RELATIONSHIP BETWEEN GES SYSTEM AND DISTRIBUTION OF AQUATIC BIRDS IN AN URBAN RIVER ENVIRONMENT

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1. INTRODUCTION

Kamo River is an urban river which runs through Kyoto City in Western Japan. Historically it is prone to flooding and after a severe flooding disaster in 1935 a series of river works were implemented. These works include straightening and deepening of the river channel, laying of concrete banking, laying of artificial river beds and the creation of a series of weirs. The effects of these works on the river environment are a key consideration of this research which was undertaken to investigate the relationship between aquatic bird communities in Kamo River and local geo, eco and socio (GES) environment systems. As Kamo River is the main urban river in Kyoto City it may be considered a focal point for local residents. In this study the aquatic bird communities were chosen as being one of the central ecological factors of the river ecosystem. The objective of this research is to clarify the following three issues of aquatic bird species: (1) structural factors of their habitat, (2) distribution characteristics and (3) feelings of riverside residents towards them. The above three resolutions create some objectives and boundary conditions for urban social and ecological environment management.

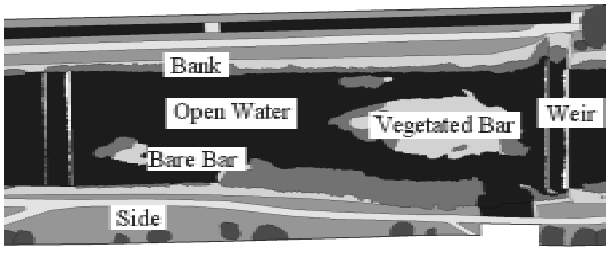
2. QUANTIFICATION OF BIRD HABITAT, BIRD COMMUNITY AND LOCAL RESIDENTS OPINIONS

The research area was established from Kamo Bridge to Sanjo Bridge in Kamo River, Kyoto City. The area was divided into eight sections using the weirs as a border. In section one the uppermost edge of the section was defined based on the position of the delta tip where Kamo River and Takano River merge.

a) Quantification method

The quantification method is introduced in three parts; first the habitat and second the bird community and third a social survey. This method is seen as a survey process of Systems Analysis approach methodology for water resources and environment management system.

b) Environmental quantification method



Open Water: water within the river channel

Weir: area from top step to bottom step of weir

Vegetated Bar: bar structure covered with vegetation

Bare bar: bar structure without vegetation

Bank: concreted, inclined area leading into river channel

Side: flat area alongside the bank

Figure One. A schematic map of six main habitat categories in a section of Kamo River.

Aerial photographs and GIS data were taken of the study sites on 9th October 2006. Using this data six habitat categories likely to be required by the aquatic bird species were selected (Figure One). Measurements of each of the habitats were made using the GIS software ArcMap

c) Bird Community quantification method

Bird community observations were made from 10th June 2006 to 27th May 2007 from the river side in each section either using the naked eye or binoculars. The site was surveyed 15 times. Using maps of each section records were made of the location of each individual or group of birds found on the river, the species and number of individuals.

d) Social quantification method

In November 2006 a survey was undertaken of residents of Suemarucho to discover their feelings towards the Kamo River environment, especially considering their likes and dislikes.

3. EXAMINATION OF RESULTS AND DISCUSSION

a) Geographical characteristics of Kamo River

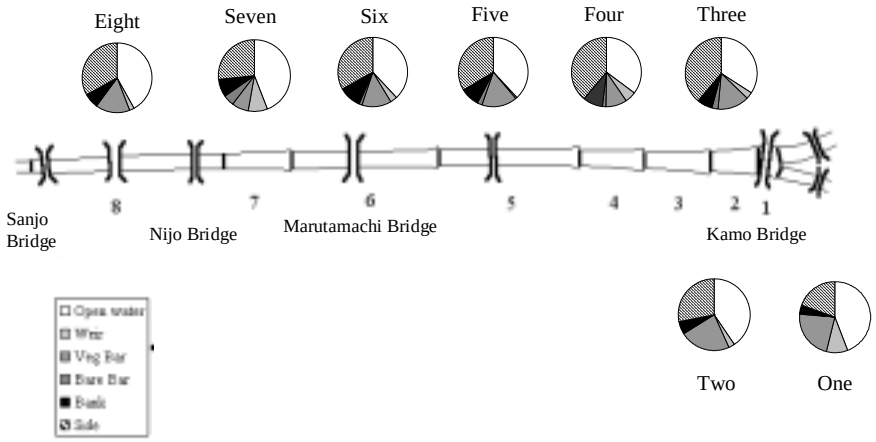


Figure Two. Schematic map showing proportion of six main habitat categories in each section

The composition of each section is different (Figure Two). Section 1 has the smallest total area and has a smallest proportion of side (19%) and bank (4%). Section 7 had the largest proportion of bare bar structures (5%), in comparison sections 2 and 8 had no bare bar. Section 7 had the smallest proportion of vegetated bar (7%). Sections 1 and 2 had the largest proportion of vegetated bar structures (22% and 23% respectively). The proportion of weir varied from 1% in section 5 to 10% in section 1. Finally, the proportion of open water varied from 34% in section 3 to 44% in both sections 1 and 7.

b) Distribution patterns of bird community

There were two distinct bird communities, the residential birds which were present throughout the year and the migratory species which were present only in winter. The number of residential birds did not vary significantly between the seasons when migratory birds were present or not (Figure Three). Thus most of the seasonal changes in numbers of birds were due to variations of migratory species. There was an increasing abundance of individuals in the lower sections with both the residential and migratory species with the exception of section 7 which is shorter in length.

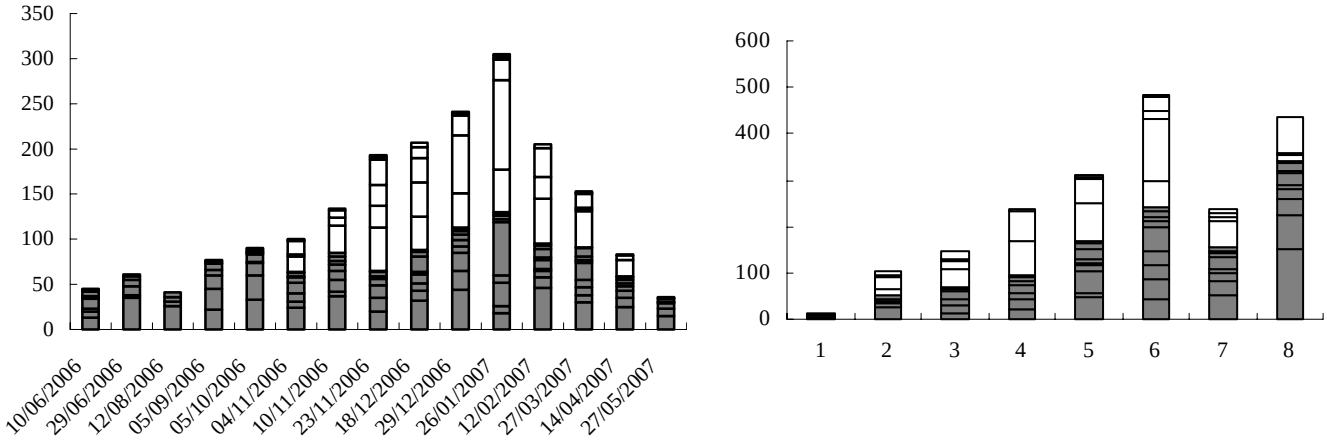


Figure Three. The distribution of bird communities in relation to time period and section number with the number of birds on the Y-axis. Each division of the bars shows a species. Shaded sections are residential species and un-shaded sections are migratory species.

c) Relationship between bird communities and habitats

We considered the habitat requirements of species that were recorded more than 20 times during the research period (Table one).

	Weir	Open Water	Veg Bar	Bare Bar	Bank	Side
Wigeon	31	342	58	6	61	0
Mallard	21	332	44	31	0	1
Spot-billed duck	6	172	27	33	0	0
Pintail	13	141	1	12	0	0
Green-winged teal	88	32	0	0	0	0
Little egret	39	101	41	13	3	0
Great white egret	16	22	13	0	1	0
Gray heron	24	36	36	13	1	0
Black-crowned night heron	14	2	1	4	8	0
Japanese wagtail	17	28	14	24	30	15
White wagtail	1	8	3	12	8	5
Black-headed gull	125	432	1	0	0	0

Table One. The habitat usage of each species recorded more than 20 times in the research period.

(1) Ducks: Most duck species, with the exception of green-winged teal, were mostly found in open water. The green-winged teal was the only species mostly found in weir. The second most favourite habitat for ducks was vegetated bar. Spot-billed ducks, mallards and pintails were also found largely on bare bar structures. All duck species were found in the weir area but only wigeons were recorded on the bank. This shows a widespread usage of different habitats by different duck species.

(2) Herons: Little egret and great white egret all showed a preference to open water. Gray heron showed an equal usage of open water and vegetated bars which was the second favourite habitat used by little egret. Both had used weir as third favourite. The second most used habitat structure for the great white egret was weir followed by vegetated bars in third. The black-crowned night heron was mostly found in the weir and then on the bank structures. We hypothesize the difference is due the the shorter leg length of this bird which makes it unsuitable for standing in the river channel.

(3) Wagtails: Japanese wagtail showed a wide usage of habitats being found in abundance in all six habitat categories. Its main usage was bank then open water then bare bar. White wagtails were mostly found in bare bar then bank then open water. In comparison to the other aquatic bird species the wagtails move from place to place rapidly, which is reflected in their wide usage of different habitats.

(4) Black-headed gulls: These were largely found in open water and weir. As this species nests at a different site they are only found at Kamo River during the daytime for feeding.

d) Comparing the abundance of bird species with likes and dislikes of local residents

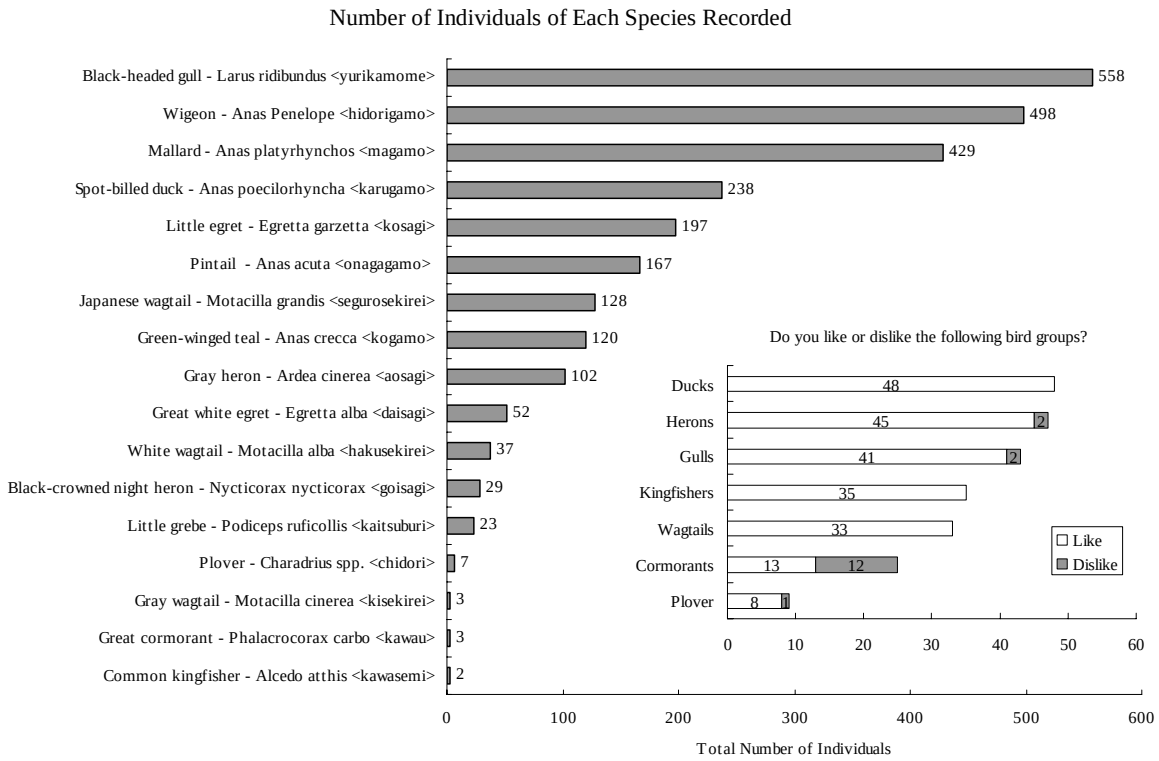


Figure Four. Number of Each bird species recorded and Results of Social Survey (inset)

Finally we will consider the viewpoint of riverside residents towards the Kamo River environment and the bird communities. The social survey showed that local residents are happy to live near Kamo River (60 agree, 0 disagree) indicating it is seen as a positive environment overall.

The most common species recorded were black-headed gull and wigeon (Figure Four) which are both migratory species. There were 5 species of duck (wigeon, mallard, spot-billed duck, pintail and green-winged teal), as a group they comprised 52% of individuals recorded. Local residents also showed the most interest in ducks (48 likes, 0 dislikes). The heron group comprised 4 species (little egret, gray heron, great white egret and black-crowned night heron), as a group they comprised 14% of individuals recorded. Local residents also showed a lot of interest in herons (45 likes, 2 dislikes). The wagtail group comprising 3 species (Japanese wagtail, white wagtail and gray wagtail) comprised 6% of individuals. They were also viewed favorably (33 likes, 0 dislikes). Excluding these groups the rarest species recorded were common kingfisher and great cormorant with 2 and 3 individuals recorded respectively. Despite being rare the local residents showed a lot of interest in these species viewing the kingfishers favorably (35 likes, 0 dislikes) but with mixed opinions of cormorants (13 likes, 12 dislikes).

e) Comparing the river environment with the likes and dislikes of local residents

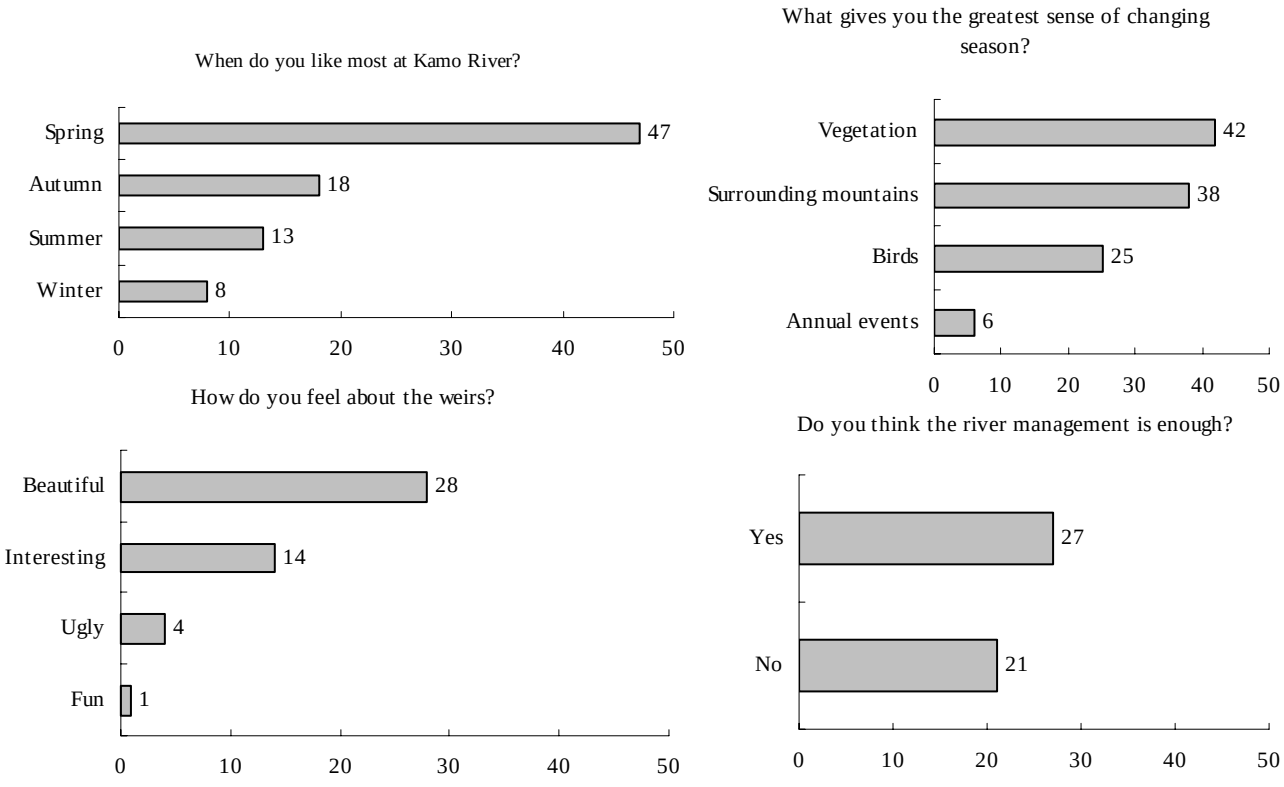


Figure Five. Feelings of riverside residents towards the Kamo River environment.

Riverside residents ranked birds as the third most common feeling of seasonal change (Figure Five). This is consistent with our ecological survey as the aquatic bird species showed a large change between seasons as a result of winter migratory species. However the riverside residents said their favorite season was spring. This is

the season when aquatic birds are fewest. Winter which has the most abundant numbers of birds and species was the least favorite season. This shows while the residents showed an interest in birdlife there are other factors which influence their feelings more towards the riverside as a whole.

Overall the riverside residents responded positively to the weirs. Most felt the weirs were beautiful or interesting with only 2 respondents saying they were ugly. As the weirs were used as a habitat by many bird species this result shows an agreement between social perspective and ecological perspective from the viewpoint of birds. Slightly more than half the residents felt riverside management was enough but a significant number felt it was not enough (27 agree, 21 disagree). As such we can say many residents have a desire for greater riverside management.

4. CONCLUSIONS

Until now environmental management research took on a natural scientific approach and a social scientific approach which were used separately. This research combines two approaches: the distribution of bird communities in respect to habitat distribution and a survey of local residents focusing on contact points of socio and eco riverside. The riverside residents have mostly positive feelings towards aquatic birds. They have a lot of interest in abundant bird species and like them. Not only that but they also had a lot of interest and positive feelings towards migratory birds and rare bird species. This shows for local residents the presence of these birds increases the value of the riverside environment.

The Kamo River environment, despite having artificial flood control structures such as weirs and concrete banking, supports a large aquatic bird community which is mostly seen favorably by the local residents. These weirs and banking are seen favorably by the local residents not just from perspective of flood control but as adding beauty to the riverside environment and are often used as a habitat by the bird communities.

However many residents feel the riverside management is not adequate. This reflects dissatisfaction with other aspects of the riverside environment. As current management practices have created a mostly positive environment for the bird communities we must consider what impact changes in management may have on aquatic bird communities and their habitats in the future and how this relates to the social system.

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