

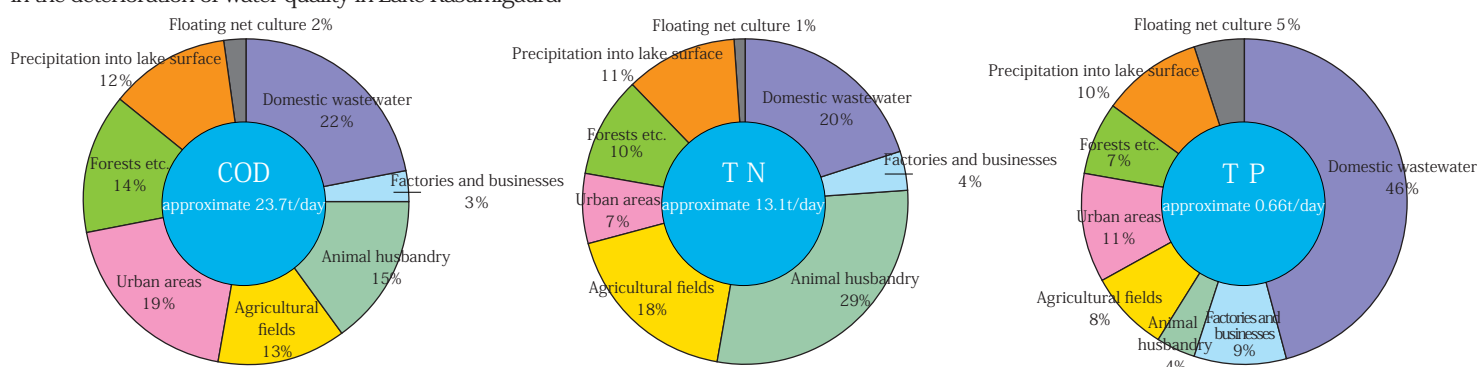
# Countermeasures for water-quality preservation of Lake Kasumigaura

## 1 Causes of water quality deterioration in Lake Kasumigaura

Water quality deterioration factors in Lake Kasumigaura can be classified into two main categories. The first is the external input of organic matter, N and P. Domestic wastewater, industrial effluents, animal husbandry (e.g., cattle, swine) and run-off from agricultural fields and urban areas in the basin are potential sources of pollutant loads into inflowing rivers. Natural loads from forests and precipitation (into the lake surface), as well as from carp farming, should be also considered.

The other category is the release of N and P from the bottom sediment of the lake. Phytoplankton grows actively in the lake using the N and P from the aforementioned sources as nutrients. Massive growth of phytoplankton can cause an increase in COD, decrease in transparency, and odor (due to the decay of dead phytoplankton) in lake water.

In summary, riverine loads of pollutants and release of N and P from bottom sediment, as well as massive growth of phytoplankton in lake, result in the deterioration of water quality in Lake Kasumigaura.



Pollutant loads from each source to Lake Kasumigaura (FY2015)

## 2 Ibaraki Prefectural Ordinance for Water-Quality Preservation in Lake Kasumigaura

In Lake Kasumigaura, the deterioration of water quality due to eutrophication has been exacerbated by population growth and the progress of socioeconomic activities in the basin. In 1978 and 1979, the degradation of water quality was especially severe, which motivated the implementation of some countermeasures.

In order to prevent the eutrophication of Lake Kasumigaura and to promote environmental preservation, Ibaraki Prefecture established the Ordinance to Prevent Eutrophication of Lake Kasumigaura in December 1981; it was executed in September 1982. This ordinance implemented the regulation of N and P in industrial effluents, prohibition of household synthetic detergents containing P, and countermeasures for agriculture, animal husbandry and carp farming. To involve every citizen in the basin in water quality preservation in all the aspects of daily life, the Ordinance to Prevent Eutrophication of Lake Kasumigaura was revised in March 2007 and renewed as the Ibaraki Prefectural Ordinance for Water Quality Preservation of Lake Kasumigaura, which was executed in October 2007.

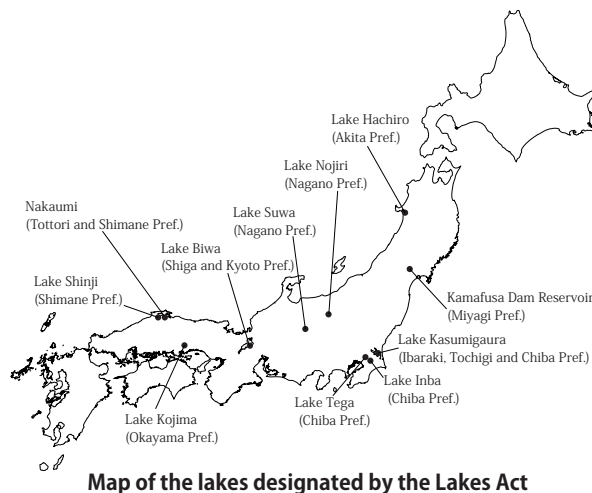
## 3 Plan for Conservation of Lake Water Quality

### (1) Special Measure Act for the Preservation of Lake Water Quality

The Japanese government established the Special Measure Act for the Preservation of Lake Water Quality (Lakes Act) in July 1984, and it was executed in March 1985. This Act contains special measures (e.g., installation of sewer systems, countermeasures for agriculture) for preserving the water quality of lakes that have suffered from various types of environmental problems due to eutrophication. The Lakes Act designates the lakes as having a special need for general and systematic countermeasures for water-quality preservation. The Plan for Conservation of Lake Water Quality is to be formulated for these lakes, and includes the installation of sewer systems and countermeasures for industrial effluents and pollutant loads from non-point sources.

## (2) Plan for Conservation of Water Quality in Lake Kasumigaura

Lake Kasumigaura was specified for protection by the Lakes Act in December 1985. In March 1987, Ibaraki Prefecture, in cooperation with Tochigi and Chiba Prefectures that form a part of the lake basin, formulated the 1st Plan for Conservation of Water Quality in Lake Kasumigaura (FY1986-FY1990). Currently, general countermeasures for improving water quality are implemented under the 7th Plan (FY2016-FY2020).



Map of the lakes designated by the Lakes Act

In this iteration the following were set as long-term goals; "Lake Kasumigaura where we can swim" and "Rivers where we can play". To achieve them, the plan calls for improvements in water quality to be undertaken in stages.

Causes for water-quality deterioration in Lake Kasumigaura vary among regions. Therefore, different measurement goals have been established for Lake Nishiura (including the Wani River) and Lake Kitaura, and various kinds of countermeasures for water-quality improvement have been undertaken depending on the pollution sources.

## 4 Countermeasures for water quality improvement

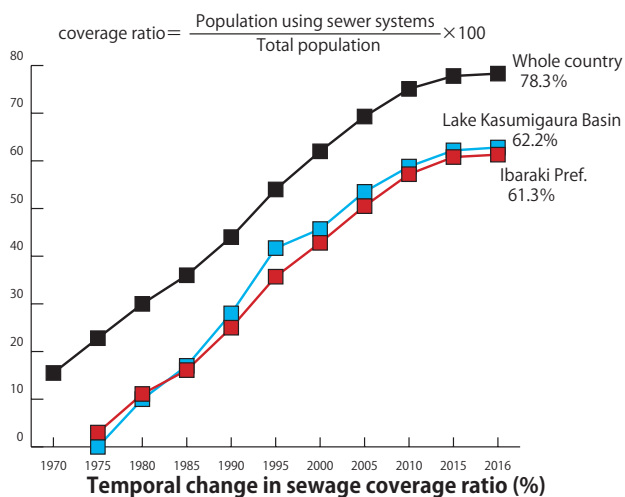
### (1) Countermeasures for domestic wastewater

Domestic wastewater is directly discharged into rivers and canals unless it is treated in sewer systems, and can therefore be a significant cause of water-quality deterioration in lakes and rivers. Connecting to sewer systems or farm village wastewater treatment facilities, as well as installing advanced septic tanks able to treat human excrement and household wastewater simultaneously while removing N and P, is thus of particular importance. In addition, it is also important for residents to take actions such as not disposing kitchen wastes and used cooking oils into the sink, conserving water, and using detergent properly.

#### A. Development of sewer systems

In order to secure a comfortable living environment, Ibaraki Prefecture and municipalities in the Lake Kasumigaura Basin have advanced the development of sewer systems. In the Lake Kasumigaura Basin, four regional sewer systems (the Kasumigaura-Jonan, Kasumigaura-Kohoku, Kasumigaura-Suigo and Kokaigawa-Tobu [Kokai River East]) have been developed. In addition, municipalities are developing basin-wide public sewer systems, stand-alone public sewer systems, or public sewer systems for a specific environment depending on the regional characteristics. In 2015, sewage population coverage in the Lake Kasumigaura Basin was about 600 thousand, for a ratio of about 62.2%.

Furthermore, the terminal wastewater treatment plants operate advanced treatment facilities for N and P. They also conduct studies on more stable and efficient treatment methods.



Ibaraki Prefectural Kasumigaura Wastewater Treatment Plant (appearance)

## B. Installation of farm village wastewater treatment facilities

In 2015, about 64 citizens in the Lake Kasumigaura Basin used the farm village wastewater treatment facilities. All the facilities that discharge treated wastewater into Lake Kasumigaura (total of 62) employ advanced treatment systems for N and P.



Namegata City Tamatsukuri North Regional Wastewater Treatment Plant (appearance)



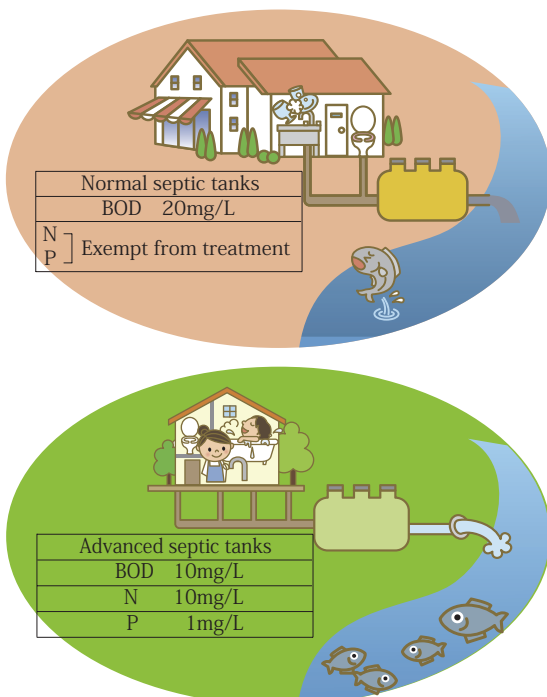
Namegata City Tamatsukuri North Regional Wastewater Treatment Plant (interior)

## C. Promoting the dissemination of advanced septic tanks

In regions where sewer systems or farm village wastewater treatment facilities have not been developed, septic tanks are to be installed in order to enable flush toilets. Normal septic tanks treat human excrement and household wastewater simultaneously to remove organic pollutants. In the Lake Kasumigaura Basin, however, advanced septic tanks must be installed to remove N and P that can cause eutrophication.

To promote the installation of advanced septic tanks, in FY1999 Ibaraki Prefecture established an institution to support citizens in the Lake Kasumigaura Basin who wished to install advanced septic tanks. Furthermore, such installation has been compulsory since October 2007 under the Ibaraki Prefectural Ordinance for Water Quality Preservation of Lake Kasumigaura. Accordingly, Ibaraki Prefecture began a project to offset the personal expense for such installations so that advanced septic tanks are comparable in price to normal systems. The Environmental Tax for Forest and Lake Conservation, adopted in FY2008, was utilized for this project. Since FY2014, rebates have been increased to promote the upgrade from single treatment-type septic tanks. The capability of a high-performance septic tank cannot be fully exercised unless it is properly maintained. Periodic inspection and cleaning of the septic tank are necessary, as are annual performance tests.

Ibaraki Prefecture also encourages the installation of “municipal” septic tanks that are installed and managed by municipalities to reduce personal expenses.



Comparison between normal and advanced septic tanks



advanced septic tanks

## (2) Countermeasures for industrial effluents

### A. Effluent regulation

In addition to the effluent regulations enacted under the Water Pollution Control Law, strict effluent standards are applied to wastewater from factories and businesses based on the Ibaraki Prefectural Ordinance for the Preservation of the Living Environment and the Ordinance for Water Quality Preservation of Lake Kasumigaura.

These ordinances also regulate effluent-discharging facilities that are not regulated by law.

### B. Administrative guidance

The factories and businesses to which the effluent standards are applied are supervised as to whether they comply with the standards by on-the-spot inspections. Remedial guidance is given to facilities that violate the standards. The Ibaraki Prefectural Ordinance for Water Quality Preservation of Lake Kasumigaura sets the wastewater standards for the factories and businesses not ruled by the effluent standards.

To help these factories and businesses comply with the standards, guidance is provided for the installation and maintenance of wastewater treatment facilities.

### C. Thoroughness of self-management and support for installation of wastewater treatment facilities

To reduce the environmental loads due to the activities of factories and businesses, Ibaraki Prefecture promotes voluntary environmental actions (such as environmental management and audit) by enterprises.

In addition, Ibaraki Prefecture has established an institution to manage the finances and interest subsidies for the installation of wastewater treatment facilities.



On-the-spot inspection in factories and businesses



Effluent treatment facility

## (3) Countermeasures in agriculture

The Ordinance for Water Quality Preservation of Lake Kasumigaura prescribes the proper management of fertilizers and irrigation water. Regional Agricultural Development and Extension Centers, in cooperation with municipalities and local farming communities, promote dissemination of environmentally friendly agriculture with reduced chemical fertilizer application. In lakeshore paddy fields, circular irrigation is promoted; i.e., the reuse of agricultural drainage as irrigation water to reduce environmental load.

### A. Rice paddy fields

- Improvement of fertilizer application methods, including the introduction of rice-planting machines capable of applying fertilizers simultaneously
- Optimization of fertilizer application rates
- Promotion of proper use of controlled availability fertilizers
- Prevention of discharge of surface run-off from paddy fields by halting continuous irrigation and drainage and protecting the ridges between paddy fields

### B. Dry fields

- Reduction of fertilizer application rates by employing controlled availability fertilizers and fertilization machines in rows
- Optimization of fertilization methods

### C. Lotus paddy fields

- Promotion of proper use of controlled availability fertilizers



Fertilizer drill rice planter



Proper management of livestock barns

#### (4) Countermeasures in animal husbandry

Ibaraki Prefecture has established a Plan for Promoting Utilization of Livestock Manure under the Act on the Appropriate Treatment and Promotion of Utilization of Livestock Manure. The plan promotes and supports the installation and management of livestock excrement treatment facilities. The Ibaraki Prefectural Ordinance for Water Quality Preservation of Lake Kasumigaura also prescribes the application of livestock manure to agricultural fields after fermentation.

In addition, extensive distribution of livestock manure, as well as its use for purposes other than agriculture, is promoted.

##### A. Proper management of livestock barns

Ibaraki Prefecture supports the installation of livestock excrement treatment facilities and offers guidance for proper barn management practices, such as improvement of structures and sanitation management.

##### B. Extensive distribution of livestock manure

By utilizing “manure coordinators”, Ibaraki Prefecture promotes the distribution of manure produced by animal farmers to regions outside of the Lake Kasumigaura Basin.

##### C. Utilization of livestock manure for purposes other than agriculture

Ibaraki Prefecture promotes utilization of livestock excrements as a fuel for farm boilers.



**Catching unutilized fish**



**Wetland constructed at the mouth of the Kawajiri River**

#### (5) Countermeasures for fisheries and fish net culture

##### A. Promotion of water-quality improvement by fish catch

Catching unutilized and alien fish that have taken up N and P from the lake water has been conducted to remove these nutrients from the lake. Fishery management can help remove N and P from the lake efficiently through fish catch. Therefore, Ibaraki Prefecture supports efforts on resource-control in fisheries, which secure the sustainable and stable catch of valuable fish such as pond smelt.

##### B. Promotion of proper management and efficiency of fish net culture

Efforts toward environmentally friendly aquaculture are encouraged, such as compliance with the standards on feeding, and proper treatment of dead fish, as well as comprehensive use of improved feed. In addition, Ibaraki Prefecture advances studies on the improvement of carp production efficiency to reduce pollution loads from aquaculture.



**Water purification facility at Tsuchiura Port**

#### (6) Countermeasures for water quality improvement in inflowing rivers

##### A. Countermeasures for water quality improvement in rivers

The Ministry of Land, Infrastructure, Transport and Tourism constructs vegetation-based purification facilities (wetlands) at the mouths of inflowing rivers to reduce pollutant loads at the beginning of rain events, and to recreate vegetation zones along the lake shore. In these facilities, the status of sediment deposition is continuously monitored.

Ibaraki Prefecture also advances nature-oriented river improvements that consider the habitat and growing environment of animals and plants, as well as the landscape.

##### B. Countermeasures for water quality improvement in Tsuchiura Port

To improve the quality of lake water, a facility that removes P from water using magnetic force was installed at Tsuchiura Port in FY2013. Since then, the effect of this facility on suppression of algal blooms has been monitored.



**Facility for suppression of algal blooms**

## C. Countermeasures for algal blooms in Lake Kasumigaura (Nishiura) and Kitaura

Massive algal blooms can occur in summer if water quality and climatic conditions are suitable for phytoplankton growth. During the period from June to October, the Japanese Government, Ibaraki Prefecture, and municipalities make a cooperative effort to decrease odor due to the decay of massive algal biomass. These efforts include the forecast and patrol of algal blooms, installation of fences at the river mouths to prevent algal biomass from entering the rivers, prevention of accumulation of algal biomass using boat screws, and removal of algal biomass using dedicated boats and hand skimmers.

In the Shin River in Tsuchiura City, a facility was installed for the suppression of algal blooms using a type of adsorbent, and it operates during the summer (July - September) to prevent the accumulation and decay of algal biomass from the lake.

### (7) Conservation of the natural environment around Lake Kasumigaura, including green areas

#### A. Conservation, maintenance, and creation of forest

Forests provide public benefits by, for example, keeping water resources in the watershed of the lake. In order to prevent deforestation and decrement, the Ibaraki Prefectural administration promotes the conservation and maintenance of forests. In addition, the prefectural government promotes awareness of the multiple functions of forests (i.e., contribute to the conservation of the living environment and purification of river and lake water) in residents and municipal governments, as well as the necessity of forest conservation and maintenance.

#### B. Conservation and restoration of the lake ecosystem

The Ibaraki Prefectural Government manages to catch alien fish such as Channel catfish that impact indigenous fish, including by inhibiting their proliferation. In addition, the government attempts to conserve and restore ecosystems with the aim of abundant biodiversity, developing vegetation zones, and maintaining or increasing fishery resources like Pond smelt.

### (8) Raising public awareness of water quality improvements

It is essential that residents understand and cooperate in the goal of lake water purification. The Ibaraki Prefectural Government promotes activities with municipalities and residents including citizen groups.

#### A. Special month dedicated to water purification in Lake Kasumigaura

The Ibaraki Prefectural Government, together with related organizations, designated the time from July 21 (Marine Day) to Sept 1 (Kasumigaura Day) as the special month for water purification in Lake Kasumigaura, and it holds various awareness-raising events.

- Summer festival in Kasumigaura Environmental Science Center
- Poster contest eligible to schoolchildren focused on Kasumigaura water quality
- Street campaign for water purification of the lake on Kasumigaura Day, Sept 1

#### B. Mizube-Fureai Project for interaction with the lake

Projects for which residents are eligible include various activities that allow them to interact with plants and other creatures on the lakeshore to promote environmental consciousness.

#### C. Promoting water-quality purification projects

There are 56 rivers inflowing into Lake Kasumigaura, and 0.96 million residents live in the basin. It is important that residents cooperate with water-quality purification activities from the upper to lower stream area. Therefore, a new framework for a water quality purification movement has been promoted, including simultaneous water quality monitoring in the inflowing rivers, and exploration by schoolchildren in the watershed.



**Summer festival in the Kasumigaura Environmental Science Center**



**Project for interaction with the lake**



**Water-quality monitoring in all inflowing rivers**



**Exploring the river project**

- Water-quality monitoring in all inflowing rivers

Water-quality monitoring activities are performed at the inflowing rivers with the participation of school children and residents to promote awareness of water purification and improvement of the water environment.

- Exploring the river project

Exploration from the upper to the lower streams of inflowing rivers allows participants including residents and schoolchildren, to learn about the nature, history and culture of the lake, to enjoy new discoveries, and communicate with each other. Residents are eager to connect such activities to raising consciousness regarding the water environment, and to creating attractive regions. At present, there are five organized councils for exploring rivers consisting of residents, citizen associations or groups, and administration officials.



#### D. The Lake Kasumigaura and Lake Kitaura Region Clean-up Grand Operation

Since 1984, a clean-up project has been performed twice a year (August, March) with residents participating at the lakeside and inflowing rivers throughout the basin. In particular, residents of 21 municipalities in the watershed take part in this activity on the first holiday of March, designated as Kasumigaura Clean-up Day.

fiscal year	August		March		Total	
	Collected Amount of Waste (t)	Number of Participants (People)	Collected Amount of Waste (t)	Number of Participants (People)	Collected Amount of Waste (t)	Number of Participants (People)
2012	30.9	24,552	139.9	90,207	170.8	114,759
2013	26.2	24,758	105.6	83,362	131.8	108,120
2014	27.3	32,535	121.9	86,624	149.2	119,159
2015	24.9	31,509	117.6	89,305	142.5	120,814
2016	23.1	31,349	142.4	88,081	165.5	119,430

**The Lake Kasumigaura and Lake Kitaura Region Clean-up Grand Operation**  
Number of Participants    Collected Amount of Waste



**2016 Base district (Tsuchiura City)**

#### E. Others

- Activity of the Council for Promotion of Household Wastewater Purification

The Council for Promotion of Household Wastewater Purification, established in each of the 21 municipalities in the watershed, is promoting education and raising awareness of household wastewater through clean-up projects for waste oil and kitchen wastewater.

- Publication of information bulletin

Several kinds of brochures and flyers, such as “For Clean Water”, and “10 Articles for the Purification Measures of Lake Kasumigaura”, are published and distributed to residents in order to raise their awareness and promote purification activities and measures.



**Activity of the Council for Promotion of Household Wastewater Purification**

#### (9) Kasumigaura Environmental Science Center

The Kasumigaura Environmental Science Center was founded in 2005, after a group advocated for its establishment at the 6th World Lake Conference held in 1995 in Tsukuba and Tsuchiura. This center aims to effectively perform its four functions: (1) research and technical development; (2) environmental education; (3) cooperation with and support for citizen activities; and (4) information exchange. These functions are performed through partnership with citizens, researchers, businesses, and government bodies, and tackle issues related to the conservation of the water environment of lakes and rivers, as well as air quality in Ibaraki Prefecture.

This center is expected to accomplish effective research on water-quality improvement, including how best to encourage and support the environmental education of people and schoolchildren, stimulate citizen activities, and offer useful information to the people about the lake.



**Kasumigaura Environmental Science Center**

# The four functions of the Kasumigaura Environmental Science Center

## 1 Research and Technical Development

Conduct studies and pursue technical developments for the conservation of lakes and rivers including Lake Kasumigaura, and air quality in Ibaraki Prefecture

- Provide suggestions for environmental policies based on research achievements
- Hold open seminar and presentations on research results to share environmental information with researchers and citizens

## 2 Environmental education

Provision of opportunities and locations for environmental learning through practical experience to study, think and act

- Facilities for environmental education

Exhibition Room: A comprehensive look at Ibaraki's lakes and rivers

Teaching Laboratory: Experiments and workshops

Outdoor Plaza: Observation of living creatures and ecosystems in the natural environment

- Environmental education programs

- (1) Instruction by lecturers and tutors
- (2) Learning in school classrooms
- (3) Workshops on practical learning

## 3 Cooperation and support for citizens' activities

Provision of space for environmental activities and support through the creation of a network with professionals and agencies

- Provision of a salon for citizen activities involving environmental conservation and exchange of information
- Direct participation of volunteer partners in the operation of the center through assisting environmental education and working as staff at conservation events
- Loaning equipment for environmental conservation activities and education
- Provision of financial support to citizens' groups involved in conservation activities

## 4 Information Exchange

Collecting and sharing information about Lake Kasumigaura

- Providing information through the website, e-mail magazine, and SNS
- Provision of a reference library to lend related materials
- Hosting exchange events and symposiums for citizens, researchers, businesses and government officers



**Research and Technical Development**



**Environmental Education**



**Loaning equipment  
(environmental conservation activities)**



**Reference Library**



## (10) World Lake Conference

### A. The 6th World Lake Conference

The 6th World Lake Conference, held in Ibaraki, Kasumigaura in October 1995 to find out the latest know-how for lake conservation and management, gathered wisdom from around the world towards solving various problems such as the eutrophication of lakes.

Through discussions at this conference, the current situation and challenges of world lakes were clarified. We also realized the importance of people collaborating on lake conservation and the necessity of international cooperation. On the final day, we presented the “Kasumigaura Declaration”, a guiding principle for the 21st century, to the world.

- Dates: October 23–27, 1995
- Venues: Tsuchiura City and Tsukuba City
- Theme: Harmonizing Human Life with Lakes—Towards the Sustainable Use of Lakes and Reservoirs
- Participants: 8,203 (421 from other countries), a total of ~12,000 persons from 75 countries, 1 area and 4 international organizations
- Presenters: 459

### B. The 17th World Lake Conference

The 17th World Lake Conference (Ibaraki Kasumigaura 2018) will be held in Ibaraki Prefecture after 23 years.

Information sharing and opinion exchange around what measures are still needed to sustainably utilize ecosystem services will be held among people involved in lakes, including residents, those engaged in agriculture, forestry, and fisheries, businesses, research, and government

- Dates: Monday, October 15 to Friday, October 19, 2018
- Main Venue: Tsukuba City (Tsukuba International Congress Center)
- Satellite Venue: Footholds in Tsuchiura City, Kasumigaura City, Hokota City, Ibaraki Town and Mito City
- Theme: Harmonious Coexistence of Humans and Lakes—Towards Sustainable Ecosystem Services
- Participants: ~4,000 currently enrolled (citizens, researchers, businesses and administrators)

### C. Citizen Participation

Citizens and researchers performing activities geared toward and studies about the conservation of Lake Kasumigaura from Ibaraki Prefecture have participated in every conference to present their results orally or with posters and exchanged information and opinions with foreign participants (i.e., researchers and NGO members).

### D. Ibaraki Kasumigaura Prize

Ibaraki Prefecture has awarded the “Ibaraki Kasumigaura Prize” to researchers and participants from developing countries to support their study and participation in the conference since the 7th World Lake Conference (excluding the 9th Conference held in Shiga Prefecture, Japan)



The 6th World Lake Conference Opening Ceremony



Before 100 days Campaign Activities towards The 6th World Lake Conference



The 17th World Lake Conference (Ibaraki Kasumigaura 2018) Pre-conference