ENVIRONMENTAL IMPACT ASSESSMENT ON DAL LAKE SRINAGAR KASHMIR

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ABSTRACT:

Dal lake is known as ***"liquid heart"*** *of Kashmir which is summer capital of Jammu and Kashmir .Dal lake's ecologically is getting polluted day by day in fact dying day by day by the human activities. The present paper summarises the conservation measures taken to retrieve the pristine glory of the lake with an attempt to put forth the environmental impact assessment studies of the various measures viz. catchment treatment, silt and sedimentation Control, wastewater management, weed infestation, improvement in lake hydrology, combatting algal blooms and solid waste management.*

KEY WORDS: EIA, Catchment. weed infestation, hydrology, blooms ,physio-chemical characteristics ,floating gardens, soil erosion.

INTRODUCTION: Catchment administration by way of rebuilding of degraded forests, through manors form, hedgerow and in situ moisture preservation, waste line treatment through properly planned check dams, RCC structures, retards ,gabion stone dividers, trenching etc. other than scrounge production through silvi pasture advancement and on cultivate development.

b) Siltation and sedimentation control measures by way of construction of settling bowl on the section of lasting water source (TELBAL NALLAH) into Dal Lake counting intake structures, diverting goads, backwater bunds and RCC Deck Bridge.

c) Algal sprout control measures were taken by bubbling pure oxygen into contaminated waters through coasting aerators.

d) Houseboat sanitation through realignment and relocation of houseboats and connect alia interfacing to primary sewer system.

e) Solid Waste management; The solid waste management in human settlements within the lake (more than 50,000 souls plus 10,000 persons in boats) is one of the contributing factors of the lake environment and thus are managed through garbage bins and the door to door collection including houseboats and the final disposal is being done by Srinagar Municipality.

The Dal Lake is of incredible visitor and financial significance for the individuals of the Kashmir valley. The Dal Lake which has contracted in measurements, from 25 sq. km in past century to less than 11 sq. km presently is battling a loosing fight against wild contamination and sedimentation. As a pilot consider, the Dal Lake watershed spread over an region of 337 sq. km was taken up for soil disintegration consider utilizing remotely detected information, GIS and reenactment modelling .

The ponder utilized distinctive sorts of information counting Overview of India topographic maps for producing DEM of 40 meter determination, soil outline, Landsat TM & ETM adj. information and the field perceptions. Two date Landsat picture, 1992 and 2001, were utilized for creating the arrive use/land cover outline of the study zone and to identify the changes between these two time periods.

Table -1 Details of DAL LAKE

characteristics	Details
Location	Srinagar , Jammu and Kashmir , India
Lake type	Warm monomitic

coordinates	34 07'N 74 54'E
Primary inflows	Inflow channel TELBAL NALLAH from Mansar lake-291.8 Million cubic metres
Primary outflow	Dal gate and nalla Amir
Catchment area	316 square km
Max. length	7.5 km
Max. width	3.5 km
Surface area	18-23 square km
Average depth	Approx. 2 metres
Max. depth	6 m
Shore length	16 km
Surface elevation	1582 m
frozen	During severe winter
islands	Two islands as SONA lank and RUPA lank

LOCATION OF DAL LAKE

Fig. ASI-38-1 Sketch map of Dal Lake.

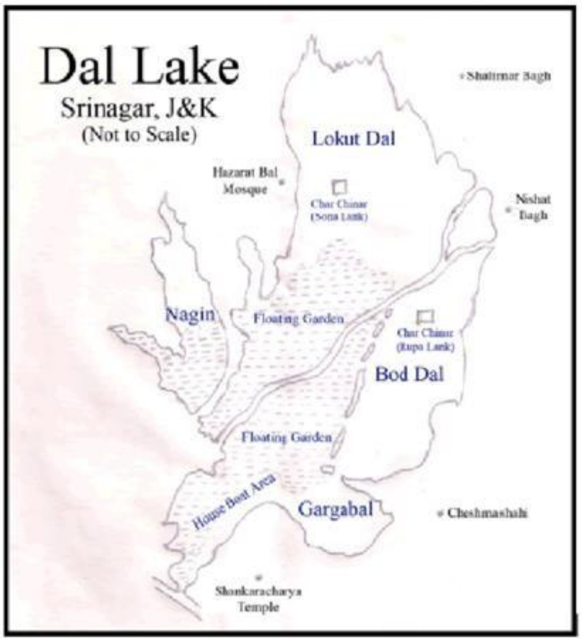

Table-2 :DAL lake area in Km

S.No.	Division	Open water Basin	Marshy land	Total area
01	Hazratbal	5.7	3.1	8.8
02	Bod Dal Basin	4.2	-	4.2
03	Gagribal Basin	1.3	-	1.3
04	Boulvard Basin	0.3	0.2	0.5
05	Floating Gardens	0.3	4.5	4.8
	Total	11.7	7.9	19.6

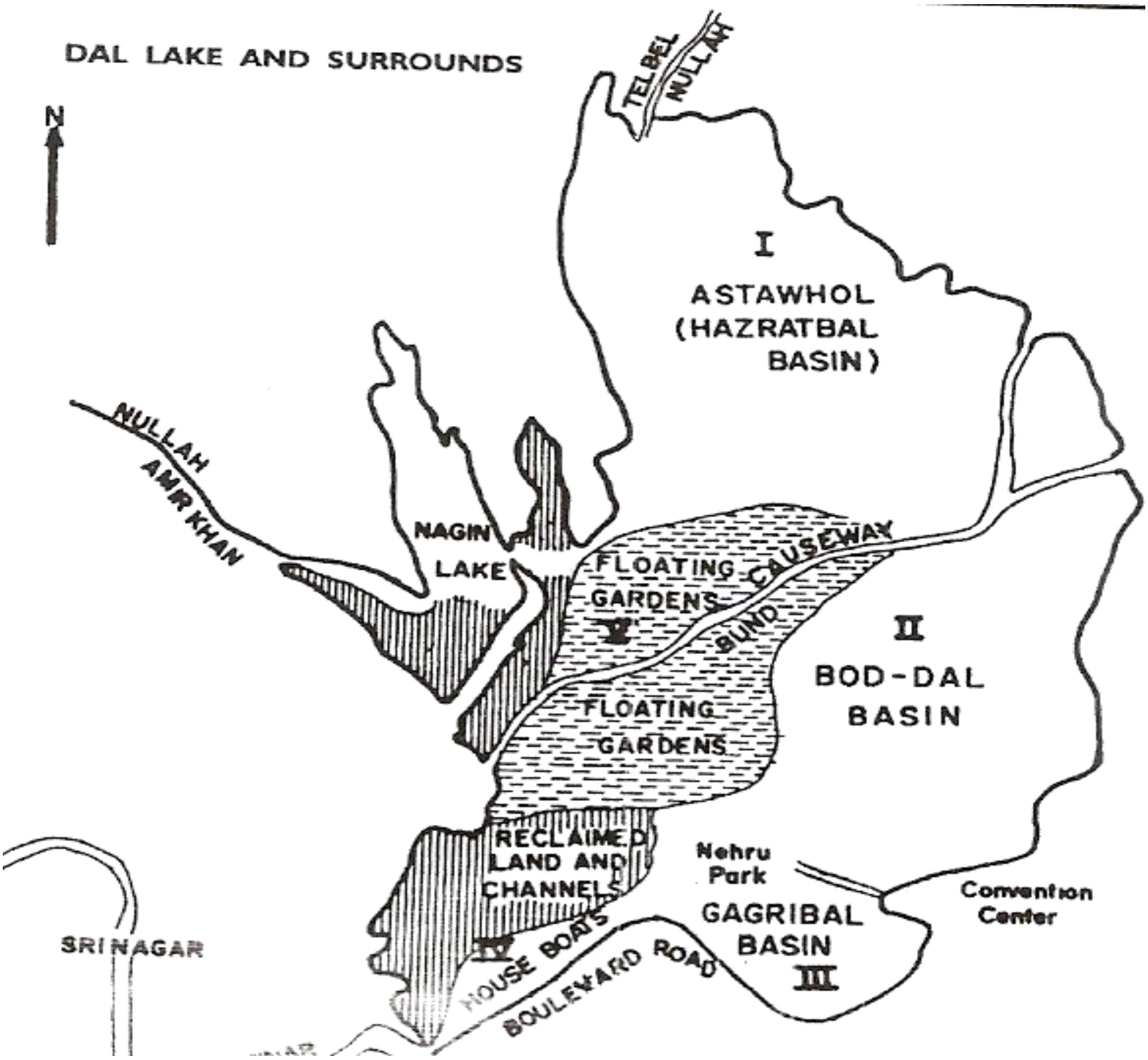

Fig-1 Dal lake basins

METHODOLOGY

Clinical trials were conducted in accordance with the Water and Wastewater Research Standa rd (APHA, 2017). Measure the water temperature with a portable digital thermometer and me asure the pH with a digital pH meter. The pH meter is standard with solutions of pH 9.2 and 4 .0 before use.The oxygen and conductivity of the lake water were also measured with the hel p of a portable digital oxygen meter and electricity meter; Both devices were sampled with st andard sodium sulfide (5%) and potassium chloride (0.01 M) solutions, respectively, before u se. . Ca2+, Mg2+, Cr and HCO3- concentrations were determined by volumetric method. Ca2 + and Mg2+ are estimated by EDTA titration using Eichrome black T and merexite as indicat ors, while for CI- estimation the water sample is titrated against AgNO3 using potassium chr omate as shown and against HCO3, H2SO4 and methyl orange for titration. used as an indica tor. Na+ and K+ concentrations were determined by flame photometry.

Samples were prepared from dry fresh NaCl and KCl. In this model, the water sample is atom ized and sprayed into the furnace, and the intensity of the light emitted by the special line is measured by photocell and galvanometer. Sulfate was calculated gravimetrically. NO3 was m easured using a spectrophotometer. In this type of photometry, light passes through the absorb er side of the color and strikes a photosensitive device that converts radiant energy into electri cal energy. Therefore, the current produced is measured with a precision voltmeter. Engineering measures have been taken in an area of 9,700 hectares in the Dal Lake Basin, an d the agricultural area is over 1,416 hectares. A total of 625,853 saplings of various species w ere planted and a 60% survival rate was achieved. For more than three years, wastewater cons truction for the treatment of silt volume of about 80,000 tons per year has been commissioned with good results and soil and waste have been greatly reduced thanks to these measures. Ho wever, the continuous silting of the tank cannot be filled in time, which affects the operation of the tank and requires immediate removal of the tank. Surrounding open swamp area, inclu ding frozen groundRemoving excess water by cutting the gutters along the riverbank from Ni shat Bagh to Habak has regained 1.5 square kilometers of the lake. When Kundangar and Ad nan (2001) examined the effect of edge dredging on the ecology of Dal Lake, they reported th at water depth, ammonia nitrogen and orthophosphate levels increased after dredging, but wat er transparency, pH value, dissolved oxygen, BOD and COD increased. reduced and missing plankton Significant changes in diversity.

b) Improve lake hydrology and hydraulics by constructing sand chamber gate regulators alon g the boulevards. Stacked biofilters and gated regulators help control sediment flow and nutri ent seepage during stagnation. In addition to cutting the Nishat pipeline, the Kabutarkana and Isbar dams were also removed to increase water flow from the lake. Improvements were made to Nallah Amir Khan to increase Nallaha's carrying capacity from 4.25 kumec to 37 ku mec by closing channels and flow control structures.26 meters of gold. Pipeline construction in Fatehkadal to extend and connect Brari Nambal Lagoon in Dal Lake to Jehlum River to en sure adequate water flow from Brainambal Lagoon to Jhelum River.

c) Sewage and sewage treatment is an important part of the Dal Lake Conservation Plan and i s addressed by providing six nonSTP (sewage treatment) technologies as FAB (fluid aerobic bed and biofilter) technology.

d) Weed Control of the infested area of Dal Lake by mechanical harvesters and traditional manual method during the growing season

Table -*2: Impact of Dredging on the lake waters of Dal Lake.*

Parameters	Units	Av. at Dredged sites	Av. At Undredged sites
Depth	M	3.1	0.6
Transparency	M	0.6	0.3
Ph	-	8	8.1
D. oxygen	mg1- 1	6.7	8.4
Calcium	//	44	43
Magnesium	//	6.5	8.4
Nitrate –N	µg1-1	387.6	572.3

NH4 – N	//	1376	782
O – phosphate	//	29.3	22.8
T – phosphate	//	179.8	189
BOD	mg1- 1	19.8	28.2
COD	//	19.7	28.6

Table -3: impact of deweeding on water

(A) De-weeding by mechanical means

Parameters	Units	Site I		Site II	
		Pre	Post	Pre	Post
pH	-	9.8	9.1	7.9	8.2
Sp. Conductivity	/µs	224	152	251	289
D. oxygen	Mgl-1	8.4	10.6	9.5	11.5
Iron	Mgl-1	674	232	199	170
Nitrate-N	Mgl-1	801	69	561	90
Total-P	Mgl-1	1262	386	1379	831
Site I Nehru Park basin			Site II Nigeen Basin		

(B) De-weeding by manual means

Parameters	Units	Site I		Site II		Site III		Site IV	
		Pre	Post	Pre	Post	Pre	Post	Pre	Post
Ph	-	8.8	8.4	8.4	8.2	8.4	8.0	8.4	8.2
Sp. Conductivity	Ms	317	248	291	132	357	258	326	247
D. Oxygen	Mgl-1	8.7	7.4	8.6	8.2	6.5	6.7	7.6	7.4
Iron	Mgl-1	318	122	125	104	157	86	184	157
Nitrate-N	Mgl-1	640	590	721	873	487	768	385	715
Total-P	Mgl-1	627	585	429	388	415	380	389	357
		Site I Nehru Park basin		Site I Nishat basin		Site I Hazratbal basin		Site I Nigeen basin	

For the present study two sampling stations (i) Littoral zone (site – I) and (ii) Central zone (site

– II) of Hazratbal basin were selected for detailed investigations. The water samples were analyzed for various physico-chemical parameters followed by the methodology in APHA,1998.

Table-4:Variation OF TEMPERATURE IN DEGREE CELSUS

	Site I		Site II	
	Air	Water	Air	Water
Maximum	18.6	16.5	21.1	17.2
Minimum	8.01	6.4	6.8	6
Average	15.30	12	14	12.3

Table-5: variation in Secchi Transparency (m) at two sites of Dal Lake

	Site I	Site II
Maximum	2.14	2.6
Minimum	1.5	1.76
Average	1.79	2.05

Table-6: variation in conductivity (µs) at two sites of Dal Lake

	Site I		Site II	
	Surface	Bottom	Surface	Bottom
Maximum	345	350	320	332
Minimum	328	332	263	276
Average	335	340	298	316

Table-7:Total alkanility

	Site I		Site II	
	Surface	Bottom	Surface	Bottom
Maximum	128	145	121	130
Minimum	90	101	97	76
Average	107	117	110	100

Table-8:Total dissolved oxygen mg\l at two sites of Dal Lake

	Site I		Site II	
	Surface	Bottom	Surface	Bottom
Maximum	12.3	12.9	12.1	11.3
Minimum	6.0	4.7	7.5	6.1
Average	8.3	8.4	9.7	9.2

Table-9:Variations in Calcium Hardness. (mg/l) at two sites of Dal Lake

•	○ Site I	•	○ Site II	•
	• Surface	• Bottom	• Surface	• Bottom
• Maximum	• 33	• 39	• 33	• 35.3
• Minimum	• 25	• 31	• 25.7	• 25.4
• Average	• 29	• 35	• 29.8	• 31

Table-10:Column variations in Mg (mg/l) at two sites of Dal Lake

	Site I		Site II	
	Surface	Bottom	Surface	Bottom
Maximum	4.9	7.8	7.7	7.7
Minimum	3.7	3.8	4.7	2
Average	4.3	5.8	6.2	4.8

Table-11:Column variations in Chloride (mg/l) at two sites of Dal Lake

	Site I		Site II	
	Surface	Bottom	Surface	Bottom
Maximum	35	15	10	11
Minimum	10	8.5	6.5	7.0
Average	22.5	11.75	8.3	10.

Table-12:Column variations in Sulphate (mg/l) at two sites of Dal Lake

	Site I		Site II	
	Surface	Bottom	Surface	Bottom
Maximum	41	40	28.5	30.9
Minimum	13.6	14.3	12.2	12.2
Average	22.8	22.7	20.2	21.3

Table-13:TOTAL NITRATE

	Surface	Bottom	Surface	Bottom
Maximum	844	1147	873	850
Minimum	728	401	699	745
Average	783	739	776	794

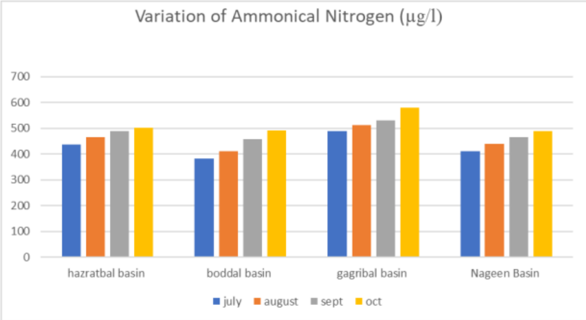

Chart-1: TEMPORAL REPRESENTATION OF NITRATE ON DAL LAKE

Table-14:Impact of HOUSE BOAT sanitation on water on Dal lake

Parameters	units	Site A	Site B	Site c
pH		8.2	7.5	7.9
D-oxygen	Mg-1	7.2	5.8	7.7
Nitrate-M	Ugl-1	794	530	324
Amm-M	Ugl-1	820	715	271
Po4-p	Ugl-1	83.7	239	83.4
Total coliform	CUF\100ml	19283	730	399
Faecal coliform	CUF\100ml	700	38.2	401

Table-15: TOTAL BOD AND COD OF DAL LAKE

PARAMTERS\SITES	SITE A	SITE 2	SITE 3
BOD mg\l	16	17	18
COD mg\l	75	78	79
Facial coliform MPN\100mg	9	10	13

SUMMERY AND FINAL STATEMENT

A four,month study of various anomalies in Dal Lake and the seasonal variations of different physical and chemical properties are discussed and their relationships are discussed.The wate r temperature is similar to the normal air temperature for small water bodies (Wetzel, 1975). The transparency of water in aquatic ecosystems is one of the most important factors regulati ng the energy balance of different trophic levels. The transparency of Dal Lake is between 1.5 and 2.15 meters. Rawson (1960), Pechlaner (196871) used water transparency as an indicator of lake eutrophication. The low transparency of the lake may be due to the presence of stones in the water flowing into the canal. A similar situation was reported by Zutshi (1968) in the e xample of Lake Anchar.Zutshi et al. (1980), light penetration into water is greatly reduced du e to high plankton or large obstructions.

The I PH value of the Dal Lake area varies between 7.4 and 8.06 units. And the average is 7.5

8 to 7.

9. The pH of the lake water does not change much. The water in the pool appears sterile as th ere is no sudden change in pH. This is in line with the findings of Khan and Zutshi (1980) tha t the bicarbonate system dominates when total alkalinity is highest and the pH range is genera lly on the alkaline side, as in this study.

Increased specific yield is considered an indicator of high nutrient availability (Berg et al. 195 8).

Many workers attributed the increase in conductivity to the enriched condition. When this par ameter was applied to Dal Lake (327346 μs), it was observed that it was at a higher level in th is lake. As reported by Zutshi and Vass (1977), the total implementation cost is close to that o f other semiarid lakes in the region. There is not much difference between the base and surfac e conductivity values between the two sites.

In both places, the average D.O of the bottom water of Dal Lake is smaller than the surface w ater. Higher oxygen levels in surface water may be due to atmospheric saturation. Also, meta bolic activities such as microbial respiration consume oxygen, which reduces the background oxygen concentration.

Changes in oxygen levels in the water column are considered the most reliable indicators for assessing nutrient availability and eutrophication of water bodies (Edmondson, 1966). The lack of oxygen in this study may have been caused by mixing of water in deep water.

In Field - I, Alkalinity range 91 to 129 (X = 108). In Field-II, the 4-month period ranges from 96 to 120 (X=112). Previously, Moir had classified the lake water a s soft, medium and hard based on total alkalinity. According to this classification, water with alkalinity below 40 mg l-1 is soft, water between 40 and 90 mg l1 is medium, and water above 90 mg l-1 is hard.

If this classification is used, Dal Lake is a hard water type with yearround bicarbonate alkalinity. The bottom of the lake in area has a very high alkalinity value - I, this may be because carbonate is precipitated from mud b y aquatic organisms and then converted into carbonic acid bicarbonate. Chloride levels in Lak e Dal range from a minimum of 9.5 mgl-1 to a maximum of 34 mgl-1 (X = 15.8).

Thresh et al. (1944) attributed the high chloride concentration in water to organic pollution of animal origin. Cole (1975) concluded that there is an average of 5 g cl-1 in humans and animals. The chloride concentration in Dal Lake was within acceptable limit s (< 200 mg l-

1) by water quality standards, but was higher compared to other lakes in the valley except for Trigam Lake in Kashmir, where more chloride is generally reported for chlorine. mixed conte nt (Khan, 1978).

Calcium is generally the predominant cation in Kashmir lakes (Zutshi, 1980) Zutshi and Kha n (1977) noted that in some Kashmir lakes the ratio of calcium to magnesium is 4:1. In this st udy, the ratio of calcium to magnesium in Dal Lake is 7:1. Calcium predominates in the lake because of the limerich rocks that dominate the watershed. It is associated with agricultural fertilizers (lime and s uperphosphate) used for cultivation in floating gardens and lake basins. The lake can be classi fied as rich in calcium as its calcium content ranges from 24 to 32 mgl-1 (X = 29.5 mgl-1).

, but usually low in magnesium (average = 4.3 mg l-

1) For Dal Lake. The low concentration may be due to chlorophyll production, magnesium po rphyrin metal complexes and Mg^{2+} increase from plants during enzymatic conversion (Wetz el, 1975).

The solid waste generated in Dal Lake is calculated as 0.024Kg per person per day with 0.135 5. polythene bags per person per day. The estimated load of solid waste is 1200 Kg per day besides a high percentage of vegetable wastes. In order to overcome Dal lake area has been declared as "No polythene" zone by the authorities and as such use of polythene bags is totally banned in this area. Other methods adopted include composting and sanitary land fillings.

CONCLUSION

The high content of calcium and bicarbonate indicates that the air in the water area is harsh, a s the water of Dal Lake is predominantly composed of carbonates and volcanic rocks. Similar ly, chemical weathering of minerals such as dolomite, pyroxene, and olivine can release magn esium ions, but at a lower rate compared to calcium, and this lower concentration may be due to its lower geochemical abundance. According to the research, pollutants entering Dal Lake every day mainly include the following categories. Sewage and, agricultural water, detergents and soaps, animal waste, waste (plastic, paper, polyethylene, rusty metal), waste from boat h ouses, hotels and businesses around Dahl, and land from the river. The following measures sh ould be taken to reduce this pollution.

• All houseboats are equipped with central treatment facilities and not all waste products will be discharged directly into Dal Lake.

• Renovation services for home/hotel owners and residents in and around Dahl.

• Continue clearing excess vegetation from Dal Lake.

• Create STP on all incoming routes.

• Restoration of natural outlet channels 4444 (drainage i.

For example, "Nalla Mar") will absorb and remove more pollution from Dal Lake. It should b e noted here that "Nalla Mar" is a long flowing river that was closed in 1960. It then turned in to a stone path.

• Build toilets for Dal Lake residents to reduce the direct flow of water into the lake.

• Maintain water quality by reducing farmers' pesticide use. They should be encouraged to us e organic pesticides instead of pesticides.

• Farmers can avoid using commercial fertilizers (nitrogen and phosphorus) and animal manu re on fields in rivers. They should be encouraged to develop and implement nutrition manage ment to reduce over application of fertilizers.

• Reforestation in watersheds and

• Animal management in watersheds.

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