

SIMULATION ANALYSIS ON POLLUTANT BEHAVIOR IN RICE PADDY FIELDS AROUND AKANOI BAY OF LAKE BIWA, JAPAN

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ABSTRACT

Lake Biwa is the largest lake in Japan and used as a drinking water resource by 14 million people in Western Japan. It has a huge catchment basin and more than 100 rivers which flow into the lake. Pollutants discharged into Lake Biwa through such inflowing rivers and streams are considered to have a great influence on water quality in Lake Biwa. Ratios for each land use in the Lake Biwa basin are 12% for urban areas, 23% for rice paddy fields, 1% for cropfields and 64% for mountainous areas. Therefore, the rice paddy fields in the Lake Biwa basin are considered to be one of the largest pollutant sources for agricultural runoff. The rice paddy fields use and discharge much water for irrigation. They also discharge turbid water during the busiest season for farming. Surplus fertilizers and pesticides used for the rice paddy fields are discharged with such irrigated water and stormwater to downstream portion of the basin. This runoff water from the rice paddy fields is known to contain highly concentrated nutrients. But characteristics of such pollutant runoff from the rice paddy fields have not been clarified enough so far, because of the complex networks of irrigation canal in the basin. Akanoi Bay is one of the most polluted waters in Lake Biwa, because of many factors such as enclosed lakeshore around it and a large amount of runoff pollutants from its catchment area. It is located in the eastern side of southern Lake Biwa. The catchment area of the Akanoi Bay is 23.5km² and rice paddy fields occupy no less than 60% and residential areas occupy 38% of the basin. Water for irrigation here are drawn from a river located upper-stream portion of the basin and used for farming through complex networks of irrigation canals. In addition, pumped-up water from Lake Biwa is used for irrigation in the downstream portion of the basin. There are also several residential areas with point pollutant sources such as domestic wastewater and industrial wastewater. The objectives of this study are to clear characteristics of nutrient runoff from rice paddy fields into Akanoi Bay of Lake Biwa by simulating its behavior in the basin. The observations of runoff discharge and water quality in several streams in the Akanoi Bay basin were done during dry weather periods and wet weather periods from 1997 to 2002. And a mass balance model for runoff water and nutrients in the basin were developed using the observed data. Here, the Akanoi Bay basin were divided for 150 small basins taking considerations of the irrigation canal networks, and the mass balance model calculated discharged water and nutrients from each small basins to its downstream portion one after another. As a result of the calculations, annual runoff load into the Akanoi Bay was 179t/y for TN and 31.3t/y for TP. The calculations also cleared the ratio of runoff loads from rice paddy fields in the loads from all over the basin and showed significance to control such runoff pollutants from the rice paddy fields. Thus, significant information for the environmental management of Lake Biwa has been obtained.

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