

京都市の都市化された水辺環境における鳥類群集の分布様式  
**DISTRIBUTION PATTERN OF AQUATIC BIRD COMMUNITY IN URBAN ENVIRONMENT OF KYOTO CITY**

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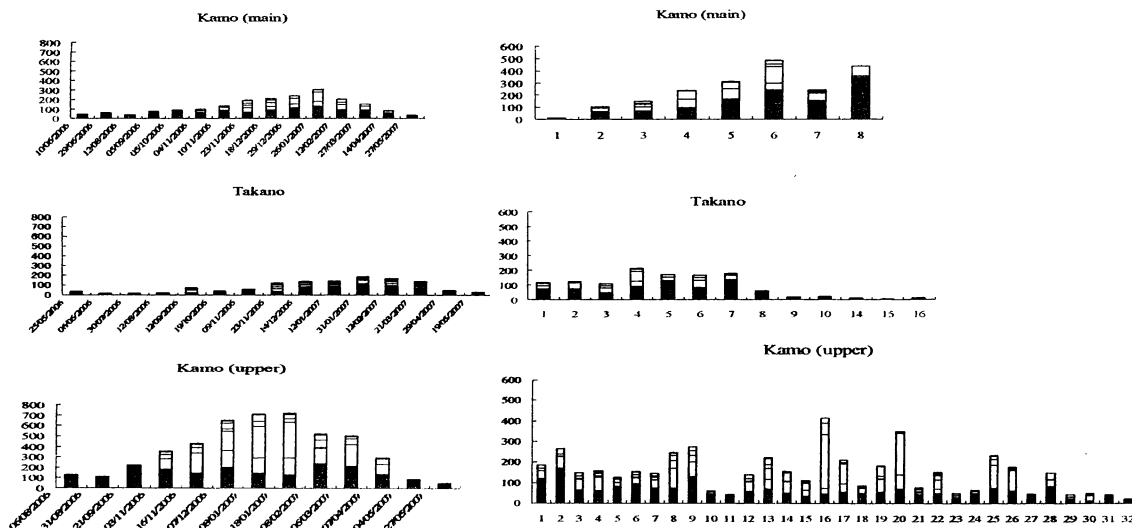
**1. INTRODUCTION**

The Kamo River system has had a long history of flooding disasters and consequently flood control measures. In 1935, a large flood occurred which resulted in the deaths of 12 people and considerable property damage. As a result, flood control works were started in 1936 which included straightening and deepening of the river channel, laying of concrete banking, laying of artificial river beds and the creation of a series of weirs. Effects of these works on the river environment are considered in this research. Relations between aquatic bird community distribution and habitat structure of Kamo River were analysed by creating distribution models for select species based on multiple regression analysis.

**2. METHOD**

Study sites in three segments of Kamo River in Kyoto City were established and divided into sections separated by weirs: Kamo (upper) (6 km, 32 sections), Kamo (main) (2 km, 8 sections) and their tributary Takano River (4 km, 16 sections). Seven basic habitat categories were established for comparison within this survey. These habitat categories were chosen based on two factors: their usage by aquatic bird species and our ability to measure the area of the factors using GIS data and aerial photos taken on 9<sup>th</sup> October 2007. Bird community observations were made from 25<sup>th</sup> May 2006 to 27<sup>th</sup> May 2007.

**3. RESULTS**

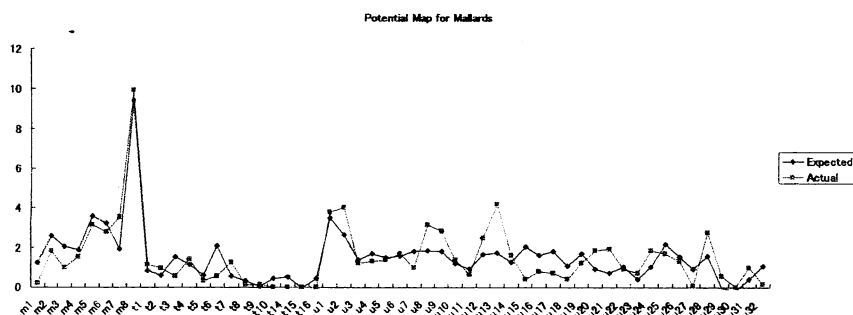


**Figure 1. Distribution of bird communities in relation to time period and section number with the average number of birds per section on the Y-axis. Each division of the bars shows a species. Shaded sections are residential species and un-shaded sections are migratory species.**

There were two types of aquatic bird communities studied, the year-long residential bird species and the migratory species (Figure 1). As most of the migratory species were winter migratory all sites had a greater number of individuals and species in winter. Kamo (main) showed an increasing abundance of individuals in the lower sections with both the residential and migratory species. Takano had more individuals in the lower sections and very few in the upper sections. Kamo (upper) showed more residential species in the lower sections and an uneven distribution of migratory species.

**a) Distribution pattern of ducks**

There were six species of duck recorded in this survey including mallard (*Anas platyrhynchos*, magamo) which is residential. Mallards primarily use the river channel and vegetated bars. There is a lower density of mallards in Takano and the upper sections of Kamo (upper). They showed a preference to larger, more open sections with smooth flowing water.



**Figure 2. Comparison of the results of multiple regression analysis with observed distribution of mallards.**

The distribution model for mallards was based on multiple regression analysis of the abundance of bird per section and the area of each habitat per section (Figure 2). The main correlating factors for mallards are area of open water and bank. Bank and bare bar have a negative relationship and distribution is affected by all factors except weir

**4. DISCUSSION**

There are correlations between the distribution of aquatic bird species and habitat factors. However the factors depend on the species. In the case of evenly distributed bird species such as herons, there is a correlation to the area of section. Herons are territorial birds so they have a preference to be distributed further away from each other. In the case of aggregated species such as ducks they showed a positive correlation to large open sections. There was a greater distribution of ducks in Kamo (upper) and Kamo (main) compared with Takano which shows a preference to shallower, still areas of open water compared with a narrow channel with riffles.

The habitat selectivity of the bird species assessed in this study may be applicable only to the Kamo River system or probably fairly similar urban rivers fragmentally sectioned by a number of weirs. Within the Kamo River system, however, the findings on the environmental requirements of the major bird species and the multiple regression formulae for predicting their density in relation to the environmental factors are vital enough for future environmental planning of Kamo River. Based on the formula, for example, if the government widens the channel of open water, more mallards are expected to appear, whereas if the number of weirs are reduced to increase the area of riffle and bare bar, wagtails, egrets and herons will be expected to increase in density.