Response to Reviewer #2

Thank you very much for your approval to our manuscript and we appreciate your valuable suggestions. Those comments have been helpful in revising and improving our paper. We have carefully considered the comments and have revised the manuscript accordingly. The comments and detailed responses can be summarized as follows:

1. Comment: Page 812, line 9 "The monthly average nutrient inputs for total nitrogen (TN) and total phosphorus (TP) are 21.83 t and 0.56 t, respectively (Zhao et al., 2010). The monthly average TN and TP concentrations in the lake were respectively 5.15 mg L^{-1} and 0.54 mg L^{-1} from 2000 to 2009…" There is no reference for the source of the averaged concentrations. It should be mentioned if any field measurement has been made or otherwise some discussion on how the averaged concentrations are calculated. The monthly input mass ratio between TN and TP is close to 40. The average concentration ratio between TN and TP is close to 10. Explanation would be needed for such differences / discrepancy.

Response:

Most of the statistic data used in this study was obtained from Anxin Environmental Protection Bureau. Our group has conducted much work to investigate the polluting condition in Baiyangdian Lake (Zhao et al., 2010; Yang et al., 2012; Zhao et al., 2013). According to the research by Zhao et al. (2012), the monthly average TN and TP concentrations in Baiyangdian Lake were respectively 2.6-5.6 mg/L and 0.1-0.6 mg/L from 2000 to 2009. "The average nutrient concentrations of water samples for planting reeds were 5.15 mg/L for TN and 0.54 mg/L for TP, respectively." However, an understanding error occurred at this place. The average value in this sentence means average in space, rather than in time. These two values were obtained through field sampling and the process of field sampling has been clearly described in another paper by our group (*Ying Zhao, Zhifeng Yang, Xinghui Xia, Fei Wang. A shallow lake remediation regime with Phragmites australis: Incorporating nutrient removal and water evapotranspiration. Water Research. 46 (2012) 5635-5644.*).

Thus, this sentence in this manuscript should be revised into "*The monthly average nutrient inputs for total nitrogen (TN) and total phosphorus (TP) are 21.83 t and 0.56 t, respectively (Zhao et al., 2010). The average TN and TP concentrations of* *water sample in the lake are respectively 5.15 mg* L^{-1} *and 0.54 mg* L^{-1} *(Zhao et al., 2012)...*"

The monthly input mass ratio between TN and TP is close to 40, while the average concentration ratio between TN and TP is close to 10. This phenomenon can be explained by several possible reasons, such as the land characteristics of the region or polluting history of the lake. For example, these two average values about nutrient inputs are due to statistic data from 2000-2009, but we don't know the nutrient input condition in last century. The input mass ratio between TN and TP in last century may be lower than 10. This reason is rational to explain the current nutrient concentration ratio in the lake.

2. Comment: Page 815, line 8 / Table 1 The contribution of sediments removal of TN is close to 10 times to that of TP. "The efficiency of rhizosphere denitrification can be doubled." From Table 1, the total nutrient absorbed (aboveground and underground) for TN is roughly 10 times as of that for TP. This cannot explain the total input difference seen for TP and TN. The experiment has been mentioned within the text so there could be some more systematical comparison in between the experiment result and the simulation results. Suggesting including overall mass balance tables for both TP and TN.

Response:

The total input difference seen for TP and TN has been explained in last response. In this study, in order to investigate the amounts of nutrients removed by reeds, field simulation experiment was conducted in Baiyangdian Lake during the growing season from April to November 2010. The reed rhizomes, water, and sediment for the simulation experiment were all sampled from the lake at the beginning of April. The field sampling site was located in the north part of Baiyangdian Lake. A series of buckets (radius=0.33 m, height=0.60 m) were filled with sediments of 27±2 cm and water of 25 cm, which were in consistent with that in the water submerged reed stands of Baiyangdian Lake. Then, reed rhizomes were planted in the buckets. After reeds germinating, parts of reeds were harvested to measure the amounts of nutrients absorbed by reeds in each month. Besides reed uptake, sediment contribution also led to nutrient variation in the water body. We measured nutrient amount variation in water body and compared to the amounts of nutrients absorbed by reeds. Then the amounts of nutrients removed by sediment contribution could be obtained. A simplification was conducted at this place. We used the monthly average value in this study and did not consider the difference of sediment contribution in different months. All data about nutrient removal have been described in the new manuscript.

3. Comment: Page 816, line 18 / Table 2. The evapotranspiration for zone 2 in March, April, October and November is ignored. Explanation is expected.

Response:

Zone 2 is the zone with reeds growing. Reeds normally begin to germinate at the end of March or the beginning of April in Baiyangdian Lake(Zhao et al., 2012). It is easy to understand that we don't need to consider reed transpiration in March. In April, only reed burgeon occurs and reed leaves have not developed sufficiently, so the transpiration of reeds at this time is really weak and can be ignored.

The highest aboveground nutrient storage of reeds occurs in September, so reeds should be harvested at the end of this month to prevent them releasing nutrients to the lake. Although the transpiration of reeds in October and November may be still obvious, but all reeds have been harvested at the end of September. Thus the transpiration of reeds is not considered after September in this study.

Several sentences have been added into the new manuscript. "*Reed transpiration in March and April is negligible. In October and November it also does not need to be considered because all reeds are harvested before October.*"

4. Comment: Page 819, line 15, I noticed that only the monthly harvesting rates for the 5 growing months were selected as the input parameters for AGA, the initial reed planting area was not considered. I wonder if there is any motivation for the way the method has been used. The methodology appears good, while not all the details on Adaptive Genetic Algorithm (AGA) are clear to me. It is then suggested for more discussion on the application.

Response:

Initial reed planting area is also an important variable needing to be determined besides the monthly harvesting rates for the five growing months. The monthly harvesting rates of five months are directly obtained through AGA. We can also select reed planting area as a variable and obtain it through AGA. However, considering the actual practicality, we decided to create scenarios to determine the optimal area instead of setting it as an optimal variable.

The planting area can be optimised as a discretionary value below 197 km^2, and then managers can define the boundaries of the planting area according to the optimal results. However, defining boundaries in the actual lake environment is a complex process, which includes two main tasks. First, we need to define the boundaries on a topographic map. Then measurements need to be made to determine the actual boundaries in the lake. If the optimal area varies randomly below 197 km^2, managers need to define the boundaries accordingly every year. This work is time consuming. In this study, several scenarios for different planting areas are created. Managers can define the boundaries for each of these scenarios at once. In the following years, managers only need to choose the best scenario and do not need to redefine the boundaries. This method may reduce the accuracy of the optimal result, but it is much easier to implement in practice.

Genetic algorithm (GA) is a search heuristic that mimics the process of natural selection in the computer science field of artificial intelligence. This heuristic is routinely used to generate useful solutions to optimisation and search problems. It can generate solutions to optimisation problems using techniques inspired by natural evolution, such as inheritance, mutation, selection, and crossover. Genetic algorithms with adaptive parameters (adaptive genetic algorithm, AGA) is a significant and promising variant of genetic algorithms. The probabilities of crossover (pc) and mutation (pm) greatly determine the degree of solution accuracy and the convergence speed that genetic algorithms can obtain. Instead of using fixed values of pc and pm, AGA utilizes the population information in each generation and adaptively adjust the pc and pm in order to maintain the population diversity as well as to sustain the convergence capacity. AGA has been widely used in various fields, including environment science area (Kaini et al., 2012; Yin et al., 2012; 2014). In this study, the fitness of AGA is to make the total gap index of one year as small as possible. There are five optimisation variables, which are the reed harvest ratios from May to September. The planting area can be determined through comparing these scenarios. After modelling all scenarios, we can determine the best reed planting area and harvest scheme, under which the most satisfactory water quality will be attained in Baiyangdian Lake.

One sentence has been added to introduce AGA in the new manuscript. "*AGA is one kind of global optimisation algorithm, which is widely used in various scientific computing fields. It can generate solutions to optimisation problems using techniques inspired by natural evolution, such as inheritance, mutation, selection, and crossover*."

5. Comment: Page 820, line 22 / Table 4 The gap index appears to be monthly averaged value throughout the year. Clarification is needed if this is the case.

Response:

The gap index at this place is truly the monthly average value throughout the year. We call it total gap index because it is the sum of monthly average values for TN and TP. In the method part, we have clearly defined the total gap index in the new manuscript. The specific sentence is showed as below.

The objective of the model is: $\min \overline{\delta} = \min(\overline{\delta}_{TN} + \overline{\delta}_{TP})$

where $\overline{\delta}$ *is the total gap index used to show the water quality for a year,* $\overline{\delta}_{TN}$ *and* $\overline{\delta}_{TP}$ *are the monthly average gap indexes for TN and TP, respectively.*

6. Comment: Fig.1 / Page 821, line 16 The curve for the "current area" appears to be field measurements. The starting point of the curve then should correspond to a specific TP or TN concentration measured in 2010. This presumably should be different from the 2002-2009 averaged values. It has been mentioned in the text some extrapolation has been done. Explanation / clarification would be expected.

Response:

As mentioned in the manuscript, the result of the figure is extrapolated based on the nutrient balance and water quantity balance investigated in this study. The curve for the "current area" is also extrapolated, rather than due to field measurements. During the calculating process of the curve for the "current area", the plant growing area is set as the current area in the lake, and then the water quality is calculated based on the nutrient balance and water balance equations. In order to better comparing the influence of reed area on water quality, the initial nutrient concentrations are the same as the concentrations used in the model. Thus, the starting points of these two curves are the same in the Figure 1.

In the new manuscript, one sentence has been replaced by new one. "*Both these two curves in the figure are extrapolated based on the nutrient balance and water quantity balance investigated in this study*."