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Ecology of Otters and Utilization of Artificial Holts in the Ecosystem Conservation Region of the Seomjin River

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Abstract - The purpose of this study was to ascertain the prey composition and utilization of the Eurasian otter, *Lutra lutra*, in the ecosystem conservation region of the Seomjin River. The study was conducted for a 12-month period from March 2003 to February 2004 by spraints analysis and an investigation using artificial holts. We found seasonal variation in the number of spraints and composition of prey items. Fish were the main prey items throughout the period (82%), and other prey items included birds (14%), amphibians (2%) and arthropods (1%). In addition to prey identification, we investigated habitat utilization by otters through spraints distribution. The traces of otters were discovered in five of the six total artificial holts. However, the utilization of the artificial holts in the study area seemed to be limited as evidenced by the low frequency of traces in the holts.

Key words : Eurasian otter, prey composition, artificial holt, Seomjin River

INTRODUCTION

The Eurasian otter, *Lutra lutra* L., a member of the family *Mustelidae*, is a semi-aquatic mammal that is distributed along most of the river systems and seashores in Korea (Wilson and Reeder 1993; Nowak 1999). However, Korean otter populations have decreased drastically in recent years and, therefore, the Korean government designated the Eurasian otter as a Natural monument in 1982 and an endangered species in 1998 (Won and Smith 1999). In particular, the Seomjin River was designated as an ecosystem conservation area for otter in December 2001, and there have been intensive efforts for otter conservation, such as the construction of artificial otter holts. Nevertheless, there has been no research on the basic ecology of otters in the conservation area of the Seomjin River and no verification of their use of artificial holts.

In the United Kingdom, artificial otter holts have been constructed along the developed river systems and used for observing and photographing otters, as well as providing them with shelter (Aquarium of the lake 2003; Earthwatch 2004; Cannonfarm 2004). Researchers in the U.K. have used various materials and forms in constructing artificial holts, such as log files and cement blocks. However, Kruuk (1995, 1998) has claimed that prey is more important than holt availability as a factor limiting otter populations. Regardless of their relative importance, both prey and holts are necessary for otter conservation (Mason and Macdonald 1986).

Artificial otter holts were first tested in Korea in the Seomjin River and they were very expensive to construct.

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Despite the construction of the holts, there has been no research on otters in the conservation area. Although the area was designated as a conservation area, evaluation criteria and the essential ecological knowledge for otter conservation are still unavailable.

The purpose of this study was to provide basic information on otter ecology, such as their spatial distribution and prey composition in the Seomjin River conservation area and their utilization of artificial holts. Therefore, we hope that this study will be the foundation of otter conservation in the Seomjin River conservation area and in all of Korea.

1. Study site

The survey site was located in Masan-myon and Toji-myon of Gurye-gun, Jolanam-do, and this site included the ecosystem conservation area (Fig. 1). The conservation area was designated on 1 December 2001, and the size was 1.83 square kilometers. For this study, six artificial holts were constructed and villagers were paid not to fish in 2004. The

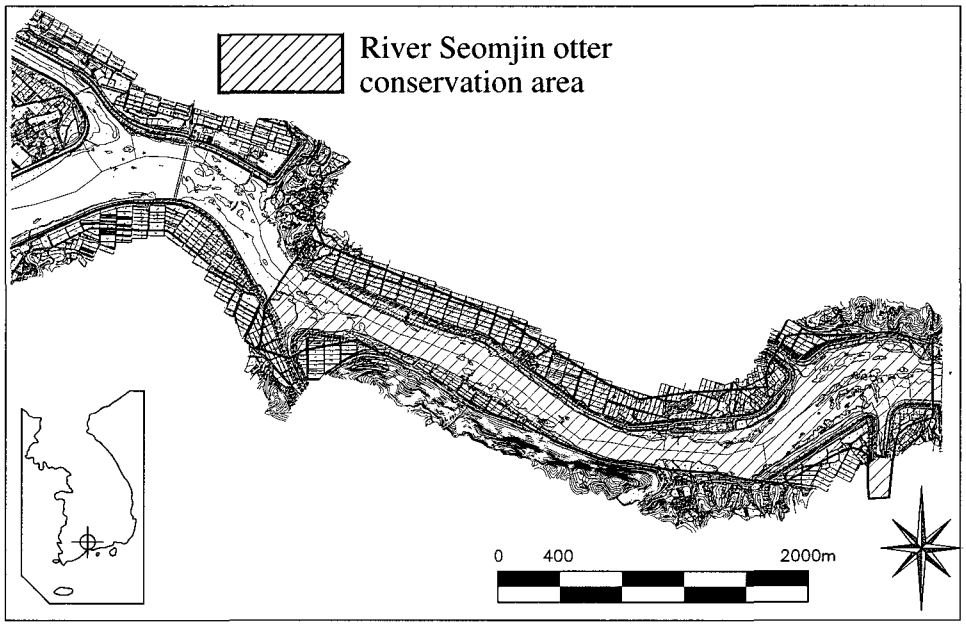

Fig. 1. Study area.

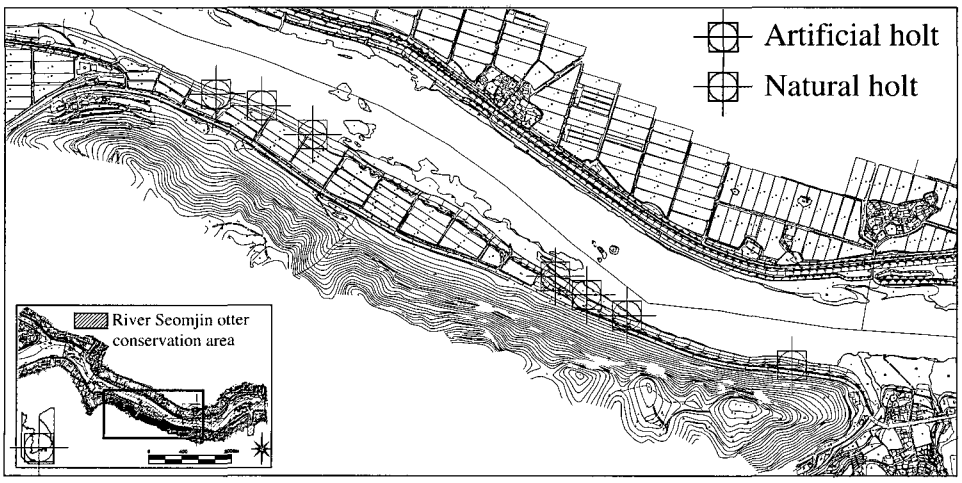

Fig. 2. Location of artificial and natural otter holts in the study area.

northern river bank was covered with a concrete embankment, and no natural habitat remained. However, the southern bank was preserved as a natural area with reeds, shrubs, rocks and bogs. A local road ran along the southern bank, but the road was close to the water only along the eastern part of the river. The width of the river ranged from 40 m to 100 m, and the average flow rate was <1 m per second.

Vegetation types were divided into willow, *Salix gracilistyla*, bamboo, *Phyllostachys bambusoides*, and reed, *Phragmites communis*. To prevent floods, trees near the water have been removed regularly to maintain river flow, and farmers have burned weeds along the northern bank for their agriculture.

Zacco species were the most common fish, and relatively big fish, such as *Hemibarbus labeo* and salmon, *Oncorhynchus keta,* were not rare (Kim and Yang 2002). In addition to fish, black-spotted pond frogs, *Rana nigromaculata*, and tiger keel back snakes, *Rhabdophis tigrinus*, were abundant.

Six artificial otter holts were constructed in January 2002, with three in each of two sites. One site was below a rice field and the other was along a rocky cliff (Fig. 2). The artificial holts in each site were located close together ($<$ 100 m spacing) and in a row. Each holt was made of rock and cement and had three rooms inside with one entrance (Fig. 3).

MATERIALS AND METHODS

Spraints, footprints, and other signs were surveyed along the study site from February 2003 to February 2004. To verify the use of artificial holts, we scanned inside them and interviewed local conservation area observers and villagers. To prevent multiple counts, each otter sign in and around the artificial holts was counted and then removed. Each of the individual spraints was collected in a polyethylene zipper bag, which was labeled with the date and locality. The samples were stored at $-20°C$ for subsequent analysis. The analysis of spraints followed the method of Jacobsen and Hansen (1996), and prey items were classified at the class level (e.g., Class Mammalia). The occurrence of a particular prey category was expressed as a percentage of the total number of occurrences in a sample, with the sum of all occurrences being 100%. Since the spraints in February 2003 might have included spraints before then, we excluded the data collected in February 2003.

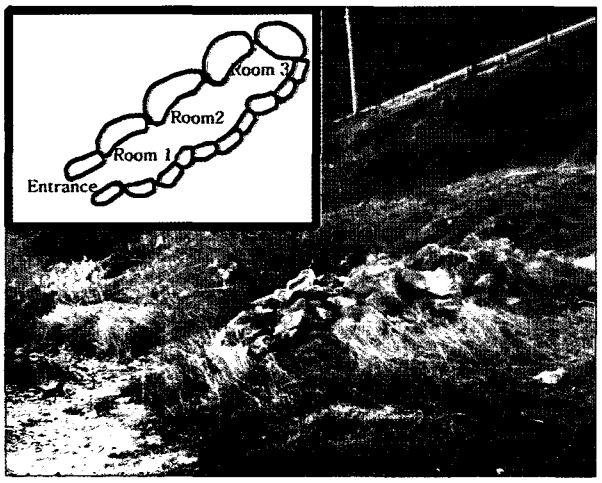

Fig. 3. Artificial holt and its internal structure.

RESULTS

1. Seasonal variation in the number of spraints

From March 2003 to February 2004, a total of 1,201 spraints were identified in the study area along the Seomjin

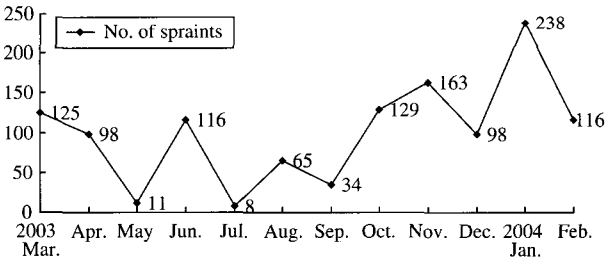

Fig. 4. Monthly variation of the number of spraints in study area.

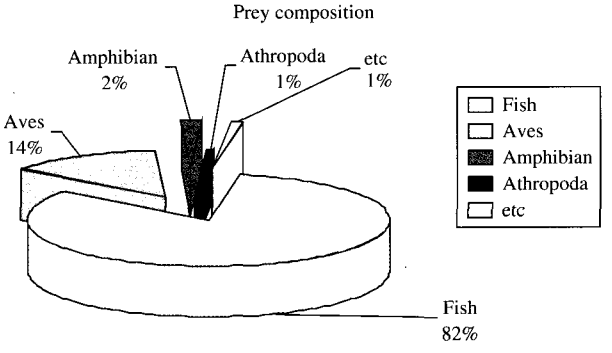

Fig. 5. Prey composition in spraints of study area.

River. The number of spraints was the greatest, at 238, in January 2004. On the other hand, only eight spraints were found in July 2003 (Fig. 4). The number of spraints fluctuated throughout the study period. However, the number was low from spring to autumn, while it increased continuously during winter except for December 2004.

2. Prey composition

A total of 1,201 spraints were analyzed for prey composition. Prey items consisted of fish (82%), birds (14%), amphibians (2%), insects (1%), and other items (1%). The other items included seeds, pieces of plastic, and unidentifiable objects (Fig. 5).

The composition of the otter diet fluctuated monthly. With fish as prey, the composition rate varied from 65% to 95%, and birds showed rates between 4% and 30%. The remaining items were not over 10% but amphibians exhibited rates of 7% during July and August 2003 (Fig. 6).

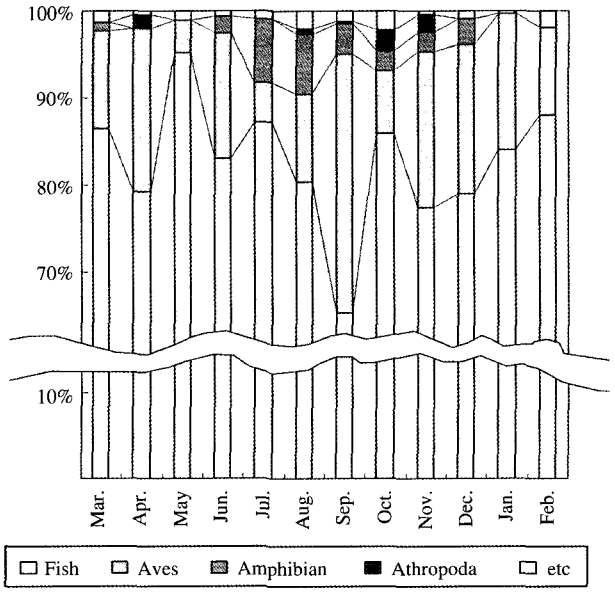

Fig. 6. Monthly variation of prey composition.

3. Use of artificial holts

We could identify otter signs in or around all artificial holts except holt 5. In holt 5, only one eating sign was found 10 m from the holt in January 2004. Signs were found inside holts 1, 2, 3, and 6 while there were spraints on the top of holt 4 in August 2003 (Table 1). In addition to otter signs, there were footprints of a raccoon dog, *Nyctereutes procyonoides*, in March and June 2003.

Table 1. Results of artificial holts investigation

	2003										2004	
	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.
Holt 1		F·S	S	S		S		F*			S	
Holt 2	S		S	S		S·F*			S		S	
Holt 3	S			F*		S	F·S					
Holt 4						S						
Holt 5											P	
Holt 6	F*					S					F*	F*

F: Footprints, S: Spraints, P: Prey remains, *signs identified inside of holt

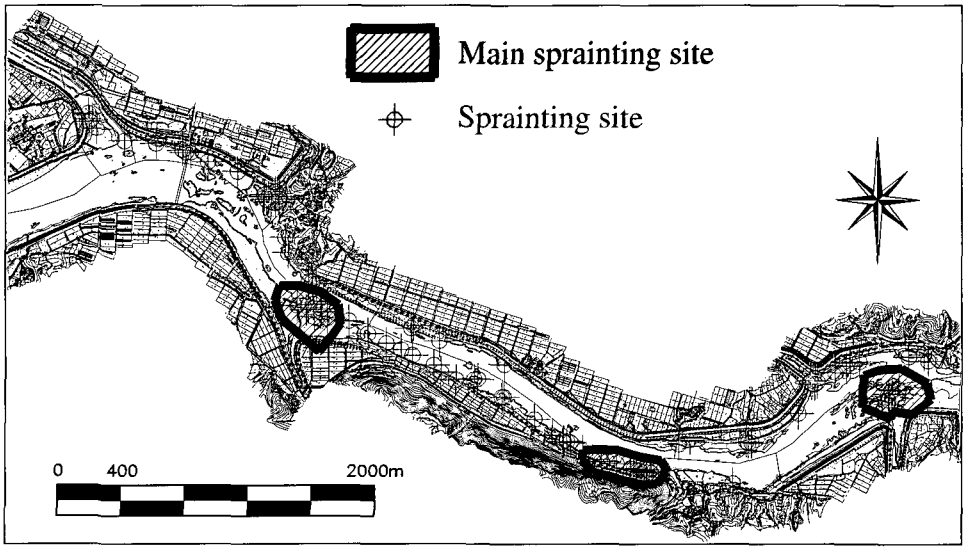

Fig. 7. Distribution of sprainting sites, which were defined as any places where spraints were deposited at least 1 m from other spraints.

4. Spatial distribution of spraints

Most of the spraints were found along the southern river bank and especially near the confluence and the rocky bank., A few spraints appeared along the northern concrete bank. The main sprainting sites were at the western and eastern confluences of the southern bank and around a natural holt in the rocky area (Fig. 7). During this study, spraints were identified on the main sprainting sites in every month.

DISCUSSION

In this study, we discovered the otter's prey use, the seasonal difference in the number of spraints, and the distribution along the conservation area by a spraints survey. In addition, we identified the use of artificial holts by otters at the study site. In Korea, artificial otter holts are first being tested for otter conservation, and the usage of holts needs verification before others are constucted in the future.

The differences in the number of spraints between summer and winter was similar to those observed in European studies and in other regions of Korea (Mason and Macdonald 1986; Macdonald and Mason 1987; Kruuk 1995; Won *et al.* 2002; Jo 2003; Won 2004). Excessive sprainting behavior in the limited season is thought to be scent-marking to prevent overlap of hunting territories during that season (Hutchings and White 2000). In this research, the number of spraints in the highest month was 30 times more than in the lowest month. In January 2004, the highest month, otter foraging was difficult because of ice. In June 2003, however, we gathered 116 spraints during the summer season. Since there was no replication in June 2002 or 2004, we can't say conclusively whether there was temporal augmentation without more survey. The low number of spraints in May and July 2003 might have been caused by heavy rains during the survey period. If rain was the reason for the low number of spraints before and after June 2003, the number in June 2003 might not be unusual.

Prey composition was more similar to that in other countries with climates similar to the study site than to other river sites in Korea. This study site was located in the southern part of Korea and has relatively warm climate even in winter. The conditions are similar to the Mediterranean climate, and prey composition was also similar in that fish were the highest proportion of prey (Beja 1996; Clavero *et al.* 2003). On the other hand, other rivers at high altitude and latitude exhibited relatively lower proportions of fish than in this study although fish were still the main prey item (Brzezinski *et al.* 1993; Jo 2003). Jo (2003) reported that fish were only three fourths of the total prey items and that they were $< 50\%$ in September 2002 on the Ungok River in Bonghwa-gun. The temperature seemed to affect prey composition of otters either directly or indirectly though abundance or diversity of prey species.

Prey utilization has been regarded as the most important limiting factor for otters (Kruuk 1995). During the research period, we found big fishes whose intestines alone were eaten selectively by otters. That means that providing prey at the study site was good during the survey period. However, the river systems upstream and downstream of the study site have been developed extensively, and that development also has had impact on the fish community. For the long term conservation of otters in this site, management of fish is necessary throughout the entire Seomjin River system as well as the small study site.

During the year survey period, four artificial holts had otter signs inside among the six holts and only holt 6 had more than two otter signs inside while the others had just one. There was no significance in the number of spraints between holts and other places. In addition to artificial holts, we found a natural otter holt in the study area, and therefore, we could compare its use by otters with that of the artificial holts. We found few otter signs among the artificial holts during the survey, and therefore, we conclude that otters did not use the artificial holts.

Indeed, since the study area provided a number of potential natural holts, there was no reason for the otters to use the artificial ones. In addition, radio telemetry research showed that otters spend a lot of time in the shrub community or reed bed rather than inside holts when resting (Green *et al.* 1984). In this survey, we saw otters several times in the marsh area with reeds and shrubs during the daytime. For the appropriate construction of artificial otter holts, we suggest first that it is necessary to ascertain whether the holt is the limiting factor in otter populations and second, if the holts are needed, that they are placed appropriately.

In addition, there was an economic problem with the artificial holts in the conservation area. The local government in Gurey-gun paid two hundred million won to cons-

truct them. In contrast, artificial holts have been made of inexpensive materials such as logs in the U.K. (Norman 2004).

In summary, the preservation of prey species and natural habitats is more important to otter conservation in the Seomjin River conservation area than the constructing of holts and holts must be placed correctly when they are needed (Caughley and Gunn 1996).

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