

## Observations in Laizhou Bay and tidal lands of Yellow River delta in summer of 2007

Guo X.<sup>1</sup> · Q. Wang<sup>1</sup> · H. Yamaguchi<sup>1</sup> · T. Yanagi<sup>2</sup> · L. Zou<sup>3</sup> · H. Gao<sup>3</sup> · T. Mi<sup>3</sup>

<sup>1</sup>Ehime University, <sup>2</sup>Kyushu University, <sup>3</sup>Ocean University of China

### 1. Introduction

In September 2004 and May 2005, we carried out two observations in Laizhou Bay and central area of Bohai, which allow us knowing general spatial distribution of water temperature, salinity and nutrients and their seasonal variations. A large difference was found between the nutrients concentration of sea water and those of Yellow River and ground water. This motivates us to know the nutrients above tidal lands and near shore area, where is between sea water and river water or ground water. Moreover, high nutrients concentration was observed far from Yellow River mouth in 2004 and 2005. This suggests the necessary to know nutrients loads from the small rivers around Laizhou Bay, which can be an important source for nutrients in the bay. On the other hand, an increasing trend in the past 30 years has been found in the nutrients concentration in Laizhou Bay, while the same trend cannot be found in nutrients loads from Yellow River. This inconsistency reminds us to examine the nutrients supply from culture ponds for shrimp and crab around Laizhou Bay since such fisheries have been greatly developed in the past 30 years.

For addressing the above problems, we carried out a survey in Laizhou Bay and tidal lands of Yellow River delta from July 3 to 9 2007. The survey is divided into three groups as shown in Fig.1: sea group for Laizhou Bay (Fig.1, upper panels), tidal land group for tidal lands and near shore area (Fig.1, middle panels), and land group for small rivers and ponds (Fig.1, lower panel). Since there is a large spatial gradient in nutrients concentration in these areas, we set stations as fine as possible. Our survey measured water temperature, salinity, nutrients, Chl-a, SPM, PAR, DO. The survey period is at the end of an artificial event for adjusting water and sand fluxes in Yellow River (Fig. 2).

### 2. Results

An apparent influence of Yellow River water on surface salinity distribution is presented in Fig. 3. In general, salinity in Laizhou Bay is lower than 30 psu, which is lower than the salinity observed in September 2004 and May 2005. Such low salinity is due to the large fresh water supply from Yellow River before the survey (Fig. 2). The most interesting finding in the salinity distribution is that the diluted water spread eastward, not southward. This suggests that with a large river discharge, inertia of Yellow River water contributes greatly to the behaviors of Yellow River plume. In addition, the southwest wind during the survey period also favors a northeastward movement of Yellow River plume (Wang et al., 2008).

Among nutrients (Figs. 4&5), high concentration areas of nitrate, TN, TP and silicate correspond to the diluted water: extending eastward. This feature indicates that the load of such nutrient components from Yellow River at this period mainly contributes to the central area of Bohai Sea, not inside of Laizhou Bay. On the other hand, high concentration areas of nitrite, ammonium and phosphate were found around tidal lands and near shore area, not corresponding to the river plume. Such feature suggests that biological activities at tidal lands, not the land loads, affect more on the distribution of ammonium. The phosphate distribution is due to its low concentration in Yellow River but high concentration in some small rivers around Laizhou Bay. This suggests that the small rivers around Laizhou Bay must be paid sufficient attention as we discuss the source of phosphate in sea water. Finally, since we did not observe high concentrations of nutrients in ponds for shrimp or crab, we can therefore remove the possibility for the culture ponds as an important source for nutrients in sea water.

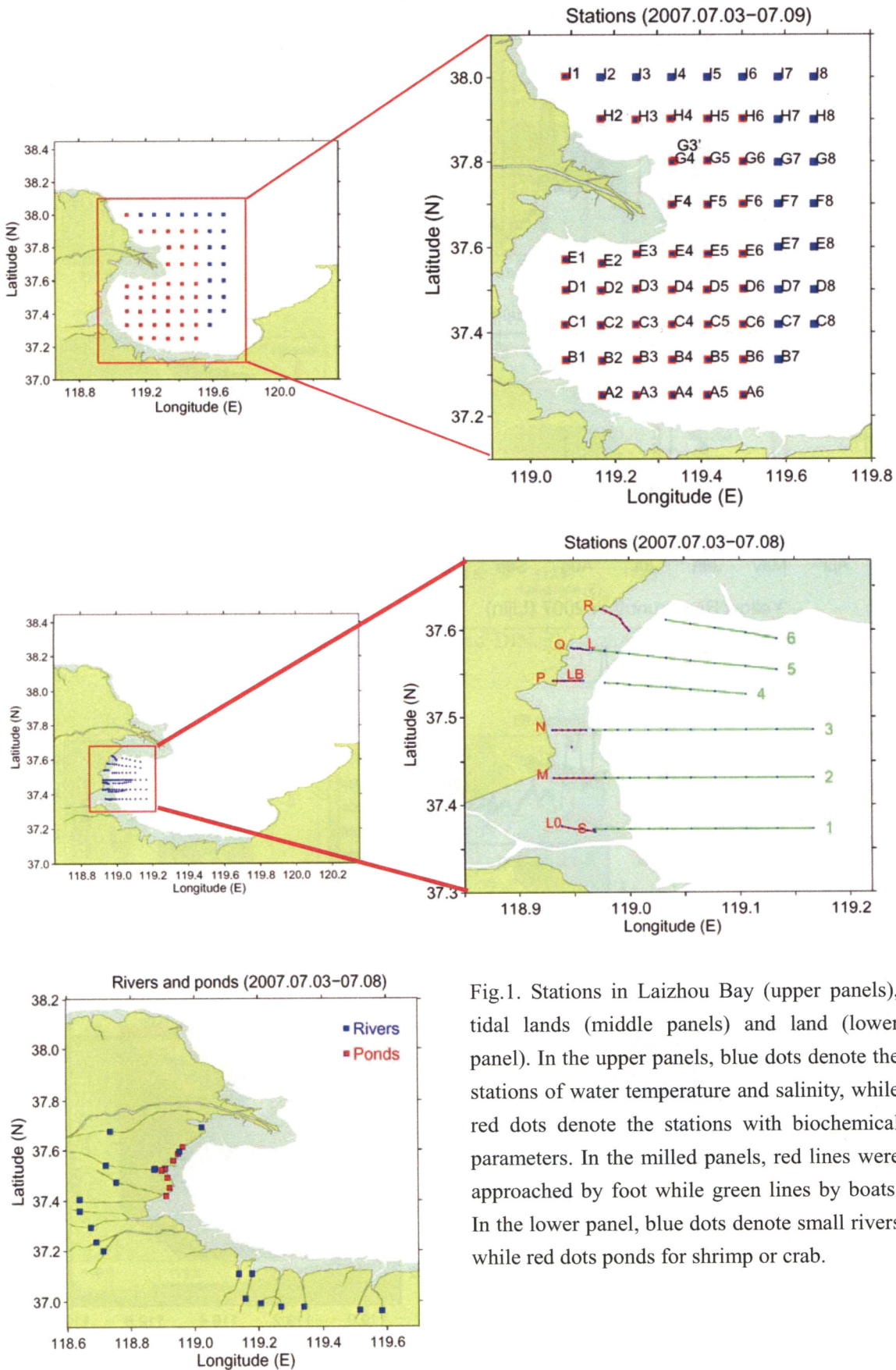


Fig.1. Stations in Laizhou Bay (upper panels), tidal lands (middle panels) and land (lower panel). In the upper panels, blue dots denote the stations of water temperature and salinity, while red dots denote the stations with biochemical parameters. In the middle panels, red lines were approached by foot while green lines by boats. In the lower panel, blue dots denote small rivers while red dots ponds for shrimp or crab.

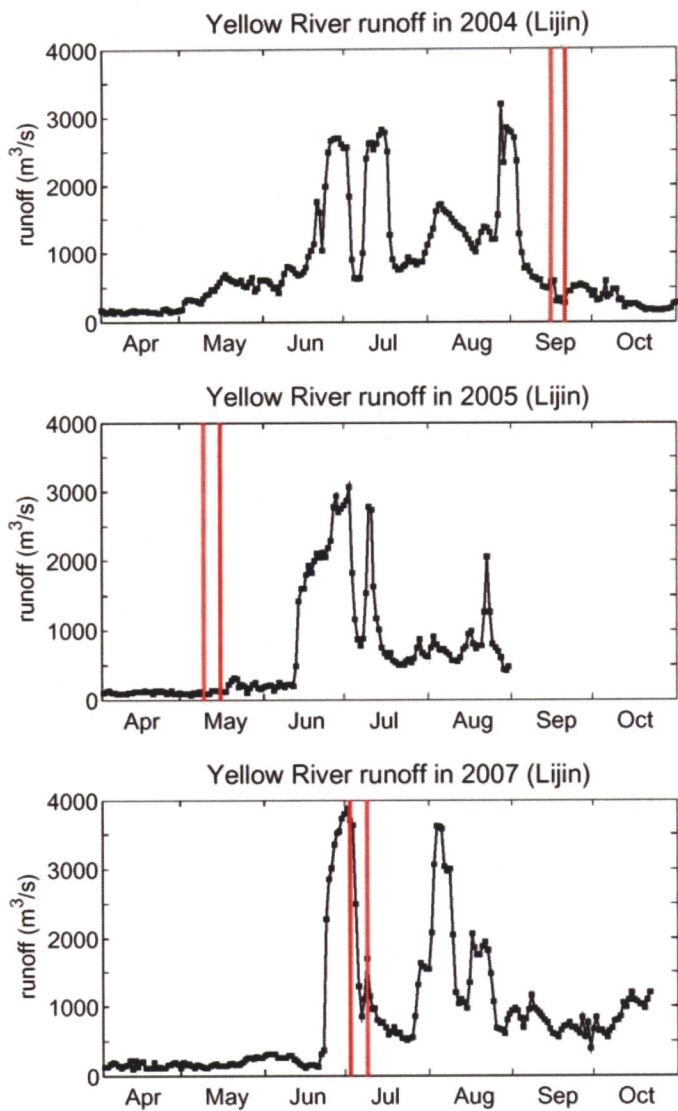


Fig.2. River discharge of Yellow River from April to October in 2004, 2005 and 2007. The time between two red lines denote the survey period in each year.

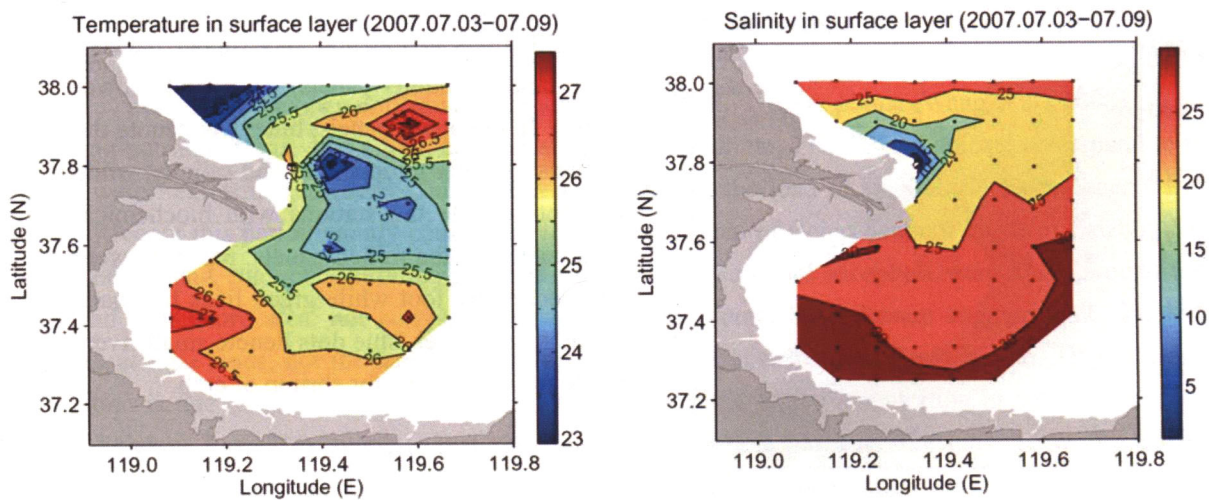


Fig.3. Surface water temperature (left) and salinity (right) in Laizhou Bay in July 2007.

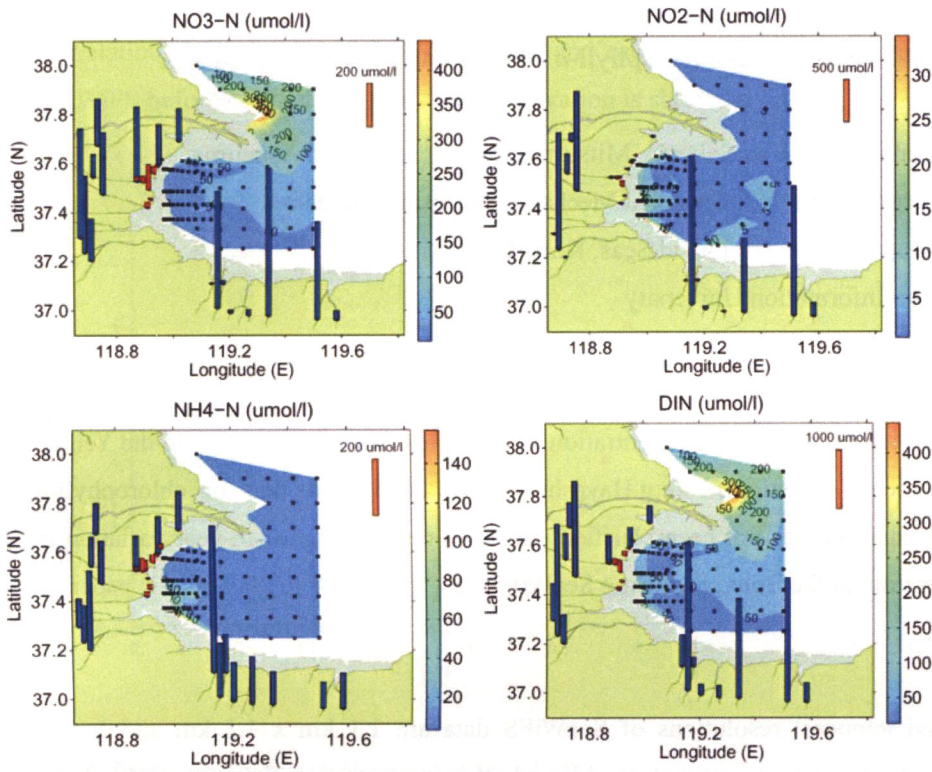


Fig.4. Distribution of nitrate, nitrite, ammonium and DIN in Laizhou Bay, tidal lands, small rivers and ponds.

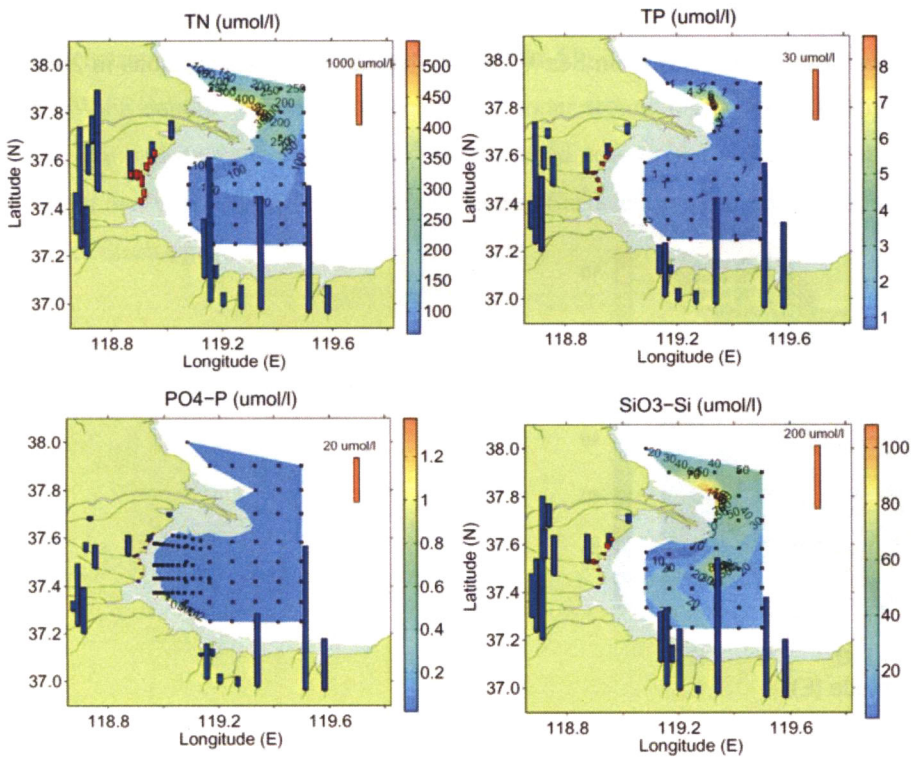


Fig.5. Distribution of TN, TP, phosphate and silicate in Laizhou Bay, tidal lands, small rivers and ponds.