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Environment Effects of Fish Culture Pond on Chemical Factors and Water Quality in the Shenrod River (North of Iran)

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ABSTRACT

The Shenrod River is located in the North of Iran, Gilan province, Lahijan and flows in the Caspian Sea. Its drainage basin is of utmost importance for the city.
Samplings were carried out to determine the factors effecting on water quality and the changes in those factors before and after fish culture ponds in the river. Fish culture ponds and their sewage produced are one of the most important sources of water contamination in the river.
There are 3 fish culture ponds in this river and all of them culture Rainbow trout and there is a margin distance of 2 km between them. The waste of these ponds was dumped into the river without being controlled.
We had six sites before and after each pond and they were weekly sampled during six months from April to September 2008 in the Spring and Summer (Warm Seasons). We surveyed Chemical factors in those stations and estimated water temperature, Do, BoD, CoD, No_3, No_2, pH, NH_3 and PO_4 Concentrations.
The mean (±SD) results show that: water temperature 19±7 ◦C, pH 8.1±0.6, Do 5.7±1.9 mg/lit, BoD_5 1.3±2.2 mg/lit, CoD 4.7±3.4 mg/lit, No_3 6.2±2.7 mg/lit, No_2 0.18±0.9 mg/lit, NH_3 6.9±4.8 mg/lit and PO_4 0.13±0.9 mg/lit.
The changes of Do, BoD_5 and NO_2 as chemical factor indexes are very clear in before and after those Ponds. In 1st, 3rd and 5th Station (St. before Ponds) Do is high with mean (±SD) 6.2±0.9 mg/lit but in the 2nd, 4th and 6th stations were in low levels with mean (±SD) 4.1±1.2 mg/lit, but BoD_5 and NO_2 were just the opposite of Do and increased after ponds with entering sewages. Other factors had a little change and the result shows the contaminating effects of the Ponds swage on this river.

KEYWORDS: Water quality, Fish culture Ponds, the Shenrod River, Caspian sea, Iran.

INTRODUCTION

Aquatic ecosystems are threatened world-wide by pollution as well non-sustainable land-use and water management practices that are reaching critical level (Mayes et al., 2007, Devi et al., 2008). Studies of the integrity of water bodies have evolved from studies of water quality monitoring based primarily on water chemistry (Cairns 1995) to more comprehensive assessments of aquatic ecological systems (Hering et al., 2006 and Astin 2007).

Water and land, the vital resources of life, are increasingly being polluted in the wake of popular growth, potter land use system, agriculture activates, industrialization, out of water from fish culture ponds and anthropogenic impact on the freshwater ecosystems. The effect of poor water quality on human health was noted for the first time in 1854 by John Snow, when he traced the outbreak of cholera epidemic in London to the Thames river water which was grossly polluted with raw sewage. Since then, the science of water quality progressed. In the third world countries 80% of all diseases are directly related to poor drinking water and unsanitary conditions (Sharma et al., 1995). The industrial units located at the outskirt in cities, intensive agriculture practices, indiscriminate disposal of domestic and municipal wastes are the sources for the river water pollution.

But biological parameters are increasingly studied as more sensitive indicators of ecosystem integrity than physicochemical parameters (Craft et al., 2007, Flinders et al., 2008 and Smith et al., 2007).

Extensive research has been carried out into environmental pollution from livestock farming (e.g. Bergstrom & Kirchmann 2006, Bosoh et al., 2006) However, compared to studies relating to manure spreading, there has been relatively little emphasis on pollution caused by animals grazing in the field (e.g. Oliver et al., 2005, Byers et al., 2005). Aquaculture practices are increasing all over the world due to progressive impoverishment of natural fish stock population and world-wide increasing demand for fish associated proteins (FAO 2000). Paradoxically farming activities have a strong negative feedback on natural fish populations as a consequence of two main reason:

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1) the enormous need of fish (from natural stocks) to be converted in farmed fish feed (Naylor et al., 2000 and 2) the deterioration of coastal areas due to high loads of organic matter and nutrients introduced by fish farms (Christensent et al., 2000).

Land-based fish farms require a huge input of energy in order to sustain cultivated biomass in terms of water demand (Handerds of litres per second), Oxygen supply, food, antibiotics and electricity. Furthermore, fish ponds require daily management due to in-pond rapid growth of various types of primary producers that must be removed to allow water circulation and avoid night oxygen consumption.

The enormous mass of fish stocked in modern fish ponds (up to 30/40 kg/m^3) determines a rapid consumption of dissolved O_2 and a considerable increase of dissolved nitrogenous compounds (mostly NH_4^+) due to direct fish excretion.

The shenrod River is located in the North of Iran, Gilan province, Lahijan city and flows in the Caspian Sea. Its drainage basin is of utmost importance for the city.

In this study we evaluated factors effecting on water quality of river.

Samplings were carried out to determined the changes in those factors before and after fish culture ponds in the river. The fish culture Ponds and their sewage produced are one of the most important sources of water contamination in the river. There are 3 fish culture Ponds in this river and all of them culture Rainbow trout and the waste of these Ponds was dumped in the into the river without being controlled.

2. MATERIALS AND METHODS

The study was carried out the shenrod River in the south-west of the Caspian Sea (North of Iran). There are 3 fish Ponds in this river and there is a margin distance of 2km between them.

We had six sites before and after each pond and they were weekly sampled during six months from April to September 2008 in the Spring and summer (Warm Seasons).

We surveyed physicochemical factors in those Stations and estimated water temperature, pH. Dissolved Oxygen, BoD5, CoD, nitrate (NO3), nitrite NO2, NH3 and PO4 total hardness concentrations.

River water samples were taken from the surface of the river (Upper 50cm). samples were taken at each station 3 times in a week. All sampling stations were located between 150-200m away before and after ponds. Storage and treatment of water samples were done according to Fresenig et al., (1988) and APHA (1998).

The pH and temperature were measured at sampling site using potable meters. The water samples were analyzed for phosphate (PO4), ammoniac (NH3), Nitrate (NO3), Nitrite (NO2), dissolved Oxygen (Do), total hardness, Biological oxygen demined (BOD) and chemical Oxygen demined (COD) were determined by sing the standard methods (APHA, 1998).

RESULTS AND DISCUSSION

The determined values of quality parameters of the water samples are given in table 1.

The analytical results given in the table is the means (and standard deviations) for 3 samples taken from each location for six sampling station.

Table 1: Means (±SD) and water parameters values during six stations in Shenrood River

Stations / Factors	S1	S2	S3	S4	S5	S6	Means±SD
Water Temperature	17.8	18.3	18.9	19.9	20.9	22.7	19±7
pH	7.8	8.2	7.9	8.1	8.4	8.7	8.1±0.6
DO	7.3	4.6	7.1	4.2	6.9	3.8	5.7±1.9
BoD_5	1.7	1.2	1.6	1.1	1.6	0.9	1.3±2.2
CoD	3.5	5.7	3.1	6.1	3.7	6.9	4.7±3.4
No3	6.7	7.4	5.3	7.9	5.9	8.1	6.2±2.7
No2	0.11	0.27	0.15	0.31	0.17	0.38	0.18±0.9
NH3	0.03	0.76	0.33	0.84	0.47	0.94	0.69±4.8
PO4	0.08	0.11	0.09	0.14	0.11	0.16	0.13±0.9
Total Hardness	518	523	570	575	515	542	528±102

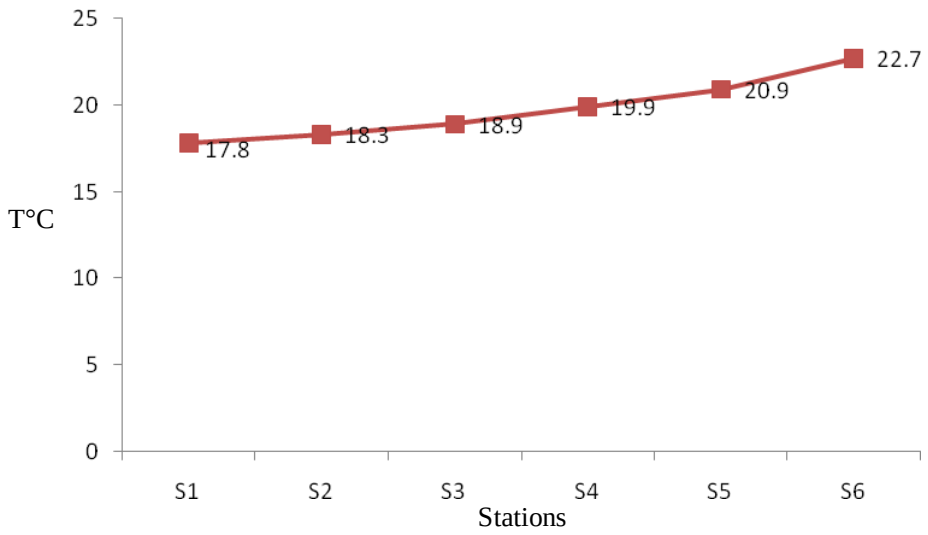

Fig 1: Water Temperature (°C) during six stations

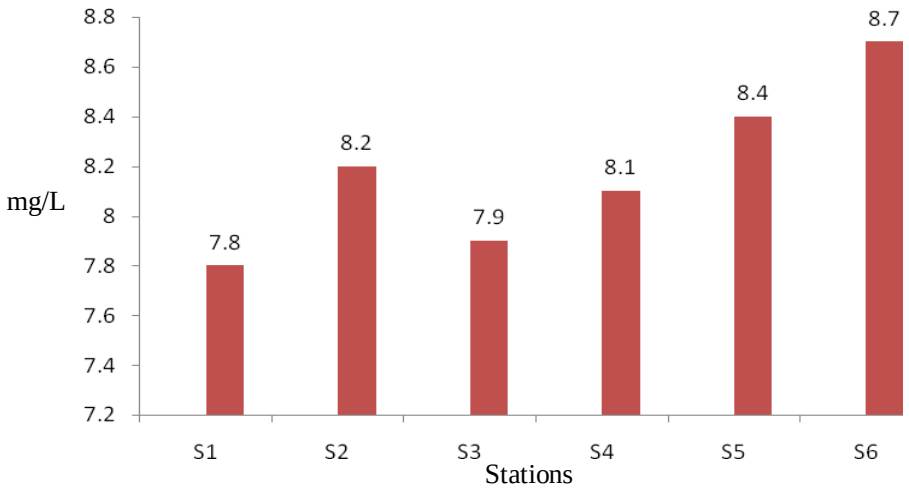

Fig 2: pH during six stations

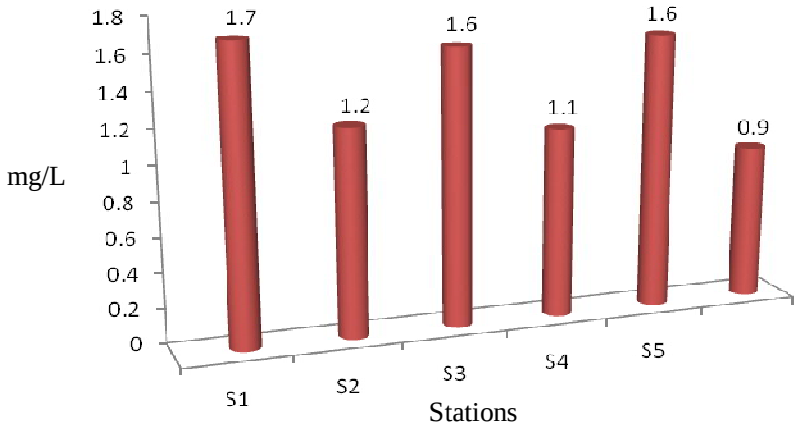

Fig 3: BoD_5 (mg/L) during six stations

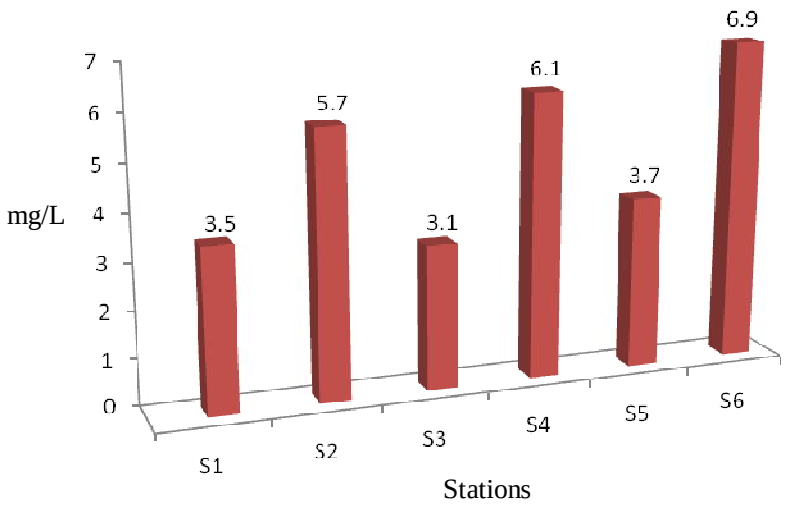

Fig 4: CoD (mg/L) during six stations

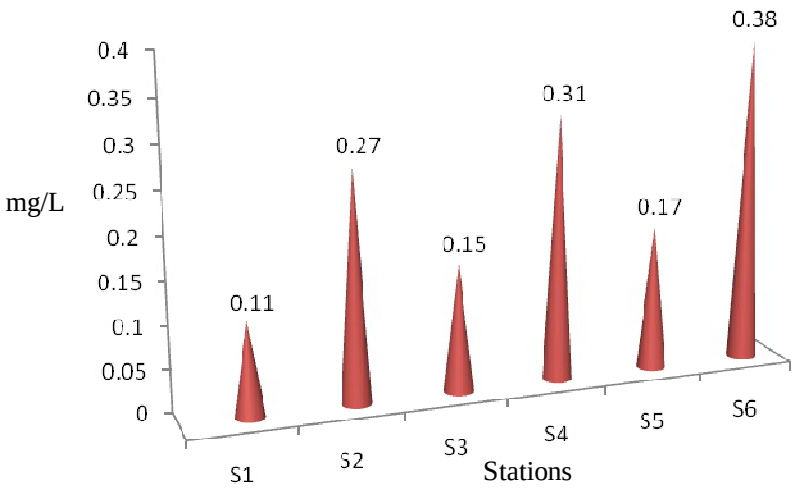

Fig 5: NO_2 (mg/L) during six stations

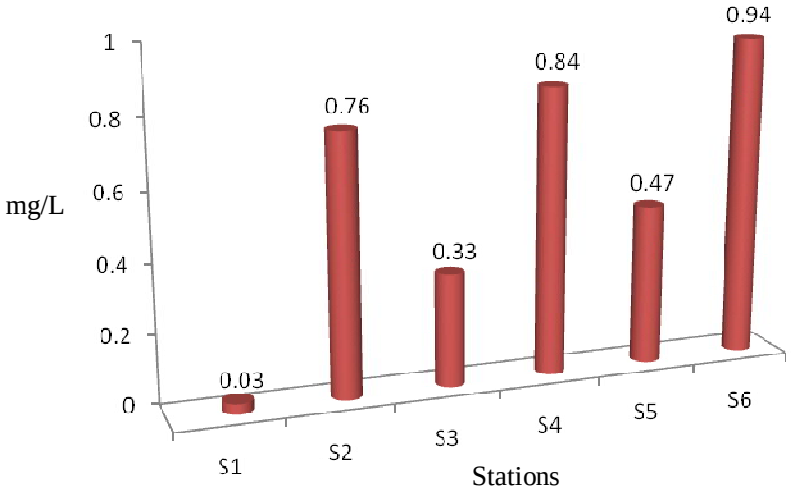

Fig 6: NH3 (mg/L) during six stations

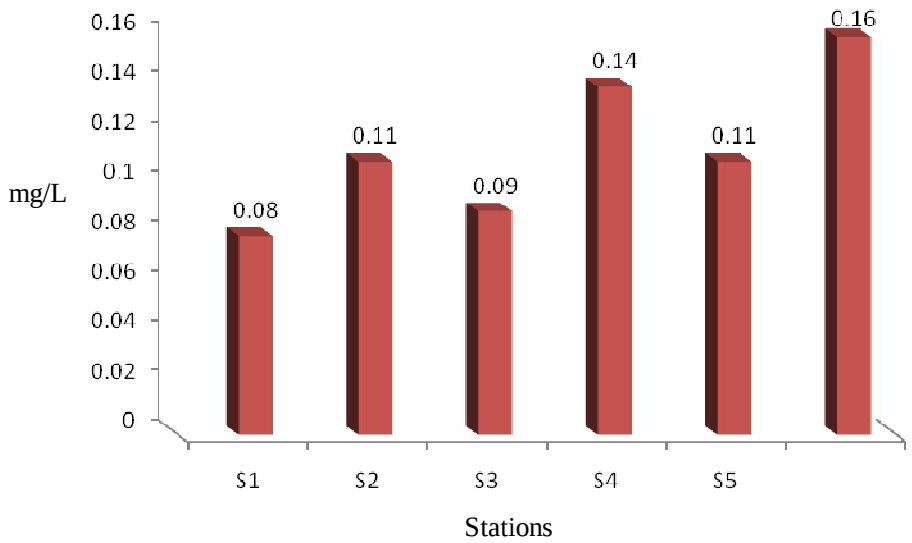

Fig 7: PO_4 (mg/L) during six stations

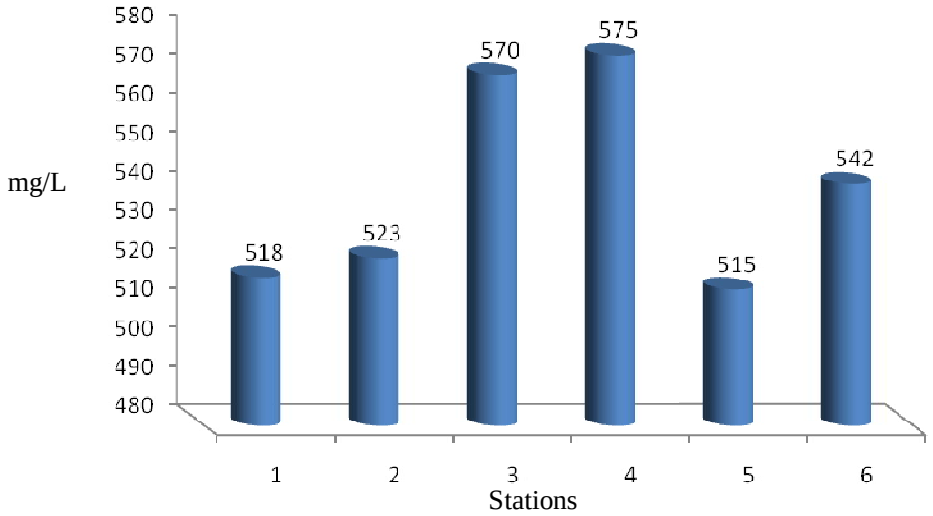

Fig 8: Total hardness (mg/L) during six stations

The temperature of the water samples analyzed ranged from 17.8 to 22.7 °C during survey (Table 1) the average pH values varied from 7.8 to 8.7 during the river and low pH values may be partly due to high content of humic acids in the springs and streams in the upland the river. Hardness of water depends mainly upon the amounts of Calcium of magnesium salts or both.

The limits of Ca and Mg ions in potable water range from 75 to 2000 mg dm^{-3} and 50 to 100 mg^{-3} respectively (ICMR 1975).

The total hardness (TH) varied from 515 to 570 $mgdm^{-3}$ $CaCo_3$.

The maximum concentration of nitrate for public water supplies is 45 $mgdm^{-3}$ (WHO 1988). The concentration of nitrate in the river water were 5.3 to 8.1 mg/L and in the stations 2, 4, 6 were high than stations 1, 3, 5. The phosphate ion content (table 1) in the water samples studied were 0.08 to 0.16 mg/L and after fish Ponds shown a increase values.

The mean inorganic nutrient content of river mater (before and after fish ponds) were compared with them (low and high pollution).

Physicochemical factors had a change du ring the river and result shows contaminating effects of the ponds swage on this river. Ponds swage and agricultural land use, anthropogenic activities and industrialization are the major main causes pollution in the river. Those are main source for the high ammonia, nitrate, nitrite and phosphate ions in this river. Domestic and industrial discharges into the river are probably responsible for the observed high concentration values of total hardness, total dissolved solids and other contaminating factors.

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