Habitat selection of Bewick's swans in the rice crop land of the Yasugi plain

Yoshiharu Nagano

Nakanoumi Waterbirds International Exchange Foundation.
Yonago Waterbird Sanctuary, Hikona Shinden 665, Yonago City, Tottori Pref 683 Japan
E-mail:XLY01344@niftyserve.or.jp

Introduction

Bewick's swan(Cygnus columbianus bewickii) in the winter is distributed over both Europe and eastern Asia(Atkinson, Horiuchi, Won 1980). In Japan there ar many examples of Bewick's swan eating cereal in farm land after rice has beem harvested (Nagano 1997).
The rice crop is the staple crop of eastern Asia. However, there has been little examination of the Bewick's swan's selection of rice land as its habitat. So it is necessary to examine how the rice farmer and the Bewick's swan can co-exist. This report investigates quantitat ively the habitat selection by Bewick's swan in the rice crop land.

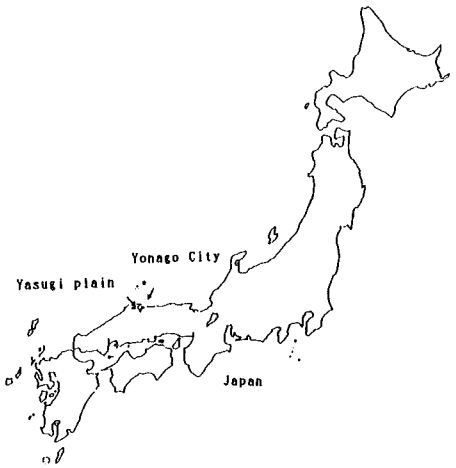

Fig 1. The Yasugi Plain. The investigation was comducted on the Yasugi Plain in Yasugi City, Simane Prefecture, Japan(35° 24´N, 133° 14´E). About 1,000 Bewick's swan(Cygnus columbianus bewickii) are in the winter is distributed over the Yasugi plain.

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Investigation site and method

The investigation was comducted on the Yasugi plain in Yasugi City, Shimane Prefecture, Japan(35° 24′ N, 133° 14′ E) on 26 days between November 1996 and February 1997. Data was collected four times on each investigation day. Bewick's swans on the Yasugi plain use Yonago Waterbird Sanctuary park as a roost and spend the day time on the Yasugi plain. On the Yasugi plain in winter time there is some snow but few times when the temperature falls below freezing (Nagano 1997). The investigation site is a flat area of 2500ha. The site was divided into eight possible habitats:brush land (4%), Damp ground (0.1%), secondary growth of rice land (2.7%), post-harvest field (78.7%), grass land (3.3%), cultivated land (0.4%), farm land (1.2%), and other land (9.3%). The investigation recorded the number of Bewick's swans observed in each habitat and what action the swans were Performing. The action of the Bewick's swans were classified into five catagories:foraging, preening, roosting, head-up, and other actions.

Artificial variables and their influence on habitat selection were also examined. The investigation was the Yasugi plain, (35° 24′ N, 133° 14′ E) on 6 days between November 1995 and February 1996 and on 14 days between November 1996 and February 1997. These variables included: the distance the swan maintained from an object which interrupted its sight (these included geographical barriers such as riverbanks, etc.), the distance maintained from nearest house, the distance maintained from the nearest road, the width maintained from the nearest road, the volume of traffic on the nearest road, and the distance maintained from the nearest electrical wires. Discriminant analysis was conducted at 20 areas to which Bewick's swans came flying and 20 areas where no swans were found, all ramdomly chosen.

Results

1) The actions of Bewick's swans on the Yasugi plain

Foraging was the most common action of the Bewick's swan. Head-up was the second-most common action, preening was third, and roosting was fourth.

2)The habitat selection

As for the habitat which Bewick's swans chose in November, post-harvest field was chosen by 50.9% of the swans, secondary growth of rice land by 48.4%, damp ground by 0.6%, brush land by 0.06% and grass land by 0.03%. They avoided post-harvest field, marsh land, brush land, and grass land, preferring secondary growth of rice land (Chi-square test, $p < 0.001$). As for the habitat which Bewick's swans chose in December, post-harvest field was chosen by 95.0% of the swans, secondary growth of rice land by 4.8%, brush land by 0.04%, grass

land by 0.03%, damp ground by 0.02% and cultivated land by 0.01%. They avoided brush land, grass land, marsh land, coltirated land, preferring secondary growth of rice land and post-harvest fields(Chi-square test、 $p < 0.001$).

As for the habitat which Bewick's swans chose in january, post-harvest field was chose by 98.6% of the swans, damp ground by 0.6%, grass land 0.5%, secondary growth of rice land by 0.1%, brush land by 0.05% and cultivated land by 0.02%. They avoided marsh land, grass land, secondary growth of rice land. brush land, preferring post-harvest land (Chi-square test、 $p < 0.001$).

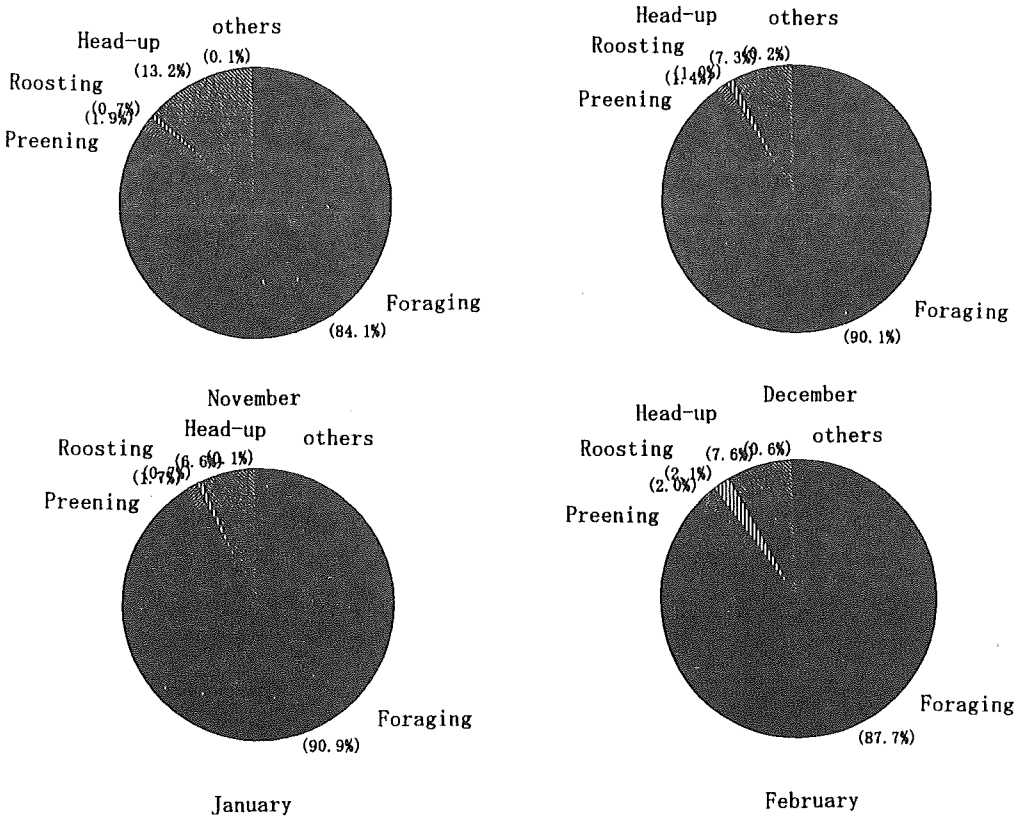

Fig 2. The actions of Bewick's swans on the Yasugi plain. Foraging was the most common action of the Bewick's swans.

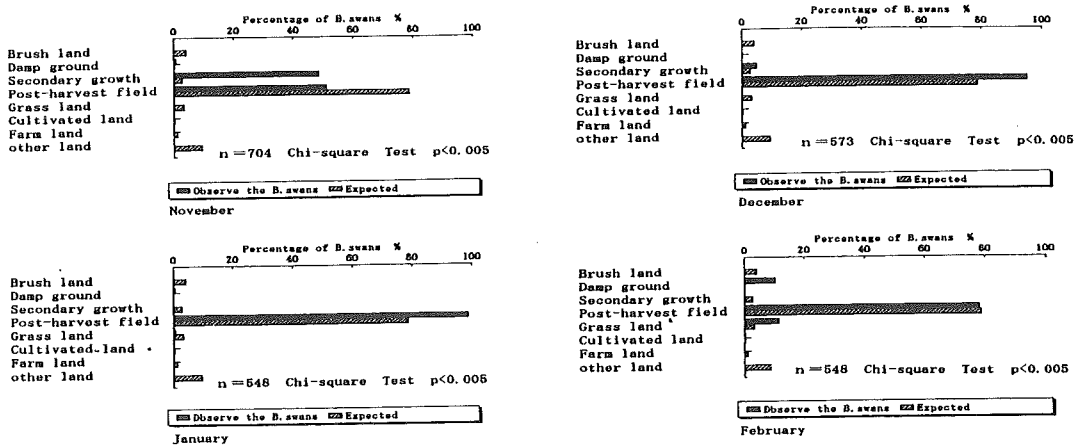

Fig 3. The habitat selection. The site was divided into eight possible habitats: brush land, damp ground, secondary growth of rice, post-harvest field, grass land, cultivated land, farm land, and other land.

As for the habitat which Bewick's swans chose in February, post-harvest field was chosen by 78.1% of the swans, grass land by 11.4%, damp ground by 10.3%, cultivated land by 0.1%, secondary growth of rice land by 0.06%, and brush land by 0.03%. They avoided cultivated land, secondary growth of rice land, brush land, preferring marsh land, post-harvest fields, and grass land (Chi-square test、$p < 0.001$).

Table 1. The artificial influence. Discriminant analysis was conducted at 20 areas to which Bewick's swans came flyind and 20 areas where no swans were found, all ramdomly chosen.

Explanatory variable	Coefficie	t value	F value	p value
The distance maintained from the nearest road(m)	0.01977	1.75708	3.08733	0.08765
The volume of traffic on the nearest road(n/h)	-0.0311	-3.1864	10.153	0.00303
Distance maintained from the nearest electrical wires(m)	0.00378	2.41973	5.85509	0.02086
The distance the swan maintained from an object which interrupted its sight(m)	0.00352	3.69032	13.6185	0.00076
Constant value	-0.9241			

3) The artificial influence

The number of explanatory variable was four. The distance maintained from nearest house and the width maintained from the nearest road didn't suit explanatory variable. The F value of artificial variables and ther influence in habitat selection occurred in this order: the distance the swans maintained from objects which interrupted their sight, traffic uolume on the nearest road, the distance maintained from the nearest road, and the distance maintained from the nearest electrical wire. In each case, the F value was large.

Conclusion

Bewick's swan on the Yasugi plain was eating the cereal of the rice (The falls rice in post-harvest fields and secondary growths of rice). Bewick's swan in November through January was choosing the habitat where the cereal was easy to eat. In February, it was choosing the habitat where it was easy to eat green plants in addition to the cereal. This resembles the case of the Whooper swan (Cygnus Cygnus Cygnus) in England on which Brazil reports (Brazil 1980). The Bewick's swans tend to avoid electrical wires, objects which interrupt their sight and stay away from roads with heavy traffic volume.

In England, the Mallard (Anas Platyrhynchos) and Greylag goose (Anser Anser) now eat potato-their diets having changed with the change of agricultural farming methods and machanization (Brazil 1980). Whooper swans, too, now eat potato after a very severe winter in the 1940s (Brazil 1980). It is possidle that birds which eat cereal in the agricultural land in the eastern Asia area, are increasing. As the efficiency of argricultural macinery improves, little of the fallen rice ear remains on the ground. When the fallen ear becomes rapidly scarce, the birds' bait is lacking. Agriculture doesn't change rapidly but when it does, it is difficult for the birds which are accustomed to eating the fallen ear of rice to adjusting their eating habits and trouble between the bird and the farmer occors.

When the population distribution of a species of birds centers in one place, like the example of Izumi city, Kagoshima, Japan, the trouble occurs between the crane and the agricultural community (Osako et al 1989). The maintenance of more suitable bird habitat should disperse distribution as much as possible and would be beneficial for both the farmer and the waterfowl (Nagano et al 1992, 1994).

Summary

This report investigates quantitatively the habitat selection by Bewick's swan in the rice crop land. Bewick's swan on the Yasugi plain was eating the cereal of the rice (The falls rice in post-harvest fields and secondary growths of rice). Bewick's swan in November through january was choosing the habitat where the cereal was easy to eat. In February, it was choosing the habitat where it was easy to eat green plants in addition to the cereal. The Bewick's swans tend to avoid electrical wires, objects which interrupt their sight and stay away from roads with heavy traffic volume.

要　約

この報告は，1997年９月にモンゴル，ウランバートル市で開催された International Workshop on Wetland Conservation in MONGOLIA and NORTHEAST ASIA(北東アジア及びモンゴル湿地保全国際会議)

で使用したものの一部である。

島根県安来平野において、1995年11月～1997年２月に26日コハクチョウの稲作農地における環境選択性について、1995年11月～1997年２月に14日人工物とコハクチョウの環境選択の関係について調べた、コハクチョウの行動を採食行動、羽づくろい、寝る、頭上げ、その他の行動の５つに分類して調べた。11月～２月までいずれの月も稲作農地での行動は、採食行動が最も多かった。稲作農地におけるコハクチョウの環境選択は、採食のために行われるものと思われる。稲作農地の環境をヤブ、湿地稲の二番穂、刈田、草地、耕作地、畑地、その他に分類して調べた。コハクチョウの環境選択は期待値の割合と異なっており，11月は二番穂、12月は二番穂と刈田、１月は刈田、２月は湿地と草地でそれぞれ有意に期待値を上回っていた。

人工物とコハクチョウの環境選択の関係について、ランダムに選出したコハクチョウが居た地点20ケ所と居なかった地点20ケ所について調べた。変数は、それぞれの地点から最も近くにある視界を遮る物体との距離（m）、最も近い家からの距離（m）、最も近い道路の交通量（n／h）、最も近い道路との距離（m）、最も近い道路の幅（cm）、最も近い電線からの距離（m）を使用し，判別分析を行った。結果は最も近い視界を遮る物体との距離，最も近い道路の交通量，最も近い電線との距離，最も近い道路との距離の順でF値が大きかった。最も近い家との距離と最も近い道路の道幅は説明変数として使用することは不適切であった。

以上の結果よりコハクチョウは稲の二番穂の生える環境や刈田の環境を好んで選択し，２月には湿地と草地の環境を好んで選択しているものと思われる。コハクチョウの環境選択に視界を遮る物体，道路の交通量，電線，道路との距離の順で影響を与えているものと思われる。

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