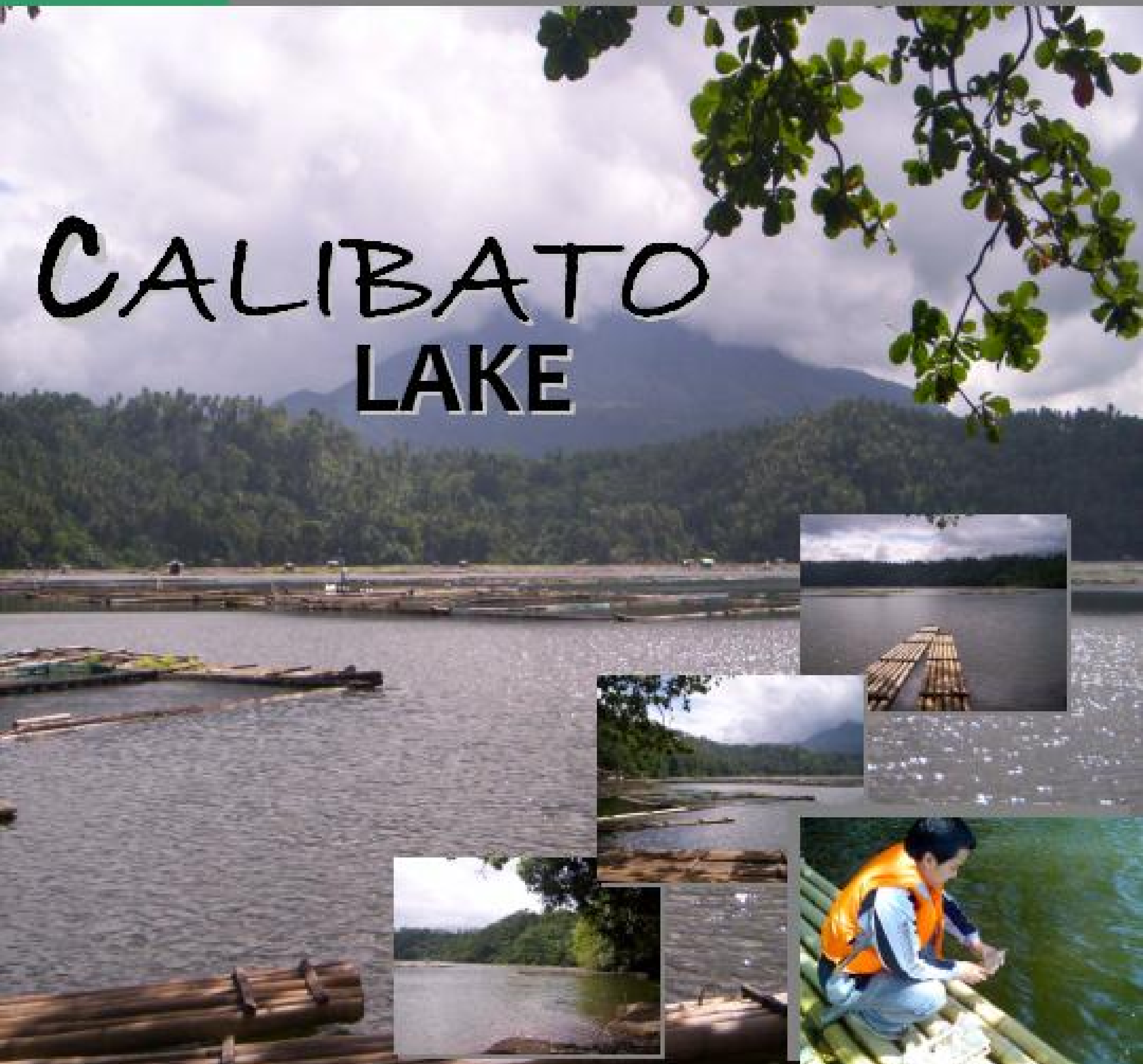
Water Quality Report

on

CALIBATO LAKE



Laguna Lake Development Authority
Environmental Quality Management Division

WATER QUALITY REPORT ON CALIBATO LAKE
1996 – 2005

Prepared by:

Jocelyn G. Sta. Ana – OIC, Environmental Quality Management Div.
Bileynnie P. Encarnacion – OIC, Biology Section
Reheema Myra E. Escultor – Chemist II
Archilles R. de la Cruz – Data Encoder

Reviewed by :

Jacqueline N. Davo – OIC, Lake Management Division
Eriberta R. Wagan - Management and Audit Analyst II

For more information, please contact

Environmental Quality Management Division (EQMD)
Laguna Lake Development Authority
Km. 24 Manila East Road
Club Manila East Compound
Taytay, Rizal

Tel. No. 286 –61-19
Fax No. 286-61-19

Email Address: eqmd@llda.gov.ph

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CALIBATO LAKE

LAKE FEATURES

Calibato Lake is the deepest lake among the seven lakes of San Pablo with an average depth of 156 meters and surface area of 43 hectares. The lake has two jurisdictional areas: Brgy. Sto. Angel in San Pablo City and Brgys. Tala and Antipolo in Rizal, Laguna.

WATER QUALITY MONITORING PROGRAM

The Laguna Lake Development Authority (LLDA), by virtue of RA 4850, as amended, has the primary responsibility to promote the development of the Laguna de Bay region, which includes San Pablo City, while providing for environmental management and control, preservation of the quality of life and ecological systems, and the prevention of undue ecological disturbance, deterioration and pollution.

The LLDA has been conducting regular water quality monitoring with the following objectives:

- To accurately assess the suitability of the lake for all its present and intended beneficial uses;

- To evaluate the impacts of development activities on the lake's water quality that will serve as important criteria for environmental planning and management; and

- To provide sound technical basis for water resources management policies and programs for the lake.

Routine monitoring programs conducted by LLDA cover the Laguna de Bay and its tributaries as well as the Seven Lakes of San Pablo City and Tadlac Lake in Los Baños.

METHODOLOGY

One sampling station was established for Calibato lake. During the conduct of the sampling activity, water temperature and dissolved oxygen concentration are measured at the surface and at 2, 4,6,10,15,20, 25,30 and 35 meters depth. A gallon of composite water from surface to 5-meter depth is also collected for chemical analysis. The chemical parameters analyzed at the laboratory include pH, total suspended solids (TSS), total dissolved solids (TDS), turbidity, chloride, nitrate, ammonia, inorganic phosphate, biochemical oxygen demand (BOD) and chemical oxygen demand (COD). Zooplankton and phytoplankton samples are collected by passing five pails of lakewater through a 35-micron mesh-sized plankton net. Zooplankton sample is preserved in a 10% formalin solution. On the other hand, phytoplankton sample is preserved with Lugol's solution. Chlorophyll sample is collected by grab method at the surface. Water transparency is likewise measured and all the physical observations including weather condition are noted and recorded.

At present, monitoring is conducted during the first (January, February, March) and last quarters (October, November and December) and in June and September.

EVALUATION OF RESULTS

Although monitoring of Calibato Lake was conducted since the 1980s, some problems were encountered, such as equipment breakdown, power interruptions and lack of chemicals such that analyses of some parameters were not completed.

This report presents the water quality monitoring data from 1996 to 2005 since this period represented a more complete set of data. Data for 2001 were incomplete due to the laboratory repair at that time, hence, they were not included in the statistical analysis.

Monthly data and annual averages are presented in Table 1. The variations of key parameters for the past ten years from 1996 to 2005 are depicted in the figures using a three-year moving trend analysis based on annual means. With this presentation, erratic trends are subdued and correlations between parameters are easier to establish.

Assessment of the water quality was based on the criteria for key parameters for Class C Waters as provided in the DENR Administrative Order No. 34.

Table 1. Water Quality Monitoring Data of Calibato Lake from 1996 to 2005

	pH	**COD**	**BOD**	**NH3**	**NO3**	**IPO4**	**TDS**	**TSS**	**Cl**
DATE	**units**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
1996									
17-Jan-96	6.9	12	3	0.1650	0.0020	0.6240	266	4	19
21-Feb-96	7.4	20	5	0.7240	0.0200	0.3030	235	2	15
28-Mar-96	7.7	12	5	1.0160	0.0140	0.3590	243	14	19
18-Jun-96	7.5	20	5	0.3800	0.0020	0.4850	227	4	15
09-Sep-96	7.6	8	4	0.0070	0.0020	0.0780	206	29	15
28-Nov-96	7.4	28	1	0.2130	0.0640	0.5180	299	6	15
18-Dec-96	7.7	52	2	0.2020	0.0680	0.2500	220	41	11
Average:	7.5	21.7	3.6	0.3867	0.0246	0.3739	242	14.3	15.4
Std. Dev.	0.3	14.9	1.5	0.3576	0.0292	0.1843	31.3	15.1	2.6
1997									
09-Jan-97	7.0	12	5	0.8777	0.0082	0.7134	250	2	15
06-Feb-97	7.5	20	4	0.5735	0.0259	0.6812	238	8	15
03-Mar-97	7.4	56	4	0.3406	0.0078	0.6145	239	7	19
07-May-97	8.0	22	4	0.2891	0.0020	0.5005	226	4	7
21-Jul-97	6.8	4	1	0.3660	0.0401	0.4820	215	2	19
27-Oct-97	7.0	16	3	0.1434	0.0054	0.5524	200	2	15
27-Nov-97	7.6	20	2	0.4962	0.0163	0.5241	240	2	19
15-Dec-97	7.6	16	4	0.6530	0.0024	0.5595	200	2	15
Average:	7.4	20.8	3.3	0.4674	0.0135	0.5785	226	3.6	15.4
Std. Dev.	0.4	15.3	1.2	0.2324	0.0134	0.0840	19.1	2.5	3.7
1998									
13-Jan-98	7.6	4	5	0.2234	0.0020	0.5164	205	17	7
17-Feb-98	7.7	8	4	0.1538	0.1735	0.0859	227	3	19
19-Mar-98	7.8	8	4	0.5845	0.0063	0.1055	261	8	15
06-May-98	7.2	16	4	0.2954	0.0020	0.3730	297	2	71
08-Jul-98	7.3	8	3	0.1930	0.0020	0.4640	229	3	11
02-Sep-98	7.1	4	7	0.2900	0.0060	0.4100	231	2	11
07-Oct-98	7.5	4	2	0.1420	0.0060	0.3190	268	7	19
24-Nov-98	7.2	24	5	0.2064	0.0060	0.3529	183	6	7
15-Dec-98	7.1	4	4	0.2220	0.0420	0.3360	197	1	11
Average:	7.4	8.9	4.2	0.2567	0.0273	0.3292	233	5.4	19
Std. Dev.	0.3	6.9	1.4	0.1336	0.056	0.146	36.6	5.0	20.0

Non-compliance with DAO 34 Water Quality Criteria Class C Waters

DATE	pH units	COD mg/L	BOD mg/L	NH3 mg/L	NO3 mg/L	IPO4 mg/L	TDS mg/L	TSS mg/L	Cl mg/L
1999									
27-Jan-99	7.5	12	7	0.4470	0.5662	0.0075	205	1	11
23-Feb-99	6.9	4	2			0.5503	200	1	11
19-Mar-99	7.8	6	3	0.2719	0.0110	0.5740	214	1	11
24-May-99	7.2	12	4	0.5083	0.0108	0.3918	207	1	11
14-Jul-99	7.4	24	3	0.4587	0.0073	0.6456	214	2	11
27-Sep-99	7.1	6	6	0.4927	0.0427	0.6605	217	1	11
25-Oct-99	6.8	40	5	0.6486	0.0884	0.7087	213	3	11
11-Nov-99	6.8	16	4	0.3928	0.0686	0.6771	214	2	11
09-Dec-99	6.8	22	3	0.3897	0.1152	0.4976	202	9	11
Average:	7.1	15.8	4.2	0.4512	0.1138	0.5237	209.6	2.3	11.0
Std. Dev.	0.4	11.5	1.6	0.1091	0.1871	0.2177	6.1	2.6	0.0
2000									
13-Jan-00	7.1	16	4	0.5838	0.0508	0.9628	208	3	11
02-Feb-00	6.7	24	9	2.1782	0.0020	0.6608	217	2	19
02-Mar-00	7.1	20	6	2.9248	0.1658	1.2496	221	5	15
04-May-00	8.3	32	4	2.9463	0.1832	1.4321	214	2	11
11-Jul-00	7.1	16	4	0.8838	0.0011	0.7115	238	8	11
14-Sep-00	6.9	4	11	0.4388	0.0020	0.6854	232	1	7
15-Nov-00	7.1	2	4	0.3436	0.0020	0.7395	226	5	7
06-Dec-00	7.2	4	2	1.1195	0.0249	0.7854	220	1	7
Average:	7.2	14.8	5.5	1.4274	0.0540	0.9034	222.0	3.4	11.0
Std. Dev.	0.5	10.7	3.0	1.0933	0.0765	0.2896	9.7	2.4	4.3
2002									
24-Jan-02	7.9	8	7	1.1913	0.2354	0.7088	218	9	9
28-Feb-02	7.2	4	7	0.8905	0.0895	0.6047	234	0.5	9
14-Mar-02	7.0	2	5	1.3546	0.0426	0.7185	249	0.5	11
19-Jun-02	7.4	20	6	1.2388	0.0512	0.6645	229	5	13
11-Sep-02	7.1	14	4	0.9304	0.0203	0.6699	199	0.5	13
08-Oct-02	7.0	2	3	0.7235	0.0244	0.5928	213	6	15
12-Nov-02	7.0	2	7	0.8367	0.2172	0.6194	213	0.5	15
10-Dec-02	7.3	2	4	0.7719	0.5687	0.2738	214	1	15
Average:	7.2	6.8	5.4	0.9922	0.1562	0.6066	221	2.9	13
Std. Dev.	0.3	6.8	1.6	0.2363	0.1868	0.1421	15.5	3.3	2.6
2003									
14-Jan-03	7.4	2	6	0.7407	0.0010	0.4945	216	1	11
11-Feb-03	7.1	10	7	1.2189	0.0255	0.5880	209	1	11
11-Mar-03	7.2	27	4	1.5164	0.1065	0.0107	244	0.5	7
19-Jun-03	6.8	19	2	0.9215	0.1554	0.6365	225	0.5	7
09-Sep-03	6.9	8	8	0.5256	0.0774	0.5587	221	0.5	15
14-Oct-03	6.7	2	8	0.8699	0.0895	0.5049	222	1	15
11-Nov-03	6.9	2		0.733	0.1432	0.499	205	0.5	22
09-Dec-03				0.5943	0.0010	0.5640	225	1	33
Average:	7.0	10.0	5.8	0.8900	0.0749	0.4820	221	0.8	15
Std. Dev.	0.2	9.7	2.4	0.3315	0.0606	0.1967	11.9	0.3	8.7

Non-compliance with DAO 34 Water Quality Criteria
Class C Waters

DATE	pH units	COD mg/L	BOD mg/L	NH3 mg/L	NO3 mg/L	IPO4 mg/L	TDS mg/L	TSS mg/L	Cl mg/L
2004									
13-Jan-04	6.8	16	22	0.4354	0.0718	0.8314	256	5	37
10-Feb-04	7.0	12	8	0.335	0.1318	0.9083	261	8	48
09-Mar-04	6.9	19	7	0.6532	0.0348	0.7770	252	4	67
15-Jun-04	7.2	8	3	0.968	0.5620	0.7813	242	10	15
14-Sep-04	7.0	15	10	1.6582	0.11	0.6733	211	2	22
12-Oct-04	7.0	2	4	0.9967	0.0102	0.5639	207	8	15
18-Nov-04	7.4	2	9	1.3449	0.1362	0.6503	179	6	15
14-Dec-04	7.4	4	4	0.6479	0.1114	0.4135	193	1	11
Average:	7.1	9.8	8.4	0.8799	0.1460	0.6999	225	5.5	29
Std. Dev.	0.2	6.7	6.1	0.4540	0.1741	0.1590	31.5	3.1	20.1
2005									
11-Jan-05	7.4	8	5	0.5475	0.0668	0.4992	212	2	19
15-Feb-05	7.0	65	7	1.785	0.0074	0.6860	254	4	11
8-Mar-05	7.2	12	8	1.6227	0.0339	0.6464	237	9	15
14-Jun-05	7.3	19	24	1.0312	0.1764	0.7451	215	7	7
8-Sep-05	6.9	2	9	1.0483	0.0923	0.6928	224	2	11
18-Oct-05	7.2	8	6	1.2682	0.0440	0.6661	210	0.5	12
15-Nov-o5	7.0	24	11	1.1028	0.0205	0.655	224	9	7
13-Dec-05	7.2	8	7	0.9914	0.0726	0.6247	206	0.5	8
Average:	7.2	18.3	9.6	1.1746	0.0642	0.6519	223	4.3	11
Std. Dev.	0.2	20.1	6.1	0.3874	0.0533	0.0715	16.0	3.6	4.2

Non-compliance with DAO 34 Water Quality Criteria
Class C Waters

pH

pH is a measure of the concentration of hydrogen ions in the water. This measurement indicates the acidity or alkalinity of the water. On the pH scale of 0 to 14, a reading of 7 is considered to be "neutral". Readings below 7 indicate acidic conditions, while readings above 7 indicate the water is alkaline, or basic. Naturally occurring fresh waters have a pH range between 6 and 8. The pH of the water is important because it affects the solubility and availability of nutrients, and how aquatic organisms can utilize them. The pH of natural waters can be made acidic or basic by human activities.

The Class C water criteria for pH is between the values of 6.5 to 8.5. The pH of water in Calibato Lake is within the set criteria.

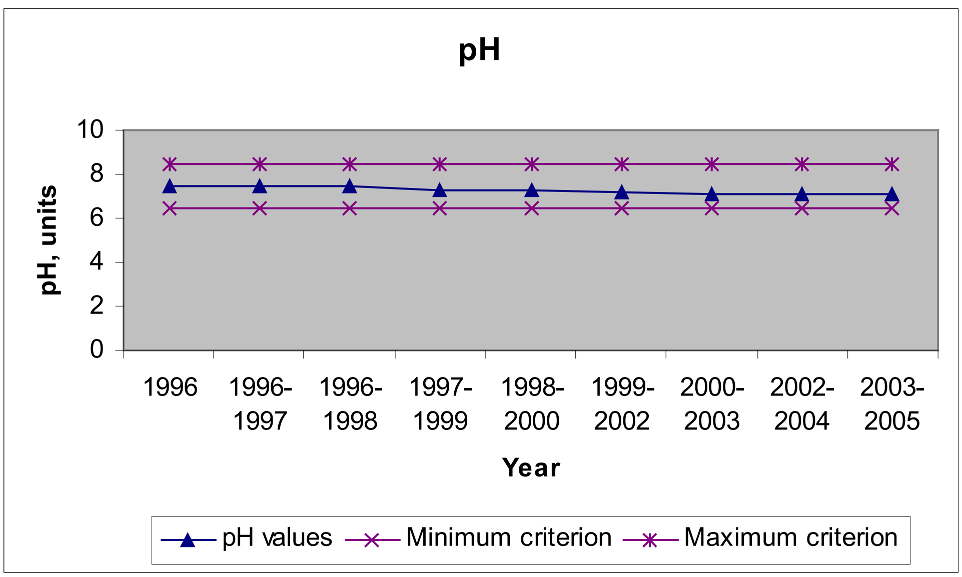


Figure 1. Three-year trend of pH values in Calibato Lake

Nitrate (NO3)

Nitrogen is abundant on earth, making up about 80% of our air as nitrogen gas. Most plants cannot use it in this form. However, blue-green algae have the ability to convert nitrogen gas into nitrate (NO^{3-}), which can be used by plants. Plants use nitrate to build protein, and animals that eat plants also use organic nitrogen to build protein. In this form it is relatively common in freshwater aquatic ecosystems. Excessive concentrations of nitrate can be harmful to humans and wildlife. High levels of nitrate, along with phosphate, can over stimulate the growth of aquatic plants and algae, resulting in high dissolved oxygen consumption, causing death of fish and other aquatic organisms. Nitrate thus enters streams from natural sources like decomposing plants and animal waste as well as human sources like sewage or fertilizer.

The Class C water quality criterion for nitrate is set at 10 mg/L in lakes, reservoirs and similarly impounded water. An increasing trend in nitrate concentration was observed in Calibato Lake during the study period but the levels are still low as compared to the standard.

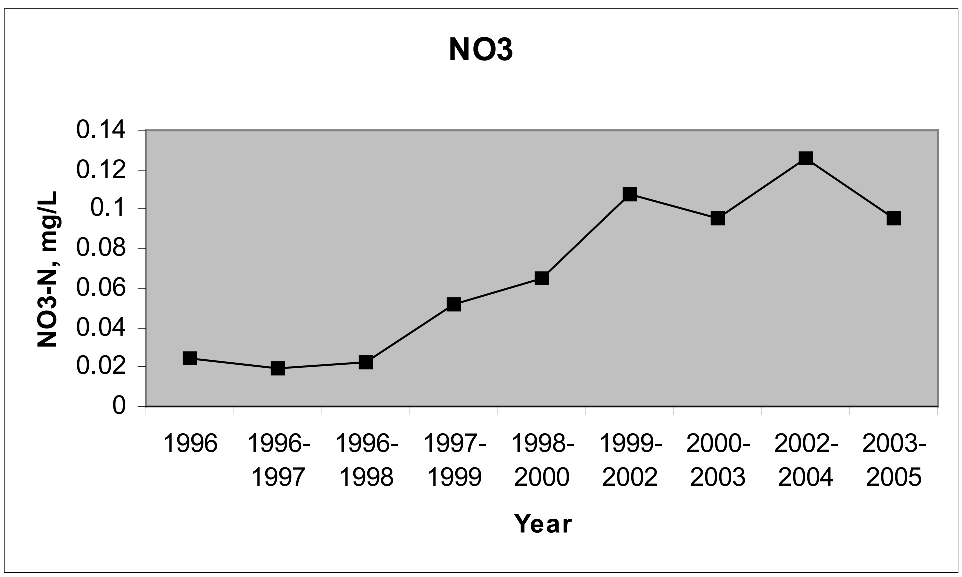


Figure 2. Three-year trend of nitrate levels in Calibato Lake

Ammonia (NH_3)

Ammonia is the most reduced inorganic form of nitrogen in water. It is a common constituent of domestic sewage resulting from either the decomposition of nitrogenous organic matter (vegetable or animal wastes) or the microbial reduction of nitrates or nitrites under anaerobic conditions. Industrial discharges may also contribute ammonia in water.

Fish cannot tolerate large quantities of ammonia since it reduces the oxygen-carrying capacity of the blood and thus the fish may suffocate.

Ammonia concentration for Calibato Lake is quite high as compared to the other lakes in the system. From a concentration of 0.4 mg/L it increased to more than 1mg/L for the 10-year period. Human activities surrounding the lake may have contributed to the increase in levels of ammonia concentration in the lake. Although there is no Class C water quality criteria set for ammonia, levels should be kept as low as possible.

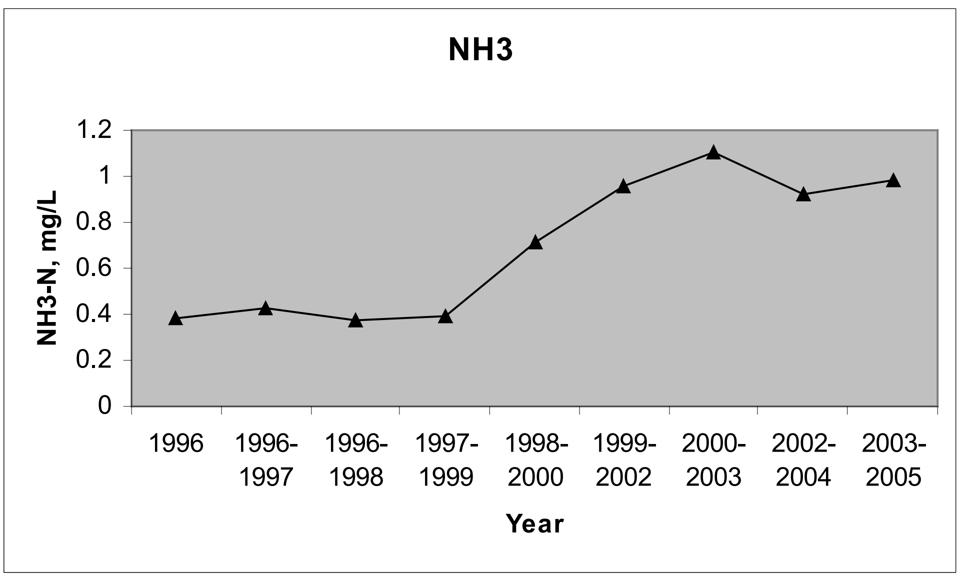


Figure 3. Three-year trend of ammonia levels in Calibato Lake

Inorganic Phosphate (IPO4)

The discharge of excessive amount of phosphates to streams or lakes may result in an over-abundance of algae. Upon decay, dead algae competes with the dissolved oxygen endangering fish life and giving off unpleasant odor. In themselves, however, phosphates seldom exhibit toxic effects upon fish and other aquatic life.

For Class "C" waters, the allowable phosphate concentration is set at 0.4 mg/L. When applied to lakes and reservoir, the phosphate concentration should not exceed an average of 0.05 mg/L nor a maximum of 0.1 mg/L.

Calibato Lake recorded high levels of phosphates as compared to the other lakes in the system. Starting with a 0.4 mg/L concentration, it increased to about 0.7 mg/L. This should be monitored closely not to continually increase more as this could pose threats to the lake's water quality.

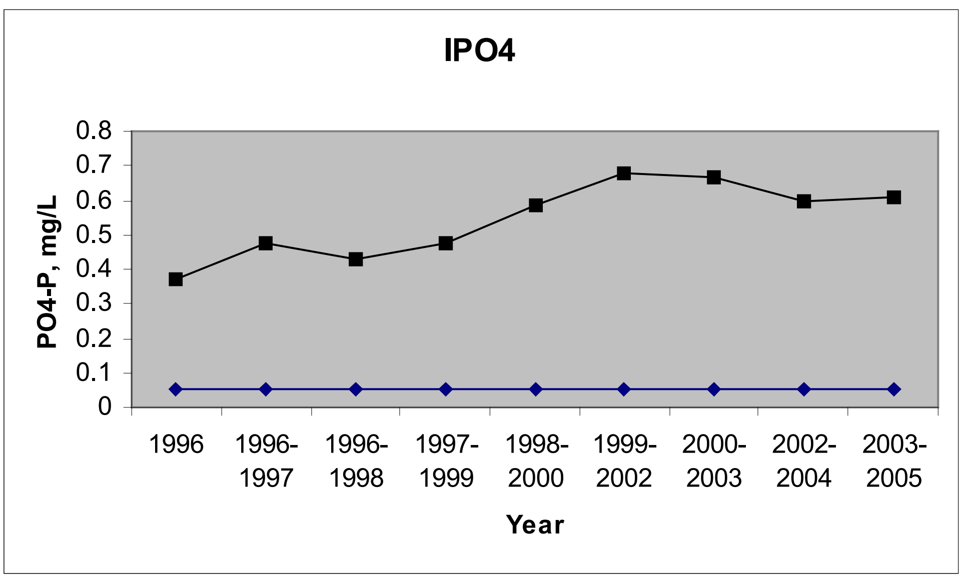


Figure 4. Three-year trend of phosphate levels in Calibato Lake

Solids (Total Dissolved Solids (TDS) and Total Suspended Solids (TSS))

Suspended solids can clog fish gills, either killing them or reducing their growth rate. They also reduce light penetration. This reduces the ability of algae to produce food and oxygen. Indirectly, the suspended solids affect other parameters such as temperature and dissolved oxygen. Because of the greater heat absorbency of the particulate matter, the surface water becomes warmer and this tends to stabilize the stratification (layering). This, in turn, interferes with mixing, decreasing the dispersion of oxygen and nutrients to deeper layers.

A positive effect of the presence of suspended solids in water is that toxic chemicals such as pesticides and metals tend to adsorb to them or form chemical complexes with them which make the toxics less available to be absorbed by living organisms.

Calibato Lake exhibited a decreasing trend for both dissolved and suspended solids. Although no Class C water criteria are set for TSS and TDS, this low level should be maintained.

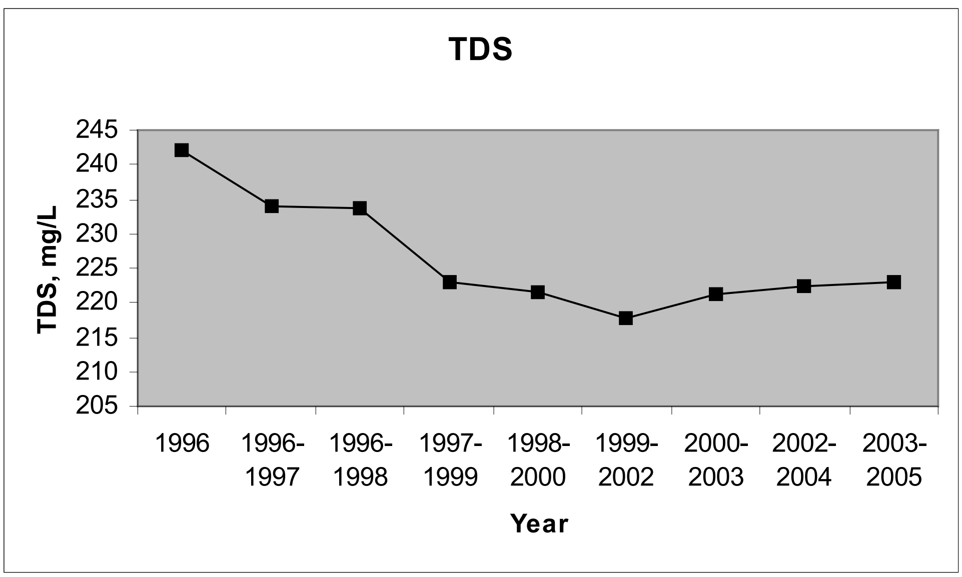


Figure 5. Three-year trend of TDS levels in Calibato Lake

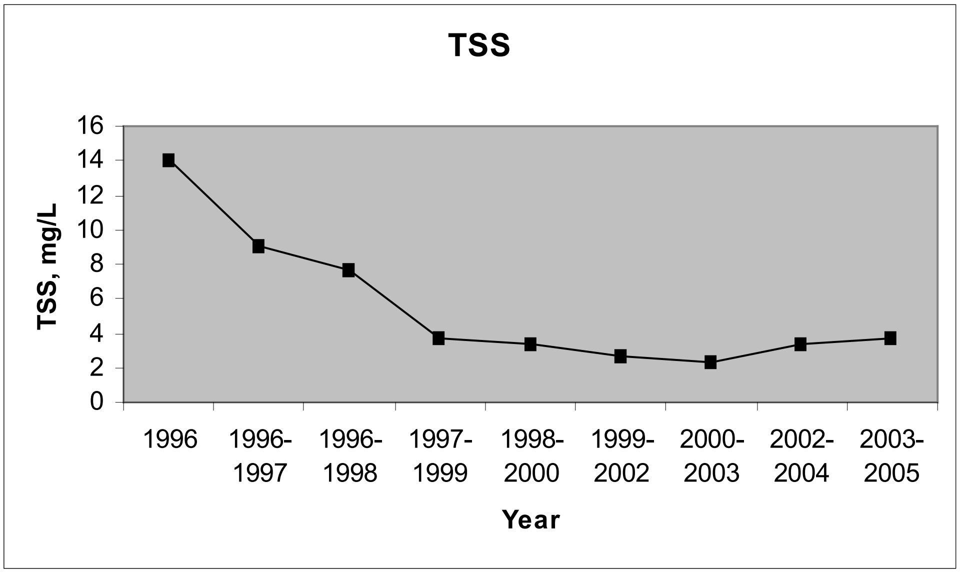


Figure 6. Three-year trend of TSS levels in Calibato Lake

Chloride

Chloride is found in most natural waters. It is not usually harmful to people but high levels of chlorides may affect fish and aquatic communities. Chlorides may get into surface water from several sources including rocks containing chlorides and agricultural runoff.

Calibato Lake is a freshwater lake thus a very low concentration of chloride is expected. The Class C water criterion is 350 mg/L.

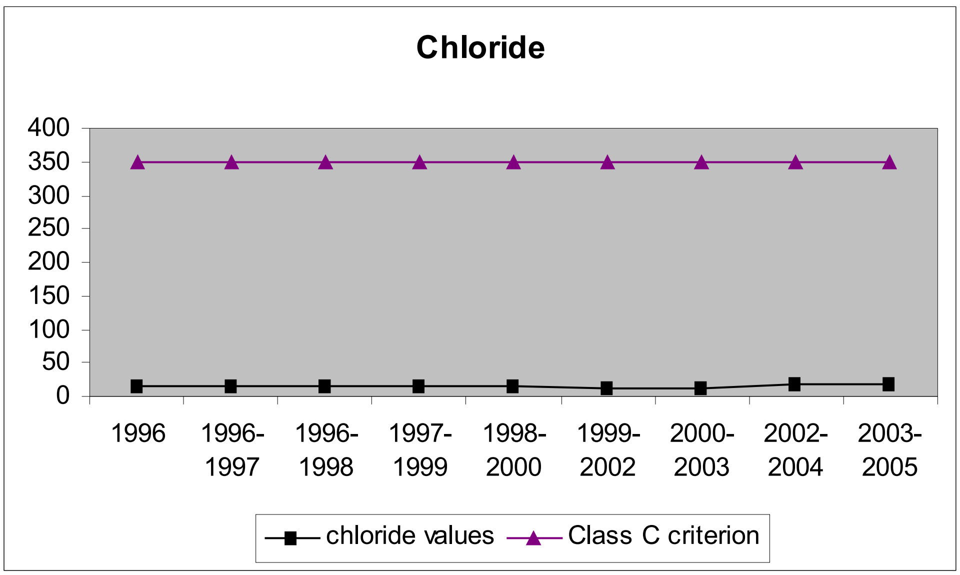


Figure 7. Three-year trend of chloride levels in Calibato Lake

Biochemical Oxygen Demand (BOD)

Biochemical Oxygen demand is the measure of the quantity of oxygen consumed by microorganisms during the decomposition of organic matter. The higher the BOD, the less dissolved oxygen is available for other aquatic organisms.

The Class C water criteria for BOD is 10 mg/L. Calibato Lake water is within the criteria set but there is an increasing trend in the ten-year period indicating a rise in the amount of organic matter in the lake.

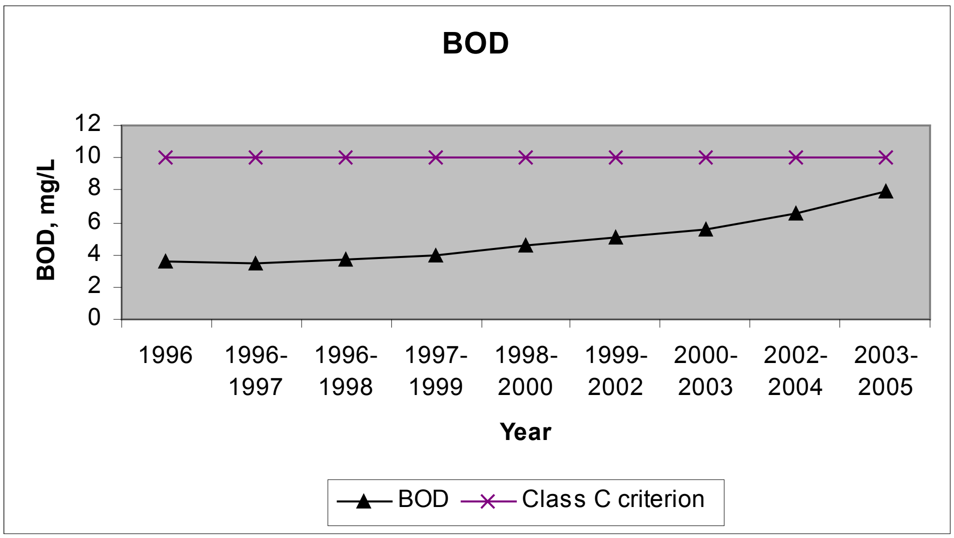


Figure 8. Three-year trend for BOD levels in Calibato Lake

Chemical Oxygen Demand (COD)

The Chemical Oxygen Demand is used as a measure of the oxygen equivalent of the organic matter content of a sample that is susceptible to oxidation by a strong chemical oxidant. Increases in COD concentration affect the available oxygen in the water.

There is no Class C water criterion for COD but its concentration should be kept as low as possible. The 10-year period showed decreasing levels of COD concentration which shows improved water quality for Calibato Lake in terms of COD.

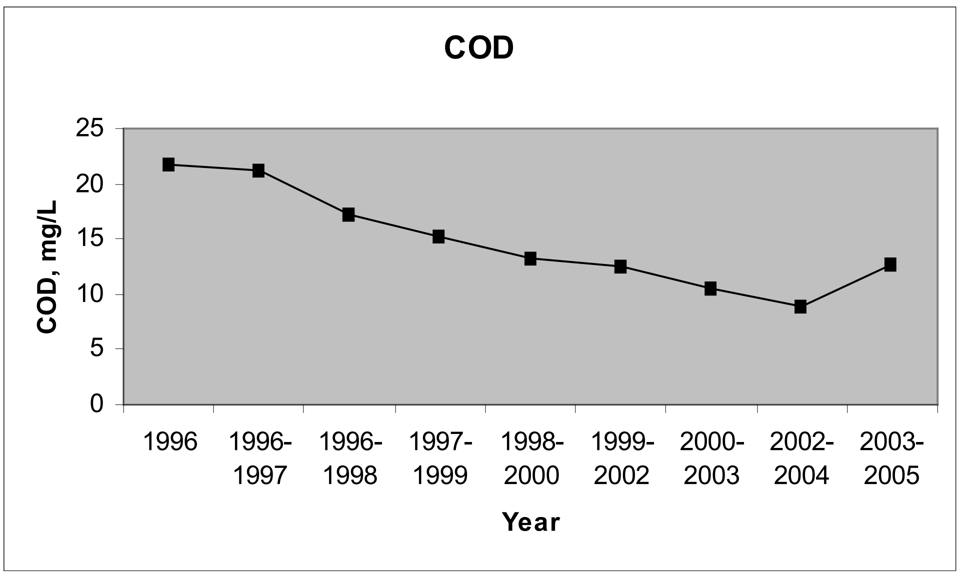


Figure 9. Three-year trend of COD levels in Calibato Lake

Dissolved Oxygen (DO)

The oxygen dissolved in water may be derived from either the atmosphere or from the photosynthesis by aquatic plants including phytoplankton. The amount of oxygen dissolved in natural water varies since it is dependent upon temperature, salinity, turbulence of the water, and atmospheric pressure.

Inadequate dissolved oxygen in surface waters may contribute to unfavorable environment for fish and other aquatic life. The absence of DO may give rise to odoriferous products of anaerobic decomposition.

Dissolved oxygen (DO) values at different depths were averaged on a monthly basis as shown in Table 2 and Figure 10.

Dissolved oxygen concentrations may change dramatically with lake depth. Oxygen production occurs in the top portion of a lake, where sunlight drives the engines of photosynthesis. As seen from the graph below, high levels of DO are recorded at the surface and as the depth increase, the DO concentration decreases. Oxygen consumption is greatest near the bottom of a lake, where sunken organic matter accumulates and decomposes. Seasonal changes may also affect dissolved oxygen concentrations. Warmer temperatures during summer speed up the rates of photosynthesis and decomposition. When all the plants die at the end of the growing season, their decomposition results in heavy oxygen consumption which results to low DO concentration.

Table 2. Monthly average of DO at different depths (1996-2005)

Depth	D.O. (mg/L)									
	Jan	*Feb*	*Mar*	*May*	*Jun*	*Jul*	*Sep*	*Oct*	*Nov*	*Dec*
0	6.7	8.0	5.8	8.0	9.8	6.8	9.1	8.3	6.7	6.2
2	4.9	5.6	5.3	6.9	7.3	5.9	6.4	6.6	5.0	5.4
4	4.2	3.4	3.6	5.1	4.4	4.0	4.4	4.4	4.5	3.9
6	3.4	3.4	3.6	3.8	3.8	3.4	4.4	4.2	4.1	3.9
10	3.4	3.2	3.2	3.6		3.3	4.6	4.2	3.6	4.0
15	3.5	3.6	3.1	4.0	3.2	3.6	4.2	3.8	3.5	3.5
20	3.3	3.5	3.3	4.1	3.2	3.2	4.1	3.8	3.4	3.7
25	3.2	3.5	4.1	4.0	3.6	3.6	3.7	3.6	3.5	3.2
30	3.2	3.6	4.3	4.3	2.8	2.9	3.9	3.4	3.6	3.6
35	3.4	3.5	3.6	4.0	3.4	4.0	4.0	3.4	3.7	3.7

Compliance to DAO 34 Water Quality Criterion Class C Waters

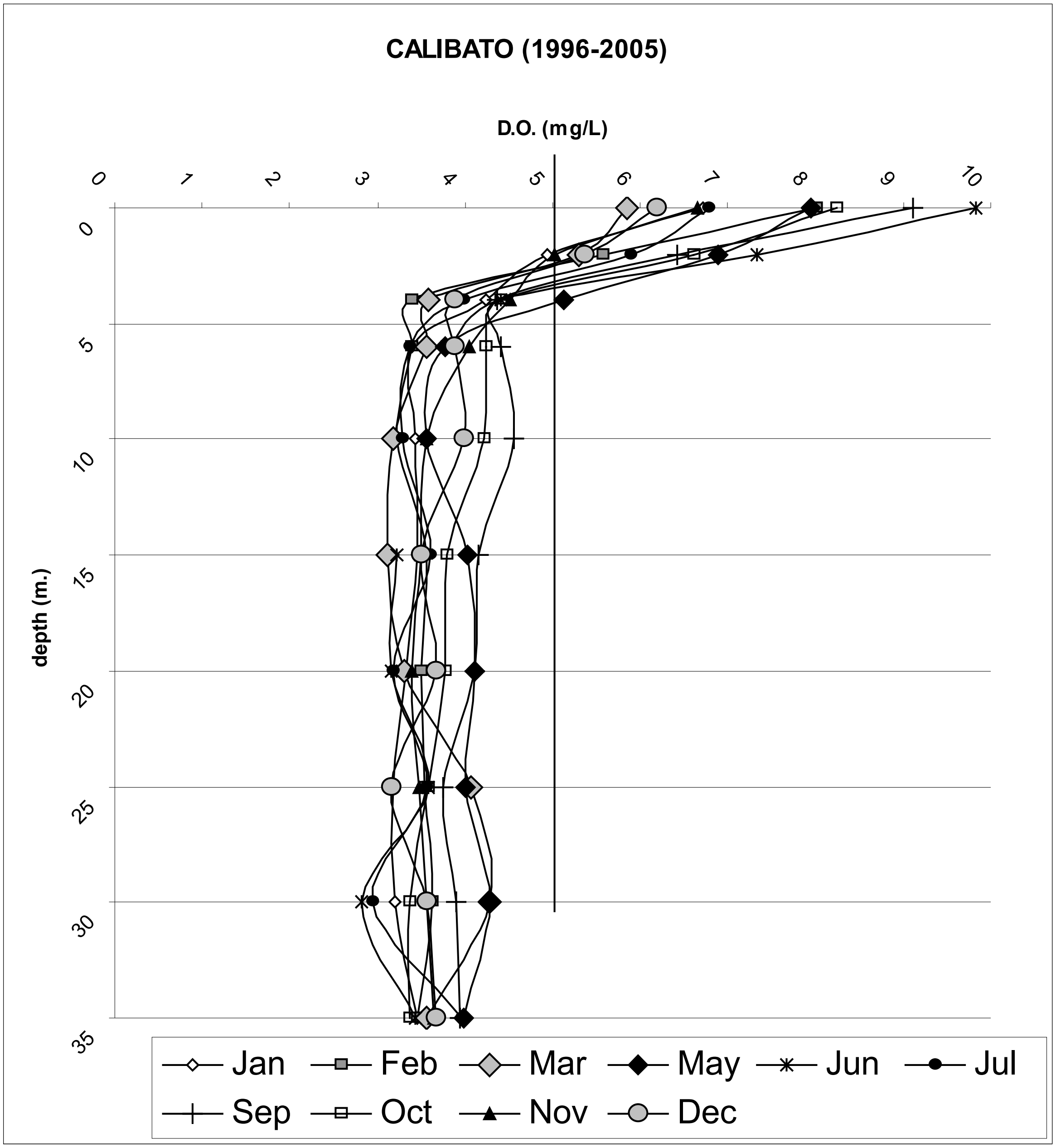


Figure 10. Monthly DO average at different depths

Phytoplankton

In Calibato Lake, 22 genera of algae were identified during the ten (10) year period. Five genera belong to Cyanophyta group (bluegreen algae), 6 belong to Chlorophyta group (green algae), 10 belong to Bacillariophyta group (diatoms) and 1 belong to Pyrrophyta (dinoflagellate).

The highest algal counts was recorded in 2001 with an average value of 7380 cells/ml while the lowest algal counts occurred in 1996 with an average value of 650 cells/ml. Two genera of algae dominated the counts during peak production; namely *Microcystis sp*., a bluegreen algae and *Melosira sp*., a diatom, representing about 43.19% and 39.81% of the total algal counts. In 2002, high algal counts was also observed with an average value of 3121 cells/ml. It showed that bluegreen algae, *Microcystis sp*., dominated the counts contributing about 81.09% of the total population.

Table 3. Phytoplankton Counts by Group, 1996 - 2005

	Bluegreen	Green	Diatom	Dinoflagellates	Total
1996	134	121	379	17	650
1997	727	580	651	379	2338
1998	874	529	142	16	1560
1999	162	880	382	61	1485
2000	1053	414	97	7	1570
2001	3033	302	3875	171	7380
2002	2204	304	608	6	3121
2003	313	622	595	20	1550
2004	298	1919	838	5	3060
2005	212	1144	359	15	1730

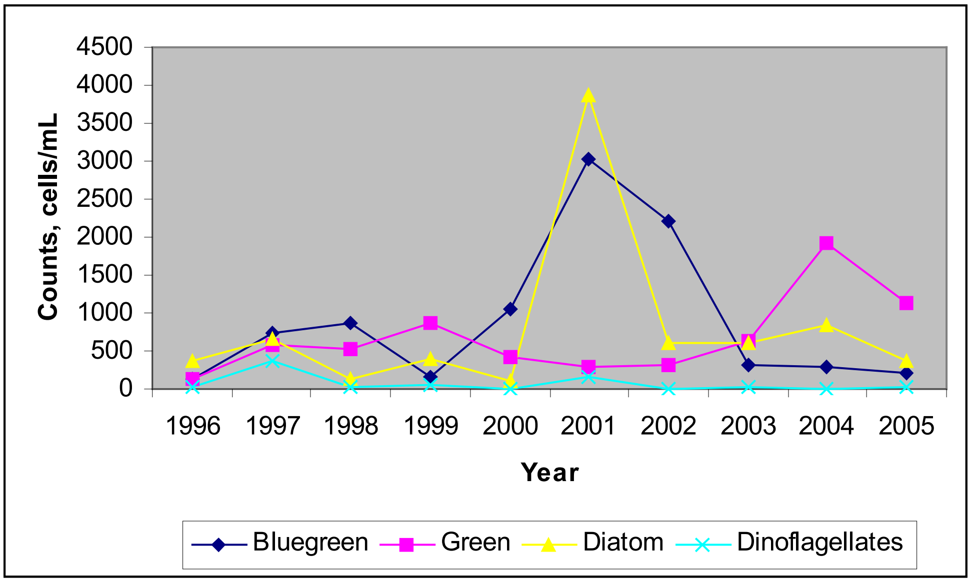


Figure 11. Phytoplankton Counts by Group

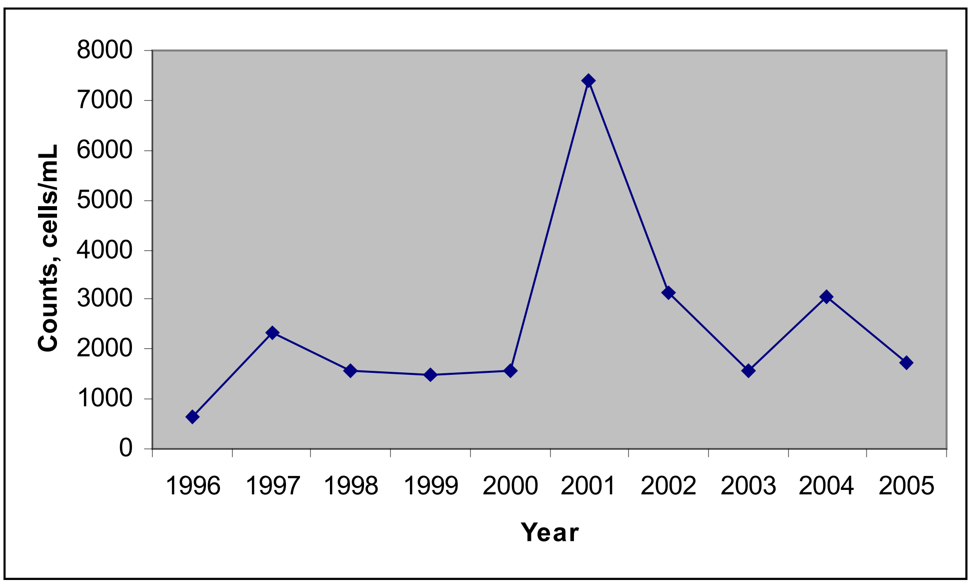


Figure 12. Total Phytoplankton Counts

Zooplankton

Zooplankton are organisms usually drifting in the water column. They are primarily transported by currents but some zooplankton have a power of locomotion used to avoid predators. Zooplankton can respond relatively with phytoplankton abundance during bloom. Zooplankton productions depend on the availability of phytoplankton biomass and other small organisms. They are considered as the first consumer in the food web of aquatic ecosystem.

There are about 19 species of zooplankton identified in Calibato Lake representing the three groups: rotifera, cladocera and copepoda. Copepods dominate the counts in 1998, 1999, 2002, 2004 and 2005. Aside from copepods, rotifera showed high counts during the study period. There are 13 genera of rotifera identified, 3 genera of cladocera and 3 genera of copepoda found in the lake.

Following are the zooplankton by groups in Calibato Lake:

Rotifera

Brachionus calicyflorus
B. caudatus
B. falcutus
B. forficula
B. angularis
B. urceolaris
B. quadridentatus
Filinia longisita
Lecane ungulata
Keratella sp.
Trichocerca sp.
Asplachna siebaldi
Hexarthra fennica

Cladocera

Diaphanosoma excisum
Bosmina longinastris
Ceriodaphnia urnuta

Copepoda

Mesocyclops sp.
Arctodiaptomus sp.
Thermocyclops sp.

Copepodid stage
Calanoid stage
Nauplius stage

The next figure presents the percentage contribution of the different zooplankton groups from 1997 to 2005.

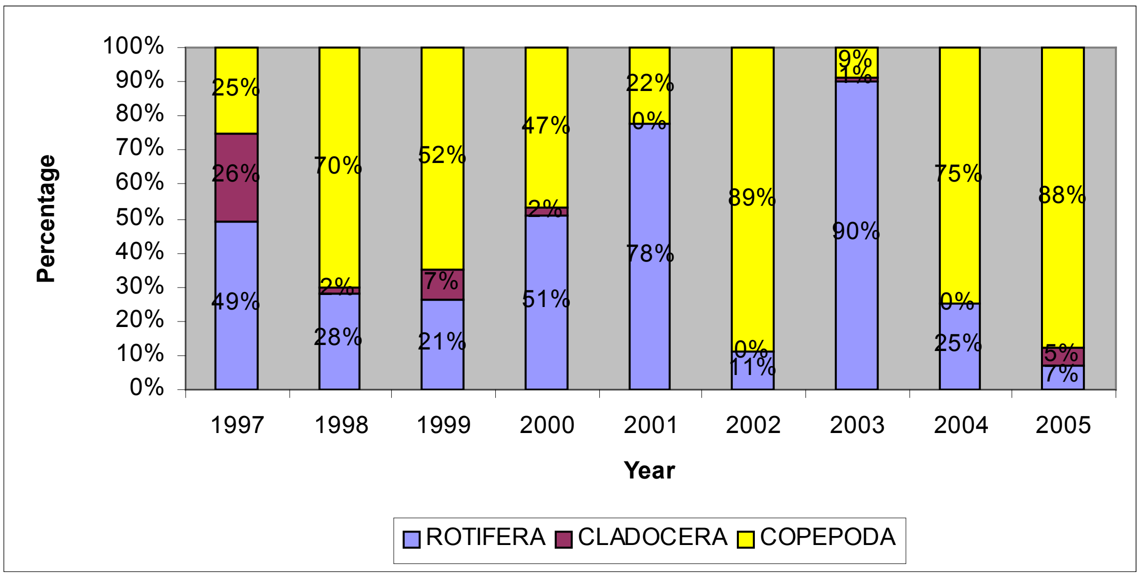


Figure 13: Percentage of Zooplankton by Group

Chlorophyll "a"

Chlorophyll plays a vital role in photosynthesis allowing plants to absorb light to energy. It is often used as indicator of algal standing biomass in an ecosystem.

Based on the 10 year data, the highest annual average was attained in 2001 with an average value of 58.47 μg/liter. During this period, the dominant algae were the bluegreen. In 2004, another increase occurred in June with value of 118.85. The high value could have been due to the Chlorophyta group or green pigment algae dominating the algal population. Chlorophyll reading ranges from 23.55 to 39.73 in the other years. The value of chlorophyll average falls within the eutrophic level

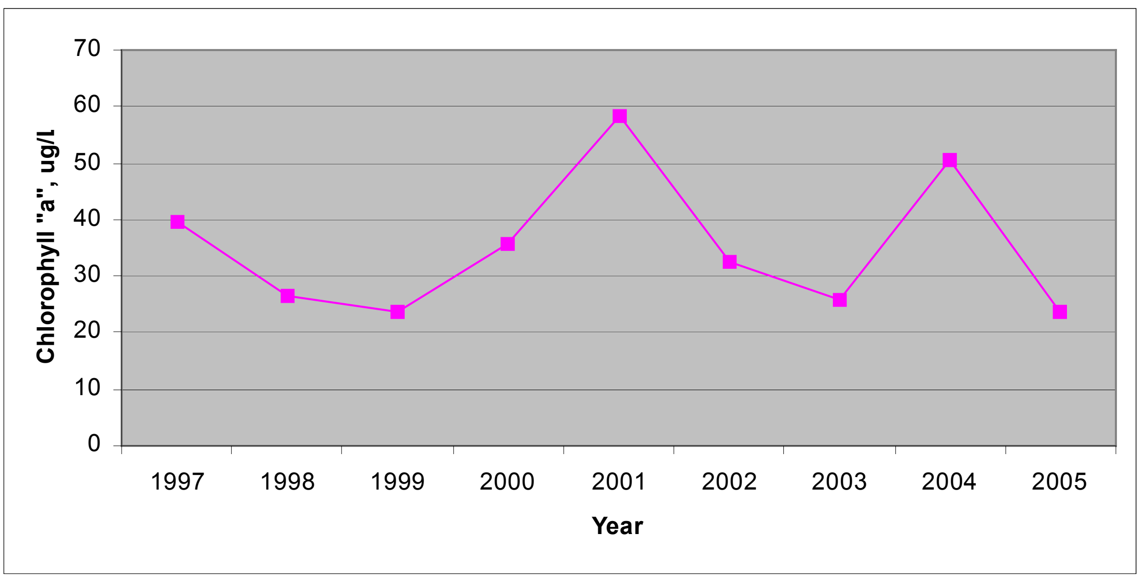


Figure 14: Annual Average of Chlorophyll "a"

.

CONCLUSIONS AND RECOMMENDATIONS

Calibato Lake is in critical state in terms of water quality.

The BOD level from 1996 to 2005 met the criterion, however, it had been increasing. Measures must be undertaken to prevent further increase.

The desirable DO level of 5 mg/L was virtually attained only up to 2 meters depth.

In terms of total dissolved solids and total suspended solids, the water quality is improving. The solids content exhibited a decreasing trend.

The phosphate level in Calibato Lake had consistently exceeded the allowed average of 0.05 mg/L. Ammonia almost doubled during the study period.

The high nutrient loading in Calibato Lake could be attributed partly to the aquaculture activities in the area. Unconsumed feeds add up to the pollution in the lake. Fishcage/ fishpen areas exceeded the 10 % allowable area allocation for aquastructure operation pursuant to the Fisheries Code. Efforts must be done to reduce the aquaculture area.

Domestic wastes from the surrounding areas also contribute to the organic pollution in the lake. Mitigating measures must also be undertaken.

The improvement of the water quality of Calibato Lake could not be done by the LLDA alone. All stakeholders must work together to attain such goal.