Spatial and Temporal Distribution of Sea grasses in Chilika Lagoon

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***Abstract*- Sea grasses meadows are acknowledged as valuable ecosystem service providers and integral in underpinning the health and productivity of the marine coastal ecosystem. With the increase in anthropogenic pressures and climatic change it has become a scientific concern to maintain the healthy growth of these meadows. Chilika lagoon studded like a zircon on the golden stretch of Eastern sea coast of Odisha, India, a hotspot of biodiversity as it support many rare, endangered and endemic species. With this view, the present investigation has been carried out which throws light on the spatial and temporal distribution of sea grasses meadows in the lagoon as their conservational management in now and in future requires detail knowledge of their distributional pattern. For the present study, the lagoon is divided into four sectors i.e., Northern, Central, Southern and outer channel. Again each sector is divided into four stations; Five species are found i.e., Halodule uninervis, Halodule pinnifolia, Halophila ovate, Halophila ovalis, and Halophila beccari are identified till date. Halophila species are found in close association with Ruppia martima (but it has not been considered as sea grass till date) in the shallow water of Southern & Central sector. The environmental conditions; such as stable salinity, especially in the month of winter and summer (November & February) has led to growth of sea grasses in the deep-water zone and occurrence of species like Halodule pinnifolia and Halophila ovalis. In the southern sector sea grass bed are found in close association with the red algae Gracillaria verrucosa. Near Arakhakuda, Nalaban and shoreline of Southern sector Halophila beccari is in abundance pattern of macrophtyes of Chilika lagoon and its adjoining area.**

***Index Terms*- Sea grasses, Ruppia martima, Gracillaria verrucosa Halodule uninervis, Halodule pinnifolia, Halophila ovate, Halophila ovalis, and Halophila beccari.**

INTRODUCTION

Seagrasses, the flowering plants have a profound influence in supporting the health and productivity of coastal ecosystem. Like other blue carbon habitats (mangroves and tidal marshes), sea grasses also provide coastal defence and sediment stabilization. Though seagrasses occupy only 0.1% of the seafloor still they are responsible for 12% of the organic carbons buried in the ocean which reduces greenhouse gases.[5]

Seagrasses are distributed worldwide but unlike other taxonomic group are less diverse but still serve as a "biologicalsentinels" or "Costal Canaries".They are valuable biological indicators as they intergrate environmental impact over measurable parameters.

Due to anthropogenic pressure and climate change there is a threat to this seagrasses meadow. Conservational management of seagrasses in coastal and marine ecosystem requires the knowledge of their distrubutional parameters.[3]

Chilika lagoon is an unique assemblage of marine, brackish and fresh water ecosystem with estuarine characters. A hotspot of biodiversity supporting many rare, endangered and endemic

Species. It is one of first two wetlands of India to be included under Ramsar convention in 1981, due to its unique biodiversity.

Therefores, Seagrass which is an important species of the lagoon must be conserved and managed for its ecosystem services provider activity.

Therefore the present study involves evaluation of spatial and temporal distribution of seagrass in Chilika lagoon for its effective conservation and management of seagrasses

METHODOLOGY

Sampling stations:

Sixteen sampling stations have been fixed by taking into considerations, the satellite based macrophtye distribution maps in Chilika Lake and actual field study for collection of data on

Spatial and temporal distribution of Seagrass.

The Chilika lagoon was divided into four sectors i.e, Northern, Central, Southern and Outer channel again each of them was divided into four sampling stations.

Bhusandpur, Kaluparaghat, Sorana and Borokudi (Northern sector), Baulabandha, Nairi, Balugaon and Nalaban (Central Sector), Pathara, Keshpur, Budhibara and Rambha (Southern sector), Satapada, Khirisahi, Gabakunda and Arakhhkuda (Outer Channel).

The sampling stations with number and geographical extensions were written below:

Longitude & Latitude Extension of the present study stations

Sector	Sl.no	Station name	Longitude	Latitude
Northem sector	1	Bhusandapur	85.47483	19.82659
	2	Kaluparaghat	85.42074	19.85990
	3	Sorana	85.38287	19.83289
	4	Borokudi	85.52532	19.76628
Central Sector	5	Baulabandha	85.33148	19.79868
	6	Nairi	85.29993	19.77978
	7	Balugaon	85.24403	19.74467
	8	Nalabana	85.28911	19.69426
Southern Sector	9	Pathara	85.17370	19.62765
	10	Keshpur	85.15206	19.58714
	11	Budhibara	85.18903	19.59344
	12	Rambha	85.13132	19.53042
Outer channel	13	Satapada	85.43787	19.66815
	14	Khirisahi	85.49467	19.66185
	15	Gabakunda	85.52983	19.68166
	16	Arakhkuda	85.58933	19.70506

The study covers three prominent seasons i.e., summer, Monsoon, winter for collection of data.

Monitoring trips were planned in such a manner that every part of the area is covered in the three different seasons.2

Field and Herbarium Methods:

Each Seagrass was collected in its flowering or at vegetative stage, field notes on its locality, habitat, collector's name, collection number, uses and plant details were maintained in field notes.

The specimen were brought to the laboratory and were identified by studying morphological

Characters by following State floras, Monographs, or by matching with herbarium available in India(Central National Herbarium, Kolkata) and some with consultation with state taxonomist.

During monitoring information on soil types, depth and salinity were also gathered to assess the environmental conditions for the growth of seagrasses and also local uses and threats to the seagrasses meadows were studied through visual observations and interacting with local peoples.

RESULTS AND DISCUSSIONS

Chilika is quite rich in its flora, species context and vegetational diversity and economical potential.

In the present study five species of seagrasses are reported i.e, Halodule uninervis,Halodule -pinifolia, Halophila ovate,and Halophila beccari. And Halophila ovate are new distributional occurrence.

Table-1 Distribution of Seagrassess in different sector of Chilika Laggon

Name of the species	Northem Sector				Central Sector			
	St-1	St-2	St-3	St-4	St-5	St-6	St-7	St-8
	Bhusandpur	kaluparaghat	Soron	Borokudi	Baulabandha	Nairi	Balugaon	Nalaban
Halophila beccari	-	-	-	-	-	-	-	+
Halophila ovalis	-	-	-	-	-	-	-	+
Halophila ovata	-	-	-	-	-	-	-	+
Halodule uninervis	-	-	-	-	-	-	-	-
Halodule pinifolia	-	-	-	-	-	-	-	-

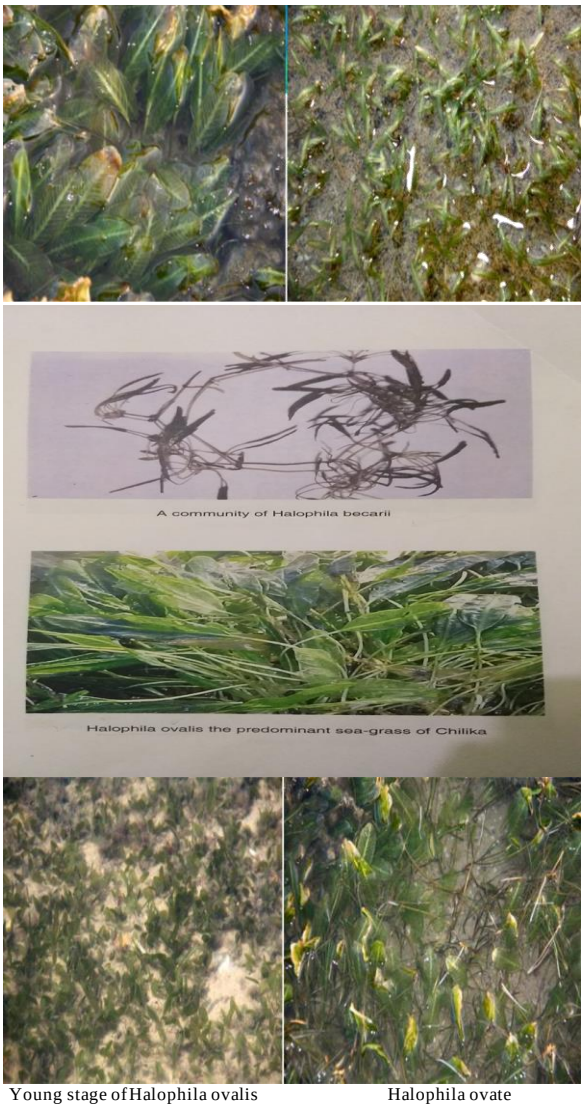
Name of the species	Southem Sector				Outer Channel			
	St-9	St-10	St-11	St-12	St-13	St-14	St-15	St-16
	Pathara	Keshpur	Budhibara	Rambha	Satapada	Khirisahi	Gabakunda	Arakhakuda
Halophila beccari	+	+	+	+	+	+	+	-
Halophila ovalis	-	+	+	+	+	+	+	-
Halophila ovata	-	-	-	-	-	+	+	-
Haloduleuninervis	-	-	-	-	-	+	-	+
Halodulepinifolia	-	-	-	-	-	+	-	+

Seagrasses meadows are found in their profuse state in the southern sector and outer channel. Where salinity and sandy soil is present.

The opening of new mouth of Chilika has almost increased the growth of seagrasses in it. Prior to it only Halophila ovalis is seen in scanty and . patchy manner .Beds of Ruppia maritime were found to be common with Halophila species in water of southern and central sector.1

With the opening of new mouth, Halophila exhibit profuse growth and spread even to the deep water zone.The opening of new mouth provided stable salinity ,improved water quality especially during the month of winter & summer which favors the growth of seagrass.

Halophila ovalis Halophila beccarii



Young stage of Halophila ovalis Halophila ovate

Dominant sea grasses of Chilika lagoon

The seagrass meadows are found at their abundance in the south eastern part of southern sector which has a salinity of 37ppt and a sandy substratum. Though sepecies occurs in sandy substratum, but the predominant seagrass i.e., Halophila ovalis also occurs on fine mud and silt with an salinity of 35ppt.It occurs everywhere except northern sector.

Summary of range of environmental conditions for each sea grass species

Sl. No.	Species	Depth (cm)	Salinity (ppt)	Sediment	Notes
1	*Halodule pinifolia*	40-250	12-37	Fine mud, sand	Occur with Halophila ovalis, Creeks and sand bank
2	*Halodule uninervis*	35-255	12-35	Silt, sand	Occur with Halophila ovalis and Halodule pinifolia Luxuriant growth in creek area
3	*Halophila beccarii*	20-90	9-36	Sand	Mostly on sand bed
4	*Halophila ovalis*	20-200	3-35	Fine mud, silt, sand	Observed in around the year except Northern sector
5	*Halophila ovata*	20-110	10-36	Mud, sand	Found in creeks

Seagrass meadows compromising of Halophila ovate,Halophila ovalis,and Halodule uninervis are also seen along with Ruppia maritima in central sector.

Nalabana exhibit abundant growth of seagrasses due to its less fluctuations in salinity,soft bottom and shallow water.

In Pathara (southern sector) a very good seagrass meadow of Halodule uninervis and Halophila ovalis along with red algae Gracillaria verrucosa is found.

Table2: Seasonal Variation of Seagrasses in different sectors of Chlika lagoon

Name of the species	Northern Sector											
	St-1(Bhusandpur)			St-2(Kaluparaghat)			St-3(Soron)			St-4(Borokudi)		
	M	W	S	M	W	S	M	W	S	M	W	S
Halophila beccari	X	X	X	X	X	X	X	X	X	X	X	X
Halophila ovalis	X	X	X	X	X	X	X	X	X	X	X	X
Halophila ovate	X	X	X	X	X	X	X	X	X	X	X	X
Halodule uninervis	X	X	X	X	X	X	X	X	X	X	X	X
Halodule pinifolia	X	X	X	X	X	X	X	X	X	X	X	X

Name of the species	Central Sector											
	St-5(Baulabandha)			St-6(Nain)			St-7(Balugaon)			St-8(Nalaban)		
	M	W	S	M	W	S	M	W	S	M	W	S
Halophila beccari	X	X	X	X	X	X	X	X	X	√	√	√
Halophila ovalis	X	X	X	X	X	X	X	X	X	√	√	√
Halophila ovate	X	X	X	X	X	X	X	X	X	X	X	X
Halodule uninervis	X	X	X	X	X	X	X	X	X	X	X	X
Halodule pinifolia	X	X	X	X	X	X	X	X	X	X	X	X

Name of the species	Southern Sector											
	St-9(Keshpur)			St-10(Pathara)			St-11(Budhibara)			St-12(Rambha)		
	M	W	S	M	W	S	M	W	S	M	W	S
Halophila beccari	√	√	√	x	x	x	x	x	x	√	√	√
Halophila ovalis	x	x	x	x	x	x	√	√	√	√	√	√
Halophila ovata	√	√	√	x	x	x	x	x	x	x	x	x
Halodule uninervis	√	√	√	x	x	x	x	x	x	x	x	x
Halodule pinifolia	√	√	√	x	x	x	x	x	x	x	x	x

Name of the Species	Outer Channel											
	St-13 Satapada			St-14 Khirisahi			St-15 Gabakunda			St-16 Arakhkuda		
	M	W	S	M	W	S	M	W	S	M	W	S
Halophila beccari	X	X	X	√	√	√	√	√	√	√	√	√
Halophila ovalis	X	X	X	√	√	√	√	√	√	√	√	√
Halophila ovata	X	X	X	X	X	X	X	X	X	√	√	√
Halodule uninervis	√	√	√	X	X	X	X	X	X	X	X	X
Halodule pinifolia	X	X	X	X	X	X	X	X	X	√	√	√

M=Monsoon, W=Winter, S=Summer

The seagrass abudance decreases during rainy seasons(August/September) for e.g the seagrass formation along the outer channel disappear due to fall in salinity,as there is an unidirectional flow of water from northern sector towards outer channel discharging the flood water.But once again the seagrass meadows reappears in the winter and summer seasons.

Halophila beccari is seen to occur in its profuse state in Arakhakuda, and Nalabana.

CONCLUSION

It is concluded from the present investigation that seagrasses are seasonal and area dependent, its growth reaches at its peak in winter and diminishes in rainy seasons due to fall in salinity. Seagrass meadows are seen in all the three sectors i.e., Central, Southern and outer channel except Northern Sector due to silt and muddy substratum and less salinity.

Seagrasses are essential in balancing the ecosystem and are good ecosystem providers such as Habitat for fish, inveretebrates, vertebrates including birds and juvenile, carbon sequestration, Coastal protection, Sediment accreation, Sediment stabilization, Mariculture, Education and Research.4

Climate change is a significant threat to sea grasses, therefore for effective conservations and restorations of them needs developing greater knowledge of their distributional pattern both spatial and temporal.

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