Bird populations have been declining recently in many parts of the world (Askins et al. 1990). In North America, for example, forest-dwelling species are known to have decreased between the 1940s and 1980s. Multiple causes were considered to be responsible for the decline of forest birds, such as deforestation on their tropical wintering grounds and forest fragmentation in their temperate breeding grounds (Tojo 2009). The impacts of habitat loss or fragmentation tend to vary between species with different life history traits. Amano and Yamaura (2007) showed that medium body size, solitary breeding, low annual productivity, a strong tendency to monogamy, farmland use and long-distance migration to the tropics are major factors having a negative effect on the Japanese avifauna. In addition to these factors, low nesting is also likely to be a contributory factor, as it is in population declines in Europe and North America (Batary & Baldi 2004; Lloyd et al. 2005). Ya-

Changes in the avifauna of the Hokkaido University campus, Sapporo, detected by a long-term census

Tomoyuki NAMBA1,2,#, Yuki YABUHARA1, Kazutoshi YUKINARI1 and Reiko KUROSAWA3

1 Hokkaido University Birding Club: Circle Hall, Hokkaido University, Kita-17, Nishi-12, Kita-ku, Sapporo 060–0817, Japan.
3 Japan Bird Research Association: 1-29-9, Sumiyoshi-cho, Fuchu 183–0034, Japan

Abstract We report the results of a 15-year bird census conducted on the Hokkaido University campus in Sapporo city. A standardized route census was carried out monthly by the students of the Hokkaido University Birding Club (HUBC). Bird species were classified according to their migratory status as: long-distance migrants (LDM), short-distance migrants (SDM), winter visitors (WV) and residents (R). Of a total of 88 species of birds identified, 18 were Rs, 21 LDMs, 26 SDMs and 10 WVs. The overall bird abundance for the R group was greatest, however this was strongly affected by fluctuations in the Eurasian Tree Sparrow *Passer montanus* population, representing more than half of the total bird abundance. This species declined sharply in 2006, and has not recovered yet. LDMs declined in both species richness and bird abundance, whereas SDMs and WV had fluctuated annually in their abundance. Three major tendencies were detected by comparing nationwide changes of bird communities with those of the study site. 1) Overall population declines in the wintering and stopover grounds, which were aggravated by habitat degradation in the breeding grounds of the study site (White-throated Needletail *Hirundapus caudacutus*, Black-faced Bunting *Emberiza spodocephala*, Oriental Turtle Dove *Streptopelia orientalis*), 2) Nationwide population increase while the population declined in the study site due to intensified management of vegetation (Great Tit *Parus major*, Great Spotted Woodpecker *Dendrocopos major*), 3) Population increases in species adapted or adapting to human landscapes (Large-billed Crow *Corvus macrorhynchos*, Mallard *Anas platyrhynchos*, Slaty-backed Gull *Larus schistisagus*). In addition, the drastic decline of Eurasian Tree Sparrows in early 2006 was caused by a local die-off event apparently due to an infectious disease. General recognition of the academic and conservation importance of a long-term census is hoped to enhance motivation for and efforts towards a census in various areas.

Key words Cavity-nester, Long-distance migrants, *Passer montanus*, Route census, Shrub-nester.
mura et al. (2009), on the other hand, pointed out the importance of the relationship between species groups and the change of their primary habitats. For economic reasons, for instance, Japan began to import timber products primarily from Southeast Asia in the late 20th century instead of using domestic ones. As a result, forests and plantations have matured and have provided larger areas of favorable habitat for forest birds in Japan. Resident or short-distance migrant species favoring mature forest have increased in Japan. However, resident or short-distance migrant species depending on early successional stages have lost suitable habitat and have declined in Japan. Meanwhile, Southeast Asia has experienced a severe loss of mature forests, which has negatively affected forest species wintering in the region. Long-distance migrants wintering in the mature forests of Southeast Asia have declined (Yamaura et al. 2009). In addition, short-term events such as wind-throw and small outbreaks of infectious diseases will cause local scale effects on bird communities.

Since changes in ecosystems are generally hard to detect over a short period of time, ecosystems can experience serious problems without our noticing them. It is, therefore, important to collect quantitative data on a regular basis. The monitoring of bird populations and habitats is becoming increasingly important in order to detect bird species declining due to habitat changes and take effective conservation measures (Yamaura et al. 2009). Considerable effort by voluntary workers is required in order to monitor bird populations for conservation purposes because monitoring needs to be carried out at multiple sites in various habitats over long periods of time. In Europe and North America, a great number of bird monitoring surveys have been conducted primarily by voluntary workers, such as the Breeding Bird Survey (BBS; Newson et al. 2005) in Great Britain and the Christmas Bird Count (CBC; Dun et al. 2005) in North America. In Japan, the first wildlife-monitoring program was initiated by the Environment Agency in the 1970s (http://www.biodic.go.jp/reports/2-1/af00y.html). Since it was aimed at determining domestic distributions of target species, however, the data obtained did not allow for quantitative analyses. In 2003, the Ministry of the Environment initiated a program of “Monitoring-site 1000” with the cooperation of voluntary workers (http://www.biodic.go.jp/moni1000/index.html). This monitoring program covers various habitats, such as forests, grasslands, wetlands, islands and open bodies of water. However, it does not include large parts of human inhabited areas of urbanized cities, and thus fails to provide information on the abundance and distribution of common garden birds (Hirano 2009). Therefore, a “Veranda Bird Watch” program aimed at surveying birds in human settlements was started by a private organization in 2005 (Japan Bird Research Association; http://www.bird-research.jp/1_katsudo/index_veranda.html). It is expected to provide a database for multiple biological fields in the future.

Hokkaido University, which is situated in a center of Sapporo City, provides birds with various habitats such as small woods and grasslands. Since birds of various life histories use the university campus, it is reasonable to assume that they sustain diverse effects from the environmental changes of the campus. Monthly bird censuses on the campus were initiated at the request of the university administration, and have been carried out by the students of Hokkaido University Birding Club (HUBC) as one of the club activities since 1995. The HUBC census data have been accumulated for 15 years. In Japan, few monitoring surveys of birds have been undertaken in a fragmented landscape of an urbanized area. Those long-term censuses undertaken in school are led by researchers or faculties (Uchida et al. 2003). Therefore, the HUBC census data provide a valuable contribution to assessing the status of our urban avifauna. In recent years, land-use on the university campus has been intensified, which has reduced the area of grasslands and woods. In addition, decayed trees have been removed to improve visitor safety, while brush and leafy branches have been removed to enhance the park-like quality of the campus. These activities have an adverse effect on some bird species, such as hole-nesters, canopy nesters, low shrub nesters and grass-land nesters. In contrast, advanced urbanization has a favorable effect on human-dependent species and urbanized environment-users.

Therefore, we report the results of the HUBC avian censuses conducted on Hokkaido University campus, and discuss the possible function of the study site for birds as well as the probable effects of environmental changes on both global and local scales. Four major events that apparently had a significant effect on the avian community of the study site occurred during the study period: i) opening-up of habitat as a result of tunnel construction in the northern campus (2001), ii) increase in building construction after the privatization of the university (2004), iii) wind-throw by a
typhoon (September 2004) and iv) mass mortality of Eurasian Tree Sparrows *Passer montanus* in January 2006 (Kurosawa et al. 2006).

Here we address the following questions: (1) Many species of long-distance migrants have declined due to a reduction in tropical forest area on their wintering grounds. How do land-use changes in the study site affect them? (2) Short-distance migrant mature forest species have increased and early-successional species have declined across Japan due to the maturation of forests. How do land-use changes in the study site affect bird species that use different stages of vegetation succession? (3) Some other bird species have changed in abundance in the study site. Do these species have any characteristics in common? And what factors may have contributed to their changes in abundance?

**MATERIALS AND METHODS**

We carried out standardized route censuses in Hokkaido University campus (area of ca. 2 km²) located in a fragmented landscape in the urbanized area of Sapporo City, Hokkaido, northern Japan (Fig. 1). This area belongs to a cool temperate region and its major forest type is the *Tilia maximovicziana*– *Quercus mongolica* community in which major tree species are *Quercus mongolica* and *Acer mono* (Kurosawa & Askins 1999). The habitats of the campus are highly diverse because it includes low and tall buildings, wooded lots, crop fields and pastures. The bird census was started in October 1995. This paper uses the data of 1996, 1998, 2000, 2003, 2006 and 2008 that are without missing data. The years indicate the Japanese academic year that starts in April and finishes in March. For instance, the census year of 1996 includes months from April 1996 to March 1997. The census covered basically 25 m on each side of the route. We conducted censuses once a month until 2005, but twice a month after 2006 to enhance the reliability of data. We started the census from the geographical center of the campus (43°04’30.78”N, 141°20’31.65”E), taking two census routes forking north and south. The censuses on the two routes were performed on the same day or within two days. Each of the routes was divided into sections of about 150 m in length. The bird species detected during the census were recorded in each section of the route. The censuses were started approximately one hour after sunrise and usually finished within two hours. The parts of the census routes were changed over time because of construction work on the campus. The census routes were also shorter during periods of winter snow, because some parts of the routes were not accessible.

The abundance of each bird species was calculated by using the mean of each section of the two routes. When the censuses were carried out more than once a month, the mean of the censuses was used. Bird abundance was indicated by the mean number of birds of each species along the two routes in a year. For the analyses, the bird species were classified, based on their migratory status in the local area of lowland Hokkaido, into the following five categories: (1) long-distance migrants that breed in Japan and winter in tropical regions (LDM), (2) short-distance migrants that breed in Hokkaido and winter in temperate regions such as Honshu or southern Japan (SDM), (3) winter visitors that breed north of Japan and winter in Hokkaido or Japan (WV), (4) residents that occur in Hokkaido throughout the year (R) and (5) passage migrants that stay in the study site during their migration (P) (Table 1; Ornithological Society of Japan 2000). As for the residents, we defined these as the species that live in the study site all year round, and did not include species that remain in lowland Hokkaido throughout the year but occur in the study site only in winter (Table 1). The latter species, such as Eurasian Jay *Garrulus glandarius* and Eurasian Treecreeper *Certhia familiaris* account for only 0.7% of the residents. Passage migrant species were also excluded from the analyses due to an insignificant proportion (0.08%) of the total bird abundance.

We used mean values of bird abundance and
species richness for each migratory group and selected species in four local seasons. The seasons were classified as spring (April–May), summer (June-August), autumn (September–November), and winter (December–March). The winter season represents the snowy period when the ground is wholly covered with snow in this area. We selected major species based on their occurrence more than five times during the major resident period, and in addition, more than 1.5 mean individuals per year (year-round for R, summer for LDM and SDM, and winter for WV). A total of 17 species were included in the analysis (Table 1). Scientific and English names follow IOC World Bird List (Gill & Donsker 2010).

Table 1. Bird grouping by migratory status (after Ornithological Society of Japan 2000). Scientific and English names are after IOC World Bird List (Gill & Donsker 2010). * shows species excluded from analysis due to occurrences limited to the winter season in the study site. # indicates selected species for analysis. See materials and methods.

<table>
<thead>
<tr>
<th>Long-distance Migrants</th>
<th>Short-distance Migrants</th>
<th>Winter Visitors</th>
<th>Residents</th>
<th>Passage Migrants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Falco subbuteo</td>
<td>Aix galericulata</td>
<td>Haliaeetus albicilla</td>
<td>Andea cinerea</td>
<td>Aythya fuligula</td>
</tr>
<tr>
<td>Gallinago hardwickii</td>
<td>Anas platyrhynchos #</td>
<td>Bombycilla garrulus</td>
<td>Milvus migrans</td>
<td>Larus canus</td>
</tr>
<tr>
<td>Cuculus canorus</td>
<td>Anas poecilorhyncha</td>
<td>Bombycilla japonica</td>
<td>Accipiter gentilis</td>
<td>Anthus spinoletta</td>
</tr>
<tr>
<td>Cuculus saturatus</td>
<td>Scolopax rusticola</td>
<td>Turdus naumanni #</td>
<td>Accipiter nisus *</td>
<td>Phoenicurus auroreus</td>
</tr>
<tr>
<td>Hirundapus caudacutus #</td>
<td>Larus schistisagus</td>
<td>Fringilla montifringilla</td>
<td>Phasianus colchicus</td>
<td>Turdus pallidus</td>
</tr>
<tr>
<td>Apus pacificus</td>
<td>Larus crassirostris</td>
<td>Carduelis spinus #</td>
<td>Columba livia</td>
<td>Turdus obscurus</td>
</tr>
<tr>
<td>Anthus hodgsoni</td>
<td>Streptopelia orientalis #</td>
<td>Carduelis flammea</td>
<td>Picus canus</td>
<td>Ficedula mugimaki</td>
</tr>
<tr>
<td>Luscinia cyane</td>
<td>Treron sieboldii</td>
<td>Leucosticte arctoa</td>
<td>Dendrocoptes major #</td>
<td>Dendrocoptes kizuki</td>
</tr>
<tr>
<td>Saxicola maurus</td>
<td>Alauda arvensis</td>
<td>Loxia curvirostra</td>
<td>Emberiza rustica</td>
<td></td>
</tr>
<tr>
<td>Turdus cardis</td>
<td>Delichon dasypus</td>
<td>Pyrrhula pyrrhula</td>
<td>Microscelis amaura</td>
<td></td>
</tr>
<tr>
<td>Urosphena squameiceps</td>
<td>Motacilla cinerea</td>
<td></td>
<td>Troglodytes troglodytes *</td>
<td></td>
</tr>
<tr>
<td>Locustella fasciolata</td>
<td>Motacilla alba</td>
<td></td>
<td>Poecile palustris</td>
<td></td>
</tr>
<tr>
<td>Acrocephalus bistrigiceps</td>
<td>Lanius bucephalus</td>
<td></td>
<td>Periparus ater *</td>
<td></td>
</tr>
<tr>
<td>Phylloscopus borealis</td>
<td>Tarsiger cyanurus</td>
<td></td>
<td>Poecile varius</td>
<td></td>
</tr>
<tr>
<td>Phylloscopus boreoloides</td>
<td>Zoothera dauma</td>
<td></td>
<td>Parus major</td>
<td></td>
</tr>
<tr>
<td>Phylloscopus coronatus</td>
<td>Turdus chrysolaus</td>
<td></td>
<td>Sitta europaea</td>
<td></td>
</tr>
<tr>
<td>Ficedula narcissina</td>
<td>Cettia diphone</td>
<td></td>
<td>Certhia familiaris</td>
<td></td>
</tr>
<tr>
<td>Cyanoptila cyanomelana</td>
<td>Regulus regulus</td>
<td></td>
<td>Carduelis sinica</td>
<td></td>
</tr>
<tr>
<td>Muscicapa sibirica</td>
<td>Aegithalos caudatus</td>
<td></td>
<td>Passer montanus</td>
<td></td>
</tr>
<tr>
<td>Muscicapa dauurica</td>
<td>Zosterops japonicus</td>
<td></td>
<td>Spodiopsar cineraeus</td>
<td></td>
</tr>
<tr>
<td>Agropsar philippensis #</td>
<td>Emberiza coides</td>
<td></td>
<td>Garrulus glandarius</td>
<td></td>
</tr>
<tr>
<td>Emberiza fucata</td>
<td>Emberiza sspodephala #</td>
<td></td>
<td>Corvus corone</td>
<td></td>
</tr>
<tr>
<td>Uragus sibiricus</td>
<td>Eophona personata</td>
<td></td>
<td>Corvus macrorhynchos</td>
<td></td>
</tr>
<tr>
<td>Eophona sibiricus</td>
<td>Eophona sibiricus</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

RESULTS

Of a total of 88 species of birds identified, 18 were year-round residents (R) in the study site (Table 1). Among the four seasons, summer had the highest richness of 47 (SDM and LDM combined), far surpassing that of 33 species in winter (WV and R combined). As for the bird abundance, spring had the greatest total bird abundance (332.5) with summer second (280.4) (Fig. 2). The annual trend of species richness indicates a decrease in summer. The maximum abundance of overall birds was recorded in spring, autumn and winter of 2003. The peak summer bird abundance was observed in 2000 and 2003. The abundance of overall birds declined during 2006 and has not recovered since (Fig. 2). This tendency of bird abundance corresponded to that of residents (Fig. 3), whereas species richness followed the tendency of LDM (Figs. 4a, b, c).

The species richness of the residents (R) showed no fluctuations (Fig. 3). However, their bird abundance reached a peak in 2000 and 2003, and declined sharply in 2006. This sharp decline coincided with a rapid decline in the number of Eurasian Tree Sparrows, a species that was the most dominant species accounting for nearly 50% of the birds in the study site (Fig. 5). The abundance of Eurasian Tree Spar-
rows reached its maximum in 2000 and 2003, but declined drastically in 2006 and did not recover during the study period. This species’ decline was responsible for the drastic reduction in the total bird abundance as well as that of the resident species. This corresponded to the period when mass mortality of Eurasian Tree Sparrows occurred in the region (in early 2006; Kurosawa et al. 2006). In addition to Eurasian Tree Sparrows, Great Spotted Woodpeckers *Dendrocopos major*, and Great Tits *Parus major* as well as Carrion Crows *Corvus corone* declined in all four seasons (Figs. 6a, b, c). Seasonal declines were observed in Marsh Tits *Poecile palustris* (Fig. 6d) in three seasons except for spring and Brown-eared Bulbuls *Microscelis amaurotis* (Fig. 6e) in summer. Grey-capped Greenfinches *Carduelis sinica* (Fig. 6f) showed an overall tendency to decrease except for a temporary increase in winter in 2000 and 2003. In contrast, Large-billed Crows *C. macrorhynchos* increased from 2003 onwards (Fig. 6g). No clear tendency was detected for Varied Tits *Poecile varius* (Fig. 6h) or White-cheeked Starlings *Spodiopsar cineraceus* (Fig. 6i).

Both total bird abundance and species richness of long-distance migrants (LDM) declined in summer from 2004 onwards (Fig. 4b). White-throated Needletails *Hirundapus caudacutus* (Fig. 6j) decreased in summer abundance. Chestnut-cheeked Starlings *Agropsar philippines* increased temporarily in 2000, but maintained its original abundance afterwards (Fig. 6k). Although not included in the selected 17 common species, there are several species that have disappeared from the study site since 1998, namely the Common Cuckoo *Cuculus canorus* and Latham’s Snipe *Gallinago hardwickii*.

The bird abundance and species richness of short-distance migrants wintering mostly in Japan (SDM) seemed to show no clear tendency (Figs. 4d, e, f). There are, however, species that showed declines in this group, namely Black-faced Bunting *Emberiza spodocephala* (Fig. 6l) and Oriental Turtle Dove *Streptopelia orientalis* (Fig. 6m). The species that
showed greatest variability in bird abundance was the Mallard *Anas platyrhynchos* (Fig. 6n). It increased in summer, but its numbers fluctuates greatly in spring and autumn. Although not included in the 17 common species, the Slaty-backed Gull *Larus schistisagus* has been observed regularly in the study area from 2003 onwards. Among SDM that were previously considered to leave the study site for the winter, some species such as the Hawfinch *Coccothraustes coccothraustes* and the Slaty-backed Gull are now observed to overwinter in the site.

Due to great annual fluctuations, no linear tendency is apparent in the bird abundance of winter visitors (WV; Figs. 4g, h, i). The winter bird abundance of WV, however, is not increasing at least. Eurasian Siskin *Carduelis spinus* (Fig. 6o) and Dusky Thrush *Turdus eunomus* (Fig. 6p) are the commonest winter visitors to the study site, and their abundance fluctuates greatly between observation days and years.

**DISCUSSION**

Species richness varied between seasons in the study site. It was greatest in summer (47 species) and lowest in winter (33 species), as is typically the case in snowy regions (Oka & Nakamura 1998). It is, therefore, reasonable to assume that the study site provides various breeding habitats for birds visiting a snowy area in summer. The abundance of birds tended to be highest in spring. This tendency was caused by flocks of Eurasian Siskin, Hawfinch and Grey-capped Greenfinch visiting the study site to forage on tree seeds. This suggests that the study site is highly important as a staging site for birds passing over this area on migration because natural food is in short supply before buds break in spring. In autumn large flocks of Mallards are observed to stay, suggesting that the campus pond provides an important resting site for them.

The overall trend of the bird community of the study site was determined by that of the most com-
mon resident species, namely the Eurasian Tree Sparrow. The bird abundance of residents experienced a decrease in 2006 (Fig. 3) as a result of the local population collapse that year of Eurasian Tree Sparrows, which had accounted for more than half of the bird abundance of residents before their crash (Kurosawa et al. 2006; Fig. 5). Eurasian Tree Sparrows are, however, still the dominant species among the residents even though they represent less than 50% of their previous abundance. Since the fluctuation of the resident bird abundance depended largely on the population demography of Eurasian Tree Sparrows, this species is likely to be responsible for fluctuations of bird abundance that the residents will experience hereafter.

Of the resident group, the species tending to decline are: Great Tit, Great Spotted Woodpecker, Brown-eared Bulbul, Grey-capped Greenfinch and Carrion Crow. These species depend on woodlands for their nest sites. Great Tits and Great Spotted Woodpeckers use tree cavities, Brown-eared Bulbuls and Grey-capped Greenfinches use shrubs and Carrion Crows trees. It is, therefore, reasonable to assume that the decline of these species resulted from the loss of breeding sites, caused by an increase in building construction on campus after the university privatization in 2004 and wind-throw as well as tree damage caused by a typhoon in September 2004. Since these human and natural events occurred almost at the same time, however, it is difficult to determine which cause is responsible for the decline of each species. In addition, brushy habitat has been largely eliminated from the campus by the general use of portable power brush-cutters, which results in depriving shrub-nesting birds of suitable breeding sites. Since Carrion Crows use a mixture of woods and open habitats (Yoshida 2006), the intensification of land use on campus that has changed open grass-
lands into built-up habitats may have caused their decline. Also, Carrion Crows share trees as nest sites with Large-billed Crows, which have increased in number in the study site, as is the case in many other urbanized areas in Japan (Ueta et al. 2003). The increasing numbers of Large-billed Crows, the larger of the sympatric species, may be a contributory factor in the breeding failure of Carrion Crows (Yoshida 2006). It is assumed that large stands of tall trees in the study site and a plentiful supply of rubbish easily available to scavenging crows in the neighborhood of the study site have attracted a great number of Large-billed Crows to the campus (Kurosawa et al. 2003). Further monitoring is required, however, to determine the factors responsible for the increase of Large-billed Crows in relation to the numbers of breeding pairs and roosting individuals as well as the rubbish management of the areas surrounding the study site.

The abundance of long distance migrants (LDM) on campus is in decline and there also seems to be a decline in species richness (Figs. 4a, b, c). LDMs are reported to be declining across Japan, with deforestation of their wintering grounds being considered as one of the main causes (Higuchi & Morishita 1999). The indicator species of inner forest, such as warblers and flycatchers, however, were under-represented in the study site and their low numbers did not allow for analyses of their abundance. Since these species prefer large forests (Kurosawa & Askins 1999), the small wooded area of the study site was not suitable for monitoring their population tendencies. White-throated Needletails were one of the few long distance migrant species for which we detected an abundance trend, because they are common during the breeding period in the study site. Since this species nests in tree cavities, and as it was previously observed to have used tree cavities on the campus (Abe Hisashi personal communication), their decline is presumed to have been caused by the removal of old decaying trees or branches, which is likely to have had an adverse effect also on locally breeding Great Tits and Great Spotted Woodpeckers. Chestnut-

Fig. 5. Annual fluctuations of the most dominant species (Passer montanus). Bars indicate bird abundance and lines ratio of sparrow to total bird abundance. Error bars show standard deviations.
Fig. 6. Annual fluctuations of representative species in each migratory status group in the season that the species mainly occurs. Lines indicate bird abundance. Error bars show standard deviations.
Ten species breeding in northern regions visit Hokkaido to winter (WV). The study site provides a stopover site, as well as a wintering ground, for these species. The representative wintering species are Eurasian Siskin, Common Redpoll Carduelis flammea and Red Crossbill Loxia curvirostra. The annual variation in the abundance of each species in winter appears to result from population fluctuations on their breeding grounds. These finches were observed to feed on the seeds of birch Betula spp., elm Ulmus spp. and pine Pinus spp. trees, which provide important feeding sites for these wintering birds. Vegetation management with a disregard for ecosystems has an adverse effect on these bird species.

This study failed to distinguish factors affecting LDM birds in the study site from those in their wintering and/or stopover sites due to a lack of information on forest species. This was probably because the study site is small and fragmented, and is affected by local events more strongly than those in wintering or stopover regions. The reactions of bird species to habitat changes vary according to their own life history traits (Batary & Baldi 2004; Lloyd et al. 2005; Amano & Yamaura 2007). Here, we compared the population fluctuations of the study site with national population trends in each bird species. LDMs are in decline due to losses of tropical forests on their wintering grounds (Amano & Yamaura 2007). In the study site, White-throated Needletails are decreasing and Common Cuckoos are now absent. It is assumed that these LDMs have been negatively affected by a combination of habitat loss on their wintering grounds and degradation of their breeding habitat in the study site. The maturation of forests has reduced early-successional habitats across Japan, resulting in a decline in bird species dependent on early-successional habitats (Yamaura et al. 2009). Among the temperate early-successional species, Black-faced Bunting and Oriental Turtle Dove have declined in the study site. Their declines were presumably caused by losses of suitable nesting sites in the shrub layer due to intensified vegetation management. Mature forest species, such as Great-spotted Woodpecker and Great Tit, which are increasing across Japan, have declined in the study site probably due to the loss of breeding tree cavities resulting from windfall and the removal of decaying trees.

Some bird species have changed in abundance primarily due to habitat changes in the study site. Large-billed Crows on the one hand have benefited from the land-use changes, while on the other hand...
Carrion Crows have been negatively impacted. The modification of a pond on the campus seems to have favored the Mallard, which now visits in larger numbers and is fed there by people. Other factors thought to be affecting bird abundance in the study site are adaptation to human landscapes and interspecific interactions. For example, Slaty-backed Gulls have started breeding on man-made structures in the urban areas of Sapporo and have recently increased in the study site. The interaction between the two species of genus *Corvus* may also be a contributory factor in the decline of the smaller Carrion Crow. In the case of the Eurasian Tree Sparrows (Une et al. 2007), they suffered a local population collapse because of a local outbreak of an infectious disease. Since these species all use human-dominated landscapes, their changes in abundance may reflect changes in habitats and in the behavior of urban citizens.

In conclusion, the census survey suggests that there are three trends in the abundance of birds on Hokkaido University campus. Some species have declined due to degradation of their breeding habitats, in addition to the loss of their wintering grounds. Some species are increasing across Japan, but are decreasing in the study area as a consequence of habitat deterioration there. Some species have increased as they benefit from the man-made environment and by exploiting human-supplied resources. The long-term HUBC census has contributed to our understanding of how lowland, and suburban/urban bird populations may be faring in Hokkaido. However it has certain problems; firstly, the census routes do not represent all habitat types. Large pastures were not included in the original census routes, thus changes in open land bird populations, probably affected by habitat degradation due to building construction, were not monitored. Secondly, the effects of habitat changes occurring only in particular sections of campus could not be detected because all data from each part of the census routes was pooled. Thirdly, large flocks of single species produced considerable variability in the census results. This problem is especially severe in flocking species, such as Mallard, Hawfinch and other SDMs. Nevertheless, voluntary studies conducted by college students and clubs have the advantage of continuity over prolonged periods, as long as motivation is maintained and regular monthly surveys conducted and as long as the census techniques are handed down effectively to new members each year. The involvement and cooperation of faculty researchers in future so as to facilitate the analysis of data collected by students is highly desirable.

Avian data sets become increasingly valuable as they are collected long term. Such data have the potential to enhance our understanding of lowland bird population trends. It is hoped that many groups and institutions will conduct similar long-term censuses in other regions, as such data sets would provide a powerful tool for the analysis of trends in avian communities and habitats on a large scale.

**ACKNOWLEDGMENTS**

We are grateful to K. Masumoto, T. Kaji, Y. Ono, and M. Kato for their assistance in the completion of this paper. We also thank all the members of Hokkaido University Birding Club who have contributed by collecting data for this study.

**REFERENCES**


Kurosawa R, Tokunaga T, Kobayashi K & Hirata K


