



## Socio-ecological review of Bolgoda Lake in Sri Lanka

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### Abstract

Sri Lanka is a beautiful island surrounded by the sea, also our country is worldwide famous as a country rich of Bio-diversity. It is the richest country in South Asia when consider the Bio-diversity. However this position is going down gradually. Bolgoda Lake, rich with Bio-diversity flows through Moratuwa in Colombo district. But it is being polluted at present due to the Carpentry industry. This research is both explanatory and analytical to survey how the collapse of Bio-diversity affects the environment, the issues related and also the solutions for them. In order to collect information from the chosen area a questionnaire was used as a sub document of the interviews. Those documents used to collect information from householders, businessmen who own saw mills and carpentry shops and state officials. In addition to used observation too. Also a laboratory test was done to check the nature of the water of The Bolgoda Lake.

Bolgoda Lake area is mainly a Sinhalese settlement. The majority of the people are Buddhists. Most of the residents have completed education only up to GCE (O/L). The most of them have been in this area for more than fifteen years. Carpentry industry is the most prevalent and main employment in Moratuwa. It was further observed whether there is a relationship between carpentry industry and environmental pollution. Most people consider waste from carpentry industry such as saw dust and wooden chips as garbage. Water of Bolgoda Lake hasn't been used for drinking for the past 25 years. Laboratory test was indicating that carpentry industry is mainly responsible for the pollution of waters in these areas. So it can be said that Bio-diversity around Bolgoda Lake has declined in the present. This situation can develop further. It is essential to have a proper program to enlighten people about their unsystematic use of the lake, and to attend employments environmentally friendly manner.

There are some important suggestions introduced by people who living this area. They say that certain place and a proper system should be introduced for discharging saw dust. And saw mills and huts should be covered to avoid spreading saw dust. Workers in the factories must wear safety masks. Most of the people accepted that saw dust and wooden chips can be used for a worthy cause. There were several suggestions of using saw dust and wooden chips in large scale advantageously. To produce new kinds of boards (MDF etc) and to use for brick and tile kilns, to produce manure as an alternative for chemical manure, To produce heat electricity by burning them, etc. It can finally be said, with the association of state and private sector organizations and with the help of the residents, a systematic project should be introduced to protect Bio-diversity and environmental balance.

**Keywords:** Sri Lanka, Bolgoda Lake, bio-diversity, carpentry industry, environmental pollution

### Introduction

Human struggles for survival can be seen everywhere. However, activities related with these struggles may cause problems between the human and nature. Sri Lanka, also facing such issues at present, and such issue is related with the Bolgoda Lake.

### Bio-diversity in Sri Lanka and the Bolgoda Environmental Zone

It can be simply said that the bio-diversity is needed for all beings including humans for their physical existence. But man needs the diversity for mental and social existence too. The man has no existence without diversity. As far as Sri Lanka is concerned, it is a beautiful land surrounded by the sea, enriched all environmental constituents conducive for living. There are a number of environmental systems divergent from each other. The examples are the sea coast, mangroves, bays, rivers, fresh water reservoirs, swamps, highlands, and various forests. The climatic diversity also is in a high position. The number of living creatures of above mentioned environmental

systems is also high. So our country is worldwide famous as a place having high bio-diversity. Sri Lanka is the richest country with bio-diversity in South Asia. This small island is also among the 25 countries of the world having rich bio-diversity.

Colombo district is considered as the most polluted and the busiest place in this island with bio-diversity. Moratuwa Divisional Secretariat is one of the most precious places that have many environmental systems. Moratuwa inherited this fame as the Bolgoda Lake flows through that area. The Bolgoda Lake borders the South and East parts of Moratuwa Divisional Secretariat. The Bolgoda lake system is situated in the low country wet zone between longitudes E. 79 55'- 79 58' and latitudes N. 6 40' – 6 48' It contains 24 Grama Niladari divisions. The water of the Bolgoda Lake is being vastly polluted due to the increasing of population density along its banks and other environmentally adverse activities.

Bio-diversity, plant diversity, and environmental diversity of the Bolgoda Lake area are very dominant. So many animals and fresh water fish are living around the lake. The Bolgoda

Lake has been specially identified as a place where prawns are abundant. The fish diversity used to be in the past is vanishing today. The varieties of birds are facing the same destiny. Bolgoda was one of the resting places for migrated birds in the past. When considering the plant diversity many mangrove trees have grown. The invading aquatic plants have invaded the lake. The environmentally friendly trees grown along the banks are not to be seen today. It might have caused the constant discharging of wastes into the lake. This environmental system once attracted tourists. But it is out of their attention at the moment.

### **Objectives**

This research is both explanatory and analytical to survey how the collapse of Bio-diversity affects the environment, the issues related and also the solutions for them. Some suitable projects to minimize the harm done to the left bank area of the Bolgoda Lake due to collapsing of bio-diversity are introduced by this research.

### **Sample and procedure of data collection**

Moratuwa Divisional Secretariat laid on the left bank of the Bolgoda Lake is the study area of this research. Ten sub Divisions have been chosen as the sample where carpentry industry is attended minor and large scale, people abundantly occupied, and the Bio-diversity is being vastly damaged, that revealed due to basic observations. 178 household units from these sub Divisions were chosen randomly to introduce a questionnaire to collect information.

When the information was collected from the relevant household unit either the head of the household or a responsible elderly person was contacted. The majority (76%) of the sample who furnished the Information from the household unit is householders. Twenty five out of 178 were women and remaining 153 were men. So 86% of who furnished information represents male and 14% female. This selection was done randomly. The sample is also consisted 15 businessmen who engage in large scale carpentry industry and 10 other state officials working in the area.

The age of the person who furnishes information regarding a complex topic such as bio-diversity is very important. The value of the information given depends on the age and the experiences of the respondent. So the persons engaged in the research consisted of 8 age groups. The minimum of the sample represents both the lowest and the highest age groups. The majority of the sample represents the middle aged persons. There is a considerable representation of the youth too. It is important for the success of the research.

In addition to seven water samples taken from the middle and close to the bank of the lake in the relevant area for the physical observation, how the informal waste discharges of the carpentry industry has damaged Bio-diversity of this certain area.

### **Methodology of Data Collection**

In order to collect information from the chosen area a questionnaire was used as a sub document of the interviews. Those documents used to collect information from householders, businessmen who own saw mills and carpentry shops and state officials. In addition to information were

collected through mere observation too.

A laboratory test was done to check the nature of the water of The Bolgoda Lake. Seven water samples were taken from different stations of the lake and also from the middle, near the bank etc. using suitable apparatuses. Parameters measured were, Temperature (Digital Thermometer), pH (digital pH meter), Dissolved Oxygen (Winkler's method), Biological Oxygen Demand (BOD) (Winkler's method), Chemical Oxygen Demand (COD), Total Solids (TS) (gravimetric methods), Total Suspended Solids (TSS), Total Dissolved Solids (TDS), Total Nitrogen (TN) and Conductivity. They were examined by an internationally accredited institute (Rubber Research Institute of Sri Lanka). The technical analysis issued by the above institute was also referred preparing this report.

### **Results and Discussion**

#### **Socio-economic Background**

The Bolgoda Lake area is mostly a Sinhala habitation. The majority of them are Buddhists (69%). The remaining are Christians and Roman Catholics. It's a special feature that there seem not to be any Hindus or Islams.

62% of the participants have studied bellow Grade 8. Forty seven participants have completed GCE (O/L) that is 27 % in percentage. 7.33% of the participants have studied up to GCE (A/L). Only one Diploma/Degree holder was found. The percentage of never schooled is 3.37%. This information reveals us that the educational level of the area is not in a higher position.

Most of them (145) have been living in this area for more than 15 years. Eleven of them have been living for 10-15 years. Eight household units have been residing for 5-10 years. The remaining 14 household units have been living for less than 5 years. The percentage living for a longer period in this area is 82%. It is implied that most of the subscribers have gathered experiences living in this area more than one and half decades. When considering the general information of the subscribers' their residential status is also important. Most people of the sample have been living in this area from their birth. The percentage of the people who resided after marriage is 10%. The percentage resided on account of employment is 4%. 7% have furnished other reasons. Some of them have changed their original habitats and have resided in this area building new houses. Some of them have bought lands from this area. A few of them had to change their residencies due to changing their children's accommodations.

The majority of the people earn a considerable monthly income. The highest income is earned by the people who engaged in carpentry industry as a self-employment. The other additional income avenues are fishery industry, electricity work, masonry and three-wheeler driving. The employments and income avenues hold a better position. But the living condition of the area is not in a high standard comparatively. This is discussed as "The culture of Poverty" in anthropology. This situation is very common in many developing countries.

#### **Carpentry industry and The Bolgoda Lake**

One of the main objectives of this research to examine whether there is a relationship between carpentry industry and Bolgoda Lake getting polluted. Carpentry industry has

acquired a rapid improvement at present than in the past. The present artisans have been able to make many products than before using developed machinery to fulfill increasing modern demands. Implementing of workers and new machinery has increased gradually. Though the industry has developed the demand has gone down. It's an unfavourable situation in carpentry industry. It is important to observe the effects of carpentry industry against the environment in comparison. 51% percent of the sample pointed out that the improvement of carpentry industry is harmful to the environment somehow or other. It is important that a few people mentioned it is not harmful. It is clear when the information is considered that the improvement of carpentry industry has badly affected the environment. It is important to examine the harm done to the environment with the improvement of carpentry industry. So the people who mentioned that it was harmful were asked their opinions.

Many people believe that the reason for getting polluted of Bolgoda Lake is discharging waste from carpentry industry into it. It has also pointed out that waste from neighboring houses equally discharge garbage into the lake. The output pipe lines of cesspools also lead to the lake. This discharging is being done not only by the carpentry industry but also by state institutes such as municipal councils. According to the majority despondence, the lake has become narrowed than before due to discharging saw dust and waste on its bank. They pointed out if this situation continues another ten years there wouldn't be a lake to be seen.

### **Carpentry industry and The Health issues**

Health issues are the main harm done to the environment with the improvement of carpentry industry. Lung diseases such as wheeze, asthma, and phlegmatic disorders are some examples. It is the notion of majority. One of the other main issues is air pollution due to their opinion. The improper burning of saw dust and the bad smell exuded from the rotten saw dust is also conducive air pollution. Water pollution of Bolgoda Lake has increased due to discharging saw dust into it as garbage. Some people pointed out that transportation of wood using heavy vehicles caused to damage the road and it has become a pool of mud. This situation leads spreading epidemics such as dengue fever. The polluted environment, due to improper human activities has caused this situation. So it is clear that the majority of the sample is aware of the relationship between spreading diseases and environmental pollution.

### **Waste of carpentry industry use for worthy purposes**

The subscribers of the research were asked whether they consider saw dust and wooden chips as waste from carpentry industry. The objective of this question was to check their knowledge, whether they know how to use the waste from carpentry industry for some valuable purposes. More than half of the sample (52.80%) considers saw dust and wooden chips as garbage. But some people point out that they are used for worthy purposes. It is 35.95 in percentage. It is a specialty to be seen. These worthy purposes are using them for kilns as fuel, selling them as fire-wood, using them for domestic consumption, and for saw dust hearths as a fuel. But it is clear that a few people are implementing this waste usefully. All state officials participated in the research think saw dust

and wooden chips as a non-waste substance. It is a particular thing that most of the businessmen to think saw dust and wooden chips as useful. But they said that they often discharge them as litter. They use them to heap up low lands, and sometimes heap up along the sea coast. Some people pointed out that they either burn them or put into the lake. The information shows that they have enough knowledge about implementing saw dust and other waste from carpentry industry usefully. It is assured by the notion of the majority. The harm done by saw dust and other waste can be avoided with systematic disposal. And they can be implemented in large scale to earn more benefits.

Majority of the sample has mentioned about the ability of producing various kinds of boards in large scale, using saw dust. Producing wooden boards has already been started in small scale. Some persons have mentioned that saw dust and other waste can be used to make incense sticks. And some are suggested using it as a fuel for domestic purposes. Some persons have mentioned about the ability of using them for kilns in large scale to bake bricks, tiles, and lime. There were some other suggestions to use them for breeding mushrooms, producing mosquito coils, and manure. To use for generating electricity in large scale is another suggestion. They can be used for making ornaments. And they can also be used in farms and to fix holes on wood.

Also observed about the institutes that can involve in this regard. Several institutes were mentioned. The institutes that can assist for implementing waste from carpentry industry usefully categorized as Follows. The Samurdhi Authority, Industrial ministry, Ministry of agriculture, Ministry of small industries, Ministry of power and energy, State timber cooperation, State engineering cooperation were such suggested state institutes to be involved. And a considerable number of people suggested some local bodies such as the Provincial Councils, The Divisional Secretariats, The Municipal Councils, should involve in this regard. NGOs and state banks also have some responsibility. Even Central Environmental Authority has been mentioned. few persons suggested involving of rural bodies such as women's societies, village development societies and self-employment training institutes to be involved.

There are some other suggestions to introduce example productions, motivating people by enlightening them, training to start projects. There were no responses to be seen about establishing a formal system of rules and introducing community control systems. With the further perusal of above information giving technical and monetary aids, introducing example productions, and starting large scale factories have been highly appreciated.

### **Advantages taken from Bolgoda Lake**

The water of Bolgoda Lake is often used for bathing, washing clothes, mixing concrete, bathing animals, relieving nature, and for agricultural use. But today the advantages take from the water of the lake have decreased due to pollution of it. Even though it was used for daily purposes such as bathing, it cannot be done today. They themselves described the involvement of state officials to solve social and environmental issues arisen. It is said that they launched awareness programs, free labour campaigns for removing

Water Hyacinth accompanied with other organizations once a month. In addition to this the municipal council has involved to avoid putting garbage everywhere. A road has been constructed in the mangrove areas. They expect to minimize heaping up garbage near the lake. But these programs remain unsuccessful due to minimum contribution of less educated residents.

### **The nature of the water of Bolgoda Lake**

It is important to observe whether the water of Bolgoda Lake was fit to drink in the past and today. Much important information was revealed by the research study regarding this matter. There are so many ideas about not using the water for drinking today. 31% said it is not fit to drink as it contains too much salts. 64% said water is polluted. It was revealed by the research that various reasons have caused this pollution. More than half of the sample pointed out getting added waste into the lake as the main reason. Some people said the lake is too muddy, and water hyacinth gets putrefied. The water remains still without flowing also causes this pollution.

When they were asked about the nature of the water in Bolgoda Lake, specially the taste today, many people mentioned about its colour to be seen. It seems that they don't have any idea about its taste as it is not used for drinking today. Some people said it couldn't be drunk as it has various colours. They are 59.63 in percentage. They are afraid of taking the water into their mouths to predict about it. 87 said it was blue and it implies there used to be clean water in the lake 25 years ago. It was revealed the water in the lake has completely changed today. A higher number of persons, id est.; 108 said the water of Bolgoda Lake is green today. 15.74% said it hasn't changed. Even though they are residents of near the lake that implies their inattentiveness towards it. However the majority pointed out the smell has changed.

The common notion of the residents is there are changes of taste and smell of the water. It is important to find out the reasons conducive those changes. Subscribers were given three possible hypotheses about the changes of the water and due answers were received. Some persons pointed out mixing manure and pesticides from nearby farmlands as a reason. And 18 persons said waste from factories gets collected to the lake. Most of the sample believes discharging garbage along the bank as main reason for these changes. 76 people mentioned putting saw dust into the lake is another reason to this pollution. It seems that an acceptance of their own guilty. There were some other reasons to be seen too. Stirring mud when water level becomes low, leading cesspool output into the lake, putrefaction of water hyacinth are those other reasons mentioned.

### **Fish population of Bolgoda Lake**

The responses about the decreasing of fish population in Bolgoda Lake between past and the present. Ninety six out of the sample mentioned the fishes have been facing extinction. It is 53.44 in percentage. If the fishes used to be in the past, have vanished in the present, it might have caused various reasons. But no fishes were identified as extinct. It is clear that the fishes in the present are facing both extinction and decline of population.

Being the lake polluted is one of the main reasons for

extinction of fish. 51.68 percent bear that notion. The reasons for getting the lake polluted are mixing waste, oil and chemicals, increasing the layer of mud in the lake, mixing excrement, putting saw dust into the lake to get it filled up etc. Putrefaction of water hyacinth is another reason in this regard. In addition to the natural causes some other reasons might be conducive for extinction of fish. Those reasons are; copious fishing, depriving fish of their laying grounds, washing away fish into the sea with low tides and eating of other fishes' eggs by a fish called Batta. There is no proper place for fish to live along the bank. In the rainy season population of fish gets decreased. Unsystematic human activities also cause for extinction of fish. Using unsuitable fishing apparatuses, unsystematic fishery industry are those causes. Some people mentioned ruining of the bank is another reason for extinction. Filling up the bank, cutting down trees along the bank, building up houses on the filled up bank were the reasons they pointed out.

The fishes of the lake were also observed whether they have changed in appearance especially in colour of skin. Majority of people assures no changes in colour of the fish. But 23.03% has mentioned various colour changes to be seen. The fishes would become black in colour when the lake gets too muddy. And there are tawny and golden coloured fishes too, according to these people. And most of them believe that the pollution of the lake might have caused getting infection with diseases. Getting the lake too muddy, getting it too salty, getting added garbage, saw dust, harmful chemicals, leading excrement pipe lines into the lake cause it to be polluted.

### **Other aquatic species living in Bolgoda Lake**

It was observed about other aquatic species lived in Bolgoda 25 years ago comparing with the present. Otter, Tortoise, Water snake, Prawn and Crocodile are the other aquatic species living in Bolgoda Lake from 25 years ago. But some species lived there in the past cannot be seen today. And some new species have been living there instead. A decline of their population can be seen than a disappearance of them. The main reason for this decline is the increase in consumption. 28.43 percent accepted it. Prawns, lobsters, crabs, and tortoises are facing extinction due to this over consumption.

Harm done to the lake causes this situation. Responses in this regard were 24. It is 23.52 in percentage. The harm done to the lake was getting the bank filled up, getting the lake polluted, clearing both sides of the lake. few persons mentioned some other reasons The newly bred fishes, setting up big fishing nets, being the lake too salty, getting the water level down, causes the fish and other aquatic species to be dead or decline of population, they believe. A considerable number of people have mentioned there are aquatic species harmful to human being and unfit for human consumption.

### **Birds and other animals lived in the past and live today**

Many birds, animals and reptiles have been mentioned that used to be around Bolgoda Lake 25 years ago. They were cranes, cormorants, curlews, kingfishers, water hens, Mynahs, Crows, Parrots, Kitalayas, Babblers, Swallows, Swans, magpies, hawks, Crow-pheasants, Goose, Iguanas, Pittas, Blue doves, Flycatchers, Weaver birds, Blue fowls, Paradise flycatchers, Pelicans, Orioles, Ducks, Black munias, Bats and

migrated birds. And there used to be monkeys, Panthers, Monitors, Cobras, Vipers, Frogs in the past. But there is a decline of animal population due to the harm done to the environment. A scarcity of Cranes, Cormorants, Monitors and Swans can specially be seen. There is a decline of reaching migrated birds than in past.

Following reasons were introduced as the causes for decreasing animal population. 43.25 percent has mentioned the pollution of the lake as the main reason. Unsystematic use of the lake is one of the main harms done. Filling up the lake by the residents themselves for building houses is another reason for extinction of animals.

It was revealed that the scarcity of trees along the bank is one of the other main reasons for decreasing animal population. 39.76 percent from the sample have mentioned this idea. Scarcity of trees such as kadol and Kirala causes depriving of dwelling places of birds. They also face scarcity of food due to cutting trees. There are several other reasons for decreasing animal population. 12.35 percent pointed out killings animals by human, their own activities, too much noise and allergic of water as reasons for extinction of animals. Only a few persons said that no animal faced extinction. So according to the majority there is a numerical scarcity of animals comparatively with the past. And various human activities have caused in this regard.

#### **Aquatic plants used to be in Bolgoda Lake in the past and which can be seen today**

It is important to observe the knowledge of residents about aquatic plants used to be 25 years ago in order to identify plant-diversity around Bolgoda Lake. The moss used to be there even in the past as an invader plant. In addition to that there are aquatic plants such as Water Lily, Lotus, Lily and Kekatiya. Sylvania and Water Hyacinth have been identified as both invaders and strangers. They used to be there even in the past. A considerable number of participants had mentioned that there had been curry leaves such as Mukunuwenna, Gotukola. There had been some other plants such as Alocacia, Water Alocacia, Tulhiriya, Diyaberaliya, kinds of weeds and bamboos. Mukunuwenna is one of such plants which has herbal value. With the vanishing of these valuable plants some invading and strange plants have taken that place. It was revealed that they had spread around Bolgoda Lake area aggressively.

#### **Plants used to be along the banks and which are to be seen today**

It is important to observe about the plants used to be along both banks of the lake in order to identify decline of Bio-diversity. The plants used to be in the past and can be seen at present are Kumbuk, Mangroves, Kaduru, Rush and Alocacia. They all are aquatic plants. There used to be some other plants such as Aatta, Reeds, Bimtamburu, Tulhiriya, Almond, Diyaberaliya, Bokutu, Bamboo, Bread-fruit, Domba, Rukattana, Arecanut, Slime apple, Banyan, Lunuwila, Maara etc.

It was revealed that there are Alocacia and Kirala abundantly along the both banks of the lake. But there is a scarcity of Screw Pine, Kaduru and Rushes. Some people said that there

are some harmful plants to the environment such as Alocacia, Rushes, Reeds, Weeds etc. 63% mentioned about it. The environment around the lake has changed immensely than before. The population of birds such as cranes and parrots used to be seen in the past has decreased today. The reason for this deficiency is cutting down plants such as Kirala and Screw pine and filling up the 50 meter preservative land along the bank for building houses. And depriving of dwelling places for animals has minimized their reaching. Too much noise also has blocked their access to the area.

#### **Knowledge of residents about the concept of bio-diversity**

Bio-diversity is basically a collection of plants, living creatures, genes and environmental systems. It can be introduced as a combination of environmental systems of whole living beings. There are several factors on which Bio-diversity depends. They are the variations of environmental systems, species and genetics. So Bio-diversity is an important discourse. It is important to observe the knowledge of the participants about Bio-diversity when its decline is concerned. According to the research it is clear that many people of the area have at least some knowledge about Bio-diversity.

#### **The results of water quality data from the Bolgoda Lake Temperature**

The mean water temperature recorded for the seven stations was  $30.29 \pm 0.73$  °C and ranged from 29.70 °C to 31.40 °C (Table 1). In the stations where temperatures were taken both from the bank and the middle, the temperature in the banks were slightly higher than the middle.

#### **pH**

Mean water pH for the seven stations was  $7.97 \pm 0.28$  and ranged from 7.5 to 8.3 (Table 1). pH of other reservoirs were Senanayake Samudraya 6.2 – 7.9 (CEA, 1993a), Minneriya Reservoir 7.54 (CEA,1993b) and Victoria Reservoir 6.9 – 8.1 (Nathanael and Edirisinghe, 2001). Beira Lake which is most polluted, recorded a pH value between 7.2 – 9.8 (Nahallage and Piyasiri, 1998).

#### **Chemical Oxygen Demand (COD)**

The Chemical Oxygen Demand ranged from 100mg/l to 600mg/l, average was  $328.57 \pm 205.86$  mg/l (Table 1). Chemical oxygen demand (COD) is a measure of the capacity of water to consume oxygen during the decomposition of organic matter and the oxidation of inorganic chemicals such as ammonia and nitrite. COD measurements are commonly made on samples of waste waters or of natural waters contaminated by domestic or industrial wastes (<http://science.jrank.org/pages/1388/Chemical-Oxygen-Demand.html>). Minimum quality criterion of 40 mg/l was recommended for Class III waters (general waters). In drinking water maximum permissible COD value is 10 mg/l. When looking at the very high COD values of the Bolgoda Lake we can say that the lake contains lot of organic and inorganic wastes. Therefore these waters are not good for daily use. Contrarily to this the COD value of the Laxapana Reservoir is 0.8 mg/l to 1.7 mg/l (Nahallage and Piyasiri, 1998).

### Biological Oxygen Demand (BOD)

The mean BOD value was  $12.57 \pm 6.92$  mg/l (Table 1). The BOD level ranged from 4mg/l to 22mg/l. Biological Oxygen Demand is the amount of oxygen taken up by microorganisms that decompose organic waste matter in water. It is therefore used as a measure of the amount of certain types of organic pollutant in water. A high BOD indicates the presence of a large number of microorganisms, which suggests a high level

of pollution. The proposed limits of the ambient water quality are in the range of 3 to 5 mg/l. Therefore the water of the Bolgoda Lake is highly polluted. Beira Lake which is considered as highly eutrophic and polluted, the BOD values range from 33.45mg/l to 68.35mg/l, where as in Senanayake Samudraya, the recorded BOD value was 0.25 mg/l (CEA, ). If BOD is over 10 mg/l, the water is considered as polluted, this further confirms that the Bolgoda Lake is polluted.

**Table 1:** Water quality parameters of the Bolgoda Lake.

| Site                     | Temp. <sup>o</sup> C | pH  | COD    | BOD <sub>5</sub> | TSS    | TDS    | TS     | TN<br>(mg/l) | DO     | Conductivity |
|--------------------------|----------------------|-----|--------|------------------|--------|--------|--------|--------------|--------|--------------|
|                          |                      |     | (mg/l) | (mg/l)           | (mg/l) | (mg/l) | (mg/l) | (mg/l)       | (mg/l) | (mv)         |
| Kospalana bank (control) | 29.9                 | 7.5 | 200    | 7                | 10     | 228    | 5756   | U.D.         | 7.9    | 20           |
| Koralawella Bank         | 29.8                 | 8   | 600    | 22               | 555    | 9028   | 18322  | 5.6          | 5.3    | 20           |
| Koralawella Middle       | 29.7                 | 8   | 600    | 21               | 553    | 12484  | 15958  | 5.6          | 6.6    | 30           |
| Pahala Indibadda Bank    | 31.4                 | 7.9 | 200    | 8                | 47     | 4404   | 5860   | U.D.         | 6.7    | 20           |
| Kadolana middle          | 29.9                 | 8.3 | 400    | 12               | 217    | 4848   | 15886  | 2.8          | 9.2    | 30           |
| Kadolana Bank            | 31.3                 | 7.8 | 100    | 14               | 310    | 5024   | 5434   | U.D.         | 4.3    | 20           |
| Willorawatte middle      | 30                   | 8.3 | 200    | 4                | 47     | 980    | 680    | U.D.         | 9.5    | 10           |

U.D. Undetectable

### Dissolved Oxygen (DO)

Mean DO value recorded from the stations was  $7.07 \pm 1.92$  mg/l. DO values ranged from 4.3 mg/l to 9.5 mg/l. Oxygen, in water is measured as dissolved oxygen (DO). If more oxygen is consumed than is produced, dissolved oxygen levels decline and some sensitive animals may move away, weaken or die. If this continues the fauna of the lake could be replaced by organisms which require low oxygen levels and who can tolerate pollution conditions. If DO levels are severely low, large quantities of fish may die. Low DO is also caused by fertilizer and manure runoff from streets, lawns and farms. According to CEA proposed standards for fish and aquatic life a minimum DO of 3 mg/l is required. DO level of a water body varies with the water temperature? For the average temperature recorded in the stations (30.29<sup>o</sup>C), required DO level is 7.54 mg/l. The recorded mean DO 7.07 mg/l falls within this limit. In Beira Lake they DO values ranged from 7.82 to 14.41 mg/l (Nahallage and Piyasiri, 1998). The intense algal production leads to an excessive production of oxygen in the surface waters of Brira lake and it's depletion in the lake bottom. Some of the DO values recorded in other reservoirs were, Senanayake Samudraya 6.35 mg/l (CEA, 1993a), Minneriya Reservoir 7.90 mg/l (CEA, 1993b), Tabbowa 5.9 mg/l (CEA, 1993c) Victoria reservoir 4.4 mg/l to 6.5 mg/l (Nathanael and Edirisinghe, 2001).

### Total Solids (TS), Total Suspended Solids (TSS) and Total Dissolved Solids (TDS)

The mean TS, TSS and TDS values recorded were  $9689.43 \pm 6851.13$  mg/l,  $248.43 \pm 234.35$  mg/l and  $5285 \pm 4300.72$  mg/l respectively. Total solids are a measure of the suspended and dissolved solids in water. The terms "sediment" and "silt" are often used to refer to suspended solids. Suspended solids

consist of an inorganic fraction (silts, clays, etc.) and an organic fraction (algae, zooplankton, bacteria, and detritus) that are carried along by water as it runs off the land. Dissolved solids are those that pass through a water filter. They include some organic materials, as well as salts, inorganic nutrients, and toxins.

The concentration of dissolved solids in stream water is important because it determines the flow of water in and out of the cells of aquatic organisms. Elevated levels of total solids, however, can lead to eutrophication of the stream or increased turbidity. Both eutrophication and increased turbidity result in a decrease in stream water quality. Elevated concentrations of total solids may indicate the presence of agricultural activities, dredging, or mining. Drinking water may have a TDS reading of 25-250 mg/L. Drinking water should not exceed 500 mg/l TDS. In Minneriya reservoir the recorded TDS value was 153 mg/l (CEA, 1993a). While In Tabbowa reservoir, a eutropic lake the TDS was 478 mg/l (CEA, 1993c) still within the usable range. In Bellanwila Atthidiya marsh another polluted water body, the TDS value ranged from 306 mg/l to 1267 mg/l (CEA, 1993d). According to the recommended pollution limits for waters used for livestock and irrigated crop production (US Environmental Agency, 1973b) the values suitable for livestock use range from 3000 to 7000 mg/l and for crops 700 mg/l. Therefore we can say that the Bolgoda lake water is not suitable for drinking and for use in livestock and crops as well.

### Total Nitrogen (TN)

Total nitrogen was recorded only in the Koralawella stations and Kadolana middle station. Highest values were recorded in the Koralawella stations. This indicates that this station contains more organic waste than others.

When consider the overall results, Bolgoda lake water is polluted in some stations compared to others. On the whole the lake is less polluted than the Beira Lake but more polluted than the Senanayake Samudraya, Minneriya, Tabbowa and Victoria reservoirs. The water of the lake is not suitable for drinking, or for use for the livestock or for use in the agricultural crops. The extraordinary high levels of TS, TSS, TDS in the lake water is not due to agricultural, mining or dredging activities as can be seen in other areas since these activities are not taking place in Bolgoda Lake area. The highest total solids, suspended solids and dissolved solids, coupled with high BOD and COD values recorded in the areas where the carpentry industry is at its most, and near the saw dust dumping sites, indicating that this industry is mainly responsible for the pollution of waters in these areas.

### Conclusion

Sri Lanka is a beautiful island surrounded by the sea, enriched with all environmental factors favourable for existence of living beings. There are many environmental systems vary from each other. Sea coast, Mangroves, Bays, Rivers, Fresh water reservoirs, Marshes, Highlands, various forests are some examples. And the climate diversity is in a high position. The species living in various environmental systems are immense in number. So our country is worldwide famous as a country rich of Bio-diversity. It is the richest country in South Asia when consider the Bio-diversity. It is also among the 25 countries in the world with rich Bio-diversity. However this position is going down gradually.

Bolgoda Lake, rich with Bio-diversity flows through Moratuwa in Colombo district. Bolgoda Lake area is mainly a Sinhalese settlement. The majority of the people are Buddhists. Most of the residents have completed education only up to GCE (O/L). The most participants of this research have been in this area for more than fifteen years. Bolgoda Lake is being polluted at present due to the increase in population density.

Carpentry industry is the most prevalent and main employment in Moratuwa. 75% of the residents in Moratuwa are directly engaged in this employment and almost all others have direct or indirect relationships with the industry. It was further observed whether there is a relationship between carpentry industry and environmental pollution. Most people consider waste from carpentry industry such as saw dust and wooden chips as garbage.

Water of Bolgoda Lake hasn't been used for drinking for the past 25 years. So it can be said that Bio-diversity around Bolgoda Lake has declined in the present. In other words the environmental balance has broken. This situation can develop further. There is a vast difference in Bio-diversity between past and the present. It is clear this situation had created due to human activities, especially the unsystematic use of Bolgoda Lake and surrounding area for carpentry industry. It is essential to have a proper program to enlighten people about their unsystematic use of the lake, and to attend employments environmentally friendly manner.

There are some important suggestions introduced by people who living this area in order to avoid these harmful conditions. They say that certain place and a proper system should be introduced for discharging saw dust. And saw mills

and huts should be covered to avoid spreading saw dust. Workers in the factories must wear safety masks. Building of houses along the bank should be banned. Lorries should be used for transporting saw dust from factories to due places. But they also pointed out that the income earns from the industry is not enough for this transportation. They expect assistance from the government or any other organization.

Most of the people accepted that saw dust and wooden chips can be used for a worthy cause. Implementing saw dust and wooden chips can be seen in small scale. There were several suggestions of using saw dust and wooden chips in large scale advantageously.

- To produce new kinds of boards (MDF etc.)
- To use for brick and tile kilns
- To produce manure as an alternative for chemical manure
- To produce heat electricity by burning them
- To produce fire-wood
- To produce ornaments

It is further explained that assistance of the government, other organizations; local or foreign, must be needed to implement these suggestions. Though producing heat electricity has already begun it faced failures due to lack of durable plans. An Indian organization has launched an observation project for using saw dust to generate electricity. Housewives can be joined immensely for making ornaments. Many employment opportunities would appear if those suggestions implemented. And it would be a solution for the above mentioned issues.

It can finally be said, with the association of state and private sector organizations and with the help of the residents, a systematic project should be introduced to protect Bio-diversity and environmental balance.

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