

## Variations in Water Quality Parameters of Ala-Gol Wetland in Golestan Province, Iran

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**Abstract:** Land areas which are wet during part or all of the year are referred as wetlands. The water quality parameters such as: weather and water temperature, PH, DO, BOD, EC, salinity, turbidity and depth were studied for the Ala-Gol Wetland from April 2011 to March 2012. The PH of water was alkaline throughout the Wetland. Higher pH, DO and EC were in winter, with average 8.94, 9.9 mg/l, 6.71 ds/m respectively, higher water temperature was in summer, with average 26.9°C. One-way ANOVA with Tukey tests was used to inspect for differences in water quality parameters during seasons of the year. The results showed that there was a significant difference in weather and water temperature, DO and depth in the four seasons of Wetland ( $P < 0.05$ ), but there weren't any significant differences in pH, BOD, EC, salinity and Turbidity ( $P > 0.05$ ).

**Key words:** Water Quality • Ala-Gol Wetland • Golestan Province

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### INTRODUCTION

Wetland creation is the process of converting a system that was previously upland or shallow water into a wetland [1]. They are one of the most important and productive ecosystems in the Earth. They are found throughout the world, ranging in size from a few hectares to thousands of square kilometers. They are often located along edges of lake basins, on river floodplains and on the river mouth deltas. It is estimated that approximately 6% of the Earth's surface is covered with wetlands, equivalent to about 8.6 million Km<sup>2</sup> [2].

Ala-Gol, Alma-Gol and Aji-Gol wetlands are located in Golestan province the northern of Iran, These complex wetlands area is 3027 hectares. Ala-Gol is the largest wetland, having a surface area of 2500 ha and a maximum depth of 2.0-2.5 meter [3, 4]. In Turkish language "mud" refers to wetland and wetland names means in the Turkmen language salty lagoon and muddy. This wetland is one of the most valuable and important habitats in Iran of hydrological, biological and ecological vitality of the region. The important reason assumptions of Ala-Gol wetland in list of international wetlands is the presence of hundreds species of waterfowl, wader and terrestrial birds inside and margin of these wetlands.

The quality of water as determined by its physical and chemical constituents is of great importance in determining its suitability for a certain use such as public water supply, irrigation, industrial application etc [5].

Fish and other aquatic animals depend on dissolved oxygen (the oxygen present in water) to live. Metabolic rate and the reproductive activities of aquatic life are controlled by water temperature. Water temperature varies with season, elevation, geographic location. Conductivity itself is not a human or aquatic health concern, but it is easily measured, it can serve as an indicator of other water quality problems. If the conductivity of a stream suddenly increases, it indicates that there is a source of dissolved ions in the vicinity. Therefore, conductivity measurements can be used as a quick way to locate potential water quality problems. Turbidity is indicator of the amount of material suspended in water; it measures the amount of light that is scattered or absorbed. Turbidities of 10 NTU or less represent very clear waters; 50 NTU is cloudy; and 100-500 or greater is very cloudy to muddy. Some fish species may become stressed at prolonged exposures of 25 NTUs or greater.

In the study, the objectives are to determine the water quality parameters of Ala-Gol Wetland in Golestan Province.

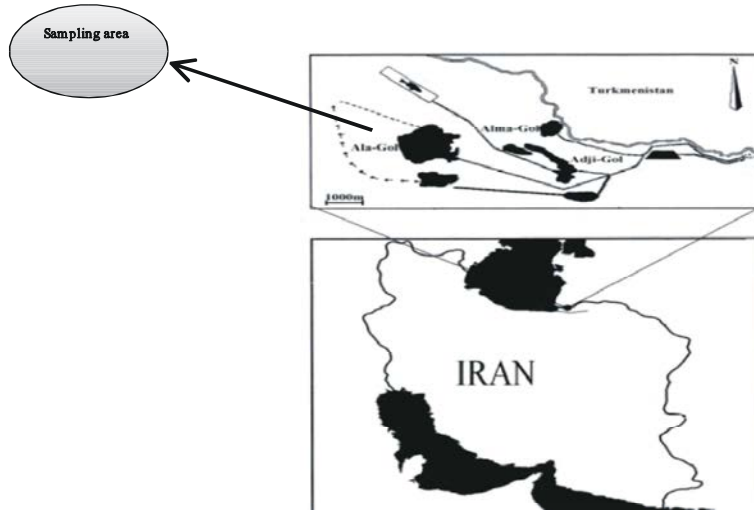


Fig. 1: Location of the Ala-Gol wetland in the South Caspian Sea, Iran

## MATERIALS AND METHODS

**Study Area:** The study was performed in international wetland Ala-Gol, which is situated on the Turkmen steppes near the border with Turkmenistan in the Golestan Province, in north of Iran (Figure 1). Four stations were chosen for the study area. First station is in the input of the wetland, Second station is after the first station in the early part of the wetland, Third station is in the output of the wetland and Fourth station is after the output of the wetland.

**Collection of Samples:** Water samples were collected from this area in four seasons from April 2011 to March 2012. Water samples were stored in the ice box to retard the biochemical activities. The samples were analyzed as per standard methods mentioned in laboratory [6]. The standards reagents used in analysis were prepared using double distilled water. Nine water quality parameters namely weather and water temperature, pH, EC, DO, BOD, Salinity, Turbidity and depth were measured.

After end of sampling, the information was entered into computer and was analyzed by statistical software SPSS One-way ANOVA and Tukey test.

**Methodology:** The aim of this study is to describe the trend and variations of the selected water quality parameters of the wetland. The study also aims to ascertain the levels of the quality parameters and in the absence of any detectable impact from any source, may serve as baseline values [7]. The water quality test methods are shown in Table 1.

## RESULTS AND DISCUSSION

The range values of the Ala-Gol Wetland water quality parameters of the present study are presented in Table 2.

The range values of the Ala-Gol Wetland water quality parameters in four stations of the present study are presented in Figure 2.

Table 1: Water Quality Test Methods

No.	Parameters	Units	Test Method
1	Water temperature	°C	-
2	Air temperature	°C	-
3	pH	-	Electrometric
4	Electrical Conductivity (EC)	µS/cm	Electrometric
5	Dissolved Oxygen (DO)	mg/l	Winkler method with Azide Modification
6	Biological Oxygen Demand (BOD)	mg/l	5 days incubation
7	Salinity	mg/l	Electrometric
8	Turbidity	NTU	Titration
9	Depth	cm	-

Table 2: Water quality parameters in four seasons of Ala-Gol Wetland in Golestan Province, Iran

Water quality parameters									
Season	T water (°C)	T weather (°C)	pH	EC (dS/m)	DO (mg/l)	BOD	Salinity	Turbidity (NTU)	Depth (cm)
Spring	23.34	26.22	8.8	6.24	7.51	3.92	4.6	33	242
Summer	26.9	30.63	7.88	5.17	5.95	4.66	4.33	26.66	211.66
Autumn	12.66	17.5	8.23	6.64	8.29	3	6	28.33	128.33
Winter	10.16	13.66	8.94	6.71	9.9	3.15	5.66	33.33	126.66

T: Temperature

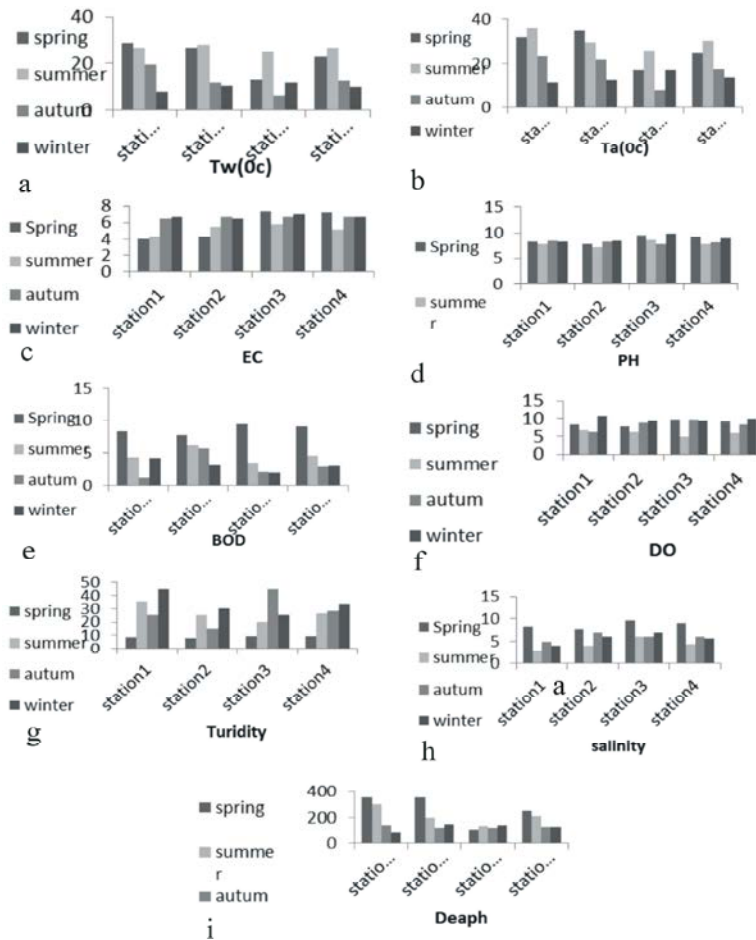


Fig. 2: Water quality parameters in four stations of Ala-Gol Wetland

Table 2: Results of One-way ANOVA with Tukey tests of water quality parameters among the four studied seasons in Ala-Gol wetland

Water quality parameters	*Sig	F**
Weather temperature	0.007	6.59
Water temperature	0.002	9.32
PH	0.150	6.12
EC	0.198	1.86
DO	0.005	7.21
BOD	0.227	1.66
Salinity	0.123	2.35
Turbidity	0.150	2
Depth	0.013	5.54

\*Sig: significance \*\*f: Degrees of freedom

One-way ANOVA with Tukey tests was used to inspect for differences in water quality parameters with seasons of the year in Ala-Gol wetland. The results showed that there was a significant difference in weather and water temperature, DO and depth in four seasons of Ala-Gol Wetland ( $P < 0.05$ ), but it wasn't significant difference in PH, BOD, EC, salinity and Turbidity ( $P > 0.05$ ) (Table 2).

Level of the water in wetlands is important to plant and animal life. The PH of the Ala-Gol wetland was slightly alkaline, which varied from 7.88 to 8.94. Sudden, dramatic changes in pH could endanger the lives of

young animals; in particular Wetlands are defined as land areas that are at least partially covered with water for all or part of the year [8]. A similar relationship between pH changes was observed by Sun *et al.* [9].

BOD was low, which varied from 3 to 4.66. A study conducted in Taiwan reported that BOD is the most important contaminant for analysis [10].

The DO was found to be lower in summer, which may be due to anthropogenic activities and around Balugaon Ghat area. The higher DO values often more than saturation values were found mostly in the stations where more weeds are present and may be due to their photosynthetic activities.

The obtained results showed that DO values were higher in winter than any other seasons. And minimum DO values were lower in summer. The minimum values of DO during summer may be due to increase photosynthesis process of the algal blooms resulting into the precipitation of carbonates of calcium and magnesium from bicarbonates [11].

Depth values are higher in spring than other seasons, because of the rains.

Ala-Gol wetland, however, is slightly saline, which in present study varied from 5.17 to 6.71. This site is not nationally designated as protected area although, as with all wetlands in Iran, is under the jurisdiction of the Department of Environment. Factors (past, present or potential) adversely affecting the site ecological character, including changes in land use and development projects. The extraction of water from Ala-Gol wetland for irrigation purposes and a fish hatchery has resulted in lower water levels in the wetland, especially in summer.

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