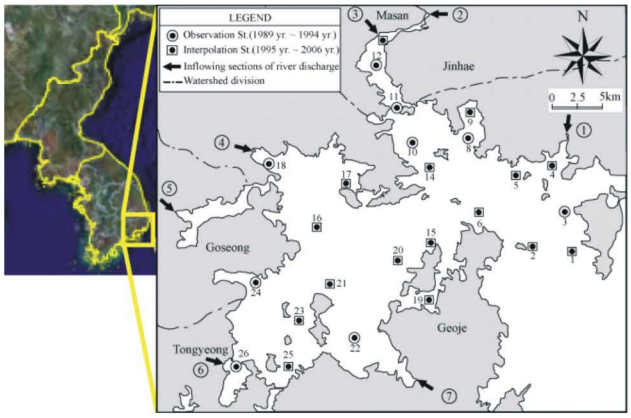

Fig.1 The map shows inflowing point of river discharges and divided area for calculated of pollutant load and observation stations of water quality in this study

qualities was investigated. Jinhae bay is a representative semi-enclosed bay which is located on the south-eastern coastal sea of Korea, and be surrounded by Masan, Jinhae, Changwon, Geoje, Tongyeong, and Goseong. The latitudinal and longitudinal length is about 25 km and 35 km, respectively. The average water depth in Jinhae bay is about 10 m and freshwaters from seven rivers inflowing into the sea area (The Korea ministry of Environment 1991). In this study, the analysis of annual variation for oxygen deficient water mass (ODW) in Jinhae bay was carried out. For the purpose, first, 26 stations where the construction of Pusan Newport is being processed were selected to investigate the characteristics of water quality in Jinhae bay. Second, the cluster analysis was conducted using the water quality data of the 26 Stations from 1989 to 2006, which were collected from the National Fisheries Research and Development Institute, KOREA (NFRDI). Third, Jinhae bay was divided into regions having similar water quality based on the collected data. Forth, by observing the annual variation of water qualities, the severe polluted area was found, and the effects of a special management sea area in Masan bay and the construction of Pusan Newport on the water qualities was investigated. Finally, we estimated oxygen deficient water mass (ODW) area, ratio and volume in Jinhae bay. **Fig. 1** The map shows inflowing point of river discharges and divided area for calculated of pollutant load and observation stations of water quality in this study. Finally, we estimated ODW_{area}, ODW_R and $ODW_{vol.}$ In Jinhae bay. From the study, it is shown that overall water quality at 2000s has been improved by investigating the variations of dissolved oxygen, chemical oxygen demand, etc. From cluster analysis, Jinhae bay was classified into four regions. The four regions were defined as Southern (I), Central (II), Northern (III), and Eastern (IV). ODW was occurred in all areas of Region I in 1993 and 2002~2004. The value of 1.92 km^3 is the highest value of Region I in 1993 and 2002~2004. ODW were not occurred in Region IV because seawater was well exchanged in the eastern part of Jinhae bay. On the other hand, ODW was generated every year in Region I, this means the southern part is the most polluted area in Jinhae bay. ODW_R was decreased in Region III; hence, it is shown that water quality of Region III has been improved since operating wastewater treatment plant in 1994.

Continuous surface sea water surveillance on Poly Aromatic Hydrocarbons (PAHs) from the Tokyo Bay, through the East China Sea, then to the South China Sea

Huifeng REN [1], Tsubasa KAWAGOE [1], Huijuan JIA [1*], Hideaki ENDO [1], Sumio GOTO [2] & Tetsuhito HAYASHI [1]

[1] Dept Ocean Sci, Tokyo Univ Mar Sci & Technol, Konan-4, Minato-ku, Tokyo, 108-8477 Japan
*E-mail: yoko7604@kaiyodai.ac.jp
[2] Dept Environ Health, Azabu University, Fuchinobe, Sagamihara, Kanagawa, 229-8501 Japan

Purpose: Although the toxicity of most PAHs is much weaker than that of dioxins, the total toxicity of PAHs on earth is bigger, because a much larger amount of PAHs is produced than dioxins, and their harmful influence could be more serious. Many reports on the distribution of PAHs in large cities and in coastal sea areas are available; however, only a few exist on the high seas. The aim of this study is to elucidate the situation of pollution by PAHs in the East China and South China Seas.
Materials and methods: Surface water, from 200 km south of the Shikoku Island to the Straits of Malacca (8 samples, 765— 1079 L/day), was collected continuously on a long voyage (Nov. 21— 29, 2005) of the *Umitaka-maru*, a research and training ship of the university. PAHs were adsorbed by Blue Rayon, eluted with methanol, and then analyzed by HPLC (Wakosil-PAHs). Sample #2 and part of #3 were collected along a line parallel to the southeastern edge of the East China Sea, and samples #4-8 were collected along a diagonal line in the South China Sea in the direction of northeast to southwest. Water depth

and tidal stream (direction and speed at the depth of 30 m) was monitored by an Acoustic Doppler Current Profiler (ADCP) at all times during the voyage, and the number of ships at the periphery of the sailing route was recorded by using an Automatic Identification System (AIS).
Results: The total amount of PAHs was measured in each sample and found to range between 30.4－120.2 ng/L. The highest concentration was observed in sample #3, which was collected along the eastern shore of Taiwan. Ten different PAHs were detected in total, and acenaphthylene was observed in all samples. The three highest PAHs (26.1－67.2 ng) concentrations of acenaphthylene were observed in sample #4－6. In sample #1－3 and 8, naphthalene (23.0－ 52.0 ng) was the highest compound. Benz(a)anthracene (3.3－27.8 ng) was found in sample #1, 3, and 5－7, and was the highest PAHs in sample #7. The chemical composition of PAHs varied considerably after passing the center of the South China Sea, and benzo(a)pyrene, the most toxic compound in 16 PAHs, listed by USEPA, was detected in sample #7－8 (2.3－2.4 ng).
Discussion: Sample #3 collected along the eastern shore of Taiwan showed the highest total PAHs concentration and the nearby sample of sample #4 exhibited the lowest. The difference in the total amount of PAHs in these two samples was about four times. According to the ADCP, the current from Taiwan to the sea lane apparently changed to the opposite direction, namely from the Pacific Ocean to mainland China, at the border of sampling areas sample #3 and sample #4. Such a significant distinction in local ocean drift caused this big difference in the total amount of PAHs in the two adjacent samples. As a result, the degree of contamination in the enclosed sea coastal area is likely to be influenced by the presence of a pollutant source such as a big city or an upstream industrial belt, rather than by the depth of the sea. The high density of ships observed by AIS along the sea lane suggested that exhaust smoke from those ships was also responsible for the pollution.

The contribution of atmospheric deposition of nutrients to the Yellow Sea

Huiwang GAO *, Jianhua QI & Han YAN

Key Laboratory of Marine Environmental Science and Ecology, Ministry of Education of China, Ocean University of China, Qingdao 266100, China
* E-mail: hwgao@ouc.edu.cn

Atmospheric deposition is one of vital paths for chemical substance into the ocean, and an important source of nutrients, such as nitrogen, phosphorus and iron. Using the data of the total suspended particles (TSP) and size-segregated particles, Air Pollution Index (API), the deposition fluxes of aerosols and nitrogen over the Yellow Sea and Qingdao coastal seas were estimated, and the impacts of the dust weather on the seasonal varieties and spatial distributions of the aerosols and nitrogen were also discussed.
In 2002-2007, the dry deposition fluxes of aerosols and total nitrogen (TN) over the Yellow sea attenuated with longitude from west to east, and were about 544.2-1400.1 mg/m^2/month and 9.17-23.6 mg N/m^2/month respectively. The wet deposition fluxes of TN varied between 16.5-436.1 mg N/m^2/month. The ratio of dry deposition to total deposition for TN was about 33%. The wet deposition fluxes of total inorganic nitrogen (TIN) was 15.0-393.9 mg N/m^2/month, contributed more than 66% of TN. The ratio of dry deposition to total deposition for TIN varied between 1.5-63%. The wet deposition of nitrate and ammonium were about 1.6-9.5 and 3.0-17.3 mg N/m^2/month, respectively. The average ratios of dry deposition of nitrate and ammonium to total deposition were 28% and 18% respectively.
The levels of dry deposition fluxes of aerosols and nitrogen over the Yellow Sea were about 1482.9-2641.0 mg/m^2/month and 9.19-16.6 mg N/m^2/month during dust period, respectively. They were about 2558.5 mg/m^2/month and 16.1 mg N/m^2/month over Qingdao coastal seas. The impact of the dust weather on the dry deposition of aerosols mainly focused on the coarse particles with the diameters above 3.3μm. The effect of dust weather on ammonium was larger than on nitrate.
River and atmosphere are both important sources for nutrients in the Yellow Sea. Compared with riverine input, the contribution of atmospheric deposition to total inputs of NO_3^-+NH_4^+ from the two sources was about 31.1%-35.5%.

Evaluation of water quality change and inflowing pollutant loads in the Gwangyang Bay of southern coast, Korea

JinHyuk KIM *, HwaHun KONG & In-Cheol LEE

Department of Ocean Engineering, Pukyong National University, Busan 608-737, Korea
* E-mail: jurnykim@nate.com