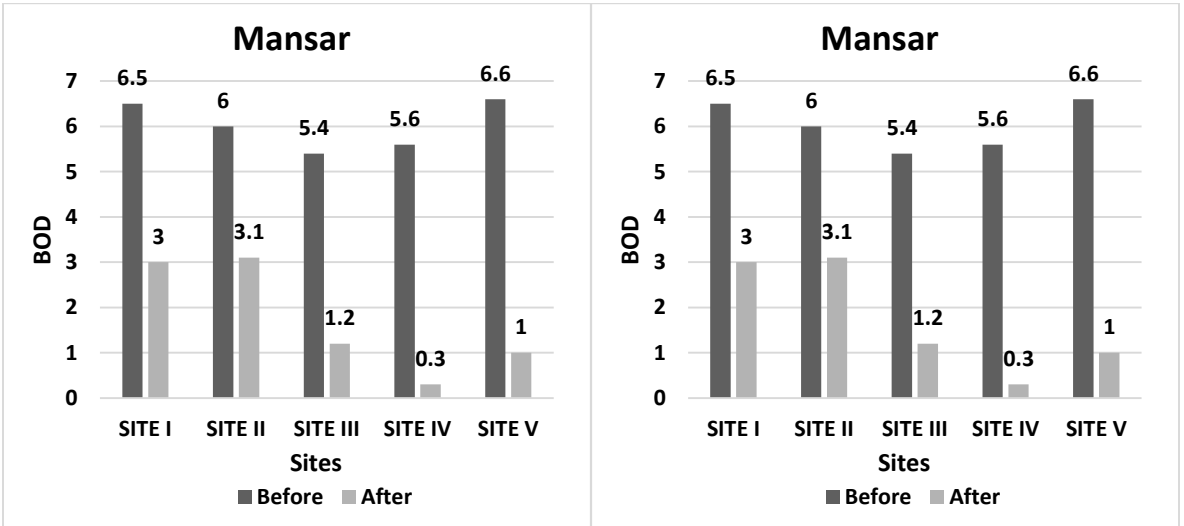


Fig 2.11: BOD (mg/l.) at different sites of Mansar-Surinsar wetland

Results of physicochemical water quality parameters reveal that the value of the parameters such as DO and BOD remained within the permissible limits due to restrictions imposed on various anthropogenic activities; with less man- nature interaction. The values of other parameters such as Alkalinity, TDS, Electrical conductivity, salinity, Turbidity have also reduced as compared to the concentrations prior lockdown. Managing wetland ecosystem also require monitoring of water quality, water level, vegetation and buffer area. Increase in the anthropogenic activities which imposes threat to the natural environment include (a) discharge of various organic as well as inorganic waste from the agricultural field, (b) increase in tourist activities, (c) conversion of buffer area to residential and commercial area, (d) feeding activities, (e) residues of construction activities, (f) increasing level of other pollutants.

Suggestions regarding water quality monitoring-

- Samples should be collected every two months: May/June, August, October, December, February, and April. This will generate six samples from lakes i.e. from pre and post monsoons, dry seasons like winter.
- Five important parameters such as pH, EC, DO, BOD, TDS should be tested every year at different season to get initial information as well as trend analysis.
- This can be achieved by doing analysis as shown in the following table-

Parameter Group	Initial	Trend
General	Temp, EC, pH, DO,TDS	Temp, EC, pH, DO,TDS
Organic Matter	BOD, COD	BOD, COD
Microbial	Total coliforms	Total and fecal Coliforms

2.8 GENERAL ECOLOGICAL FEATURES INCLUDING FLORA AND FAUNA

2.8.1 Flora

2.8.1.1 Vegetation type and composition in the catchments

The vegetation of the surrounding mountains and highlands around these two lakes are characterized by sub-alpine moist forest and mostly dominated by lower Siwalik vegetation type such as Chirpine (*Pinus roxburghii*), and Deodar (*Cedrus libani*) forests. Among the other common tree species that make most of the adjacent forest covers along with the dominant species flanking both the lakes are Bamboo, Shesham, Amaltas, Kanchnar, Palash and few subtropical species like mango (*Mangifera indica*), Peepul/sacred fig (*Ficus religiosa*), Black mulberry/ tut (*Morus nigra*). During our study period, we have identified 25 species of plants those are mostly found around Mansar and Surinsar wetland. (Appendix 2)

2.8.1.2 The aquatic vegetation types and extent

The littoral zone of both lakes used to have thick vegetation cover of emergent plants like *Typha* sp., *Phragmites* sp., *Ipomea* sp, *Scirpus* sp., and submerged vegetation comprising of *Hydrilla verticillata*, *Potamogeton* sp., *Nitella* sp. etc. Almost the entire area of the lake e edges and other shallow water area is covered with Ipomea. In recent times, deweeding of lakes resulted in removal most of the Ipomea along the banks and its effect is more visible in Mansar lake where there is no *Typha* present. Surinsar lake have decent amount of Ipomea and a scattered *Typha* patches are still left and serve as important microhabitats for several water birds and many insect species. However, both of these wetlands lack persistent amount of floating vegetation (like *Nelumbium* sp. and *Nymphoides* sp.) cover.

2.8.2 Fauna

2.8.2.1 Birds

The survey of bird species in the Mansar - Surinsar Wetland was conducted as an attempt to understand the avifaunal diversity in and around both lakes. Bird census was carried out from October' 2019 till February'2020 (once or twice in every month depending on weather and other favorable conditions) except the month of December due to bad weather throughout that time of

month. For sampling we used techniques such as Point count methods (5points each of 50m radius and approx. 150-200m apart from other are being selected randomly for both the lakes), Encounter rate methods (counting individual of a species seen per unit efforts, here birds/unit time; 1:30 hrs. are given for each survey during this study) and block counts method (to estimate resident and migratory water-birds). Observations were made essentially in the early morning (8:30- 12:30) when birds were mostly active and visible at these places surrounding lakes. In our 4 months of surveys, we have recorded a cumulative of 82 species of birds from the whole study area out of which 15 species were water birds (Appendix 3). Bird surveys of total 6 weeks (as 6 sampling sessions in each lake) yielded an accumulation of 65 species in and around Mansar wetland and 47 species in Surinsar wetland (Figure 2.12 & 2.13).

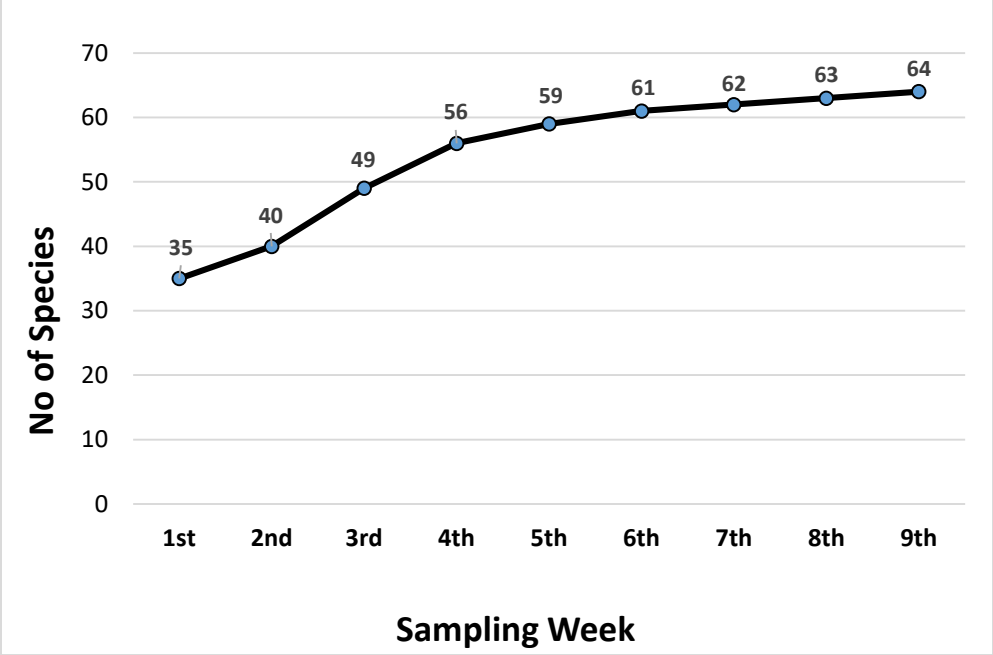


Fig 2.12: Species Accumulation Curve of avifauna of Mansar Wetland

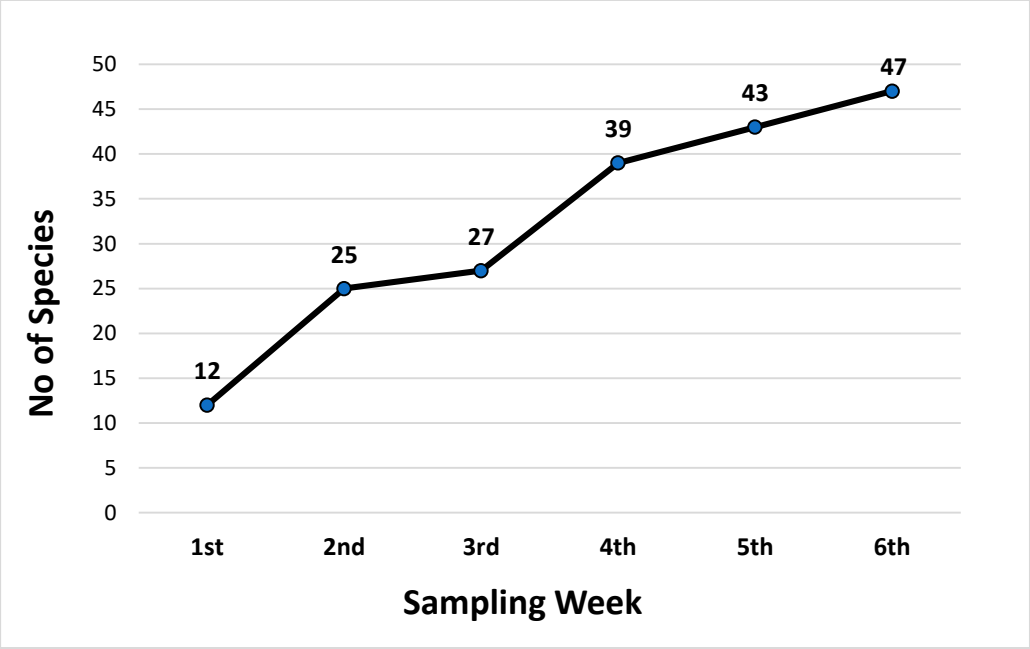
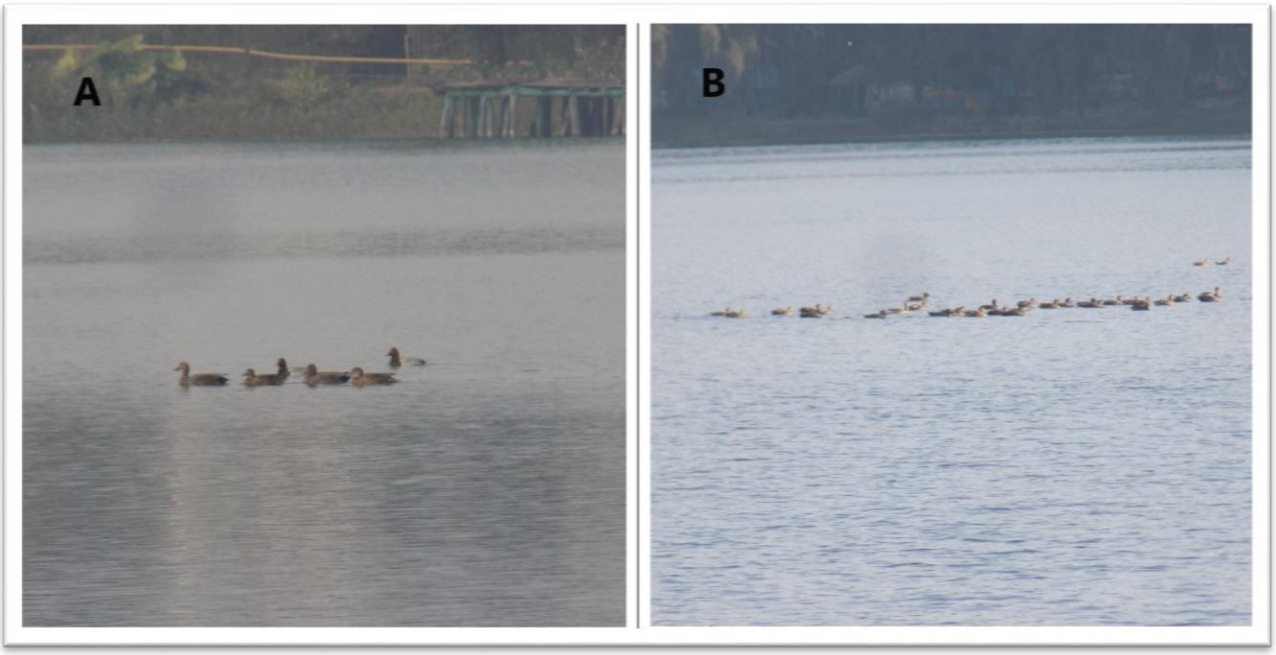


Fig 2.13: Species Accumulation Curve of avifauna of Surinsar Wetland

Among the recorded species Great Cormorant has been found to be the most abundant species while Mallard, Common Pochard, Ruddy Shelduck were least abundant birds in Surinsar-Mansar wetland areas. In the months of December-March we did not encounter any large gatherings of migratory water birds visiting the lakes except just on one occasion in Mansar where a flock of Gadwalls (n= 40) were seen during the first week of March (Vide Picture 1.1). A few scattered flocks of Northern Shoveller (n= 4), Mallard (n=2), Common Pochard (n=2), Lesser Whistling Duck (n=10), Ruddy Shelduck (n= 2) were seen gathering transitionally during these months of our study period.

The pictures of some important wetland species are included in Plate no. 1 and 2 in a format which can be developed into a poster by the reserve management.



Picture 2.1: A. Small flock of Common Pochard in Surinsar; B. Flock of Gadwalls in Mansar.

Comparative account of migratory avifauna at both the lakes:

Lake Surinsar and Mansar were important wetlands and designated RAMSAR sites as these two lakes support a number of species of migratory avifauna. In an earlier study, Singh (2004) had recorded 15 species of migratory waterfowls in Mansar. Another study (Kotwal, 2012) had found only 5 species of migratory waterfowls during 2008-2009 period. Present study also noticed a decline in the migratory avifaunal assemblage and only observed 7 species of migratory water birds (e.g. Coot, Mallard, Shoveller, Common Pochard, Shelduck, Gadwalls, Lesser whistling duck). Comparative Table (2.4) shows the population dynamics change of migratory water birds from our study time to earlier periods.

Table 2.4: Comparative account of population dynamics of migratory water fowls at Mansar Surinsar lakes.

Sl no.	Bird Species	No of birds in 2008 study (Kotwal, 2012)	No of birds in 2009 study (Kotwal, 2012)	Present study (2019-2020)
1	Coot	131	207	36
2	Mallard	7	11	1
3	Shoveller	13	2	4
4	Gadwall	12	4	46
5	Common Pochard	46	6	2
6	Ruddy Shelduck	0	0	2

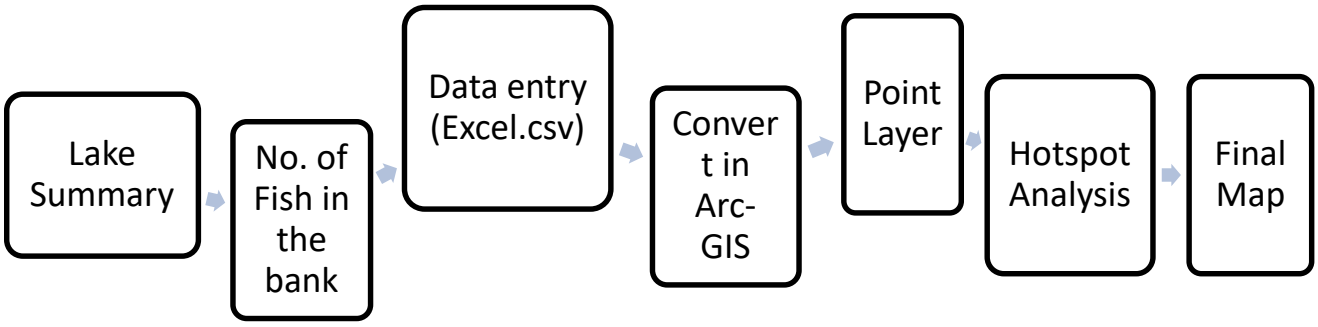
It is evident from the table above that almost all the species of waterfowl have registered a decrease in numbers during the period of comparison. This significant lack of assemblages of waterfowls may be owing to decline in deep water areas because of siltation, loss of habitat for e.g. floating and submerged vegetation, increase in boating and other anthropogenic activity around these lakes. Previous studies and present study have shown that both Surinsar and Mansar lakes were important due to their potential to support numbers of migratory avian species, but increased human practices over the years had imparted a cascading effect on both these lakes.

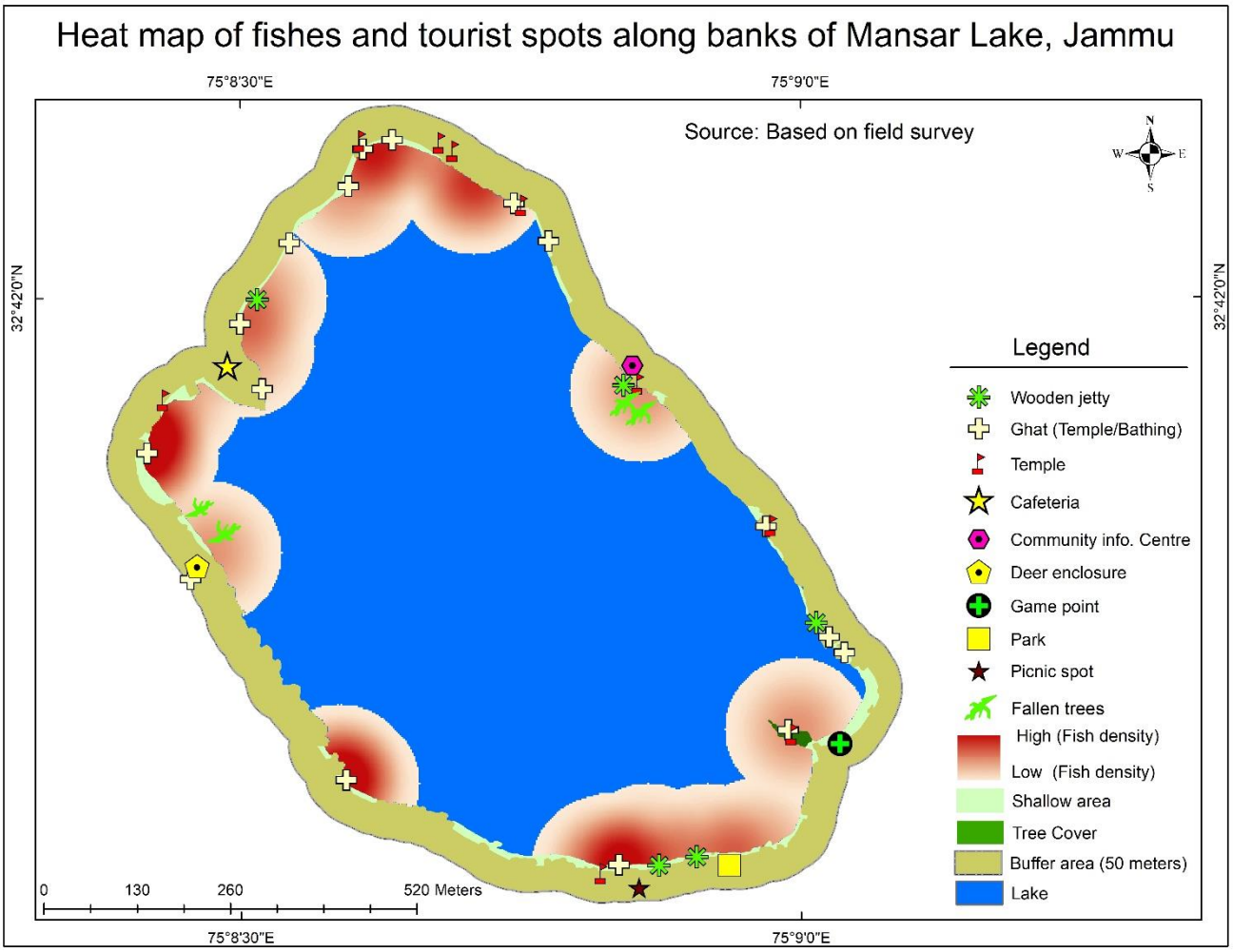
2.8.2.2 Ichthyofauna

Surinsar Mansar wetland supports several native and one introduced exotic species of fishes. During our study period we have documented around 7 species of native fishes (Plate 3). A list of documented fish fauna during our field survey has been given in Appendix 4.

Fish hotspots

Exotic carp density has been shown in the map which picturizes the high (in dark reddish hue) and low (in light reddish tone) crowding of fish at or near the edge in several locations. During our study period we have observed over 70,000 exotic carps in Mansar and 22000-25000 in Surinsar through total counts from photographs taken above large congregations. These hotspots (appears as semicircles in tones of red colour) are at locations which include main ghats (boating, mandir) where they are fed with ‘atta’ by tourists (Map 7& 8). The fish hotspot map was prepared by the following steps-

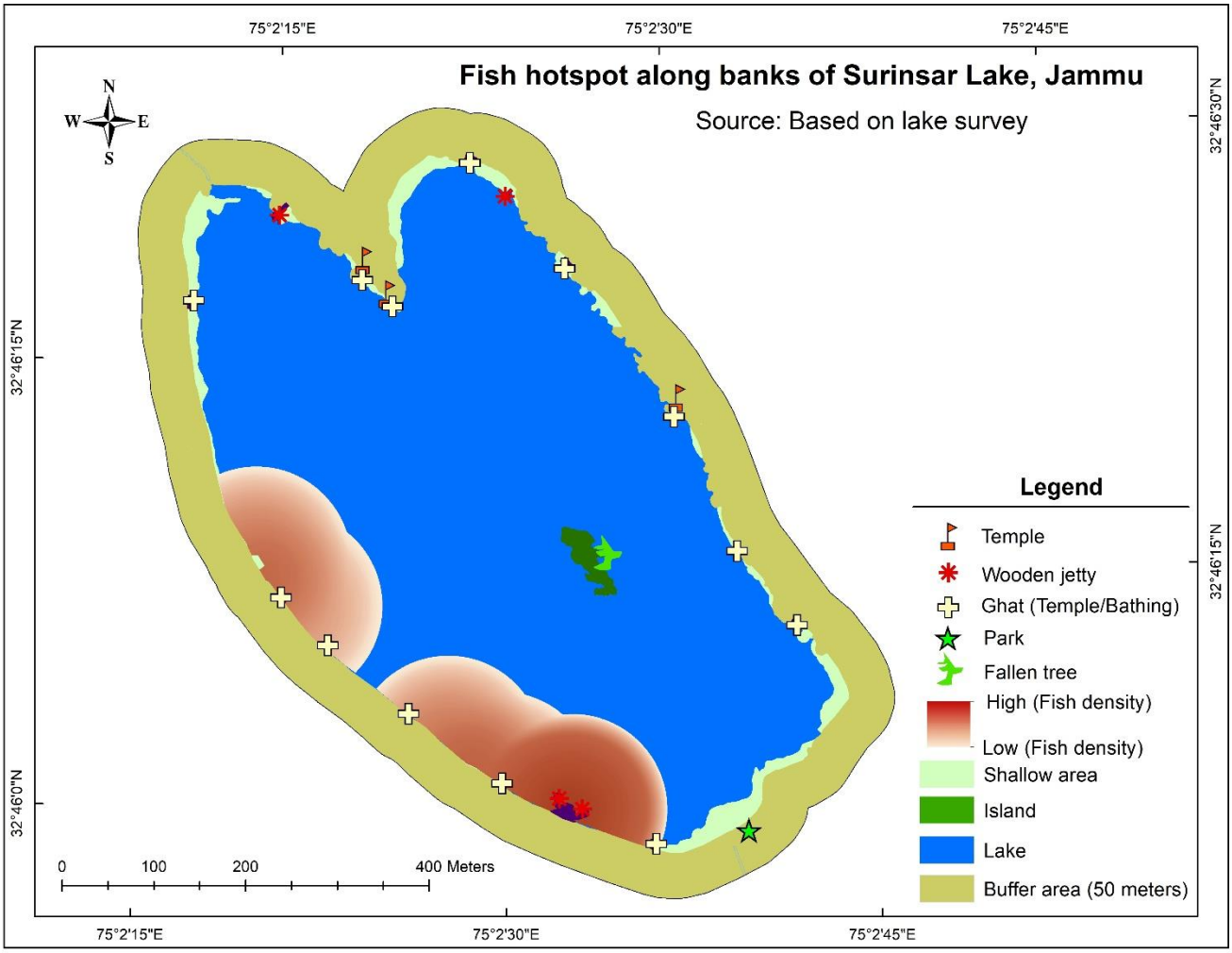




Map 7: Exotic Fish hotspots in Mansar lake with respect to all built up area

Mansar lake: There are significant congregations at places like all temple ghats, boating site, Temple ghats, wooden jetty's and also where persistent amount of aquatic vegetation exists, mostly along the north west to north and south east bank of the lake. At those places there were schools of fish approximately numbered around 10000-20000 at single feeding point where tourists offer atta (Wheat) to fishes (during field surveys in January- February'2020).

Surinsar lake: In Surinsar lake the carp congregation is much less compared to the situation in Mansar lake. Here the fish gathers only at the area stretching from south (near park area) to west side (main boating site of the lake) where mainly tourist gather to feed these fishes with atta (vide Map 8).



Map 8: Exotic Fish Hotspots in Surinsar Lake with respect to important built up area

Observation on mass fish mortality in Mansar Lake

Approximately around 15th January, 2020 we started observing mass fish mortality in Mansar lake. All the exotic carps (*Cyprinus carpio*) were dying out in thousands of numbers continuously throughout the span of a week (approx. 15th Jan- 21st Jan) and were seen floating mostly near edge in front of cremation Ghat behind deer park, lake portions in front of Hanuman mandir (where a major outlet of nearby agricultural field directly connects to lake), places in front of shops nearby Mansar picnic spots, areas adjacent to private property and Boating Ghats. We could only measure and weigh a subset of samples (n=150) among these quintals of corpses that were removed from the lakes by forest guards and supporting staffs along with the help of few local people (Picture 1.2). From our sample analyses and based on observations we found that most fishes that succumbed to death were from a weight range of 2000-4000 gm on an average (Fig. 2.14).

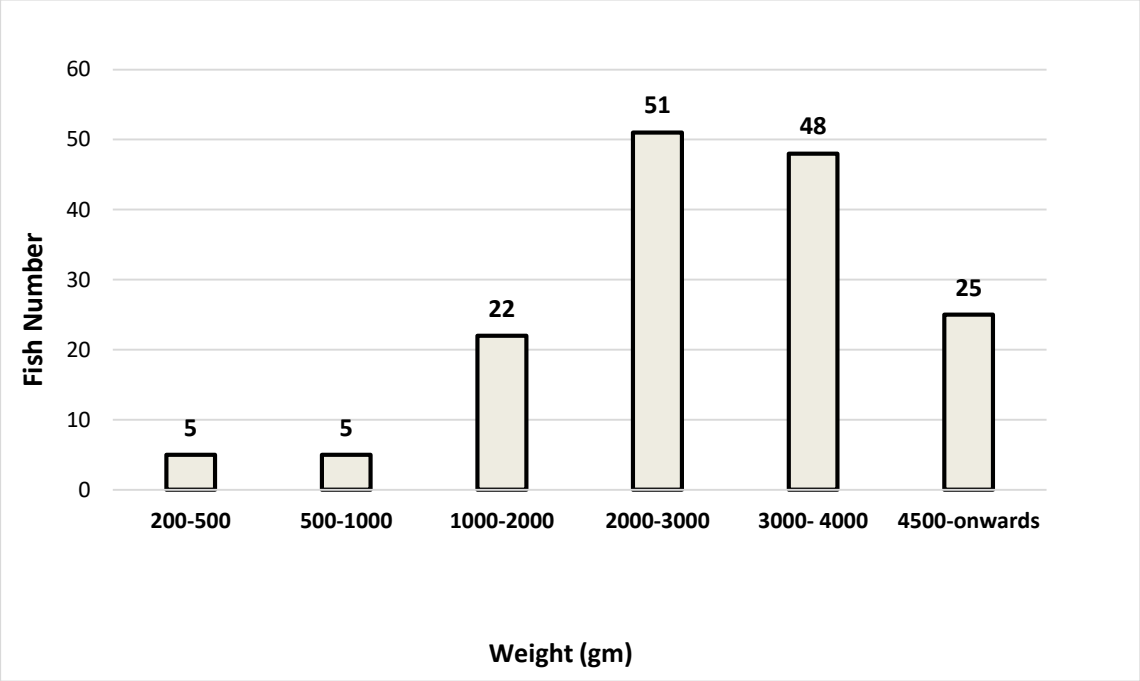


Fig 2.14: Number of dead fishes (n=156) with relation to weight ranges in Mansar lake



Picture 2.2: Incidence of mass mortality of common carp in Mansar lake and removal by forest department staffs

2.8.2.3 Turtles and other Herpetofauna

During our survey we have recorded four species of amphibians and 11 species of native reptiles. Among reptiles we have found five species of turtles, of which we have confirmed the first distributional record of *Pangshura tentoria* (Indian tent turtle) from Jammu & Kashmir, India (Banerjee & Das, 2020). List of herpetofauna documented during the present study is mentioned in Appendix 5.

Survey methodology

All the Visual Encounter Surveys (VES) are concentrated along the wetlands. VES method (by Crump and Scott 1994) is a popular technique to estimate relative abundance and species richness.

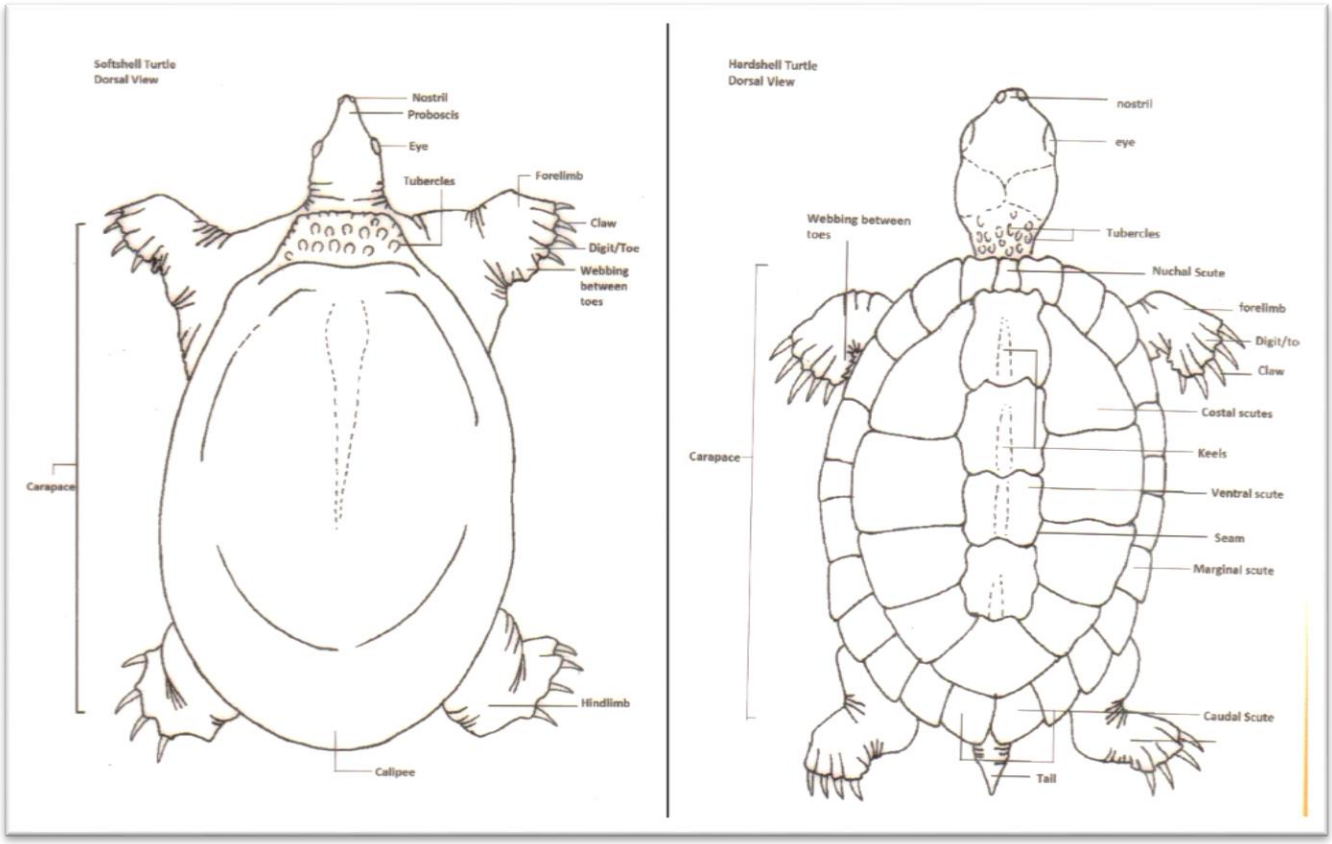
In both the lakes, VES was performed along the periphery of both lakes once or twice in every week for a duration of one hour. GPS locations of hotspots, subsequent water temperature and distance from the edge has also been measured for further analysis. VES were conducted in October-November' 2019; February- March'2020 & January-March'2021.

Special note: Turtles of Surinsar Mansar wetland

Turtles and tortoises belong to the Order Testudines and are a group of reptiles that are covered with bony plates enclosing their soft body parts. The dorsal plate is known as the 'carapace' and the ventral plate is called as 'plastron'. Tortoises spend all its life on land, whereas turtles mostly spend its time in water and only comes to land to lay eggs. The carapace of the tortoise is dome shaped in compared to laterally compressed and streamlined for swimming. In turtles, the forelimbs are modified as flippers (in marine turtles) or have webbing (in fresh water species); whereas the limbs of tortoises are short, elephantine, unwebbed and skin of the fore limbs are covered with strong horny scales. Tortoises can retract its head into the shell, whereas turtles can partially retract its head into shell.

Among the freshwater turtles there are two different families i.e. hardshell (fam. Geoemydidae) and softshell (fam. Trionychidae).

Members of hardshell group of turtles have a hard bony plate like covering on the carapace known as scutes. The softshell turtles on the other hand have carapace covered with a leathery skin, scutes are replaced by a continuous layer of soft skin. A schematic diagram with all morphological characters is given below.



Picture 2.3: Schematic diagram showing morphology of Hard shell and soft shelled turtle (Diagram courtesy: TRAFFIC, Turtle Identification Cards 2019)

1. *Nilssonia gangeticus* (Cuvier, 1825) [Plate 5. C & D]

Common name: Gangetic softshell turtle.

Diagnostic Characters: Carapace low and oval, grey or green or grey black in color with black reticulation; plastron is pale yellow, creamy white or yellowish in color. Head olive green with several black stripes on forehead and side arises from the space between two eyes and extending up to nape. Head is broad and massive with a long proboscis like nose. Legs are greenish.

Habitat: The turtles are generally found in fresh water bodies like rivers, lakes, ponds burying itself in the mud near the shallow regions.

In Mansar Surinsar lake this turtle is mostly found around the edges of the lake where the water level is low and some mud banks are present. They are often seen basking on the mud platform or on the middle island of the Surinsar.

Habits: The turtle is mainly omnivorous in nature feeding on small fishes, frogs, mollusks as well as aquatic plants and fruits. They are generally aggressive in nature when approached, they also display aggression towards conspecific males. Males are known to become territorial during breeding season. Mating takes place at the onset of rainy season in comparatively shallow waters. Eggs are laid mostly during July- October with sometimes a slight peak in early November for the population in Mansar & Surinsar. Loose soils near the shallow regions of bank are dug and the eggs are laid with an average clutch size of 25-35. During October we have found many hatched egg shells near the bank. Some holes (nest) with approx. 20 broken egg shells have also been found during month of February [Picture 1.4]



Picture 2.4: Evidence of nesting activities of softshell turtles in Mansar lake

Distribution: Distributed over the northern parts of the Indian subcontinent including the drainages of larger river systems like Ganges, Mahanadi etc.

This species was commonly found and sighted turtle species in both Surinsar and Mansar lake during our study period.



Picture 2.5: *Nilssonia gangeticus* (Gangetic softshell turtle)

2. *Lissemys punctata* (Webb, 1980) [The subspecies *L. punctata andersoni* is found in the said study region] [Plate 5. A & B]

Common name: Indian Flapshell turtle.

Diagonistic Characters: Carapace is circular to oval, moderately arched and olive green in color with dark yellow spots (key I'D character of subspecies *andersoni*) of varying shapes and size. Plastron is cartilaginous with seven callosities and cream or pale yellow in color. There are pair of flaps in the inguinal area under which the limbs can be retracted and closed under the skin flaps, gives the very name of this species as 'Flapshell turtle'. Head is olive with faint yellow blotches. Fore and hind limbs are grey with light yellow spots.

Habitat: The ability of this turtle to adapt to a variety of environment made them exploit various habitats such as salt marshes, river, lakes, ponds, rice fields, swamps, canals etc. Basking takes place on riversides, Banks of ponds, sandbars, driftwoods and floating vegetation. It is the second most common turtle species after *N. gangeticus* found in the study area. Its occurrence was found to be more common in Mansar lake than Surinsar. In Mansar Surinsar this turtle is observed to come out of water in order to bask under the sun, and on little disturbance it jumps back in water.

Habits: The aggression depends and varies among individuals. This species is omnivorous and feed on fishes, frogs, aquatic insects like water beetle and aquatic vegetation like *Hydrilla* sp. etc. They mostly hunt on lands during night. In Mansar and Surinsar the turtles are found to hibernate between November to February. Even during summers when the water recedes the turtle has been reported to burrow in soil and aestivate for several months.

Breeding mostly happens during rainy season, when the turtles make long overland journeys are found in nearby agricultural fields. Mating in Jammu region has been observed in April (Das, 1996). They lay around 5-13 eggs between August to October.

Distribution: The subspecies *L. punctata andersoni* is distributed throughout north and north east Indian states. They are also being recorded from Jammu city and lake Mansar Surinsar. In our present study we have also located this species several times in Mansar and in one or two occasion in Surinsar.



Picture 2.6: *Lissemys punctata* (Indian flapshell turtle)

1. *Pangshura tecta* (Gray, 1831) [Plate 4. A]

Common name: Indian roofed turtle.

Identifying Characters: Carapace elevated, oval with a light brown, red or orange along the first three vertebrals; carapace margins with light yellow border. Plastron yellow or pink with 2-4 black markings on each scute. Snout pointed; head with orange or reddish crescent shaped margin behind the eyes; neck dark with thin yellow stripes.

Habitat: This turtle is mostly found in standing or slow moving waterbodies, although it is seen to also occur in some large rivers. This turtles are often seen basking on floating trunks, partially submerged vegetation and water banks.

Habits: Non- aggressive, this turtle make no attempt to bite on being handled. When threatened, it moves it head and neck closer to the ground, raises its posterior end and try to evade away. Mainly feed on plant food, like algae, floating vegetation etc. In Mansar-Surinsar lake this turtle is seen along the lake edge and on floating tree branch/trunks. They mostly come out of hibernation in early to mid-February.

Breeding mostly happens during months of March to October; lays around 4-10 eggs in this region (Das, 1995).

Distribution: The commonest member of the genus, found throughout northern Indian states in the floodplains of Narmada, Brahmaputra, Ganges river stretch.

It was the most encountered hardshell species of turtle in our study area.



Picture 2.7: *Pangshura tecta* (Indian roofed turtle)

2. *Pangshura tentoria* (Gray, 1834) [Plate 4. C]

Common name: Indian tent turtle.

Identifying characters: Carapace elevated, oval with a distinct vertebral keel on the 3rd vertebral; plastron truncated. The carapace is brownish olive with light colored stripe on vertebrals; the plastron is yellow and unpatterned. Head is brownish olive, with a pink patch behind the eyes.

Habitat: Primarily a riverine species and found in both small and large rivers, can also be found in larger waterbodies like lakes. Basking turtles can be seen on rocks, tree trunks.

In Mansar- Surinsar lake the turtle is mostly observed on the fallen tree trunks along the lake banks which are fairly sunlit.

Habits: This turtle is mostly non aggressive. Primarily herbivorous in their diet, but also found to be carnivorous at times. Mainly feeds on algae, aquatic plants, grass, macrophytes etc.

Mating takes place during rainy months. Eggs are laid in March, October and November; some population are seen to lay eggs around December (for the northern Indian sub-species *P. tentoria flaviventer*). They lay 6-10 eggs in single clutch.

Distribution: The known distribution of *flaviventer* was from the states of Bihar, Uttar Pradesh, Uttarakhand, West Bengal. Previously, it was documented from the places along northern, upper, and central drainages of River Ganga in central to eastern India, Mahanadi to the Krishna River systems of Peninsular India, extending eastward in Bangladesh, Nepal, and Pakistan (Iverson 1992; Baruah et al., 2016). Thus, it confirms the first distributional record of this species from Jammu & Kashmir (Mansar Surinsar lake) and probably documents the northernmost distributional limit of this species in India (Banerjee & Das, 2020). According to our field observations this is one of the rarely encountered turtles in these two lakes.



Picture 2.8: *Pangshura tentoria* (Indian tent turtle)

3. *Pangshura smithii* (Gray, 1863) [Plates 4. B]

Common name: Brown roofed turtle

Identifying Characters: Carapace oval and depressed; brownish olive, with a dark brown vertebral stripe; plastron yellow without dark markings (*P. smithii* subspecies *pallidipes*), some black smudges are present around the marginal. Head with reddish brown blotch.

Habitat: The brown roofed turtle is found in both fast flowing and slow moving or still backwaters. They prefer habitats with water bodies choked with grass and weed.

Habits: This is an exceedingly shy species and withdraws its head inside the shell even with slightest of disturbance. They are known for communal basking along the water banks. They are mostly herbivorous and feed chiefly on grass or grass like plants like *Typha, Potamogeton* etc. They are also known to feed on freshwater prawns.

The nesting season in Jammu and other north India is between late August and mid-November. The clutch size in this region is 3-11.

Distribution: The subspecies *pallidipes* is known from states of Bihar, U.P., Punjab, Jammu. It is also found in Lake Mansar and Surinsar, but the sighting is not so common compared to *P. tecta*.



Picture 2.9: *Pangshura smithii* (Brown roofed turtle)

PRESENCE OF INVASIVE TURTLE SPECIES AT MANSAR LAKE

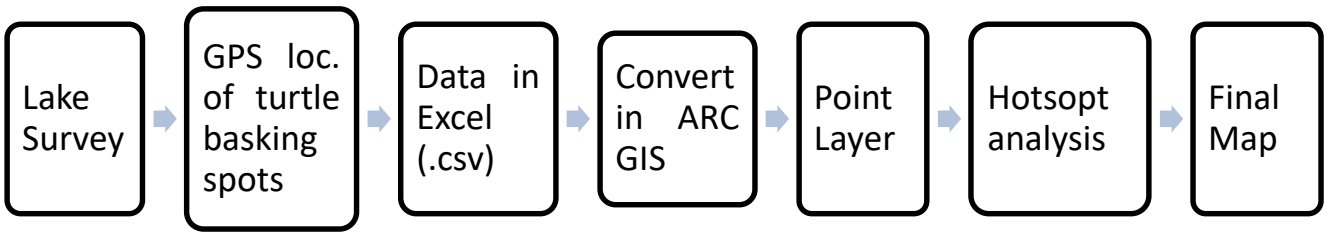
The present survey has documented a single male individual of *Trachemys scripta elegans* (see pic.2.10) commonly known as red eared slider which is an invasive species for Indian subcontinent. ***Trachemys scripta* is a native freshwater turtle species of America and *T. scripta elegans* (a subspecies) is also found in Mexico.** Red eared slider is a "hardy species" that got introduced in many countries outside its range such as -Australia, Malaysia, Europe, China, Korea, Philippines, Sri Lanka, India mainly via Pet/aquarium trade. In India the species was already reported from natural habitats in Gujarat, Goa and West Bengal (Munjpara, 2014; Jadhav et al. 2018; Choudhury et al. 2018). *T. scripta* is known to use limited food resources in more efficient ways for their growth and thus negatively impact the growth of native species (Pearson et al. 2015). Thus *T. scripta* and ***T. scripta elegans*** **has been recognised as one of the top hundred invasive species of the world** (Lowe et al. 2000). Accidental release of this species in the natural ecosystem may be detrimental for the poorly known native turtle species.



Picture 2.10: A *Trachemys scripta elegans (*red eared slider) in Mansar lake Jammu

Turtle basking sites

While conducting this study we have documented each basking location (closest location possible) where a turtle has been basking. These locations will help us to decipher that what are the hotspot areas for basking and stratify among temporary and permanent basking spots, which can later be implemented during conservation action plan. With the collected field data two separate map has been prepared for each of these two lakes by the following methodology.



Our preliminary study findings suggest that turtles prefer areas with greater proportion of sunlight (Fig 2.14) and peak basking hour ranges mostly from 10 am till 2:00 pm (Fig 2.15) preferably on a sunny day, after which the number of basking turtles get reduced towards afternoon.

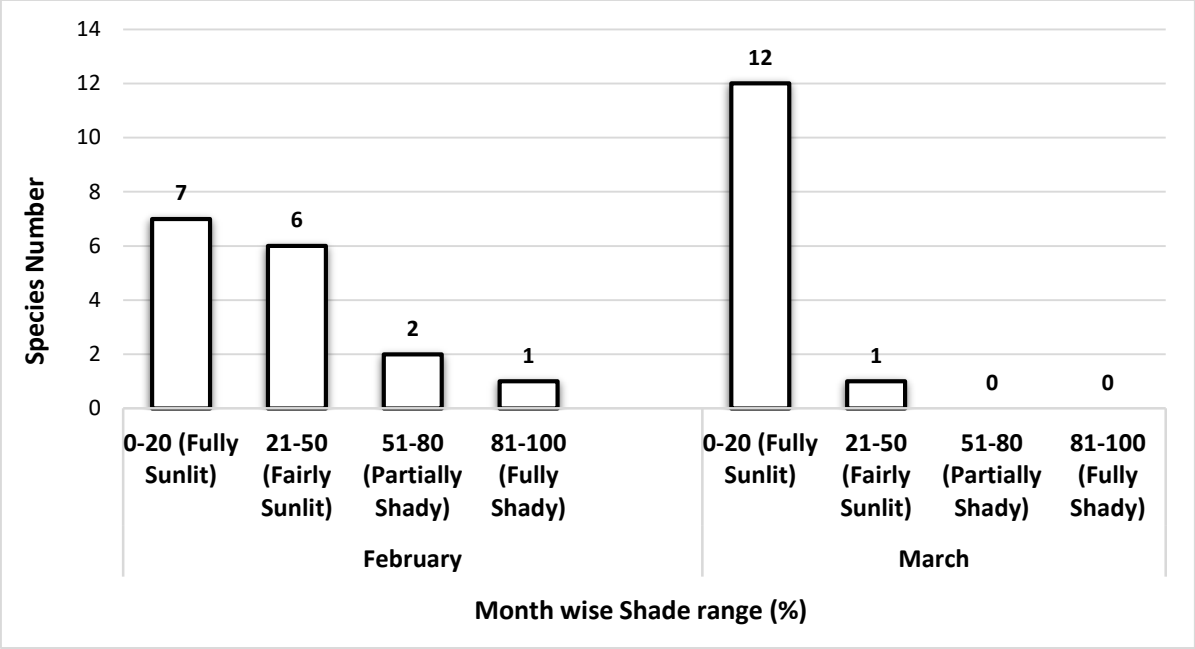


Fig 2.15: Number of basking turtles with relation to Shade (%) during February and March'2020

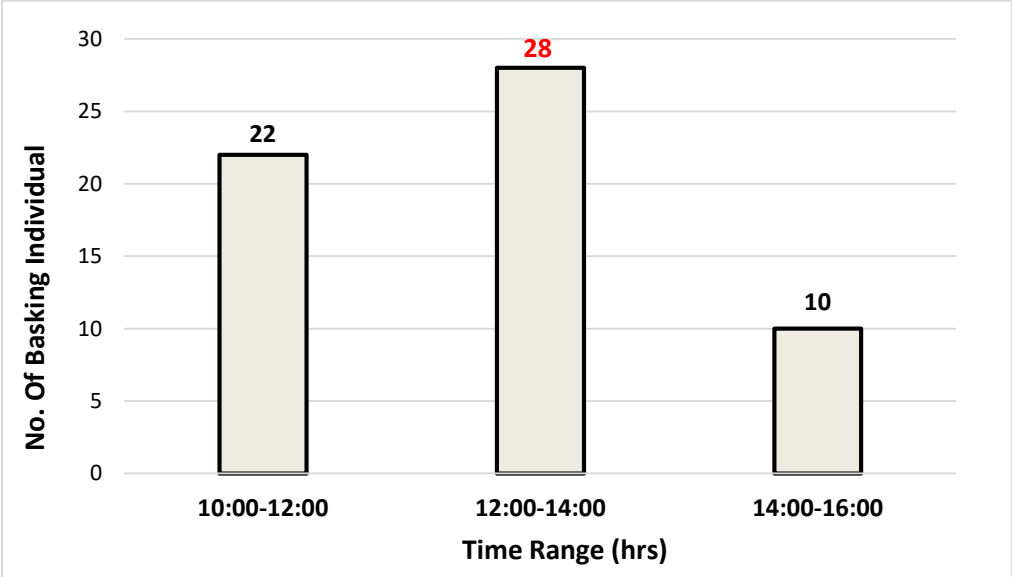


Fig 2.16: Number of basking turtles during different hours of day (January- March'2020)

Visual Encounter Survey of total 7-8 weeks also showed that *Nilssonia gangetica* (Gangetic softshell turtle) and *Pangshura tecta* (Indian Roofed turtle) are the most frequently encountered species among all other turtle species found in these two lakes (Fig.2.16).

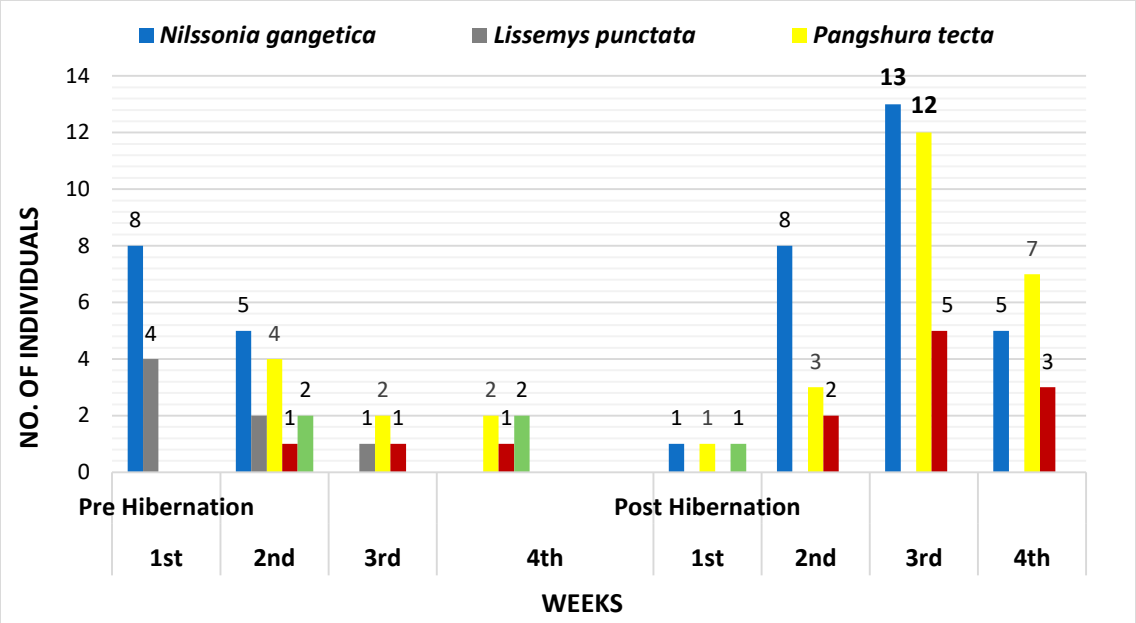
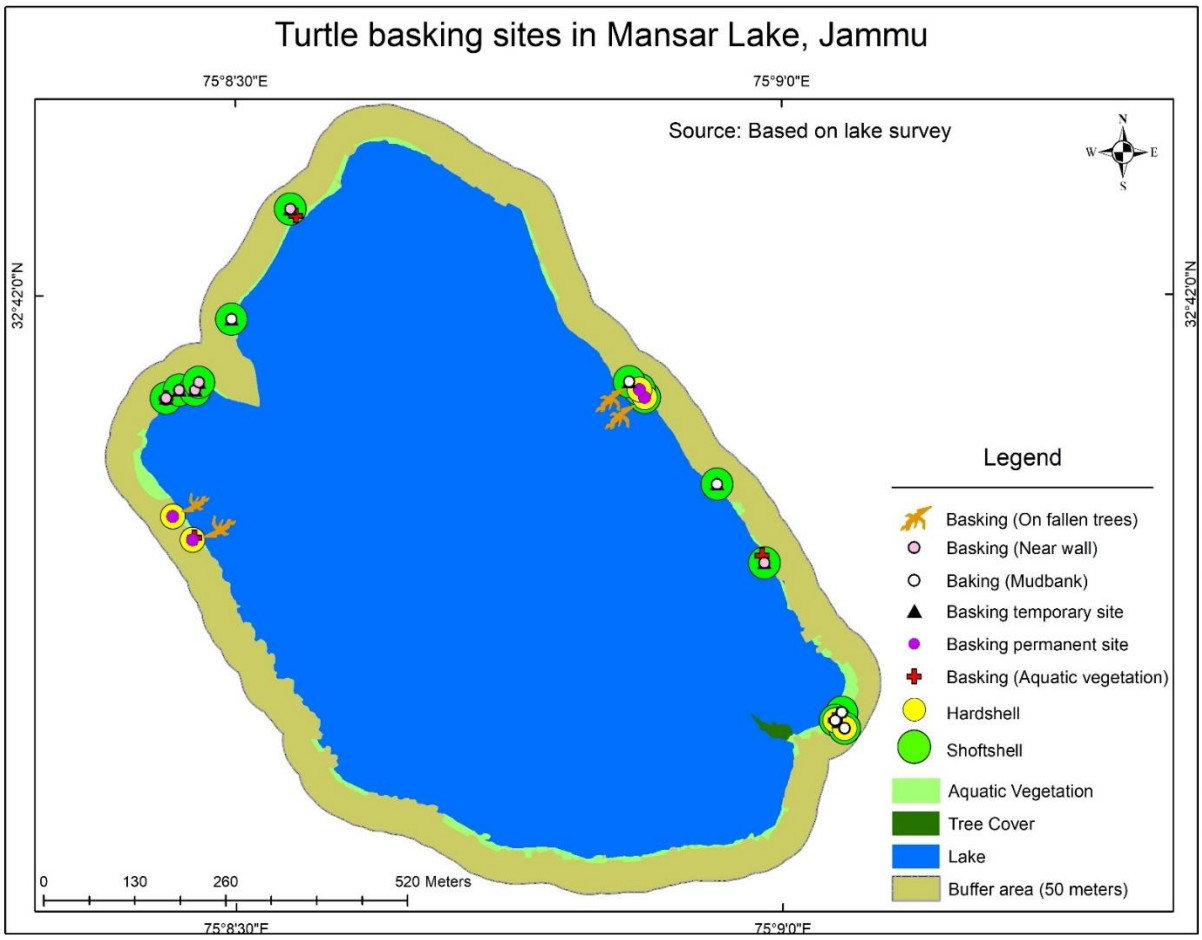


Fig 2.17: Encounter rates of turtle during pre and post hibernation during study period.

Mansar lake

The map 7 indicates the amount of suitable habitat still intact for the turtles to bask. Very few locations spaced out at different directions show such availability of hotspots. As marked under legends the map shows 'big green' and 'small yellow' circles as pointers for softshell and hardshell turtle species respectively (Map 9). There are few permanent locations (marked as violet dot) along the north west bank (two fallen tree logs in front of hanuman mandir) and one location at eastern bank (near BDO office). The maximum individual count that we have recorded during a single survey amongst all the VES (n=20) in Mansar lake was 19 individuals (adult) of *Nilssonia gangetica*, nine individuals of *Lissemys punctata.*

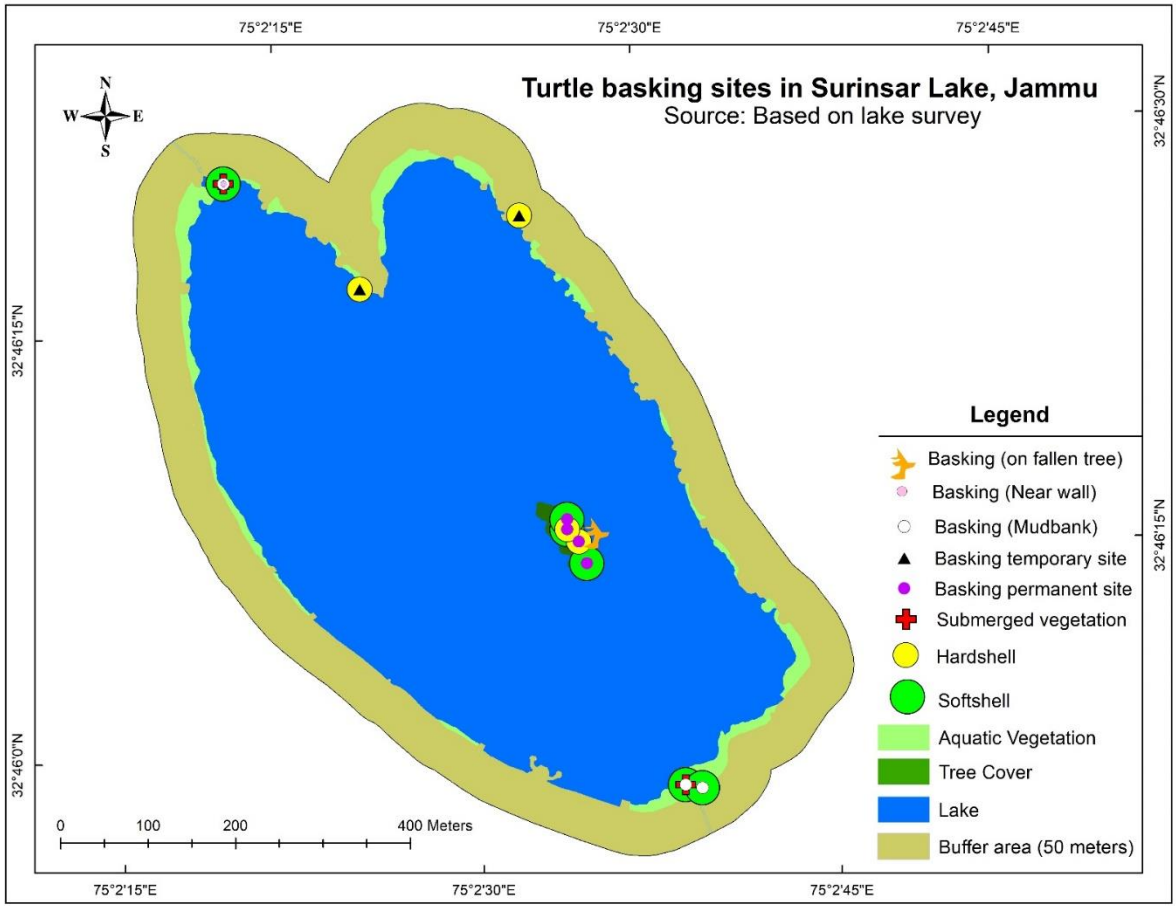
Among all the temporary locations, only few of them have been seen to hold good numbers of basking turtles (mostly softshell species) as marked in map near the north west bank (old turtle breeding ground region) and one location along the south east bank (private property & dumping site) when the disturbance was low and environmental conditions were suitable. Common habitat factors that were noticed in most of these preferred basking sites were presence of aquatic vegetation (marked in 'red plus' sign) and shallow water level (vide water depth map).



Map 9: Basking locations of softshell and hardshell turtles in lake Mansar

Surinsar lake

In Surinsar the most prominent and permanent refuge for turtles to bask freely is at the middle island. There are rocky substrates above lake water and several floating uprooted trees that serve as basking area for both softshell and hardshell turtles. Apart from the island all other basking locations are temporary sites (Vide Map 10). There is a stretch of fallen trees north side of the lake where few hardshell species were seen basking few times. West to north west there are shallow area at the lake edge where on two occasions softshell turtle is seen to bask. In Surinsar lake, out of 15 VES conducted, the maximum count of basking individuals for single survey (VES) has recorded 11 individuals of *Nilssonia gangetica* and four individuals of *Lissemys punctata*



Map 10: Basking locations of softshell and hardshell turtles in lake Surinsar

2.8.2.4 Important Odonates

List of dragonflies and damselflies that were documented during our survey period is provided in Appendix 6 [Plate 6.]

Special Note: The present survey did not document any presence of the **freshwater medusa (*Mansariella lacustris*)** in any of these two lakes. Freshwater medusae are very sensitive to water quality and with any kind of minor depletion to that might cause their extinction from the particular aquatic system.

2.8.2.5 Habitat quality, quantity and key areas around the lake

Land Use Land Cover (LULC) mapping around lake

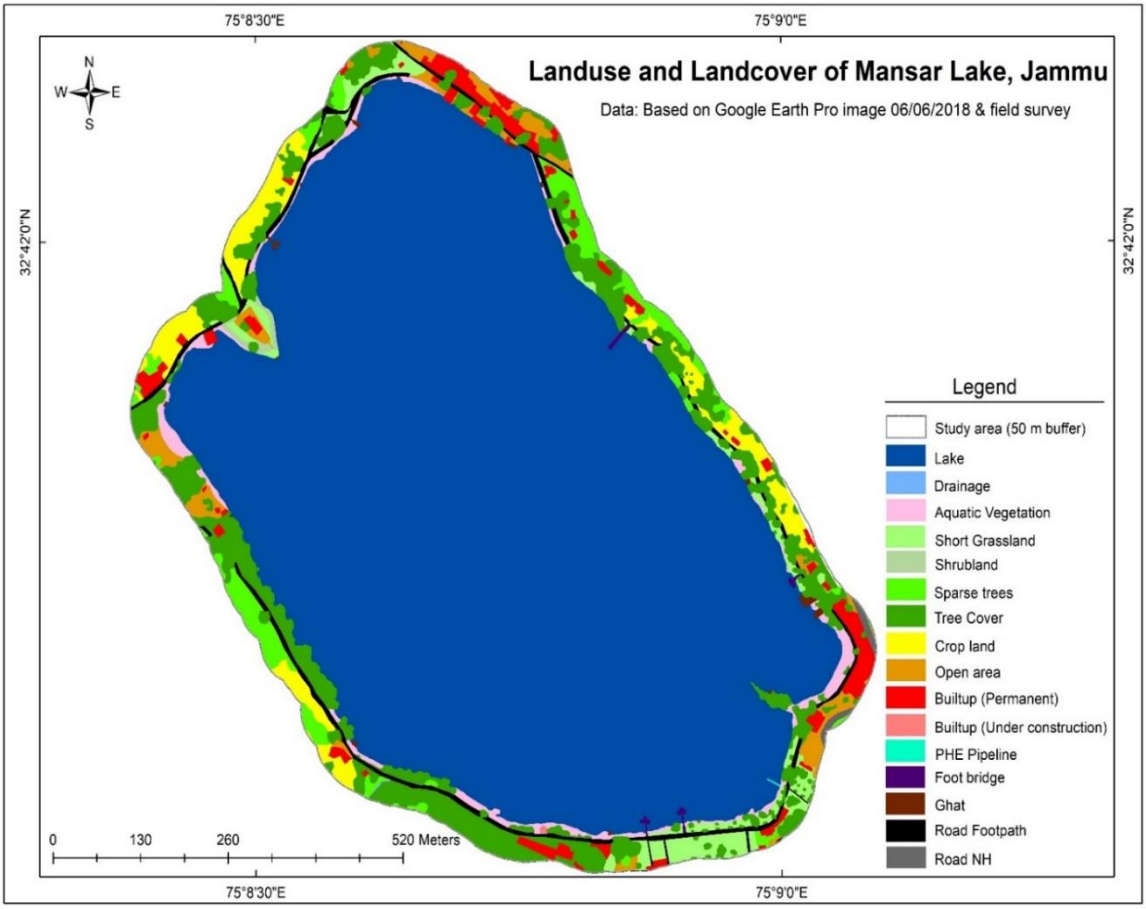
A detail habitat mapping of Mansar- Surinsar lake with its surrounding areas of 50 m buffer has been considered. All the relevant classes in and around Mansar lake (32◦ 46′11.25″N; 75◦ 08′38.5″E) and Surinsar (32◦46′11″N; 75◦02′31″ E) had been surveyed extensively and latitude and longitude values with associated attributes or information were collected using hand held Garmin GPS 64s with an accuracy of 2 to 3 meters. Thus maps of Land-use land cover (LULC), Infrastructure around lakes were prepared (vide Map 3, 4 & 11, 12).

For the analysis of LULC of the study area, Google earth pro image of very high resolution of 6th June 2018 has been used. Pre-processing of satellite image such as Geo-reference based on Ground reference points (GCPs), Sub-setting, re-projection to UTM zone no. 43 N has been done using ERDAS Imagine software. Based on ground observations and surveys, GPS points and on screen digitization of different land use and land cover classes with associated attributes has been done using Arc GIS software with a scale of 1:1000. All the GPS points of different LULC classes in and around lake with 50 m buffer have been converted into polygon for attribute generation. Following which the area calculation and map preparation was done in ARC GIS software.

For reference, a representation of the classification scheme of Mansar-Surinsar lake LULC along with the map statistics is also provided (Table 2.5).

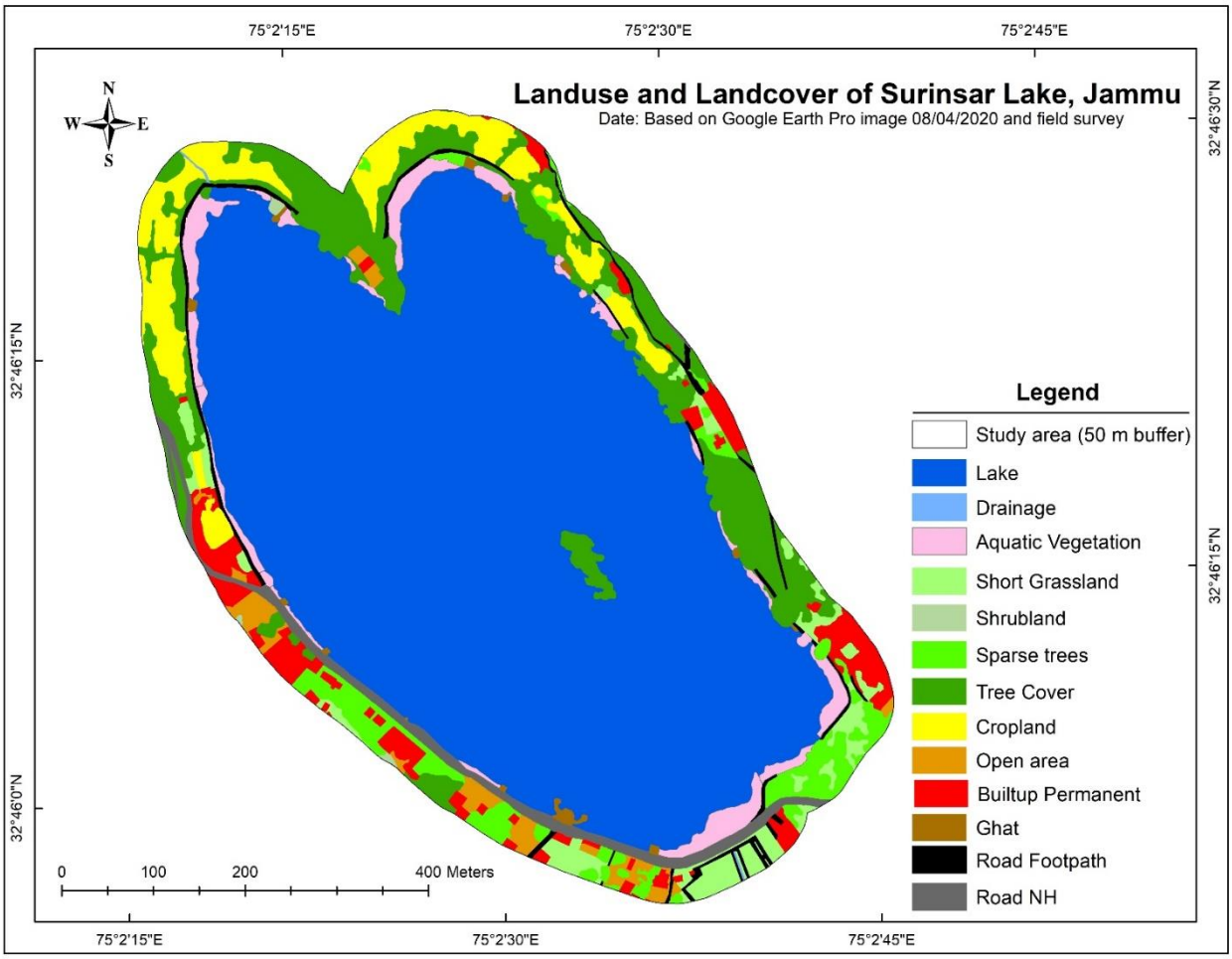
The total area of Mansar lake that was taken into consideration is of 75.8 hectares, of which ‘Lake area spread’ encompasses 58.71 hectares (77.45 %) and the rest were land buffers. Land areas surrounding the lake are dominated by tree covers of total 6.56 hectares (8.65 %) followed by

croplands covering area of 1.98 hectares (2. 62 %)& built up areas of 1.6 hectares (2.05 %) [vide Map 11].



Map 11: Land-use Land-cover (LULC) around Mansar lake

Whereas, in Surinsar the 'Lake area spread' is 30.6 hectares (66.7%) and among the rest the tree cover was around 4.57 hectares (10%) followed by cropland of 2.26 hectares (5%). Built up area in Surinsar lake is of 1.64 hectares where open area was just 0.6 hectares (Map 12).



Map 12: Land-use Land-cover (LULC) around Surinsar lake

Table 2.5: Area under various land use categories in Mansar wetland ecosystem

Sl.no	Land-use and Land-cover Classes	Mansar lake		Surinsar lake	
		Area in hectares	**Area in Percentage**	**Area in hectares**	**Area in Percentage**
1	Lake	58.711	77.45	30.06	66.73
2	Drainage	0.006	0.01	0.02	0.05
3	Aquatic Vegetation	1.106	1.46	1.41	3.14
4	Short Grassland	1.384	1.83	1.21	2.68
5	Shrubland	0.120	0.16	0.04	0.09
6	Sparse trees	1.806	2.38	1.56	3.46
7	Tree Cover	6.559	8.65	4.57	10.14
8	Crop land	1.988	2.62	2.26	5.02
9	Open area	1.175	1.55	0.63	1.39
10	Built-up (Permanent)	1.556	2.05	1.64	3.64
11	Built-up (Under construction)	0.010	0.01	–	–
12	PHE Pipeline	0.005	0.01	–	–
13	Foot bridge	0.066	0.09	–	–
14	Ghat	0.089	0.12	0.14	0.31
15	Road Footpath	1.095	1.44	0.63	1.40
16	Road NH	0.126	0.17	0.88	1.96
	Total	75.802	100.00	45.04	100.00

The Surinsar Mansar lakes and its associated sanctuary area is small (98 sq.km) but with a very high habitat diversity and hence all the areas are considered important. Areas around both the lakes are considered to be equally important as they serve as key habitat (especially aquatic vegetation, shallow land buffer) of many of the threatened taxa.

2.8.2.6 The limiting factors

Weed infestation

The surrounding area of both the lakes are infested with weed like *Lantana camara*, *Parthenium hysterophorous*, *Ageratum conyzoides*, *Argemone mexicana*. Water edges of both the lake are heavily infested with *Ipomea carnea* and other aquatic weed resulted in loss of native flora as well as shrinkage of lake. The spread of *Ipomea* and *Lantana* are more in Surinsar lake than Mansar (Pic. 2.11). Dense growth of these weeds prevents rainwater infiltration leading to elimination of mesophytes.



Picture 2.11: Heavy infestation of *Ipomea* and *Lantana* around the periphery of the lake

Siltation in catchment area

Siltation leads to disturbance in the geometry of lakes leading to its shallowing day by day. Due to agricultural practices and overgrazing near the catchment area of lakes had resulted in a large amount of deposition of silt into it. Most of the sediment deposition takes place during the monsoon season. It was also noticed that these banks later slid to the deeper section of the lakes which ultimately encouraged growth of both macrophytes and algae leading to shrinkage of Lake diameter. This phenomenon was observed to a large extent in case of Lake Surinsar. The silt comes in the lake through a huge drainage that connects to the park and beyond areas at the base of the surrounding mountains. Development of a children park has an outlet in the Surinsar Lake that causes heavy siltation. De-siltation procedure was conducted by the forest department to get rid of silt from the lake (vide pic. 2.12). The catchment area of both the lakes is composed of lower

Siwalik rocks, which are highly prone to erosion. As a result, the rate of siltation is increasing day by day leading to shrinking of its area.



Picture 2.12: Desiltation practice by forest department in Surinsar lake

Erosion

Due to increase in water level of the two wetlands there has been significant increase in the erosion of the banks. This has resulted in frequent uprooting of old trees along the shoreline and disappearance of native shoreline vegetation such as typha patches. (Pic 2.13)



Picture 2.13: An example of eroded concrete footpath in Surinsar lake

Concretization of lake banks and effects of nearby roads

Concrete footpath has been constructed all around the Surinsar and Mansar lake for public use. These developments impacted in ecological connectivity of the wetlands with surrounding landscape (Pic 2.14). The intervention has impacted the littoral zone of the lake and the subsurface water flow, depressing the water table and affecting the amount of groundwater available. This depression can affect many water dependent faunal and floral species. Moreover, these paths act as a potential barrier for the turtles to walk across and reach their nesting sites.



Picture 2.14: The concrete embankment act as physical barrier for faunal species movement

The road (Surinsar Mansar road) can play significant role in habitat fragmentation. Many species will not cross the open space created by a road due to the threat of predation and roads also cause increased animal mortality from traffic. This barrier effect can prevent species from migrating and recolonizing areas where the species has gone locally extinct as well as restricting access to seasonally available or widely scattered resources.

Uncontrolled discharge and dumping of several waste materials

Several activities (tourism, religious, local) around the lake add up huge amount of waste materials directly into the lake. The biggest contributor of the waste id all the inflow drains from the households and restaurants adjoining the lakes. These inlets (see inlet outlet map) bring all the

household affluent and discharges from agricultural fields (chemicals, fertilizers). Apart from all these, the biggest concern is plastic waste that go directly into the lake. During tourist season the amount of non-biodegradable garbage are heaped is beyond expectations. After a flush of rain all these plastics go directly into lakes causing serious biodiversity degradation. Due to lack of proper dumping facilities as well as strict administrative observation the plastic pollution is slowly creeping up both the lakes and leading to deterioration of water quality and shrinking of lake volume thereby affecting various water dependent vertebrate species.

Wastes from Deer park in the form of animal excreta and ashes from open cremation ground causes serious imbalance of water quality and biotic component of lake. It increases the enrichment of nutrients in lake which further results in acceleration of siltation and eutrophication process. It not only reduces the lake surface area but also negatively influences diversity of aquatic birds. Sharma (2002) also recorded that disposal of wastes poses a great threat to diving as well as dabbling ducks.

Threats on turtles in Mansar-Surinsar wetland

Two species of soft shelled turtles i.e. *Lissemys punctata* (Indian Flap shell turtle) and *Nilssonia gangeticus* (Gangetic softshell turtle) were found in Lake Surinsar and Mansar. Both these species of turtles play a vital role in cleansing the aquatic habitat. These are the threatened turtle species and have been included in the schedule I of the wildlife (Protection) Act 1972 and CITES (Convention on International Trade in Endangered species (Choudhary & Bhupathy, 1993). During breeding season, these species come out of water and lay their eggs on the banks in small pit dug in soil as well as in the surrounding fields. But these eggs get destroyed either by animals (stray dogs, cattle, mongoose and monitor lizard) or human interference which is due to construction of concrete footpath around these lakes. Turtle population are known to bask and lay eggs in areas that are shallow, close to water edge, with sandy loamy substrate, open and moderately sunlit, with ground vegetation cover and devoid of any kind of disturbances.

The middle island of Surinsar have been seen to be a safe refuge for turtles on that lake, but for laying eggs they had to travel to nearby agricultural fields through the tunnels or outlets. At times, they stuck outside, get dehydrated, eggs laid in the fields mostly do not survive due to predation or being trampled by grazing cattle or tractors.

Scenario in Mansar lake is even bad for the turtles, they face lots of disturbances due to tourist gatherings, in and around lake activities, cattle grazing near lake bank and steep embankment as a result, turtles find it difficult to walk across to reach their nesting sites. In Mansar, there is hardly any natural lake bank left which is devoid of disturbances or threat. The turtles in Mansar do come out of water to bask or to feed as a part of their natural instinct but often face interruptions. We observed basking turtles immediately dived into the water when they sense slightest of disturbances in the nearby areas. If the condition persists like this, it will be possible that these species of turtles may become extinct in the area under investigation. Also, the recent findings on the presence of an invasive species of turtles (see Pg. 45-46) is definitely a serious threat to the native population if not managed properly.

2.9 MAJOR FUNCTIONS AND VALUES

2.9.1 Direct use value

Under this method, wetland should be valued for all direct benefits of lake generated by market pricing. Based on the data collected from SMDA (Surinsar-Mansar development authority), JKTDC (Jammu Kashmir Tourism Development Corporation), Forest department and local people the approximate revenue generated per year for Mansar – Surinsar is as follows:

1. Revenue generated by the JKTDC lodging – 18.00 lacs (@ 1.5 lacs/month)

2. Revenue generated from recreational activities (Boating and cafeteria) – 12.00 lacs.

3. Revenue generated through the entry fee – 8.50 lacs.

4. Approximate revenue generated by the Road side vendors – 27.00 lacs (10.8 lacs/year/vendor * 25 vendors).

Total revenue generated: 65.50 lacs/year.

[N.B- These revenues are variable based on tourist influx and were very low than the approximate amount during covid-19 lockdown period.]

2.9.2 Indirect use value

The Surinsar- Mansar wetland provides significant ecosystem services in terms of groundwater recharge, erosion control, flood control and other recreational purposes. These two wetlands are the prime source of water for drinking, irrigation and household needs. These wetlands have socio

religious values and it attracts a huge number of tourists and devotees even from outside states. The place is also important in terms of ornithological recreation and attracts a large number of bird watchers at the same time. Though the potential of proper nature tourism has not been fully exploited or implemented, it could become a major source of livelihood for the local people.

Chapter 3

HISTORY OF MANAGEMENT AND PRESENT PRACTICES



3.1 GENERAL (SITE STATUS) PROTECTED AREA ETC.

Protected area

Surinsar Mansar wetland is protected under Jammu & Kashmir Wildlife Protection Act, 1978 (section 17) and declared as Wildlife Sanctuary by Govt. of Jammu & Kashmir through its notification dated 10th April, 1990. (vide Appendix 1).

Ramsar Site

Surinsar Mansar wetland covering area of total 350 ha. was designated as Ramsar Site (no. 1573) dated 8th November, 2005 by Ramsar Wetland Convention because of the following criterions:

Criterion 2:

The lake supports two important species of turtles namely Indian Flapshell Turtle (*Lissemys punctata*) registered in the CITES (Appendix II) and Indian Soft-shell Turtle (*Nilssonia gangeticus*) listed in CITES Appendix I and vulnerable in IUCN Redlist 2003.

Criterion 3:

The Mansar lake supports very rare medusa (*Mansariella lacustris*) besides a rich growth of Macrophytes in the shallow Littoral zone. The Lake has among the Phytoplankton, 86 algal genera of 207 species. The dominant family is Chlorophyceae with 46 genera with 135 species. There are about 54 Zooplankton taxa in the lake freshwater, unique and rare to the region.

Criterion 4:

The Mansar lake is an ideal and attractive habitat for migratory waterfowl, such as *Fulica atra, Gaillinula chloropus, Podiceps nigricollis, Aythya fuligula, Aythya ferina and Podiceps cristatus, Anas querquedula, Anas strepera, Anas platyrhynchos, Anas clypeata* (Northern Shoveler), *Anus acuta, Anas penelope* etc. at a critical stage of their life cycle & also provides refuge during adverse conditions. Other common waterfowls found in the lake include Pond heron (*Ardeola grayii*), Yellow bittern (*Ixobrychus sinensis*), Large egret (*Ardea alba*), Little egret (*Egretta garzetta*), Teal (*Anas crecca*), *Tadorna ferruginea* and *Porphyrio porphyry*.

3.2 LEGAL STATUS AND LAND TENURE IN THE SURROUNDING AREAS

Legal status: The area of interest is a reserve forest and after its identification as potentially viable wildlife area it was notified as Wildlife Sanctuary, vide Govt. order no: FST/9/WL/60, dated 10-04- 1990. Presently the sanctuary area is under the administrative and technical control of Department of Wildlife Protection, J&K govt., which is trying to protect and propagate the life forms supported by the area with the help of scientific management practices.

Land tenure: (a) within the Ramsar site: Wildlife Department of J&K govt. The two lakes with some catchment area from the part of Surinsar- Mansar WLS are managed as per the principle of wetland conservation by Department of Wildlife Protection, J&K govt.

(b) In the surrounding area: Forest and waste lands are owned by the state government and other areas are privately owned. Many tourist huts, lodges, game center, cafeteria in Mansar are Managed by J & K Tourism Department (JKTDC) & Surinsar-Mansar Development Authority (SMDA). Part of the land is owned by Dharamarth Trust which looks after the shrines of the lake embankment. The Wildlife Department of Jammu & Kashmir government has constructed wild animal enclosures (Deer park, established in 1982-83), an inspection hut and an office for Wildlife range officer and a horticulture office is also under construction on the western bank of the Mansar lake. While in Surinsar, there is a single inspection hut made at the top of the mountain on the north-western part of lake.

3.3 LEASES

From our present study there has been no information regarding the area being leased out to any outsourced sectors.

3.4 DEPENDENCY ON WETLAND

Both the lakes are surrounded by many villages, which directly or indirectly depend on these water bodies and catchment area. About 17 such villages were mentioned (Management plan Report, 2005, Dept. of W.L.P., J& K) which are very close to these wetlands and adjacent wildlife sanctuary.

The lake is currently used for various purposes. The local people use the lake for irrigation of their agricultural fields, for bathing and bathing domestic animals. Sometimes buffaloes and cattle enter shallow part of the lake, mostly during summer months.

The Tourism Department uses the lake for promoting tourism by running motor boats, amusement park and has raised many structures (restaurants, lodges) along the banks. This has led to some income generation for the local people. There are a few temples around the lake and the offerings made in these temples also find their way into the lake.

The lake and the catchment form a part of Mansar – Surinsar wildlife sanctuary are managed as per the principles of wildlife conservation. Although, a substantial number of Bakharwal families along with their livestock depend on the sanctuary area for grazing and livelihood.

3.4.1 Water harvesting

There are various agricultural fields associated nearby both the wetlands. For irrigation purpose water are being pumped out using motor pumps from both the lakes. Drinking water supply for nearby villages come from these wetlands through respective 'Pumping House' installed at both the lakes. There was no such report of water harvesting from these wetlands for industrial purpose that has been reported.

3.4.2 Fishing

Fishing is completely prohibited in both the lakes owing to its socio religious importance. The local people protects the fish of the lake as their own 'God'. There were no incidences of illegal fishing attempt made in these wetlands.

3.4.3 Biomass cultivation

There are many agricultural setup flanking near Mansar Surinsar wetland. There are continuous patches of wheat, maize, rice etc. cultivation at the south western flank and some at the norther part of Mansar lake. Where as in Surinsar some patches of maize and wheat cultivation present at western- north western side of the lake. The major source of water for irrigation are drawn from the lakes specifically during non-monsoon season.

3.4.4 Biomass extraction

There is no report of direct biomass extraction from the lake during our study period. In earlier times aquatic vegetation were reported to be used as fodder for livestock by local residents. However, there are some reports of fuelwood and fodder collection near sanctuary area by Bakharwals and few local people living up or near mountains.

3.4.5 Water transport

These two wetlands are secluded from each other and with other places for any water connectivity to establish. There are no water transport present for Surinsar Mansar wetland.

3.4.6 Religious sentiment

The lakes have strong religious sentiment entangled with them and culturally very significant as they owe their origin to the Mahabharata period and an important and popular tourist destination in Jammu region. The lakes have many temples around it and a fair is held every year. Devotees from various places visit these lakes and temples to perform various religious ceremonies (mundan) and rites (cremation related rituals for near and dear ones).

3.5 STATUS OF PROTECTION

3.5.1 Encroachment & other forms of wetland reclamation

Only along the bank of Mansar there are few private land (at south eastern part, used as dumping ground as of during study period), agricultural field, few constructions (Cafeteria at western flank) that might lie partly inside wetland boundary and their status needs to be checked. However, there are rampant developments happening around these wetlands for tourism without any mitigation measure being taken at its initiation.

3.5.2 Poaching of water birds and other animals

There are no official as well as on site (during study period) records or instances of waterfowl or any kind of poaching that has happened at Surinsar Mansar wetland.

3.5.3 Sand mining, quarrying, and other activities

There were no signs or direct reports during our study period on sand mining, quarrying nearby Mansar Surinsar wetland area. However, outskirts from the Mansar lake (approx. 50-100 m. away) on nearby mountains there were some light quarrying, dirt collection and dumping were going on for making of new constructions for the police quarter stationed at Mansar.

3.5.4 Illegal biomass extraction

As stated earlier, some biomass collection takes place in the form of fuelwood and fodder collection from adjacent sanctuary, but as per forest departments view, it is on a small scale for subsistence.

3.5.5 Livestock grazing in the wetlands and in the surroundings

Domestic Livestock of the nearby village graze on the shallow regions and mud bank fringes of the lakes. This is more common in the summer months when the buffaloes like to wallow in water as well. Sometimes it has been noticed in Surinsar that the buffaloes reach almost half inside of the lake (Picture 1.7). Grazing is very common in Surinsar lake that Mansar, and some of the cattle sheds are situated just few meters away from the lake water.



Picture 3.1: Buffaloes wallowing in Surinsar lake water.

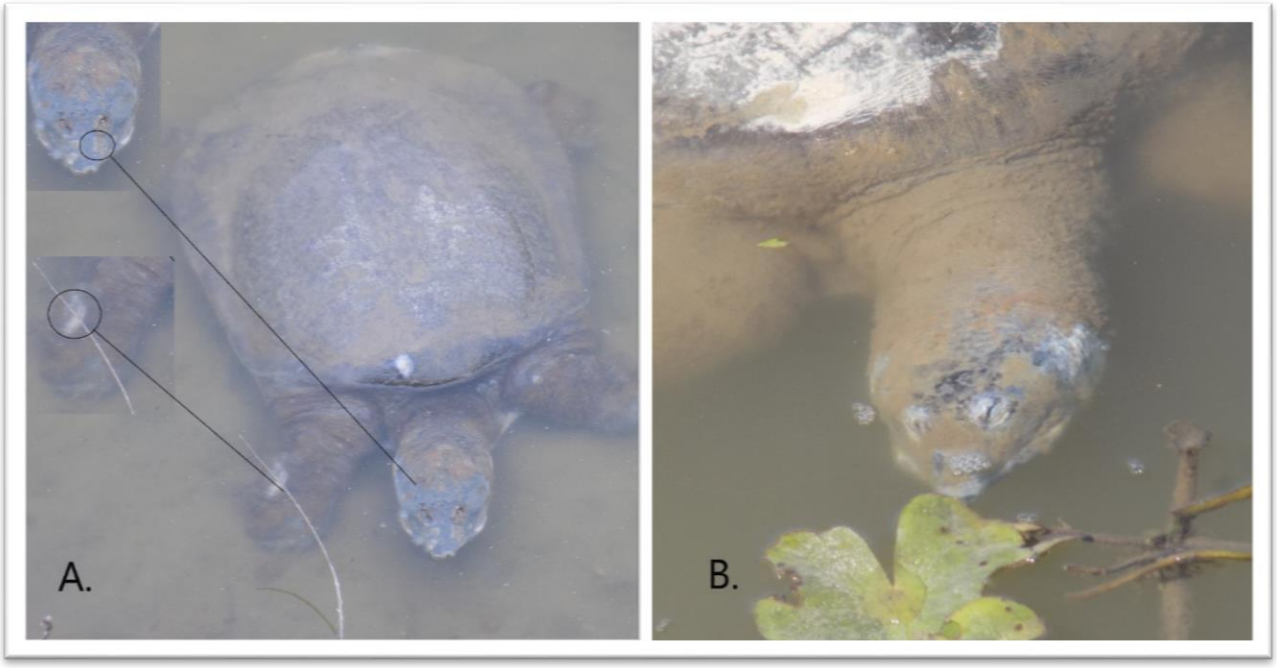
3.5.6 Sewage, effluent and solid waste disposal

In the absence of a proper sewerage disposal system, all the waste flows down into the lake. Drainages from nearby shops, restaurants, households all directly feed the lake without any filtration. Agricultural runoffs also bring effluents that are directly mixed into the lake. The lake is also being used by the people for their bathing and cleaning of their animals. There also is a cremation ground on the bank of the lake the waste from which also flows down into the lake. Wastes in the form of animal excreta from Deer park and other cattle sheds also cause imbalance of water quality and biotic component of lake causing eutrophication. Solid waste for e.g. largely plastics (cups, plates, wrappers, glasses), some leather materials also enter lake after each influx

of tourists (Picture: 1.9). These pollutants bring changes chemical as well as physical properties of lake water. A detailed account of water quality has been given in section **2.7.6**.

3.5.7 Wildlife Health

Due to increase of anthropogenic stress and various other pollution the degradation of health of few taxa have been observed during our survey. There have been few observations on diseased turtle with lesions and scars on their carapace. We have also seen deceased turtle floating on the Surinsar lake (Picture 1.8). This could be an effect of degraded water quality of both the lakes and increased plastic pollution.



Picture 3.2: A. Diseased turtle with skin lesion (inset); **B.** Dead turtle in lake Surinsar.

The common carp population is observed with several scale and fin related diseases. There has been an incidence mass mortality where thousands of carps have died in Mansar lake (vide picture 1.2). This mass mortality happens every year in both the lakes as confirmed by both forest department and local people. One reason could be their ever increasing population along with severe rate of eutrophication followed by depletion of oxygen level in lake waters. Even the animals such as spotted deer, Nilgai inside the animal enclosure do not look properly healthy and might have been affected by few infections.

There are signs of broken egg shells of turtles in the open unprotected zone nearby lake bank, which could have been trampled by unrestricted cattle grazing or might get predated by stray dogs and cats. Presence of stray dogs can be a threat to the breeding population of birds, turtles as they are capable of chasing and killing their young ones even within the shallow zones of lake.

3.5.8 Interagency programs and problems

The priorities of daily needs, source of income from tourism and nature conservation sometimes come in conflict. There has been a conflict between water pumping house and forest department regarding lowering of water level, which is mostly prominent in Mansar. However, both the concerned departments (PHE and forest) now seem to be settling their conflicting issues with benefits of the both. The tourism department has several cafeteria and amusement center which plays loud music during several functions which might create a noise pollution and affect the fauna around the lakes. Even several Mandir plays loud prayers and chanting through mikes during multiple hours of the day directed straight towards lakes. As this is directly related to religious sentiments, should be handled strategically for the wellbeing of both people's belief and nature.

Another use of the lake is that of plying of paddled boats. Initially the boating was only practiced in Mansar lake. Last year, with few boats boating has been newly introduced in lake Surinsar also. Over the years through official and unofficial setups with the forest and tourism development only a portion of the lake Mansar have been permitted (40% of total lake area; pers. com. FD officials) for boating activity. But as the current scenario stands the tourists ply the boat at every possible extent of the lakes and indirectly create severe disturbance to migratory fowls that come in the lake. There are at least 25-30 boats that are in ply in Mansar lake with carrying capacity of 4 in each and during peak tourist season (March- June and October- January) they are all over in whole lake. In Surinsar lake there are fewer boats introduced for time being with restricted movements of 30% of the total lake (pers. com F.D., J&K) and prohibited strictly around the central island. But as far the tourist excitement goes, several times it has been seen that they approach and try to go as close as they can reach the island. The island appears to be a safe abode to various birds (night herons, egrets, cormorants), bats as well as turtles. Clear regulation in this regards are the need of the hour which may permit such activities and specific prescriptions are being recommended in Chapter 10 (Section 10.3.2) only to the extent that they cause minimal disturbance to the wetland ecosystem and its biodiversity values particularly diverse avifauna.

3.5.9 Human activities in the surrounding areas

Several houses, cattle sheds, shops are located just at the immediate vicinity of the lake. Disposals of excreta and waste may source some diseases to the surviving wildlife as well as the people nearby. Some of the buffer areas that are important for the survival of wetland and its species are not monitored or protected. As the observations go, during any festive seasons these open banks are used for various recreational activities (picnics etc.) even by large gatherings at times. This may pose immediate threat of the fauna for e.g. basking turtles, foraging water birds etc. These activities should be monitored and checked for the sustainability of both wildlife and tourism.

3.6 TOURISM

Tourism is in developing stage and highly encouraged in this area. This place has got both socio religious and ecological importance which draws a large number of tourists from different places even from outside states. The lakes have religious importance owing its origin since Mahabharata period and dotted with many shrines along the periphery. Throughout the year these two lakes get huge influx of tourists and devotees during religious ceremonies. For recreation purpose and bird watching attract many nature lovers and various educational institutions.

For the welfare and amusement of the tourists, the Tourism Department in collaboration with the Jammu and Kashmir Tourism Development Corporation has constructed buildings around both the lakes and has involved boating facility in Mansar Lake some 10 years back. Recently they have also introduced boats in Surinsar lakes also. Paddle boating in these two lakes have become one of the prime attraction and must do activity to the visitors.

There is a huge park situated at Surinsar lake which is undergoing renovation to implant various amusement settings. Once built and starts in full swing Surinsar lake can also draw large number of tourists as Mansar does. In Mansar lake, there are few tourist lodges where tourists can halt at their will. The forest department has established a ‘Deer Park’ in Mansar which also attracts a large number of tourists. Developmental authority has their own indoor game point which creates amusement amongst children.

There are two temples in Mansar in the name of the most worshiped and obeyed deity of the lake ‘Seshnag Temple’. Every year during pre-monsoon and monsoon month fair is held, where people

gathers in huge numbers to perform their rites and offer their devotion to the god. These time (April- May-June) of the year the tourism faces a boom surrounding these two lakes.

These are several restaurants and canteens that have sprouted up surrounding the lake with provides required refreshments to the tourists visiting the place. The number and quality of restaurants is far better in Mansar than Surinsar. Where Mansar has almost developed as a tourist spot in past 5-6 years, Surinsar has a long mile to go.

But 'Tourism' also brings along lots of waste products (Vide picture 1.9). The amount of leftovers and plastics disposed by tourists in these two wetlands, specifically in Mansar is unimaginable. Both these lakes are suffering the ill effects of this uncontrolled garbage issues that have arisen and piled up due to lack of strict measures from the concerned department and also sheer lack of awareness and goodwill from the tourists.



Picture 3.3: Glimpses of pollution due to unsustainable tourism.

3.6.1 Scope

Due to the close proximity of this place with Jammu city and close to a highway (NH 44) and interconnectedness among these two wetlands make them a potential tourism place. On weekend many visitors come especially to the wetland for picnicking and recreation. These wetlands are also visited by regularly by school and college students, trainees particularly those who studies in Jammu region. At present the interpretation facilities are negligible at Surinsar- Mansar, because of which the volume of nature based educational tourism is nowhere close to what the area could potentially have.

Surinsar Mansar can become an ideal place for conservation education programs particularly targeting the school children. These two wetlands are well popular among the local bird watchers but can become a must visit site for birdwatchers from the entire northern India if the lake habitats are managed properly to bring back the migratory bird population. A nature or trail walk can be made through the mountains nearby for trekking purpose with local guides (local people with sound knowledge of surrounding nature). Perhaps all this can go on with low levels of pure recreational activities such as paddle boating in small part of the wetland and remaining habitat should be left undisturbed.

3.6.2 Visitor statistics

The data regarding visitor statistics (monthly) for the year 2018-2020 in Surinsar Mansar wetland is given as follows. The data has been mostly collected from the parking booth at Mansar where a parking slip is given to the visitors coming. Apart from that they also do approximation of the influx of tourists on daily, monthly and annual basis. It is clearly visible from the graph that the tourist counts dropped drastically during March- September ‘2020 strict lockdown period.

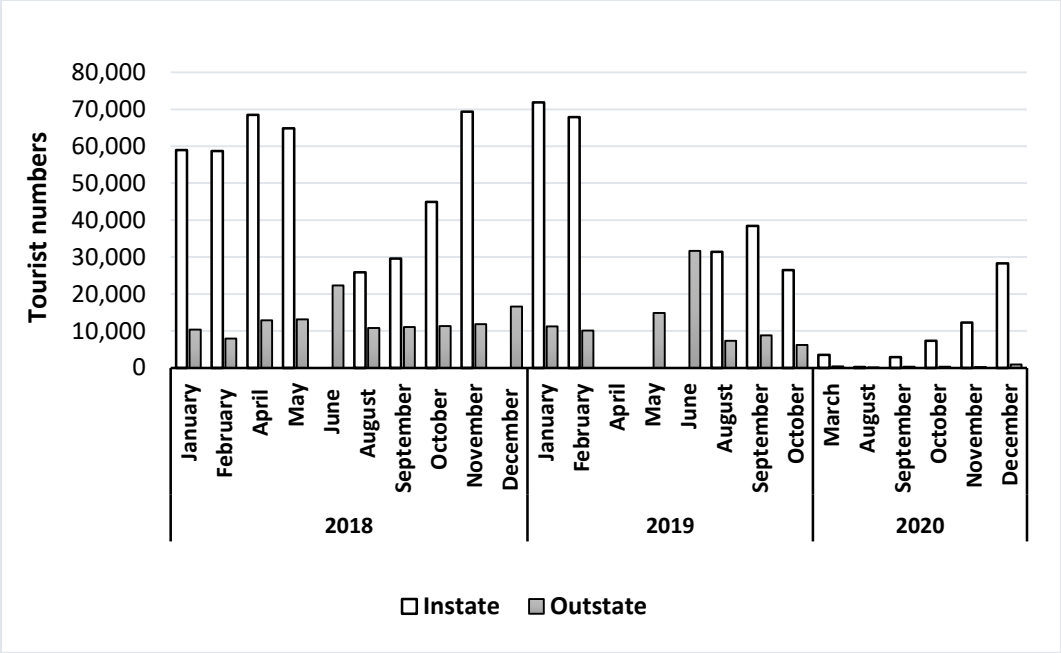


Fig 3.1: Visitor Statistics (2018-2020) in Mansar-Surinsar.

3.6.3 Interpretation Program

The interpretation program presently is restricted to signages depicting important fauna (turtles, birds) of the wetland and some directional, administrative signages from the Forest department as well as SMDA. Many of these have been put up very recently and do not have proper information about the lakes as well as old data have not been updated in those hoardings, which should be available to tourists. The place lacks a proper interpretation center at main arrival points at different part of the city, viz. in Railway stations, Airports, highway roads. Even there are any communication center available at both these lakes where people can get informed about the importance and specialty of these lakes. There is a building of developmental authority which might be used as building interpretation center but that's only been used as official purpose.

3.6.4 Facilities

In terms of lodging and stay there is very minimum facility available for the visitors. There are two hotels from JKTDC in Mansar that have boarding facilities and all other guest house are private specifically booked for people from contacts of Forest Department or SMDA and not open to any visitors. In Surinsar, the scenario is even bad as there is only one guest house that too remains in a very dejected condition.

There are no camping facilities in and around sanctuary. The restaurants that are present in Mansar have a very time bound (9:00 a.m. – 7:30 p.m.) working hours. However, the car parking facility is available and in Mansar it is pretty well managed by the authorities in concern.

3.7 RESEARCH, MONITORING AND TRAINING

Mansar Surinsar wetland could have been an ideal nature spot for conducting research, monitoring and training activities for nature enthusiast, local people, forest guards and researcher around.

3.7.1 Research and monitoring

The research activities that have been carried out in Mansar Surinsar wetland are sporadic and scattered. The most number of studies that has been carried out by researchers, scholars and scientists mostly from University of Jammu, National Institute of Hydrology at various times by Sahi, 1979 on the Herpetofauna of the region; Verma et al. 1999 on 'Observation on the nesting of Gangetic soft shelled turtle in Mansar lake'; Rai et al. 1998, on Bathymetric study of Mansar lake; Rai et. al., 2007 on 'Sedimentation rate and pattern of Himalayan foothill lake' & 'Hydrochemical Characteristics of Mansar Lake, Jammu and Kashmir in India'; Slathia & Dutta, 2009 on 'Limnology of Surinsar lake'; Kotwal, 2012 on 'Studies on Vertebrate Diversity of Surinsar-Mansar WildLife Sanctuary'; Kotwal & Sahi, 2013 published a case study on 'The influence of anthropogenic activities on vertebrate diversity of Surinsar-Mansar wildlife sanctuary'; Sharma & Dua, 2017 published a case study on 'Strategies for wetland Conservation of Surinsar Mansar wetland'; Assadullah & Deepika, 2018 on 'Water quality changes and winter mortality of major carps in Mansar lake'. However, there has been a serious lack of compact biodiversity assessment of these lake and a proper management plan. Mansar Surinsar management action plan report was made long time ago in the year 2004-2005 by then CWLW Mr. Tahir Shawl. Since then there has been hardly any wholesome information on the monitoring of species in these twin lakes. In recent times, Department of Wildlife Protection carries out few scientific research in collaboration with the Department of Environment and Remote Sensing of Jammu University.

3.7.2 Training

There has been no training facility that is available for the forest guards for this region. The Surinsar Mansar wetland and sanctuary falls under Kathua forest division and it seemed from the

statement of the forest staffs there has been no proper training on regular intervals (apart from initial trainings through seminars) that is being provided to them. There is also serious lack of refresher course or hands on training for the newcomers to the department to make them equipped with rescue, rehabilitation operation and conflict management.

3.8 WILDLIFE CONSERVATION STRATEGIES AND THEIR EVALUATION

Legally the lake and surrounding areas form a part of Mansar – Surinsar Wildlife sanctuary and the management of the area is carried out according to different management plan that had been earlier proposed by the forest department. There they have mentioned that protection of the wetlands include water shed management, weed removal, desiltation, fencing etc. Although the department tries to implement most of them, they are yet to put forward proper scientific approach in management of aquatic fauna & flora and siltation to the lake. Recently the forest department have made artificial basking and nesting sites for turtles in few selected areas by fencing them and making gradual slope of land using sand, mud, gravel and stone. They have recently installed CCTV cameras at selected places near the deer park. But comprehensive conservation planning and materialization lacks considerably in many parts.

3.9 ADMINISTRATIVE SET UP

The main objective of the administrative set up is to facilitate required manpower (administrative staffs) to manage the sanctuary with all its efficacy. Financial organizational setup ensures financial sustainability for the sanctuary. The control and management of the department lies in the hand of Chief Wildlife Warden (CWLW), Department of Wildlife Protection, Jammu & Kashmir govt. The lakes being part of the sanctuary are controlled under the administration of CWLW through Wildlife Warden and D.F.O, East Kathua division. A Range Officer (R. O.) with one Forester in each block (here whole Surinsar- Mansar) are appointed along with several field staffs to look after the area. The present sanctioned staff strength of Wildlife Division, Kathua is given in Appendix no 7.

3.10 COMMUNICATION

There are two well connected road networks that communicate these two lakes. Mansar lake can be assessed from Jammu through Jammu-Surinsar road (Jammu-Surinsar=33km; Jammu-Mansar = 48km) and also by Samba Mansar Udhampur road (Samba-Mansar=25km; Samba-

Surinsar=40km). The Samba Mansar Udhampur road directly connects to the NH44 highway. There has been frequent bus services to Mansar lake from Jammu, Kathua, Samba, Udhampur and the buses connecting Jammu- Surinsar- Mansar ply at every 2 hours of interval. After disengaging of Article 370 in August' 2019 there were complete loss of internet connection for at least 6 months in Jammu unlit it got slowly started with limited access (2G) around February '2020. Now the internet services and other communication system has been revived to normalcy. There is only a single Cyber café from where one can access internet services. The nearest postal service of Indian Post where postal service is active is about 22 Km away in Samba.

3.11 SUMMARY OF THREATS TO WETLAND AND WILDLIFE

These are discussed in detail in the previous chapter in the section 2.8.2.5

Chapter 4

THE WETLAND AREA AND THE INTERFACE LAND USE SITUATION



4.1 THE EXISTING SITUATION IN THE ZONE OF INFLUENCE (ZI)

Mansar Surinsar wetland is mainly fed by ground water and rain water and a small portion by agricultural and surface runoffs. The catchment characteristic of these two wetlands has been discussed in section 2.5. The catchment area has been situated all around Mansar Surinsar and its adjoining villages. Since past 5-6 years many changes have happened in terms of infrastructures, increasing human settlements and agricultural land extension in the catchment area itself (vide map 11, 12).

4.1.1 Villages in and around the wetland

As identified and mentioned by the forest department in their previous report there are around 17 villages nearby the wetlands and Sanctuary area. The villages are situated at the confluence of Samba, Udhampur district and lies on either side of Sidhra- Mansar- Surinsar road. The list of the villages is given in Appendix no. 8.

4.1.2 Ethnic identities, traditions, customs, relationships between distinct groups

The peoples from the wetland areas are settlers since past three generations almost. The Bakarwals are nomads who make temporary settlements on mountains outside sanctuary areas. There are also few families called as ‘Gujjar’. A significant proportion of the villagers belong to below poverty line (BPL) group and agriculture is their major profession. The primary dialect of this region is ‘Dogri’ a combination of Hindi, Punjabi mixed with local variations. There are both Hindus and Muslims living in this area with a slight majority in Hindu population. They share friendly relationships among each other.

4.1.3 Relationship with wetland

The dependence of local people on the biological resources of Mansar- Surinsar wetland is discussed in detail in section 3.4.

4.1.4 The state of people's economy

Barring few families from the temple’s priests and businessman most of the people from the surrounding villages are generally poor or comes under Below Poverty Line (BPL). They are mostly dependent on agriculture to meet their source of earning. They are always on a look out for alternative employment to support and boost their incomes.

4.1.5 Vocations, land use, use of wetland and wetland products

Most of the people in the villages in the vicinity of Surinsar Mansar practice alternate intercropping or marginal agriculture. Most of them have land holdings in surrounding areas. They also have shops of various types, small restaurants nearby wetlands. Some of them work as temporary laborers in nearby construction related works. Gujjar and Bakharwal communities have herds of cattle, goats and ships and they sell milk and milk associated products in the market. Many of these nomads visits nearby sanctuary areas to collect firewood and also to graze their livestock. There are few farms and cattle sheds in the villages.

4.1.6 Implications of the land use and resource dependency

The resource dependency has been discussed in section 3.4.

4.1.7 Wetland management practices and their implications for people

The direct dependence of the people on the wetland is mainly on water for drinking, irrigation purposes and sometimes with occasional grazing and wallowing by buffaloes in Summer. To maintain the water supply of the people sustainable direct implications of wetland management practices like water shed management, desiltation and catch water drains, proper outlet drains, bioremediation methods, effluent treatment plant, polluters pay principle etc. should be implemented. Although there has been a proposal of such action plans been mentioned in the previous report by Surinsar Mansar forest dept. but most of them has not been properly introduced to the people living nearby.

4.2 THE DEVELOPMENT PROGRAMMES AND CONSERVATION ISSUES

The list of development programmes/ proposals that was put forward by forest department in Mansar Surinsar wetland for five years (2005-2010) management plan report is given in Appendix 9.

4.2.1 A summary of problems faced by people that affect the management of the PA & the ZI.

The people in the vicinity of Surinsar Mansar are in general not so wealthy and are always on look for new avenues to augment their income generation. They are greatly dependent on these two wetlands as a possible source of employment and income generation mainly from tourism. Most of the people living at the edge or partially inside the sanctuary are yet to receive final land

resettlement notification. There is serious problem regarding the sewage treatment facility and sewage dumping sites, all the sewers directly flood into lake which contaminates the water which is also the people's primary drinking source. The catchment of these two lakes are not properly managed which might be the reason of major siltation problem in lake. But as the situation stands the majority of the catchment area are already preoccupied by settlements and construction. Definitely it won't be easy to manage such issues for the department. The people of the area even have slightest of agitation regarding the lack of co-operation between different administrative sectors and forest department with local people. A proper management plan cannot be successfully carried out without full co-operation of inhabitants of the place. The people of lake Mansar and Surinsar understands the problems that are caused by the exotic carp. Majority of them agreed to the proposal of periodical removal of fish from the lake but still there are (or will be) conflict of interest among the group of local people and with peoples from the temple authority. This is one of the major issue that needs to be dealt delicately and efficiently by forest department for the management of these two wetlands. The dependency of local people on the biological resources of the sanctuary is low (apart from fodder and fuelwoods), it does exist. It is a challenge for the sanctuary management to wean out these pressures without antagonizing the local people

Chapter 5

PROBLEMS AND ISSUES



5.1 PROBLEMS RELATED TO PHYSICAL PROPERTIES

Unplanned development in and around the wetland has tailing impacts on local ecology and biodiversity, like decline of water bodies, vegetation, increase in pollution levels (land, water and air). There is a need to adopt holistic approaches in regional planning considering the physical components such as hydrophytes at the fringes of the lake which are majorly missing, shallow areas i.e. land and water buffers are mostly occupied with concrete structures (specifically the embankment) etc. The lotus, water hyacinth, Typha grass like floating and submerged vegetation are primordial habitats for several migratory water birds, which have been cleared out by the exotic carps. Even all the submerged vegetation is outplaced by invasion of lantana and Ipomea patches. These problems destroy the physical serenity of any wetlands and misbalance its ecological stability. Under this scenario, studies concerning carrying capacity of biological diversity and infrastructure should be carried out before implementing any major projects in and around the Surinsar and Mansar wetland.

5.1.1 Tenure issues – Ownership issues

Surinsar Mansar sanctuary does not have a very clear tenure. Although the sanctuary including these two wetlands are not that large area, there are a number of agencies which control or use the land resources of the wetland. These include the Forest Department, Surinsar Mansar Development Authority (SMDA), Jammu & Kashmir Tourism Development Co. (JKTDC), Dharmrath Trust, some lands are claimed by gram panchayat, surrounding village people also have some private lands at the periphery of these two lakes. Private land owners practicing subsistence agriculture on the land near to the lake. There are some portion of land in Mansar that belongs to some local people and has conflict in land use with the forest department.

5.1.2 Encroachment for development activities

The present study personnel did not find and/or receive any information regarding recent encroachment for developmental activities. All the infrastructures were already existing during our study period.

5.1.3 Water quality assessment (Pollution & Eutrophication)

Both Surinsar-Mansar lake is famous religious tourist destination with tourist coming throughout the year for performing various religious rituals. Pilgrimages arrive to perform ritual bathing

ceremonies in the lake each year. Some religious sects come here to perform the ritual first haircut of their sons. Agriculture-over use of fertilizer and poisonous pesticides reaches lake as runoff from fields [Effects of dumping waste and untreated sewage is discussed in details under section 2.8.2.5].

Two times water sampling analysis (see section 2.7.6 for results) reveal that during the pre-lockdown period (January'2020) that the value of the parameters are not in the preferable limits such as the value of DO decreases to a larger extend due to increases in the parameters of the Electrical Conductivity, TDS, Turbidity, Salinity, Chlorophyll. All this results in the deterioration of water quality of the Wetland, which in turn may affected the mass mortality of exotic carps in Mansar lake that reached its peak during the months of December'2019 till January' 2020. The main reasons behind this could be increase in the anthropogenic activities such as untreated discharge of various organic (domestic waste, livestock excreta) as well as inorganic wastes from the agricultural fields, drains from shops and household areas, increase in tourist activities and subsequent pollution to water, conversion of buffer area to residential and commercial area, fish feeding activities, residues of construction activities, increasing level of other pollutants especially plastic associated materials. Whereas after the imposition of Covid'19 lockdown restrictions, results of physicochemical water quality parameters reveal that the value of the parameters such as DO and BOD remained within the permissible limits (June' 2020). The values of other parameters such as Alkalinity, TDS, Electrical conductivity, salinity, turbidity were also reduced as compared to the concentrations prior lockdown. However, important parameters such as chlorophyll content, DO & BOD showed alarming level not meeting the permissible limits set by CPCB, specifically in Mansar lake which needs proper management interventions through sewage treatment (see water quality assessment, pg.- 26 & sewage discharge norm: pg. 108)

5.1.4 Siltation in the catchments

The problems associated with siltation is discussed in detail in section 2.8.2.5.

5.1.5 Water abstraction and demand

There are two pumping house situated just at the bank of these two lakes which pumps out water from the lakes and supply to nearby villages through installed pipeline connections. The amount of water abstracted by this two pumping stations and the extra release of water is given in following table.

Table 5.1: PHE station water extraction data from Surinsar Mansar Wetland

	Lake Mansar	**Lake Surinsar**
Total Outflow(per day)	90,000- 135,000 Gallons	60,000 Gallons
Inflow (into lakes; if any)	10,000-15,000 Gallons * (during water treatment reservoir pipeline cleanup)	Approx. 40,000 Gallons (Rainy season excess water)*

* data collected upon interviewing pump station officials & workers.

Apart from these two pumping stations people around the periphery of these lakes often setup temporary motor pumps and directly drain out water for their household needs. Even during winter irrigation time people set up pumps in their field to flood the crop land. While for every construction works around the lake, required water is being extracted in the similar methods.

5.1.6 Water shortage

There was no information about water shortage in nearby wetland vicinity during our study period.

5.2 HABITAT MODIFICATION AND DEGRADATION

The development activities along both Mansar and Surinsar lake have encroached the buffer space along the water body. In case of Mansar lake the situation in south eastern part of the lake near Mansar bazaar is such that some of the constructions have come up to the level of water (Vide map 3,4). In short, in Surinsar-Mansar wetland increasing demand of grey infrastructure had started overshadowing the natural infrastructure. Due to unavailability of the land buffer lake area is getting enclosed and degrading as habitat. Soil erosion in the remaining fringes have started because of lack of proper tree cover and stability of the bank. The remaining buffers have invasive organic growth that are (lantana, Ipomea etc.) encroaching up to the lake. The detailed discussion on declining biodiversity values and the limiting factors of wetlands are given in section 2.8.2.5.

5.3 DEPENDENCY OF LOCAL COMMUNITIES

The dependency of the local communities on the lake is discussed under section 3.4.

PART II

PROPOSED MANAGEMENT

Chapter 6

VISION, OBJECTIVES AND PROBLEMS



6.1 VISION

*This Management Plan envisages to propose wetland management prescriptions for **ten years** (2022/23- 2033/34) for the two wetlands under present study. A midterm evaluation after **five years** of management interventions is proposed to be carried out by the respective department.*

The vision of the plan is "To make the ecologically and culturally significant 'Surinsar-Mansar Wildlife Sanctuary' as an important heritage site of Jammu and Kashmir with healthy ecosystem that transforms the Jammu into an outstanding ecotourism and nature education destination".

MISSION

"*To conserve, economically develop and sustainably manage the Surinsar-Mansar Wildlife Sanctuary in partnership with local communities and other stakeholders for the benefit of the people of Jammu and Kashmir*."

GOALS

A. To protect and restore the health and resilience of wetlands ecosystems, and its associated biodiversity of the Wildlife Sanctuary

B. To safeguard the endangered fauna and flora and their habitats in the Sanctuary

C. To ensure ecologically sustainable use of Sanctuary and benefits the current and future generations of Jammu and Kashmir.

6.2 OBJECTIVES OF MANAGEMENT

- To strengthen the protection and monitoring of biodiversity wealth of Sanctuary in partnership with other stakeholders of the region.
- To promote the integrated and sustainable management of the Sanctuary in partnership with stakeholders.
- To recover and restore the threatened fauna and flora especially the birds, turtles, etc.
- To recover the native species of the wetlands by removing or managing the invasive species including invasive alien fish species.

- To strengthen and self-sustain the Eco-Development Programs around the Sanctuary to improve the livelihoods of present and future generations of the region.
- To strengthen the research and monitoring of various habitats, fauna and flora of the wetlands.

To promote eco-friendly tourism that provides a rich experience for tourists, economic benefits to the local people and support to the Sanctuary.

6.2.1 Immediate objective

The immediate goal of the current action plan

- Conserve the last remaining exquisite biodiversity that these two lakes still have to maintain the ecological functions and biodiversity values in the sanctuary.

- Community empowerment in order to make the conservation measures more fruitful and compact as well as effective and mutually beneficial engagement of stakeholders.

- Promote eco-friendly tourism that provides a rich experience for tourists, economic benefits to the local people.

To achieve these action plans two stakeholder workshops were conducted as a part of the Management Planning exercise. *The first workshop was conducted on 5th of February, 2021* in Mansar and the second workshop was done in Surinsar on 6th of February, 2021 major stakeholders to understand the issues of the wetlands and capture the suggestions of the participants for the effective management of the area. Subsequently another goal was to set objectives and strategy formulation. Based on the outcomes of these workshops, subsequent meetings and logical framework analysis, the summary of targeted plans are as follows:

1. To protect and improve the wetland ecosystem reduction of water level to historic level (2-3m reduction of current level) to expose shallow areas near fringe which will act as buffer.

2. Periodical removal of exotic carp fishes to save the last remaining population of native fishes and lake integrity. Also removal of exotic fish will limit the destruction of remaining aquatic vegetation

3. Revival of aquatic (floating and submerged) vegetation by planting seeds (*Nelumbium* & *Nymphoides*) near the lake fringes; alongside sustainable removal of *Ipomea* vegetation; plantation of native trees to sustain and stabilize the rock erosion in the island at Surinsar.

4. Siltation treatment with special focus on catchment area stabilization.

5. Sewage and garbage management and treatment of sewer water; demarcation of disposal and dumping area.

6. Strengthen the ownership of local communities through sustainable resource use and alternative livelihoods.

7. To develop Mansar Surinsar as a site for recreation and nature education for visitors through participation of local communities.

8. Establishment of proper implementation and interpretation center to support nature tourism.

6.2.2 Long term objectives

Long term objectives will include periodical monitoring of wildlife and establishment of captive breeding facilities (w.r.t. turtle and waterfowl population) in both lakes. Maintaining the successfully implementation of the proposed strategies for the management of the wetland. Inclusion of local communities along with forest department staffs for expanding participatory conservation activities for these two wetlands.

6.3 PROBLEMS IN ACHIEVING GOALS

To achieve certain goals a number of challenges that are likely to confront the forest management and other stake holders. A brief account of various problems against each objective are documented as follows:

Goal 1: To protect and improve the wetland ecosystem reduction of water level to expose shallow areas near fringe which will act as buffer.

Problems: a. Unscientific management of the area.

b. Inadequate outlet discharge facility.

c. Resistance from water pump house dept. to not reduce lake water level.

d. Hesitation of a part of local residence to lower water level (as they are solely dependent on this lake water.

Goal 2: Periodical removal of Exotic carp fishes to save the last remaining population of native fishes and lake integrity.

Problems: a. Religious sentiment related to the fish as they worship the fish as god.

b. Resistance of temple priests in favor of removing fishes.

Goal 3: Revival of aquatic (floating and submerged) vegetation by planting seeds near the lake fringes; alongside sustainable removal of Ipomea vegetation; plantation in the island at Surinsar.

Problems: a. High water level and unavailability of lake buffer

b. Inadequate/ Limited staff capacity.

c. lack of scientific knowledge/exposure of the dept. to execute the proposal.

Goal 4: Siltation treatment with special focus on catchment area stabilization.

Problems: a. Porous nature of the surrounding mountain and habitat destruction.

b. Settlements and infrastructure occupying major catchment area.

c. Inadequate institutional capacity and lack of scientific execution.

Goal 5: Sewage and garbage management and treatment of sewer water; demarcation of disposal and dumping area.

Problems: a. Lack of municipal infrastructure and sewage disposal planning.

b. Inadequate awareness about sewage dumping among local community.

c. Improper management plans and lack of strict regulations.

Goal 6: Strengthen the ownership of local communities through sustainable resource use and alternative livelihoods.

Problems: a. Lack of socio-economic incentives to local communities.

b. Poor community engagement.

c. Loss of traditional connect with the nature.

Goal 7: To develop Mansar Surinsar as a site for recreation and nature education for visitors through participation of local communities.

Problems: a. Lack of long-term vision and plan.

b. Lack of supporting infrastructure and other resources.

c. Inadequacy in supportive programs.

Goal 8: Establishment of proper implementation and interpretation center to support nature tourism.

Problems: a. Lack of co-ordination between stakeholders and local communities.

b. Lack of awareness and integrated vision/plan.

c. Poor baseline information about the surrounding areas.

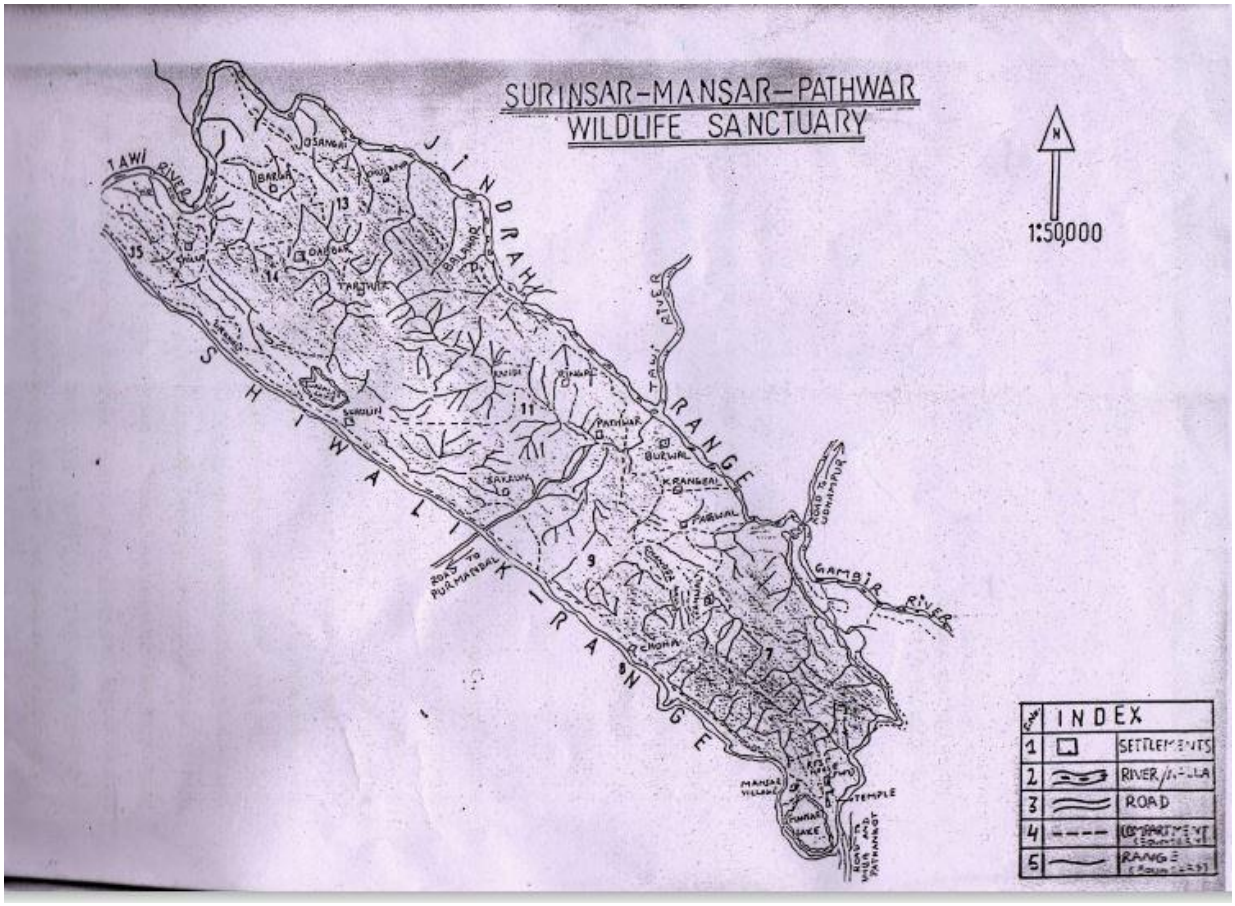
Chapter 7

THE STRATEGIES



7.1 WETLAND BOUNDARIES

The wetland boundaries are not well defined in the notification, even on the ground they are not that clear. The Surinsar and Mansar lakes are located in the two extremities of the Wildlife Sanctuary (North west and South East respectively) at the base of Siwalik range. River Tawi flows from North to North- West. The specification of the boundaries in notification is hand sketched in a map of sanctuary as follows.



Picture 7.1: Sanctuary boundary as given in notification SRO 138: 10th April, 1990

7.2 ZONATION

Surinsar Mansar wetland area and associated sanctuary is a very small area with undulating terrain consist of mountains in the surroundings and valley. The main management zones are two wetlands i.e. Mansar which is approximately 329 hectares and Surinsar is approximately 21 hectares. Under the warrant of this management plan, the area can be mainly divided in "**No tourist nature zone"** and "**Tourist zone"**. These can be further subdivided into

Recreational sub zone: Only a small area of both the lakes (20% of the lake area) for paddle boating facility in front of Boating Ghat. The movement of visitors interested in observing any aspect of nature will be restricted only to some portion of temples and picnic spot near main entry.

The deer parks, forest inspection hut, children's park can be utilized as recreational as well as conservation education interpretation centers.

Nature Watch sub zone: The nature watch area can be done in nearby mountains where watch towers and accessible tracks are there.

Interference free subzone: Remaining part of the wetlands should be considered 'No tourists zone' which will be basically the natural shallow areas with flat mud bank and tree cover, whatever is left nearby lake fringes.

7.3 ZONE PLANS

Certain general regulations would apply uniformly to the entire area of the wetland. They are mentioned as follows:

1. The entire wetland area would be declared as 'plastic free zone'. To implement this regulation necessary notification may be issued under the section 5 of Environmental (Protection) Act, 1986 from the appropriate authority. Proper signages may be put up at the designated places such as entry points, parking places, near main ghats, mandirs. Strict rules need to be applied to penalize the outlaw.

2. The wetland surroundings need to be declared as 'noise free zone' (no horn and loud music zone) and related signage may be installed at the right places.

3. The entire lake water would be 'No litter zone' and proper sanitary facilities and signage must be erected to inform people about the location.

4. The catchment area of Surinsar Mansar wetland should be proposed to declare as 'Eco-sensitive zone' owing to its high erosion prone nature with a regulation on external discharges (household, agricultural effluents etc.). Monitoring points may be needed to check the pollution level as well as siltation.

7.4 THEME PLANS

The following theme plans are proposed for Surinsar Mansar Wetland area:

1. Protection
2. Ecotourism and interpretation
3. Eco development.
4. Research, monitoring and training.

Among above theme plans only protection theme plan is discussed in brief and the remaining plans are discussed in rest of the chapters.

7.4.1 Protection

Mansar and Surinsar wetland with a limited area of 61 ha. and 30 ha. do not face serious protection issues due to their small extend and location. However, necessary and vigil steps need to be maintained so that any unforeseen threats can be tackled and the wetlands can be saved from any major threats in near future.

7.4.1.1 Protection issues

The protection issues that need to be handled in the Surinsar Mansar wetland are:

Boundary demarcation and maintenance: The boundary of the wetland area is not well demarcated. The old fencing and demarcation are mostly being damaged at several places and some of the places the wildlife area and private area does not match with the map feature. Fresh demarcation of boundaries in wildlife sanctuary specifically around these two wetlands are necessary to avoid any kind of encroachment, degradation or unwanted interventions by tourists in near future.

Patrolling operation: Tourist influx and followed by disturbances caused by their various activities are very prominent in these wetlands specifically in Mansar. There are several instances when these tourists try to catch the turtles by offering them food, when they surface near the edge. Boating activities are also seen to scare away water birds and in spite of restrictions the boats ply the whole lake due to lack of proper patrolling and regulations. Hence, patrolling and security need to be strengthened especially during the migratory season of birds as well as breeding season of turtles and certain other steps to improve the protection status need to be adopted. Apart from these wetland edges should be patrolled regularly to reduce threats of stray dogs, cats and intrusion of grazing cattle inside fenced area of lake edge where they might become a threat to wildlife.

Entry site regulation: At present entry tickets are only being priced at Mansar lake as a part of parking which is situated at the Eastern part near the main entry gate from the Samba- Mansar-

Surinsar road. There are no such entry booth or system in Surinsar. There is a need to review the present system and make changes to ensure that a reasonably priced ticket is made with proper bills for visitors of both lakes.

Traffic regulation: The Samba- Mansar Highway that connects Surinsar and further Jammu runs just few meters away from the lake periphery. At time there are high density of traffic with fast moving cars including heavy vehicles passing through the vicinity of lakes (Specially in Surinsar). There is also the problem of vehicles being parked on the main road for visiting the lakes, attending the shops or taking rest as there are no designated parking stand. The passing vehicles, buses blow loud horns during heavy traffic that is also under no regulation due to lack of administrative structure. Proper signage with traffic control instructions, speed breakers at constant intervals, restrictions of heavy vehicles during bird migration and turtle breeding season and diversion of vehicle to take other circular road in Surinsar lake must be implemented.

7.4.1.2 Proposed Suggestions

I. Boundary demarcation and maintenance: The following steps are suggested to be taken up regarding this issue.

a. Proper survey and demarcation of wetland boundaries. 'Boundary Demarcation Exercise' needs to be carried in the presence of Revenue as well as other concerned administrative sectors.

b. Construction of new boundary pillars/ fencing leaving the buffer land open based on the above survey.

Recommendations regarding fencing and protection-

1. Placement of **cattle guards** on the footpath should be installed at least 5m away from either side of underpass/ culverts and either side of shallow areas.

2. **Animal proof fencing** should be installed all along the area demarcated as turtle basking sites (Map 9& 10).

3. A concrete base of 50 cm is to be constructed on which the animal proof fencing should be installed.

4. The height is the fencing should be a minimum of 3-4 m.

5. The fencing should be fine and double meshed at the site of turtle passage prevent entry of smaller predators like cats, monitor lizard etc.

6. It is advisable to have fencing beyond the buffer land to protect lake integrity from outside interventions i.e. the fencing should separate the concrete embankment used by tourists from the remaining buffer land.

c. Maintenance of existing boundary pillars.

d. Demarcation of separate boundaries in the regions mentioned in map where turtles nest and bask.

e. Setting up "no sitting zone" for tourists in turtle breeding sites.

f. Deploying floating buoy/ fixing rope surrounding the mid island keeping a buffer of 20-25 meter at least from the island edge to restrict the movement of boat close to the island.

II. Patrolling operations: The suggestions are as follows

a. Providing wetland patrolling guards and beat guards with proper maps where clear demarcation of area is there.

b. Engaging more staffs in both the lakes for patrolling daily round the tourist presence and also close monitoring during turtle breeding season. Currently the strength of lake guards is not more than 1-2 in both the wetlands which surely need to be increased.

c. Construction of a patrolling hut near lake so it could be used for overnight stay during the turtle breeding season.

d. The Range Officer should also arrange periodical training programmes for the staffs to make them better equipped in handling situations like turtle eggs protection, hatchling recovery and release, turtle breeding area maintenance, periodical plantation of aquatic vegetation and its monitoring protocol etc.

e. There is a need of annual cleaning of weeds (Lantana, Ipomea) nearby lake fringes where they are invading and excluding the native species.

f. Stray dogs, cats can be potential threat to the wildlife (turtle eggs, hatchlings; bird chicks etc.), appropriate methods need to be employed to remove this threat.

III. Entry Site regulation: The suggestions for this will be as following

a. Setting up automated tickets vending **Kiosk** machine. There is a need to set up two kiosks at the other two designated parking zones so that nominally priced entry tickets can be provided to the visitors.

b. No tourist vehicles except of the local residents and forest dept. officials should be allowed entry nearby lake for parking which happens near the North West site of the lake.

IV. Traffic regulation: The steps that are required to be taken up to deal with this issue are-

a. Restriction of heavy vehicle traffic and taking diversion (when possible) through an alternate route. It is suggested that the Chief Wildlife Warden, Jammu division may also consider issuing an order as per section 33(b) of the Wildlife (Protection) Act, 1972 to restrict the movement of the heavy vehicles through or near the Surinsar Mansar Wetland vicinity.

b. To reduce the speeding vehicle proper signage along the road indicates the need to reduce the speed and also by constructing speed breakers at constant intervals along the road passing near the periphery of wetland.

c. Setting up more designated parking zone to avoid congestion of vehicle near the lake periphery (in case of Surinsar) or on the main road (In case of Mansar).

Chapter 8

HABITAT MANAGEMENT STRATEGIES



8.1 INTRODUCTION

Surinsar Mansar Wetland are geographically situated in a very unique natural set up nestled by mountains and forest of pine and other sub alpine montane vegetation. As discussed previously, both of these lake supports unique biological diversity. The approach of habitat management would therefore be taking steps to ensure that this habitat diversity is maintained so that the wetlands and its surrounding areas continue to support the remaining amazing biodiversity.

8.1.1 Major issues in habitat management

The major issues in habitat management in Surinsar Mansar wetland are discussed in details under section 2.8.2.5.

8.1.2 Proposed strategies

a. Management of weeds and other hydrophytes:

The problem of weed infestation is not so severe but still definitely needs action so that it does not become a serious problem. The weed removal works need to be done every year to achieve success in weed management. There would be two phases of this work. The first phase must be carried out before rainy season where a portion of *Ipomea* strands from the edge of the lake and all other terrestrial weeds like *Lantana, Parthenium, Cannabis* sp. etc. would be physically removed to stop its flourish during rainy months. The second phase should be done during October period before the arrival of migratory birds where the residual weeds will be removed. *Ipomea* plants should be removed in a controlled measure as they also serve as roosting and perching site for few of the birds for e.g. Pond heron, Bitterns, Coots, Cattle egrets etc.

c. Revival and maintenance of shallow banks:

Mansar and Surinsar lake presently lacks land buffer in most of its periphery. Owing to the higher water level (more in Mansar lake) and heavy density of *Ipomea* infestation (more in Surinsar) there are no proper available exposed littoral zone which are essential habitats for aquatic macrophytes and other associated biodiversity. To achieve this plan first water level of both lakes, have to get reduced. Reduction of water level of approx. 1.5-2 meter at initial phase will expose shallow aquatic edges of more than 5-10m which will be essential. However, for restoration of littoral zone further reduction of up to 3-5 m is suggested. Followed by reduction, planting of submerged vegetation, *Typha, Cyperus* etc. seeds need to be planted and their growth should be monitored in

regular intervals. Marginal weeds like *Phragmites* should not be planted as these weed variants are known to spread very quickly and it is very hard to control growth. A few native trees like *Ficus* spp. may be planted in order to give strong support of the buffer ground.

d. **Habitat management for birds:**

Different types migratory birds visit this Sanctuary during winter and several resident birds breed here. But, different birds required different kinds of habitats. Some birds are divers and require deep water for foraging, some are waders need shallow water, some forage hydrophytes, etc. Therefore, it is important to provide diverse habitats to accommodate diverse bird species. In this context, it is proposed to maintain the water level of the lake accordingly. For example, there is a need for lowering the lakes water level by suggested level to accommodate waders at the periphery of the lake. Existing mound (island) in the wetland needs management intervention to replace the dying trees with new tree plants (only native) so that these trees on the island can be used for roosting and nesting of birds. One of the important habitat for all waterfowls are the floating vegetation for e.g. Lotus, water hyacinth, water lilly etc. As stated earlier, both of these lake lacks the required amount of floating vegetation to sustain a good breeding and foraging ground for water birds. Although, there is a small proportion of such vegetation in Surinsar lake, there is almost nothing in Mansar lake (Pic. 8.1). Surinsar lake mid island trees are important roosting sights for several water birds and fruit eating bats. Hence, this mid island trees need to be protected from erosion and when necessary more native trees must be planted.



Picture 8.1: Remnants of floating vegetation in Surinsar lake



Picture 8.2: Mid island in Surinsar is a key roosting habitat for water birds and Bats

There are immediate requirements to plant such floating vegetation by consulting or getting the help from concerned authority/department. Meanwhile the forest depart is suggested to make or buy artificial floating planks with layer of mud and some plantations (grass, flowering plants, some semi aquatic plants), which might temporarily serve the purpose.



Picture 8.3: Fallen tree branches as important perching sites for water birds

Alongside that all the large trees around the periphery of these lakes should be protected and maintained properly as these trees are primary roosting sites for many birds such as cormorants, egrets, herons etc. (Pics 8.3 & 8.4).



Picture 8.4: Large trees near the lake periphery serve as potential roosting and perching places for water birds.

e. Invasive Fish Management:

Surinsar Mansar wetland supports several native species of fishes that use to be important food sources for visiting migratory birds as well as resident birds. Further, these fishes were also supporting the survival of turtles of the lake. However, after introduction of exotic carps *Cyprinus carpio* or commonly called Chinese carps, the populations of native fishes declined significantly that resulted in decline in the populations of visiting migratory birds and turtles in the Sanctuary. *These exotic fishes have significantly changed the habitat of wetland by overgrazing on the hydrophytes (including lotus)* that has resulted in declining of native fishes and caused problems to migratory birds and turtles. Hydrophytes of the wetlands are feeding and breeding habitats of native fishes and turtles. Further, people who visit the Lakes have started feeding these exotic carps as a religious practice that again enhanced the population of this exotic fish which is currently a

major threat to ecosystem of wetland. The basking turtles mostly avoid areas that are congregated by these fishes. In this context, Wildlife Institute of India has organized stakeholder's consultations with all stakeholders of the lakes. People were informed about the ill effect of exotic carps and importance of removing this fish from the Lakes. Most of the stakeholders and community members have agreed to remove the exotic fish from the lakes, although a few were concerned about their life and yearlong religious sentiments. Therefore, they suggested to relocate the captured fish to some other water bodies but within the Jammu UT.

In this context, this Management Plan suggest to remove all exotic fish on batch wise and phase wise manner and relocate the live fishes to aquaculture or man-made irrigation tanks in consultation with State Fisheries Department. Exotic carps removed from these lakes should not be released into another natural wetlands or rivers.

The protocol for removal and relocation of exotic carps have been given below-

Step 1. Consult State Fisheries Department for identification of relocation ponds/ irrigation tanks assign responsibility to the Fisheries Department for safe removal.

Step 2. Mobilize live fish transportation facilities with the help of State Fisheries Department and use drag netting for capturing live fish from the wetland.

Step 3. During every operation, remove at least 1000 live individuals and immediately transport to the identified relocation site with the help of Fisheries Department live fish transport facilities. It should be continued at least 10 times in month to reduce the exotic species abundance in the wetland.

Step 4. In order to avoid environmental stress (temperature) the entire operation should be carried out either in the early morning or in the late evening.

Step 5. Involve local community during the fish relocation process also involve Fisheries health inspectors and Veterinary doctors for monitoring health status of the captured and relocated animals.

Step 6. The same procedure should be repeated yearly once until the exotic fish population get reduced in the wetland.

f. Pollution Management:

Pollution is a problem that is being prevailed in the area especially sewage waters and agricultural wash. The households as well as business establishments at the close proximity are discharging their effluents on the lake side. Management of pollution in the wetland area can be done by following the guidelines laid down by MoEF & CC for the development of new industries/projects and for the existing industries, projects, treatment and dumping grounds in and around the area.

SOP regarding discharge norms in to the lake –

- Proper sewage and individual septic tanks should be installed at every house hold and shops at the periphery to prevent any discharge in to the lake.
- No household and shop can dispose of effluents into the lakes as it comes under Wildlife sanctuary
- For agricultural runoffs, forest department must install soak pits and divert all the runoff through a channelized drainage into those specified soak pits.
- Controlled discharge can be maintained by installing sediment catcher/collected at every opening of sewage pipe which reduces sediments and other pollutants to come directly in lake.
- Meshed nets or Sewage Treatment Plant must be installed at the openings of major inlets to prevent entry of plastics and other solid discharges into lakes.

The effluents from sewage should follow the Standards laid by the Central Pollution Control Board, Government of India for Common Effluent Treatment Plants as per, (Environment Protection Rules, 1986) which shows the maximum concentration of elements that are permissible in the effluents meant for release after treatment.

- Further, people around the wetland need to be educated and encouraged to avoid or minimize the use of inorganic farming and pesticide.
- Agriculture runoff is the most important source of pollution to the wetlands especially during winter and summer (See SOP for discharge norms). Therefore, organic farming needs to be promoted at surrounding areas.
- Waste materials from the nearby water pumping station should not be directly released into the lake water without doing proper treatment.
- As these two lakes falls under Wildlife sanctuary, so wallowing of buffalo needs to be strictly prohibited in both the lakes as it disturbs the ecological integrity.

- Further, the Forest Department should carry out soil conservation programs at the surrounding areas as part of 'Catchment Area Treatment' to prevent siltation of the lakes.

g. Protection/ re-enforcing wetland bank:

Owing to the unplanned development and encircling the lake with concrete walkway there is severe degradation of lake bank buffer zone. As a result, the remaining fringe of lands need protection and proper wetland bank revival structures need to be built in both the wetlands. To achieve its goal, certain parts of the wetland banks (where the land is still intact) might be kept free from all tourist or people activities to provide the breeding birds and turtles an undisturbed nesting habitat.



Picture 8.5: Last remaining natural land buffer in Surinsar and Mansar lake that can be modified as potential basking sites for turtles

In Mansar, the most appropriate area for it would be the stretch of land behind the deer park. The land from the spotted deer enclosure can be made open and modified for turtle's basking site, since that area already has the right slope, sunlight, mixture of sandy-loamy soil and gradual connection to water with slight submerged vegetation. Also, the area is nearby the forest range office, so it is expected that it would get necessary protection **[Vide Box below for specific comments on Deer enclosure].**

Suggested mitigation on Deer park enclosure

1. The deer park is holding a potential breeding and basking area for softshell turtle species. The area is characterised by gentle slopes with considerable sandy deposition which may be developed as a nesting site by making the slope conducive towards turtle climbing towards lake edge. The concrete ledges or any such barriers should be removed to make the area in continuum with the lake.

2. Further, permanent tourist resting places nearby that place (if any) may also be removed in order to reduce the disturbance of nesting turtles.

3. Signage declaring the area as 'No Disturbance Zone' may be erected.

Apart from this, there are few areas with mud banks near BDO office, stretch from masjid to forest quarter and another important stretch of land that is available is now the private dumping ground on the east side of the lake just after main boating ghat, nearby the game center. All of these land needs to be protected and prepared for land buffers with requirements like gradual slope till water, sandy loamy soil, presence of aquatic vegetation and grass (*Typha*) cover, free from any short of disturbance i.e. properly fenced (Pic 8.5).

While in Surinsar, artificial turtle basking site have been recently made, but the artificial site lacks enough sandy slope, steep, too much exposed to sunlight and adjacent to concrete road.

Thus, this site might not be preferred by turtles as it is highly disturbed. Whereas, available stretches of shallow areas can be modified properly by maintaining land buffer of 20-25 meters with at least 1-meter-deep sandy loamy substrate and proper protection to avert any disturbances. There is a land stretch on the west to north west side of the lake near the only outlet of the lake.

The outlet has been widened for the passage of turtle but the tunnel leads to a dead end i.e. fenced agricultural field. Also it is not channelized properly and guarded by iron grill so, turtles might not find their way comfortably through it. So, WII suggests it to remove this passage and instead

modify the existing outlet for the same (vide Chapter 9: Habitat management for turtles). There should be multiple underpasses for better connectivity with adjacent landscape.

There are stretches of land in front of the new under construction mandir (North to north east portion) with lots of fallen trees. These areas are shady areas where some overhead canopy could be cleared followed by maintaining proper ground/aquatic vegetation cover, muddy-sandy base and proposal of no interference within 15-meter radius of the area.



Picture 8.6: An uprooted tree near the lake bank.

Lastly, all the standing old tree bases need to be reinforced with muds to prevent their uprooting as they are the most important entity to hold the mud bank intact and refrains it from break away (Pic. 8.6). At the same time, all the fallen trees should be retrieved and maintained properly as they might serve good basking spots for the turtles (Pic. 8.7).



Picture 8.7: An example of fallen tree near the lake bank that serves as important basking platform of turtles

f. Plantation of native tree species: Due to past exploitation of several mountain forest patches, followed by recent deforestation most of the surrounding forest patches are in the way of degradation. Because of very fragile nature of Shiwalik ecosystem, interventions need to be very carefully planned and implemented. Therefore, it is proposed that some augmentation of degraded patches should be done with fast growing and native species like *Terminalia bellirica* (Beheda), *Terminalia chebula* (Harad), *Phyllanthus emblica* (Amla), *Sygzium cuminii* (Jamun), *Aegle marmelos* (Bael), local varieties of *Zizyphus* etc. These areas need to be continuously monitored to ensure that the exotic and invasive species do not encroach these areas. Some local trees could also be planted near the shallow ends of lake so as to provide nesting spaces for the water birds.

Prioritization of key management strategies of early restoration of wetland integrity

Top 10 priority points that are to be followed are summarised as below-

1. Water level reduction in both lakes following WII suggestions, more prominently in Mansar lake by making the outlets functional.

2. Immediate removal exotic carps following prescribed methodology and with the consultation and collaboration from state fishery department.

3. Monitoring of water quality periodically at least twice (Pre and Post monsoon/ Winter) in a year and also artificial aeration through machines during cold season.

4. Turtle basking and nesting area maintenance and protection through animal proof double meshed fencing and regular monitoring.

5. Construction of turtle ex situ hatchery, breeding and protection centre by following given norms.

6. Control of tourism activity beyond suggested restricted zones.

7. Restoration and maintenance of shallow areas, plantation of submerged aquatic vegetation (*Nelumbium* sp.; *Nymphoides* sp.).

8. Regulation and regular filtration of discharged water from various outsources into lakes by planting STP (Sewage Treatment Plan).

9. Immediate demarcation of no restriction zones near all basking sites, middle island in Surinsar and all the shallow edges following given map; deploying floating buoy wherever possible or strong ropes to restrict entry of tourist boats (mainly surrounding middle island).

10. Strict regulation on complete ban on feeding atta dough or any kind of food to fishes and turtles.

11. Installation of appropriate dustbins all around the lakes and complete ban of plastic materials around the lake.

Chapter 9

TURTLE AS KEYSTONE/ FLAGSHIP/PRIORITY SPECIES MANAGEMENT STRATEGIES



9.1 INTRODUCTION

The freshwater turtles inhabit a wide range of aquatic habitats, and due to their diverse life-history traits and role as transformers of biomass, they are often considered keystone species of the aquatic ecosystems (Moll et al., 2004). Scavenging freshwater turtles, particularly soft-shell turtles of the genus *Nilssonia* are known to be found in large flowing rivers, although they have also been documented from stranding lakes, temple ponds etc. These turtle of genus *Nilssonia* are widely known for their sacredness and are being worshiped in various shrines across the country. They are also strongly associated with the Temple Pond culture and religious beliefs which consider turtles the holy 'kurma' reincarnation of the Hindu God 'Vishnu'.

As mentioned earlier Mansar Surinsar wetland in Jammu also harbors significant population of Gangetic softshell turtles (*Nilssonia gangetica*) and a population of Indian flapshell turtle (*Lissemys punctata*). For these two lakes to survive and remain intact with its biodiversity the role of these two turtle species are very important and thus one could say that for these two wetlands they are 'keystone species'.

9.1.1 Population estimation of Ganges Softshell Turtle (*Nilssonia gangetica*) using Mark recapture study

Capturing, handling and marking large sized softshell turtles is invasive, labor intensive and long term process. However, unique natural body patterns of the animals may be utilized as to estimate population of any difficult to sample animal in a non-invasive photographic mark recapture technique (Patel and Das, 2020). *Nilssonia gangetica* have unique head patterns which ontogenetically varies among individuals. But the head pattern does not change within short period of time and keeping that consideration we have continuously surveyed 7 days and tried to take photographs of adult individual only. These patterns can be photographed from a distance and used for individual identification using software such as semi-automated Computer-Assisted Pattern Recognition Software (CAPRS) HotSpotter. We tried to locate basking and surfacing *N. gangetica* and after each detection we photographed them (Targeting clear shot of head region) with high range Nikon Coolpix P1000 point and shoot camera.

Then we made a hybrid approach of identifying the recapture of adult individuals using Hotspotter software as well as manually calculating observations to compensate the possibility of identification error that might happen in software due to many reasons (photo angle, clarity,

orientation etc.). We uploaded total 192 clear head-shot photographs of *N. gangetica* adult in the software from recent (2-8 Nov'2022) and previous surveys (October-Nov 2019/2020) conducted as well. From the image recognition and later followed by total count the present survey has documented 41 unique individuals of *N. gangetica* out of 123 photographic captures in Mansar lake and 14 unique individuals of *N. gangetica* out of 69 photographic capture in Surinsar lake. However, these number might not be exhaustive and more number of repetitive surveys over longer period are required to make any conclusion on the actual population and can also enumerate trend of these turtle population in this two lakes. Out of 41 individuals from Mansar lake photographic snapshot of 35 individuals are provided in Plate: 8 pg. 219 and Out of 14 counted individuals from Surinsar lake 12 snapshots are provided in Plate: 9 pg. 220.

9.1.2 Problems and threats to the turtles

a. **Lack of connectivity to adjacent landscape:** Freshwater turtles inhabiting wetlands require connectivity through the landscape to adjacent aquatic ecosystems for foraging and breeding. Well connectivity of wetland and buffer land ensures the viability of the population. Over the recent years' human activities around the lake have modified the catchment area and surrounding buffer with settlements and agricultural fields, decrease biological connectivity significantly. There is hardly any buffer land left for the turtles to perform their important biological activities like basking, foraging and mostly breeding. In order to do welfare of tourism a path (known as 'Parikrama') was constructed along the periphery of the lake enclosing the lake water fragmented from associated habitat. Moreover, this concreted embankment act as a serious barrier for the turtles as they are unable to cross the steep road.

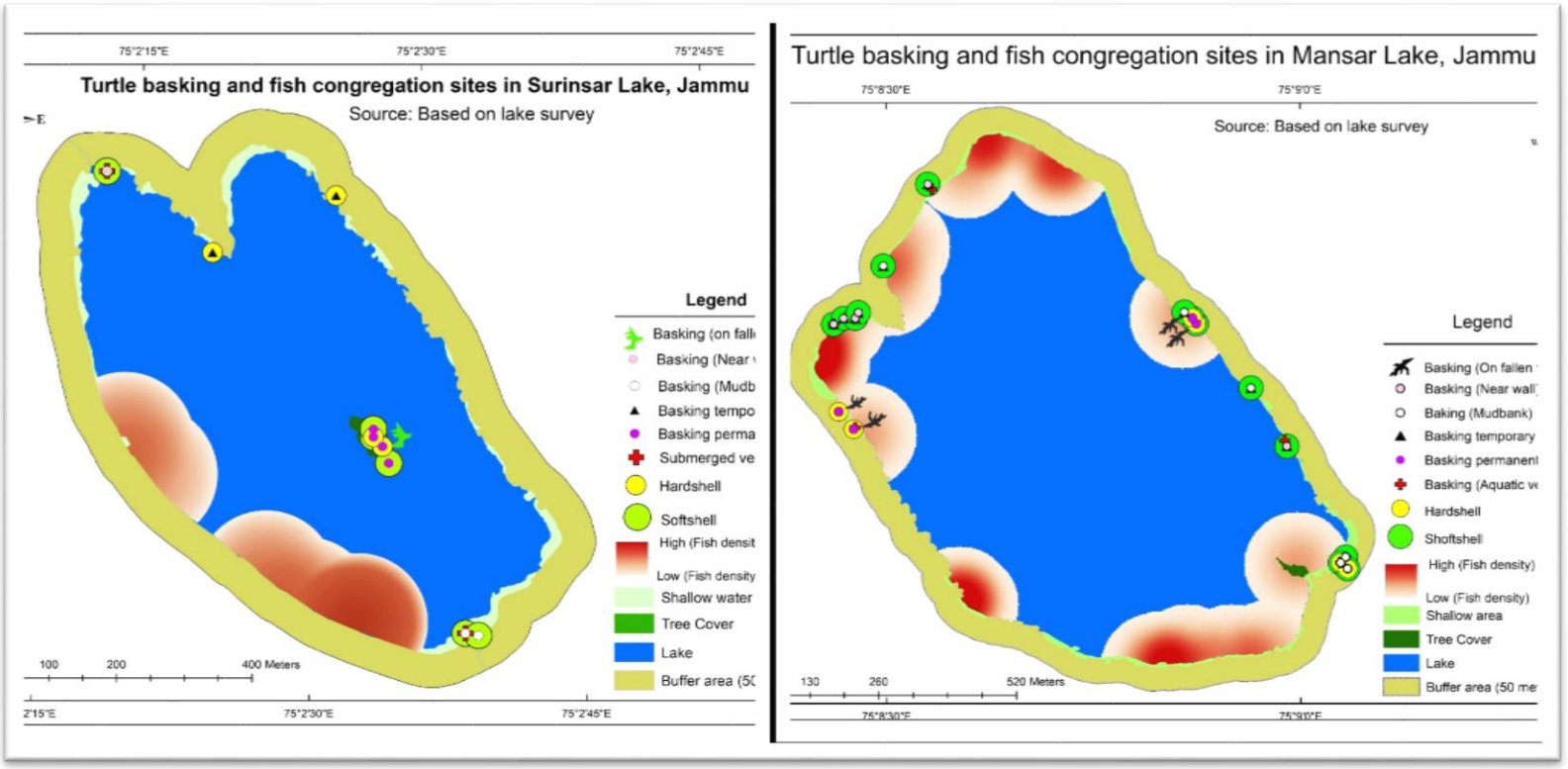
b. Loss of proper breeding habitat for turtles: Due to construction of concrete footpath around these lakes there are very less shallow land buffer left. Also due the porous nature of the soil and lack of big trees to hold them tight all the wetland embankment has now eroded (erosion happens during monsoon) into very steep banks which are nearly impossible for turtles to access. Rest of the remaining buffers have uplifted areas with hard solid mud and thick grass cover where the turtles find it difficult to lay eggs as they cannot dig a hole on those tough surfaces.

c. Predation threats: During breeding season, these species come out of water and lay their eggs on the banks in small pit dug in soil as well as in the surrounding fields. But these eggs get predated

by animals like stray dogs, cats, mongoose and monitor lizard or trampled by grazing cattle which are often seen to graze inside the fenced area on the mud banks.

d. General disturbances: Lack of proper fencing leads to predation and destruction of many turtle eggs and hatchlings. Adding to that tourist pressure and paddle boats pose serious disturbances to the basking turtles. Loud music playing in nearby shops, temples also cause problems to turtles.

e. Competition for food: Both of these lakes have dense population of exotic common carp species. These fishes breed multiple times and have almost exterminated native fish population as well as aquatic plants, which are one of the main food source for these turtles. Turtles selectively avoid areas where the fish population density is high (Map 13**).**



Map 13: Turtle basking area with respect to fish congregation**.**

f. Degrading water quality: Solid garbage and liquid sewage flow through open drains from the households, restaurants and agricultural on the periphery lake pollutes water. There were several observations of slimy green layer (probably algal bloom) on lake water surface mostly near the edge in Surinsar lake.

g. Presence of Invasive turtle species: Recent survey has documented presence of invasive red eared slider (*Trachemys scripta elegans*) in lake Mansar. This particular invasive species is known to outnumber native species in terms of competition for food and breeding. Presence of this turtle in any natural ecosystem like lake Mansar might pose serious threat to the turtles and remaining native fish population (Vide Chapter 2. Pg. 45-46).



Picture 9.1: Degrading water quality in lakes due to effluent disposal and heavy pollution.

9.2 PROPOSED STRATEGIES

a. Mitigating connectivity barriers of lake to adjacent landscape: Connecting corridors should be made that connects the lake with adjacent landscape through tunnels and underpasses. The

underpass and tunnels should be designed scientifically to maximize chance of utilizing those. Tunnels should be selected in places which are well vegetated and provides a gentle slope for migrating or dispersing turtles. Existing large drainages (Large Inlets & outlets) should be managed in following ways to make a nice passage for the turtle.

Suggested design for Turtle passage (Pic- 9.2 a)

All the natural outlets and bigger inlets should be provided with underpass for turtles (Vide Map 5 & 6). To achieve this, existing box and round culverts that connects adjacent land/ waterbody can be modified as following:

1. The turtle underpass should have funneling structure for guiding the turtles towards the passage. The structure may have enough natural (vegetation) cover for turtles to cross.

2. Both outlet and inlet openings should be free from any fencing or barrier. Ideally the box culverts should be at least 2 X 2 or 2X 3 sq-meter dimension (height above existing water level) to provide safe passage of turtles during breeding season. However, fencing should be made on top of opening to avoid any intrusion of predators (Pic- 9.2b)

N. B.: The existing outlet in Surinsar lake may be **widened** with at least 2 meter of passage height (culvert height) to provide enough passage for turtles to move freely during their migration. **The road over the outlets may be elevated to provide enough space and disturbance free movement of turtles. The side of the outlet may be broaden maintaining a gentle slope without concretization.**

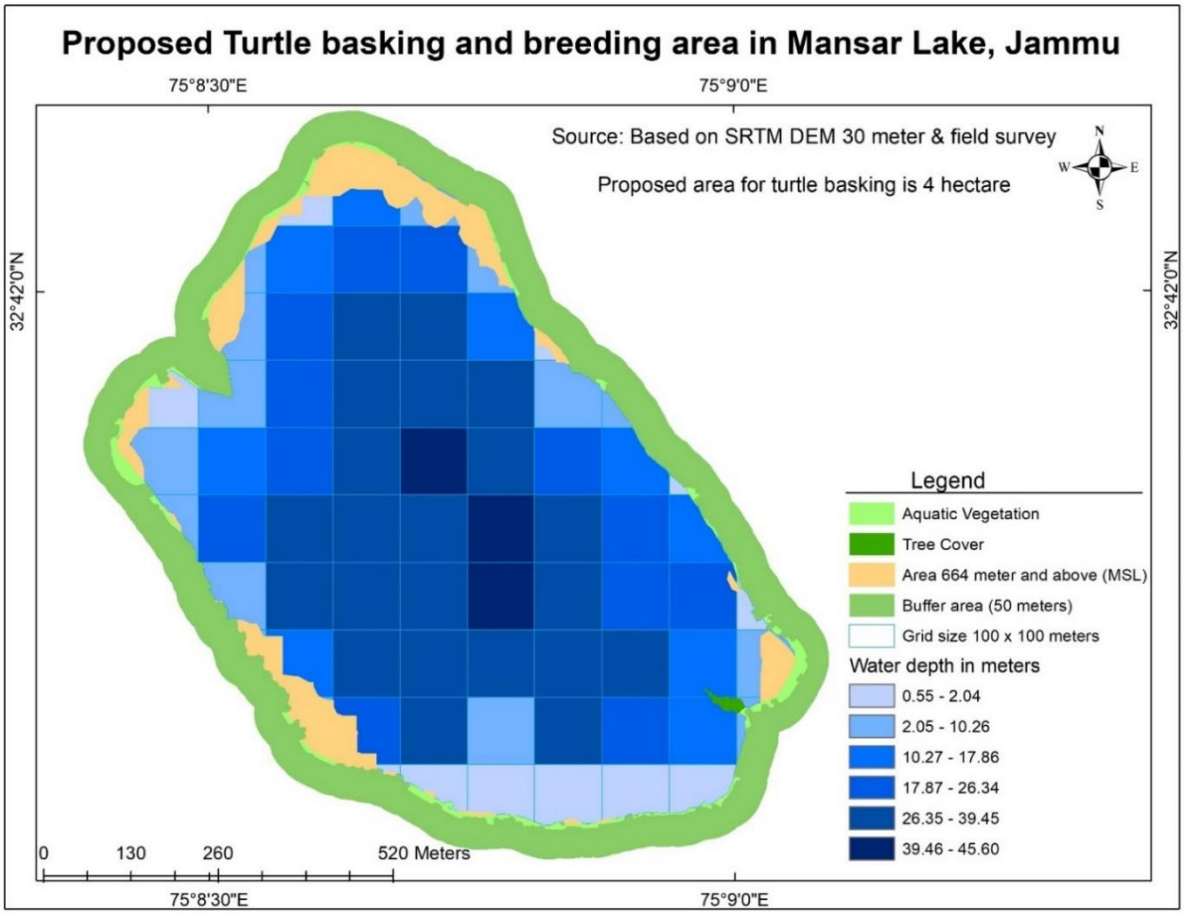


Picture 9.2a: Sample photographs of ideal turtle underpasses (Source: online images) that need to be implemented in Surinsar Mansar



Picture 9.2b: Animal proof double meshed fencing types. (Source: online)

b. Reduction of water level: Water levels should be reduced by 2-4 m to expose shallow areas and a measure scale needs to be installed to monitor the water level increase or decrease. As per our on ground survey and further analysis, the level of water must remain below the mean sea level of 664 m for lake Mansar and 605 meter for Surinsar so that the area marked (yellow coloured) in the map would get exposed. Reduction of water level will expose shallow areas which will act as wetland buffers.

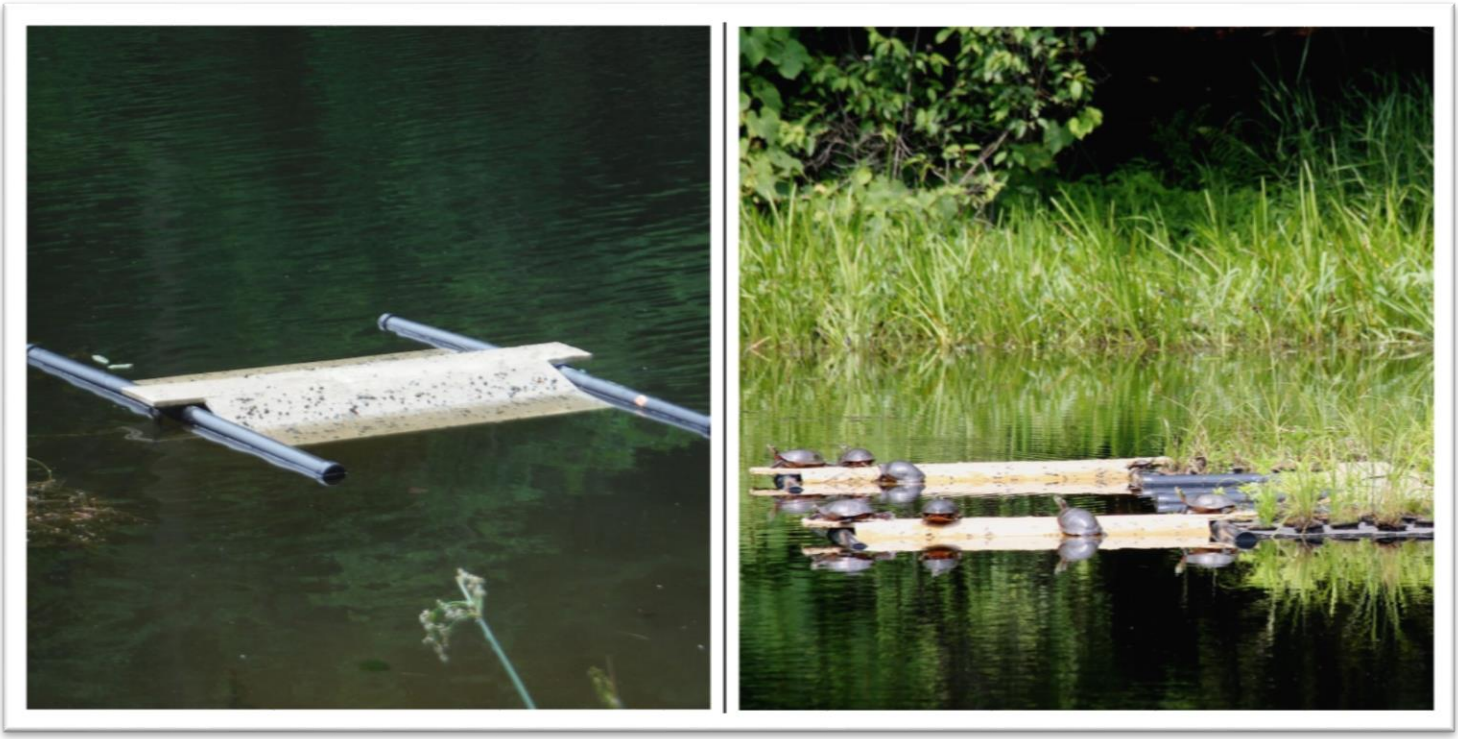


Map 14: Exposed shallow area for turtle basking and breeding sites in Mansar after reduction of water level

Remaining shallow areas should be managed properly by planting aquatic vegetation seeds, *Typha* grass etc. Steep bank slopes can be made gradual slopes with slope angle not more than 5-10◦ and ground should be covered with sand tracks interspersed with herb cover. To save the eroding

banks, more trees should be planted alongside those areas and the standing trees should be given proper support (See map 13 & 14)

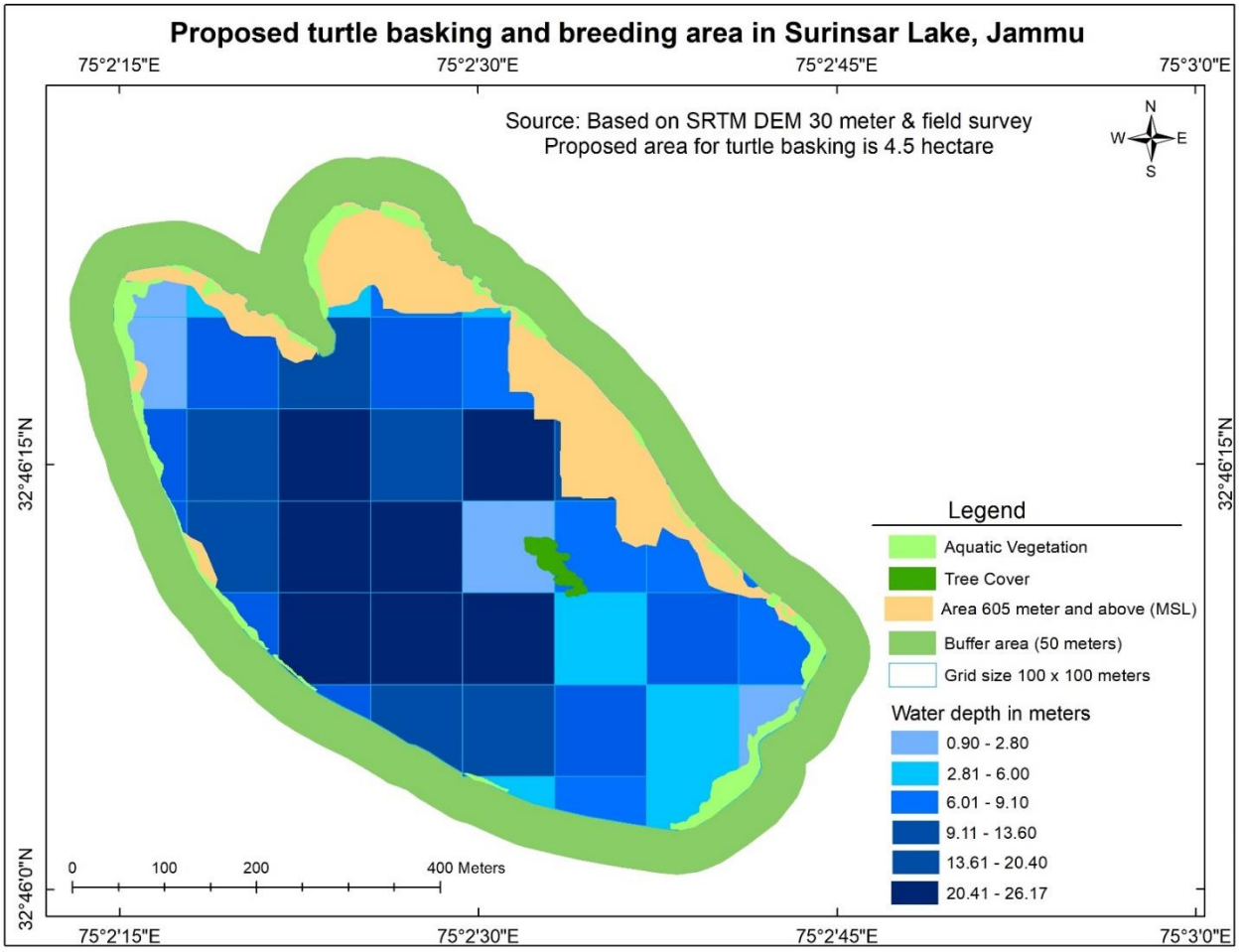
c. Providing basking area for turtles: Setting up of basking areas by retaining the big fallen trees and creating artificial floating planks (Pic. 9.3) increases the basking potential of the species, and sighting of these large turtles during basking hours can serve as an educative tool for visitors and generate positive interest in conservation of these two lakes.



Picture 9.3: Example of artificial turtle basking platforms (Image source: Online)



Picture 9.4: Fallen trees that can be retrieved for natural basking spot for turtles



Map 15: Exposed shallow area for turtle basking and breeding sites in Surinsar after reduction of water level

d. Safeguarding hatching turtles and eggs: To reduce the risk of eggs or hatchling predation from the stray animals nesting sites must be identified based on regular monitoring during breeding season and those areas should be properly fenced and patrolled. Strict care should be taken so the area remains 'no interference zone' and 'no sitting/ stopping zone' for that hatching time period. Ideally a buffer of at least 25 meter should be kept (wherever possible) from the nesting zone to human interference. In this case, forest department might manage and modify the land area which is now been used as chital (Spotted deer) cage inside animal enclosure. Ex-situ hatchery and

breeding center at Mansar or Surinsar may be infrastructure following WII suggestion for success of hatching and breeding of large soft shelled turtles.

Ex – Situ turtle management SOP

Ex situ management of turtle breeding requires utmost protection and care as the eggs are being taken from the natural location to an in-housed setup/s. Ex situ turtle hatchery include egg relocation, hatchery incubation and release of hatchlings into the natural habitat. To carry out this exercise as a long term approach following points are key-

1. The hatcheries should be made at a site that is as similar as possible to the habitat of the nesting site of the turtles. This makes the transport of eggs less labor intensive, and makes it possible to transplant eggs into hatcheries relatively quickly.

2. The hatchery should be located nearby lake buffer area and not too far inland or in heavily shaded or in areas with high human interference.

3. The hatchery can be enclosed by chain link fence or wire mesh. Inexpensive wooden poles, cane and bamboo or slats can also be used. To prevent the entry of snakes, monitor lizards, dogs, cats, jackals and other burrowing predators, chicken wire mesh (or any small mesh material) can be buried to a depth of 0.5 meters along the inside of the fence.

4. The hatchery shape should be either rectangular if the land area is narrow, or ideally be circular to give more space with proper perimeter fencing.

5. Ideally eggs should be collected, transported and placed in the hatchery within 2-4 hours after egg deposition to increase the chance of survival of eggs. Eggs can be collected in a clean plastic or cloth bag or in a bucket with sand at the bottom to give shock absorption. The bags or buckets need to be clean and not contaminated.

6. During each collection the nests should be marked with numbers and the same number marking must be done to the egg batch of that particular nest. It is also advised that the date of laying and number of eggs should be recorded, so that the date of emergence can be estimated with accuracy.

7. Inside the hatchery the ground has to have some slope, bottom layer should be mix of sandy loamy or same soil materials to that of the actual nesting place, moderately sunlit (too shady or too much sunlight is detrimental to hatching success).

8. The eggs can be placed by digging nearly similar sized holes and must be kept in same order as they were collected from the nest. For this to achieve, the eggs must be numbered according to their position in original nest and later aligned in the same way.

9. If the nest area is getting hard sunlight the ex-situ nesting holes can be covered by thatch basket by making a slight hole at the bottom of basket as the shade on the basket will provide the nest towards the end of incubation, which can help to reduce mortality especially during summer. However, the nests should not be shaded too early during incubation, as this could affect sex ratios.

10. The eggs should be monitored daily by trained personnel to keep them away from either drying out or fungal spread inside nest due to humidity.

11. The hatchery personnel should anticipate hatching for each nest. Expected dates of hatchling emergence can be estimated from date of collection. For northern population of *N. gangeticus* the egg laying peak is primarily during July- October and the incubation period is roughly around 180-260 days from laying with variations from place to place and environmental condition.

However, this is a very labor intensive procedures and takes time to perfect the setup. So under such situation it is suggested that the natural nesting sites along the lakes must be given proper protection, strict monitoring during breeding season, the known egg laying sites must be modified by making gradual slope to the lake edge and reinforcing the land with sand and soil cover.

e. Regulations to reduce general disturbances: Strict regulation should be imposed to restrict the loud music play. All the lights in the surrounding vicinity should not be directly projecting towards lake water or lake edges. Because at night turtles forage and thus light and noise pollution impedes their important biological process. Identified basking sites should be maintained as “NO DISTURBANCE ZONE” demarcated by signage.

f. Mitigating food scarcity and competition: Relocation of exotic carps so the population remain under control and reintroduction of native fish seeds as well as planting floating aquatic vegetation. All of these will help increasing the food base for turtles.

g. Reduction the risk due to pollution: Proper drainage and sanitary system should be installed with filtration system at releasing point (vide. SOP for discharge norms into the lake, pg. 106). The local stakeholders can be empowered to take on the responsibility for the upkeep of the lake, ensure proper sewage disposal systems to prevent further pollution which negatively effects the turtle population.

g. General protection: With reference to Map 9,10, 13 & 14 which shows important basking sites and shallow areas cattle should not be allowed to wallow inside the lake as these come under protected area and may cause disturbance to basking and egg laying also might cause degrade habitat and wetland ecology.

h. Removal of invasive turtle species: Mansar lake is home to five native turtle species among which one of the species has 'Vulnerable' status under IUCN red list category. So **WII further suggests that this invasive turtle should be captured and removed by using cast nets or baited basking traps from the lake ecosystem** and handed down to fishery or aquaculture department. Further care should be taken that it must not be released in any natural aquatic body.

9.3 FUTURE APPROACH FOR POPULATION MONITORING OF SOFTSHELL TURTLES

There are few basic and easy methods for monitoring turtle population.

a. Non- invasive methods for periodical short term observation-

i. Basking turtles should be counted following Visual Encounter Survey (VES) method in pre and post monsoon month (vide Chapter 2; Section 2.8.2). VES data can provide a trend in turtle population abundance over the years. An attempt has been made to showcase the trend of turtle encounters during several months of study period.

ii. Relative abundance for all the basking turtle species may be counted from the VES seasonal data. It can be attained by dividing the number of species from one group by the total number of species from all groups. This will enumerate overall abundance and density of turtles in both the lakes.

b. For other long term monitoring, the following two approaches might be implemented-

i. Tagging of males and females of *Nilssonia gangetica* by attaching radio transmitters on its carapace and monitoring them on different seasons across the years. This marking techniques will help to enumerate population density using assumptions of a close population.

ii. Tissues and fecal samples are reliable and non-invasive sources of DNA for molecular analysis. Therefore, mitochondrial DNA-based marker can be used for identifying the species from tissues and scat samples from designated laboratories or institution.

iii. E-DNA or environmental DNA samples can also be used to detect turtle species through proper scientific protocol which is also a non-invasive procedure.

Chapter 10

ECOTOURISM, INTERPRETATION AND CONSERVATION EDUCATION



10.1 ECOTOURISM

10.1.1 Background

Ecotourism has emerged as a platform to establish partnerships and to jointly guide the path of tourists seeking to experience and learn from natural areas. The term ecotourism is defined as "responsible travel to natural areas that conserves the environment and improves the well-being of local people" (International Ecotourism Society, 1990). The International Union for Conservation of Nature and Natural Resources (IUCN) in 1996 described ecotourism as:

"Environmentally responsible travel and visitation to natural areas, in order to enjoy and appreciate nature (and any accompanying cultural features, both past and present) that promote conservation, have a low visitor impact and provide for beneficially active socio-economic involvement of local peoples".

Relations among conservationists, communities and tourism practitioners have not always been smooth and collaborative. For years, protected areas have been managed through minimal collaboration with the people living in and around these areas. However, the concept and practice of ecotourism brings these different actors together.

Tourism, interpretation and environmental education in Surinsar Mansar wetland are in its nascent stage and yet to develop more in coming days. These two lakes gained prominence due to its religious and spiritual significance as well as its geographical setup along with its biodiversity that attracts all kinds of tourists from devotees to nature enthusiast. These two wetlands beam with tourists throughout the year. Due to the location of these two wetlands which are well connected by highways to adjoining cities of Jammu it has tremendous potential of transforming into a tourism site. The area provides advantages of both terrestrial as well as wetland habitats, which could be used for providing good visitor experience. Expected revenues from the tourism will help the local communities and gram panchayat in strengthening and improving their livelihood opportunities.

Eco-Tourism, interpretation and environmental education can better develop in these wetlands so that it can sustain for a longer period and help the enhancing livelihoods of local people. These wetlands gained prominence due to its religious and cultural values but it has also had a lot of natural heritage values that need to be promoted.

10.2 OBJECTIVES

The main objective of ecotourism in Surinsar Mansar wetland is to ensure ecologically responsible tourism, which is responsive to the economic gain of local and rural communities. In this communication the specific objectives can be listed as follows:

a. To promote conservation awareness amongst the visitors and local people through conservation education and interpretation.

b. To generate alternate livelihood opportunities for local community.

c. To establish harmonious relationship between the wildlife sanctuary, visitors and the host communities.

10.3 STAKEHOLDERS IN ECOTOURISM

A key to the success of ecotourism is the formation of strong partnerships so that the multiple goals of conservation and equitable development can be met. Partnership may be difficult because of the number of stakeholders involved and their different needs, but forging relationship is essential. The following figure depicts the partnership details between different stakeholders

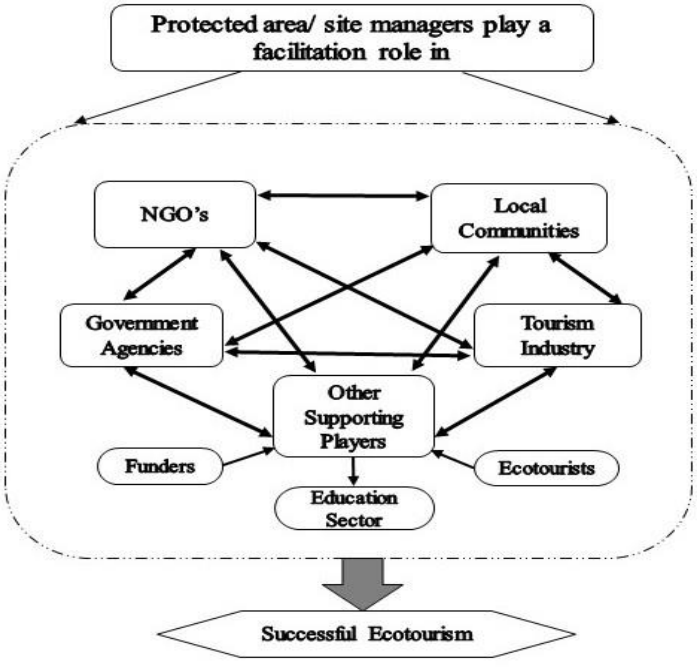


Fig 10.1: Ecotourism Partnerships needed for success (adapted from Drumm & Moore,2005)

10.3.1 Target Groups

The major target groups among the visitors in Surinsar Mansar Wetland will be:

1. Inter and intrastate visitors, who visit to perform religious rites.

2. Nature Enthusiasts, including international visitors, who are interested in different ecological and socio-economic attributes of the sanctuary.

3. Bird Watchers, with specific focus on the avian fauna of the area.

4. Students, who may visit as part of their school/institute's nature education programs.

5. Youth and other enthusiasts, who are interested in trekking the nearby forested areas on the mountains.

6. General public, who visit for leisure and recreation.

10.3.2 Strategies

Surinsar-Mansar wetlands are smaller in sizes, therefore, there is a little scope for zonation or spatial planning. However, it is proposed to have an Eco-tourism zone in the water areas for various recreational activities (bird watching and boating) to increase the enjoyment and safety of each pursuit. Minimum 60% of the water bodies that are critical for birds, turtles, etc. should be kept free from tourism activities. Boundaries of Tourism Zone should be clearly demarcated with colour buoys and it should be informed to boatmen. The proposed ecotourism management strategies around Surinsar Mansar Wetland can be

A. Nature Watch/Boating Subzone

The objective of this zone is to protect the natural environment and offer recreational opportunities characterized by a minimum of environmental impact and very few group encounters. The zone will allow movement of visitors interested in observing nature, particularly bird watching and animal sighting. The zone could be restricted to nature trail on the specified sectors of mountains that comes under Forest dept. surveillance, where the tourists will also get the 'Lake view'. This will help only nature enthusiast tourists from diverting away from designated paths. Suitable signages without disturbing the aesthetic of the area will have to be fixed to provide information to the visitors.

Rules and regulations:

I. Public use is limited to special groups accompanied by guides i.e. local people from the area for trekking.
II. The entire sanctuary will be plastic free zone.
III. Payment for these treks will be over and above the entry fees of these lakes.

B. Conservation education subzone:

General objective of this zone will be to offer educational and recreational opportunities within a relatively natural environment, with medium concentration of visitors. It will consist of Deer park, Forestry hut, Forest department enclosure and nearby short trails and self-guided walk followed by an interpretation center.

Rules and regulations:

I. Site will provide all basic amenities like toilet, drinking water and refreshment outlet.
II. Picnicking by visitors will not be allowed. Refreshments and food facilities will be provided on payment basis at site through the JKTDC & SMDA.
III. While planning development infrastructure, the needs of differently abled visitors will have to be kept in mind.
IV. All trash must be removed by the visitors and on littering the area subsequent fines should be levied on the offender.

C. Recreational subzone and ritual sites:

This is the most important zonation of these two wetlands as these areas will have high concentration of tourists. The main recreation of this wetlands include paddle boating and picnic near the main entries. Apart from that, all the main temples will have large number of devotees performing religious rituals at different time of the year. So, it is very important to maintain the balance of such tourists in a way that the natural tranquility of these two wetlands are not hampered. The zonal division should be restricted within which such activities (boating, setting up langars, picnic etc.)

Rules and regulations:

I. Picnicking by visitors allowed in designated area i.e. only within the provided park near main entry site but use of loud music system will be strictly prohibited. Arrangements can

be done to pre book slots of picnic during peak tourist season to maintain huge tourist rush and subsequent chaos.

II. The specific SOPs regarding boating activities will be

- Only paddle boats will be permitted in identified area within the zone and no motor or speed boats should be allowed in the zone and elsewhere in the wetland.
- All boats should have one jetty points for better regulation and management of the tourism activity.
- Clear instructions regarding Do's and Don'ts maybe incorporated at the same jetty points.
- Boating area should not exceed more than 30% of the total lake area spread.
- At least, 50 meters of distance should be maintained from the turtle basking area (as reference to the map 9 and 10) and recognized nesting areas.
- Boating activities during winter must be regulated during the peak basking time from 10-13:00 Hrs. with respect to figure no. 2.16.
- Limited number of boats (maximum 8) shall be permitted to ply at the same time.
- Visualizing future scenario, no landing is permitted in the middle island in Surinsar.
- **Tourist boats should maintain a 50 m from the middle island in Surinsar lake**; **a buoyancy fencing with designated markers might be deployed around the island to prevent tourists to visit the island.**
- Boating should be strictly prohibited in shallow zones where turtles lay and basks or migratory birds feed.

Apart from boating new adventure activities that involve the wetland should be refrained to minimize the chance of disturbance.

III. Swimming, bathing and washing clothes is strictly controlled.

IV. All the wooden existing jetties can be transformed into fiber bridges for better stability.

V. Temple authority should maintain crowd in a proper way to reduce excessive noise.

VI. Areas should not be polluted by food and other offerings; in such scenario 'polluters pay' principle can be applied.

VII. No plastic use zones and removal of all the devotees offering to the lake immediately after the rituals. Few people may be employed by the SMDA and Mandir trusts to carry out this work.

VIII. Restaurants and nearby shops near the periphery should avoid using plastic materials and maintain the sanitary system around the place clean. Restaurant owners, shopkeepers as a part of local community can take up the responsibility to aware people about not littering the place and disturb the naturalness of these two lakes.

10.3.3 Proposed activities

Following activities are proposed for sustainable ecotourism in the plan period:

I. Creation and management of 'Eco-club' with local students and youths, other stakeholders of the wetland for conservation of wetlands and its surroundings. Selected members of the Eco-club can be trained in eco-tourism and they act as tourist guides. Further, all boatmen and merchants around the lakes need to be encouraged to be part of the Eco-club.

II. Natural walk trail around the wetland should be minimum 10 m away from the high flood level. Green belt with native plants species can be created all around the wetlands that can also act as roosting/nesting places for birds.

III. All free roaming dogs need to be removed from the surrounding areas as they are threat to visitors as well as to turtles and birds' nests.

IV. Further, turtle friendly illumination of lights at night needs to be encouraged in the buildings around the wetlands.

V. Government of Jammu and Kashmir may support and promote the Home Stay Programme in the region so that local community could benefit from the tourism.

VI. Setting up two guided trails on the nearby mountain area and developing them suitable for good bird watching and animal sighting trails, with minimum intrusion or disturbance to the habitat. Along the trail routes, locations for watch towers, hides and observation points (Bare minimum number) need to be identified and installed.

VII. Selected local youth, preferably from villages around Surinsar Mansar sanctuary and forest department staff should be trained in ecotourism. The local youth should act as nature guides for running the ecotourism program in nature watch sub-zone. These guides will

have a dual responsibility of visitor management and protection of the sanctuary and lakes while taking visitors on trails.

VIII. Employing community people in the safeguard of the lake along with more forest department staff. They will be responsible for management of tourists in all aspect so that the purpose of ecotourism is served as well the natural integrity remains intact.

IX. Infrastructure development such as setting up of an interpretation cum information center and hall for participants attending an educational activity. Location and structure of these facilities has to be carefully planned, so that these are compatible with the natural surroundings of the area and these do not hamper with the tranquility of the landscape.

X. Interpretation center can be designed around the important themes of the area i.e. Geological history and significance of Shiwaliks, history of Jammu and Mansar Surinsar wetlands, its cultural and religious values, Biodiversity of the wildlife sanctuary as well as wetland and our role in conservation of this landscape, etc. [vide section 10.4]

XI. A ticketing counter near the entrance gate and stall for eateries and refreshments near the information center need to be put in place.

XII. Extension and education material such as signages, wayside exhibits, banners, posters and brochures, films highlighting the wetlands may be developed [vide section 10.4].

XIII. Preparing regulations and rules and advertise it in signboards and leaflets about ‘no plastic use’; ‘no loud music’; ‘no entering within fenced areas’; ‘no littering and dumping garbage on lake’; ‘no boating near restricted zone’ viz. nearby islands in Surinsar etc. should be made into action.

XIV. Setting up security booths at important sites employing local youths with the help of local police departments and taking necessary steps against the offenders who violate given laws.

XV. Website of Surinsar Mansar wetland Sanctuary (www.jammuwetlands.org):

a. An exclusive website for the Sanctuary needs to be developed and this website should be linked to the websites of J&K Forest Department, J&K Tourism Corporation, Incredible India etc.

b. Website should provide all information required all kind of visitors and stakeholders of wetlands especially Surinsar Mansar wetland, regarding the significant of Sanctuary, threats, management approach, guide to tourists, etc.

10.4 INTERPRETATION

Interpretation and imparting Conservation Education on the importance of coastal and marine environments and its biodiversity for visitors and local communities of the Sanctuary is consider to be an important activity of the Management Plan. Only through a clearer understanding of the importance of wetland ecosystem, the citizen, planners, administrators, younger generation and stakeholders will ensure and support conservation and protection of the Sanctuary. For this, a comprehensive interpretation, extension, education and awareness conservation program is proposed for the sanctuary. This will include setting up of State of Art Interpretation Center, Information Centers, way side information kiosks, state of art aquarium, information signages, hoardings, brochures, leaflets, films, audio-visuals, innovative and interactive, unattended and attended services and use of print, electronic, traditional and time tested extension and educational media through competent and trained professional educated. Once people get into the wetland reserve area, they will want to know about the resources and facilities available, what activities are permitted or forbidden and about safety and security. As their understanding of the area grows, visitors show more curiosity about its natural environment. This is the demand to which interpretation has to respond. The result of well-planned interpretation should be a more fulfilling visitor experience.

10.4.1 Objectives

Main objectives of interpretation for Surinsar Mansar Wetland will be:

I. To educate the visitors and other stakeholders about the importance of this area and ongoing management initiatives.
II. To enhance livelihood opportunities for local residents/community.
III. To provide the visitors with a fulfilling experience.

10.4.2 Interpretation Centre

The interpretation zone will have to have comprise of an interpretation center. This center will help disseminate information, generate awareness and enhance visitor experience. As already hinted, the interpretation center will provide written and audio-visual information on the evolution of the Surinsar Mansar wetland, the array of ecological, religious and cultural values of the two lakes as well as weave a story around the development of Surinsar Mansar as a site of ecotourism supporting the biodiversity.

There are few buildings in Mansar lake that can be modified into such interpretation center, for e.g. some floor space of the gaming center can be used; the cafeteria at the north west of the lake could be one option. In Surinsar the rest house or near park buildings can be modified into an interpretation center. While constructing the center, it will be essential to ensure that the structure does not impinge the natural beauty of the lake and gels well with the surroundings.

10.4.3 Interpretation technique

Broad interpretation techniques for Surinsar Mansar wetland are given in the table 2.6.

Rules and regulations

I. Entry charges to the interpretation will be included in the entry ticket. Separate charges may be levied for tour guides.
II. Strictly no trashing of place, and inclusion of 'polluters pay' principle.
III. No crowding at one place and 'no loud music' near vicinity of lake.

Table 10.1: Interpretation techniques

Technique	Components	Comments
Personal services	• Information desk at the entry, a kiosk at the Interpretation center. • Guided tours. • Lectures and demonstration	Provide information directly to visitors by nature guides from local area and forest department staff.
Non-personal services	• Interpretation center with panels of model and photographs. • Signage (Directional & Interpretive). • Publication (pocket guide, hand book etc.) • Audio Visuals and films.	Non-personal services can make information widely available at a relatively low expense per visitor contact.

10.4.4 Signs and Visitor Circulation

To facilitate and direct the visitor in a systematic manner several categories of signs are needed. The types of signs are as follows:

10.4.4.1 Pathway Directional Signs

In order to regulate the flow of visitor's pathway directional signs should be placed at regular intervals so that the visitors are aware which way to go. The signs should lead them to all the major facilities that are available for the visitors such as toilets, drinking water, deer park and conservation education center. Since the area is open for visitors and minimum park management personnel is visualized in this complex therefore steel reinforced concrete footing with granite sign panel is recommended.

The sign structure should also include sections like “Things to remember” near the entry site, deer park, interpretation center, nature trail and wildlife important zones which should tell about DO’s and DON’T’s.

Signages declaring the presence of the Surinsar Mansar Wetland at Samba bus stand, all main interstate bus terminus in Jammu, Jammu Railway station and Airport.

10.4.4.2 Interpretive Signage

Interpretive signage about the importance of wetland, geophysical setting, religious, historical importance of the Mansar Surinsar lake and about birds, turtles can be placed around the wetland and on the viewing platform. These signages should be low lying and non-obtrusive. The signages can either be made on steel panels or in ceramic, both of which are vandal proof and are outdoor material.

10.4.4.3 Temporary Signages

Since the area receives migratory birds for a limited period therefore some signs can be made temporary which can be removed. These signs can be placed for interpreting seasonal or temporary

things like migratory bird's arrival (during winters) and during turtle breeding and egg laying seasons (i.e. during monsoon). The signs are to be placed all around the wetland.

10.4.5 Publications

All publications should have a masthead so that the viewer can know which department has produced it. This would also act as a means of publicity for the area and the department. Following publications for the area are proposed:

- Wetland brochure.
- Checklist of resident and migratory birds, animals in sanctuary, fishes of lake.
- Leaflets on biology of turtles along with checklist.
- Poster.
- Outreach material.

Publications can be priced and the money generated can be ploughed back through village eco-development committee. The revenue can be used for replenishing the stock of publications and maintaining the conservation education center.

Wetland brochure

The brochure would consist of all the information that would be required by a visitor for planning the visit and what one can expect to see in the area. The brochure would also have the Things to remember i.e. what one is allowed to do on the trip within the wetland and what is prohibited. It would also mention on these wetlands historical importance.

Checklist of resident and migratory birds, animals in sanctuary, fishes of lake

Sanctuary has different mammalian species. These two lakes have both native fishes and exotic carps, as well as several resident and migratory birds. The area can be promoted as a birding site for bird lovers and students. In order to assist the students, a checklist of birds needs to be prepared. This checklist can be regularly updated with the help of birdwatchers and new records mentioned. The checklist can be produced in Dogri, Hindi and English so that the students from the

neighboring schools and colleges can also be benefited. Services of some retired officers of the department or other experts can be taken to design these materials.

Leaflets on biology of turtles along with checklist

Turtles are important inhabitants of these two wetlands, they maintain the ecological balance of the lake. A checklist of 5 species of turtles with detail information of their biology can be given to the tourists in the form of leaflets from the forest department at the interpretation center.

Poster

A series of 5 pictorial posters are recommended:

1. Avifauna
2. Fishes, Amphibians and Reptiles.
3. Flowering Plants
4. Mammals of Sanctuary.
5. Importance of Surinsar Mansar wetland including role of community and their socio-cultural history.

These posters can be sold as souvenirs for the visitors and can also be used as outreach material for the visitors, including school children. The posters can be produced in two languages Hindi and English.

Establishment of Nature Camp

Ideal camp sites around the sanctuary will be selected. These sites will be developed and required facilities will be created. Camping equipment will be provided to interested tourists on payment. These camps can be used for school and collage going students for nature education and awareness. Further, the same camps can also be used for training frontline staff of Jammu and Kashmir Forest Department towards wetland management. Members of Eco-Club can play a major role in running these camps with help of Forest Department.

Outreach Programs

Different outreach programs required to be carried out for greater publicity of this Sanctuary. For the people's awakening towards Lake Ecosystem & publicity, an awakening program will be imparted through a program on national days such as wet land day, wild life week, world environment day, sanctuary day etc. Film shows on birds etc. on that day will be organized in Interpretation center. A competition in schools and colleges regarding the values of sanctuary, ecology, birds etc. will be held on those national days to awaken and create interest about wild life in children. A quarterly newsletter will be published. Hand bills, pamphlets will be published and distributed. Strategies to decrease consumptive use of natural resources will be developed and shared with local populations. Awareness and orientation workshops will be organized for officials of different departments and other stakeholders working in sanctuary so as to build conservation concerns into their activities.

Since students, local public and youth will also be potential visitors to the area, it will be important to reach out to them through publications and other means. These materials can be used during special events day such as World Environment Day (5th June), Wildlife Week (2-8th October) and Wetland Day (2nd February). Such events increase public awareness of an environmental issue and motivate people to participate by focusing their attention on a particular environmental issue. The materials can be activity booklets like draw and color, sheets or cards. The material produced has to be in easy to understand language. The activity booklets can be used by school children and on successful completion of the activity they can be given a Certificate which would motivate the children to learn more about their surrounds.

Environment clubs too can be formed in schools and colleges as well as by gram panchayat involving young locals from the respective communities around Mansar and Surinsar. Thus, environmental awareness activities can be undertaken in these eco-clubs.

10.4.6 Website

Gradually a website for these two wetlands should also be developed with the help of professionals so that people from outer states even from different countries can easily get to know about this place via internet.

10.4.7 Nature Guides

Local educated youths from the wetland area and adjoining villages should be trained as nature guides by concerning authorities. This will be an important effort to involve the community in tourism initiatives. At present even though there are enthusiastic souls who wants to pursue this line but there is a severe lack of infrastructure and availability of information from the responsible sectors. Once the facilities are developed and sensitization programs are arranged then there would be an opportunity for the youth. The youth can take groups of students/visitors on the journey around the wetland and other areas of the landscape. They can also be deployed to take care of the entry kiosk and the conservation education area.

Training of guides and staff (from forest as well as tourism dept.) should be a routine process. During non-visitation period, the guides can undergo refresher course training at the site. This would update their knowledge and sharpen their skills required for guiding visitors. During the refresher course, the performance of the guides may be evaluated and based on their knowledge and communication skill, they may be categorized by A, B, C type. Accordingly, their fee for one trip with the visitor can be fixed. The guides can charge a fee of Rs. 500/ per trip (up to 2 hrs) from the visitors initially. The group size should not be more than 10 persons. The recognized nature/tour guides may be provided with identity cards from the Surinsar Mansar management and the boat persons should be provided with life jackets with departmental logo in it.

Once the system is settled and tourism picks up the guides will have to contribute a small amount of the fee to the staff welfare fund. The other portion would be contributed by the department either from the proceeds of the sale of publications or souvenirs or else from some other funding source like donations etc. This fund would provide financial support in times of need to the guides and would provide for uniform and books for the guides.

10.4.8 Audio Visual

Films are an important media of mass communication and it works well in rural settings. Series of 20 minutes' film on Surinsar Mansar wetland, its biodiversity, socio-religious importance, threats and its mitigation can be prepared with strong visual content. The commentary can be in Dogri preferably for use in the villages but English commentary can be superscripted for use in the Conservation Education Centre. The film should be professionally done.

10.5 CONSERVATION EDUCATION PROGRAMME

Nature education program on regular intervals are essential to popularize the importance of these two wetlands among the local people and students of every academic stage. Similarly, these programs could be designed and organized for other schools and target groups as paid program. Thus it might bring schools and colleges from outside states also into this nature education initiative. NGOs and eco clubs from other places can also participate and contribute to the same. The geographical location and biodiversity provides tremendous potential of nature education in Surinsar Mansar wetlands. It is therefore proposed that these two wetlands must be developed as a center for conservation education programs for different target groups.

10.5.1 Nature camps

Nature camps are essential to create awareness among the masses to conserve the environment. These are one of the apt tools for this purpose and has been successfully carried out in various parts of the country. Such camps could be one of the important activities of the reserve for disseminating awareness about nature conservation and also for building a local constituency for the conservation of this area.

This will require infrastructure in terms of meeting hall facility for interactive sessions, audio-visual equipment, reference material, binoculars, spotting scopes, educational documentaries, brochures and pamphlets. Panel of resource person could be short-listed, who could be invited to add value to these programs and train the staffs. Necessary technical and nontechnical staff could be engaged for running these programs and the cost of the same could be borne through the incomes of the SMDA, Forest department or supports from different trusts.

10.5.2 Target groups

I. All primary, secondary and higher secondary schools.
II. Colleges and Universities.
III. Local clubs and communities.
IV. In-service staff at government and Semi Govt.
V. NGOs.
VI. Other independent organizations.

10.5.3 Syllabus

The typical syllabus of a camp should be covering

I. biodiversity local to global.
II. need for conservation of biodiversity
III. basics of wetland and its types.
IV. Elements of wetlands biodiversity typical to wetland.
V. Deforestation, habitat degradation and its impact.
VI. Pollution, types of pollution and its impact.
VII. Need and greed differentiation.

All session however small it is should talk about the actions possible by the target group. It should give what they can do as an individual and as a group. Further topics can be added based on the requirements of the participating group.

10.5.4 Infrastructure requirements

I. Accommodation facilities.
II. Conference hall/Meeting space for lectures and interactive sessions.
III. Audio-visual equipment (Projector, screen, DVD player etc.).
IV. Reference materials for teaching.
V. Binoculars, Spotting-scopes, Handheld lenses, Camera etc.
VI. CDs of wildlife films / Educational documentaries.
VII. Transport facilities.
VIII. Brochures, pamphlets.
IX. White board/Marker pens.
X. Printer/Scanner

10.5.6 Panel of Resource Persons

There should be a panel of locally available resource persons (professors, teachers from allied field) who can add value to the program.

10.5.7 Advertisements and other promotion work

Publicising the initiative by putting up ads in print and other media to invite people from all around for the program.

RESEARCH, MONITORING AND TRAINING



11.1 INTRODUCTION

The aim of the management action plan is to conserve the ecological integrity of the wetland by improving the livelihood of the local people and by strengthening the stakeholders. For effective management, some information which include an understanding of the habitats and species, how they interact to form ecosystem, the natural processes that sustain them and the threat to these processes are required. This also requires regular interaction with the local people, volunteer committee members, local staff and science based approach. So, it is in this context that the research and monitoring is very important for the formation of management action plan. Research and monitoring help in taking scientific decisions and also in increasing the awareness among all the people or organizations involved with the site, thus it enhance collective commitment to conserve the wetland. It helps in designing eco-tourism and eco-development programs. It also helps in determining the economic benefits of the wetland. The success of the implementation of this plan will also depend upon participation of local community, NGOs and government agencies.

11.2 RESEARCH

Surinsar Mansar wetland has lot of potential to conduct integrated research on various aspects of ecosystem conservation, wildlife management, ecosystem services and human dimensions of nature conservation. For successful implementation of this plan, basic applied research and biodiversity monitoring programs are a must. It is suggested that the wildlife department should invite students and work hand in hand with researchers and communities to conduct research on different aspects of the wetland. Integrated research on various aspects of ecosystem conservation, wildlife conservation and human dimension of nature conservation should be encouraged. This helps in generation of useful data and this would also draw the attention of the research communities in the future.

Immediate areas of research which can be taken as priority include:

I. Inventory assessment of all forms of life like turtle survey, birds survey, fish population survey and aquatic vegetation survey. These will include strengthening the existing baseline information on various taxa of the wetland and adjoining landscape.
    a) Turtle Survey- Conducting turtle census and study based on the restoration of identified critical habitats for them.

b) Birds survey- Finding out the number of migratory water birds, ecology of migratory water birds in and around the wetland, information of breeding birds and their habitats in and around the wetland and preparation of comprehensive checklist and photo-documentation of birds.

c) Fish Survey- Study determining species checklist of native fish species and population control of exotic carp by assessing their impacts on the native fish fauna and biodiversity.

II. Preparation of GIS Maps for the wetland and adjoining sanctuary by referring the given map prepared for this current management plan.

III. Status and restoration of different habitats around the buffer of wetlands.

IV. Study on water pollution caused by the non- point source (especially from the catchment areas, agricultural fields) and its impact on various aquatic species.

V. Detailed assessment of the ecosystem services

a) Engagement of people / tourists, using wetland by any means

b) Impact of tourism, boating, annual tourist gathering

c) Assessment of direct use of wetland

d) Community Engagement

e) Socio-economic surveys

f) Socio- economic status and dependency of local communities

g) Documentation of cultural and historical values of the wetland

h) Study the extent and impact of firewood collection

VI. Perception and attitudes of locals towards the conservation and management of the wetland.

VII. Ecotourism potentials and community livelihood.

11.3 MONITORING

For successful implementation of this plan, basic applied research and monitoring programs are a must. It is important that the management strategies should be reviewed and changed periodically as per the needs and this is called adaptive management. Monitoring is an essential part of the adaptive management. Regular monitoring of the aquatic vegetation, water and soil quality, migratory birds, monthly, seasonal and annual abundance of the water fowls is a must. As, the habitat is the important determinant of the avifauna and several other aquafauna so the habitat

monitoring is also the important. Experts, Researchers, or organizations might come forward to help by providing the information/ research finding on species diversity, seasonality and its abundance. Also, it is proposed that the departmental staff should periodically monitor the status of the forest vegetation, habitat of the wildlife species, quality of soil and water at regular intervals.

11.3.1 Biodiversity monitoring

Conservation requires the continuous monitoring for getting the information on the diversity of the species or community. Biodiversity describes the health of the natural ecosystem, therefore regular monitoring of the wildlife species, birds, aquatic vegetation and fishes is required. The main focus should be on avifaunal species. Wildlife department in collaboration with the NGOs or the professional institute should check the habitat quality for the biodiversity.

11.3.2 Avifaunal monitoring

Avifauna includes both terrestrial and the water birds. Monitoring can be done either once or twice in a year. To check the species diversity, monitoring can be done once in a year but to check the status of the migratory birds and to check the seasonal variation, monitoring can be attempted twice in a year. We can also check the status of the birds on daily basis and compile it to generate the monthly data about the birds which further help to generate the seasonal or annual data. Field staff with the help of the wildlife Warden or researchers should maintain the record of the bird species in the wetland including catchment area. Bird survey should be done using standard protocols to reduce the errors in the sampling. Proper training should be arranged for the field staff to guide them about the correct protocols of counting the birds. This will help in maintain authenticity.

11.3.4 Habitat monitoring

Habitat monitoring helps in the conservation of the species diversity and its population. This also include regular monitoring of the vegetation structure, which is also the best habitat for various species. This helps in checking the variation in the floral composition, weed control and checking the exotic species within the wetland. Regular monitoring also helps in immediate restoration, as any change in the habitat resulted in negative impact on the wildlife and other species.

11.3.5 Wildlife health monitoring

Health monitoring helps the wildlife safe from the spread of any type of the diseases or infection. Infection can be from humans or other species of the diversity. A systematic health monitoring of the birds is necessary to keep on check the possibilities of bird- flu, as this will get rid from the disease breakdown. Samples can be collected from the dead birds found within the area to collect the preliminary data which is required in disease surveillance. Regular monitoring of the health of the livestock should be done seeking the help from the Veterinary department. Standard protocols must be followed during monitoring.

11.3.6 Environmental Monitoring

This includes water and soil quality monitoring. Monitoring of the water level in the wetland is also the part of environmental monitoring. Monitoring of soil and water quality in the catchment area is also important for checking the overall ecosystem functioning. Collecting and analyzing meteorological data on regular basis helps in better management and conservation of the wetland. Monitoring reports needs to be sincerely submitted to the forest or wildlife department without any delay. Feedback surveys should be conducted for better management and to seek suggestions from the locals and tourist.

11.3.7 Water Quality and soil quality monitoring

Water quality monitoring can be done by bio-chemical analysis of water samples during summer and winter season. This include analysis of Physical and Chemical parameters of the wetland. Reconnaissance Survey includes Map of the area, Background Information, human activities, potential polluting sources, water regulation. The design of the network for analysis includes selection of the sampling locations (optimum number of locations), parameters to be measured, frequency of the sampling. Field test for some of the parameters like Temperature, pH, Colour, odor can be conducted and rest must be preserved in the field and send to the laboratory on the same day. Analysis of the microbiological and biological parameters must be carried out using standard procedures.

11.3.8 Meteorological Data Collection

A small weather station or Automatic Weather Station should be established to collect the data on weather conditions and a representative should be assigned to collect the data using prescribed

protocol. Patrolling squads can also be used to collect the data. All the data collected from surveys must be recorded in the Range Office. It is the duty of Range Forest Officer to report that data to the Divisional Forest Office on monthly basis. Instruments and database should be maintained properly which would always help in management strategies.

Criteria for the setup of the different meteorological stations network:

- Location should cover all the different hydro climatic regions.
- Different land use zones should be represented.
- Representatives of different physiographic zones.

11.3.9 Tourism monitoring

Computerized Database of the record of the tourist coming to Mansar- Surinsar wetland should be maintained. This should be the regular and important feature of the monitoring programs. Feedback should be collected from the tourist on regular basis to know about the level of the tourist satisfaction. Suggestion box should be set up two to three places to seek suggestions from the both the tourist and the local communities.

11.3.10 Catchment monitoring

Rapid increase in direct or indirect man-wetland interaction due to urbanization and industrialization near the catchment, results in acute and chronic wetland losses, degradation of water quality, ground water depletion. It is estimated that there has been a loss of over half the natural wetland and wetland habitat due to rising pressure in the catchment area. It is also concluded that the water quality is degrading tremendously due to increases anthropogenic activities especially agriculture nearby the wetland. This increases the flow of the silt in the wetland via runoff. These activities should be monitored regularly by spatial technology tools that deals with the study of wetlands, their change analyses and mapping of surface water bodies. These include Remote sensing and Geographic Information System(GIS). Attribute information on large diversity of biota also requires an extensive field framework.

11.3.11 Bathymetry

The Bathymetry Survey can be done by using Depth- Sounder. This survey helps to find out the depth of the wetland and also helpful in identifying the areas which are heavily silted. Bathymetry

surveys carried out by dividing the wetland area into grids of equal area which will help in collecting the data from different points along the length and breadth of the wetland. Numbering should be given to the grids and data should be recorded accurately on the paper along with the GPS location. This sampling procedure will prevent the overlapping of the points and hence data and will help in finding out the depth of the wetland in accurate manner with exact locations. This exercise must be carried out once in a year to know about the siltation profile of the Wetland and will help in taking decision for desiltation and proves to be the important for best management strategies.

11.3.12 Hydrological regimes Monitoring

The hydrological regimes monitoring can be carried out using stream gauging stations which will be helpful in estimating the inflow and outflow of the water. This also helps in determining the water holding capacity and water balance within the wetland. Stream gauging stations also determines the sediment load in the water bodies, for this sample should take from the outflow and inflow of the gauging station.

Criteria for selection of the stream gauging station includes:

I. Straight and stable section of the water body should be preferred.

II. Backward flow should not affect the water level

III. Encompassing all important water courses.

11.3.13 Socio- Economic Monitoring

The Socio- Economic monitoring helps in finding out the pressure of the local communities on the wetland. Hence, the conditions of the local communities their livelihood and their dependency on the wetland should be monitored on regular basis. Another aspect of Socio- economic monitoring includes tourism pressure with the help of competent authorities.

11.4 TRAINING

Modern conservation techniques and management policies help to achieve the better results and this would only possible if the monitoring of the different parameters of the wetland will be carried out with increased understanding and the awareness. Therefore, it is essential to conduct the regular

training programs which improves the knowledge of the field staff members, decision makers, community groups and local NGOs.

Box 3: The Ramsar Convention

The Convention on Wetlands of International Importance, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. Negotiated through the 1960s by countries and non-governmental organizations that were concerned at the increasing loss and degradation of wetland habitat for migratory water birds, the treaty was adopted in the Iranian city of Ramsar in 1971 and came into force in 1975. It is the only global environmental treaty that deals with a particular ecosystem, and the Convention's member countries cover all geographic regions of the planet.

Source: http://www.ramsar.org/cda/ramsar/display/main/main.jsp?zn=ramsar&cp=1_4000_0__

There are different areas where training helps the staff:

I. Expertise training should be provided for identification of wildlife, water birds assessment, turtle population survey, wildlife health assessment, research and monitoring. It will help in monitoring habitat, biology and ecology of the species.

II. Identification and Knowledge of flora and fauna in and around the wetland

III. Special training should be provided for analysis and interpretation of the data collected for use at different levels.

Chapter 12

ORGANISATION AND ADMINISTRATION



12.1 STRUCTURE AND RESPONSIBIITIES

Being a wetland and Ramsar site Surinsar Mansar will have different organization and structure. The main responsibility of Management of Surinsar Mansar Wetland will be with the management committee of this area. However, the department will play a role of facilitation and support to the Management Committee. Chief Wildlife Warden (CWLW) will have important role to approve the necessary plan of actions and periodic review of functioning of wetlands in the light of main management objectives of Surinsar and Mansar. While Range Officer is the part of management committee as member secretary, DFO (Wildlife, Kathua) will be the Chief Executive of the programme and a representative of CWLW in the field for frequent guidance and support to the management committee. It is proposed that a local sub-committee under the management committee may be created with the following constitution:

1. Divisional Forest Officer (Kathua Forest division)- **Chairman & Chief Executive.**

2. Range Officer (Surinsar- Mansar Wetland) – **Member Secretary.**

3. Assistant Engineer – **Member**

4. Manager, SMDA facility- **Member.**

5. One/ Two representative(s) of the local villages by rotation- **Member.**

This committee will discuss immediate issues regarding water drainage and reduction of water level during high monsoon so that minimal disturbance could be caused to the resident birds and turtles. Such events often need quick decisions and can be sorted out by the officers and staff present on site. Day to day issues regarding tourism and development management may also be sorted through this platform. Most of the members of the committee being located at nearby areas can be called for emergency meetings to resolve such issues of immediate concern.

The committee must meet at least twice every year, once before the onset of monsoon and once before the onset of main tourism season of winters besides the emergency meetings which may be convened as and when required. Necessary notification for the constitution of the committee may be issued by the relevant authority of the state Govt.

The administrative set up of Kathua Wildlife Division is given in Annexure 7.

12.1.2 Administrative structure

As mentioned earlier Surinsar Mansar is managed under Kathua Wildlife Division as the head of operation and a range officer is posted with a main office in Mansar who is assisted by two foresters (1 in Mansar, 1 in Surinsar), beat officer and several forest guards.

Looking at the importance of the Surinsar –Mansar wetland and its potential and development as a major center of conservation education, ecotourism these two wetlands deserve a greater attention and consequently it is proposed to be headed by an Assistant Conservator of Forest (SDO) level officer. It will not only provide the much needed undivided attention for the wetlands from a reasonable senior officer, but also help the forest guard training programs. Besides the regular managerial duties, it is expected that SDO would be able to network with the schools and other educational and training institutions of the region particularly those in and around as well as in the nearest town of importance viz. Samba, Jammu etc.

12.2 VEHICULAR INFRASTRUCTURE DEVELOPMENT

There is an urgent need for procurement of vehicles at both Surinsar and Mansar. There is a need of four-wheel field vehicle (Bolero/Jeep etc.) which would help in the mobility of the staff and help in better protection and better coordination with other agencies. In addition, a motor boat with outboard engine for movement of staffs in the water-body is needed for patrolling and executing the habitat management activities. A minibus is also required at each wetland for two purposes. It would help in organizing conservation education events for schools at Surinsar Mansar. It would also be helpful to the forest guard training school in conducting their tours.

12.3 STAFF AMENITIES

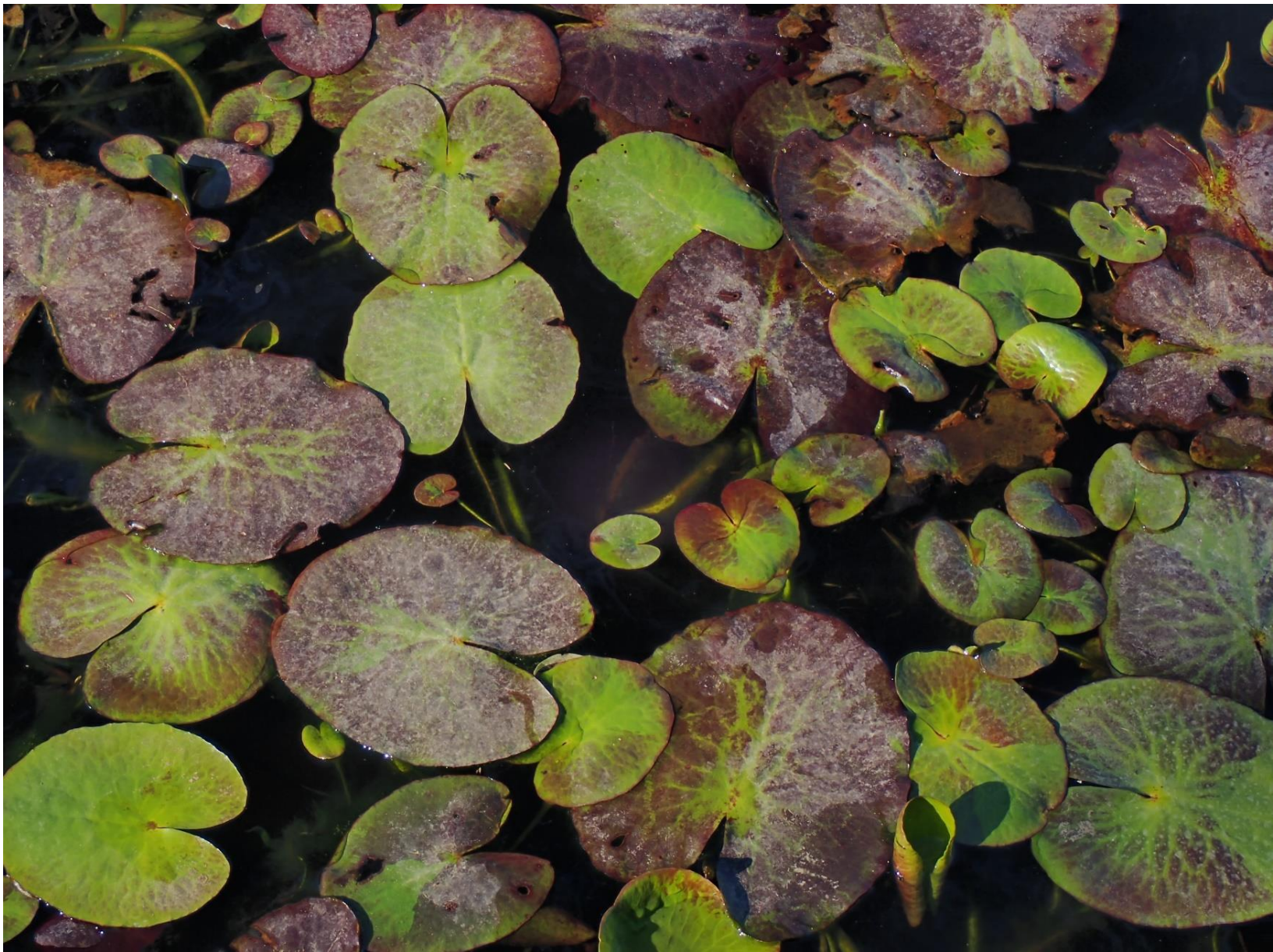
At present infrastructural facilities or amenities for the field staff is inadequate and need to improve. Staffs can be trained and appointed following the Govt. recruiting procedures from the local areas who has sound knowledge about the place. The lakes are quite big and it certainly needs more number of staffs that can patrol and take care of these two lakes more frequently and thoroughly. These would ensure the habitat management, species protection around these two lakes and also reduce unwanted interference caused by tourists, if they are trained properly. Following amenities & facilities should be provided to the staffs.

A. Housing- There is a need of regular type IV house for the proposed post of ACF. The existing housing for the remaining staff needs regular maintenance.

B. Medical facilities- Proper Govt. and medical facilities are in serious dearth around these two wetlands. There is an utmost need to maintain proper first aid kit facilities both in Mansar as well as Surinsar. This would not only help the staff but also tourists in any unforeseen emergency situation.

Chapter 13

SPECIFIC PRESCRIPTION ON ALL THREE RAMSAR SITE CRITERIA



Specific recommendations on the criteria based on Information Sheet of Surinsar Mansar on Ramsar Wetland Criterion (2005) are as following-

Criteria 2:

The criteria 2 of Ramsar notification sheet had mentioned two species of softshell turtles, *Nilssonia gangetica* and *Lissemys punctata*. Beside these two softshell species, the present survey had also recoded three additional hardshell species of turtles viz. *Pangshura tecta*, *Pangshura smithii* and *Pangshura tentoria*. Of which *Pangshura tentoria* or Indian tent turtle is the first record for Jammu and Kashmir UT (Banerjee & Das, 2020). These species include Near Threatened (NT) species *P. tecta, P. smithii, P. tentoria* according to IUCN red list 2017.

A detail of these species account has been provided in Chapter 2; Section 2.8.2.3; Pg. no-. 36-49.

The specific recommendation for long-term management turtle population is as follows-

1. Immediate securing of all the basking and nesting areas must be done. All these areas should be declared as 'No Trespassing' zone.

2. Additional area may be reclaimed and developed as a turtle basking and nesting habitat as suggested in pg. no. 121-122.

3. Monitoring of turtles may be conducted as per detailed methodology delineated in chapter 9; Section 9.3; Pg. no. 124-126.

4. Turtle underpass should be modified and maintained as per given suggestions in Chapter 9; Pg. no. 119.

5. Buffer area of 50m maintaining 'no disturbance zone' may be provided for nesting activities.

6. Appropriate signages may be displayed for awareness activities.

7. Competition for ecological resources may be minimized by removing exotic carps from the wetlands.

8. Periodical monitoring of water quality as prescribed under chapter 2; pg. no. 39 to reduce the chance of any infection or disease, must be implicated.

9. Ex-situ management of turtle eggs and hatchlings may also be envisaged for achieving long term viability of the population (pg. 123).

Criterion 3:

During our survey period we did not encounter the rare medusa. There is possibility of the medusa being extinct from its previous known spot 'Mansar lake'. The estimation of phytoplankton and zooplankton were not enlisted in WII's initial project goal.

Criterion 4:

Out of 19 waterfowl and water bird species mentioned, 11 species have been recorded during our survey. Additional important wetland species such as Great cormorant (*Phalacrocorax carbo*), Little cormorant (*Microcarbo niger*), Indian pond heron (*Ardeola grayii*), Black crowned night heron (*Nycticorax nycticorax*), White-breasted waterhen (*Amaurornis phoenicurus*), Grey heron (*Ardea cinerea*), have also been documented during the survey.

However, all these species recorded are not in large number or in migratory flocks. This might be an outcome of absence of floating vegetation essential for their roosting and breeding. The details on this is further discussed in Chapter 2; sec- 2.8.2.1; Pg. 27-31. More number of long-term surveys are needed to check if there is any migratory flocking happening around the year specially during winters.

Suggested proposal for Biodiversity Heritage Site

Mansar and Surinsar lake is home to one of the largest softshell turtle species i.e. *Nilssonia gangetica* and its confirmed presence from the UT has only been restricted to these two lakes (Das I, 1995; Verma AK, Sahi DN, Gupta VK (1999) Observation on the nesting of Gangetic soft shelled turtle *Aspideretes gangeticus* Cuvier (Chelonia: Trionychidae) in lake Mansar in Indian Shivalik, J&K State. J Ecobio 11(2):137–143). This is also the westernmost distribution for this softshell species which are mainly found in Gangetic river systems.

These two twin lakes are also reservoir to the last remaining population of local /native fish species that are important contributors to the food cycle of higher vertebrates such as water birds, turtles, aquatic snakes etc.

The middle island in Surinsar holds a geological importance and serves important habitat for migratory water birds, and also a secure basking sites of turtles.

So for future conservation approach if the suggested mitigation plans can be followed or implemented properly then these two wetlands may be considered as 'Biodiversity Heritage Site' given its uniqueness in terms of the diversity of species.

Chapter 14

THE BUDGET



A. Budget provision for Habitat Management

S.L No.	ITEM OF WORK	COST IN YEARS (LAKHS) (2023-2034)										TOTAL COST
		Yr. I	Yr. II	Yr. III	Yr. IV	Yr. V	Yr. VI	Yr. VII	Yr. VIII	Yr. IX	Yr. X	
1.	Weed management	3	3	3	2	2	3	3	3	2	2	26
2.	Relocation/ periodic removal of exotic carps	15	15	10	10	10	10	8	8	8	8	102
3.	Habitat improvement for birds	3	3	3	2	2	2	1	1	1	1	19
4.	Artificial basking site for turtles & maintenance	5	5	3	2.5	2	2	2.5	2.5	2	2	28.5
5	Provision of Turtle Passage	10	10	15	15	15	10	5	5	5	5	95
6.	Protection of turtle nesting sites	1	1	2	1	2	1	1	1	1	1	12
7.	Mudflat revival and mud bank reinforcement	4	4	6	6	6	6	4.5	4.5	4	3	48
8.	Catchment area treatment of lake bufferzones	4	7	6.5	6.5	5	5	7	7	5	5	58
9.	Acquisition of land for expansion of Turtle Breeding grounds	0	5	35	55	35	0	0	0	0	0	130
10	Improvement of Exit/inlet Channel and provision for maintenance along with desilting	10	2	15	15	2	2	7	2	2	7	64
11	Filling of good earth soil in Turtle Hatching ground	3	5	5	2	2	3	3	2	2	2	29
GRAND TOTAL		58	60	103.5	117	83	44	42	36	32	36	611.5

B. Budget provision for protection theme plan

S.L No.	ITEM OF WORK	COST IN YEARS (LAKHS) (2023-2034)										TOTAL COST
		Yr. I	Yr. II	Yr. III	Yr. IV	Yr. V	Yr. VI	Yr. VII	Yr. VIII	Yr. IX	Yr. X	
1	Boundary demarcation and maintenance by way of animal proof fencing	10	20	20	20	20	5	5	5	5	5	115
2.	Fencing of specified areas within bufferzone & maintenance	4	4	4	4	4	2	2	2	2	2	30
3.	Patrolling Operation	9	9	9	10	10	10	2	2	15	13	89
4.	Entry Regulation & maintenance by way of visitors record keeping/registration	2	2	2	1	1	1	0.5	0.5	0.5	0.5	11
GRAND TOTAL		25	35	35	35	35	18	9.5	9.5	22.5	22.5	245

C. Budget Provisions for Ecotourism and Interpretation

S.L No.	ITEM OF WORK	COST IN YEARS (LAKHS) (2023-2034)										TOTAL COST
		Yr. I	Yr. II	Yr. III	Yr. IV	Yr. V	Yr. VI	Yr. VII	Yr. VIII	Yr. IX	Yr. X	
1.	Interpretation Center	20	30	40	30	25	25	25	25	15	15	250
2.	Signages around lake shore cover(Posters, Brochure, Boards)	2	2	4	8	2	5	2	5	2	5	37
3.	Highway Signages	5	5	6	6	6	5	5	5	5	5	53
4.	Nature camps	5	5	7	7	9	9	5	5	5	5	62
5.	Training of Nature Guides	3	3	3	3	3	3	3	3	3	3	30
6.	Awareness and outreach programmes	2	2	3	3	3	4	2	4	2	4	29
7.	Society registration for each Lake: Seed money for livelihood through society registration	5	6	8	8	10	10	12	12	15	15	101
GRAND TOTAL		42	53	71	65	58	61	54	59	47	52	562

D. Budget Provisions for Research, Monitoring & Training

S.L No.	ITEM OF WORK	COST IN YEARS (LAKHS) (2023-2034)										TOTAL COST
		Yr. I	Yr. II	Yr. III	Yr. IV	Yr. V	Yr. VI	Yr. VII	Yr. VIII	Yr. IX	Yr. X	
1.	Biodiversity Monitoring (Turtle, birds, fish population)	5	25	20	20	10	10	8	8	8	8	122
2.	Environmental and social monitoring (Water quality, Bathymetry, Meteorological, Socio- Economic	5	15	25	15	15	10	10	10	10	10	125
3.	Research on turtle breeding, migratory bird and aquatic fauna	5	15	25	15	5	10	10	10	10	5	110
4.	Training (Staff, Guides, Learning center)	10	10	10	5	5	8	8	8	5	5	74
GRAND TOTAL		25	65	80	55	35	38	36	36	33	28	431

E. Budget provision for Organization and Administration

S.L No.	ITEM OF WORK	COST IN YEARS (LAKHS) (2023-2034)										TOTAL COST
		Yr. I	Yr. II	Yr. III	Yr. IV	Yr. V	Yr. VI	Yr. VII	Yr. VIII	Yr. IX	Yr. X	
1.	Vehicles (quick response jeep, Rescue boat, Emergency ambulance)	2	13	2	17	2	3	17	2	3	3	64
2.	Housing and Staff Welfare (Type IV hous, Maintenance of ranger's office, First Aid Kit, Medical center.)	3	5	3	4	30	7	3	4	10	3	72
GRAND TOTAL		5	18	5	21	32	10	20	6	13	6	136

TOTAL PROPOSED BUDGET for year 2023-24 to 2033-34 (In Lakhs)

(A+B+C+D+E)= (611+245+562+431+136)= 1985.5

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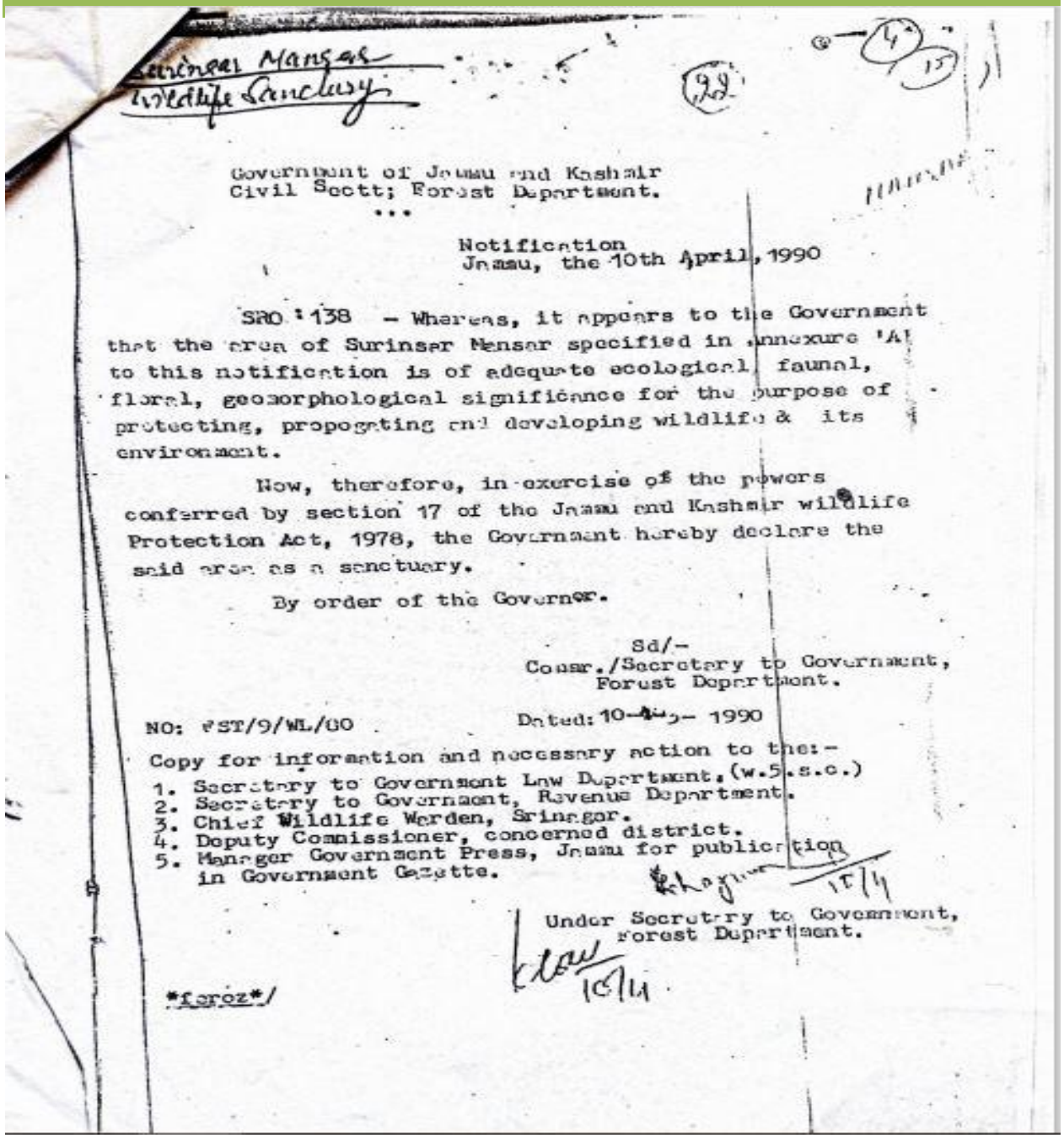
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Appendix 1: Government notification for declaration of Surinsar Mansar as a Wildlife Sanctuary



Surinsar Mansar
Wildlife Sanctuary

99

Government of Jammu and Kashmir
Civil Secttt; Forest Department.

...

Notification
Jammu, the 10th April, 1990

SRO : 138 – Whereas, it appears to the Government that the area of Surinser Mansar specified in Annexure 'A' to this notification is of adequate ecological faunal, floral, geomorphological significance for the purpose of protecting, propogating and developing wildlife & its environment.

Now, therefore, in exercise of the powers conferred by section 17 of the Jammu and Kashmir Wildlife Protection Act, 1978, the Government hereby declare the said area as a sanctuary.

By order of the Governor.

Sd/-
Comsr./Secretary to Government,
Forest Department.

NO: FST/9/WL/80 Dated: 10-4-90 1990

Copy for information and necessary action to the:-

1. Secretary to Government Law Department, (w.5.s.c.)
2. Secretary to Government, Revenue Department.
3. Chief Wildlife Warden, Srinagar.
4. Deputy Commissioner, concerned district.
5. Manager Government Press, Jammu for publication in Government Gazette.

12/4

Under Secretary to Government,
Forest Department.

10/4

feroz/

Continued...

STATUS SURVEY REPORT OF THE PROPOSED SURINSAR MANSAR WILDLIFE SANCTUARY.

...

Annexure- 'A'

NOMENCLATURE:

The proposed Sanctuary has been named after two sacred lakes, situated at its two corners, sixteen kilometres aparts.

Easy accessibility and aesthetic, ecological, faunal and floral significances of the area makes it fit to be declared as a Wildlife Sanctuary. The inhabiting fauna and deteriorted habitat due to over grazing need immediate and adequate attention to revive both.

SITUATION:

The tract is situated between river Tawi in the north and north-west, Udhampur Samba road in South East, with the two lakes located at two extremities; Surinsar in North west and Mansar in South-east.

BOUNDARIES:

North	-River Tawi.
East	-Udhampur Samba road and Gombir Khad.
South-East	-Bottal-Balour road and Mansar lake.
South-west	-Surinsar Mansar road.
North-west	-River Tawi and Surinsar lake.

AREA AND LIMITS:

The area of interest is spread over 97.82 sq.kms., and is roughly rectangular in shape. It comprises of compartments 7,9,11,12,13,14 and 15, of Mansar block.

The proposed tract is located on G.T. Sheet NO: 43 P/1 (Surveyed in 1961-62 1st edition) now 43 P/2 (Surveyed in 1967-68 -2nd edition).

The area experiences the altitudinal range between 547 to 834 m.above M.S.L.

It lies between $32^0.41'.29"$ to $32^0.49'.28"$ north latitude and $74^0.59'.54"$ to $75^0.091\ 12"$ east longitude.

The map of the area inquestion is enclosed.

APPROACHES:

The project area is quite accessible from Jammu by mettled road. Surinsar is 42 kms. from Jammu, whereas Mansar is 61 kms.via Samba, Surinsar is also approachable from Udhampur and is located at 38 kms. distance. A 16 kms. mettled roadlinks Mansar with Surinsar,running along southern boundry of the area.

Contd...2...

Continued...

LEGAL STATUS:

The area of interest is a reserve forest and after its identification as a potentially viable wildlife area, it was agreed to notify it as a Wildlife Sanctuary vide Government Order NO: FST/20 of 1981, dated 4-2-1981. Presently the area is under the administrative and technical control of the Department of Wildlife Protection, which is protecting and propogating the life forms supported by the area, with the help of scientific management practices.

FLORA:

As per the Champion and Seth's classification the forest of this area are mixed scrub forest comprising mainly broad-leaved trees and shurbs, except in compartment 15, where chir (Pinus roxibergie) is predominent. Among broad-leaved species the principal species are Acacia modesta, A catechu, Lannea grandis, Mallotus philipenensis, Cassia fistuta, Zizyphus jujube, Delbergia sissoo, Rehlica officinale, Ficus benga lansis, F.Religosa and Bauhinia variegtia.

The under story includes Adhatoda vassica, Dodonea vesocsa, Cassia opaca. The dominant climber in these forests is Bauhinea vahillii.

FAUNA:

The Wildlife (mammls) of the area includes Goral, Wild boar, Barking deer, Jackal, Porcupine, Hare and Jungle cat.

Since the year 1980-81 the area is being managed by this department. Apart from affording protection to the wild populations of herbivo-res, the department has successfully bred to Sambar, Chetal and Indian Gazella in captivity, of which Sambar have been released in the release pens and are going well over there.

The area support diverse and rich avi-fauna of which most common species are Red Jungle fowl, pea fowl, Black partridge, grey partridge, Ringdove, Blue rock pigeon etc. The bird populations include both migratory and resident species, most of them are very rare.

Sd/-
Chief Wildlife Warden,
Jammu and Kashmir Government,
Srinagar.

feroz/

Appendix 2: Flora around Surinsar Mansar Sanctuary

Sl. No.	Common Name	Scientific Name
1.	Chir pine	*Pinus roxburghii*
2.	Plum pine	*Podocarpus* sp.
3.	Deodar	*Cedrus libani*
4.	Phulai	*Acacia modesta*
5.	Peepal	*Ficus religiosa*
6.	Banyan tree	*Ficus benghalensis*
7.	Hopbush Plants	*Dodonaea viscose*
8.	Amaltas/ Golden brush tree	*Cassia fistula*
9.	Cutch tree	*Acacia catechu*
10.	Indian Ash tree	*Lannea coromandelica*
11.	Indian rosewood/ Shesam	*Dalbergia sissoo*
12.	Mango tree	*Mangifera indica*
13.	Malu Creeper	*Bauhinea vahlii*
14.	Hornwort	*Ceratophyllum demersum*
15.	Indian rosewood	*Dalbergia sissoo*
16.	Indian gooseberry	*Emblica officinalis*
17.	Bamboo tree	*Bambusa* sp.
18.	Tut/ Mulberry	*Morus nigra*
19.	Bael	*Aegle marmelos*
20.	Amla	*Phyllanthus emblica*
21.	Cotton tree	*Bombax* sp.
22.	Orchid/ Mountain ebony/Kanchnar	*Bauhinia variegata*
23.	Fir	*Abies pindrow*
24.	Palash/ Sacred tree	*Butea monosperma*
25.	Bottlebrushes	*Callistemon* sp.

Appendix 3: Avifaunal checklist of Surinsar Mansar wetland during study period

Sl.No.	Species ID	Site Mansar	Site Surinsar
1	Alexandrine Parakeet	✓	✓
2	Ashy Prinia	✓	✓
3	Ashy Throated Warbler	✓	✓
4	Asian Koel	✓	✓
5	Black Faced Warbler	✓	✓
6	Black Kite	✓	✓
7	Black Throated Tit	✓	✓
8	Blue Throated Barbet	✓	✓
9	Blue Whistling Thrush	✓	✓
10	Blyths leaf warbler	✓	✓
11	Brown fronted woodpecker	×	✓
12	Brown Rock Chat	✓	✓
13	Rusty tailed Flycatcher	×	✓
14	Cattle Egret	✓	✓
15	Chestnut Bellied Nuthatch	✓	×
16	Cinereous Tit	✓	✓
17	Common Coot	✓	✓
18	Common Crow	✓	✓
19	Common Kingfisher	✓	✓
20	Common Moorhen	✓	✓
21	Common Myna	✓	✓
22	Common Pochard	×	✓
23	Common Tailorbird	✓	✓
24	Coppersmith Barbet	✓	×
25	Crimson Sunbird	✓	×
26	Eurasian Wigeon	✓	×
27	Gadwall	✓	×
28	Great Cormorant	✓	✓
29	Greater Coucal	×	✓
30	Greater Racket Tailed Drongo	✓	×
31	Grey Bushchat	✓	✓
32	Grey headed Barbet	✓	×
33	Grey Headed Canary Flycatcher	✓	✓
34	Grey Heron	✓	×
35	Grey Hooded Warbler	✓	×
36	Grey Hornbill	✓	✓
37	Grey Wagtail	✓	✓

38	Grey Winged Blackbird	✓	×
39	Himalayan Bulbul	✓	✓
40	Himalayan Griffon Vulture	✓	×
41	House crow	✓	✓
42	Khalij Pheasant	✓	×
43	Large billed crow	✓	✓
44	Lemon Rumped Warbler	✓	✓
45	Lesser whistling Duck	×	✓
46	Little Cormorant	✓	✓
47	Little Egret	✓	✓
48	Long tailed Shrike	✓	✓
49	Mallard	×	✓
50	Black Crowned Night Heron	✓	✓
51	Northern Shoveller	×	✓
52	Oriental Magpie Robin	✓	✓
53	Oriental Turtle Dove	✓	✓
54	Oriental White Eye	✓	✓
55	Palm Swift	✓	✓
56	Plum Headed Parakeet	✓	✓
57	Plumbeous Water Redstart	✓	✓
58	Pond Heron	✓	✓
59	Puff Throated Babbler	×	✓
60	Red Jungle Fowl	✓	×
61	Red Vented Bulbul	✓	✓
62	Red Wattled Lapwing	✓	✓
63	Rose Ringed Parakeet	✓	✓
64	Ruddy shelduck	✓	×
65	Rufous Bellied Niltava	✓	×
66	Rufous Breasted Accentor	✓	×
67	Rufous Treepie	✓	✓
68	Rusty tailed Flycatcher	✓	✓
69	Scaly Breasted Munia	✓	×
70	Spotted Dove	✓	✓
71	Spotted Owlet	✓	×
72	Slaty Blue flycatcher	×	✓
73	White Breasted Kingfisher	✓	✓
74	White Breasted Waterhen	✓	✓
75	White Browed wagtail	✓	✓
76	White capped bunting	✓	×
78	White Capped Water Redstart	✓	✓
79	White Throated Fantail	✓	✓
80	White Wagtail	✓	✓
81	Yellow Bellied Fantail	✓	×

Appendix 4: List of Ichthyofauna of Surinsar –Mansar wetland during study period

Sl. No.	Common Name	Scientific name	Location of find
1	Common carp	*Cyprinus carpio communis*	Mansar & Surinsar
2	Mirror Carp	*Cyprinus carpio specularis*	Mansar & Surinsar
3	Dari Kana/ Black line Rasbora	*Rasbora daniconius*	Surinsar
4	Zebra fish	*Danio reiro*	Surinsar
5	Punti	*Puntius chola*	Mansar & Surinsar
6	Twospot Barb	*Pethia ticto*	Mansar & Surinsar
7	Spotted Snake head fish	*Channa punctatus*	Mansar & Surinsar
8	Dwarf snake headed fish	*Channa gachhua*	Mansar & Surinsar

Appendix 5: **Herpetofauna encountered during study period**.

Group	Common Name	Scientific Name
Amphibia	Indian Bull Frog	*Hoplobatrachus tigerinus*
	Indian Skittering Frog	*Euphlyctis* cf. *cyanophlyctis*
	Cricket Frog	*Minervarya* sp.
	Common Indian Toad	*Duttaphrynus sp.*
Reptilia	Himalayan Ground Skink	*Asymblepharus himalayanus*
	House Gecko	*Hemidactylus* sp.
	Himalayan Agama	*Laudakia* sp.
	Oriental Garden Lizard	*Calotes* cf. *versicolor*
	Bengal Monitor Lizard	*Varanus bengalensis*
	Checkered Keelback	*Fowlea piscator*
	Rat snake	*Ptyas mucosa*
	Gangetic Softshell Turtle	*Nilssonia gangetica*
	Indian Flapshell Turtle	*Lissemys punctata*
	Indian Roofed Turtle	*Pangshura tecta*
	Indian Tent Turtle	*Pangshura tentoria*
	Brown Roofed Turtle	*Pangshura smithii*

Appendix 6: List of Odonates (Dragonflies & Damselflies) encountered during survey period.

Family	Species Id	Common Name
Libellulidae	*Orthetrum pruinosum*	Crimson-tailed Marsh Hawk
	Orthetrum Sabina	Slender skimmer
	Crocothemis servilia	Scarlet skimmer/Ruddy marsh skimmer
	Tramea basilaris	Red Marsh Trotter
	Orthetrum glaucum	Blue Marsh hawk
	Neurothemis tullia	Pied Paddy skimmer
Coenagrionidae	*Ischnura aurora*	Golden Dartlet
	Ceriagrion coromandelianum	Yellow waxtail
	Ischnura senegalensi	Marsh Bluetail

Appendix 7: List of Butterflies of Surinsar Mansar Wetland

Family	Species Id	Common Name
HESPERIDAE	*Burara oedipodea*	Branded Orange Awlet
	Hasora chromus	Common Banded Awl
PAPILIONIDAE	*Pachliopta aristolochiae*	Common Rose
	Papilio bianor	Common Peacock
	Papilio polytes	Common Mormon
	Graphium sarpedon	Common Bluebottle
	Graphium doson	Common Jay
	Delias eucharis	Common Jezebel
	Catopsilia pomona	Common Emigrant
LYCAENIDAE	*Tarucus nara*	Striped Pierrot
	Talicada nyseus	Red Pierrot
NYMPHALIDAE	*Parantica aglea*	Glassy Tiger
	Danaus chrysippus	Plain Tiger
	Euploea core	Common Crow
	Phalanta phalantha	Common Leopard
	Acraea violae	Tawny Coster
	Junonia lemonias	Lemon Pansy
	Junonia almana	Peacock Pansy
	Kallima inachus	Orange Oakleaf
	Hypolimnas misippus	Danaid Eggfly
	Athyma perius	Common Sergeant

Appendix 8: Administrative set up with sanctioned staff strength of WL division, Kathua

S. No.	Category of Post	Pay Level	Sanctioned Strength	Working Strength
Gazetted				
1	Wildlife Warden	Level 8	1	1
2	Range Officer Gr- I	Level 6E	1	1
Gazzetted	**Total**		**2**	**2**
Non- Gazetted				
1.	Range officer Gr-II	Level 6	1	0
2.	Wildlife Forester	Level 5	4	5
3.	Senior Assitance	Level 5	1	0
4.	Junior Assistance	Level 4	2	0
5.	Deputy Foresters	Level 3B	1	0
6.	Wildlife/Anti-poaching guards	Level 2	30	4
7.	Watcher	Level 2	1	0
8.	Orderly	SL1	1	0
9.	Chowkidar	SL 1	1	1
10.	Helper	SL 1	26	32
Total Non- Gazetted			**68**	42
Total Strength			**70**	**44**

Appendix 9: List of villages around Mansar-Surinsar WLS (Source: Shawl, 2005. Annual report)

S. No	Name of the Villages	Population Status				Distance from Sanctuary (in K.m.)
		Male	**Female**	**Young**	**Total**	
1	Mansar	89	94	235	418	0.5
2	Cherwa	40	46	130	216	0.5
3	Kakari	85	95	231	411	1
4	Morian Lehary	32	38	85	155	0.5
5	Sumwal	72	65	152	289	0.5
6	Karngal	45	58	120	223	0.3
7	Pathwar	35	42	115	192	0.5
8	Sagoon	70	76	242	388	1
9	Chenad	18	15	49	82	0.3
10	Ponthal	91	81	225	397	0.5
11	Surinsar	40	32	185	257	0.3
12	Jathly	35	32	109	176	0.5
13	Urkhal	41	44	95	180	0.5
14	Chilla	90	89	277	456	0.3
15	Barga	85	77	190	352	0.3
16	Dubir	30	32	64	126	0.5
17	Challana	34	38	57	129	0.3
Total		**932**	**954**	**2561**	**4447**	

Appendix 10: The financial outlay of developmental program proposal from2005-2010 in Mansar Surinsar wetland by Dept. of Wildlife Protection, Jammu & Kashmir.

(Rs. in lacs)

S.No.	Item of works	2005-06	2006-07	2007-08	2008-09	2009-10	Total
1	Awareness Programme and Conservation Oriented Tourism	10.00	10.00	10.00	10.00	10.00	50.00
2	Nature Interpretation Centre (2 Nos.)	-	25.00	25.00	-	-	50.00
3	Purchase of equipment	5.00	5.00	5.00	5.00	-	20.00
4	Water shed management	20.00	10.00	10.00	10.00	10.00	60.00
5	Desiltation	5.00	-	-	-	5.00	10.00
6	Const. of catch water drains	10.00	20.00	20.00	15.21	10.00	75.21
7	Outlet drains	-	5.00	9.70	-	-	14.70
8	Chainlink fencing	63.24	-	-	-	-	63.24
9	Silt traps in Nallahs	-	2.50	-	-	-	2.50
10	Nallah Training Works	-	5.00	-	-	5.40	10.40
11	Const. of crossing in paths (7 Nos.)	-	4.68	4.68	2.34	4.68	16.38
12	Const. of Deer Park at Surinsar	25.00	6.94	-	-	-	31.94
13	Feed, fodder and Engagement of staff for Deer and Aqua Parks	-	5.00	5.00	5.00	5.00	20.00
14	Ticket booth	-	2.00	-	-	-	2.00
15	Souvenir shop	-	-	8.00	-	-	8.00
16	Staff qtr. and Approach road at Surinsar	-	14.35	-	-	-	14.35
17	Setting up of Aqua park and field research lab.	-	25.00	25.00	-	-	50.00
18	Installation of bins	2.00	1.00	1.00	0.50	0.50	5.00
19	Purchase of boats	14.00	-	-	-	-	14.00
20	Purchase of animal rescue van and vehicles	-	15.00	-	-	-	15.00
21	Land acquisition	-	10.00	10.00	10.00	20.00	50.00
22	POL	1.00	1.00	1.00	1.00	1.00	5.00
23	Research and survey	5.00	5.00	5.00	5.00	5.00	25.00
24	Socio-economic & Eco-development	15.00	15.00	15.00	15.00	15.00	75.00
	Total	175.24	187.47	154.38	79.05	91.58	687.72

Total = Rs. 687.72 lacs.

Appendix 11: Information Sheet of Surinsar Mansar on Ramsar Wetland Criterion (2005)

Categories approved by Recommendation 4.7, as amended by Resolution VIII.13 of the Conference of the Contracting Parties.

Note for compilers:

1. The RIS should be completed in accordance with the attached *Explanatory Notes and Guidelines for completing the Information Sheet on Ramsar Wetlands*. Compilers are strongly advised to read this guidance before filling in the RIS.

2. Once completed, the RIS (and accompanying map(s)) should be submitted to the Ramsar Bureau. Compilers are strongly urged to provide an electronic (MS Word) copy of the RIS and, where possible, digital copies of maps.

Chief Wildlife Warden Jammu & Kashmir Govt.

2. Date this sheet was completed/updated:

1. Name and address of the compiler of this form:
World Wide Fund for Nature- India,
Seceretariat, 172-B, Lodi Estate
New Delhi- 110 003
Tel: 91(11)4616532, 4691760-62

With Inputs From:
S.D. Swatantra, IFS
January 2004

FOR OFFICE USE ONLY.
DD MM YY
Designation date
Site Reference Number

3. Country: INDIA

4. Name of the Ramsar site:
SURINSAR- MANSAR LAKE

5. Map of site included:
Refer to Annex III of the *Explanatory Note and Guidelines*, for detailed guidance on provision of suitable maps.

a) hard copy (required for inclusion of site in the Ramsar List): *yes* □ -or- *no*

b) digital (electronic) format (optional): *yes* □ -or- *no*

6. Geographical coordinates (latitude/longitude):
Mansar (32^0 45' N and 75^0 23' E) & Surinsar (32^0 46' N and 75^0 02' E)

7. General location:
Include in which part of the country and which large administrative region(s), and the location of the nearest large town.

Mansar lake is located about 35 km and Surinsar lake is located about 40 km both from Jammu, towards northeast under Udhampur District in the Jammu & Kashmir State. The Administration region is in Jammu.

8. Elevation: (average and/or max. & min.)	**9. Area:** (in hectares)
Mansar Lake 710 m & Surinsar Lake 605 m.	Mansar-329.40 ha & Surinsar-20.40 ha.

10. Overview:

Provide a short paragraph giving a summary description of the principal ecological characteristics and importance of the wetland.

Mansar and Surinsar Lakes have high significance for their religious importance. Apart from this, the lakes form an ideal habitat and breeding ground for many endangered and threatened avifauna and aqua fauna. Owing to their origin to the Mahabharata period, these lakes were separated by an aerial distance of 10 km. representing the typical micro-climate of the area. Therefore, they are treated as two components of one composite wetland. Considering their importance and threats confronted from increase tourist inflow and change in land-use pattern in the catchment area, the lakes have been declared as a part of the Surinsar-Mansar Wildlife Sanctuary.

11. Ramsar Criteria:

Circle or underline each Criterion applied to the designation of the Ramsar site. See Annex II of the *Explanatory Notes and Guidelines* for the Criteria and guidelines for their application (adopted by Resolution VII.11).

1 • 2 • 3 • 4 • 5 • 6 • 7 • 8

12. Justification for the application of each Criterion listed in 11. above:

Provide justification for each Criterion in turn, clearly identifying to which Criterion the justification applies (see Annex II for guidance on acceptable forms of justification).

Criterion 2:

The lake supports two important species of turtles namely Indian Flapshell Turtle (*Lissemys punctata)* registered in the CITES (Appendix II) and Indian Soft-shell Turtle (*Aspideretes gangeticus)* listed in CITES Appendix I and vulnerable in IUCN Redlist 2003.

Criterion 3:

The Mansar lake supports very rare medusae (*Mansariella lacustris*) besides a rich growth of Macrophytes in the shallow Littoral zone. The Lake has among the Phytoplanktons, 86 algal genera of 207 species. The dominant family is Chlorophyceae with 46 genera with 135 species. There are about 54 Zooplankton taxa in the lake freshwater, unique and rare to the region.

Criterion 4:

The Mansar lake is an ideal and attractive habitat for migratory waterfowl, such as *Fulica atra, Gaillinula chloropus, Podiceps nigricollis, Aythya fuligula, Aythya ferina* and *Podiceps cristatus, Anas querquedula , Anas strepera, Anas platyrhynchos, Anas clypeata* (Northern Shoveler), *Anus acuta, Anas penelope,* at a critical stage of there life cycle & also provides refuge during adverse conditions. Other common waterfowls found in the lake include Pond heron/*Ardeola grayii*, Yellow bittern/*Ixobrychus sinensis*, Large egret/*Ardea alba*, Little egret/*Egretta garzetta* , Teal/*Anas crecca, Tadorna ferruginea and Porphyrio porphyry.*

13. Biogeography (required when Criteria 1 and/or 3 and /or certain applications of Criterion 2 are applied to the designation):

Name the relevant biogeographic region that includes the Ramsar site, and identify the biogeographic regionalisation system that has been applied.

a) biogeographic region: 4A Semi Arid- Punjab Plains

b) **biogeographic regionalization scheme** (include reference citation): **Not available**

---

14. Physical features of the site:

Describe, as appropriate, the geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; downstream area; general climate, etc.

The Mansar Lake is a semi-oval shaped water body having an average width of 680 m and a depth of 37.8 m. At the centre supporting rich growth of Macrophytes in the shallow littoral zone, 86 Algal genera with 207 species supporting wide variety of aqua fauna, common water fowls.

The Surinsar Lake is oval shaped having maximum depth of 24.04 m. Max. length of 888 m and a breadth of 444 m with alkaline water (pH 7.2 to 8.9) having a small island located 40 km. The lake harbors a complete belt of varied macrophytic vegetation all along its banks. The lake also supports five species of Fish fauna. Both lakes are an attractive habitat for a wide variety of resident and migratory water fowls, rare small freshwater medusa are also found here.

Geologically the site is occupied by Sedimentaries of Siwalik Tertiary age. Lithlogically, the area comprises of light grey sand stone, subordinate clay, Calcareous and pebbly lenses. The soil is primarily shallow and immature.

The pH of the lake varies between 6.4 and 7.6 the Maximum in July and the minimum in September. The fluctuation in water level is about 2 m and tidal variations are minimum. The water is alkaline (pH 7.2 – 8.9).

The monsoon rains extent from July to September and average rain fall is around 1500 mm. The winters are usually dry with occasional rains in January. The summers are hot with an average atmospheric temperature ranging between 35^0C and 40^0 C. Thermal stratification is clearly discernible in the lake between 5 to 15 m. Depth and the secchi transparency exhibits a by-modal peak. The water is used for irrigation in the neighboring agricultural fields and vegetation is a source of green fodder for livestock. There is no permanent inlet or outlet though a temporary inlet is observable on the north eastern end. A manually constructed outlet in Surinsar towards the north west of the lake operates only when the water level reaches 24.05 m at the deepest point during rainy season. The margin of the lake is regular because DI value (Development of the shore line) is 1.28 to 1.29.

---

15. Physical features of the catchment area:

Describe the surface area, general geology and geomorphological features, general soil types, general land use, and climate (including climate type).

A submerged spring source within the lakebed has been reported. Surrounding area has mango tree groves backed by pine trees on the hill slopes. The soil is primarily shallow and immature. Catchment comprises of sandy conglomeratic soil with boulders and pebbles. The catchment area of Mansar is about 2000 ha. The catchment area of Surinsar is about 1000 ha.

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16. Hydrological values:

Describe the functions and values of the wetland in groundwater recharge, flood control, sediment trapping, shoreline stabilization, etc.

Surinsar lake is rain-fed, and has no permanent inlet or outlet. The maximum depth is 22.7m. Mansar lake is primarily fed by surface run-off and partially by mineralised water through paddy fields which gives rise to an inlet to the lake during the rainy season.

17. Wetland Types

a) presence:

Circle or underline the applicable codes for the wetland types of the Ramsar "Classification System for Wetland Type" present in the Ramsar site. Descriptions of each wetland type code are provided in Annex I of the *Explanatory Notes & Guidelines*.

Marine/coastal: A • B • C • D • E • F • G • H • I • J • K • Zk(a)

Inland: L • M • N • O • P • Q • R • Sp • Ss • Tp Ts • U • Va • Vt • W • Xf • Xp • Y • Zg • Zk(b)

Human-made: 1 • 2 • 3 • 4 • 5 • 6 • 7 • 8 • 9 • Zk(c)

b) dominance:

List the wetland types identified in a) above in order of their dominance (by area) in the Ramsar site, starting with the wetland type with the largest area. **O.**

18. General ecological features:

Provide further description, as appropriate, of the main habitats, vegetation types, plant and animal communities present in the Ramsar site.

There is rich growth of macrophytes in the shallow littoral zone. Among the emergent macrophytes are *Typha angustata, Polygonum barbatum, P. flaccidum, P. glabrum* and *Phragmites karka* are dominant. Others include *Cyperus difformis, C. distans, C. tenuispica, Eleocharis plantagineum, Ranunculus arvensis, R. sceleratus, Rumex dentatus, Scirpus acutangulus, S. articulatus, S. mucronatus, S. validus* and *Veronica anagallis* -–aquatick etc.

Floating species include *Nelumbo nucifera*. The submerged species include *Nymphoides hydrophylla, N. indicum, Chara sp., Hydrilla verticillata, Ceratophyllum demersum, Alisma plantago-aquatica, Equisetum diffusum, Najas indica, Itella sp, Potamogeton crispus, P. lucens, P. nodosus, P. pectinatus, P. perfoliatus* and *P. natans* etc.

Among the Phytoplankton, 86 algal genera with 207 species have been reported. The dominant family is Chlorophyceae with 46 genera and 135 species. Common and dominant phytoplankton species in Mansar and Surinsar lakes are *Cosmarium sp., Staurastrum sp, Scenedesmus sp, Pediastrum sp, Tetradron sp, Oscillatoria sp, Spirulina sp, Lyngbya sp, Fragilaria sp, Synedra sp, Nitzschia sp, Cymbella sp, Navicula sp, Gomphonema, sp, Cocconeis sp, Tabellaria sp, Ceratium sp, Peridinium sp, Ankistrodesmus sp. Sphaerocystis sp, Ulothrix sp, Euastrum sp, Merismopedia sp and Euglena sp.*

19. Noteworthy flora:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 12. Justification for the application of the Criteria) indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

Ipomoea carnea, Vallisnaria spiralis, Najas graminea, Typha angustifolia, Phragmites communis and *Sparganium erectum*.

20. Noteworthy fauna:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on

information provided in 12. Justification for the application of the Criteria) indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc., including count data. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

Mansar lake is an attractive habitat for migratory waterfowl. A 1989-90 count recorded the following species: *Fulica atra* (497) *Gallinula chloropus* (114) *Podiceps nigricollis* (56) *Aythya fuligula* (26) *Aythya ferina* (38) and *Podiceps cristatus* (3). Other common waterfowl include pond heron, yellow bitter, large egret, little egret and purple moorhen.

Puntius chonchonius, Channa gachua, Rasbora rasbora, Labeoa rohita and Trichogaster fasciatus constitute the common ichthyofauna of the lake. Other noteworthy species include *Danio rerio, Mastacembelus armatus, Ophiocephalus punctatus.*

About 54 zooplankton taxa belonging to Protozoa, Coelentrata, Copepoda, Ostracoda, Insecta and the dominant Rotifera and Cladocera have been recorded. Following fish species are also found in the lake.

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21. Social and cultural values:

e.g., fisheries production, forestry, religious importance, archaeological sites, social relations with the wetland, etc. Distinguish between historical/archaeological/religious significance and current socio-economic values.

The lakes are socially and culturally very significant as it owes its origin to the Mahabharata period and an important and popular tourist destination in Jammu region. The lakes have many temples around it and a fair is held every year. Although the lakes support a variety of fishes, however due to its religious significance, fishing is not encouraged. The catchment area of the lakes supports rich and varied vegetation prominent among them being *chir* and its subtropical associates.

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22. Land tenure/ownership:

(a) within the Ramsar site: Wildlife Department of J&K govt

(b) in the surrounding area: Forest and waste lands are owned by the state government and other areas are privately owned. Part of the land is owned by Dharamarth Trust which looks after the shrines of the lake embankment. The Wildlife Department of Jammu & Kashmir government. has constructed some wild animal enclosures on the western bank of the lake.

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23. Current land (including water) use:

(a) within the Ramsar site:

The lake is currently used for various purposes. The local people use the lake for irrigation of their agricultural fields, for bathing and bathing domestic animals. The Tourism Department uses the lake for promoting tourism by running motor boats and has raised many structures along the banks. There are a few temples around the lake and the offerings made in these temples also find their way into the lake.

(b) in the surroundings/catchment:

The lake and the catchment form a part of Mansar – Surinsar wildlife sanctuary and managed as per the principles of wildlife conservation, though the funds for the purpose are inadequate. The surrounding areas also have agricultural fields.

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24. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land (including water) use and development projects:

(a) within the Ramsar site: In the absence of a proper sewerage disposal system, all the waste flows down into the lake. The lake is also being used by the people for their bathing and cleaning of their animals. There also is a cremation ground on the bank of the lake the waste from which also flows down into the lake.

(b) in the surrounding area: Many structures have come up around the lake and in the catchment area during past few years. The Tourism Department has constructed a hotel along the bank and few private buildings have also come up. Changes in agricultural practices in the neighbouring fields have also contributed towards pollution of the lake.

25. Conservation measures taken:

List national category and legal status of protected areas, including boundary relationships with the Ramsar site; management practices; whether an officially approved management plan exists and whether it is being implemented.

Legally the lake and surrounding areas form a part of Mansar – Surinsar Wildlife sanctuary and the management of the area is carried out according to different management plans proposed for the area.

26. Conservation measures proposed but not yet implemented:

e.g. management plan in preparation; official proposal as a legally protected area, etc.

The management plan for maintenance and the development of the lake is prepared annually under centrally sponsored schemes "Development of National Parks and Wildlife Sanctuaries". However, comprehensive management plan shall be prepared once the lake is included amongst the Ramsar list and fund is received.

27. Current scientific research and facilities:

e.g., details of current research projects, including biodiversity monitoring; existence of a field research station, etc. Scientific research is carried out by the Department of Wildlife Protection in collaboration with the Department of Environment and Remote Sensing of Jammu University.

28. Current conservation education:

e.g. visitors' centre, observation hides and nature trails, information booklets, facilities for school visits, etc.

The lake receives a large number of visitors throughout the year, especially when the annual fair is held. The information booklet giving details about the lake and its surrounding areas is published and circulated by the Wildlife Protection Department. The surrounding area has a tourism bungalow of Jammu and Kashmir Tourism Department and an inspection hut of Public Works Department.

29. Current recreation and tourism:

State if the wetland is used for recreation/tourism; indicate type(s) and their frequency/intensity.

The wetland is used extensively for recreational purposes by a large number of tourists including school children throughout the year. It is an important tourist destination in Jammu region.

30. Jurisdiction:

Include territorial, e.g. state/region, and functional/sectoral, e.g. Dept of Agriculture/Dept. of Environment, etc.

The lake and its surrounding area falls in Udhampur District and are a part of Mansar – Surinsar Wildlife Sanctuary which is administratively controlled by Chief Wildlife Warden, Jammu & Kashmir Govt.

31. Management authority:

Provide the name and address of the local office(s) of the agency(ies) or organisation(s) directly responsible for managing the wetland. Wherever possible provide also the title and/or name of the person or persons in this office with responsibility for the wetland.

Wildlife Warden
Kathua, Dist. Kathua
Jammu Province (J&K)
Phone : 01922-34622, 544575

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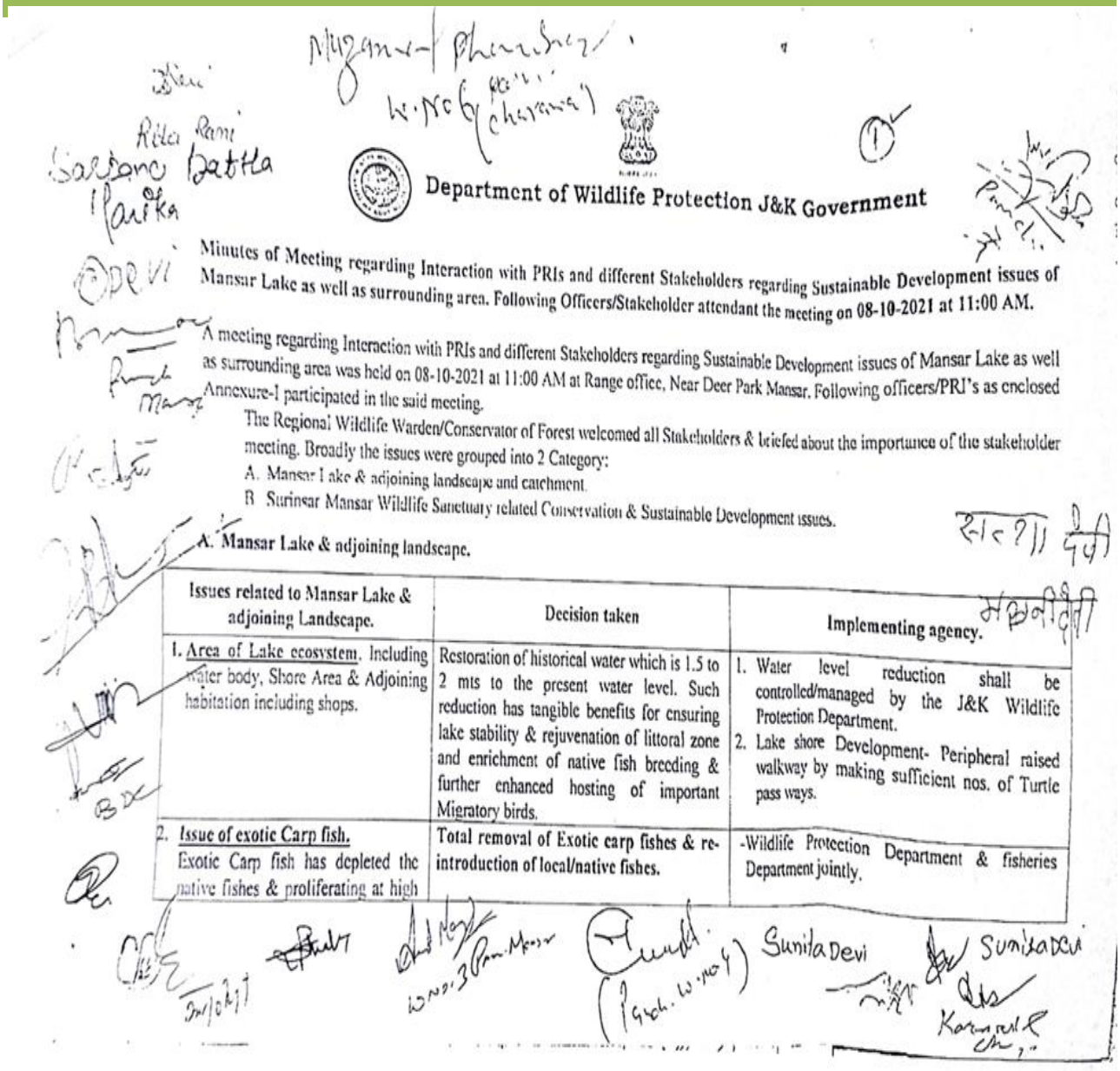
32. Bibliographical references:

scientific/technical references only. If biogeographic regionalization scheme applied (see 13 above), list full reference citation for the scheme.

Malhotra. Y.R. *et.al.* (1990). Ecology of lake Mansar with emphasis on conserving fish and wildlife population endangered by creation of recreational tourist and other human interference in the area. Department of Environment, Government of India.

W.W.F.- India's Handbook of Wetland Management, published by Avenash Datta for W.W.F.-India, New Delhi, August, 1995.

Appendix 12: Minutes of meeting conducted in Mansar by forest department with stakeholders



Department of Wildlife Protection J&K Government

Minutes of Meeting regarding Interaction with PRIs and different Stakeholders regarding Sustainable Development issues of Mansar Lake as well as surrounding area. Following Officers/Stakeholder attendant the meeting on 08-10-2021 at 11:00 AM.

A meeting regarding Interaction with PRIs and different Stakeholders regarding Sustainable Development issues of Mansar Lake as well as surrounding area was held on 08-10-2021 at 11:00 AM at Range office, Near Deer Park Mansar. Following officers/PRI's as enclosed Annexure-I participated in the said meeting.

The Regional Wildlife Warden/Conservator of Forest welcomed all Stakeholders & briefed about the importance of the stakeholder meeting. Broadly the issues were grouped into 2 Category:

A. Mansar Lake & adjoining landscape and catchment.

B. Surinsar Mansar Wildlife Sanctuary related Conservation & Sustainable Development issues.

A. Mansar Lake & adjoining landscape.

Issues related to Mansar Lake & adjoining Landscape.	Decision taken	Implementing agency.
1. Area of Lake ecosystem. Including water body, Shore Area & Adjoining habitation including shops.	Restoration of historical water which is 1.5 to 2 mts to the present water level. Such reduction has tangible benefits for ensuring lake stability & rejuvenation of littoral zone and enrichment of native fish breeding & further enhanced hosting of important Migratory birds.	1. Water level reduction shall be controlled/managed by the J&K Wildlife Protection Department. 2. Lake shore Development- Peripheral raised walkway by making sufficient nos. of Turtle pass ways.
2. Issue of exotic Carp fish. Exotic Carp fish has depleted the native fishes & proliferating at high	Total removal of Exotic carp fishes & re-introduction of local/native fishes.	-Wildlife Protection Department & fisheries Department jointly.

D.iv) Early execution of Light benches and dust bin by Tourism Department (2)

rate due to absence of natural predator which has very serious consequences on lake shore eco-system including degradation of literal zone.	-Prevention of commercial Atta feeding to the fishes by visitors.	-Restoration/Re-introduction of native/local fishes as advised by WII. -Wildlife Protection Department & Surinsar-Mansar Development Authority/Police Department.
3. Lake Water quality. -As of now major water quality parameters are well within the permissible limit. However, Ranges will we in the higher sides of the permissible limit if concertation measures are not taken. The water quality may lead to hazardous level. - The filtration/residual of the filtration plant of Jal Shakti Department is entering back in Mansar lake which is posing thrent to water quality due to Eutrophication.	-Prevention of Pollution & further improvement of water quality by construction of bypass drainage cum off channels & further diversion of effluent of water treatment plant. Construction of STPs. - Ecofriendly disposal of household wastes. - Regulation of Noise & light Pollution near lake and focuses of light should be away from lake area.	-Pollution monitoring by JKPC Committee -Installation of STP, operation, maintenance, bypasses, runoff by SMDA & Wildlife Protection Department. -Soakage Pit by Rural Development Department. -Ban on use of Polythene by JKPCC & Revenue Authorities & PRIs. -Enforcement by Wildlife Protection Department, Police Department & PRIs. -Light & Sound Pollution regulation by Tourism Department, SMDA & monitoring by Wildlife Protection Department.
4. Lake Landscape & Species Restoration. Apart from littoral restoration zone, & lake ecosystem restoration by having sufficient turtle passage ensuring proper drainage & removal of obnoxious weeds & timely.	-Restoration zone, & lake ecosystem restoration by having sufficient turtle passage ensuring proper drainage & removal of obnoxious weeds & timely.	By SMDA, Tourism & Wildlife Protection Department.
5. Preparation & approval of Mansar Development Rejuvenation.	-SMDA & Directorate of Tourism to get necessary Forest & Wildlife Clearance & any other clearance in vogue instead of piecemeal development.	-Tourism Department & SMDA.
6. Institution of Register Societies. Like home stays, Traditional cuisines & Community participation.	-With participation of PRIs and local Community participation.	PRIs & Youth clubs & NGO including Civil Society to get registeration. Wildlife Protection Department to assist for same.

D.vii) Overflow water be provided for common cremation ground. (3)

D.viii) Initiative for shifting of common cremation ground

7. Infrastructure : By SMDA & Tourism. By PDD. By Jal Shakti. By PWD. By Rural Development Department.	-Development of infrastructure By SMDA & Tourism, PDD, Jal Shakti, PWD, by Rural Development Department in consultation with Wildlife Protection Department.	-By SMDA & Tourism, PDD, Jal Shakti, PWD, by Rural Development Department in consultation with Wildlife Protection Department.
8. Surinsar-Mansar Wildlife Clearance & requires Wildlife & Forest Clearance except under FRA: Adequate importance to be given at the time of formulate of Plan & phasing of the project keeping in consideration the Wildlife clearance & Forest Clearance. Provides as well as cost of clearance as part of DPR.	-Adequate importance to be given at the time of formulate of Plan & phasing of the project keeping in consideration the Wildlife clearance & Forest Clearance. DPR to have adequate provision for environmental cost component.	-Respective Implementing Agencies.

Demands:- D.vi) Demarcation of lake surrounding area may be up-to 30m.

D.ii) Bawli repair & renovation, pond construction to be taken up

Wildlife Department.

D.iii) Playground ~~Structures~~ near Mansar to decided based on title ownership basis after demarcation.

D.iii) Link path / T-roads construction may be allowed to be constructed, if not inspection path be made.

D.iv) Simplify forest / wildlife clearance or NOC for PRI infrastructure

D.v) To acquire ownership lands near road for lake shore improvement

Scanned with CamScanner

Appendix 13: Minutes of meeting conducted in Surinsar by forest department with stakeholders

Department of Wildlife Protection J&K Government

Minutes of Meeting regarding Interaction with PRIs and different Stakeholders regarding Sustainable Development issues of Surinsar Lake as well as surrounding area. Following Officers/Stakeholder attendant the meeting on 07-10-2021 at 11:00 AM.

A meeting regarding Interaction with PRIs and different Stakeholders regarding Sustainable Development issues of Surinsar Lake as well as surrounding area was held on 07-10-2021 at 11:00 AM at Inspection Hut Surinsar. Following officers/PRI's as enclosed Annexure-I participated in the said meeting.

The Regional Wildlife Warden/Conservator of Forest welcomed all Stakeholders & briefed about the importance of the stakeholder meeting. Broadly the issues were grouped into 2 Category:

A. Surinsar Lake & adjoining landscape.

B. Surinsar-Mansar & related Conservation & Sustainable Development issues.

A. Surinsar Lake & adjoining landscape

Issues related to Surinsar Lake & adjoining Landscape.	Decision	Implementing agency.
1. Area of Lake ecosystem. Including water body, Shore Area & Adjoining Agricultural fields.	Restoration of historical water which is 1.5 to 2 mts to the present water level. such reduction has tangible benefits for ensuring lake stability & rejuvenation of littoral zone and enrichment of native fish breeding & further enhanced hosting of important Migratory birds.	1. Water level reduction- by the J&K Wildlife Protection Department. 2. Lake shore Development- Peripheral raised walkway by making sufficient nos. of Turtle pass ways.
2. Removal of exotic Carp fish. Exotic Carp fish has depleted the native fishes & proliferating at high rate due to absence of natural	Total removal of Exotic carp fishes & re-introduction of local/native fishes. Prevention of commercial atta feeding to the fishes by visitors.	-Wildlife Protection Department & fisheries Department jointly. -Re-introduction of native/local fishes as advised by WII.

enemy which has very serious consequences on lake shore eco-system.		-Wildlife Protection Department & Surinsar-Mansar Development Authority/Police Department.
3. Lake Water quality. As of now major water quality parameters are well within the permissible limit However, Ranges will we in the higher sides of the permissible limit if concertation measures are not taken. The water quality may lead to hazardous level.	-Prevention of Pollution & further improvement of water quality by construction of bypass drainage cum off channels & further diversion of effluent of water treatment plant Construction of STPs. -Regulation of Noise & light Pollution near lake and focuses of light should be away from lake area. Ecofriendly disposal of household wastes.	-Pollution control by JKPC Committee. Installation of STP, operation, maintenance, bypasses, runoff by SMDA & Wildlife Protection Department. -Soakage Pit by Rural Development Department. -Ban on use of Polythene by JKPCC & Revenue Authorities & PRIs. -Enforcement by Police Department & PRIs. Panchayat & SMDA location should be outside Wildlife Sanctuary. -Light & Sound Pollution regulation by Tourism Department, SMDA & monitoring by Wildlife Protection Department.
4. Lake Landscape & Species Restoration. Apart from littoral restoration zone, & lake ecosystem restoration by having sufficient turtle passage ensuring proper drainage & removal of obnoxious weeds & timely.	Restoration zone, & lake ecosystem restoration by having sufficient turtle passage ensuring proper drainage & removal of obnoxious weeds & timely	By SMDA, Tourism & Wildlife Protection Department.
5. Preparation & approval off Surinsar Lake Development Plan. As such any activity which have direct/indirect impact on Surinsar Lake required prior approval from competent Authority. It is advisable	-SMDA & Directorate of Tourism to prefer formulation of integrated Surinsar Development plan in consultation with Wildlife Protection Department and get necessary Forest & Wildlife Clearance & any other clearance in vogue instead of piecemeal development.	Tourism Department & SMDA.

to prepare comprehensive Surinsar lake Development Plan.		
6. Institution of Register Societies. Like home stays, Tradltional cuisines & Community participation.	With participation of PRIs and local Community participation	PRIs & Youth clubs & NGO including Civil Society to get reguit for same. Responsibility by Wildlife Protection Department.
7. Infrastructure : By SMDA & Tourism. By PDD. By PHE. By PWD. By Rural Development Department.	Development of infrastructure By SMDA & Tourism, PDD, PHE, PWD, by Rural Development Department in consultation with Wildlife Protection Department.	By SMDA & Tourism, PDD, PHE, PWD, by Rural Development Department in consultation with Wildlife Protection Department.
8. Surinsar-Mansar Wildlife Clearance & requires Wildlife & Forest Clearance except under FRA: Adequate importance to be given at the time of formulate of Plan & phasing of the project keeping in consideration the Wildlife clearance & Forest Clearance. Provides as well as cost of clearance as part of DPR.	Adequate importance to be given at the time of formulate of Plan & phasing of the project keeping in consideration the Wildlife clearance & Forest Clearance. Provides as well as cost of clearance as part of DPR.	Respective Implementing Agencies.

Remarks:-

1. The unanimous demand of PRIs/members & general public is not to enforce NOC/Clearance from Wildlife Protection Department on Repair/Renovation of existing public/private infrastructure in Private land within Sanctuary area.
2. Also, not to be process for clearance/NOC for works of public nature to be executed by Panchayat on Private land.

7/10/21

Appendix 14: Timeline for achievement on each goal (2023-2034)

Items of work	Priority scale	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year	8th year	9th year	10th year
Water level reduction	High										
Periodic removal of carps	High										
Removal of weeds	High										
Shallow banks revival, renovation & maintenance	High										
Turtle basking site protection & maintenance	High										
Nesting site modification, maintenance and monitoring	High										
Drainage system (Inlets and outlets) modification	Medium										
Protection around Surinsar Island	High										
Catchment area shed	High to medium										
Lake area fencing and maintenance of existing boundaries	Medium										



Plate 1: Different species of migratory water birds observed in Surinsar-Mansar wetland- A. Northern Shoveler (male); B. Pair of N. Shoveler (female); C. Common Pochard; D. Lesser whistling ducks; E. Common Coot; F. Ruddy Shelduck. [Pic courtesy for photo A &F – Agnish Kumar Das]

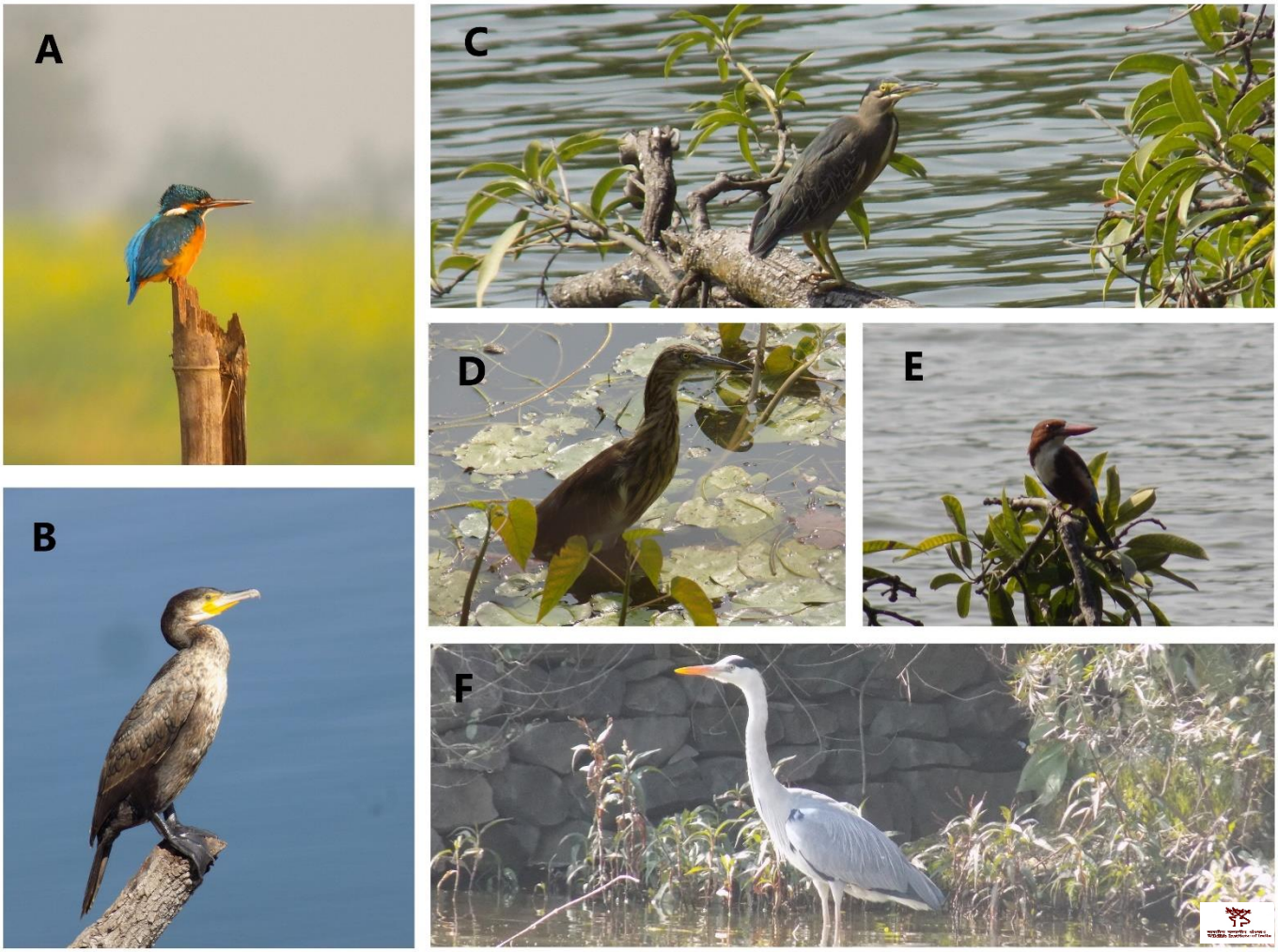


Plate 2: Other wetland associated birds- A. Common Kingfisher; B. Greater Cormorant; C. Black crowned night heron (Juvenile); D. Pond Heron; E. White Throated Kingfisher; F. Grey Heron. [Pic courtesy for photo A.- Agnish Kumar Das]

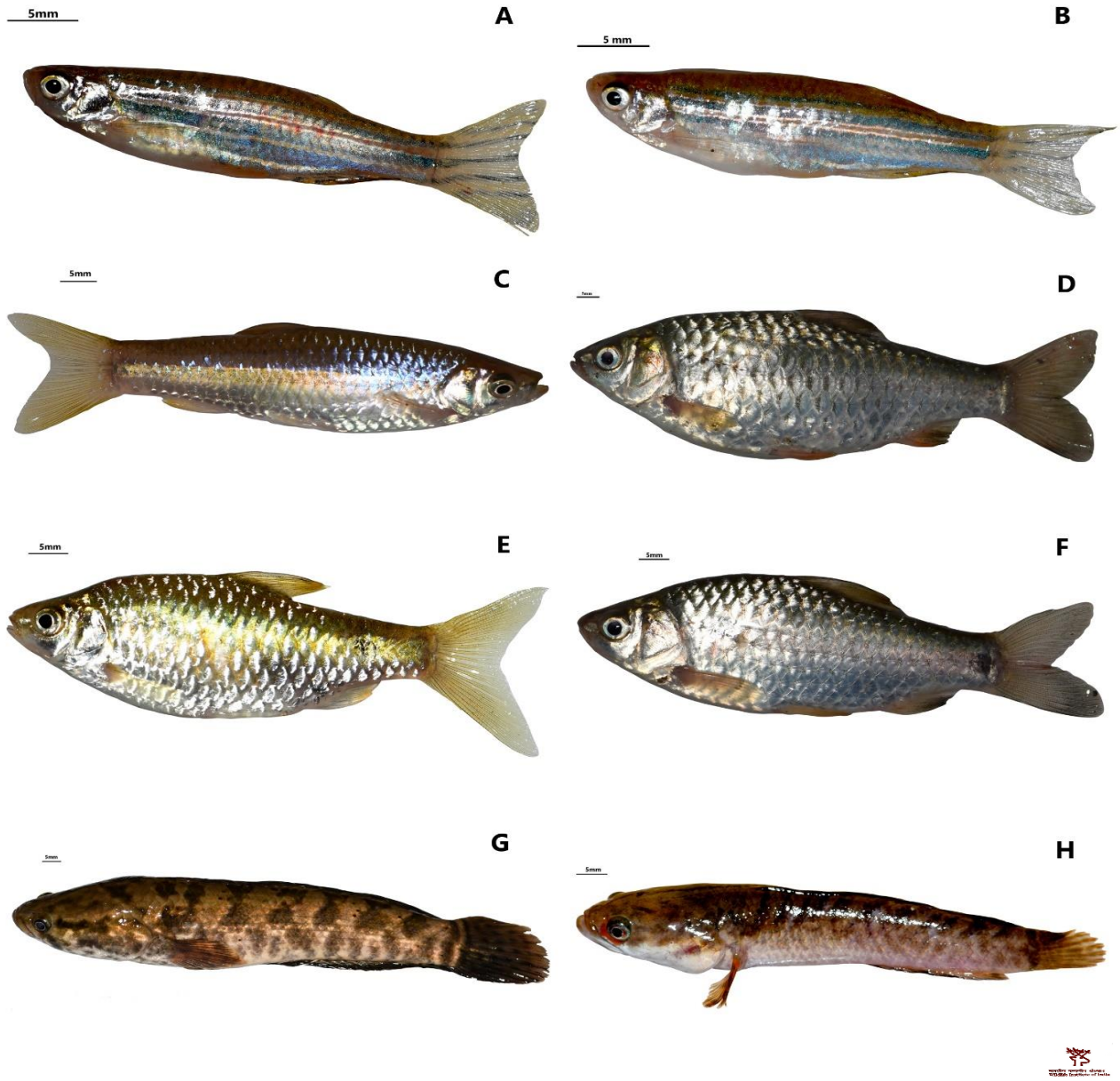


Plate 3: Different native fish species recorded in Surinsar Mansar Wetland during survey [A. *Danio rerio*; B. *Danio rerio*; C. *Rasbora daniconius*; D. *Puntuis chola*; E. *Puntius chola*; F. *Pethia ticto*; G. *Channa punctatus*; H. *Channa gachua*].

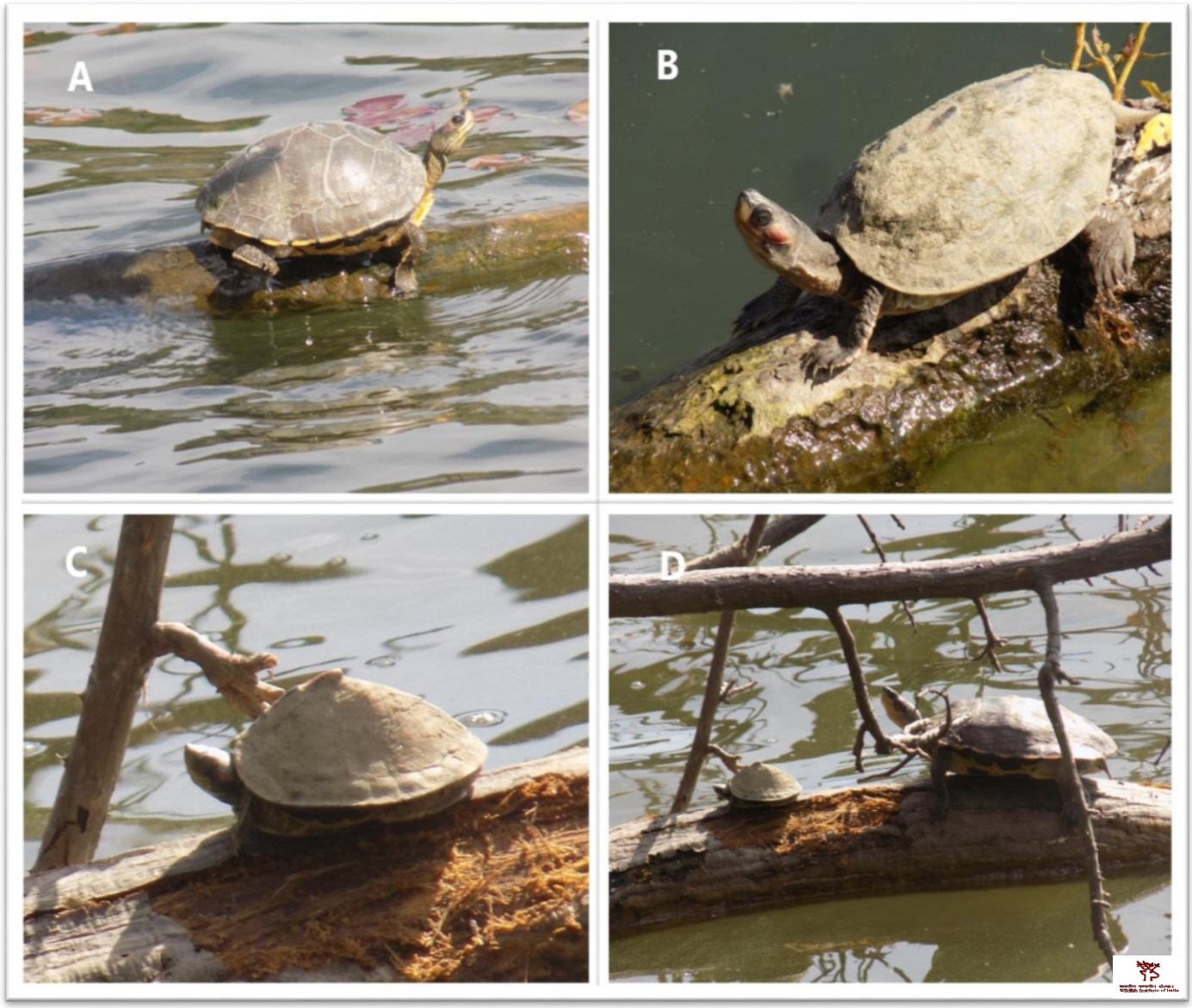


Plate 4: Hard-shell turtles of Surinsar Mansar wetland- A. *Pangshura tecta* (Indian roofed turtle); B. *Pangshura smithii* (Brown roofed turtle); C. *Pangshura tentoria* (Indian tent turtle); D. *P. tentoria* and *P. tecta* (larger) basking on a fallen log at the lake edge



Plate 5: Softshell turtles of Surinsar Mansar wetland- A-B. *Lissemys punctate* (Indian Flapshell Turtle); C-D. *Nilssonia gangetica* (Gangetic softshell turtle)



Plate 6: Glimpses of few species of Odonates from Surinsar Mansar wetland- A. Yellow waxtail; B. Slender skimmer; C & E. Scarlet skimmer/Ruddy marsh skimmer; D. Crimson-tailed Marsh Hawk; F mating pair of Marsh Bluetail



Plate 7: Butterflies of Surinsar Mansar wetland (Photo source: online)- A. Common Rose, **B.** Common Banded Awl, **C.** Red Pierrot, **D.** Tawny Coster, **E.** Common Crow, **F.** Common Jay.

Plate 8: Snapshot of Gangetic Softshell turtle unique individual headshots captured at Mansar lake

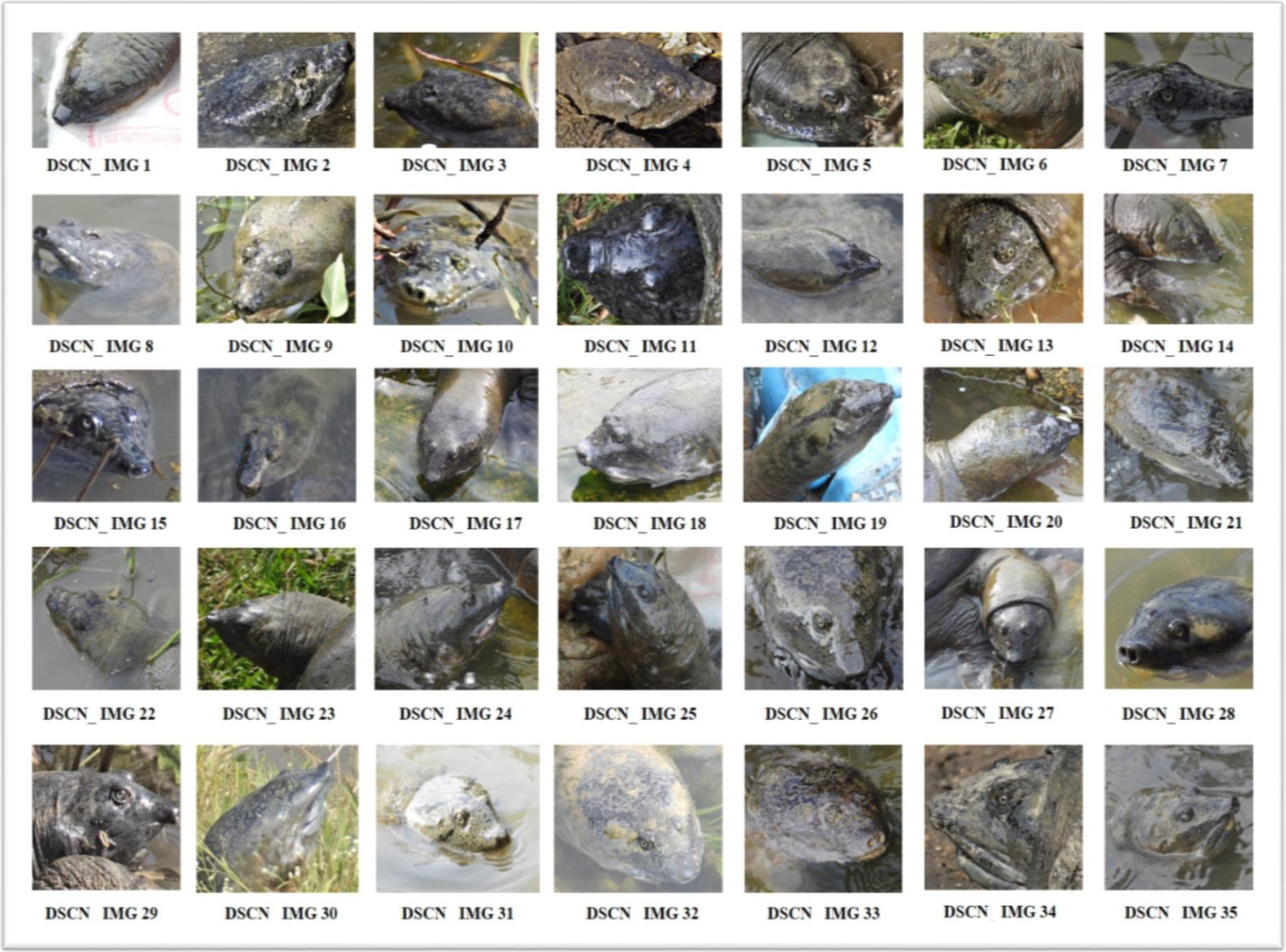


Plate 9: Snapshot of Gangetic Softshell turtle unique individual headshots captured



at Surinsar lake

Project Name: **Management plan preparation and population monitoring of turtles in Mansar-Surinsar Wetlands, Jammu and Kashmir.**

Project Investigators:

Dr. Abhijit Das

Dr. J. A. Johnson

Dr. K. Sivakumar

Project Personnel:

Mr. Krishnendu Banerjee

Ms. Arushi Mahajan

Executed by: **Wildlife Institute of India**

Funded by: **Department of Wildlife Protection, Govt. of Jammu & Kashmir.**

Citation: **WII. 2022. Management plan preparation and population monitoring of turtles in Mansar-Surinsar Wetlands, Jammu and Kashmir. Wildlife Institute of India, Dehradun, 219pp.**