Long-term Changes of Nutrients in River Water flowing into Osaka Bay, Japan

Department of Environmental Engineering,
Osaka Institute of Technology, Japan

Yukio Komai

Kazuo Muramatsu

Graduate School of Agriculture, Kyoto University, Japan

Tateki Fujiwara

Background of this study

- The amounts of load of nutrients that flow into the Seto Inland Sea have been calculated by using an unit load of point and nonpoint sources compiled by the Ministry of Environment, Japan.

- As these unit loads on pollutant sources are values gained by limited researches, there is large difference between the unit and actual loads. Therefore, the pollutant loads calculated by using the unit load will include a large error as a result.

- In addition, any changes of chemical forms in nutrients are not able to evaluate by this method.

Objectives

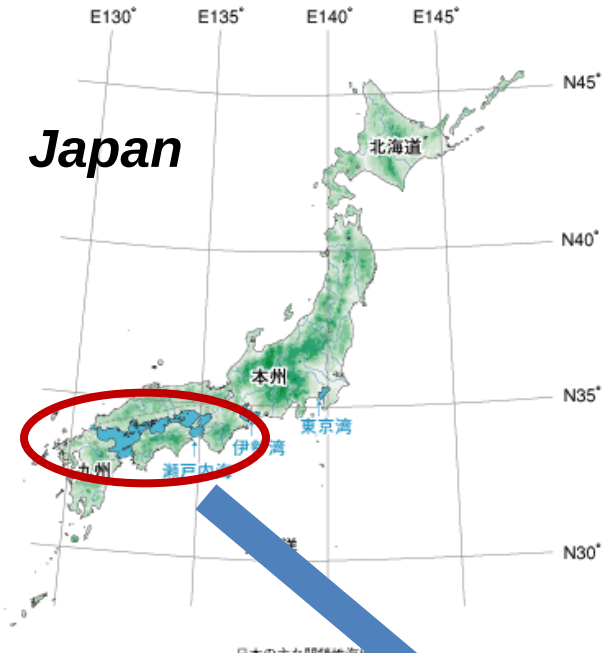
- To study the concentrations and forms of nitrogen and phosphorus in river water flowing into Osaka Bay since 1970's
- To study the changes of loads and forms of nutrient based on actual measurement
- To evaluate whether the loads of nitrogen and phosphorus from watershed surrounding Osaka Bay have been successfully cut by a total amount control or not

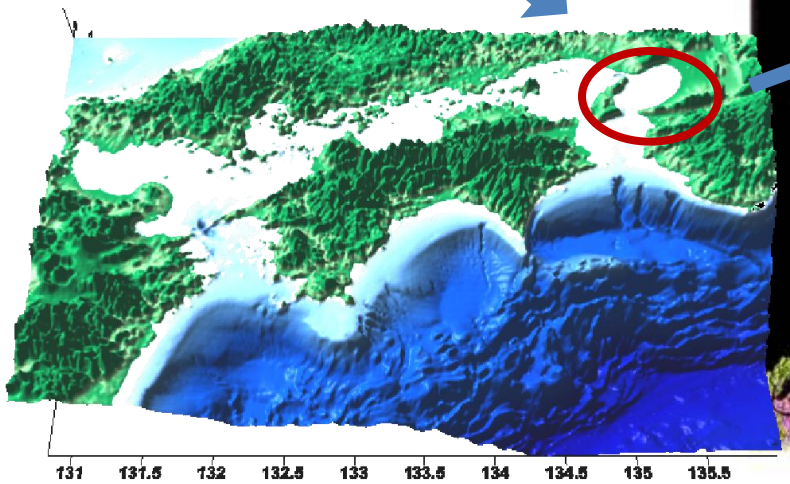
Method

- Monitoring data of a set of nitrogen and phosphorus were used, which has been collected by Hyogo and Osaka Prefecture since 1970's.

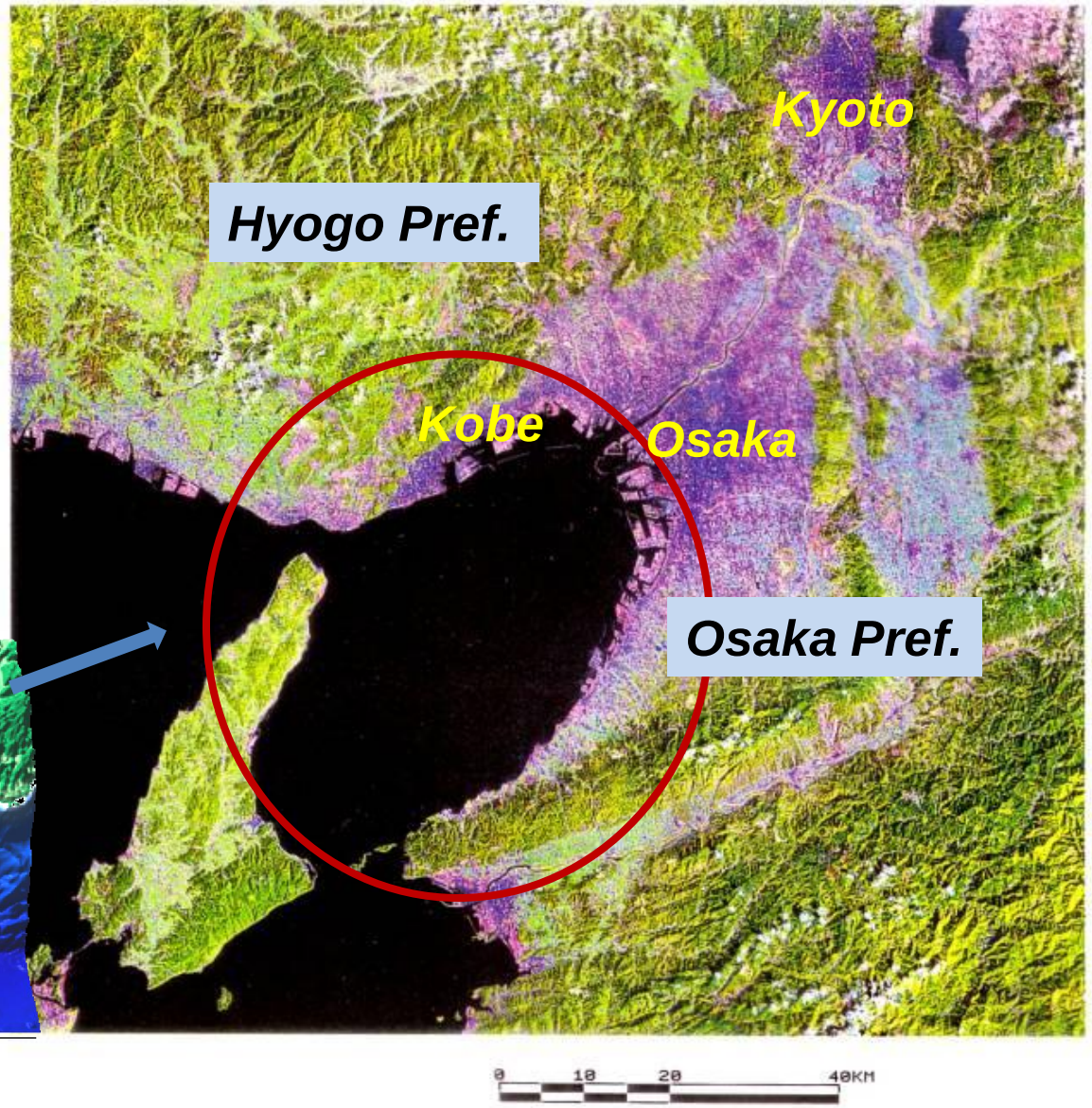
- The annual average concentrations of nutrients were calculated for thirty three rivers, which consisted of the first and the second class rivers.

Location of Osaka Bay





The Seto Inland Sea

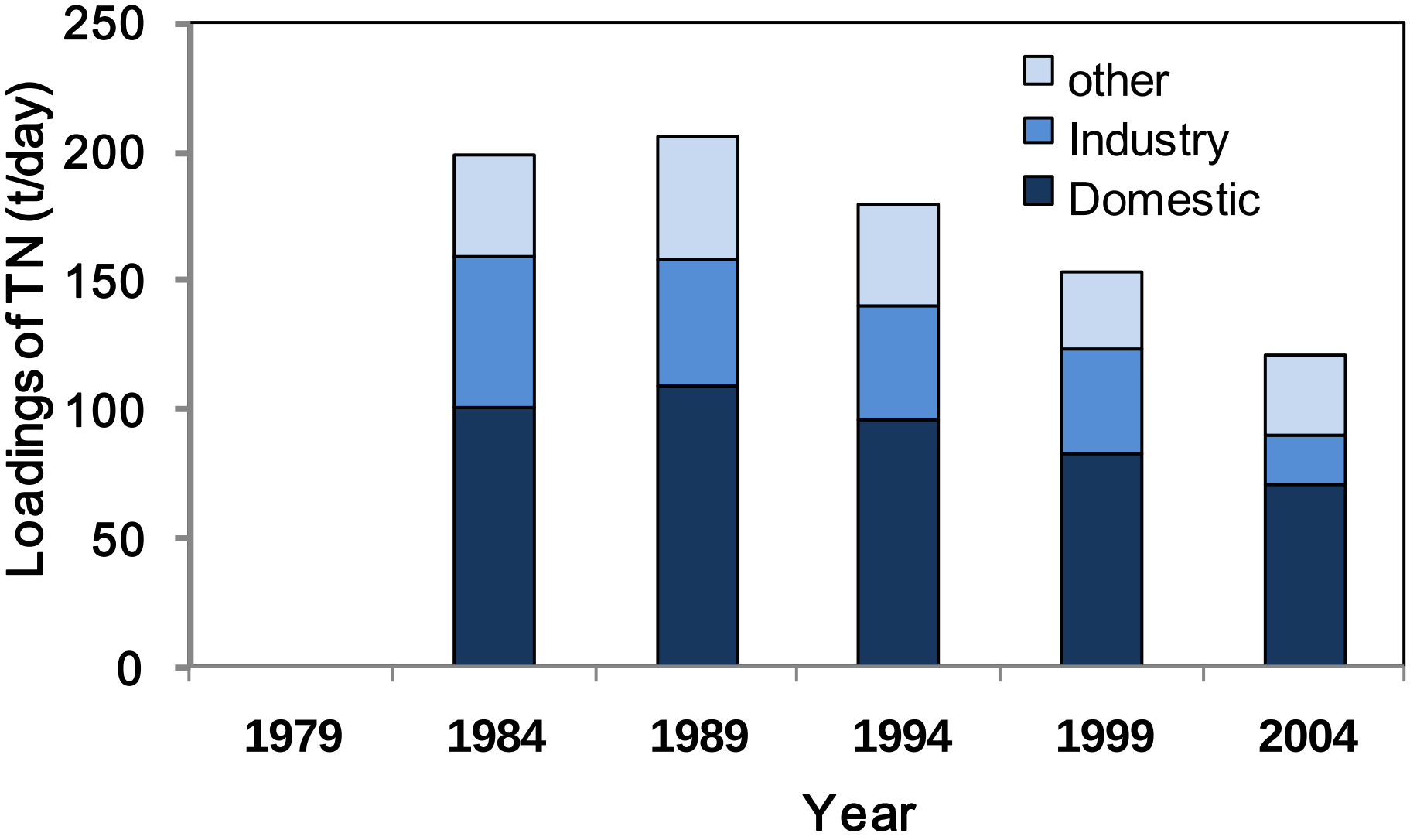


Osaka Bay

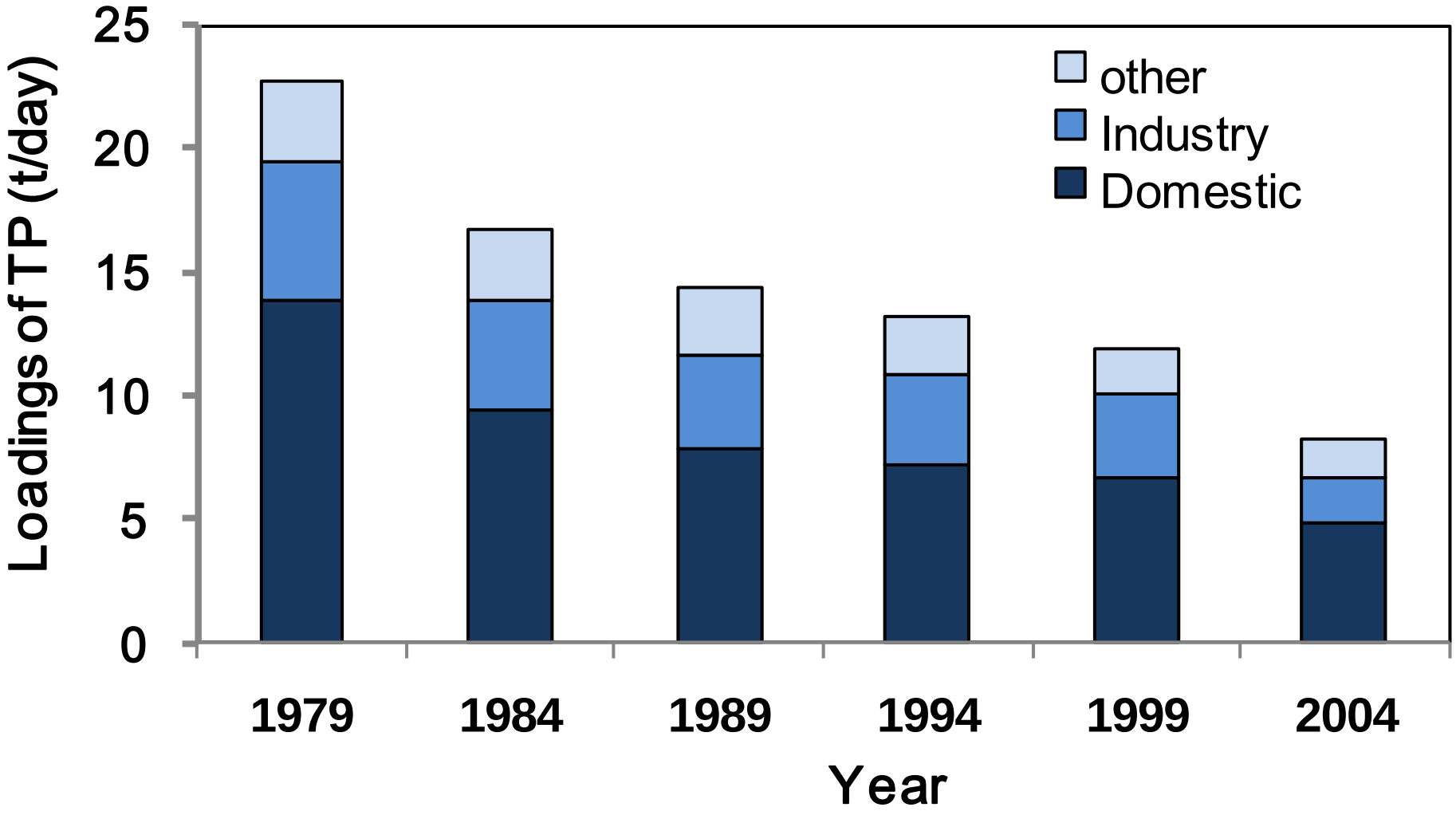
Osaka Bay Watershed

- **Catchment area : 11,000km^2**
- **Population : 17,000,000**

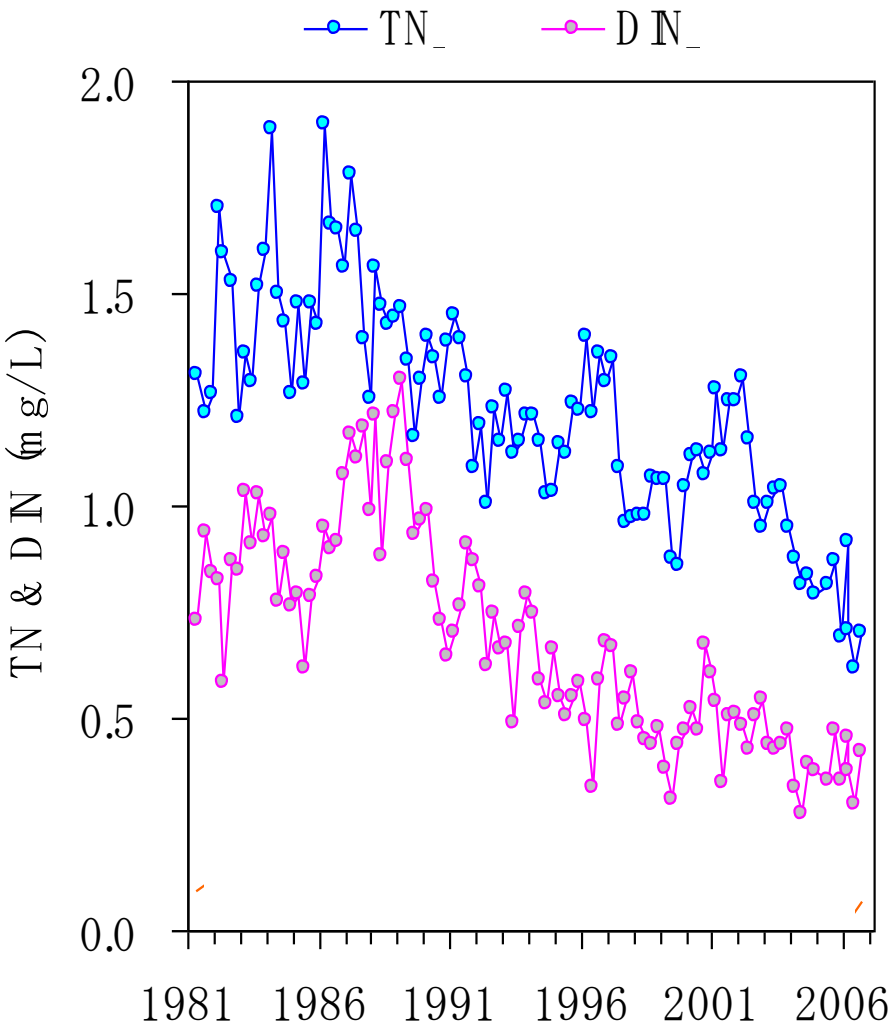
Changes of loads of total nitrogen (TN) in Osaka Bay watershed

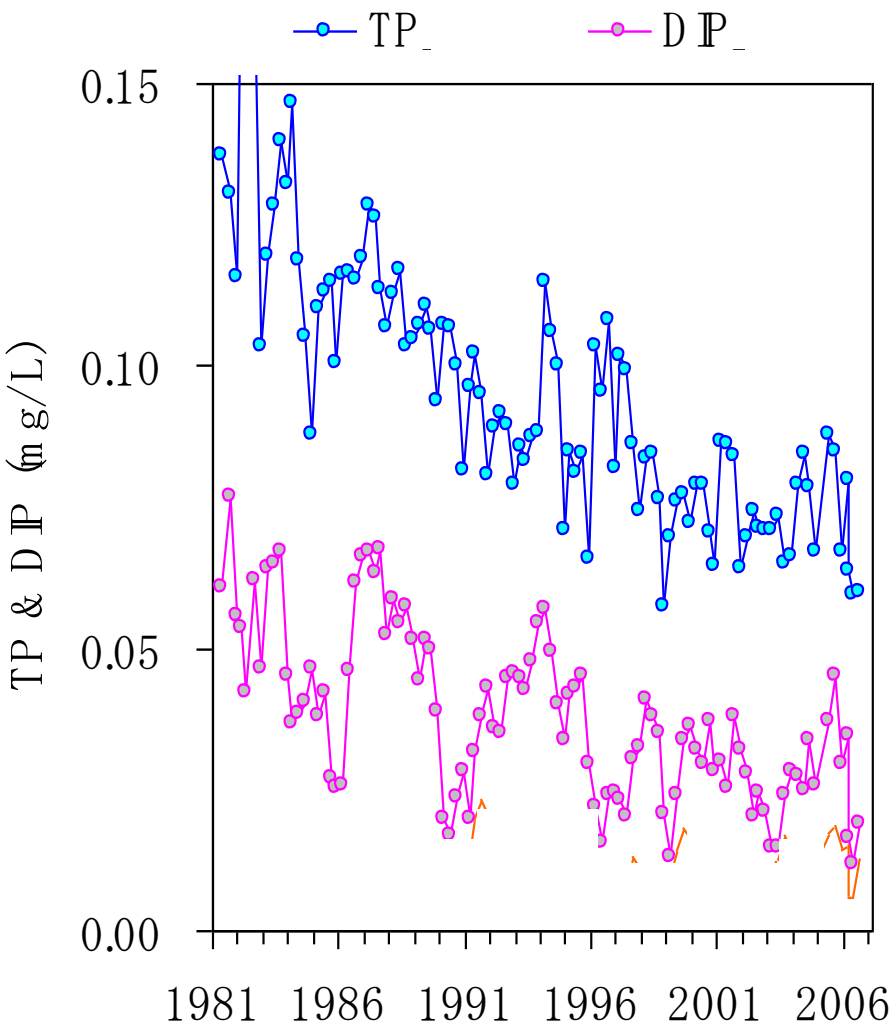


Changes of loads of total phosphorus(TP) in Osaka Bay watershed



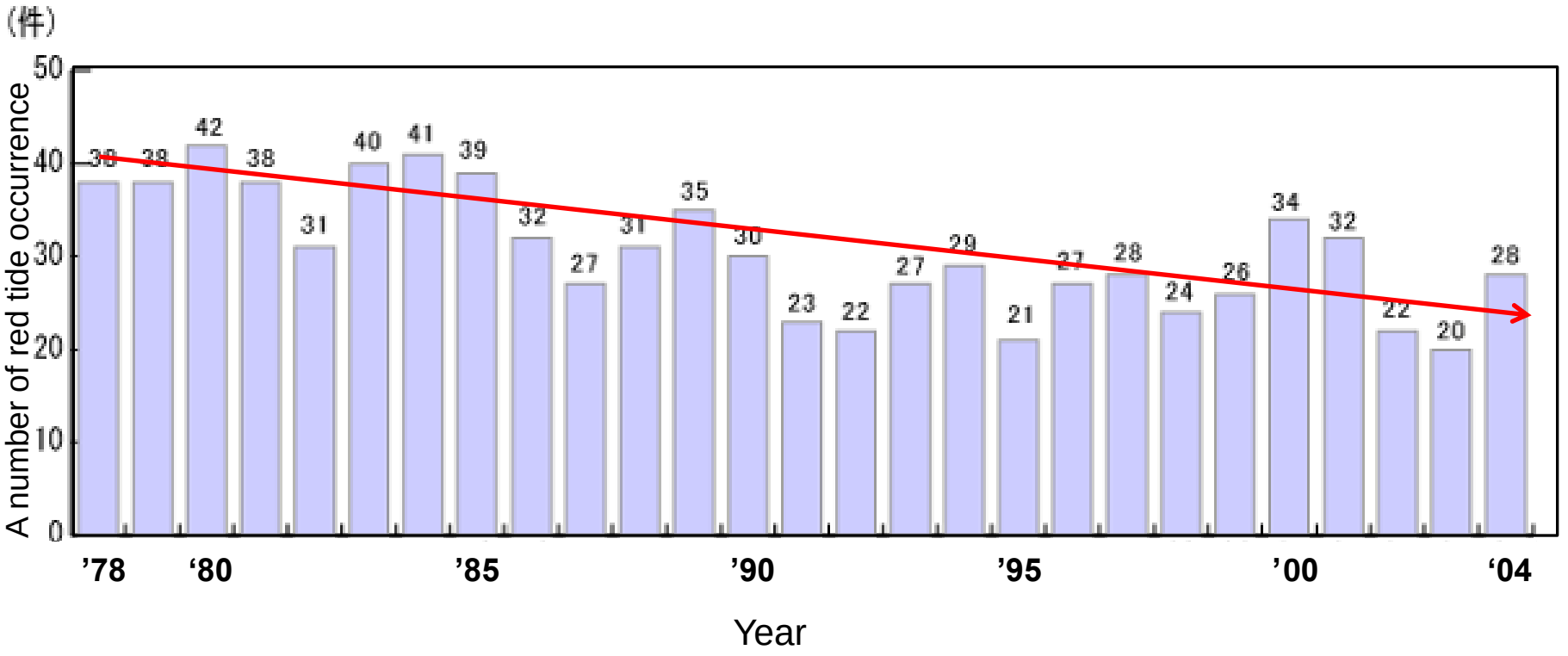
Changes of TN and TP concentrations in Osaka Bay



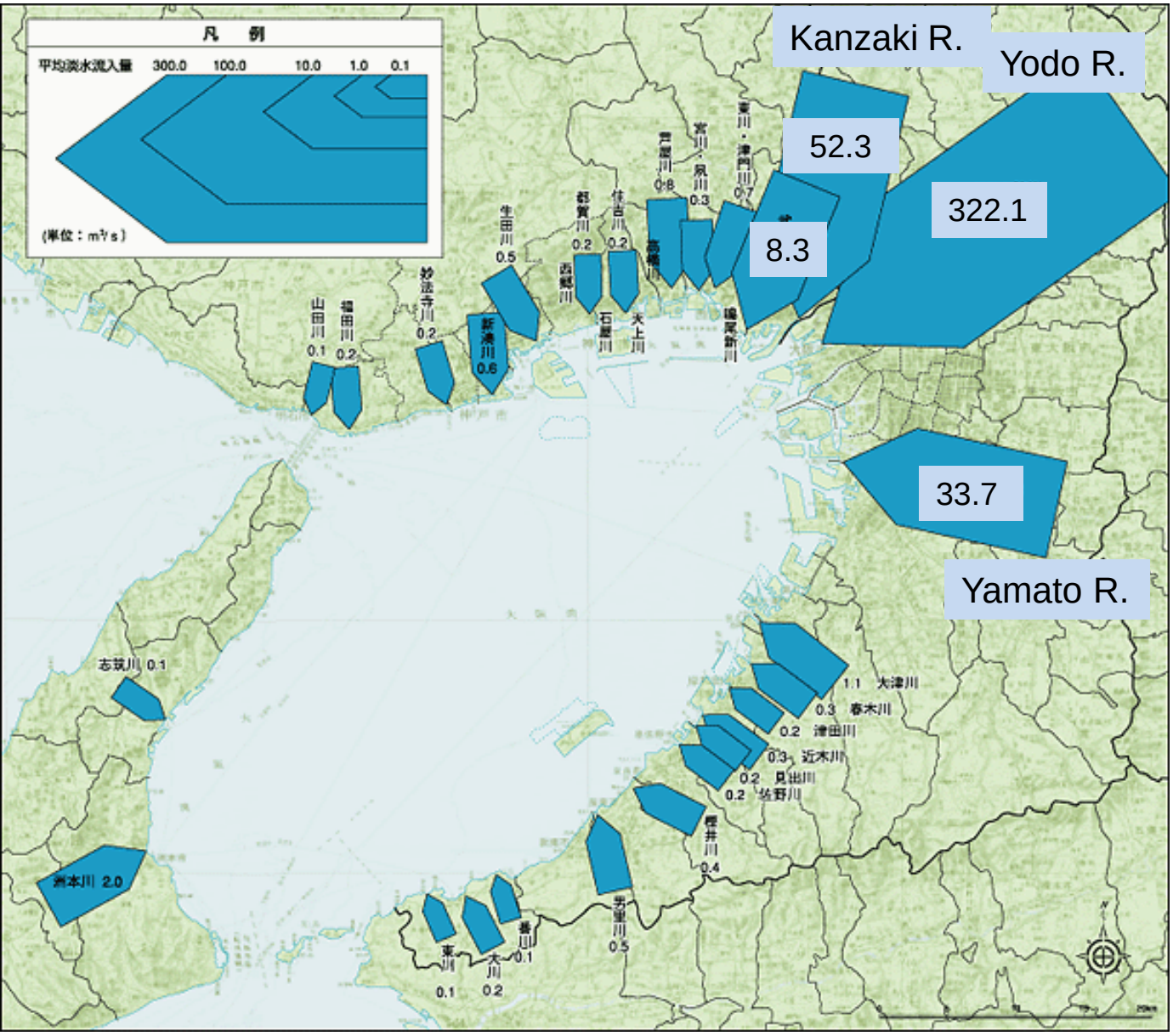


By Fujiwara

Changes of a number of red tide occurrence in Osaka Bay



Flow rate of the first and the second class rivers flowing in Osaka Bay



●First-class River

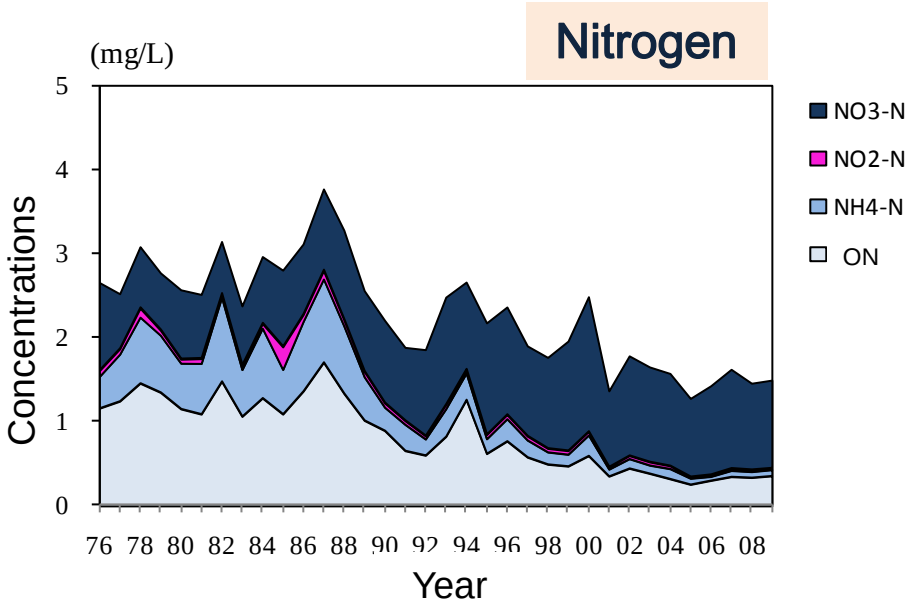
Yodo River, Yamato River, Ina-Kanzaki River

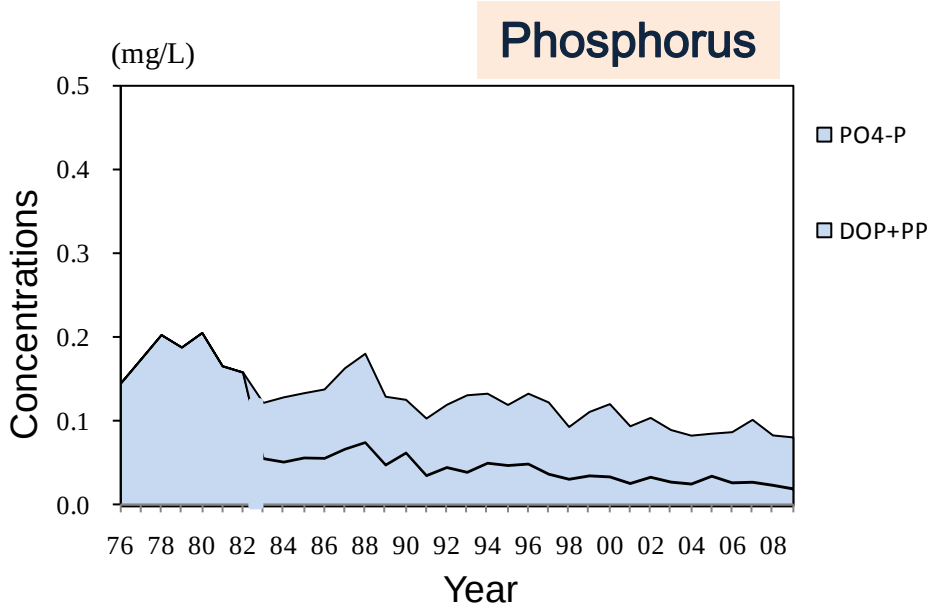
●Second-class River

- 17 rivers in Osaka Prefecture
- 79 rivers in Hyogo Prefecture
- 22 rivers in Awaji Island

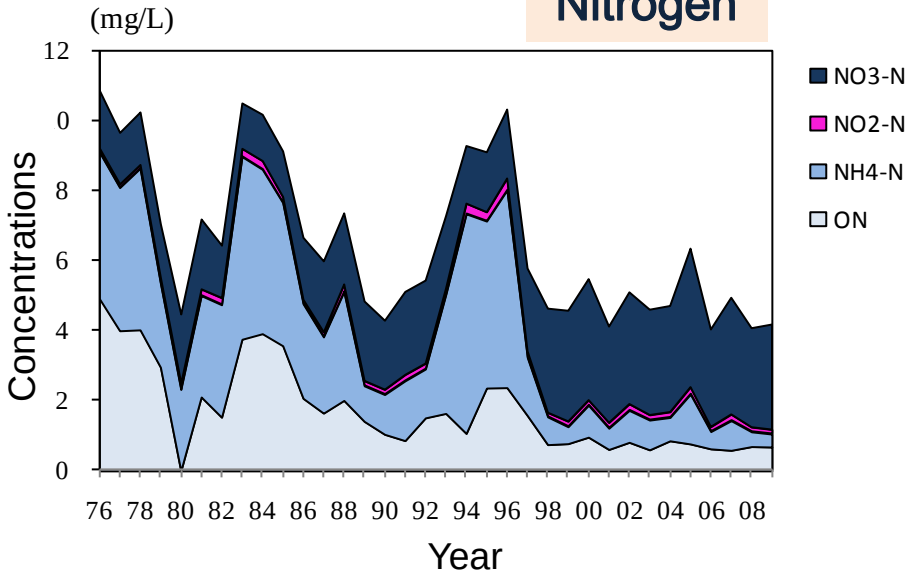
The Ministry of Land and Transportation, Japan

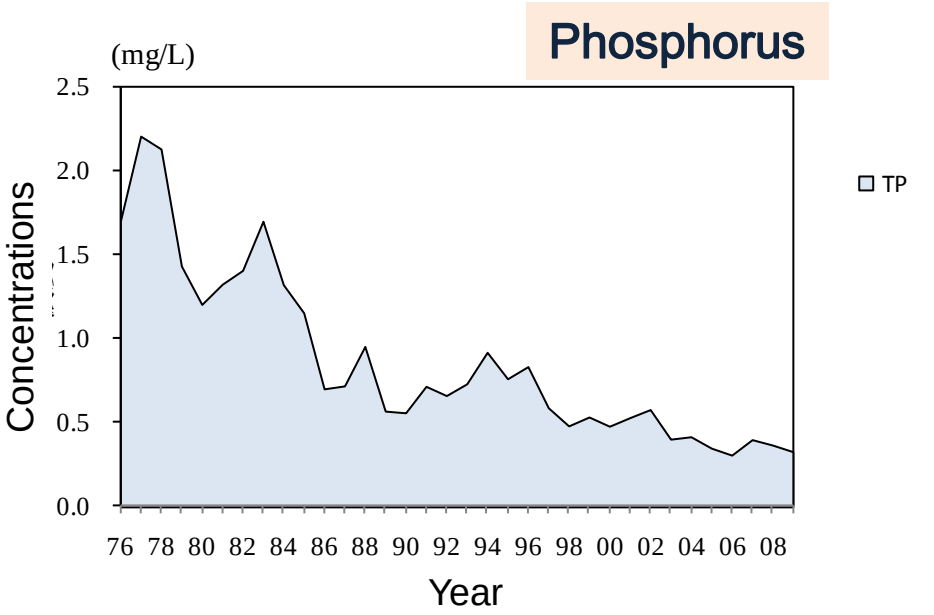
Downstream site in Yodo R.





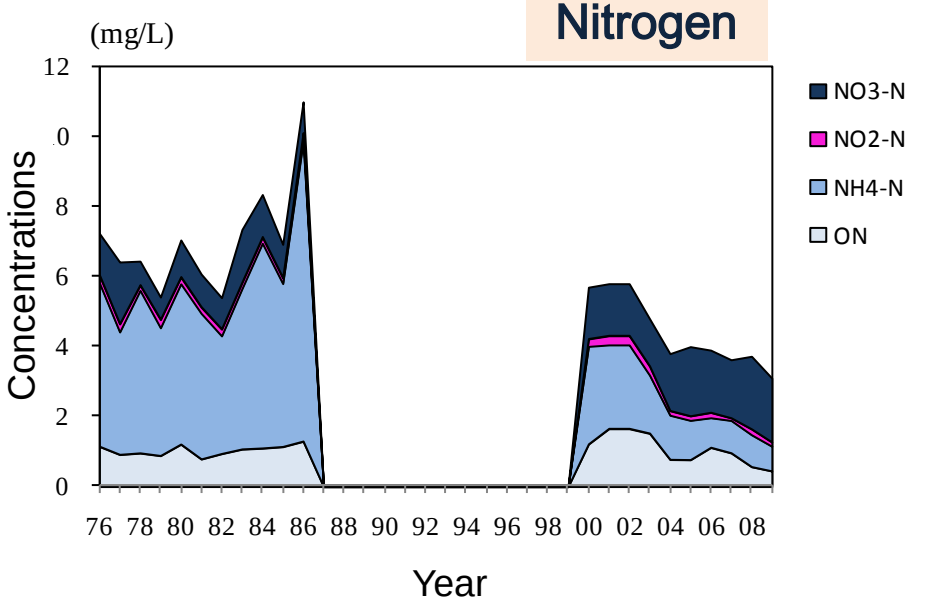
Downstream site in Yamato R.



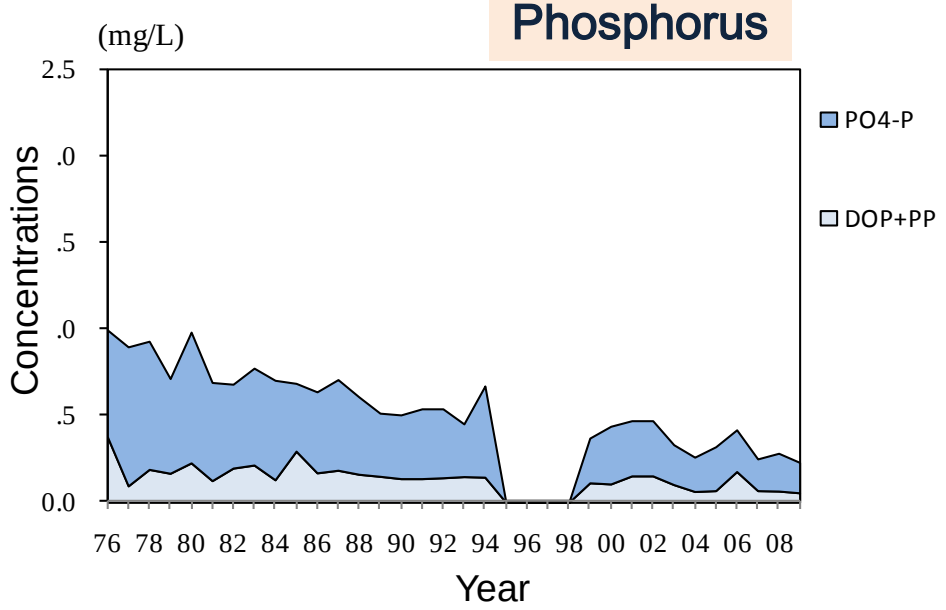


Downstream site in Kanzaki R.

Nitrogen

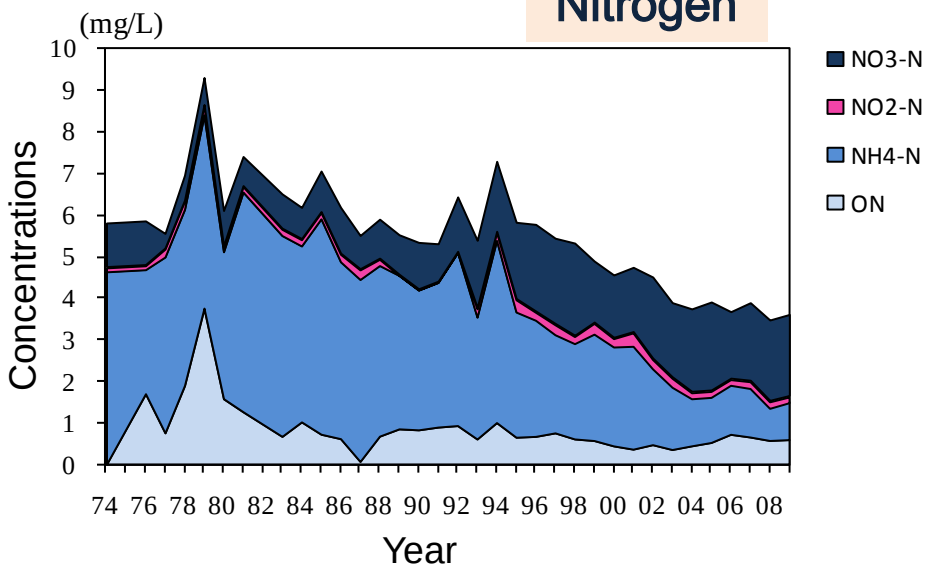


Phosphorus



Downstream site in Kanzaki R.

Nitrogen



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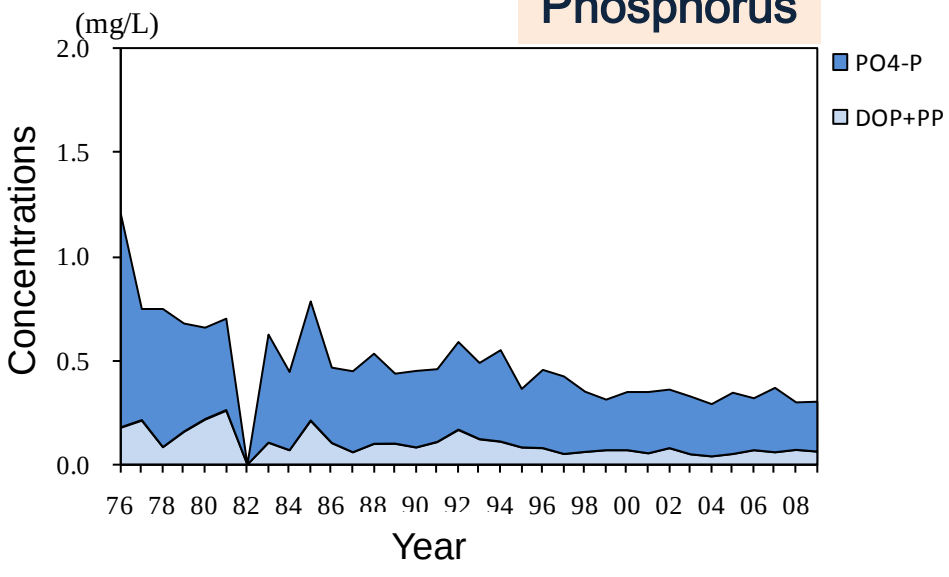
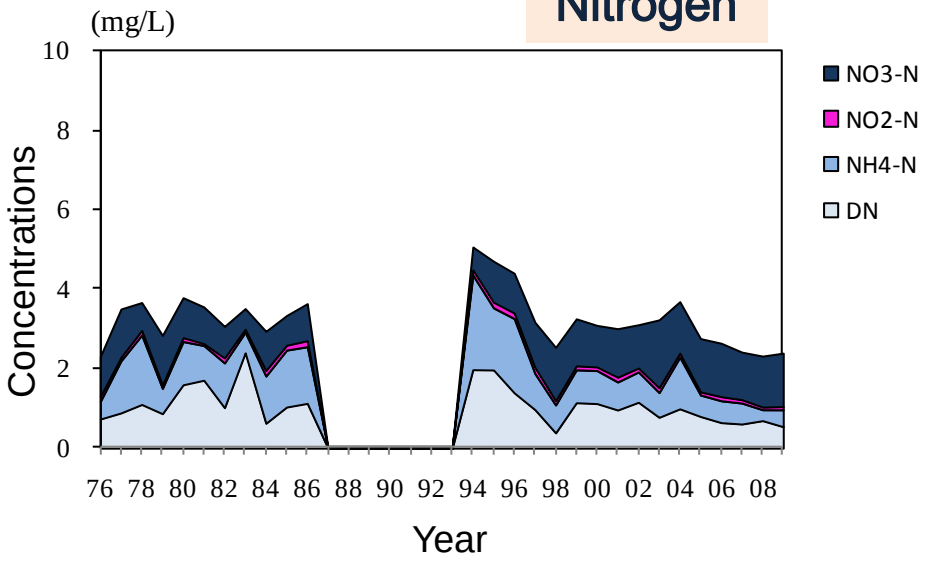
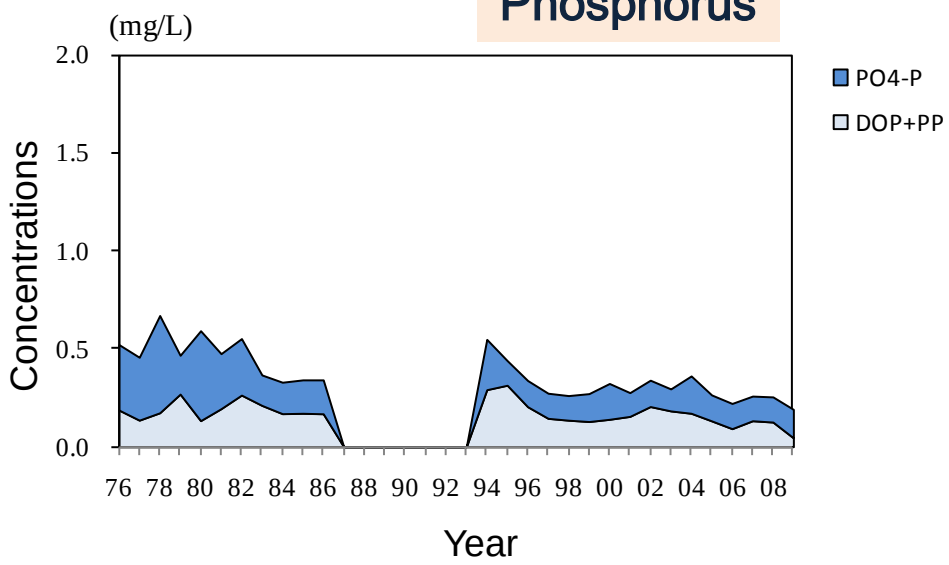


Downstream site in Kinki R.

Nitrogen

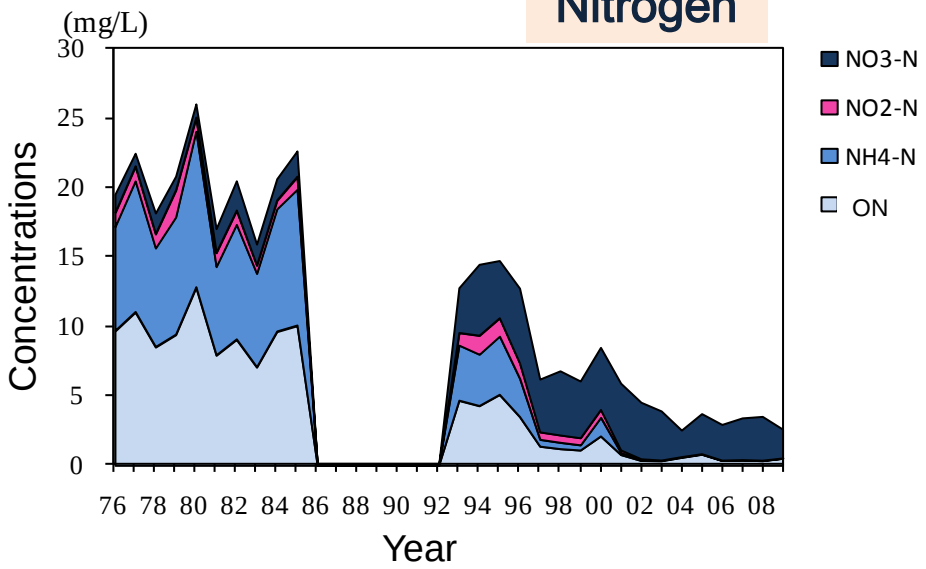


Phosphorus

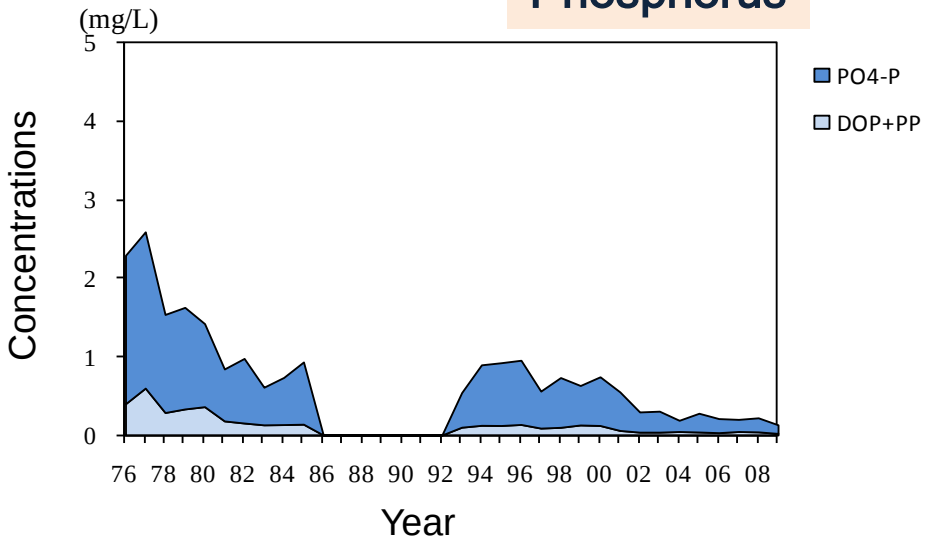


Downstream site in Shinminato R.

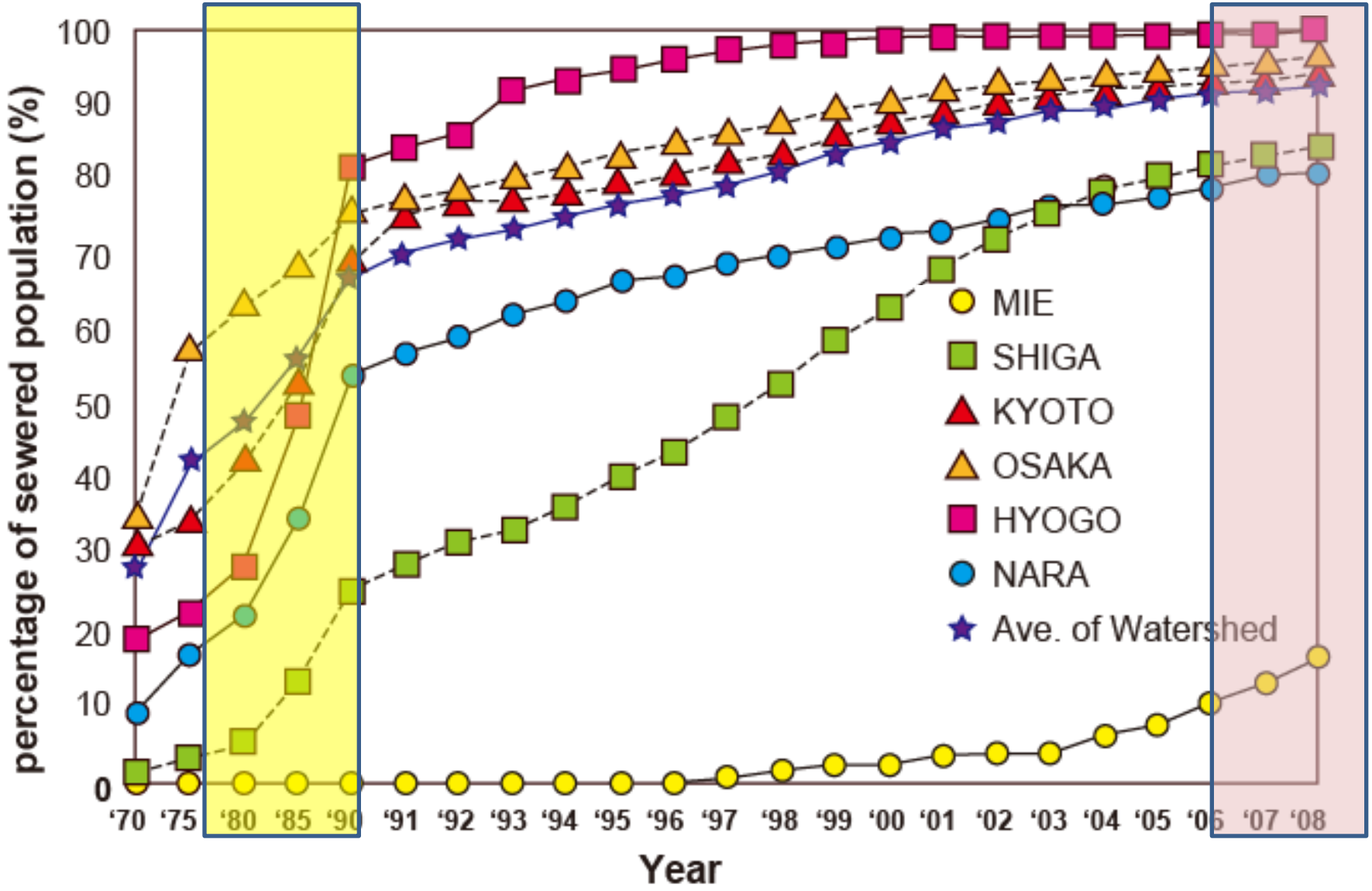
Nitrogen



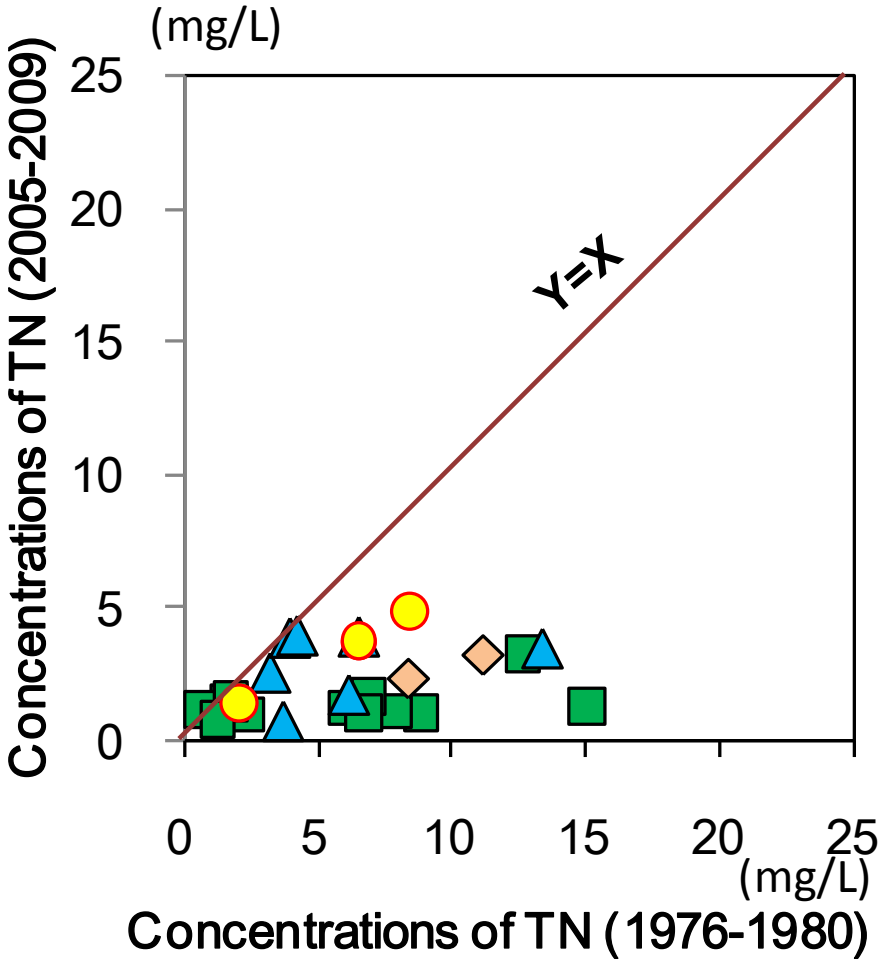
Phosphorus

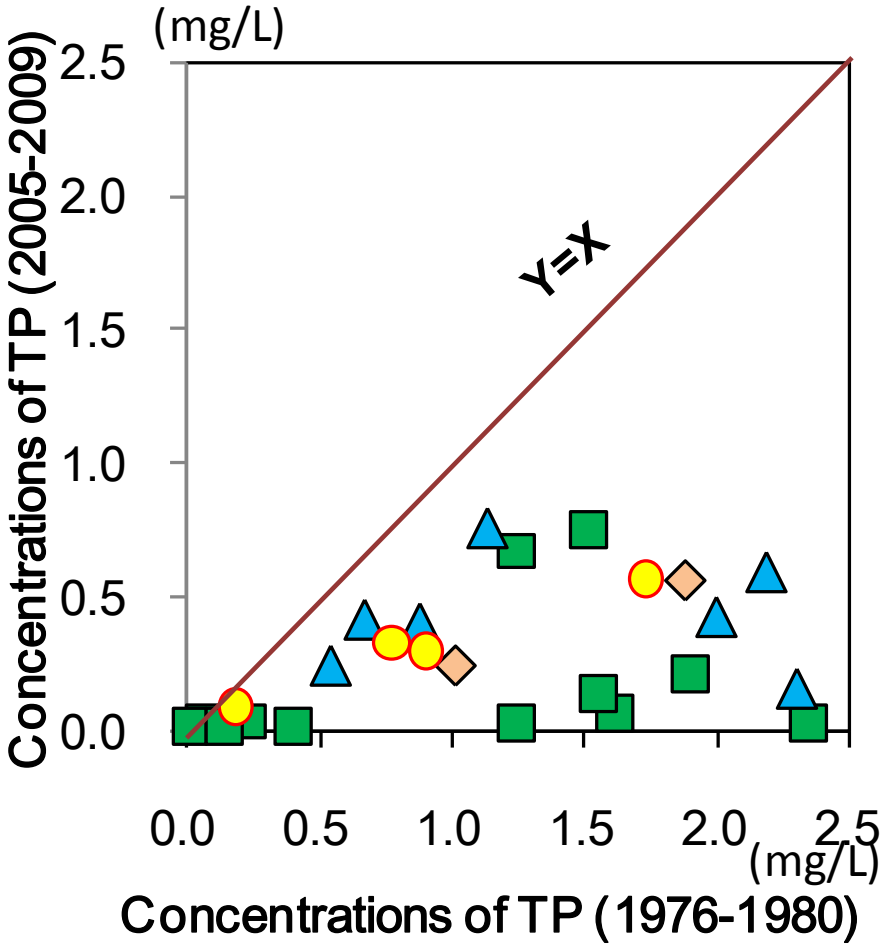


Changes of percentage of sewered population in the Lake Biwa – Yodo River watershed



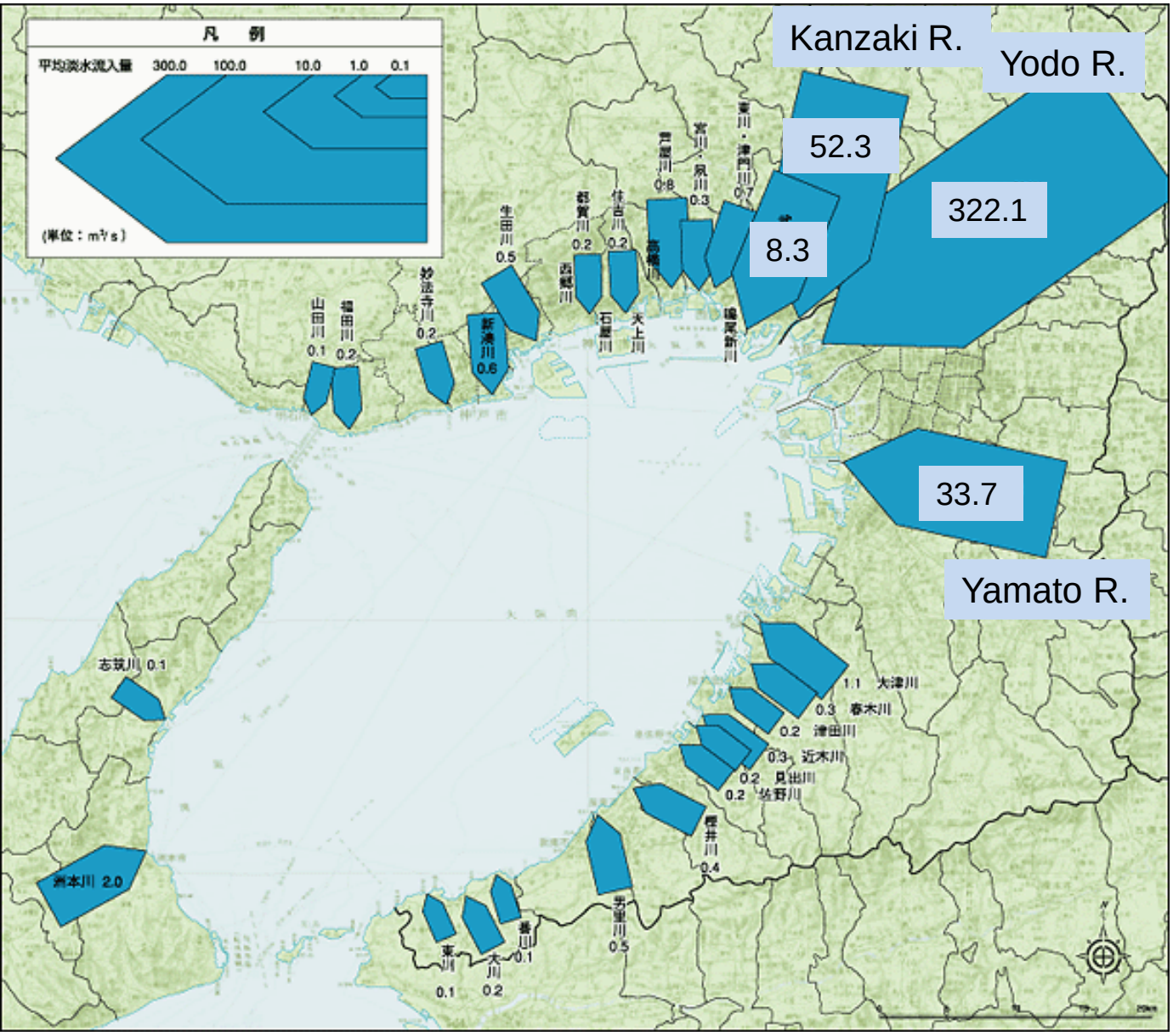
The changes of concentration of TN and TP in rivers for 30 years





- The first-class rivers
- The second-class rivers in Hyogo Pref.
- The second-class rivers in Osaka Pref.
- The second-class rivers in Awaji island

Flow rate of the first and the second class rivers flowing in Osaka Bay



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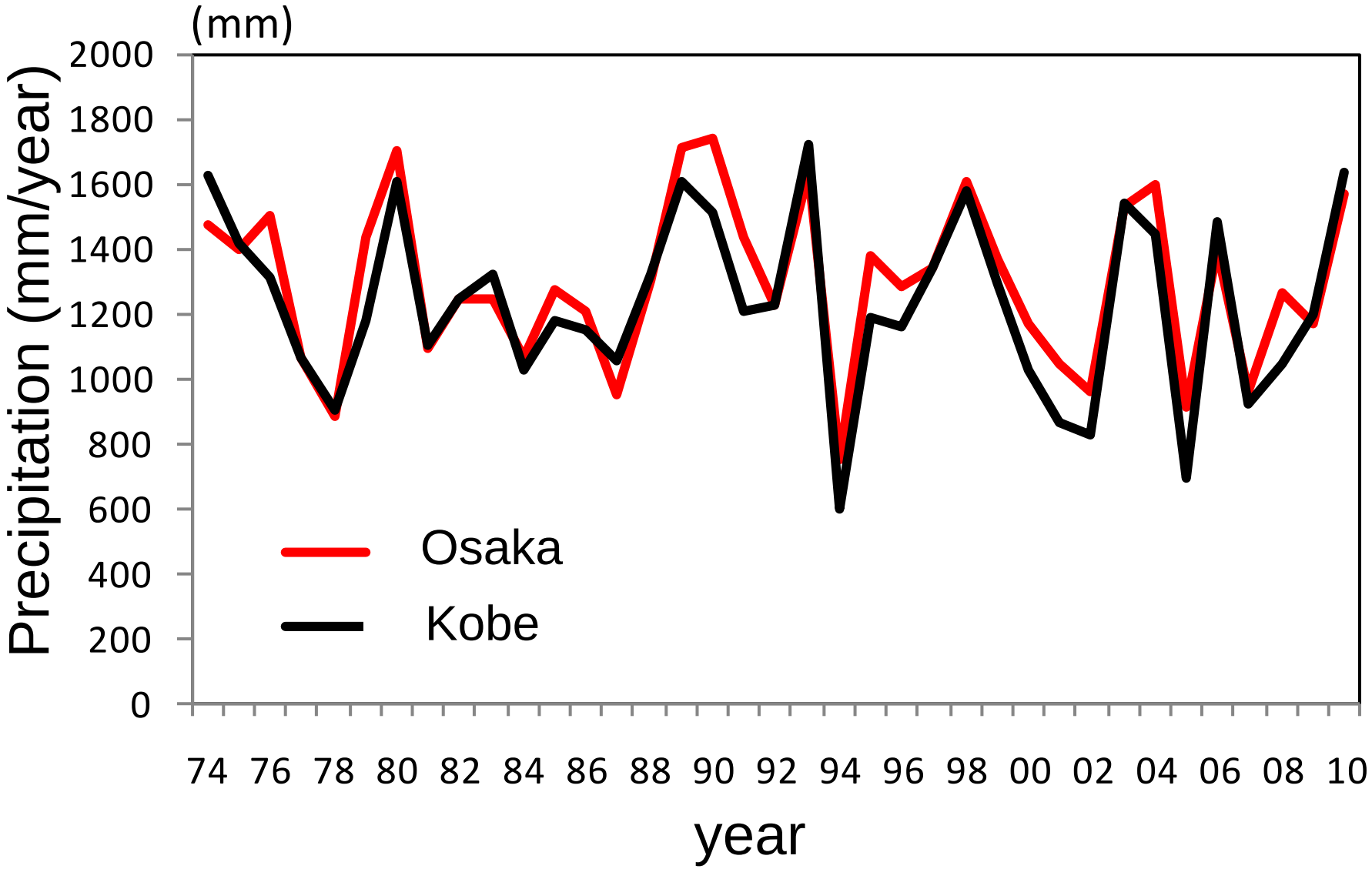
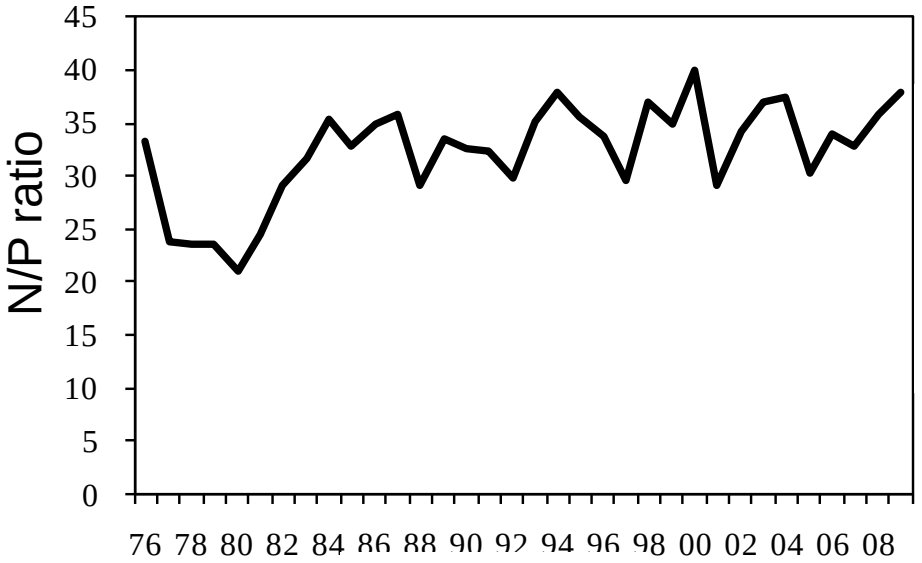
The Ministry of Land and Transportation, Japan

Yearly changes of precipitation

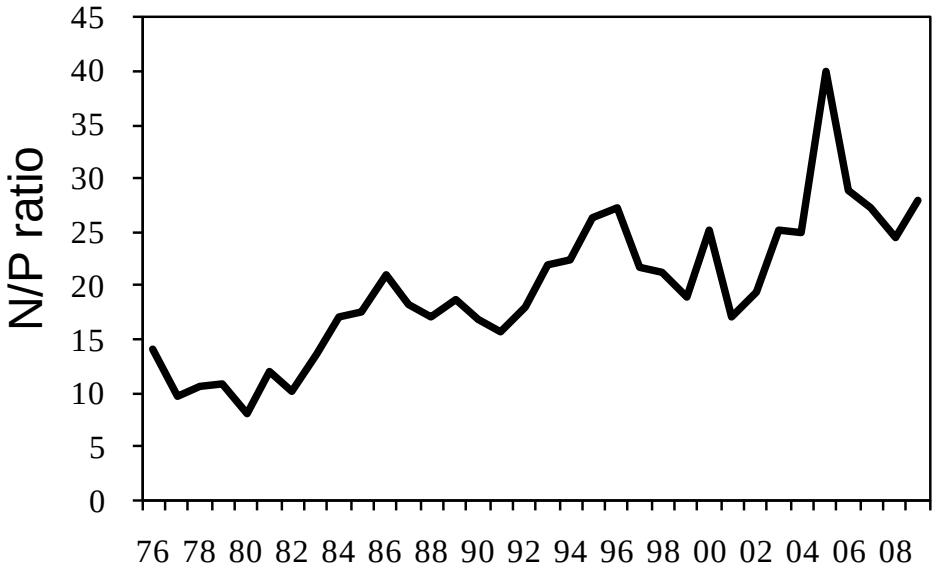


Yearly changes of N/P ratio

Downstream site in Yodo R.



Downstream site in Yamato R.



	N/P ratio	
	Yodo R.	Yamato.R
1976-1980	25	11
2005-2009	30	30
Redfield ratio	16	

Conclusions

- The concentrations of TN and TP decreased in all rivers.
- These results showed that the loadings of nitrogen and phosphorus from watershed surrounding Osaka Bay have been successfully cut by a total amount control based on the extraordinary measures law for environment conservation of the Seto Inland Sea.
- The concentration of NH_4-N decreased, and the most of DIN was occupied by NO_3-N in all rivers.
- The concentration of PO_4-P has decreased in all rivers.
- The N/P ratios of river water have increased gradually, and become lager than Redfield ratio.
- It should be considered an impact for ecosystem due to changes of N/P ratios.

Acknowledgement

This study was conducted as a part of the funded research against seaweed crop failure by Fisheries Agency, Japan