Study on water pollution change rule and source in Taihu Lake Basin

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Abstract: The main pollutants of water environment in Taihu (COD, NH3-N and DO) are studied in this paper. The statistical analysis characteristics of the weekly mean concentration of pollutants in seven automatic monitoring stations in Taihu Lake Basin were studied by statistical methods, and the correlation between the meteorological data of seven stations and pollutants was analyzed. The results show that, the normal distribution is the water quality index of each site, and the fit type selection is most consistent with the significant relationship. DO weekly mean concentrations were better correlated at several sites except for individual sites, CODMn weeks mean concentration, the correlation between the sites is very small, the correlation between NH3-N weeks mean concentration at all sites showed no correlation or low linear correlation, These results shows that the DO pollution sources of these stations have some relevance, but the pollution sources of CODMn and NH3-N are not related closely, and only a few sites are related.

1. Introduction
In recent years, great achievements have been made in China's economic construction, but the deterioration of the ecological environment is accompanied by economic growth, among which water related problems are the most prominent. It is urgent to strengthen the prevention and control of water pollution, to reduce the harm to human health and the environment caused by water pollution, and to formulate effective control strategies for pollutants[1]. The cause and treatment of water pollution in Taihu has always been a hot issue. Yin Yan,Zhang Yunlin and so on [2][3] have successively studied the temporal and spatial distribution of COD and the correlation with other elements in the northern Taihu Lake region and the whole lake area, Yang Dingtian and Chen Weimin [4] analyzed the temporal and spatial distribution of COD and its related factors in Meiliang Bay,Taihu, Xie Rongrong and so on[5] have studied the emission changes of COD and NH3-N in Taihu, and have determined the total reduction rate of these two pollutants. In this paper, the main pollutants of water environment in Taihu are taken as the object of study. By analyzing the changing trend and correlation of various pollutants evaluation indexes, the trend of the function of some pollution indexes is obtained, and based on the analysis of the sources of the major pollutants, the relationship between the various influencing factors is found, which provides the research and policy basis for controlling and reducing pollution at the source.

2. Research Area and Data

2.1 Research Area
Taihu called Zhenze, also known as wuhu, Located at longitude 119, 52 ´, 32', 120, 36 ', 10', latitude 30,
55° 40' - 31°, 32° 58', is China's third largest freshwater lake, Lake area of 2338km², drainage area of 36985km². There are 48 islands and 72 peaks. The Taihu regional map is shown in figure 1.

Figure 1 Taihu lake regional map

2.2 Research Data
The scope of this research is Jiangsu Wuxi Shazhu the water quality automatic monitoring station, Jiangsu Yixing Lanshanzui water quality automatic monitoring station, Jiangsu Suzhou Xishan water quality automatic monitoring station, Zhejiang Huzhou Xintang harbor water quality automatic monitoring station, Shanghai Qingpu Jishui harbor water quality automatic monitoring station, Zhejiang Jiaxing Wangjiangjing River water quality automatic monitoring station and Zhejiang Jiaxing Xielu harbor water quality automatic monitoring station. There are seven key water quality monitoring stations of the Taihu Lake basin. Table 1 gives the latitude, longitude and cross section information of the seven monitoring stations.

| Point name                                | Point latitude and longitude                     | Rivers                  |
|-------------------------------------------|-------------------------------------------------|-------------------------|
| Jiangsu Wuxi Shazhu monitoring station    | East longitude 120° 13′ 46″ north latitude 31° 23′ 58″ | Taihu                   |
| Jiangsu Yixing Lanshanzui monitoring station | East longitude 119° 54′ 43″ north latitude 31° 12′ 56″ | Taihu                   |
| Jiangsu Suzhou Xishan monitoring station  | East longitude 120° 12′ 0″ north latitude 31° 13′ 0″ | Taihu                   |
| Zhejiang Huzhou Xintang harbor monitoring station | East longitude 120° 50′ 20″ north latitude 30° 50′ 50″ | Xintang harbor river    |
| Shanghai Qingpu Jishui harbor monitoring station | East longitude 120° 54′ 06″ north latitude 31° 06′ 56″ | Jishui harbor river     |
| Zhejiang Jiaxing Wangjiangjing River monitoring station | East longitude 120° 42′ 31″ north latitude 3° 53′ 06″ | Beijing Hangzhou the Grande Canale |
| Zhejiang Jiaxing Xielu harbor monitoring station | East longitude 120° 42′ 31″ north latitude 3° 53′ 06″ | Xielu harbor river      |
3. Statistical distribution characteristics of water quality indicators in Taihu Lake Basin

3.1 Determine the weekly concentration optimal statistical distribution model of water quality evaluation index

The basic normal distribution, uniform distribution, Poisson distribution and exponential distribution are used in the statistical distribution model, the weekly concentration data of each site in 2011 were analyzed by representative data, the optimum distribution model of three water quality indexes (mainly DO, CODMn and NH3-N) was determined, and two kinds of goodness of fit test methods, KS test and Binomial test, were used to test the accuracy.

The fit test results about the index concentration of Jiangsu Wuxi Shazhu the water quality automatic monitoring stations in Taihu basin as shown in table 2~4.

Table 2 in Wuxi, Jiangsu Sha Zhu automatic water quality monitoring stations DO concentration goodness of fit test results in 2011

| SN | Original hypothesis | Test method       | Sig.    | conclusion               |
|----|---------------------|-------------------|---------|--------------------------|
| 1  | The categories defined by DO<=11.94 and >11.94 occur with probabilities of 0.5 and 0.5 | Single sample Binomial test | 0.000  | Reject null hypothesis   |
| 2  | The distribution of DO is normal, with an average value of 9.56 and a standard deviation of 2.74 | Single sample KS test | 0.230  | Keep null hypothesis     |
| 3  | The distribution of DO is uniform, with a minimum value of 5.87 and a maximum value of 18 | Single sample KS test | 0.000  | Reject null hypothesis   |
| 4  | The distribution of DO is Poisson, with an average value of 0.00 | Single sample KS test | —      | beyond computation       |
| 5  | The distribution of DO is exponential, with an average value of 9.56 | Single sample KS test | 0.000  | Reject null hypothesis   |

Table 3 in Wuxi, Jiangsu Sha Zhu automatic water quality monitoring stations CODMn concentration goodness of fit test results in 2011

| SN | Original hypothesis | Test method       | Sig.    | conclusion               |
|----|---------------------|-------------------|---------|--------------------------|
| 1  | The categories defined by CODMn<=3.75 and >3.75 occur with probabilities of 0.5 and 0.5 | Single sample Binomial test | 0.127  | Keep null hypothesis     |
| 2  | The distribution of CODMn is normal, with an average value of 3.60 and a standard deviation of 0.58 | Single sample KS test | 0.530  | Keep null hypothesis     |
| 3  | The distribution of CODMn is uniform, with a minimum value of 2.60 and a maximum value of 4.90 | Single sample KS test | 0.097  | Keep null hypothesis     |
| 4  | The distribution of CODMn is Poisson, with an average value of 0.00 | Single sample KS test | —      | beyond computation       |
| 5  | The distribution of CODMn is exponential, with an average value of 3.60 | Single sample KS test | 0.000  | Reject null hypothesis   |

Table 4 in Wuxi, Jiangsu Sha Zhu automatic water quality monitoring stations NH3-N concentration goodness of fit test results in 2011

| SN | Original hypothesis | Test method       | Sig.    | conclusion               |
|----|---------------------|-------------------|---------|--------------------------|
| 1  | The categories defined by NH3-N<=0.28 and >0.28 occur with probabilities of 0.5 and 0.5 | Single sample Binomial test | 0.000  | Reject null hypothesis   |
| 2  | The distribution of NH3-N is normal, with an average value of 0.24 and a standard deviation of 0.09 | Single sample KS test | 0.265  | Keep null hypothesis     |
The distribution of NH$_3$-N is uniform, with a minimum value of 0.05 and a maximum value of 0.51. The distribution of NH$_3$-N is Poisson, with an average value of 0.00. The distribution of NH$_3$-N is exponential, with an average value of 0.24.

Further analysis of the other six sites, the analysis of significant differences, it is worth the water quality evaluation index, the best fitting distribution of concentration values are all normal distribution.

3.2 Parameter estimation of optimum concentration model of water quality index

Maximum likelihood (MLE) is used to estimate the statistical parameters of pollutant concentration under optimum distribution. In the 3.1 section, the concentration optimal distribution model of water quality evaluation parameters in Taihu basin has been established as normal distribution. The parameters of these distributions are estimated at a confidence level of 95%, i.e., the level of significance is 5%. This shows that the parameter value exceeds the given value with a probability of only 5%. Table 5 to 7 respectively estimates the estimated parameters of the best concentration model for the water quality evaluation parameters of the Taihu Lake Basin using maximum likelihood.

### Table 5 The site of the Taihu Basin DO weekly concentration under the the normal distribution parameter estimation in 2011

| Site number | Mean value in distribution | Standard deviation | Sig       | conclusion       |
|-------------|----------------------------|--------------------|-----------|-----------------|
| 1           | 9.56                       | 2.74               | 0.230     | Keep null hypothesis |
| 2           | 7.80                       | 1.95               | 0.850     | Keep null hypothesis |
| 3           | 9.56                       | 2.74               | 0.230     | Keep null hypothesis |
| 4           | 9.17                       | 3.11               | 0.125     | Keep null hypothesis |
| 5           | 6.88                       | 2.23               | 0.045     | Reject null hypothesis |
| 6           | 4.46                       | 0.97               | 0.913     | Keep null hypothesis |
| 7           | 4.49                       | 1.71               | 0.889     | Keep null hypothesis |

As shown in table 5, the DO concentrations in seven sites of the Taihu Basin is vary greatly. Since the concentration of DO in the water quality automatic monitoring station of Qingpu Shanghai Jishui harbor is higher than that of 5~6mg/L, the normal fitting can not agree with the significant level of 5%. The asymptotic significance value is 0.045, close to 0.05, which can basically satisfy the normal distribution. Except for the water quality automatic monitoring station of Qingpu Shanghai Jishui harbor, the normal fitting of the other six stations is good, that is, the difference assumption is completely established.

### Table 6 The site of the Taihu Basin CODMn weekly concentration under the the normal distribution

| Site number | Mean value in distribution | Standard deviation | Sig       | conclusion       |
|-------------|----------------------------|--------------------|-----------|-----------------|
|             |                            |                    |           | Keep null hypothesis |
|             |                            |                    |           | Reject null hypothesis |
|             |                            |                    |           | Keep null hypothesis |
|             |                            |                    |           | Keep null hypothesis |
|             |                            |                    |           | Keep null hypothesis |
|             |                            |                    |           | Keep null hypothesis |
As shown in table 6, under the condition that the concentration of CODMn in the water quality automatic monitoring station of Yixing Lanshanzui in Jiangsu was 0.05 in the significant level, reject null hypothesis, that is to say, the concentration difference is not obvious at this significance level, but the asymptotic significance value is close to 0.042 and 0.05, and the other distribution fitting is far less than the normal distribution. The best fitted normal distribution is fitted.

Table 7 the site of the Taihu Basin NH3-N weekly concentration under the the normal distribution parameter estimation in 2011

| Site number | Mean value in distribution | Standard deviation | Sig | conclusion |
|-------------|---------------------------|--------------------|-----|------------|
|             |                           |                    |     | Keep null hypothesis |
|             |                           |                    |     | Keep null hypothesis |
|             |                           |                    |     | Keep null hypothesis |
|             |                           |                    |     | Keep null hypothesis |
|             |                           |                    |     | Keep null hypothesis |
|             |                           |                    |     | Keep null hypothesis |
|             |                           |                    |     | Keep null hypothesis |

As shown in table 7, compared with the concentration of the first two groups, the average concentration of NH3-N is small and the standard deviation is small, the asymptotic significance values are not less than 0.05, that is, under normal distribution, under the condition that the significance level is 0.05, the NH3-N concentration data can be tested by significance test.

4. Variation trend of water quality index concentration in Taihu Basin

4.1 Characteristics of weekly variation of water quality in Taihu Basin

This paper mainly identifies three water quality indicators (mainly DO, CODMn and NH3-N), reference <Environmental quality standards for surface water>(GB 3838-2002)[7] form State Bureau of environmental protection.

In addition to the emission sources, the concentration index of water pollution is also affected by meteorological conditions such as temperature, rainfall and so on. Therefore, in a certain area, the concentration of water quality index shows a tendency to change with time. Tables 8 to 10 describe the basic statistics of concentration values from December 27, 2010 to December 25, 2011 (the year of 2011).

Table 8 the site of taihu lake watershed DO weeks are concentration of basic statistics in 2011

| Site | average | standard error | median | mode | standard deviation | variance |
|------|---------|----------------|--------|------|-------------------|---------|
| Site 1 | 9.564   | 0.381           | 8.690  | 10.500| 2.744             | 7.531   |
| Site 2 | 7.795   | 0.271           | 7.740  | 9.890 | 1.952             | 3.812   |
| Site 3 | 7.096   | 0.213           | 6.645  | 8.110 | 1.537             | 2.362   |
| Site 4 | 9.170   | 0.432           | 7.980  | 13.500| 3.114             | 9.695   |
| Site 5 | 6.875   | 0.309           | 6.185  | 6.560 | 2.225             | 4.951   |
| Site 6 | 4.464   | 0.135           | 4.460  | 4.690 | 0.974             | 0.949   |
| Site 7 | 4.490   | 0.237           | 4.435  | 6.020 | 1.709             | 2.921   |
### Table 9: The site of Taihu Lake Watershed CODMn Weeks are Concentration of Basic Statistics in 2011

|             | Site 1       | Site 2       | Site 3       | Site 4       | Site 5       | Site 6       | Site 7       |
|-------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Average     | 3.596        | 4.054        | 4.035        | 4.588        | 3.998        | 6.165        | 7.956        |
| Standard Error | 0.081        | 0.206        | 0.125        | 0.163        | 0.087        | 0.183        | 0.071        |
| Median      | 3.500        | 3.700        | 4.000        | 4.800        | 4.000        | 6.200        | 7.900        |
| Mode        | 3.300        | 3.500        | 4.300        | 4.800        | 4.000        | 6.600        | 7.600        |
| Standard Deviation | 0.585        | 1.487        | 0.899        | 1.153        | 0.625        | 1.319        | 0.515        |
| Variance    | 3.424        | 2.210        | 0.808        | 1.329        | 0.391        | 1.739        | 0.265        |
| Kurtosis    | -0.803       | 3.118        | -0.232       | 0.596        | 0.314        | 0.549        | 0.213        |
| Skewness    | 0.250        | 1.688        | -0.001       | -0.688       | 0.297        | -0.493       | 0.213        |
| Region      | 2.300        | 7.000        | 4.200        | 5.300        | 3.200        | 6.200        | 2.600        |
| Minimum Value | 2.600        | 1.800        | 1.800        | 1.700        | 2.500        | 2.400        | 6.900        |
| Maximum Value | 4.900        | 8.800        | 6.000        | 7.000        | 5.700        | 8.600        | 9.500        |
| Sum         | 187.000      | 210.800      | 209.800      | 229.400      | 207.900      | 320.600      | 413.700      |
| Count       | 52           | 52           | 52           | 52           | 52           | 52           | 52           |

Notes: the names of each site are described in Section 3.2.

### Table 10: The site of Taihu Lake Watershed NH3-N Weeks are Concentration of Basic Statistics in 2011

|             | Site 1       | Site 2       | Site 3       | Site 4       | Site 5       | Site 6       | Site 7       |
|-------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Average     | 0.012        | 0.836        | 0.161        | 0.431        | 1.769        | 1.617        | 1.363        |
| Standard Error | 0.230        | 0.079        | 0.011        | 0.026        | 0.079        | 0.088        | 0.092        |
| Median      | 0.260        | 0.765        | 0.140        | 0.410        | 1.755        | 1.705        | 1.415        |
| Mode        | 0.088        | 0.900        | 0.120        | 0.230        | 2.240        | 2.120        | 1.340        |
| Standard Deviation | 0.008        | 0.573        | 0.079        | 0.188        | 0.571        | 0.632        | 0.662        |
| Variance    | 2.231        | 0.328        | 0.006        | 0.035        | 0.326        | 0.400        | 0.438        |
| Kurtosis    | 1.086        | 2.544        | 4.910        | -0.611       | 0.609        | -1.097       | -0.925       |
| Skewness    | 0.460        | 1.356        | 2.010        | 0.375        | 0.730        | -0.279       | 0.120        |
| Region      | 0.050        | 2.830        | 0.410        | 0.820        | 2.720        | 2.370        | 2.360        |
| Minimum Value | 0.510        | 0.060        | 0.060        | 0.060        | 0.860        | 0.370        | 0.220        |
| Maximum Value | 12.590       | 2.890        | 0.470        | 0.880        | 3.580        | 2.740        | 2.580        |
| Sum         | 497.330      | 43.490       | 8.390        | 22.390       | 91.970       | 84.100       | 70.900       |
| Count       | 52           | 52           | 52           | 52           | 52           | 52           | 52           |

4.2 Correlation analysis with the concentration index of water quality in Taihu Basin

The correlation coefficient is an index describing the degree of dispersion between the two sets of...
measurement variables. Used to determine whether changes in two sets of measurement variables are related, that is, whether a larger value of a variable is associated with a larger value of another variable (positive correlation); Or whether a smaller value of a variable is associated with a larger value of another variable (negative correlation); Or the values in the two variables are not related to each other (the correlation coefficient is approximately zero). Let \((X, Y)\) be a binary random variable, then the correlation coefficient is expressed as:

\[
r_{XY} = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2 \sum_{i=1}^{n}(y_i - \bar{y})^2}}
\]  

(1)

Formula: \(r_{XY}\) is a correlation coefficients of random variables \(X\) and \(Y\). \(r\) is a numerical characteristic that measures the degree of linear correlation between \(X\) and \(Y\) in a random variable, Its range of value is \([-1,1]\). The greater the \(|r|\) value, the higher the degree of linear correlation between variables; The closer the \(|r|\) value is to 0, the lower the degree of linear correlation between variables. Generally can be divided into three grades: \(|r|<0.3\) is low linear correlation; \(0.3 \leq |r|<0.8\) is significant correlation; \(0.8 \leq |r|<1\) is highly linear correlation.

Tables 11 to 13 shows the correlation analysis of weekly mean concentration of Taihu Lake Basin in 2011.

**Table 11** DO between sites related to the weekly average concentration of the Taihu Lake Analysis

| Site 1 | Site 2 | Site 3 | Site 4 | Site 5 | Site 6 | Site 7 |
|--------|--------|--------|--------|--------|--------|--------|
| 1.000  | 0.716  | 0.481  | 0.604  | 0.588  | 0.175  | 0.551  |
| 0.716  | 1.000  | 0.581  | 0.743  | 0.494  | 0.185  | 0.543  |
| 0.481  | 0.581  | 1.000  | 0.614  | 0.353  | 0.228  | 0.412  |
| 0.604  | 0.743  | 0.614  | 1.000  | 0.653  | 0.400  | 0.531  |
| 0.588  | 0.494  | 0.353  | 0.653  | 1.000  | 0.466  | 0.303  |
| 0.175  | 0.185  | 0.228  | 0.400  | 0.466  | 1.000  |        |
| 0.551  | 0.543  | 0.412  | 0.531  | 0.303  | 0.273  | 1.000  |

**Table 12** CODMn between sites related to the weekly average concentration of the Taihu Lake Analysis

| Site 1 | Site 2 | Site 3 | Site 4 | Site 5 | Site 6 | Site 7 |
|--------|--------|--------|--------|--------|--------|--------|
| 1.000  | 0.238  | -0.085 | -0.109 | -0.338 | -0.246 | -0.379 |
| 0.238  | 1.000  | 0.139  | 0.102  | 0.141  | 0.017  | -0.041 |
| -0.085 | 0.139  | 1.000  | 0.141  | 0.176  | 0.017  | 0.142  |
| -0.109 | 0.102  | 0.141  | 1.000  | 0.163  | 0.001  | 0.142  |
| -0.338 | -0.167 | -0.046 | 0.176  | 1.000  |        |        |
| -0.246 | 0.017  | 0.001  | -0.163 | 0.400  | 1.000  |        |
| -0.379 | -0.041 | 0.142  | 0.147  | 0.352  | 0.327  | 1.000  |

**Table 13** NH3-N between sites related to the weekly average concentration of the Taihu Lake Analysis

| Site 1 | Site 2 | Site 3 | Site 4 | Site 5 | Site 6 | Site 7 |
|--------|--------|--------|--------|--------|--------|--------|
| 1.000  | 0.018  | 0.145  | -0.356 | 0.335  | 0.287  | 0.264  |
| 0.018  | 1.000  | 0.267  | -0.121 | 0.081  | 0.227  | 0.161  |
| 0.145  | 0.267  | 1.000  | 0.071  | 0.081  | 0.172  | 0.312  |
| -0.356 | -0.121 | 0.071  | 1.000  | 0.012  | -0.194 | -0.305 |
| 0.335  | 0.081  | 0.081  | 0.012  | 1.000  |        |        |
| 0.287  | 0.227  | 0.172  | -0.194 | 0.330  | 1.000  |        |
| 0.264  | 0.161  | 0.312  | -0.305 | 0.357  | 0.771  | 1.000  |

You can see the data from tables 10 to 13: In addition to site 6 and site 1, 2, 3, 7 correlation is smaller, the other parts of the Taihu Lake Basin DO week mean concentration is better correlation, it
shows that these stations are related to the source of the change of dissolved oxygen. About CODMn, the correlation between each sites in the Taihu Lake basin was very small, only sites 5 and sites 1, 6, and 7 were included, with low linear correlations between site 6 and site 7. About NH3-N, the correlations between each sites were uncorrelated or low linearly correlated, among them, the correlation between site 6 and site 7 was close to significance. Based on the previous analysis, it is concluded that the sources of ammonia nitrogen between site 6 and site 7 may be consistent, and bring about similar diffusion effects.

5. Conclusion
In this paper, statistical characteristics of the weekly mean concentrations of CODMn, NH3-N and DO in the seven automatic monitoring stations of Taihu Lake Basin from December 27, 2010 to December 25, 2011 (2011 cycle) were studied by statistical methods, the correlation analysis of pollutants in the seven stations was carried out, and the main conclusions were as follows:

(1) On the whole, the normal distribution is fitted well for each site water quality index concentration, that most consistent with significant relationships. Although some data can satisfy other distribution types, but from the significance difference value, they all chose the normal distribution.

(2) The correlation analysis between the water quality indexes at each site, in addition to the site 6 and site 1, 2, 3, 7, they are less correlation, several other sites in Taihu basin between the weekly average concentrations of DO have good correlation, suggesting that these stations as a result of changes in dissolved oxygen sources have certain relevance. The correlation between CODMn and the stations in Taihu basin is very small. Only between 5 and 1, 6, 7 of site 6 and site 7 are low linear correlation. About CODMn, the correlation between the stations in the Taihu Lake basin is very small. Only between 5 and 1, 6, 7, and between site 6 and site 7 is a low linear correlation. About NH3-N, the correlation between sites showed no correlation or low linear correlation, specifically, the site 7 and site 3, 4, 5, 6, site 1 and site 4, 5, site 3 and site 7, site 5 and site 6 is low linear correlation, among them, the correlation between site 6 and site 7 was close to significance. It is considered that the source of ammonia nitrogen between site 6 and site 7 may be consistent and bring about similar diffusion effects.

References

[1] Strategy research group of sustainable development of Chinese Academy of Sciences. China Sustainable Development Study I in 2007[M]. Beijing: Science Press,2012.
[2] Zhang Yunlin, Yang Longyuan, Qin Boqiang, et al. Spatial Distribution of COD and the Correlations with Other Parameters in the Northern Region of Lake Taihu [J]. Environmental Science, 2008, 29(6): 1457-1462.
[3] Yin Yan, Zhang Yunlin, Shi Zhiqiang, et al. Temporal-Spatial Variations of Chemical Oxygen Demand and Biochemical Oxygen Demand in Lake Taihu [J]. Acta Scientiae Circumstantiae, 2010, 30(12): 2544-2552.
[4] Yang Dingtian, Chen Weimin. Analysis of temporal and spatial distribution and related factors of CODMn in Meiliang Bay of Taihu lake [J]. 2007 Chinese Sustainable Development Forum Chinese Sustainable Development Symposium, 2007(4): 358-362.
[5] Xie Rongrong, Pang Yong, Xu Xintong, et al. Research on pollutant discharge tendency in Taihu Lake Basin of Jiangsu Province and determine of cutting total volume quota [J]. Water Resources Protection, 2015(6): 165-169.
[6] Gao Junfeng, Jiang Zhigang. Conservation and Development of China's Five Largest Freshwater Lakes[M]. Beijing: Science Press,2012.
[7] GB. 3838-2002, Environmental quality standard for surface water[S]. Beijing: China Environmental Science Press, 2002.