RESEARCH PAPER

Hydrology of river Indus at BilianiKhyber Pakhtunkhwa, Pakistan

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Abstract

An Investigation conducted to assess the limnology in River Indus at Biliani Khyber Pakhtunkhwa, Pakistan. Sampling were carried out on monthly bases. In the current research various limnology parameters were analyzed from the selected sampling station in river Indus at Biliani. The water quality parameters such as Temp ^{o}C; pH; Dissolved Oxygen mg/l; Electrical Conductivity μs/cm; Total Alkalinity mg/l; Total Hardness mg/l; Chlorides mg/l and Total Dissolved Solids mg/l were recorded within the recommended levels. So the present study results reviled that Water quality of the current research was recommended feasible for aquatic biota and other purposes.

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Introduction

Different factors that determine the water quality of a reservoir include seasonal and climatic changes (Chapman, 1996; Barik *et al.,* 2010), precipitation, wind action, geologic origin of the catchment basin and pattern of hydrological cycle in dam (TundisiandStraskraba, 1999). Water is the most abundant compound on the earth and is essential for the survival of all living organisms. More than 50% population on the earth depends upon ground water. In most areas of the Pakistan the ground water is only source for drinking purpose. Safe drinking-water is a basic need for human development, and health. So it is an internationally accepted human right (WHO, 2001). Under nomenclature used to name chemical compounds, Dihydrogen monoxide is the scientific name for water, though it is almost never used (Barmer and Scott, 2011). On Earth, 96.5% of the planet's water is found in oceans, 1.7% in groundwater, 1.7% in glaciers and the ice caps of Antarctica and Greenland, a small fraction in other large water bodies, and 0.001% in the air as vapor, clouds (formed of solid and liquid water particles suspended in air), and precipitation. Only 2.5% of the Earth's water is fresh water, and 98.8% of that water is in ice and groundwater. Less than 0.3% of all freshwater is in rivers, lakes, and the atmosphere, and an even smaller amount of the Earth's freshwater (0.003%) is contained within biological bodies and manufactured products (Gleick, 1993).The aim of the current research work was to study the hydrology of river Indus at Biliani Khyber Pakhtunkhwa, Pakistan

Materials and methods

Study area

Biliani is very popular site of the River Indus located in Hazara Division Kyber Pakhtunkhwa Pakistan. This point of the river consisting high water bodies. This Area of the River is very wide and speed of the water is also very high. Dominant family over here is almost Cyprinidae fauna.

This site is very appropriate for wild life conservation. Most vertebrates and invertebrates fauna is present in this area. For example Jackal, wolf, Porcupine and dragonflies are very popular.

Fig. 1. Map of River Indus at Biliani site KP, Pakistan. Blue circle show sampling point of the site.

Water sampling and analyzing

Water samples were stored in clean and dry plastic bottles with screw caps and labeled. Some parameters were analyzed on the spots by using digitals meters

While other were examined by titration methods.

Analysis of field study parameters

During the field study the following water quality

parameters were analyzed on the spot discussed in detail below.

Dissolved Oxygen: The dissolved oxygen of water samples was measured by digital DO meter (Model: EZDO-7031. Taiwan).

pH determination: The pH of water samples was measured by using pH meter (China).

Electrical Conductivity: Electrical conductivity was measured by EC meter (China).

Total Dissolved Solids: Total Dissolved Solidswas measured by Digital TDS meter (China).

Temperature: Temperature was measured by Digital Temperature meter (China).

Table 1. Water quality **(**Mean ± SD) of Thakot sampling station in river Indus during 5 years study period (2013 to 2018).

Months	Temp °C	pH	DO mg/l	TDS mg/l	T. Alkalinity mg/l	T. Hardness mg/l	Chlorides mg/l	E.C µs/cm
Jan	17.69±2.08	7.71±0.77	6.34±0.52	109.26±42.26	115.46±19.52	106.56±41.47	25.94±4.37	275.85±46.45
Feb	18.74±3.85	7.53±0.24	6.51±0.62	116.58±29.85	119.53±29.16	117.33±39.58	37.94±6.17	286.86±26.27
Mar	20.37±2.56	7.56±0.52	6.28±0.51	125.46±25.34	122.89±36.44	125.89±35.75	45.59±8.15	295.89±19.57
Apr	21.47±1.22	7.34±0.45	6.61±0.42	167.28±42.06	135.47±28.21	149.58±27.84	45.86±9.46	395.42±36.55
May	23.35±2.86	7.19±0.43	5.91±0.38	179.64±49.64	149.56±39.15	156.72±39.28	58.96±10.18	405.75±12.41
Jun	24.45±1.66	7.16±0.63	5.81±0.81	189.46±52.28	152.46±19.54	174.25±29.78	64.61±11.35	412.15±10.75
July	24.85±2.89	7.18±0.82	4.52±0.91	185.29±46.61	161.57±25.24	175.82±19.35	68.69±13.23	435.56±8.56
Aug	23.68±2.36	7.28±0.34	5.67±0.59	179.58±42.62	163.72±29.14	169.56±36.55	65.96±14.56	424.85±6.54
Sep	21.46±1.29	7.31±0.28	6.82±0.26	169.56±56.38	142.46±26.45	159.83±26.29	57.69±11.19	416.82±11.56
Oct	20.32±2.36	7.46±0.48	6.64±0.97	167.25±56.21	136.36±35.51	141.75±31.47	46.26±9.59	406.85±19.16
Nov	18.47±2.05	7.59±0.09	6.13±0.58	164.25±42.52	132.86±38.55	122.89±19.47	39.64±7.29	394.43±23.54
Dec	16.89±1.25	7.68±0.24	6.62±0.28	129.56±41.31	123.29±21.22	144.56±31.65	37.53±8.59	387.41±25.59

Analysis of laboratory titration parameters
Some water quality parameters like Total Alkalinity, Calcium Hardness, Water Chlorides and Total Hardness were analyzed by titration methods.

Parameters discussed in detail below. Total Alkalinity:Water sample (25 ml) was titrated with a pre-standardized H_2SO_4 solution. Methyl orange was used as an indicator.
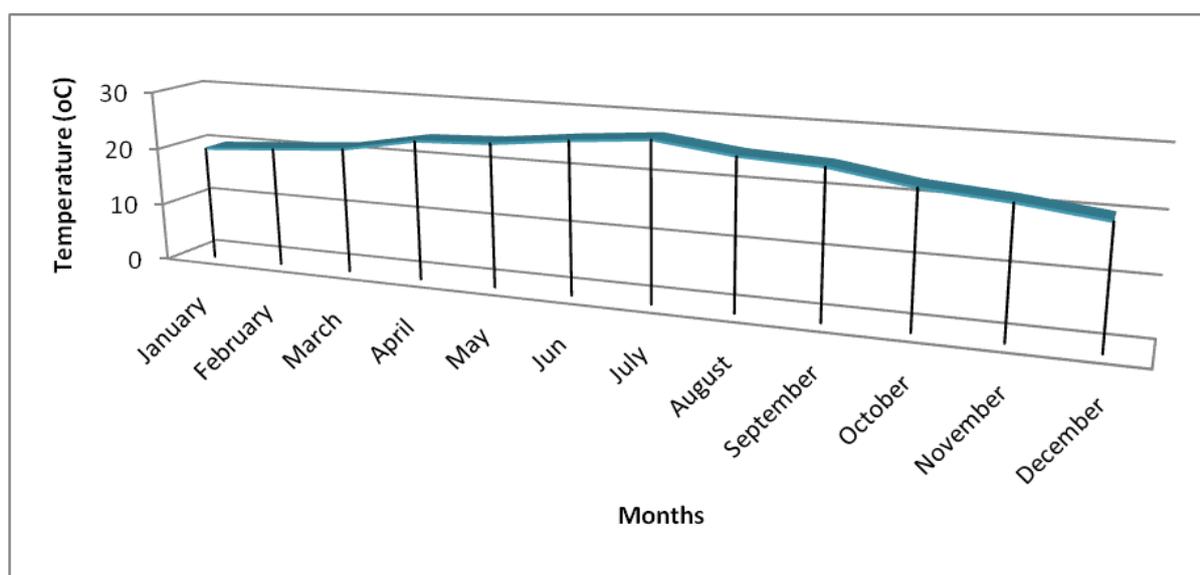
Fig. 2. Mean of Temperature (°C) from Biliani samplings station of river Dorduring 5 years study period (2013 to 2018).

The used acid solution was noted from the burette. The values were calculated by applying the following formula:

Total Alkalinity = (Vml of H_2SO_4 + 25) 5000 × N

Where, Vml stands for the volum of acid solution which was used and measured in ml. N stands for familiarity of the acid solution. The above mentioned formula will give result for alkalinity in mg $CaCo_3$ /L

directly.

Water Chlorides: 25ml sample was treated with 0.02N H_2SO_4 solution (corresponding to the alkalinity of the sample) followed by the adding of 3-4 drops of the $K_2Cr_2O_7$ solution (indicator). After that the solution was titrated with standard $AgNO_3$ solution (0.014 N) taken in particular sort of burette. The volume of silver nitrate solution was noted.
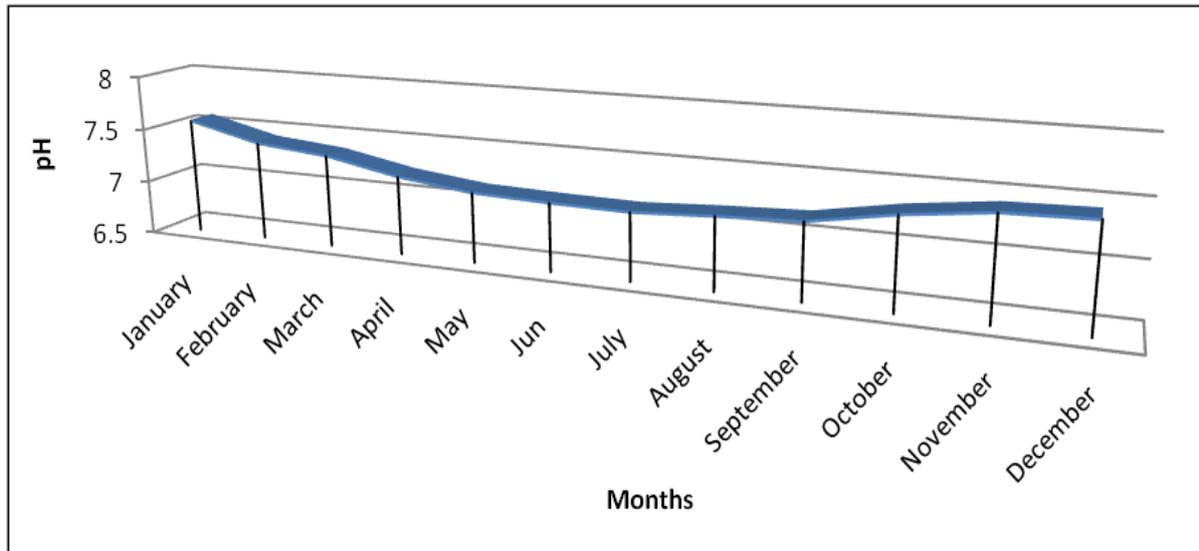

Fig. 3. Mean of pH from Biliani samplings station of river Dor during 5 years study period (2013 to 2018).
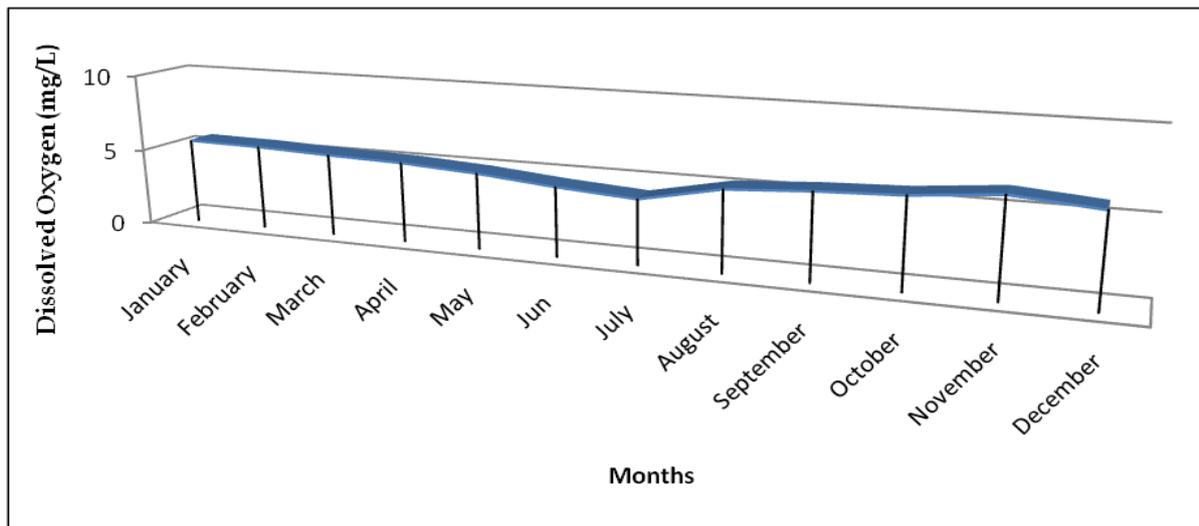

Fig. 4. Mean of Dissolved Oxygen (mg/L) from Biliani samplings station of river Dor during 5 years study period (2013 to 2018).

The formula which was used as follow

Weight of Cl⁻ mg/L= (Atomic weight of Cl⁻ ×VL×N×10²) + 25

Where, VL indicates the volume of $AgNO_3$ solution

used considered in liters and N stands for familiarity of $AgNO_3$ solution.

Total Hardness: Clean titration flask was used for

such purpose in which 25m;l sample was taken along with 2ml NH_3/NH_4CL buffer solution of pH=10 was also added. After shaking a small amount of solid Eriochrome black T, just enough for color change (as an indicator), was added with spatula. This started titrating against standard EDTA solution taken in burette after shaking. The used volume was noted as $caco_3$ mg/l.
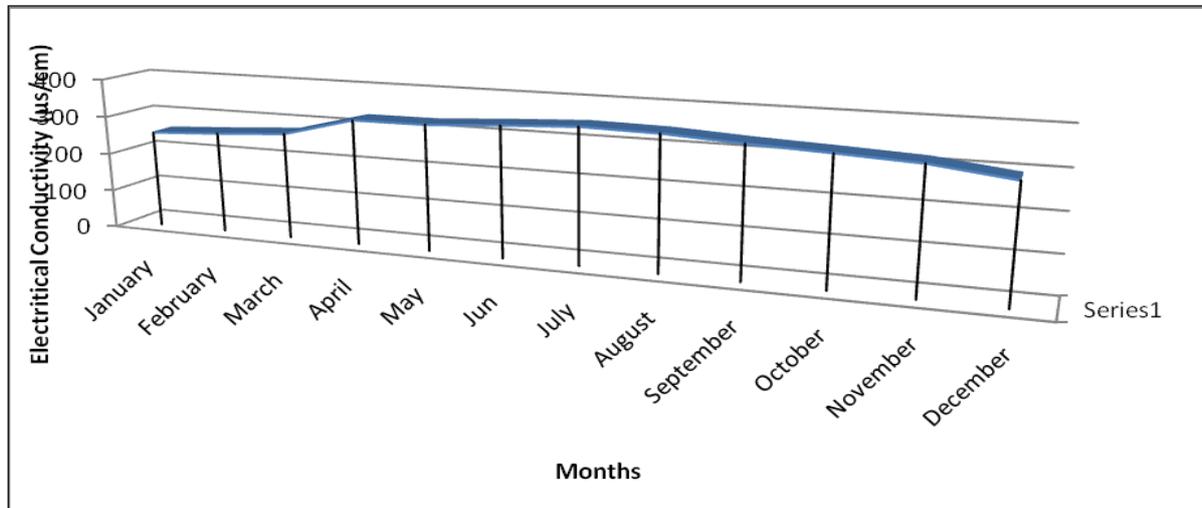
Fig. 5. Mean of Electrical Conductivity (µs/cm) from Biliani samplings station of river Dor during 5 years study period (2013 to 2018).
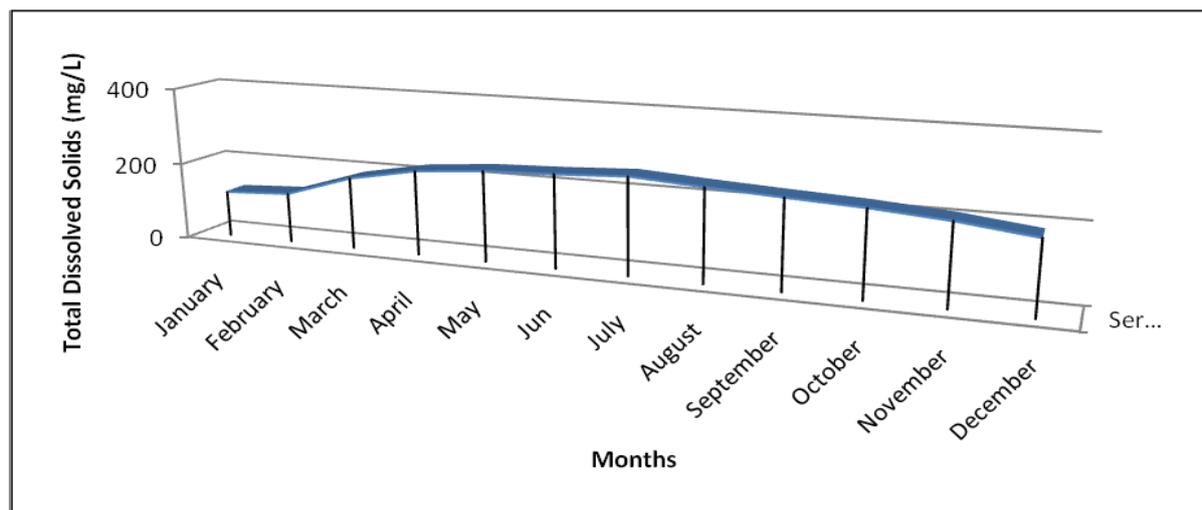
Fig. 6. Mean of Total dissolved Solids (mg/L) from Biliani samplings station of river Dor during 5 years study period (2013 to 2018).

The formula which was used as follow

Molecular weight of $caco_3$ in 25ml sample = molecular weight of $caco_3$xVL of EDTAxM of EDTA. Where VL indicates volume of EDTA solution used which was measured in liters and M indicates the molarities of EDTA solution. After this the calculation were prepared for the weight of $caco_3$/l of sample as:

Total hardness/l as= <u>VLxMx100x100</u> Ml of sample.

Results and discussion

A study was carried out to explore water quality parameters in River Indus at Biliani Khyber Pakhtunkhwa, Pakistan. Sampling were carried out on monthly bases.

In the present study, various water quality parameters were examined from the selected sampling sites in river Indus at Biliani. The water

quality parameters such as Temp °C; pH; Dissolved Oxygen mg/l; Electrical Conductivity μs/cm; Total Alkalinity mg/l; Total Hardness mg/l; Chlorides mg/l and Total Dissolved Solids mg/l were recorded within the recommended WHO levels. So, the present study results revealed that water quality of the present survey was recommended feasible for aquatic life. Surface water is an essential component of the natural environment and a matter of serious concern today. Rivers, lakes, estuaries, and seas have been exposed to wastewaters from industrial, agricultural, and domestic sources for decades. Consequently, the quality of surface water has rapidly deteriorated in many regions, and polluted surface water is now a grave public health and ecosystem problem (White and Rasmussen, 1998; Wu, 2005).
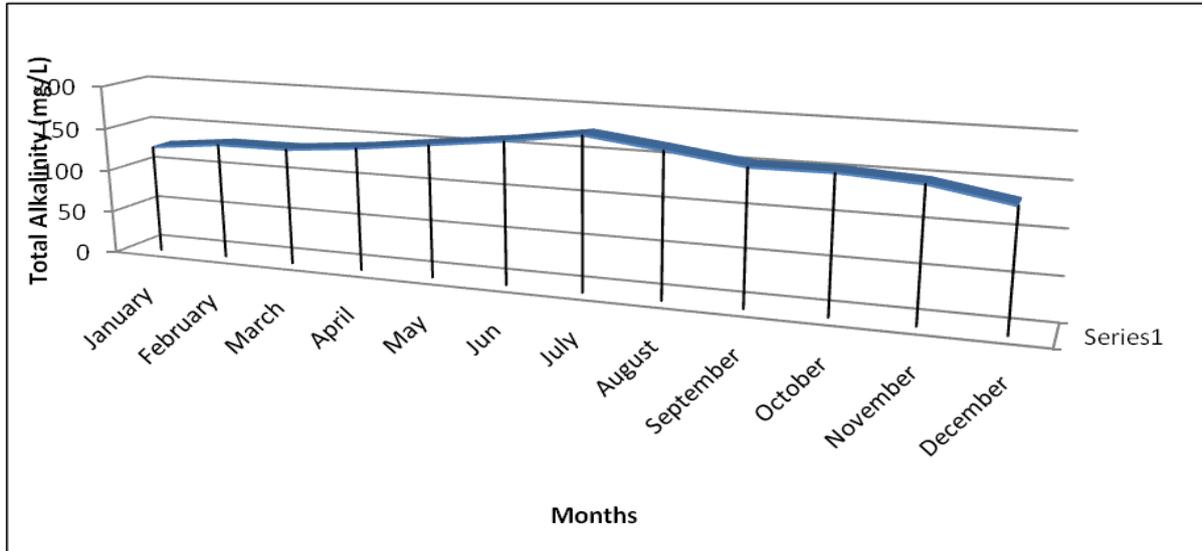

Fig. 7. Mean of Total Alkalinity (mg/L) from Biliani samplings station of river Dor during 5 years study period (2013 to 2018).
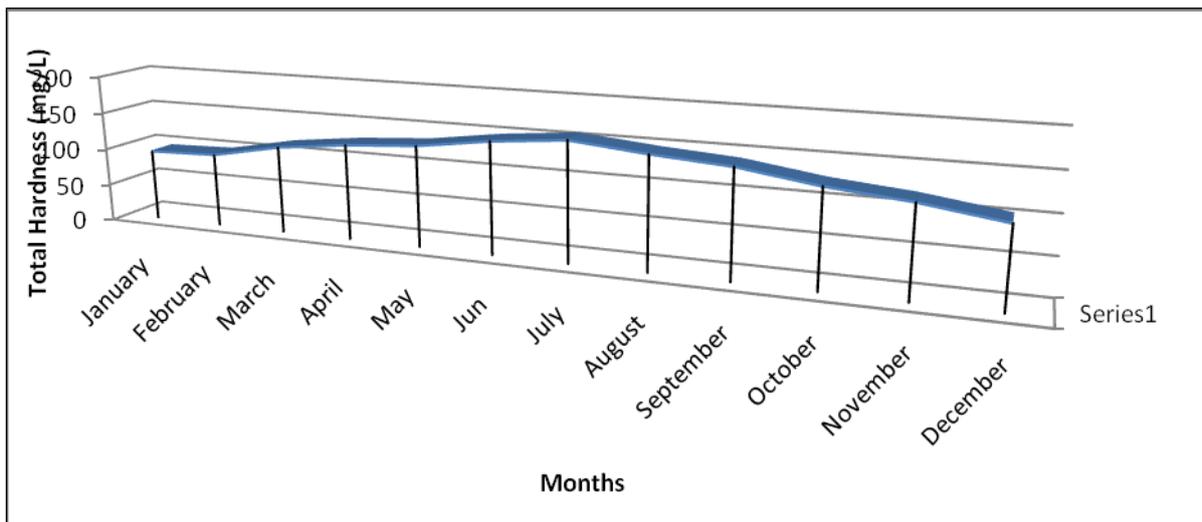

Fig. 8. Mean of Total Hardness (mg/L) from Biliani samplings station of river Dor during 5 years study period (2013 to 2018).

Furthermore, population growth and elevated living standards have been coupled with ever increasing demands for clean water. More water is also required for growing environmental concerns such as aquatic life, wildlife refuges, scenic values, and riparian habitats (Herman, 2000). Pollution of a river first affects its chemical quality and then systematically destroys the community disrupting the delicate food

web. Diverse uses of the rivers are seriously impaired due to pollution and even the polluters like industry suffer due to increased pollution of the rivers. River pollution has several dimensions and effective monitoring and control of river pollution requires the expertise from various disciplines (Trivedy, 1996).
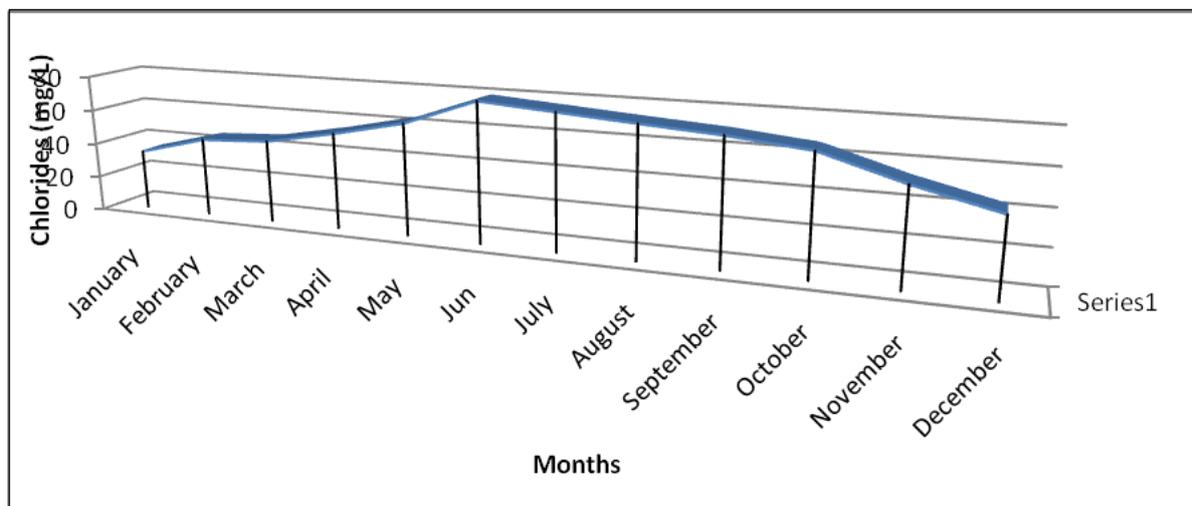
Fig. 9. Mean of Chlorides (mg/L) from Biliani samplings station of river Indus during 5 years study period (2013 to 2018).

Conclusion

From the current research conducted in River Indus at Bilianisampling station Khyber Pakhtunkhwa Pakistan was concluded thatall the recorded water quality parameters were suitable for the aquatic life.

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