3RD
YSLME
SCIENCE
CONFERENCE
15-19 July 2019
Qingdao, PR China

Watershed modelling and nutrient loadings in Haizhou Bay of Jiangsu Province, PR China

Lijun Wang

NMEMC/MEE

Outline

- Objectives
- Study area
- Method description
- Nutrient loadings in Haizhou Bay

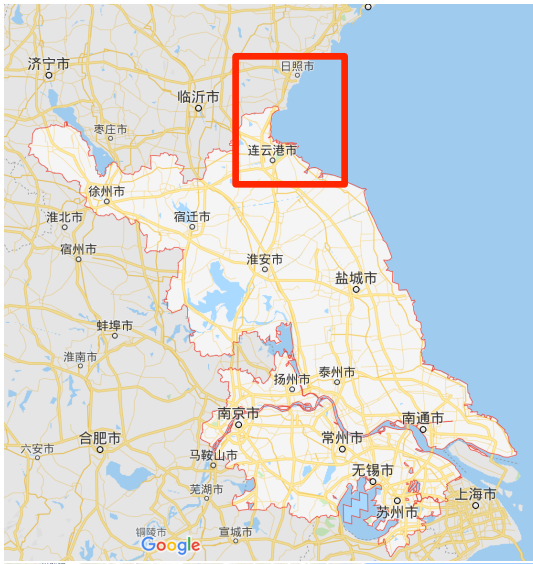
Objectives

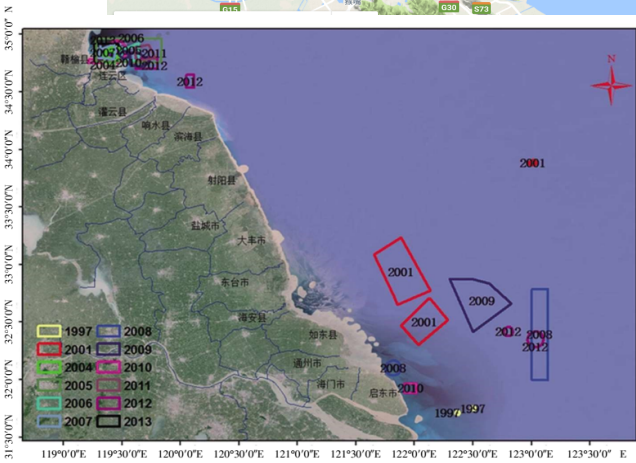
- To support a watershed model for the nutrients loading estimation in the hot spot;
- To estimate nitrogen and phosphorus discharges from the river basins and identify the nutrients sources

Study area

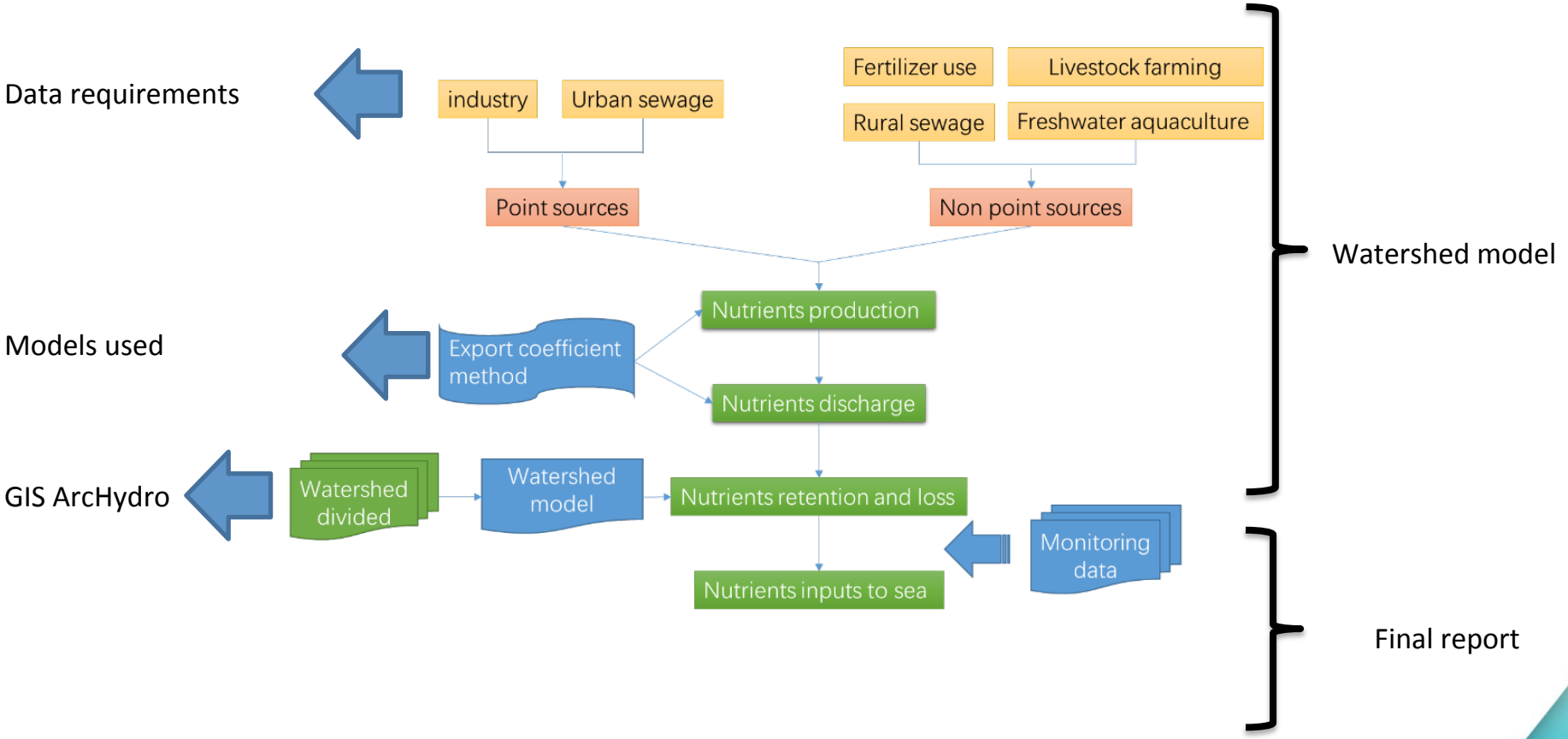
- Study area: Haizhou Bay (famous in fishing grounds)
  - Location: Lianyungang, Jiangsu
  - Coast line: 170km
  - Area: 820 km^2
  - Major cities: Lianyungang
  - Major rivers: 12 rivers into Haizhou Bay

Rivers	discharge	Catchment area
Linhong	＜1 B m^3	~2,000 km^2
Qingkou	＜100 Mm^3	＜1,000 km^2
Longwang	＜100 Mm^3	＜1,000 km^2
Xiuzhen	＜100 Mm^3	＜1,000 km^2





Model description

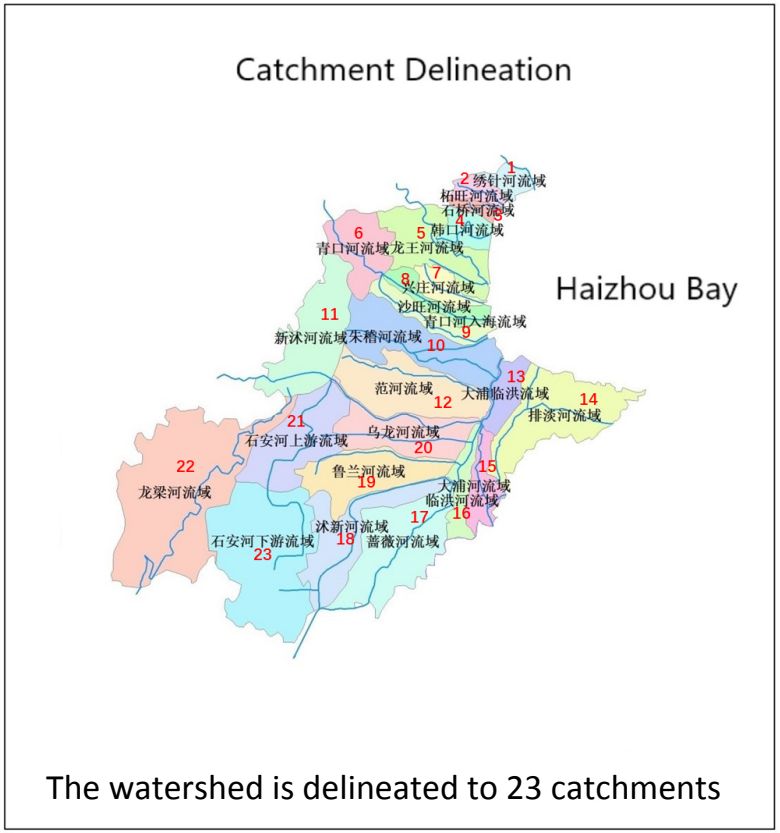


- Why export coefficient model used ?♪
  - Because Haizhou Bay is located in the Huaihe Plain, more than 12 rivers run into Haizhou Bay, the crisscross river network formed a very complex drainage system, and it is not easy to define the boundary of watershed.
  - For the freshwater demand and prevention of seawater erosion, almost each river is controlled by the tidal locks, and hydrological change is not a natural process any more, but human induced change characteristics. There may be fewer water flow into the sea in dry season, but may dramatically increase in the wet season.
  - So, distributed models is not suitable for the river in the study area, because of the lack information of mechanism that the pollutants transferred or transformed in this human induced hydrological system.

- Define Lianyungang city as the key watershed study area
  - Most of the rivers flow into Haizhou Bay originate in Lianyungang city.
  - Although some rivers originate in Shandong province, hydrological change may be human controlled, such as Linhong river, the water flow is controlled by the dam of Shilianghe reservoir.
  - So we hoped to identify the nutrient sources by focusing on Lianyungang city as the key watershed study area.
  - And, the total nutrient loading is defined as two parts: the loading that flow into Lianyungang city which can be calculated by the monitoring data and the loading that from the production in Lianyungang city.

5 Steps for watershed delineation

- Step 1: Fill sinks
- Step 2: Flow direction
- Step 3: Flow accumulation
- Step 4: Catchment delineation
- Step 5: Watershed

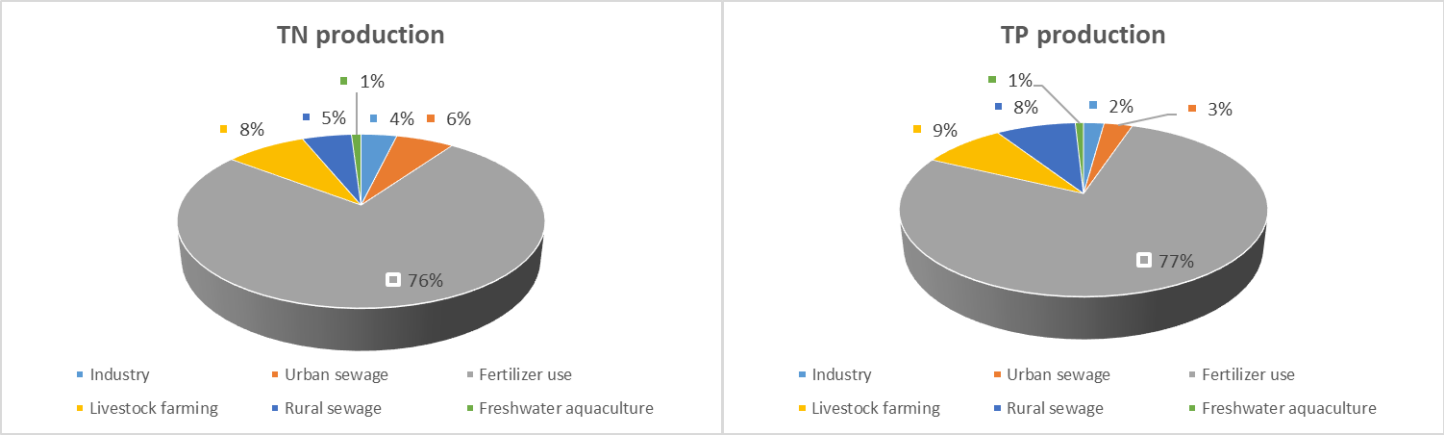


The watershed is delineated to 23 catchments

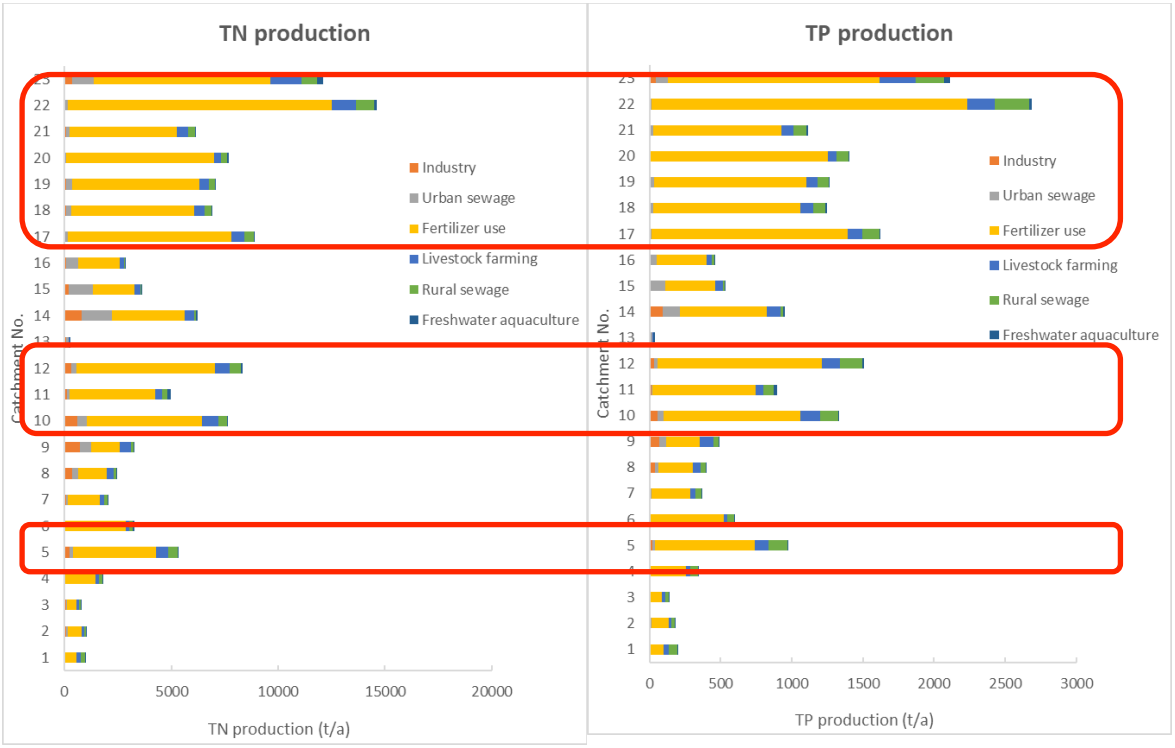
The catchment must be manually adjusted due to the complex drainage system of the crisscross river network in the study area.

Nutrient calculation result

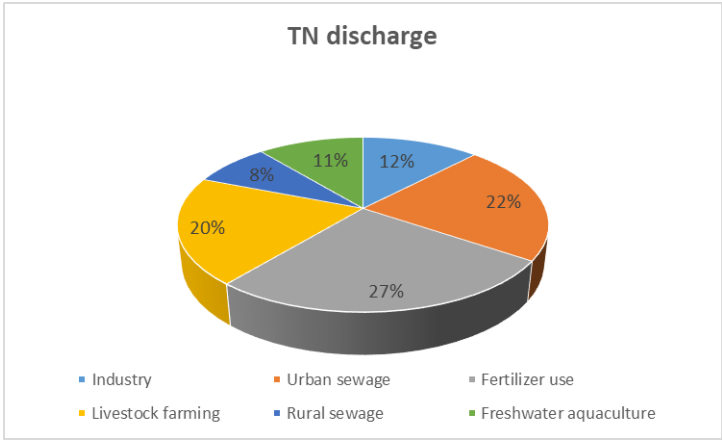
- The production of TN,TP in Lianyungang
  - Total production of TN, TP is about 118 kt and 21 kt respectively
  - The fertilizer use is the major source for production of TN, TP, more than 75% of TN， TP production is from fertilizer use, and only 1% of TN， TP production is from freshwater aquaculture

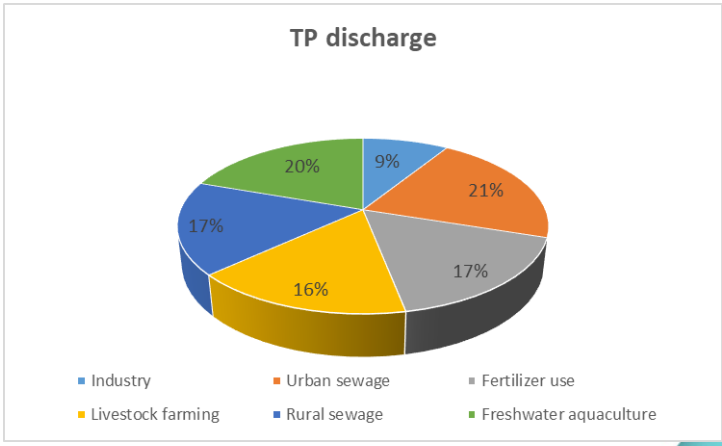


– The production of TN,TP is mainly from upper stream, such as the catchments of Longling river and Shian river, where the farmland is the dominant land use types



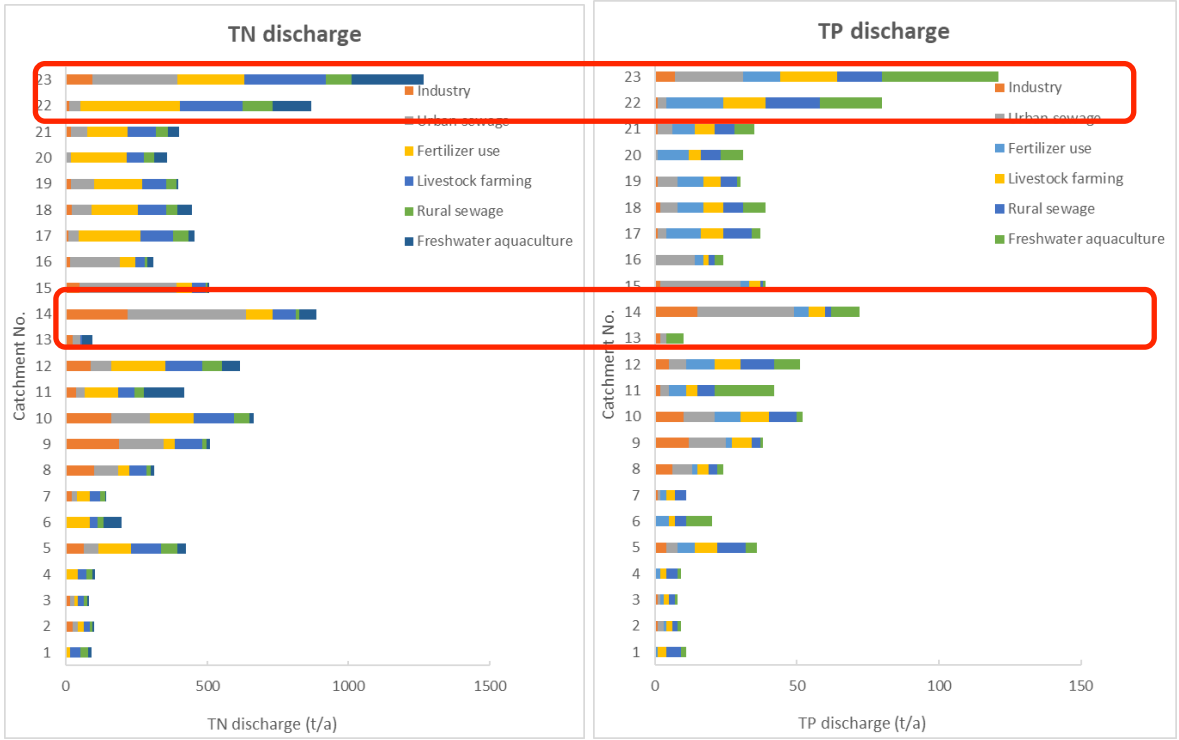
- # The discharge of TN,TP in Lianyungang
  - Total discharge of TN, TP is about 9.6 kt and 0.8 kt respectively, showed less than 10% of the TN,TP production may discharge into water body
  - Compared with the production of TN, TP, it showed a significant difference on the sources between the production and the discharge, and each source have nearly same contribution on the nutrient discharge, which indicate that only small part of TN,TP production from fertilize use can discharge into water body.



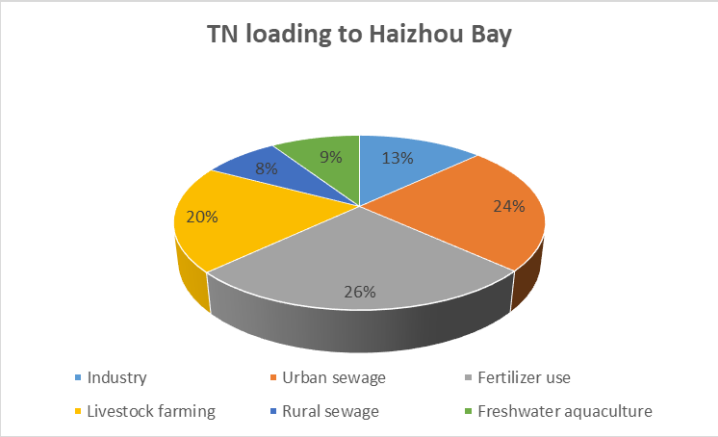


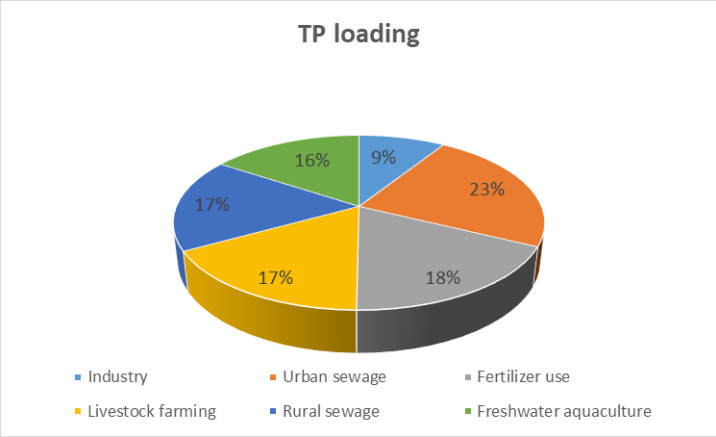
	Industry	Urban sewage	Fertilizer use	Livestock farming	Rural sewage	Freshwater aquaculture
TN discharge/ TN production	26.51%	29.99%	2.88%	19.15%	12.67%	89.63%
TP discharge/ TP production	16.48%	28.09%	0.87%	7.46%	8.17%	90.56%

– The discharge of TN,TP is also mainly from upper stream, such as the catchments of Longling river and Shian river, because of the high production of TN,TP in these areas.

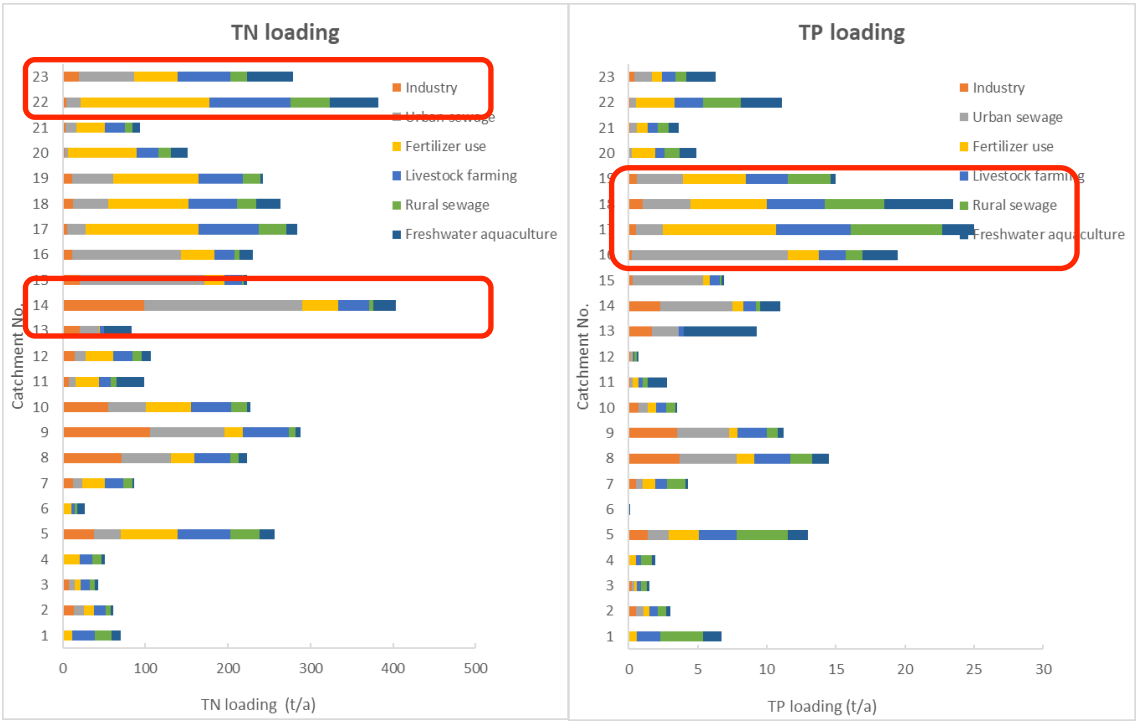


- The loading of TN,TP in Lianyungang
  - Total loading of TN, TP in Lianyungang is about 4.2 kt and 0.2 kt respectively.
  - Same as the discharge of TN, TP, the fertilizer use, livestock farming, urban sewage have the same contribution on TN loading, and almost each source has the same contribution on TP loading.





– The loading of TN is mainly from the Longling river and Shian river, and TP is mainly from Linwei river, Lulan river and Shuxin river. Although there showed a spatial difference between TN and TP loading, theses rivers are all the upstream of Linhong river.



- TN, TP total loading to Haizhou Bay
  - According to the loading flow into Lianyungang and the loading from the production in Lianyungang, the total nutrient loading showed TN 6.4 kt， TP 0.4 kt. The loading from the production in Lianyungang city account for 66% and 50% for TN and TP respectively.
  - After applying the loading of all 23 catchments to the 12 rivers that flow into Haizhou Bay, the Linhong river is the major nutrient source to Haizhou Bay， account for 56% and 59% of total loading for TN and TP respectively, and next is Xiuzhen river， account for 9% and 18% of total loading for TN and TP respectively.

- Conclusion
  - Linhong river is the major nutrient pollutant source to Haizhou Bay
  - The nutrient load to Haizhou Bay mainly from the production in Lianyungang city.
  - Although almost each source has the same contribution on TP loading, the potential loading from the fertilizer use should not be ignored, especially in the wet year or in the flood season, nutrient loading may dramatically increase

Thank you

lijunwang@nmemc.org.cn