Water Quality Report on

PANDIN LAKE

LAGUNA LAKE DEVELOPMENT AUTHORITY
Environmental Quality Management Division

WATER QUALITY REPORT ON PANDIN LAKE
1996 – 2005

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PANDIN LAKE

LAKE FEATURES

Pandin Lake is located in Barangay San Lorenzo in San Pablo City. It has an area of 240,000 sq. m. (24 hectares) and a maximum depth of 61.75 meters.

As of 2007, only 5,825 sq. m. (0.58 hectare) is occupied by aquaculture structures (3 %).

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, 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 include the Laguna de Bay and its tributaries as well as the Seven Lakes of San Pablo City and Tadlac Lake in Los Banos.

One water quality monitoring station was established for Pandin lake. During the conduct of the sampling activity, water temperature and dissolved oxygen concentration are measured at the surface and at 2,3,4,5,6,10,15,20, 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 sample is collected by passing five pails of surface 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 taken from a gallon of composite sample, placed in small plastic container and preserved with Lugol's solution. 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 Pandin Lake was conducted since the 1980s, the schedule was irregular and analysis of some parameters were not undertaken due to equipment breakdown, power failure and other related problems.

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 was 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 Pandin 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									
31-Jan-96	7.3	44	9	0.1630	0.7480	0.3740	153	5	11
12-Feb-96	7.0	4	4	0.9370	0.0760	0.3530	174	3	19
20-Mar-96	7.3	8	3	0.4760	0.0720	0.2880	181	26	11
19-Jun-96	7.2	16	3	0.8980	0.0020	0.2330	158	2	17
04-Sep-96	7.6	184	5	0.2440	0.0580	0.8310	169	5	11
05-Nov-96	7.5	24	2	0.3420	0.0250	0.0100	132	10	15
16-Dec-96	7.0	8	4	0.3440	0.0250	0.1580	151	3	11
Average:	7.3	41	4	0.4863	0.1437	0.3210	160	8	13
Std. Dev.	0.2	64.4	2.4	0.3101	0.2679	0.2569	16.5	8.5	3.2
1997									
27-Jan-97	7.1	46	10	0.1042	0.0216	0.1589	169	9	15
03-Feb-97	6.8	136	4	0.1785	0.0330	0.1764	153	6	11
06-Mar-97	7.3	36	5	0.1155	0.2068	0.1391	140	7	15
27-May-97	7.2	*	1	0.0341	0.0137	0.0440	120	7	8
14-Jul-97	6.9	12	8	0.3730	0.0195	0.1145	1000	2	15
28-Oct-97	7.1	20	3	0.0626	0.0042	0.0041	120	2	7
24-Nov-97	7.5	88	3	0.1677	0.0259	0.0451	150	2	11
04-Dec-97	7.5	16	3	0.1282	0.0020	0.0259	140	2	7
Average:	7.2	51	5	0.1455	0.0408	0.0885	249	5	11
Std. Dev.	0.3	45.7	2.9	0.1039	0.0679	0.0664	303.9	2.9	3.3

0 Non-compliance to DAO 34 Water Quality Criteria Class C Waters

	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
1998									
08-Jan-98	7.1	92	9	0.6347	0.0042	0.1583	130	2	11
16-Feb-98	7.6	36	3	0.4711	0.002	0.0299	141	3	22
18-Mar-98	7.1	12	7	0.7053	0.0007	0.0376	177	7	11
21-May-98	7.3	20	3	0.8736	0.0110	0.0845	197	8	15
13-Jul-98	7.1	8	11	0.4820	0.0110	0.0160	171	2	15
07-Sep-98	7.2	112	4	0.3480	0.0060	0.2000	154	2	15
14-Oct-98	7.0	4	6	0.4270	0.0060	0.1280	146	1	15
11-Nov-98	7.0	4	6	0.2419	0.0060	0.0588	151	5	4
01-Dec-98	6.8	10	9	0.2550	0.0080	0.0890	151	1	11
Average:	7.1	33	6	0.4932	0.0061	0.0891	158	3	13
Std. Dev.	0.2	40.6	2.9	0.2109	0.0036	0.0623	20.6	2.6	4.9
1999									
26-Jan-99	7.2	16	3	0.6200	0.0020	0.1460	115	2	4
22-Feb-99	6.8	28	7	*	*	0.0911	144	9	7
18-Mar-99	7.4	78	2	0.2771	0.0130	0.0400	136	1	11
17-May-99	6.7	24	5	0.4692	0.0908	0.1401	156	5	7
19-Jul-99	6.9	8	6	1.2060	0.0148	0.1459	148	1	7
14-Sep-99	7.0	10	4	0.3057	0.002	0.0020	134	1	11
14-Oct-99	6.8	32	5	0.0340	0.0241	0.0482	133	1	11
22-Nov-99	7.0	4	5	0.0739	0.0151	0.002	138	2	11
06-Dec-99									
Average:	7.0	25	5	0.4266	0.0231	0.0769	138	3	9
Std. Dev.	0.2	23.6	1.6	0.4005	0.0308	0.0623	12.2	2.9	2.7
2000									
19-Jan-00	6.7	20	7	0.1788	0.0254	0.0083	141	13	11
09-Feb-00	6.9	18	3	0.1415	0.0020	0.0020	228	38	15
08-Mar-00	6.8	12	9	0.6005	0.0020	0.0450	147	5	4
10-May-00	6.9	4	3	0.8791	0.0190	0.0989	162	14	7
24-Jul-00	7.0	28	10	0.9037	0.0172	0.1063	147	10	7
13-Sep-00	7.1	20	3	0.3349	0.0137	0.0020	134	20	7
05-Oct-00	6.9	8	4	0.3474	0.0020	0.0020	137	6	11
08-Nov-00	6.8	28	5	0.825	0.0020	0.0757	149	23	7
06-Dec-00	7.0	24	4	0.3025	0.0020	0.0020	114	59	7
Average:	6.9	18	5	0.5015	0.0095	0.0380	151	21	8
Std. Dev.	0.1	8.5	2.7	0.3049	0.0094	0.0446	31.7	17.5	3.3

0 Noncompliance to DAO 34 Water Quality Critera
Class C Waters

	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
2002									
29-Jan-02	7	16	4	0.0294	0.0049	0.0409	118	0.5	6
13-Feb-02	7.4	16	6	0.2119	0.0547	0.0376	153	8	9
13-Mar-02	7	16	4	0.3753	0.0062	0.108	153	1	7
6-Jun-02	7.2	32	4	0.4199	0.001	0.0864	153	0.5	9
17-Sep-02	7.2	6	3	0.1957	0.0296	0.001	120	0.5	15
9-Oct-02	6.9	12	5	0.3519	0.0403	0.094	135	7	15
19-Nov-02	7.1	36	6	0.3692	0.0244	0.0658	608	36	11
11-Dec-02	7.4	2	5	0.1115	0.0366	0.0488	130	1	11
Average:	7.2	17	5	0.2581	0.0247	0.06	196	7	10
Std. Dev:	0.185	11.7	1.1	0.142	0.019	0.035	167.0	12.2	3.3
2003									
15-Jan-03	7.4	2	1	0.098	0.001	0.0409	139	0.5	7
12-Feb-03	7.2	24	2	0.2804	0.0363	0.0518	134	4	9
18-Mar-03	7.5	16	3	0.2305	0.001	0.0357	148	2	7
17-Jun-03	7	16	3	0.3455	0.1571	0.0584	179	0.5	7
10-Sep-03	7	16		0.2068	0.2113	0.0498	134	0.5	11
15-Oct-03	6.7	16	3	0.2353	0.0323	0.0739	137	0.5	19
12-Nov-03	6.8	12		0.2464	0.0301	0.0414	116	0.5	19
10-Dec-03	7.6	2	2	0.1358	0.001	0.0332	113	0.5	26
Average:	7.2	13	2	0.2223	0.0588	0.0481	138	1	13
Std. Dev:	0.3	7.6	0.8	0.078	0.080	0.013	20.4	1.3	7.3
2004									
14-Jan-04	6.9	23	4	14.4755	0.0356	0.0762	158	6	33
11-Feb-04	7.3	8	3	0.2696	0.0717	0.0587	387	6	30
10-Mar-04	7.3	8	3	0.0586	0.0595	0.0303	122	10	41
16-Jun-04	7.1	42	8	0.2611	0.0384	0.0723	79	67	15
15-Sep-04	7.5	4	3	0.1631	0.1167	0.0451	154	2	19
13-Oct-04	7.1	4	3	0.2111	0.0303	0.0446	127	1	26
18-Nov-04	7.2	12	3	0.3455	0.0161	0.0568	118	5	15
9-Dec-04	7.2	12	1	0.2112	0.0081	0.0405	160	8	11
Average:	7.2	14	4	1.9995	0.0471	0.0531	163	13	24
Std. Dev:	0.2	12.8	2.0	5.042	0.035	0.016	94.4	22.0	10.5

0 Noncompliance to DAO 34 Water Quality Critera
Class C Waters

	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
2005									
12-Jan-05	7.4	131	2	0.1214	0.1017	0.0181	119	5	15
16-Feb-05	7.5	14	4	0.1366	0.0036	0.0291	126	3	11
9-Mar-05	7.4	15	3	0.4034	0.069	0.0378	138	6	11
15-Jun-05	7.6	8	2	0.1411	0.033	0.0188	124	0.5	11
13-Sep-05	7	13	3	0.1464	0.001	0.0166	101	0.5	7
19-Oct-05	7.7	19	1	0.0928	0.0131	0.001	118	4	11
16-Nov-05	7.4	2	1	0.1573	0.1504	0.02	135	3	4
14-Dec-05	7.5	2	1	0.0824	0.001	0.0221	116	0.5	4
Average:	7.4	26	2	0.1602	0.0466	0.0204	122	3	9
Std. Dev:	0.2	43.1	1.1	0.102	0.056	0.011	11.6	2.2	3.9

0 Noncompliance to DAO 34 Water Quality Critera
Class C Waters

pH

The pH level is a measure of the acid content of the water. A pH of 7 is considered neutral, below 7 is acidic, while a pH greater than 7 is said to be alkaline.

Most forms of aquatic life tend to be very sensitive to pH, especially to low pH. pH also affects solubility of toxic heavy metals.

The pH levels in Pandin Lake were consistently within the range of 6.5 to 8.5 which is the set criterion for Class C waters.

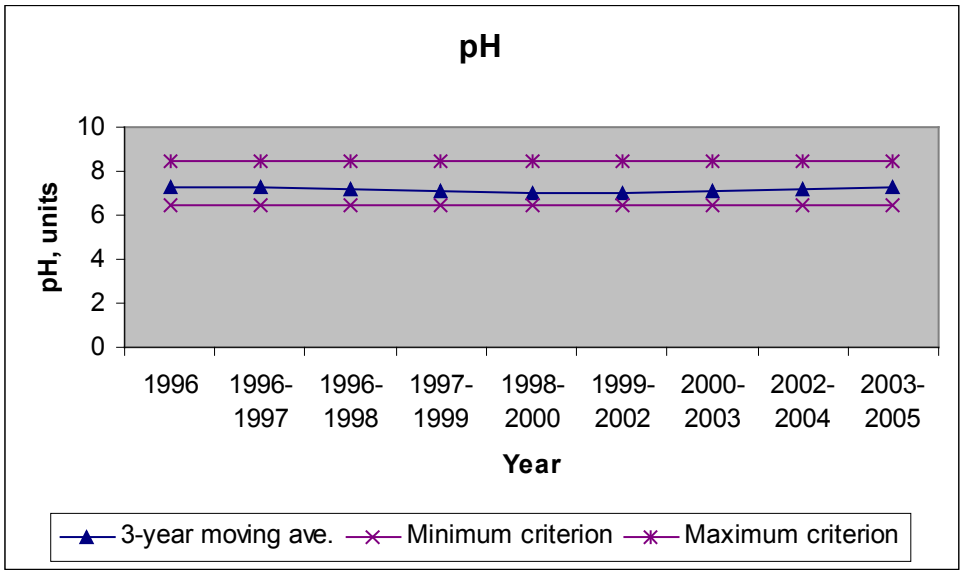

Figure 1. Three-year trend of pH values in Pandin Lake

Nitrate (NO3)

Nitrate is a plant nutrient that contributes to eutrophication. High levels of nitrates could lead to algal blooms and dissolved oxygen depletion and thereby fish kills.

The Class "C" water quality criterion for nitrate is set at 10 mg/L in lakes, reservoirs and similarly impounded water.

The nitrate levels in Pandin Lake were very low compared to the criterion. There was even a decreasing trend from 1996 to 2000 and then a slightly increasing trend up to 2005.

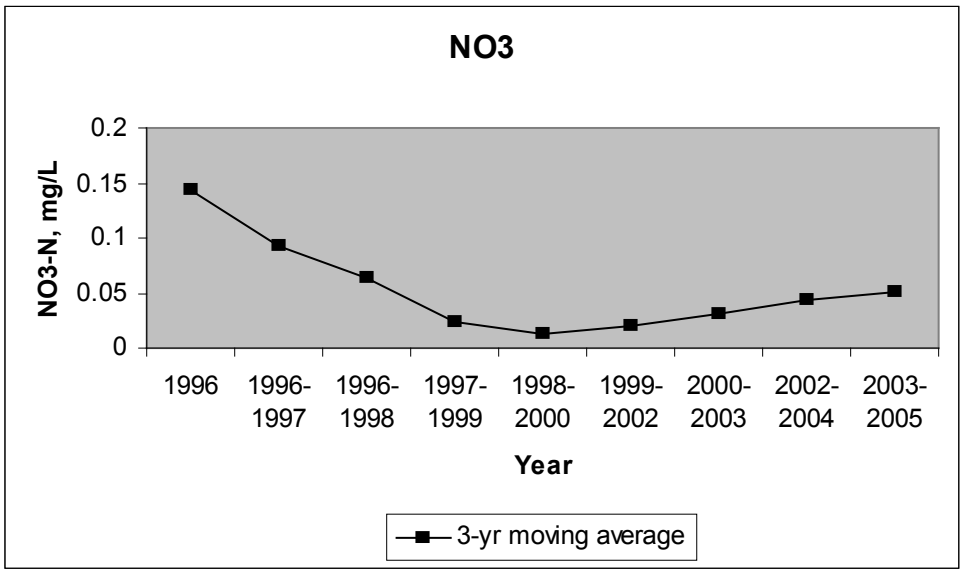

Figure 2. Three-year trend of nitrate levels in Pandin Lake

Ammonia (NH3)

Ammonia is a plant nutrient but a toxicant to fish. In aquesous solution, un-ionized ammonia exists in equilibrium with ammonium ion.

Ammonia is highly toxic to fishes, especially to larva and juveniles. Toxicity increases with increase in pH and in temperature.

From the graph on 3-year moving average of ammonia in Pandin Lake, ammonia slightly fluctuated from 1996 to 2003 and then abruptly increased in 2004. This was brought about by a very high concentration of ammonia in January 2004 at a value of 14.4755 mg/L (Refer to Table 1).

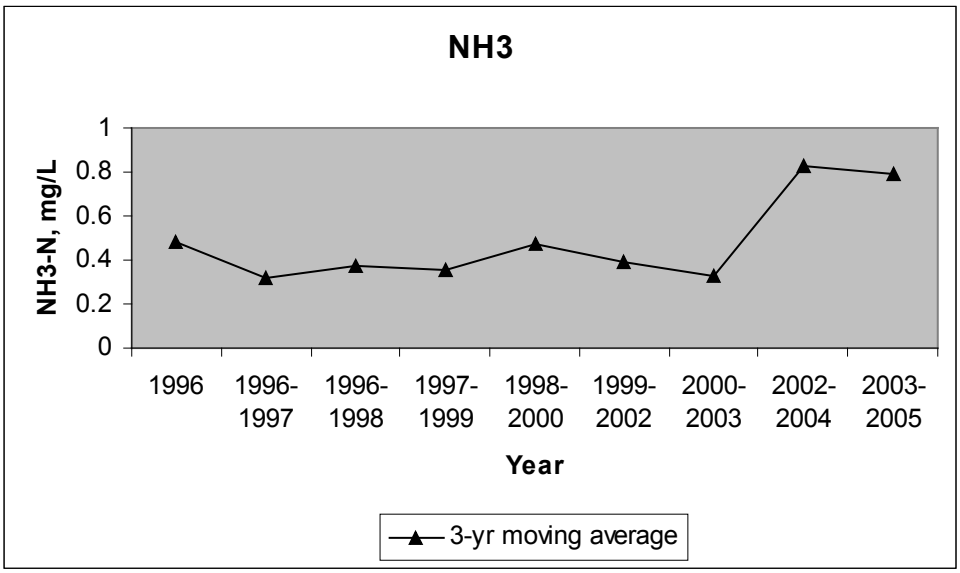

Figure 3. Three-year trend of ammonia levels in Pandin Lake

Inorganic Phosphate (IPO4)

Inorganic phosphate is an important plant nutrient and a primary element in the metabolic reactions of both plants and animals. Like nitrate, inorganic phosphate can also act as a limiting nutrient in a body of water.

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.

The phosphate concentration in 1996 was high compared to the Class C criterion. The level then exhibited a decreasing trend up to 2005. Annual average for phosphate met the criterion in 2003, 2004 and 2005 (Table 1 and Figure 4).

As a result of the low phosphate concentrations, phytoplankton counts in Pandin Lake were also low.

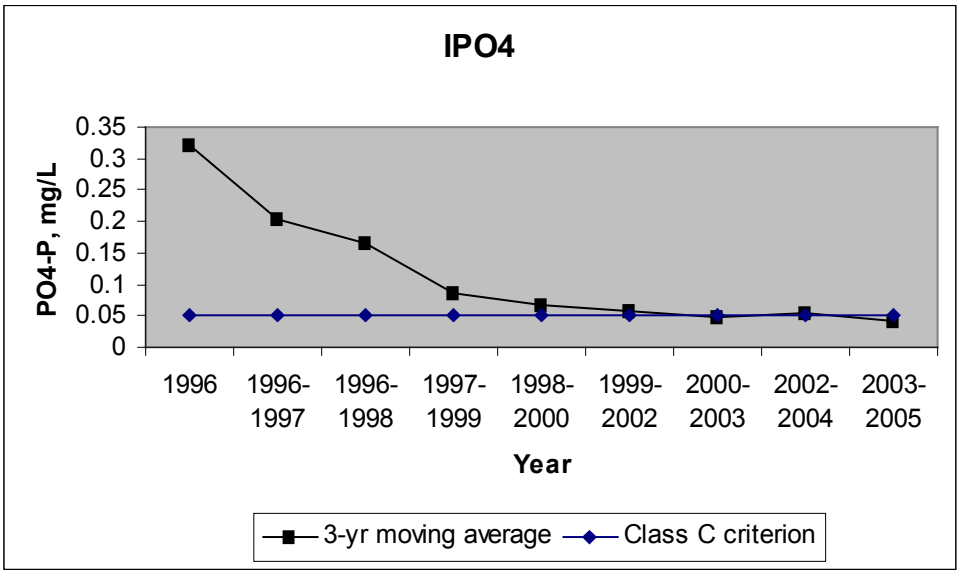

Figure 4. Three-year trend of phosphate levels in Pandin Lake

Total Dissolved Solids (TDS)

Total dissolved solids indicate the amount of dissolved materials, minerals and other ions.

A constant level of minerals in the water is necessary for aquatic life. TDS concentrations that are too high or too low may limit growth and lead to the death of many aquatic life forms.

The TDS values in Pandin Lake were almost steady except for a rare increase in July 1997 at 1000 mg/L and in November 2002 at 608 mg/L thus increasing the annual averages during these years.

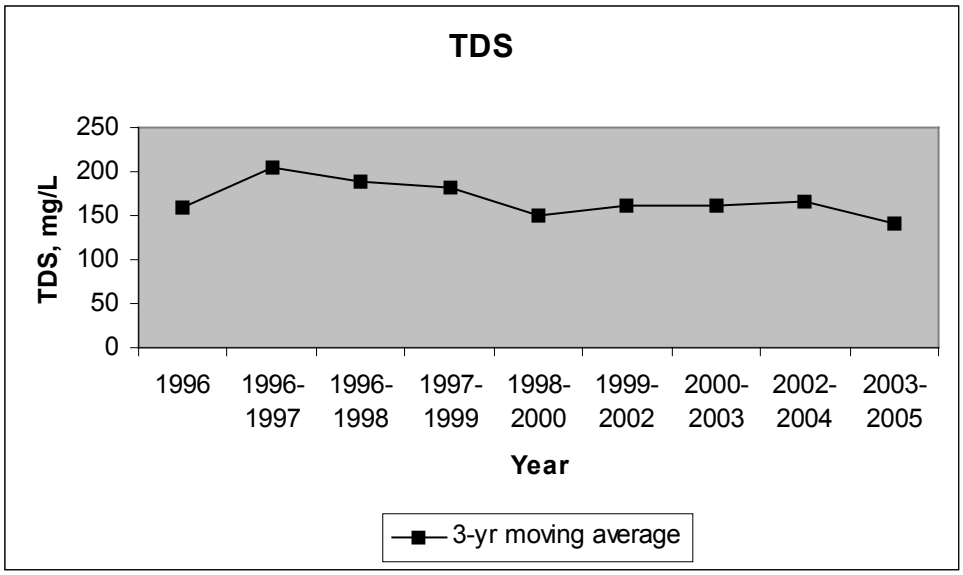

Figure 5. Three-year trend of TDS levels in Pandin Lake

Total Suspended Solids (TSS)

Total suspended solids indicate the presence of solid particulates that include clay, and organic materials. TSS reduces water transparency and contributes to dissolved oxygen depletion.

Pandin is next to Yambo Lake with the lowest TSS values, an indication that the water in this lake is clear.

Annual averages for TSS were low except in 2000 when it reached a value of 21 mg/L. This resulted to a peak in Figure 6 for the period 1998-2000.

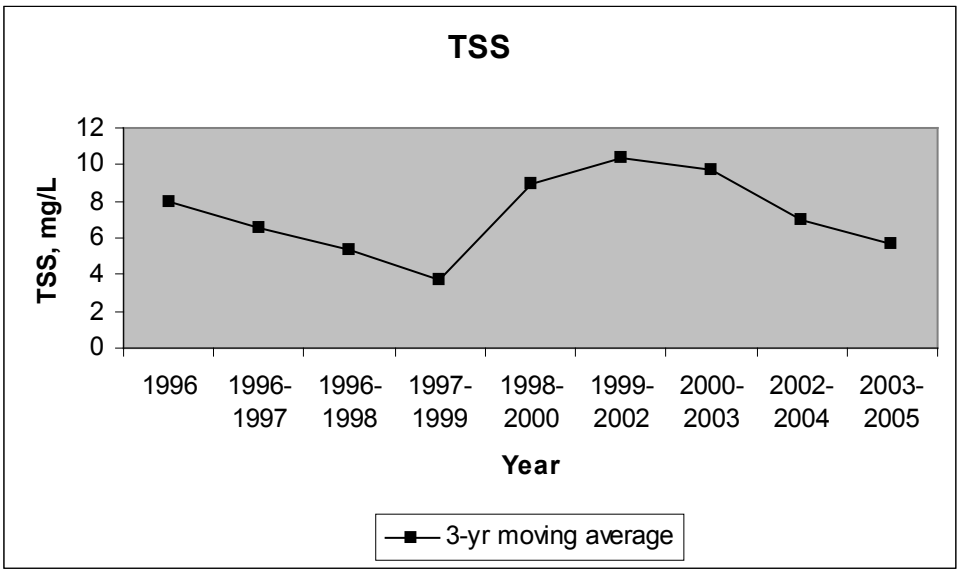

Figure 6. Three-year trend of TSS levels in Pandin Lake

Chloride

Chloride is widely distributed in nature, generally in the form of sodium and potassium salts.

Sodium chloride is widely used in the production of industrial chemicals such as caustic soda, chlorine, sodium chloride, and sodium hypochlorite. Some sources include septic tank effluents, animal feeds, and industrial effluents.

Chloride in surface and groundwater come from both natural and anthropogenic sources, such as run-off containing salts, the use of inorganic fertilizers, landfill leachates, irrigation drainage, and seawater intrusion in coastal areas.

Chloride levels in Pandin Lake remain low throughout the monitoring period.

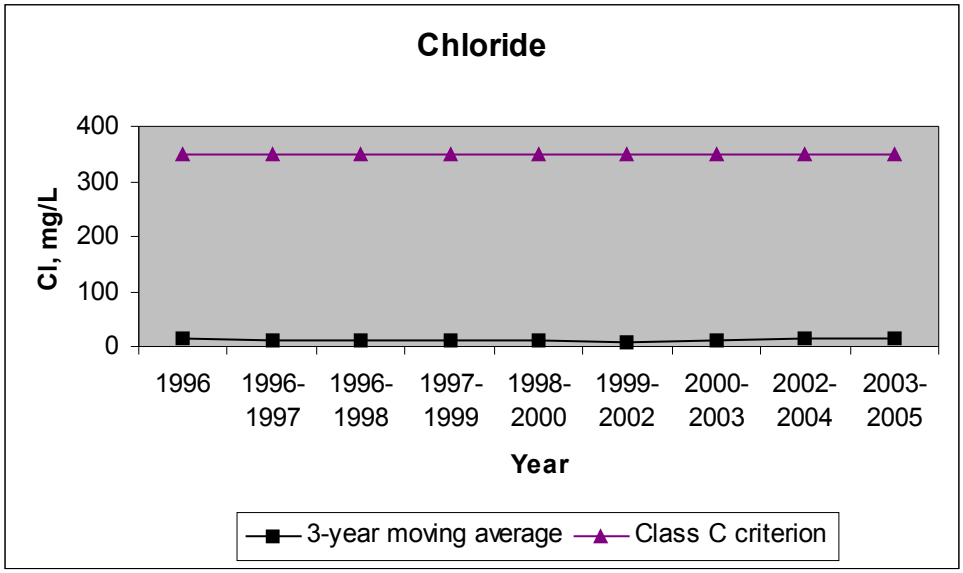

Figure 7. Three-year trend of chloride levels in Pandin Lake

Biochemical Oxygen Demand (BOD)

Biochemical Oxygen Demand is a measure of the approximate quantity of dissolved oxygen that will be required by bacteria to stabilize organic matter in wastewater or surface water. It is a semi-quantitative measure of the wastewater organics that are oxidizable by bacteria. It is also a standard test in assessing wastewater strength.

BOD constantly met the Class C criterion during the study period except for a slight exceedance in July 1998.

The highest annual average of 6 mg/L was measured in 1998 while the lowest was in 2003 and 2005 at 2 mg/L. Pandin lake exhibited a downward trend for BOD.

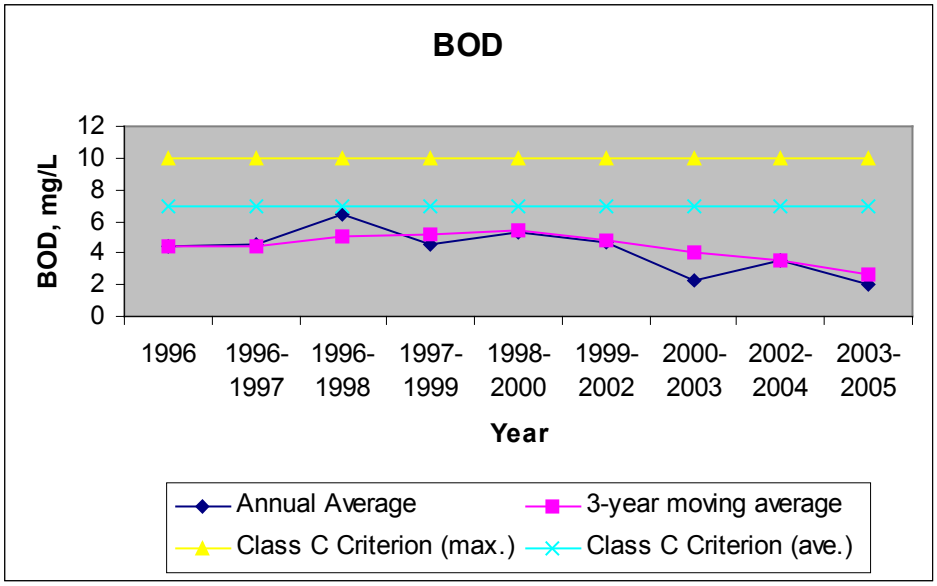

Figure 8. Three-year trend for BOD levels in Pandin Lake

Chemical Oxygen Demand (COD)

COD is the amount of oxygen required to oxidize the organic matter by use of dichromate in an acid solution and to convert it to carbon dioxide and water.

COD is used to test the strength of wastewater that is either not biodegradable or contains compounds that inhibit activities of microorganisms.

In the same manner as BOD, COD also exhibited a downward trend, as shown in the following figure.

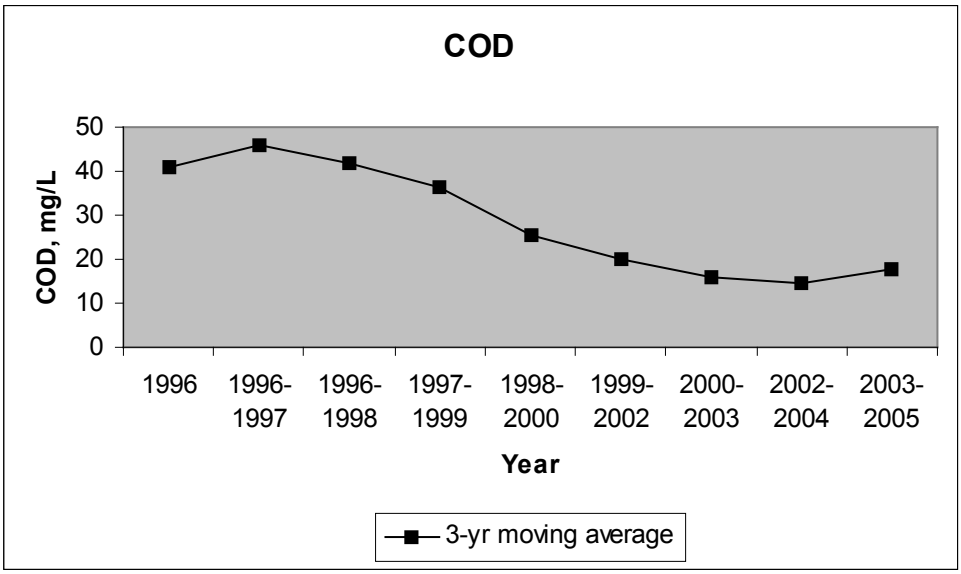

Figure 9. Three-year trend of COD levels in Pandin Lake

Dissolved Oxygen (DO)

The DO test measures the amount of life-sustaining oxygen dissolved in the water. Low level of dissolved oxygen in water is a sign of organic matter pollution.

Most aquatic plants and animals need oxygen to survive. Fish starts to die at DO level below 5.

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

Adequate DO was measured up to 4 meters in January to February, up to 6 meters in March, May, June, July while up to 20 meters in September. For October to December, the DO criterion for fishery was met even up to 25 meters.

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	7.2	6.9	8.3	7.5	8.2	8.3	7.9	7.5	7.4	7.4
2	6.5	6.6	7.9	7.4	8.0	8.3	7.7	7.6	7.4	7.2
4	5.6	6.1	6.4	7.6	7.8	6.7	7.6	7.6	7.2	7.5
6	4.9	4.7	5.8	5.0	5.9	5.5	6.9	7.0	7.0	7.4
10	4.8	4.4	4.7	4.5	4.8	4.6	6.0	6.6	6.2	6.8
15	4.2	4.4	4.4	4.5	4.6	4.6	5.2	5.3	5.3	5.7
20	4.2	4.5	4.7	4.4	4.6	4.7	5.0	5.2	5.1	5.4
25	4.4	4.3	4.5	4.3	4.3	4.2	4.9	5.1	5.1	5.3

0 Compliance to DAO 34 Water Quality Criterion Class C WAters

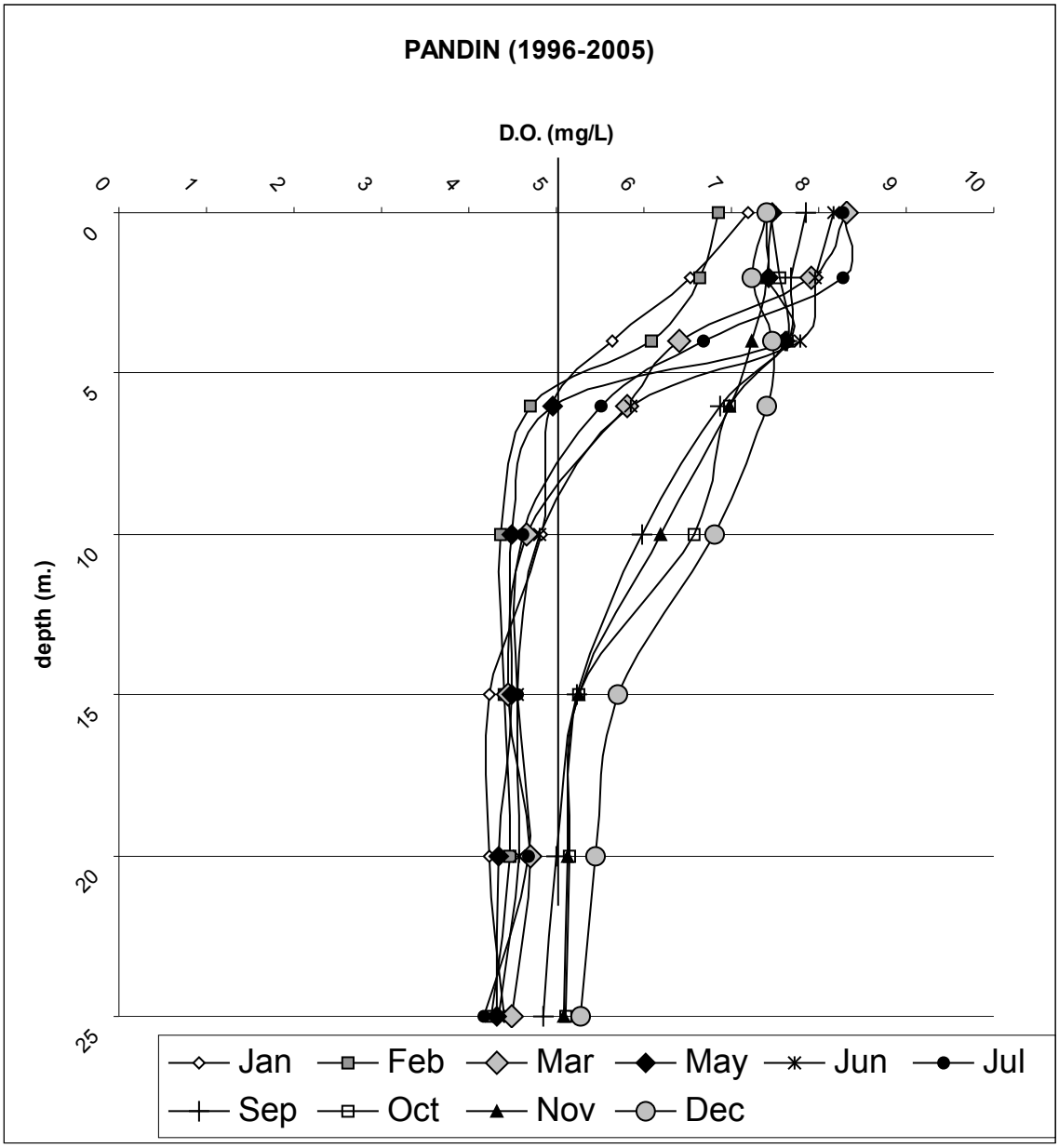

Figure 10. Monthly DO average at different depths

Phytoplankton

The existing microflora of Pandin lake consist of 21 genera most of which belong to Chlorophyta (green algae) and Bacillariophyta (diatoms). Other groups such as Cyanophyta (bluegreen algae) and Pyrrophyta (dinoflagellates) were occasionally present.

Among the seven lakes of San Pablo, Pandin showed low algal counts from 1996 to 2005. The annual average from 1996 to 2000 ranged from 193 to 2600 cells per ml while in 2002 to 2005, the average ranged from 230 to 2725 cells per ml. High counts occurred in 2001 with an annual average of 12137 cells per ml. Records show that the highest production of algae was recorded in the last quarter of 2001 (October & November). The dominant species was *Microcystis sp*. (bluegreen), contributing about 88.1% to the total algal counts.

Aside from *Microcystis sp.,* other algal species identified include *Crucigenia sp*., *Closterium sp*., *Oocystis sp*., *Cosmarium sp., Staurastrum sp., Stephanodiscus sp., Navicula sp., Melosira sp., Glenodinium sp. and Ceratium sp..*

Table 3. Phytoplankton Counts by Group, 1996 - 2005

Year	Bluegreen	Green	Diatoms	Dinoflagellates	Total
1996	137	48	2	6	193
1997	372	1173	10	25	1580
1998	92	1261	11	4	1368
1999	1925	393	81	201	2600
2000	15	589	108	55	767
2001	11901	84	145	7	12137
2002	2459	155	71	40	2725
2003	59	74	95	2	230
2004	56	581	136	15	788
2005	1045	51	220	15	1331

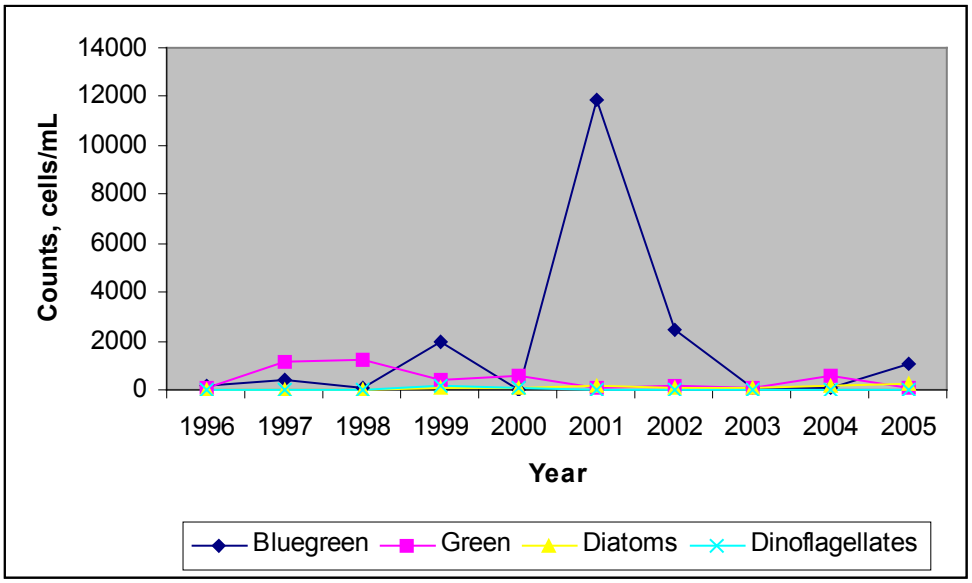

Figure 11. Phytoplankton Counts by Group

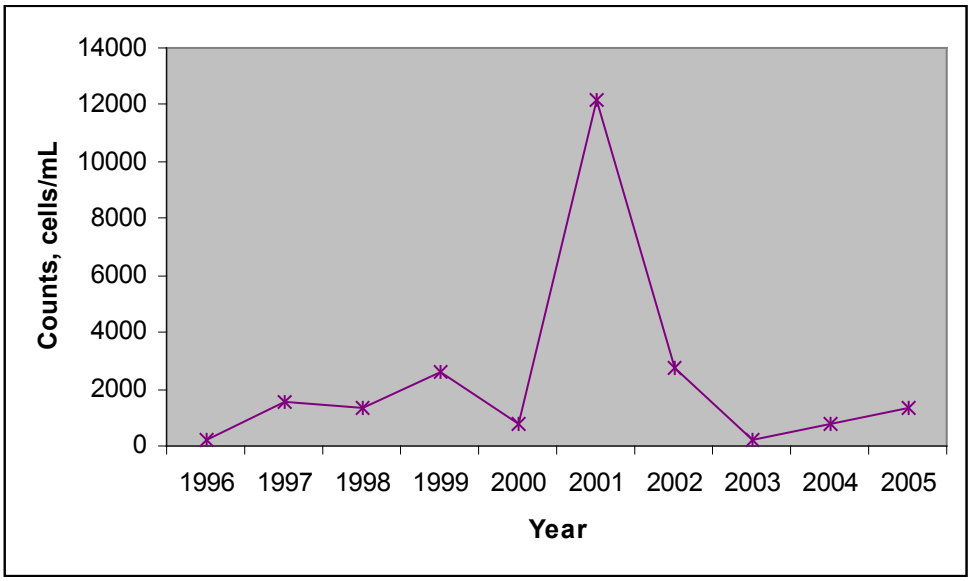

Figure 12. Total Phytoplankton Counts

There were times fish farmers complained of the prolonged culture period of their stocks due to low productivity of the lake. Fish cage culture operators in Pandin lake are very few compared to the other six lakes of San Pablo.

Zooplankton

A total of twenty (20) species composed the zooplankton population of Lake Pandin for the past nine (9) years. The identified genera belonged to three major groups, namely: Rotifera (wheel animals), Cladocera (water fleas) and Copepoda (fairy shrimps).

Among the three groups, Rotifera was the most diversified with fourteen (14) identified organism, Copepoda ranked second with six (6) organisms and the least diversified was Cladocera with three (3) organisms.

In terms of percent contribution by group, Copepoda has the highest contribution except in 2002 and 2005. A zero percent (0%) contribution by group Rotifera was recorded in 2003 and 2004 while zero percent (0%) contribution of Cladocera was measured in 1997 and 2005.

The highest zooplankton population of 542 individuals per liter was recorded in January 2005. Low counts of zero individuals per liter were also recorded at different months except in 1999 and 2002.

The annual average during the study period ranged from 1-69 individuals per liter. The highest annual average was recorded in 2005 while the lowest annual average was obtained in 1997. Higher counts were relatively measured during the dry season than wet season.

The listing of Pandin Lake Zooplankton community is presented below.

Phylum : Rotifera

Rotifera

Asplanchna sieboldi
Brachionus angularis
Brachionus calyciflorus
Brachionus forficula
Brachionus falcatus
Brachionus caudatus
Brachionus quadridentatus
Filinia longiseta
Filinia opoliensis
Hexarthra fennica
Keratella sp.
Lecane sp.
Synchaeta
Trichocerca sp.

Phylum : Arthropoda
Class : Crustacea

Cladocera

Bosmina longirostris
Ceriodaphnia cornuta
Diaphanosoma excisum

Copepoda

Diaptomus sp.
Mesocyclops sp.
Thermocyclops crassus

copepodid stage
copepodid stage (calanoid)
nauplius stage

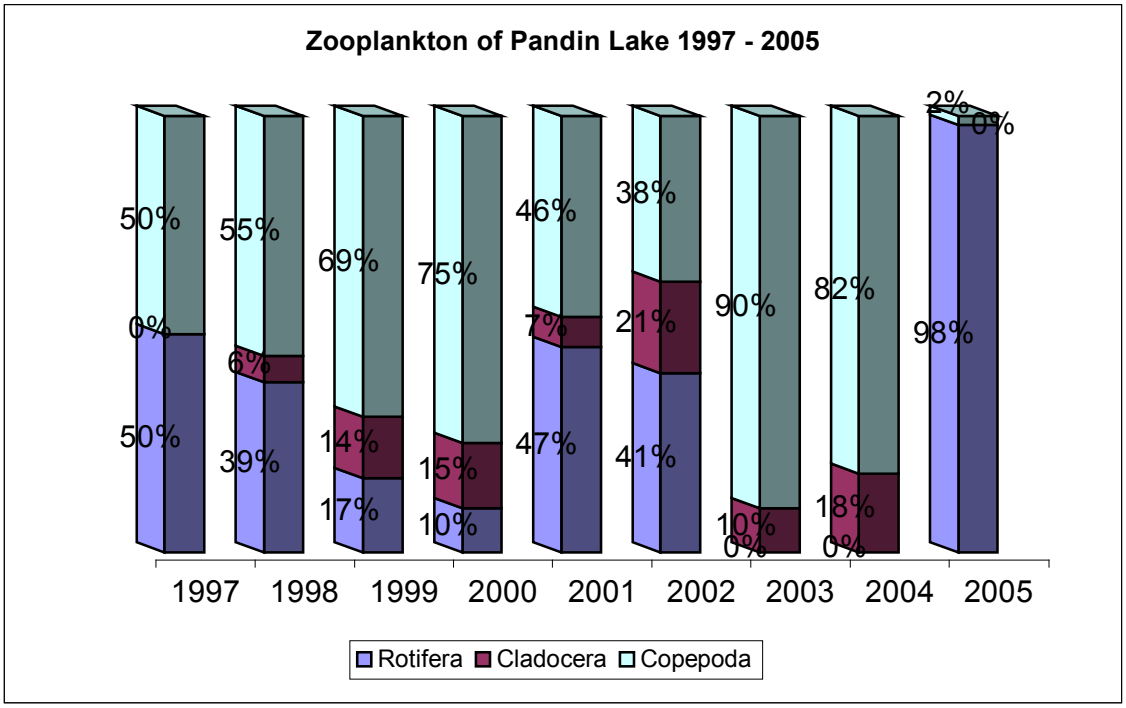

Figure 13. Percentage of Zooplankton by Group

Chlorophyll "a"

For the past nine years, Pandin Lake was second highest in terms of Chlorophyll-a measurements at 37.21 μg/L. Its abundance is a good indicator of the amount of algae present in the waters of Pandin Lake. The highest annual average during the study period was recorded in 1997 at 57.47 μg/L, while the lowest annual average was in 1999 at 27.03 μg/L.

The highest monthly average of 142.47 μg/L was measured in January 1997, while the lowest was recorded in May 2000 at 2.09 μg/L. The Chlorophyll-a concentrations in Pandin Lake are still with in the eutrophic range of 9.75 – 65.58 μg/L. (Ref: Eutrophication of Lakes in China, 1990)

The over-all present Chlorophyll-a status can still support the aquatic animals present in the aforementioned lake.

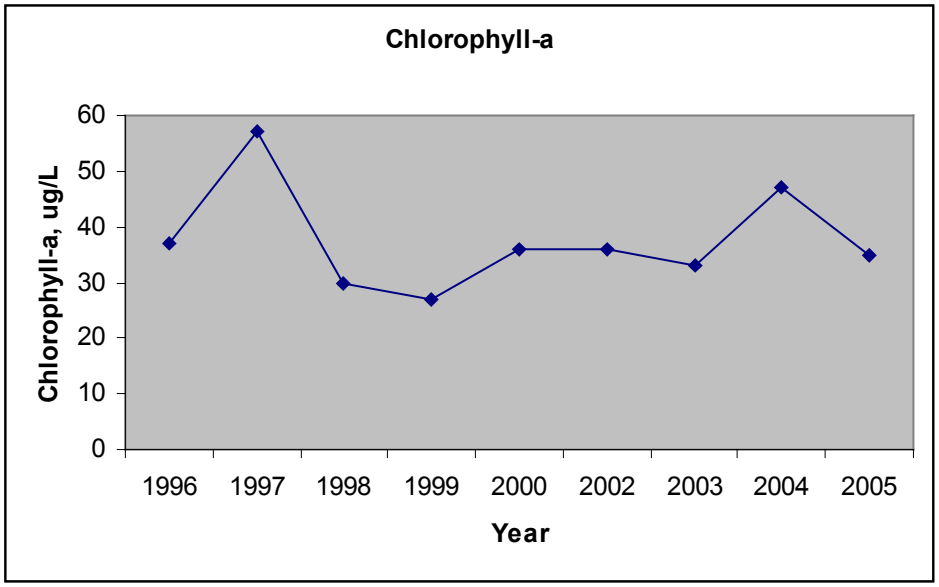

Figure 14. Annual Average of Chlorophyll-a

CONCLUSIONS AND RECOMMENDATIONS

Pandin Lake is one of the cleanest among the crater lakes of San Pablo City.

BOD exceeded the Class C criterion only once during the study period. Annual averages for BOD consistently met the set criterion. BOD and COD exhibited decreasing trends.

Adequate DO was measured at a minimum of four meters and up to a maximum of 25 meters at certain times of the year.

Phosphate, likewise, exhibited a decreasing trend. The criterion was never exceeded from 2003 to 2005.

As a result of the low nutrient levels in Pandin Lake, phytoplankton counts were considerably low compared to the other crater lakes. Fishermen complained of the prolonged culture period of their stocks due to low productivity.

Pandin Lake may be developed into an ecotourism area in San Pablo City. However, measures must be undertaken to prevent the direct discharge of wastes into the lake.

A Development Plan for Pandin Lake should be established in coordination with all the stakeholders. Livelihood projects aside from aquaculture should be looked into.

There are very few clean lakes like Pandin Lake in the country right now. This lake should be preserved for its natural beauty.