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Phytoplankton Investigation and Environmental Assessment for Dredged Area in Panlong Estuary Section of Dianchi lake, China

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Panlong River is one of the major rivers flowing into the Dianchi Lake. In this paper, phytoplankton investigation and environmental assessment for the dredged area in Panlong Estuary Section of Dianchi lake in Kunming city was reported. After microscopic identification and counting of 6 water samples(two of them is control plot), the water environment were evaluated by the phytoplankton species and quantity which were assessed by the biological diversity index, including Maglarf, Shanon-Wiener, Simpson diversity index, Pielou index and Berger-Parker dominance index. It's found that there are mainly 7 species of algae, and among them, *Microcystis spp. et al.*, are the dominant species. So the water is assessed as eutrophication, Heavy sewage. Based on the diversity index analysis, the dredged area sampling sites were relatively higher than the non-dredged areas in biodiversity of phytoplankton. Summarily, the water quality after dredging has been improved to some extent. Phytoplankton biodiversity indicators should be one of the important water environmental assessment methods.

Key words: Panlong Estuary; Dredging; phytoplankton biodiversity; Environmental assessment.

The dredging works is a main part of environmental remediation project of the aquatic environment of Dianchi Lake. The sediment dredging of the lake will change the appropriate attributes and associated wetland ecological processes, and this change will affect the lake environment, of which the biological evaluation for the impact corresponding will help further governance work in environmental remediation of Dianchi Lake. Panlong River is one of the major rivers flowing into the Dianchi Lake, which runs through the whole of city and is the longest river in the Dianchi lake basins, so the Panlong estuary is one of the most polluted areas. After dredging works, the water quality of Panlong estuarine lake is made improvement or not? It is very important way that Use of biological diversity analysis techniques reveal the waters after dredging to improve water quality or not. we have Dianchi Caohai and Daqing river estuaries similarly studied to reveal dredging works for improving the water quality impact is positive in Dianchi lake in Kunming city, China1-2. The algal biology studies 3-6, 10-13 in Dianchi Lake are also reported to some extent, however, assessing of the algae species, quantity and the phytoplankton biodiversity of dredged water in Panlong Estuary of Dianchi Drainage basins, is firstly studied. The results is helpful to accumulate the data information of characteristics of phytoplankton populations and aquatic quality evaluation of changes in the basis of comparable data of the polluted area, which is contributed to the region's eco-management and ecological studies of great significance.

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MATERIALS AND METHODS

Set four sampling point in the dredging area(S1~S4), set two sampling point in the non-dredged area as control plot(Sck1 and Sck2, Sck1 is sampled from non-dredged area in the Panlong Estuary Section near the sampling point, Sck2 is far away from sample Sck1, Sck2 is sampled from Baoshang Estuary Section in the lake) in July and August, 2011.The location and relative hydrological factors were Determined Environmental Science Press, October 2002 issue of "water (TableI). Collection and counting of phytoplankton qualitative and quantitative amount of specimen was referred to the China and wastewater monitoring and analysismethods". The microscopic observations in the laboratory werereferred to the relevant scientific literature [11-17] for methods of classification and identification of algae. Several biodiversity index such as Margarlaf (1951,1957,1958) index (Dm), Simpson index (Ds), Shannon-wiener index (H'), Pielou index (E), Berger-Parker dominance index (d) calculated using the counting results can be used to analysis and evaluate the quality of the water.

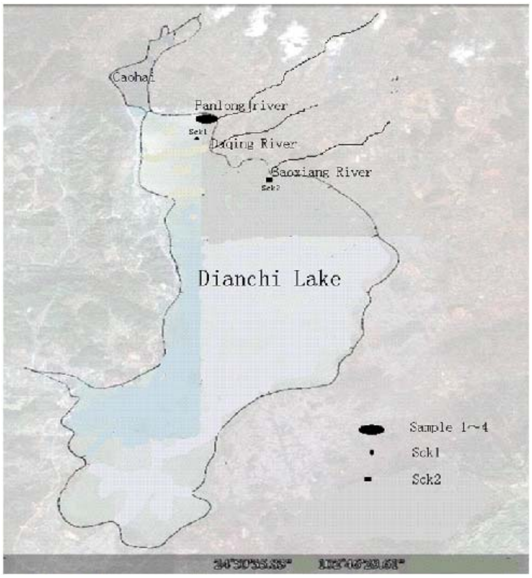

Fig.1. The dianchi lake outline (kunming city, china) and the sampling position

RESULTS AND DISCUSSION

Evaluation results according to the species and quantity of algae

After algae identification and qualitative examination of the samples, there are 4~7 genera and species, belonging to Chlorophyta, Bacillariophyta and Cyanophyta. The Chlorophyta held the most amounts of species, and then followed Bacillariophyta, Chlorophyta. The Cyanophyta was dominated in the number of the algae composition. The dominant phytoplankton species was *Microcystis* Kutz., especially species as *Microcystis aeruginosa* and *Microcystis flosaquae*. The algae result is showed water in heavy sewage.

According to Bohuslav Fott (1978) [17],algae indicated the extent of water pollution standards to be evaluated: Panlong Estuary of dredging areas and non-dredging area as polluted-water heavy sewage as algal species were recorded as many as 4 to 7 species, and the dominant species of cyanobacteria is *Microcystis* algae, and *Scenedesmus (*Chlorophyta) *Cyclotella* (Bacillariophyta) are distributed almost all the samples .The green algae *Oocystisis, Pediastrum* and *Chlorella* are main associated algae.

The water samples S1~S4 are sampled from the dredged water area, Sck1 and Sck2 are sampled from non-dredged water area, Sck2 is far away from sample Sck1. Generally speaking, the dredged area exists 1 or 4 species more phytoplankton species than the non-dredged area. The amounts of algae of the samples are very less than especially in the amount of algae Microcystis. Especially the quantity of green algae's genera discovered from dredged water samples is more than that of point Sck2. However, there is not obvious different between the samples and controlled spot Sck1, but it is obvious different between the samples and controlled spot Sck2. Because the water is flowing, the lake is as a whole and other factors, Difference is not obvious between the control group with the sample. In short, according to the species of algae and quantitative analysis, the dredging area water had made improvement in water quality than the non-dredged areas to some extent based on the genera amount and algae's quantity.

Evaluation results based on analysis of various biodiversity indexes

The water samples S1~S4 are sampled from the dredged water area, Sck1 and Sck2 is sampled from non-dredged water area.

The analysis results in Shannon index, Simpson index and Margraf index are shown in Table III.The results are relatively similar, S1~S4, respectively, the amounts are in the range of 37,518~120ÿ783, Shannon index, 0.08~0.13, (average amount,0.0975),Simpson index, 0.02~0.03 (average amount,0.0225), Marglarf index, 0.04~0.26 (average amount0.115), the control point Sck1,Sck2, respectively 0.49, 2.32, 0.16 and 0.09, 0.02, 0.07. The various points average amounts is slightly higher than Sck1 in the various biodiversity indexes, and they are very higher than the control point Sck2. This shows to some extent the dredged samples are richer than the control point in biodiversity, especially than the Sck2.

Table 1. Location and hydrological factors

Samples	E	N	T r(cm)	D(m)	PH	T°C	DO	EC
S1	102°402 333	24°572 143	20	4	9.46	25.2	14.8	476
S2	102°402 353	24°572 093	15	3.5	9.23	23.9	12.9	489
S3	102°402 333	24°572 223	19	4	9.2	23.2	11.8	484
S4	102°402 373	24°572 033	15	3.8	9.32	23.4	13.5	485
Sck1	102°402 343	24°562 053	28	3.3	9.27	23.3	10.5	473
Sck2	102°402 333	24°572 143	20	4	9.46	25.2	14.8	476

Tr: Transparency; DO: Dissolved Oxygen; T: Temperature; EC: Electrical Conductivity

Table 2. The Species and Quantity of Algae in Dredged and Non-dredged Water Area in Panlong Estuary Section of Dianchi drainage basin

Species	S1	S2	S3	S4	Sck1	Sck2
Microcystis	11,973	36,990	46,955	46,955	41,746	149,545
Scenedesmus	76	76	528	528	2,265	604
Oocystis	227	302				0
Cyclotella	453	151			453	0
Pediastrum	151				3,020	830
Ankistrodesmus	755	36,990	46,955	46,955	41,746	0
Merismopedia	76	76	528	528	227	
Genera amounts	7	6	4	4	6	3
The algae Amounts	120,783	37,518	47,483	47,483	45,596	150,979

* n/ml means algae amounts per ml.

Table 3. Biodiversity Index of The 6 Waters Samples in Panlong Estuary Section of Dianchi drainage basin

Samples	Species	Amounts n/ml	H'	H'max	Ds	Dm	E	d
S1	8	120,783	0.08	3	0.02	0.26	0.03	0.99
S2	4	37,518	0.13	2	0.03	0.12	0.06	0.99
S3	2	47,483	0.09	1	0.02	0.04	0.09	0.99
S4	2	47,483	0.09	1	0.02	0.04	0.09	0.99
Average	4	63,317	0.0975	1.75	0.0225	0.115	0.0675	0.99
Sck1	5	45,596	0.49	2.32	0.16	0.16	0.21	0.92
Sck2	3	150,979	0.09	1.58	0.02	0.07	0.05	0.99

H': Shinon-Weina index; Ds:Simpson index;Dm:Marglarf index; D: Dominance index, E: Uniformity index

Biodiversity dominance index d shows the proportion of dominant species, S1~S4, 0.99, average 0.99, same as control spot Sck1(0.92), and is lower than the control point Sck2(0.99), indicating that control point Sck2 are more than others in the dominant species (as Microcystis) and the various points are the higher biodiversity than control point Sck2. The biological diversity evenness index (E) show the diversity of species dispersion, S1~S4 is 0.03~0.09, average 0.0675, the control point Sck1 is 0.21, Sck2 is 0.05.

Overall, there are more genera of algae in dredged area than in control point, the amounts of dominant algae is less than that in the control point of the dredged area, and most of the diversity indexes are higher than that of the control point, these shows the improvement in water quality in dredging areas.

CONCLUSIONS

Generally, By the species and quantity of phytoplankton and its biodiversity index analysis ,we can access the amounts and species of algae in the local habitat to find the biodiversity in various habitats (within-habitat diversity)and the dissimilarity in species composition or the alternation rates, among the different communities of different habitats along environmental gradients [1,8]. Based on previous academic studies, the studies show the higher the level of species diversity was, the more stable aquatic ecosystem would be, and the more conducive to self-purification capacity of water and contamination resistance would be [3,6,9,10]. Using aquatic algae analysis and diversity indices analyze water quality improvement in several areas such as Caohai, Daqing and Panlong estuaries, have shown the effect of Dianchi Lake dredging project on the water quality improvement is positive. Because there are many water quality factors. However, in order to ensure reliable results, continuous monitoring and in conjunction with other monitoring tools are needed in these areas.

It is necessary to set two control spot, as the water of lake is a whole, one other spot is 2 kilometers far away from the first spot of the Dianchi Lake. The water of dredged area of the Panlong estuary section including the undredged area of the lake were evaluated to be in heavy sewage water, however, from phytoplankton biomass and biodiversity comparisons of the various parameters, the dredging areas have made improvement in water quality to some extent, and the phytoplankton biodiversity indicators should be the important water environmental assessment method.

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REFERENCES

1. Ying Wang; Wanglong Zhang; Yu Luo; Daowei Wang; Xuejun Pan; Tao XuÿPhytoplankton Investigation and Environmental Assessment for Dredged Area in Caohai Section of Dianchi Lake, China, 2012: 1-3
2. Tao Xu, Xuejun PanÿPhytoplankton Investigation and Environmental Assessment for Dredged Area in Daqing Estuary Section of Dianchi lake, China, *Applied Mechanics and Materials*. 2013; (295-298) : 726-729
3. P. M. Pu,G. X. Wang,C. H. Hu,W. P. Hu, C. X. Fan,"Can we control lake eutrophication by dredging," *Journal of lake science,* 2000; **12**: 269–279.
4. M. Zhang,Y. Li, R. N. Wang, "The research of biodiversity for the species of phytoplankton in DianchiLake,"Journal of Yunnan University (Natural Sciences Edition), 2006; **28**:73–77,.
5. Y.Li, M. Zhang, R. N.Wang,"The temporal and spation variation of the cyanobacteria which caused the water bloom in the Dianchi Lake,Kunming,China," *Journal of Yunnan University* (Natural Sciences Edition), 2005; **27**: 272–276.
6. Y. X. Deng,A. J.Zhang, "A discussion on the use of algae in water contamination monitor,"Environment and development, 1999; **14**: 43-45.
7. L. P.Liu, J. Chen, "Prediction on influence of bed-mud dredging onaquatic ecological environment in Dianchi Lake,"*Yunnan*

Environment Science, 1999; **18**: 11-12.
8. R. X. Li, M. Y. Zhu, S. Chen,R. H. Lu, B. H. Li, "Responses of phytoplankton on phosphate enrichment in mesocosms,"ActaEcologicaSinica, 2001; **21**: 603-607.
9. F. Schanz, H.Juon, "Two different methods of evaluating nutrient limitations of periphyton bioassays using water from the river Rhine and eight of its tributaries," *Hydrobiologia*, 1983; **102**: 187–195.
10. S. R. Gao, L. J. Pan,F. Sun,"Assessment on the pollution and eutrophication of environmental water by hydrobIologica," *Environmental Science and Management*, 2006; **31**:174-176.
11. H. J. Hu,Y. X. Wei, The Fresh water Algae of China, Systematic, Taxonomy and Ecology, Beijing: Science Press, 2006.
12. H. J. Hu, X. Y. Li, Y. X. Wei, The Fresh water Algae of China.Shanghai: Shanghai Science and Technology Press, 1980.
13. X. Y. Deng, Z. G. Sheng, T.Xu, X. L. Chen, "The algae report of Xishuangbanna in Yunnan Province,"Southwest *China Journal of Agricultural Sciences*, 1997; **10**):85–90.
14. L. J. Bi,Z. Y. Hu, Fresh water Algae of China, vol. 8. Beijing: Science Press, 2005,
15. H. R.Zhu, The Fresh water Algae of China, vol. 9. Beijing: Science Press, 2007,
16. J. Z.Weng,H. S.Xu, The Common Fresh water Phytoplankton of China. Shanghai: Shanghai Science and Technology Press, 2010.
17. B.Fott,Algenkunde. Translated by D. A. Luo, Shanghai: Shanghai Science and Technology Press, 1971; 422-428.