短 報 Short Communications

Jpn. J. Ornithol. 50: 85-89, 2001

The First Breeding Record of the Bush Warbler
Cettia diphone on a Flooded Bed

Shoji HAMAO* and Hajime MATSUBARA

The Bush Warbler is widely distributed in Japan and eastern China. It breeds in bushes and thickets of hilly and mountainous country, and winters in plains and lowlands (OSJ 1974). It is known that the warblers are also observed in lowlands (Kiyosu 1978, Environment Agency of Japan 1981), including riversides (Technology Research Center for Riverfront Development 1999, see also Ezaki 1998), during the breeding season. In Kyoto Prefecture where we made this study, the Bush Warbler inhabits mountainous forests throughout the year (e.g. Kamigamo Experimental Forest of Kyoto University, 100-225m a.s.l., Nimura 1992). It is also observed along the Uji (H. Sugawa pers. comm.) and Katsura River (WBSJ 1997) during the breeding season. Sugawa observed the warblers on a flooded bed where plants were growing, i.e. Common Reed *Phragmites communis*, Goldenrod *Solidago altissima*, Amur Silver Grass *Miscanthus sacchariflorus*, and a Willow *Salix* sp. Since river management generally decreases the natural disturbance on flooded beds, it will facilitate vegetation development on the bare lands. Therefore, there is a possibility that river management produces breeding habitats for the Bush Warbler in lowlands.

However, the breeding has not been recorded on flooded beds. Here, we report the breeding of the Bush Warbler on a flooded bed. We also discuss the relation between the breeding of this species and the development of vegetation on the flooded bed due to river management.

This study was conducted at a 28.3 ha sand bar along the Kizu River (34° 50' N, 135° 47' E, 16 m a.s.l.) in Kyoto, Japan. Some parts of the area were natural bare land, but the largest area was covered with grasses, Weeping-Lovegrass *Eragrostis curvula*, Fragrant Wormwood *Artemisia capillaris*, Goldenrod, stoloniferous Reed *Phragmites japonica*, and Amur Silver Grass (Fig. 1). There were also scattered patches of trees, willows *Salix* spp. and Wingnut *Pterocarya rhoifolia*, which accompanied the thickets of Multiflora Japonica *Rosa multiflora*.

The field study was carried out during the breeding season in 2000. During the season (from 13 March to 1 July), we located singing males and recorded them on a map nine times, although they were not marked individually. From 3 to 5 May, we made intensive observation, netting, and search for nests in a male's territory. To detect breeding females, we set a mist net (30 mm mesh × 12 m × 1) at two

* Corresponding author, E-mail: VZH01315@nifty.ne.jp

Fig. 1. The study area. Dotted area indicates bare land. Hatched and solid areas show the areas covered with herbs and woody plants, respectively. Arrows show the direction of water flow.

places within the territory. Captured birds were individually marked with colour leg rings, and were sexed according to the shape of the cloacal region and incubation patch (Hamao 1992, Svensson 1992). An individual which had an incubation patch, and whose cloacal region was not protuberant was determined to be female. An individual was determined to be male, if it had protuberant cloaca, did not have an incubation patch, and sang after the release. We could measure two of the captured females which were sexed by this criterion. Their wing length was 54.1 and 55.4 mm, respectively. This was consistent with the range of female wing length in previous studies (Abe 1984, Hamao 1992), supporting our sexing criterion. Additional observation and netting were made in territories other than the focal one.

Males were singing on willows and wingnuts in the tree patches on the sand bar (Fig. 2). We observed 5.4 ± 0.5 (mean $\pm$ SE,

$N=9$) singing males in each survey, indicating that some males were settled in the area during the breeding season. By the netting in the intensively studied territory, four adults were captured: one was male (male #1), and three were female (female #1, #2 and #3). Female #1 accompanied fledged young. We confirmed at least four fledglings in a bush. Their wing length was 37.6 ± 0.9 mm (mean $\pm$ SE, $N=4$), and tarsus length was 21.6 ± 0.4 mm. They had unspotted plumage and lacked in rictal bristles, which were consistent with the characteristics of juveniles belonging to Family *Silviidae* (Ripley 1952, Campbell & Lack 1985; Fig. 3). Their plumage colour (olive brown upperparts and buff yellow underparts) and long (13-20 mm) down feather on their head were consistent with the characteristics of the juvenile Bush Warbler described by former researchers (Yamashina 1941, Abe *et al.* 1974, Kiyosu 1978). The morphology of the fledglings was similar to that of

Fig. 2. Distribution of singing males. Dots show the locations of singing males observed during the breeding season. Broken lines separate singing points by different males that were singing simultaneously.

fledglings of the Bush Warbler which the senior author previously observed in 13 family groups at Myoko-kogen, Japan. Furthermore, female #1 and male #1 carried food to the juveniles (Hamao *et al.* 2001). Therefore, we identified the fledglings as the Bush Warbler.

The size of these juveniles was similar to that of juveniles which were measured 1-3 days after fledging at Myoko-kogen (wing length: 37.5 ± 0.9 mm [$N=3$ broods]; tarsus length 23.1 ± 0.5 mm [$N=3$]; S. Hamao unpubl. data). The juveniles flew within a distance of only 30-50 cm, and so we could capture them by hand. These things indicate that the juveniles were fledged from a nest within or near the territory in which they were found. A female was captured within other male's territory. This female, and female #2 and #3 had incubation patches which were more brilliantly reddish than that of female #1, so that they appeared to be incubating or have spent a short period after the incubation. We heard a 'chee chee' call within the territory of male #1, which is presumed to be uttered by females

only during incubation and nestling period (Hamao 1997). Thus, there is a possibility that these females were also breeding, although we could not detect any nest of the Bush Warbler throughout this study.

The observation of the fledglings indicates that the Bush Warbler bred on the flooded bed which has not been known as a breeding habitat of this species. The breeding is thought to be caused by that the sand bar comes to be covered with vegetation due to river management. The Kizu River originates in the Nunobiki Mountains (756 m a.s.l.), combines with the Yodo River, and then pours into Osaka Bay. Before about 1950, it often flooded (Yamagishi & Tsujimoto 2000), and many outwashes formed sand bars (River Ecology Research Group of Japan 1999). However, the Takayama Dam was built upriver for controlling floods in 1969. At that time, the Yodo River was widened, which also prevented flooding. Furthermore, the cessation of exploiting gravel in 1974 decreased the movement of outwashes. The aerial photographs of the

Fig. 3. A fledgling of the Bush Warbler observed at the Kizu River. Both photographs show the same individual.

study area show that the sand bar started to be covered with vegetation in the late 1970's (Yamagishi & Tsujimoto 2000). Now, there are scattered patches of woody plants, where bushes are growing.

Although the Bush Warbler prefers fields of dwarf bamboo *Sasa* spp. for breeding, it also bred in bushes of woody plants (Yamashina 1941, Kiyosu 1978). In a stand at Myokogen where dwarf bamboo was scarce, nests were built on Japanese Holly *Ilex crenata*, Sharpleaf Privet *Ligustrum Tschonoskii*, *Multiflora Japonica*, and Rattan Vine *Berchemia racemosa* (Hamao 1992). In the present study, all females were observed in territories in which bushes, consisting of ca. 2 m of *Multiflora Japonica*, were developed well. There were willows and wingnuts around the bushes, which were used for singing by males. The sand bar is thought to become a suitable breeding habitat to the Bush Warbler due to the developed vegetation that was caused by

river management. Besides the Kizu River, river management generally decreases the natural disturbance on river banks, and may yield breeding habitats for the Bush Warbler.

This study was done as a study of River Ecology Research Group (Kizugawa Group). We are grateful to Dr. S. Yamagishi (the chair of Kizugawa Group) for giving us the opportunity to study. We thank Dr. R. Nozaki for providing taxonomical information on plants, and M. Kajita for valuable comments on the manuscript. We also thank M. K. and A. Mitamura for their help in the field, and M. Ueta and Dr. Y. Ezaki for literature search. Thanks are also due to A. Collins for improving our English, and H. Sugawa, T. Shimada, O. Kuroda and M. Nakagawa for informing us of their observational records of the Bush Warblers around Kyoto Prefecture.

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河川敷におけるウグイスの繁殖

京都府の木津川河川敷にある砂州で、2000年5月3-5日にウグイス *Cettia diphone* の調査を行った。ノイバラのやぶが発達した部分で4羽の巣立ち雛が発見された。これらの雛は上面がオリーブ褐色、下面がパフ黄色で、頭部に長い綿羽をもち、体には斑点がなく、口ひげもなかった。また、捕獲により性を判定し、標識して個体識別した雌雄のウグイス成鳥が餌を運んでいた。これらのことから、4羽はウグイスの雛であると判定した。雛の測定値や30-50cmしか飛ぶことができないことから、これらの雛は近隣で巣立ったものと考えられた。調査地では、他にも抱卵斑の発達した雌が3羽捕獲された。しかし、巣は発見できなかった。ウグイスは一般に山地のやぶで繁殖する。調査地は低地の砂州であるが、河川管理による洪水の減少によって1970年代後半から植生が発達し始め、現在はノイバラやヤナギ類、サワグルミが侵入している。河川管理による河川敷の林地化が、ウグイスの繁殖場所をつくり出したものと考えられる。この研究は河川生態学術研究会木津川グループ（代表：山岸哲博士）の調査研究の一環として行われた。

——濱尾章二・松原 始

Authors' addresses: (Hamao) *Urawa-minami High School, 6-5-31 Tsuji, Saitama, Saitama 336-0026, Japan.* 〒336-0026 埼玉県さいたま市辻6-5-31 さいたま市立浦和南高等学校 (Matsubara) *Department of Zoology, Graduate School of Science, Kyoto University, Sakyo-ku, Kyoto 606-8502, Japan.* 〒606-8502 京都市左京区北白川追分町 京都大学大学院理学研究科動物学教室。

(Received 20 October 2000; Accepted 21 February 2001)