J. Raptor Res. 36(3):220–224

Post-fledging Movements and Foraging Habitats of Immature White-tailed Sea Eagles in the Nemuro Region, Hokkaido, Japan

Saiko Shiraki[1]
Graduate School of Environmental Earth Science, Hokkaido University, Sapporo, 060 0810, Japan

Key Words: *White-tailed Sea Eagle*; Haliaeetus albicilla; *post-fledging movement*; *foraging habitat*; *anthropogenic food sources*; *Hokkaido, Japan.*

In Far East Asia, Hokkaido is the southernmost breeding area for White-tailed Sea Eagles (*Haliaeetus albicilla*). A small number of White-tailed Sea Eagles breed in Hokkaido and are considered resident. Many White-tailed Sea Eagles, along with Steller's Sea Eagles (*H. pelagicus*), also winter in Japan, mainly in Hokkaido.

There are some reports on natal dispersal and movements of immatures for the European populations of White-tailed Sea Eagles (e.g., Helander 1980, Saurola 1981, Król 1983, Stjernberg and Saurola 1983, Meyburg et al. 1994). These authors reported that eagles mostly do not spend their first winter near their natal areas, and some immatures migrate long distances, exceeding 1000 km. However, similar information does not exist for these eagles in Asia. The objectives of this study were to monitor the movements of immature White-tailed Sea Eagles from natal areas and to determine their foraging habitats.

Study Area and Methods

The Nemuro region in eastern Hokkaido is mostly a volcanic plain less than 100 m in elevation. Annual mean temperature is 5.7°C and the climate is characterized by a foggy and cold summer, and by a dry and cold winter (Miyawaki 1988). The seacoast is sometimes covered by sea ice in winter. Marsh vegetation has developed around inland-bays and lakes (Miyawaki 1988). A mixed forest consisting mainly of Sakhalin fir (*Abies sachalinensis*) and birch (*Betula ermanii*) is found on the shore terrace, and a broad-leaved forest consisting primarily of Japanese alder (*Alnus japonica*) and Japanese elm (*Ulmus davidiana*) is distributed in the marshland (Miyawaki 1988). The plain was formerly covered with a broad-leaved forest dominated by oak (*Quercus mongolica*), but has been mostly converted to pasture (Takenaka and Ono 1995).

Twenty nestlings (4 wk of age) from eight nests in the Nemuro region were color-banded during 1992–95 (Fig. 1). Color bands were made of plastic, 2.5–3.0 cm high and the joint was glued with acetone. All individuals were marked with an unique combination of color bands. Nests were alphanumerically numbered (N1–N8) and nestlings were alphabetically coded (A–T). Eagles A–E hatched in 1992, F–L in 1993, M–O in 1994, and P–T in 1995.

Seven of these color-banded nestlings were also fitted with radio-transmitters. Two siblings, M and N in N4 were fitted with a 9.8 g tail-mounted transmitter in 1994. The transmitters broadcast at 144 MHz and had a battery life expectancy of 1.5 yr. An approximately 23.0 g leg-band type transmitter was attached to the tarsus of two siblings, S and T in N8, and Q in N4, P in N6, and R in N7 in 1995. Battery-life expectancy of these transmitters was 2 yr. All nestlings were returned to their nests immediately after banding and radio-tagging.

Monitoring of the nestlings in N4 were carried out by direct observations during June and July after attaching transmitters in 1994 and 1995. These observations were made at a distance of 800 m from the nest from dawn to dark at least every other day. To determine fledging day (the day of first flight) for each nestling at N4, the nest was observed every day starting on 26 June in 1994 and on 10 July in 1995. These observations continued until fledging. Radio-tagged fledglings were tracked upon departure from the natal areas. M and N were monitored at least once every three days during August, September, October, and December in 1994. Q was tracked during August and September in 1995.

In most cases, I monitored birds and nests weekly to determine departure days for the other fledglings in 1995. Departure day was defined as the day when a fledgling was gone from the natal area and moved to another location. When a fledgling could not be located on the day of its disappearance from the natal area, the departure date was recorded as the period from disappearance day to the day it was first relocated. When a fledgling disappeared from the place where it was relocated, the natal area was checked to determine if it had returned.

I made an attempt to locate color-banded immature eagles from autumn 1992 until March 1997 by opportunistic observations at likely foraging sites from Notsuke Bay to Nemuro Peninsula, including coastal areas, a lake, rivers, a bay, and a fish factory (Fig. 1), and by interviews with local residents. Regular searches were also conducted once or twice a month along a route that runs along the sea coast from Notsuke Bay to Nemuro Peninsula and

[1] Present address: Wildlife Section, Nature Conservation Department, Hokkaido Institute of Environmental Sciences, Kita-19 Nishi-12 Kita-Ku, Sapporo, 060-0819, Japan; present affiliation: Domestic Research Fellow, Japan Society for the Promotion of Science; e-mail address: shiraki@hokkaido-ies.go.jp

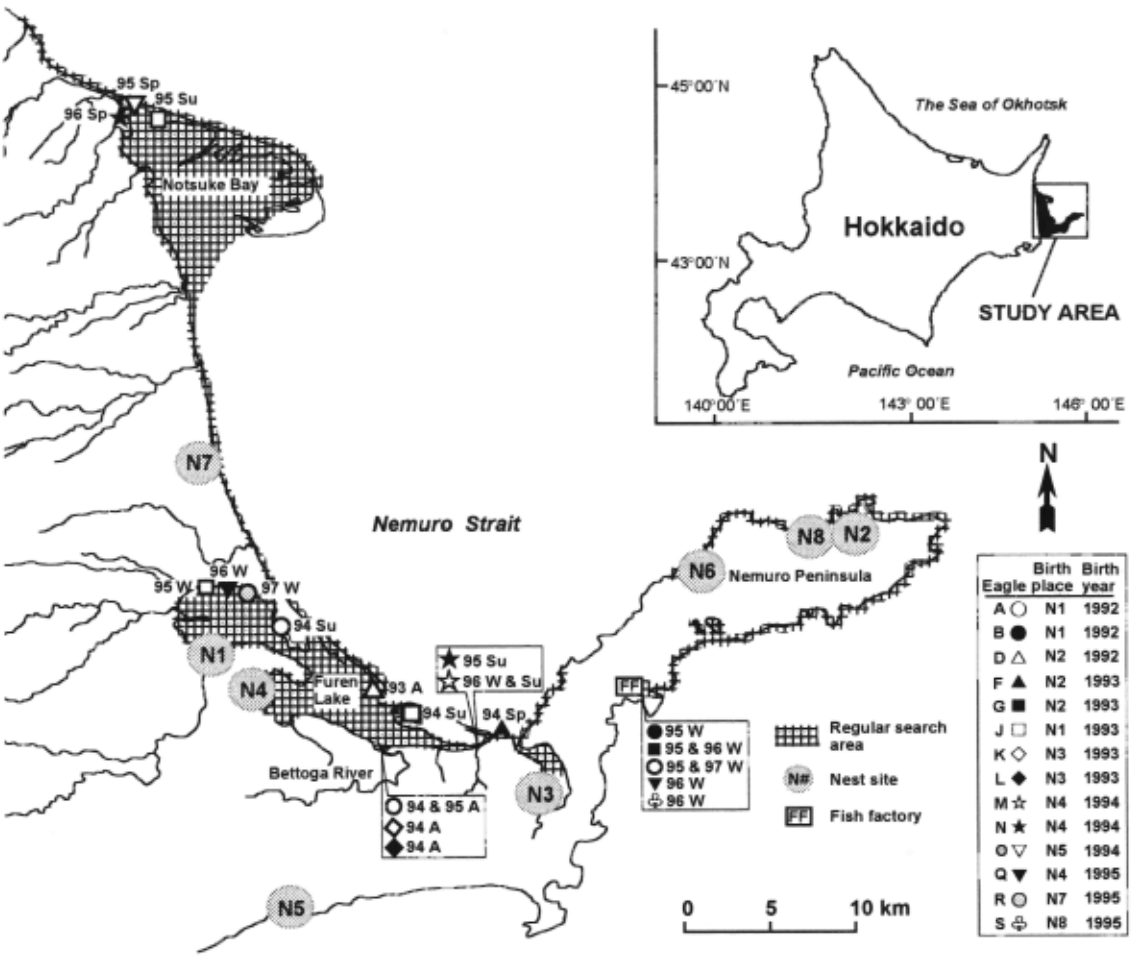

Figure 1. Study area and locations of color-banded White-tailed Sea Eagles observed during and after their first winter in the Nemuro region. Numbers beside symbols indicate year of location and letters indicate season. Seasons are defined as Sp = spring (1 April–31 May), Su = summer (1 June–31 August), A = autumn (1 September–30 November), and W = winter (1 December–30 March).

around Furen Lake from December 1994–October 1996, and in January–February 1997 (Fig. 1).

In this paper, eagles <1 yr of age are referred to as juveniles, and non-adult eagles (>1 yr and <5 yr of age) to as immatures.

Results and Discussion

Twelve (60%) of 20 color-banded eagles were observed after their first winter. Six (30%) of 20 eagles were observed after their second winter, and one (6.7%) of 15 eagles color-banded in 1992–94 was observed after its third winter.

Accurate fledging dates were determined for three radio-tagged juveniles from N4. They were 28 June 1994 for M, 30 June 1994 for N, and 12 or 13 July 1995 for Q. The dates of departures from the natal areas were determined for four juveniles. They were between 8–12 September 1994 for M and N, 9 September 1995 for Q from N4, and 13 September 1995 for P from N6. The intervals between fledging and departure were 8–11 wk. Previous studies found that, for Bald Eagles (*H. leucocephalus*), the intervals were 7 or 8 wk (Gerrard et al. 1974), 5–10 wk (McCollough 1986), 2–5 wk (Hunt et al. 1992), 4.5–10 wk (McClelland et al. 1996) and 4–11 wk (Wood et al. 1998).

Movements from the natal areas were recorded during the first autumn for six of seven radio-tagged juveniles and one color-banded juvenile (Fig. 2). The radio-transmitter of eagle R failed after 13 June 1995 and this bird was not re-sighted after 26 August 1995. Juveniles M, N,

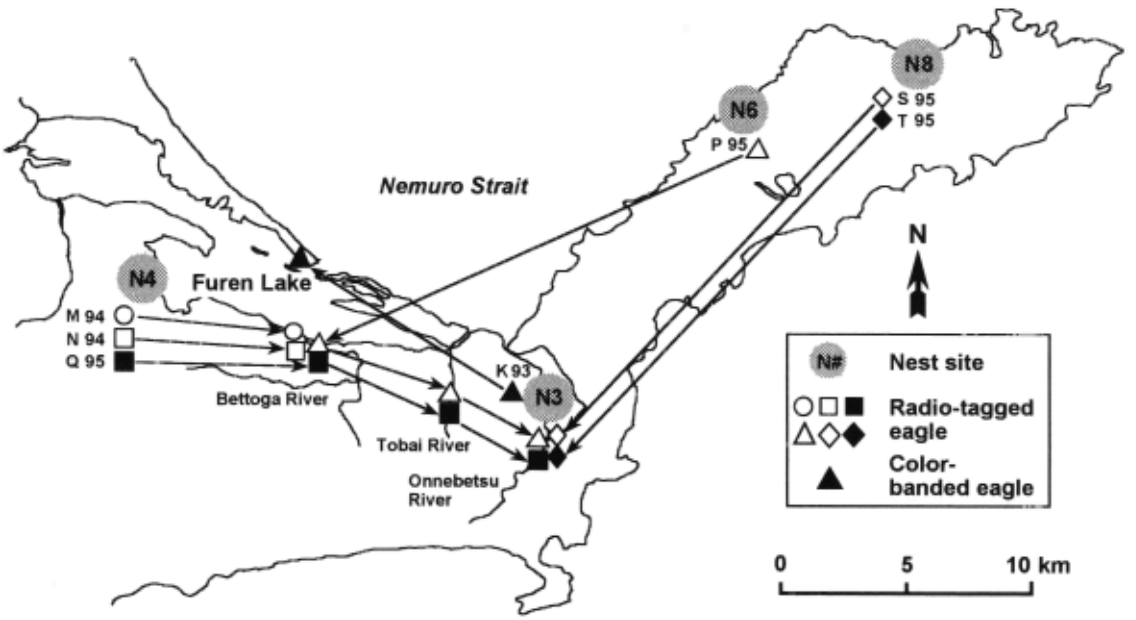

Figure 2. Enlargement of area illustrated in Figure 1. Early movements of radio-tagged and color-banded juvenile White-tailed Sea Eagles from their nests in the Nemuro region. Numbers beside symbols indicate year of hatching and letters refer to individual eagles. Arrows indicate direction of travel.

Q, and P moved from their natal areas to the Bettoga River in September (Fig. 2). Sibling juveniles S and T from N8 were occasionally detected around the natal area until 16 September 1995. They were relocated along the Onnebetsu River on 19 October 1995. Juvenile K was relocated in the first autumn at the east end of sandbar extending from northwestern part in Lake Furen. For all birds, the distance from the nest to the first location away from the nest ranged from 7.0 km to 22.0 km with no apparent preference for direction.

Pink salmon (*Oncorhynchus gorbuscha*) and chum salmon (*O. keta*) are most abundant during August–September, and October–December, respectively, in the rivers of Hokkaido (Ochiai and Tanaka 1986, Nagasawa and Torisawa 1991). Departures from the natal areas in this study seemed to correspond with the timing of salmon runs. Numerous salmon carcasses were observed on the Bettoga River between the estuary and a weir dam 4.0 km upstream from the mouth in September–October 1994. White-tailed Sea Eagles, including color-banded juveniles, and Steller's Sea Eagles were both observed on the Bettoga River feeding on salmon carcasses on the riverbanks, in shallow water and on the tidal flat at low tide. Marked juvenile White-tailed Sea Eagles were also seen on the Onnebetsu and Tobai Rivers in their first autumn (Fig. 2). Similarly, in parts of its range, the movements of post-fledging Bald Eagles are influenced by spawning salmon (Servheen and English 1979, Hodges et al. 1987). Abundant salmon carcasses are particularly important as easily-available prey for inexperienced juveniles (McClelland et al. 1983, Stalmaster and Gessaman 1984, Restani 2000).

Fourteen of the marked eagles were found during and after the first winter in their natal areas (Fig. 1). Juveniles Q and S were observed in areas where people supplied food, including the fish factory and Furen Lake, during their first winter. At the fish factory, fish offal was dumped on the ground, and on Furen Lake and Notsuke Bay, from the end of December to the end of March fishermen discarded rough fish on the ice.

Eagles A, J, N, and Q were resighted at two or more locations (Fig. 1), eagle A most frequently (five times at three different places between its third summer and its fifth winter). Immature White-tailed Sea Eagles in Europe may disperse to areas of abundant food (Love 1983). Similarly, the movements of immature Bald Eagles are nomadic and variable (McClelland et al. 1994, Jenkins et al. 1999), and are associated with temporary concentrations of prey and carrion (Harmata et al. 1999) Based on my observations, I suggest that juvenile White-tailed Sea Eagles moved among habitats probably in response to food availability.

In spring and summer, immature eagles were found on Furen Lake, Notsuke Bay and on the coast (Fig. 1). These sites had two possible food resources: "natural food," such as fish, waterfowl (e.g., *Anas* spp., *Aythya* spp.), and seagulls; and "anthropogenic food," rough

fish discarded by commercial fishermen on the tidal flats and shores.

During autumn, color-banded eagles were mostly observed on rivers, especially on the Bettoga River (Fig. 1). The rivers in the natal area are important sources of salmon carrion in autumn, not only for first-year eagles, but also for older immatures.

During winter, most eagles were found at the fish factory and at Furen Lake when it was frozen (Fig. 1). Most White-tailed Sea Eagles and Steller's Sea Eagles that wintered in Hokkaido gathered at places where people supplied fish (Working Group for White-tailed Eagles and Steller's Sea Eagles 1996), probably because sufficient amounts of natural prey were not available (Shiraki 2001). Field observations and ring recoveries in Sweden and Finland suggested that survival, especially of first-year eagles, was improved by a supplemental winter-feeding program (Helander 1985). Survival of immature White-tailed Sea Eagles hatched in the Nemuro region also may be enhanced by anthropogenic sources of food.

RESUMEN.—Los movimientos de las áreas de natalidad y de los hábitats de forrageo de juveniles de *Haliaeetus albicilla*, fueron examinados con telemetría y con observaciones de aves marcadas. La dispersión de las áreas de natalidad ocurrieron entre el 8–13 de septiembre, cuando los salmones (*Salmo* spp.) depositaron sus huevos y fueron abundantes en los ríos cercanos. Las águilas juveniles probablemente se movilizaron entre los hábitats en respuesta a la disponibilidad de comida. En primavera y verano, las águilas juveniles fueron observadas en áreas costeras y en lagos cercanos durante el otoño, las águilas juveniles fueron observadas principalmente en los ríos en donde se alimentaron de restos de salmón. En invierno, las águilas juveniles dependieron de restos de comida provenientes de desechos humanos, tales como peces y despojos de reses muertas. La sobrevivencia de juveniles reproducidos en la región de Nemuro, Japón puede estar reforzada por alimento de origen antrópico.

[Traducción de César Márquez]

ACKNOWLEDGMENTS

I thank T. Matsuo, S. Yamamoto, N. Kondo, M. Takada, N. Aoki, H. Nakagawa, M. Tazawa, K. Saito, M. Sugano, and R. Takada for help in color-banding and for precious information on marked-eagles. I also thank F. Sato for suggestions on color-banding, and M. Ueta, P.F. Schempf, M.J. McGrady, and S. Tsuyuzaki for improving an early draft of this manuscript. R.E. Yates, M.J.R. Miller, and an anonymous reviewer provided helpful comments on the manuscript. This study was conducted partly as a project of the Environmental Agency of Japan and funded by World Wide Fund for Nature of Japan.

LITERATURE CITED

GERRARD, P., J.M. GERRARD, D.W.A. WHITEFIELD, AND W.J. MAHER. 1974. Post-fledging movements of juvenile Bald Eagles. *Blue Jay* 32:218–226.

HARMATA, A.R., G.J. MONTOPOLI, B. OAKLEAF, P.J. HARMATA, AND M. RESTANI. 1999. Movements and survival of Bald Eagles banded in the Greater Yellowstone Ecosystem. *J. Wildl. Manage.* 63:781–793.

HELANDER, B. 1980. Colour-banding of White-tailed Sea Eagles (*Haliaeetus albicilla L.*) in northern Europe—a progress report. *Fauna Flora* 75:183–187.

———. 1985. Winter feeding as a management tool for White-tailed Sea Eagles in Sweden. Pages 421–427 *in* I. Newton and R.D. Chancellor [EDS.], Conservation studies on raptors; Proceedings of the ICBP World Conference on Birds of Prey. ICBP Tech. Publ. No 5 ICBP, Cambridge, U.K.

HODGES, J.I., E.L. BOEKER, AND A.J. HANSEN. 1987. Movements of radio-tagged Bald Eagles, *Haliaeetus leucocephalus,* in and from southeastern Alaska. *Can. Field-Nat.* 101:136–140.

HUNT, W.G., R.E. JACKMAN, J.M. JENKINS, C.G. THELANDER, AND R.N. LEHMAN. 1992. Northward post-fledging migration of California Bald Eagles. *J. Raptor Res.* 26 19–23.

JENKINS, J.M., R.E. JACKMAN, AND W.G. HUNT. 1999. Survival and movements of immature Bald Eagles fledged in Northern California. *J. Raptor Res.* 33:81–86.

KRÓL, W. 1983. Movements of White-tailed Eagles (*Haliaeetus albicilla*) of Central and Eastern Europe. *Ring* 114–115:97–103.

LOVE, J.A. 1983. The return of the sea eagle. Cambridge Univ. Press, Cambridge, U.K.

MCCLELLAND, B.R., L.S. YOUNG, D.S. SHEA, P.T. MCCLELLAND, H.L. ALLEN, AND E.B. SPETTIGUE. 1983. The Bald Eagle concentration in Glacier National Park, Montana: an international perspective for management. Pages 69–77 *in* D.M. Bird [ED.], Biology and management of Bald Eagles and Ospreys. Harpell Press, Ste. Anne de Bellevue, Quebec, Canada.

———, L.S. YOUNG, P.T. MCCLELLAND. J.G. CRENSHAW, H.L. ALLEN, AND D.S. SHEA. 1994. Migration ecology of Bald Eagles from autumn concentrations in Glacier National Park, Montana. *Wildl. Monogr.* No. 125.

———, P.T. MCCLELLAND, R.E. YATES, E.L. CATON, AND M.E. MCFADZEN. 1996. Fledging and migration of juvenile Bald Eagles from Glacier National Park, Montana. *J. Raptor Res.* 30:79–89.

MCCOLLOUGH, M.A. 1986. The post-fledging ecology and population dynamics of Bald Eagles in Maine. Ph.D dissertation. Univ. Maine, Orono, ME U.S.A.

MEYBURG, B.-U., T. BLOHM, C. MEYBURG, I. BÖRNER, AND P. SÖMMER. 1994. Satellite and ground tracking of a young White-tailed Sea Eagle *Haliaeetus albicilla* in the Uckermark: reintegration in the brood, break-up of the family, dispersion and wintering. *Vogelwelt* 115 115–120.

MIYAWAKI, A. [ED.]. 1988. Vegetation of Japan. Vol. 9. Hokkaido, Shibundo Co. Ltd. Publishers, Tokyo, Japan.

NAGASAWA, K. AND M. TORISAWA [EDS.]. 1991. Fishes and

marine invertebrates of Hokkaido: biology and fisheries. Kita-nihon Kaiyo Center Co. Ltd. Sapporo, Japan.

OCHIAI, A. AND M. TANAKA. 1986. Ichthyology II. Koseisya-koseikaku, Tokyo, Japan.

RESTANI, M. 2000. Age-specific stopover behavior of migrant Bald Eagles. *Wilson Bull.* 112:28–34.

SAUROLA, P. 1981. Ringing of the White-tailed Eagles in Finland. Pages 135–145 *in* Stjernberg, T. [ED.], The White-tailed Eagle Projects in Finland and Sweden. Jord-Och Skogsbruksministeriet, Helsinki, Finland.

SERVHEEN, C. AND W. ENGLISH. 1979. Movements of rehabilitated Bald Eagles and proposed seasonal movement patterns of Bald Eagles in the Pacific Northwest. *Raptor Res.* 13:79–88.

SHIRAKI, S. 2001. Foraging habitats of Steller's Sea Eagles during the wintering season in Hokkaido, Japan. *J. Raptor Res.* 35:91–97.

STALMASTER, M.V. AND J.A. GESSAMAN. 1984. Ecological energetics and foraging behavior of overwintering Bald Eagles. *Ecol. Monogr.* 54:407–428.

STJERNBERG, T. AND P. SAUROLA. 1983. Population trends and management of the White-tailed Eagle in northwestern Europe. Pages 307–318 *in* D.M. Bird. [ED.], Biology and management of Bald Eagles and Ospreys. Harpell Press, Ste. Anne de Bellevue, Quebec, Canada.

TAKENAKA, T. AND Y. ONO. 1995. Values of riparian forests in the Nishibetsu river, Konsengenya plain, Eastern Hokkaido. *Proc. Architecture* 127:122–129.

WOOD, P.B., M.W. COLLOPY, AND C.M. SEKERAK. 1998. Postfledging nest dependence period for Bald Eagles in Florida. *J. Wildl. Manage.* 62:333–339.

WORKING GROUP FOR WHITE-TAILED EAGLES AND STELLER'S SEA EAGLES. 1996. Wintering status of Steller's Sea Eagles and White-tailed Eagles in northern Japan. Pages 1–9 *in* Survey of the status and habitat conditions of threatened species, 1995. Environment Agency, Tokyo, Japan.

Received 13 November 2001; accepted 22 May 2002
Associate Editor: Marco Restani

J Raptor Res. 36(3):224–228

HABITAT PREFERENCES, BREEDING SUCCESS, AND DIET OF THE BARN OWL (*TYTO ALBA*) IN ROME: URBAN VERSUS RURAL TERRITORIES

LUCA SALVATI[1]
Piazza F. Morosini 12, I-00136 Rome, Italy

LAMBERTO RANAZZI
Via Livorno 85, I-00162 Rome, Italy

ALBERTO MANGANARO
Via di Donna Olimpia 152, I-00152 Rome, Italy

KEY WORDS: *Barn Owl*; Tyto alba; *territories*; *habitat preferences*; *breeding success*; *feeding habits*; *urban habitat*; *Rome.*

Population density of the Barn Owl (*Tyto alba*) is dependent on available supply of small rodents in both the territory and home range (e.g., De Bruijn 1994, Taylor 1994). Moreover, habitat and nest quality are decisive factors in determining distribution, breeding success, and feeding habits of Barn Owls (De Bruijn 1994, Taylor 1994, Poprack 1996, Martinez and López 1999, Zuberogoitia 2000, Baudvin and Jouaire 2001). The decrease in numbers of this owl in central Europe is probably related to the development of new agricultural practices and loss of traditional nest sites (De Bruijn 1994). In Mediterranean Europe, owl populations seem to be more stable, likely due to a milder climate and large supply of prey (Martinez and López 1999, Zuberogoitia 2000), but further information is needed.

Barn Owls commonly breed in urban areas that provide suitable nest sites (e.g., Baudvin and Jouaire 2001). The ecology of the Barn Owl is poorly known in urban habitats and no direct comparisons with neighboring habitats are available. Here, we compare data on distribution, territory characteristics, habitat preferences, breeding success, and feeding habits of Barn Owls from urban and rural areas in central Italy. Understanding

[1] E-mail address: picoidesmajor@yahoo.com