Development and persisitence of hypoxia and related environmental parameters at Jinhae Bay, south coast of Korea in 2011-2013

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Jinhae Bay, a semi-enclosed embayment located in south coast of Korea is major aquaculture area of mussels, oysters and sea squirts, and a spawning and nursery ground for commercially important fishes. Since late 1960's industrial and domestic waste from adjacent cities and industrial complexes have loaded and resulted in chronic hypoxia and red tide in Jinhae Bay. As a southeastern part of nation-wide environmental monitoring for aquaculture & fishery in Korea, Jinhae Bay was surveyed every two month (half month in hypoxia season) and observed seawater and sediment properties at 31~34 stations as well as meteorological conditions. During the study periods, hypoxia was usually developed on late May~June from innermost small bays of Wonmoon, Masan and Myoungjoo, extended out into the Jinhae Bay on August and weakened and/or disappeared by late September~October from the Jinhae to inner small bays sequentially. Duration and intensity (expressed as oxygen deficiency index) of hypoxia in 2012 were higher (17.7 weeks and 102.3) than those in 2011 (10.5 weeks and 92.7) and 2013 (12.4 weeks and 57.6), and averages of water temperature and salinity during the hypoxia period were also higher and lower, respectively than in 2011 and 2013. It means that strong stratification (expressed as stability index) in water column caused by high temperature and low salinity in surface water might be an important factor for development and persistence of hypoxia in Jinhae Bay. If high (> 0.1) levels of stability index lasts more than 2~4 weeks on May~June, thermodynamic conditions are ready to develop a hypoxia in Jinhae Bay. Water stability index also correlated negatively with lowest oxygen concentration at each station for three hypoxia seasons, suggesting that strong stratification prevent supplying oxygen to the bottom layer and sediments where biogeochemical oxygen consumption taken places. Next steps of hypoxia studies in Jinhae Bay will be focused on prediction and forecasting the hypoxia in future climate change using a simple numerical model based on temporally high-resolution measurements.