# Approaches by the Ibaraki Prefectural Government to Improve Water Quality in Lake Kasumigaura with Forest and Lake Environment Conservation Tax

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**Keywords**: Local government, Local tax, Lake Kasumigaura, Grant, Ibaraki prefectural government

## 1. Introduction

Lake Kasumigaura (the general term for Lake Nishiura, Lake Kitaura, and Hitachitone River), the second largest lake in Japan, is located in the southern part of Ibaraki Prefecture in the eastern part of Japan, facing the Pacific Ocean（Fig.1). The lake is relatively shallow, with an average depth of four meters. About one million people live in the lake basin, and lake water is used as tap water, industrial water, and agricultural water. There is also a thriving fishing industry on the lake. Water pollution of Lake Kasumigaura increased from the 1960s owing to economic development and a rise in population. This has had a detrimental effect on irrigation and environmental conservation. Consequently, in 1982, an ordinance was passed for the prevention of eutrophication of Lake Kasumigaura, and a master plan for the prevention of eutrophication of lake waters was agreed. Ibaraki Prefectural Government is striving to reduce the environmental load on the lake and is implementing measures against pollution based on the 1987 plan for conservation of lake-water quality. However, the water quality of Kasumigaura has not improved since the 2000s, with a chemical oxygen demand (COD) of 7–9 mg・$L^{-1}$ (environmental standard 3 mg・$L^{-1}$). To address this, Ibaraki Prefectural Government introduced the forest and lake environment conservation tax in 2008 and has promoted environmental conservation of the lake and responsible forestry management in the Kasumigaura basin. As of 2013, the environmental conservation tax for lakes and forests has been introduced in 33 prefectures, the first being Kochi Prefecture in 2003. About this time, I reported on the water quality of Kasumigaura in recent years and the measures against pollution of the lake taken using the forest and lake environment conservation tax.


**Fig.1 Location of Lake Kasumigaura**

**2. Description of the forest and lake environment conservation tax**

The taxable period of the forest and lake environment conservation tax in Ibaraki Prefecture is ten years (2008–2017). The tax rates for one year are 1,000 yen for an individual with an address in Ibaraki Prefecture, and 10% of an equally divided prefectural corporation tax for corporations with an office in Ibaraki Prefecture. The income from tax revenues for one year is about 1,600 million yen. Half the total tax revenues are used for forest conservation, and the remaining half are used for measures against water pollution of Lake Kasumigaura.

**3. Measures against water quality purification of Lake Kasumigaura**

The measures against water quality purification of Lake Kasumigaura that were implemented from 2008 to 2012 are summarized in Table 1.

**3.1. Measures concerning household effluents, etc. (point source)**

The connecting of agricultural communities to proper sewerage and drainage facilities was strongly encouraged. Installation of combined-type septic tanks was facilitated to reduce the load on Lake Kasumigaura from household effluents. On-site inspection of factories was performed to check drainage, and help was given for the installation of plant for composting livestock excrement.

**3.2. Measures concerning agricultural drainage (non-point source)**

Paddy fields are widely distributed along Lake Kasumigaura. Agricultural drainage-water flows directly into the lake through bank-based water canals. To ameliorate this, a circulating irrigation system that controls the load on Kasumigaura by returning irrigation water to the paddy fields was established.

**3.3. Facilitation of water conservation activities by citizens of Ibaraki Prefecture**

To facilitate the improvement of water quality by local citizens, equipment for environmental studies and activities, etc., was lent out at no charge. Civic organizations were helped

**Table 1 The state of implementation of the measure concerning water pollution granted with Forest and Lake Environment Conservation Tax (H20-24)**

| 1. Measures concerning household effluents etc (point source) | | |
|---|---|---|
| Financial assistance for installation of Combined-type septic tank | 6,089 | Cases |
| Financial assistance for connection of a sewer | 4,814 | Cases |
| Financial assistance for connection of drainage facilities for agricultural communities | 959 | Cases |
| On-site inspection in factorys | 2,785 | Places |
| Financial assistance for installation of plant for composting livestock excrement | 52 | Places |

| 2. Measures concerning agricultural drainage (non point source) | | |
|---|---|---|
| Financial assistance for installation of plant for curculating irrigation institution | 43 | Places |

| 3. Facilitation of water preservation activities by participating in citizen of Ibaraki prefecture | | |
|---|---|---|
| Financial assistance for lending for nothing of activity equipment and activity of civic organization | 84 | Groups |
| The tour for experiencing examination of water in a ship on the Lake kasumigaura | 38,166 | People |
| Assist for conservation activity of reed field | 6 | Groups |

financially in undertaking environmental activities. Given the importance of education about water environment conservation, ship tours of the lake demonstrating about water quality were organized for schoolchildren, junior high school students, and adults. Because of the importance of shoreline vegetation to breeding fish, measures to conserve the lake's reed beds were also implemented.

### 3.4. Conservation of waterside environment (lake and river)

Eutrophication and algal blooming are major problems for Lake Kasumigaura. Ibaraki Kasumigaura Environmental Science Center researched phytoplankton multiplication and the dynamic state of nitrogen, phosphorus, and organic matter in the lake and its associated rivers. It attempted to control algal blooming by installing ozonation and supersonic treatment equipment in the areas where blooms tend to occur. Patrols checking for algal blooming and sample collection were also carried out.

## 4. Water quality in Lake Kasumigaura

Change in long-term water quality of Lake Kasumigaura is shown in Fig.2. When the forest and lake environment conservation tax was introduced in 2008, annual average COD was 8.8 mg・$L^{-1}$. By 2012, it was 7.8 mg・$L^{-1}$. Annual average of T-N (total nitrogen) was 1.3 mg・$L^{-1}$ in 2008 and 1.0 mg・$L^{-1}$ in 2012; annual average of T-P (total phosphorus) was 0.12 mg・$L^{-1}$ in 2008 and 0.084 mg・$L^{-1}$ in 2012. As can be seen, water quality in recent years has tended to improve. However, T-N and T-P concentrations are still high (environmental water quality standard of T-N is 0.4 mg・$L^{-1}$ and that of T-P is 0.03 mg・$L^{-1}$). Therefore, phytoplankton levels may increase, and water quality may continue to worsen.

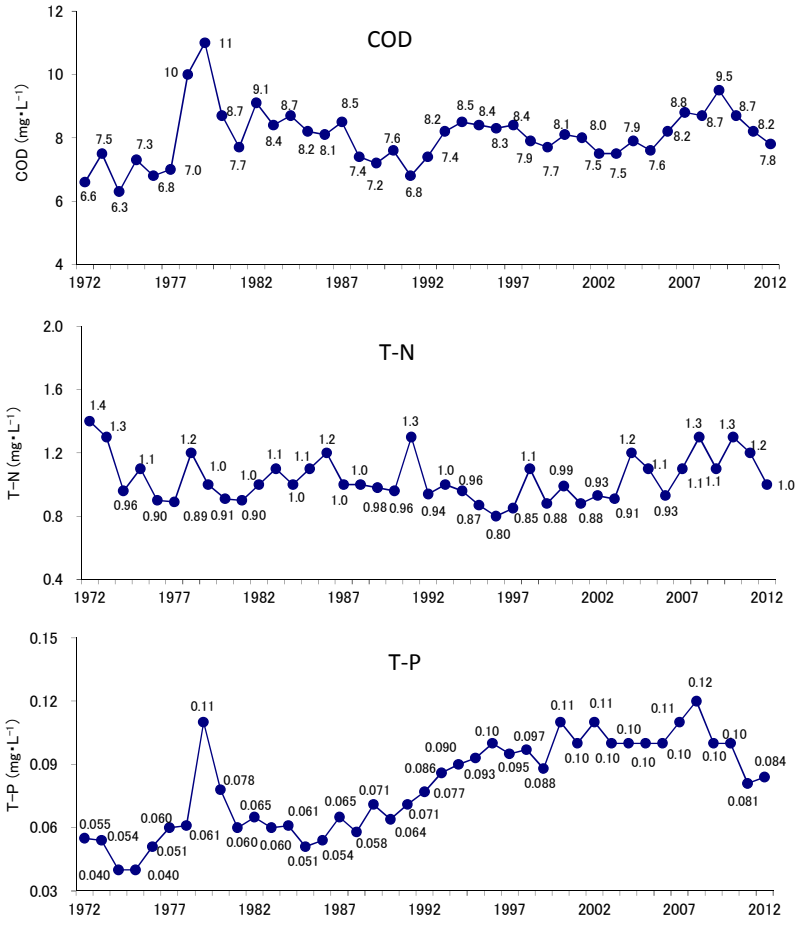


**Fig.2 Changes in Water Quality of Lake Kasumigaura**

## 5. Conclusion

Although water quality of Lake Kasumigaura has tended to improve in recent years, it is still not meeting environmental water quality standards. Continued efforts are still required to improve water quality and implement further measures against water pollution.