

# Nitrogen Pollution and Eutrophication Problem in the Jiulong River Watershed – Xiamen Bay: Management Implications

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The river- estuary-coastal system is largely influenced by the human activities and anthropogenic nutrients addition (both nitrogen and phosphorus). Understanding of nutrient sources and flux is very important for identifying suitable management interventions to abate nutrient pollution and eutrophication problem. Previous study showed that more than 50% of the nitrogen input to the Jiulong River watershed in southeastern China was lost to the environment through riverine export, ammonia volatilization and denitrification, implying that riverine input and atmospheric deposition could influence the quality of coastal waters. This study aimed to quantify the nitrogen sources including riverine input, atmospheric deposition, urban runoff and manure/sewage discharge to the Jiulong River watershed-Xiamen bay, and to analyze the nitrogen spatiotemporal patterns and associated mechanisms, and further to provide a sound scientific basis for regional management of coastal area. Monitoring, modeling and GIS techniques were linked to estimate the nitrogen flux of various sources. The historical data showed that changing human pressure and external nitrogen input in recent 30 years was a key driver of nutrient pollution and eutrophication problem in the Jiulong River watershed-Xiamen Bay. Riverine input from Jiulong River watershed (17.78 kg ha<sup>-1</sup>, about 30% of total input) dominated the nitrogen sources in the Estuary-coastal system. An averaged 70% of dissolved inorganic nitrogen with 65% of river flow was delivered to Jiulong River estuary in wet season (May through September). Nitrogen contained in rain waters was 2.71±1.58 mg L<sup>-1</sup> for three sites (Xiamen, Duxun and Qianting) located in the coastal area. On average, dry deposition and wet deposition contributed 16% and 84% to the total deposition flux (30.15 kg ha<sup>-1</sup> yr<sup>-1</sup>). The NH<sub>3</sub> source to the atmosphere may have been associated with agricultural emissions from animal excreta and fertilizers in the windward Jiulong River watershed. Reducing the anthropogenic nitrogen input by a more efficient use of fertilizer and manure during the growing season



(nutrient management), and trapping storm runoff during the wet season (hydrological control) offer the key to eliminate nitrogen pollution in this region. Control of both nitrogen and phosphorus discharge, and low flow (ecological flow) is very important to mitigate eutrophication (Algal bloom) in reservoirs/coastal sea.