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Visitation Aspect of Common Goldeneye (*Bucephala clangula*) in the Nakdonggang Estuary, Busan, Korea

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Abstract: This study was conducted around Nakdonggang Estuary located in Busan. The study aimed to figure out current state by conducting long-period monitoring of common goldeneye (*Bucephala clangula*) around Nakdonggang Estuary where surrounding environment is rapidly changing. The data recorded in the early 1990s (May, 1989~April, 1993) and in the mid-2000s (May, 2002~April, 2008) were compared and analyed. A total of 1,563 common goldeneyes were observed around Nakdonggang Estuary during the study period (total 10 years). It was shown that there was no significant difference in the visitation aspect during the early 1990s and the mid-2000s in monthly analysis of the visitation aspect of goldeneye($P>0.05$), but the number of common goldeneyes was higher in the mid-2000s (mean=241.67) than that in the early 1990s (mean=28.25). In the comparison of annual average number of common goldeneyes during the early 1990s and the mid-2000s (May~next April), it was shown that there was significant difference between December and January ($P<0.05$), and there was no significant difference during February~November. In the current state by each region, the average number of common goldeneyes was 48.33; 26.17 in Daema-deung (DMD), 1.50 in Jangja and Sinjaso (JJ and SJD), 82.33 in Saja and Doyo-deung (SJ, DYD), 62.00 in the south end of Ulsukdo (LUD) and 69.67 in Ulsukdo (USD). There was highly significant difference among regions ($P<0.01$). The common goldeneyes tend to use the upper and lower part of Noksan floodgate of Seonakdonggang (west branch of Nakdonggang) where the flow of water is smoothly, the river is wide and the water is relatively shallow due to extension construction of Noksan floodgate. In addition, as development in the west area of Busan due to construction of a new port and designation as the Free Economic Zone has harmful influences to the local ecosystem in Nakdonggang Estuary, it is under an urgent condition to prepare for the maintainance and preservation the ecosystem in this area.

Keywords: The early 1990s, the mid-2000s, Long period monitoring, Significant difference

Introduction

Due to population growth, the number of natural wetlands is decreasing globally (Czech and Parsons, 2002), and accordingly, living things which live in the wetland as their habitat have many difficulties in survival and breeding due to decrease in the number of habitats. This is one of reasons for preserving wetlands. On one hand, an estuary is a place where river water meets with seawater and many living things live, and its importance is increasing under current situation where the number of wet lands is decreasing.

Nakdonggang Estuary is located in the southernmost tip of the Korean Peninsula, and a place which many birds visit. *Sterna albifrons* and *Charadrius alexandrines* breed in this place in summer, the breeding season, and longbills and plovers stay here temporarily while moving north for breeding or moving south from the breeding place to wintering pond in spring and autumn, and swans, wild geese and ducks stay here for passing over the winters in winter (Hong SunBok and Lee InSeop, 2012a).

Bucephala spp. observed around Nakdonggang Estuary is the 1st species common goldeneye (*Bucephala clangula*). Existing studies on this common goldeneyes are almost about breeding (Ruusila *et al*., 2001; Pöysä and Pöysä 2002; Milonoff *et al*., 2002; Milonoff *et al*., 2004), and some studies on spatial distribution and habitat selecting (Ouellet *et al*., 2010) have been conducted, and as for studies on Nakdonggang Estuary, there are only some studies on long-term visitation state of *Anas* spps. and changes in visitation aspect of *Aythya* spp., and there is no study on common goldeneyes reported.

It is thought that long-period monitoring of the common goldeneyes and figuring out its visitation aspect has an important meaning for their constant visit to this place according to changes in surrounding environment and water level in the habitat.

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This study aimed to figure out the changes in visitation aspect of *Aythya* spp. around Nakdonggang Estuary by comparing and analyzing data from the early 1990s and the mid-2000s.

Study Method

This study calculated the number of common goldeneyes (the number of the most common goldeneyes observed is considered the number of the month) by conducting a survey 1~3 times per month during the early 1990s (May, 1989~April, 1993) and 1~2 times per month during the mid-2000s (May, 2002~April, 2008) in the whole areas of Nakdonggang Estuary. Survey period is shown in Table 1.

The study areas were divided into the center of Seonakdonggang and the end of Myeongji, and Doyo-deung and Sinja-do vertically and Daema-deung, the upper part of Mulgol where small-sized boats move around between Daema-deung and Jangjado, and Jangja, Sinja-do, the lower part horizontally. The upper part of small Mulgol crossing the upper part of Sajado is the south part of Ulsuk-do, and the lower part is Saja (Baekhap), Doyo-deung, and a mudflat appearing in low water in the lower part of Ulsuk-do and Jangrim Sewage Treatment Plant. Based on this division, Ulsuk-do and the south part of Ulsuk-do was divided into 5 areas; 1) Daema-deung; 2) Jangja, Sinja-do; 3) Saja, Doyo-deung; 4) south part of Ulsuk-do; and 5) Ulsuk-do (Fig. 1).

The study used both a strip transect method to observe study targets in an unaided eyes or with binoculars (35×8, Nikon) by moving along the fixed route in a small-sized boat and a point census method to examine the study targets in a barge or using a telescope (Fig. 1). Line transect census (Bibby and Burgess, 1992) and the point census method were used in Ulsuk-do. All number of the common goldeneyes observed in an unaided eyes or using binoculars or a telescope was recorded. Most of the numbers of observed targets were expressed as the sum of observed targets during the survey period. In the statistical analysis, Mann-Whitney U test was used for monthly comparison between the two groups and Kruskal-Wallis test was used for comparing the number in each area.

Table 1. Period of survey in the Nakdonggang Estuary (10 years)

Times	Period of Survey
1	May 1989 - Apr. 1990
2	May 1990 - Apr. 1991
3	May 1991 - Apr. 1992
4	May 1992 - Apr. 1993
5	May 2002 - Apr. 2003
6	May 2003 - Apr. 2004
7	May 2004 - Apr. 2005
8	May 2005 - Apr. 2006
9	May 2006 - Apr. 2007
10	May 2007 - Apr. 2008

Result

Current Conditions

The number of common goldeneyes observed in Nakdonggang Estuary during the study period (total 10 years from May, 1989 to April, 1993, and from May, 2002 to April, 2008) was 1,563.

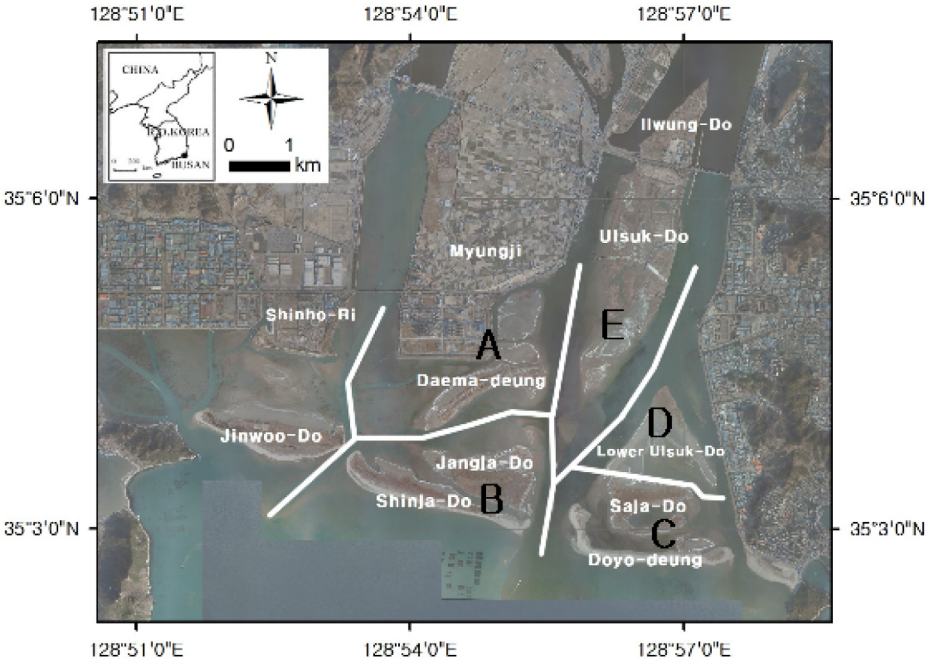

Fig. 1. Study area in Nakdonggang Estuary. The survey period between May 1989 and April 1993, and from May 2002 to April 2008.