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GEOGRAPHIC AND TEMPORAL VARIATION IN THE DIET OF YELLOW-HEADED BLACKBIRDS[1]

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Abstract. Yellow-headed Blackbirds (*Xanthocephalus xanthocephalus*) are presumed predators of sunflower (*Helianthus annuus*) in the northern Great Plains. Their esophageal contents varied temporally and among three provinces and three states in relation to regional agricultural bases but males contained more sunflower and small grains than females whereas females contained more weed seeds and insects than males. The diets of both sexes frequently included insects but insects comprised only a small proportion of the total dry weight of esophageal contents. In north-central North Dakota, sunflower represented about 50% of the esophageal contents of males in spring and fall but comprised less than 20% of the female diet. Small grains comprised about 25% of the female diet in all seasons and about 40% of summer diet of males. Insects represented about 50% of the diet of females until mid-summer when insects were largely replaced by weed seeds.

Key words: Yellow-headed Blackbirds; Xanthocephalus xanthocephalus; *diet; sunflower; northern Great Plains; North Dakota.*

INTRODUCTION

Breeding Yellow-headed Blackbirds (*Xanthocephalus xanthocephalus*) are common in the central North American prairies and seem to be increasing in number. North American Breeding Bird Surveys (Droege and Sauer 1989) suggest an average annual increase of 5.4 birds per survey route from 1966 to 1988, and a population survey in North Dakota (Besser 1985) indicated a 371% increase in Yellow-headed Blackbirds from 1967 to 1982.

Depredation of commercial sunflower crops by Red-winged Blackbirds (*Agelaius phoeniceus*), Common Grackles (*Quiscalus quiscula*), and Yellow-headed Blackbirds has prompted scientific investigations to mitigate crop losses. Hothem et al. (1988) estimated that sunflower growers in Minnesota, North Dakota, and South Dakota sustained a $5–8 million annual loss during 1979 and 1980 from bird depredations. Despite a reduced number of hectares planted to sunflower in recent years, North Dakota growers reported nearly $3 million in losses during 1989 (North Dakota Agricultural Statistical Service 1990). Continuing sunflower loss and increasing numbers of Yellow-headed Blackbirds have focused investigations on this species. Yellow-headed Blackbirds breed in large numbers in the sunflower-growing regions of North Dakota, South Dakota, and Minnesota. Also, many Yellow-headed Blackbirds that breed in Canada migrate through these states in early fall (Royall et al. 1971) and exacerbate losses.

As part of an effort to understand the role of Yellow-headed Blackbirds in sunflower depredations, we examined regional and temporal differences in their diets. Our objectives were: (1) to compare geographic variability in the spring diet of Yellow-headed Blackbirds, and (2) to identify temporal changes in the diet of Yellow-headed Blackbirds in the sunflower-growing region of north-central North Dakota.

STUDY AREA

Our study was conducted in the prairie pothole region of Alberta, Manitoba, Saskatchewan, Minnesota, North Dakota, and South Dakota (Fig. 1). The prairie pothole region has been extensively developed for agriculture but still has numerous wetlands used by breeding and roosting Yellow-headed Blackbirds. We chose to assess temporal changes only from the area in and

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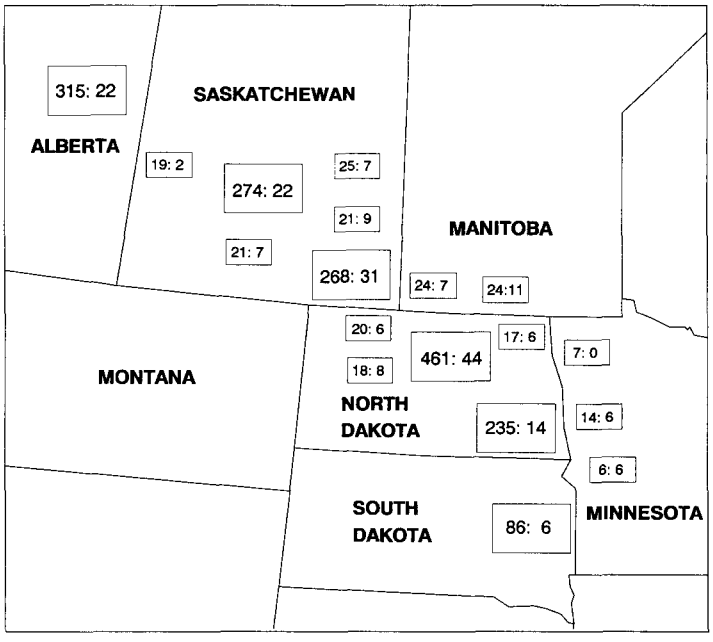

FIGURE 1. Total numbers of male and female (♂:♀) Yellow-headed Blackbirds collected at study sites in the northern Great Plains during the springs of 1987 and 1988. Locations of blocks approximate collection locations. Large blocks represent approximately 6,000 km^2 and small blocks represent approximately 1,000 km^2.

around Benson County in north-central North Dakota; this area was selected because of documented consumption of sunflower (Linz et al. 1988).

METHODS

We shot adult male and female Yellow-headed Blackbirds from 21 May–16 June 1987 and from 14 May–17 June 1988 to obtain geographic samples. We collected birds only within discrete collection areas located systematically within a transect extending from southwest Minnesota to east-central Alberta (Fig. 1). Within each collection area, birds were collected from most wetlands or their associated flight-lines during all daylight hours. To assess temporal changes in diet, we collected adult and immature birds of both sexes from 1 July–18 September 1987 and from 21 June–12 September 1988 in north-central North Dakota. By mid-September most Yellow-headed Blackbirds had migrated from the study area and collections were terminated. In late summer and fall, birds were also collected from sunflower fields, cornfields and small grain fields. However, data from birds collected in agricultural fields were used only to compare diets among habitats or within each respective habitat; these data were not used for any other statistical comparison nor were data from different habitats combined. Because we restricted collection of immature birds to those capable of flight, immature birds were represented only in summer and fall. Further descriptions of collection locations are given by Twedt et al. (1987, 1988) and Twedt (1990). Birds were placed on ice or dry ice after collection to reduce post-mortem digestion of food items and stored frozen until processed.

Esophageal contents were removed from thawed specimens, placed in ethanol, and categorically sorted as: insects, sunflower (seed kernels only), small grains (wheat, oats, barley, etc.), weed seeds (all non-crop seeds except wild oats), wild oats, corn, millet (Proso millet, sorghum, milo), and grit and chaff (non-seed vegetation). Blackbirds typically shell sunflower and consume only the kernel or seed meat; thus, all weights of sunflower in this paper represent kernel weights. Although the weed seed category included all weed seeds except wild oats, this category was almost exclusively foxtail (*Setaria* spp.). Grit and chaff were considered non-food items and were omitted from analyses. We oven-dried (76°C for 12 hrs) the sorted food items and weighed them

to the nearest 0.001 g. Dry weights of insects probably were underestimated because of our use of ethanol (Howmiller 1972); thus, weights reported may be conservative.

Only birds with food in their esophagi were considered in statistical analyses. For birds collected in the spring, we compared the square root and arcsine transformed (Zar 1984:239–240) mean proportions of dry weight of esophageal contents between sexes and among states and provinces. To make these comparisons we used a comprehensive multivariate analysis of variance (MANOVA) in SAS General Linear Models (SAS Institute 1987). All additional contrasts were made as part of this comprehensive MANOVA (Milliken and Johnson 1984). Reported F-statistics, based on Wilk's lambda, refer to simultaneous comparison of all dietary categories.

We found differences in esophageal contents among birds collected from different habitats. Therefore, for birds collected in agricultural fields, we compared esophageal contents between sexes and ages for birds collected from each crop habitat (i.e., age and sex within habitat).

For birds collected from wetlands and their associated flight-lines in north-central North Dakota, we compared esophageal contents between sexes, between age-classes, and among three seasonal categories: spring (from 14 May–20 June), summer (from 21 June–31 July), and fall (from 1 August–18 September). These intervals were chosen because many young Yellow-headed Blackbirds fledged by 21 June (Grimm 1968) and sunflower crops developed and became vulnerable to depredations around 1 August (pers. obs.). As was the case for geographic comparisons, all specific contrasts used for further comparisons of sex, age, and season were made within the context of a single comprehensive MANOVA.

In addition to statistical comparisons of mean proportions of dry weight of esophageal contents, we also determined frequencies of occurrence. Mean proportion of dry weight (aggregate percent), determined for each food component, was the average of the dry weight proportions from each individual (Swanson et al. 1974). Absolute frequency of occurrence was the number of times a food category occurred/the total number of birds; relative frequency was the number of times a food category occurred/the total number of times all food categories occurred. To illustrate the temporal dynamics of dietary change, 3-collection-day moving averages (Box and Jenkins 1970) of mean dry weight and relative frequency of occurrence of esophageal contents were graphed.

RESULTS

LAND USE

All Canadian provinces and North Dakota had over three quarters of their cropped agricultural lands in small grains (wheat, oats, barley, and rye), but small grains accounted for only 54 and 35% of the cropped land in South Dakota and Minnesota, respectively (Agriculture Canada 1989, Minnesota Agricultural Statistical Service 1988, North Dakota Agricultural Statistical Service 1988, South Dakota Agricultural Statistical Service 1989). Corn represented nearly a third of the cropped land in South Dakota and Minnesota, but only 5% in North Dakota, 4% in Alberta, and $<1\%$ in Manitoba and Saskatchewan. In North Dakota, sunflower accounted for 8% of the cropped land, but only 3% in South Dakota, and $<1\%$ in Minnesota and the three Canadian provinces. Finally, millet was planted on 3% of South Dakota's cropped land but represented $<1\%$ of the hectarage in the other states and provinces.

Of the 365,000 ha in Benson County, North Dakota, about 162,000 ha were in agricultural crops. Small grains, primarily wheat, represented about 79% of the cropland in Benson County; sunflower was planted on 14% and corn was planted on 2% of this cropland.

GEOGRAPHIC VARIATION

Geographic variability of esophageal contents of Yellow-headed Blackbirds in spring was determined from 790 males and 91 females (Fig. 2). We detected a significant interaction ($F = 1.58$; df = 35, 3,645; $P = 0.016$) between sex and geographic areas in the proportions of dry weight of esophageal contents consumed. Esophageal contents differed between sexes (Fig. 2) in Manitoba ($F = 2.64$; df = 7, 866; $P = 0.010$), North Dakota ($F = 6.94$; df = 7, 866; $P < 0.001$), and Saskatchewan ($F = 5.35$; df = 7, 866; $P < 0.001$). Esophageal contents of males contained more sunflower in North Dakota, more small grains in Saskatchewan, and more millet in Manitoba and North Dakota than females in these areas. Female esophageal contents contained more weed seeds in Manitoba, North Dakota and Saskatchewan, and more insects in North Dakota and Saskatchewan than males in these areas.

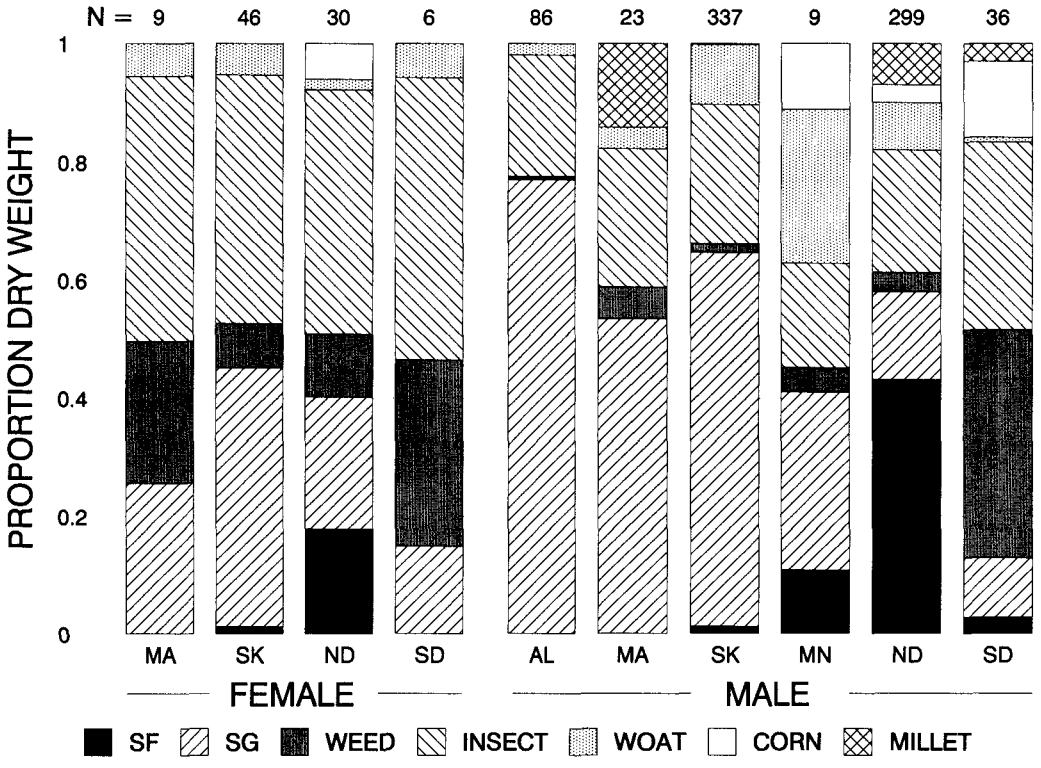

FIGURE 2. Mean proportions of dry weight of 7 dietary categories from the esophageal contents of Yellow-headed Blackbirds collected within Alberta (AL), Manitoba (MA), Saskatchewan (SK), Minnesota (MN), North Dakota (ND), and South Dakota (SD) during the springs of 1987 and 1988. SF = sunflower seed meats, SG = small grains, WEED = weed seeds (primarily *Setaria* spp.), INSECT = insects, WOAT = wild oats, CORN = corn, and MILLET = millet.

Esophageal contents of males differed significantly ($F = 25.22$; df = 35, 3,645; $P < 0.001$) among geographic areas (Fig. 2). Esophageal contents differed significantly between males from the United States (USA) and males from Canada ($F = 21.64$; df = 7, 866; $P < 0.001$); Canadian males contained more small grains but less sunflower, weed seeds, and corn than males from the USA. Significant differences in esophageal contents of males were found among the three states ($F = 16.97$; df = 14, 1,732; $P < 0.001$) and among the three provinces ($F = 2.72$; df = 14, 1,732; $P < 0.001$). Among the three states, males from North Dakota contained more sunflower but less corn than males from South Dakota or Minnesota; males from South Dakota contained the most weed seeds, and Minnesota males contained the most wild oats. Among the three provinces, Alberta males contained the most small grains and Manitoba males contained the most millet; Saskatchewan males contained more wild oats than Alberta males.

We compared esophageal contents of females only for birds from North Dakota, South Dakota, Manitoba, and Saskatchewan because few esophagi of females from Alberta and Minnesota contained food items. Geographic area significantly affected the mean proportion of dry weight of esophageal contents of females ($F = 1.95$; df = 21, 2,487; $P = 0.006$). Females from North Dakota contained more sunflower than females from any other state or province. However, in specific contrasts within the overall MANOVA, we found no significant differences between females from Canada and females from the USA ($F = 0.94$; df = 7, 866; $P = 0.473$), between females from the two provinces ($F = 1.98$; df = 7, 866; $P = 0.055$), or between females from the two states ($F = 1.59$; df = 7, 866; $P = 0.135$). Insects, and to a lesser extent small grains and weed seeds,

TABLE 1. Absolute frequencies of occurrence of dietary categories of esophageal contents from Yellow-headed Blackbirds collected in three Canadian provinces and three U.S. states during the springs of 1987 and 1988.

	Sunflower	Small grains	Weed seeds	Insects	Wild oats	Corn	Millet
Female							
Manitoba	0	33.3	44.4	55.6	11.1	0	0
Saskatchewan	4.4	60.9	28.3	82.6	8.7	0	0
North Dakota	26.7	33.3	30.0	83.3	3.3	6.7	0
South Dakota	0	33.3	66.7	100.0	16.7	0	0
Male							
Alberta	0	86.1	3.5	74.4	2.3	0	0
Manitoba	0	60.9	8.7	69.6	4.4	0	17.4
Saskatchewan	2.4	73.3	11.6	68.8	15.1	0.3	0
Minnesota	11.1	44.4	44.4	77.8	33.3	11.1	0
North Dakota	54.5	23.1	17.7	74.2	10.0	3.3	7.7
South Dakota	2.8	22.2	50.0	72.2	2.8	19.4	5.6

were a large proportion of esophageal contents of females in all geographic areas.

Mean esophageal content of male Yellow-headed Blackbirds was 0.37 g and ranged from 0.22 g in Alberta to 0.73 g in Minnesota; in females the mean esophageal content was 0.26 g (range 0.16–0.31 g). Within North Dakota, males contained mostly sunflower ($\bar{x} = 0.18$ g) and small grains ($\bar{x} = 0.06$ g), whereas females contained mostly small grains ($\bar{x} = 0.11$ g) and weed seeds ($\bar{x} = 0.04$ g).

On the basis of absolute frequencies of occurrence (Table 1), sunflower frequently occurred in esophageal contents of North Dakota males, small grains frequently occurred in Canadian males, and weed seeds and small grains frequently occurred in females from all states and provinces. Although esophageal contents contained comparatively few insects, they occurred in 55 to 100% of esophageal contents of Yellow-headed Blackbirds from every state and province. Weed seeds frequently occurred in esophageal contents of females from all areas and males from Minnesota and South Dakota.

TEMPORAL VARIATION

Esophageal contents were examined from 1,578 Yellow-headed Blackbirds (1,070 males, 508 females) from north-central North Dakota. Esophageal contents differed significantly ($F = 9.61$; df = 21, 4,468; $P < 0.001$) among four habitats: noncrop habitats (wetlands and flight-lines), sunflower fields, small grain fields, and cornfields (Fig. 3). Generally, esophageal contents of Yellow-headed Blackbirds contained the predominant forage available in each cropland habitat; in non-crop habitat, insects were more prevalent than in other habitats.

Esophageal contents of birds from non-crop habitats. Significant interactions of sex and season ($F = 4.82$; df = 12, 1,492; $P < 0.001$) and age-class and season ($F = 2.34$; df = 6, 746; $P = 0.030$) were detected when comparing esophageal contents of 761 birds collected from non-crop habitat (Fig. 4). Esophageal contents of females differed between age-classes ($F = 2.15$; df = 6, 746; $P = 0.046$); adult females contained more small grains than immature females. Female esophageal contents also differed among seasons ($F = 9.05$; df = 12, 1,492; $P < 0.001$); more weed seeds and less insects were present in fall than in spring or summer.

A significant interaction of age-class and season ($F = 2.50$; df = 6, 746; $P = 0.021$) affected esophageal contents of males. Esophageal contents of both adult males ($F = 24.42$; df = 12, 1,492; $P < 0.001$) and immature males ($F = 11.17$; df = 6, 746; $P < 0.001$) differed seasonally. Immature males contained more insects but less sunflower and weed seeds in summer than in fall. Adult males contained more corn but less insects and wild oats in fall than in either spring or summer. Additionally, esophageal contents of adult males contained the least sunflower in summer and the least weed seeds in spring. Finally, adults contained more small grains in summer than in fall, but more in fall than in spring.

We detected no significant difference in esophageal contents of adult and immature males during summer ($F = 1.65$; df = 6, 746; $P = 0.130$).

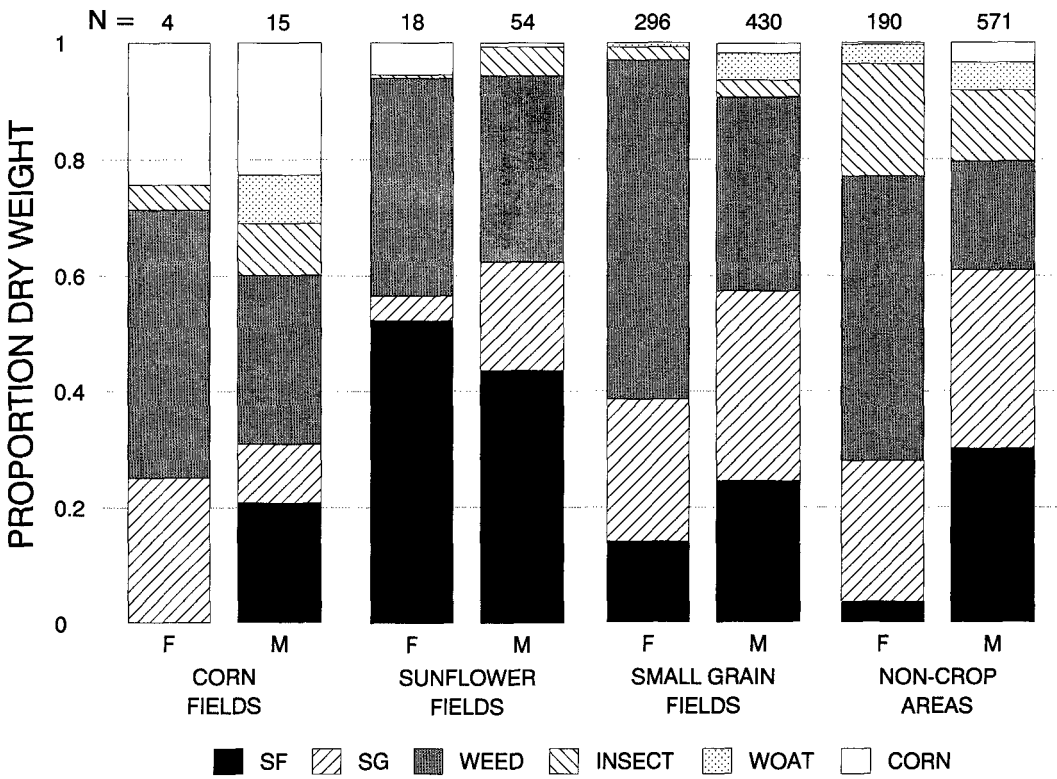

FIGURE 3. Mean proportions of dry weight of 6 dietary categories from the esophageal contents of male (M) and female (F) Yellow-headed Blackbirds collected within 4 habitats of north-central North Dakota during 1987 and 1988. SF = sunflower seed meats, SG = small grains, WEED = weed seeds (primarily *Setaria* spp.), INSECT = insects, WOAT = wild oats, and CORN = corn.

During fall, however, esophageal contents of adult and immature males differed significantly (F = 11.03; df = 6, 746; $P < 0.001$); adults contained more sunflower and corn whereas immatures contained more small grains and weed seeds.

Esophageal contents varied by sex in spring (F = 45.3; df = 6, 746; $P = 0.002$) and summer (F = 3.55; df = 6, 746; $P = 0.002$). In spring, more small grains were in esophageal contents of females but in summer more were in males. Females also contained more insects in spring and weed seeds in fall than males. During the fall, the interaction of sex and age affected esophageal contents (F = 2.32; df = 6, 746; P = 0.031). Significant differences were detected between age-classes for males (as noted above) but not for females (F = 1.82; df = 6, 746; $P < 0.093$). Esophageal contents also differed between sexes for both immatures (F = 12.67; df = 6, 746; $P < 0.001$) and adults (F = 18.88; df = 6, 746; $P < 0.001$) in fall. In both age-classes, esophageal contents of males contained more sunflower than those of females, but females contained more weed seeds than males. Immature males also had more small grains in their esophageal contents than immature females.

The mean dry weight of food material per esophagus for males increased from approximately 0.2 g in early July to >0.7 g in fall (Fig. 5). This trend also was apparent for females; dry weight of food material per esophagus increased from 0.1 g in early July to approximately 0.6 g in fall. Nearly half of the total weight of esophageal contents of males during early spring and late fall was sunflower but during mid-summer small grains comprised about half. In contrast to males, esophageal contents of females contained little sunflower.

Insects occurred most frequently in esophageal contents of males until mid-summer when weed seeds occurred with increased frequency (Fig. 6). Male esophageal contents contained sunflower

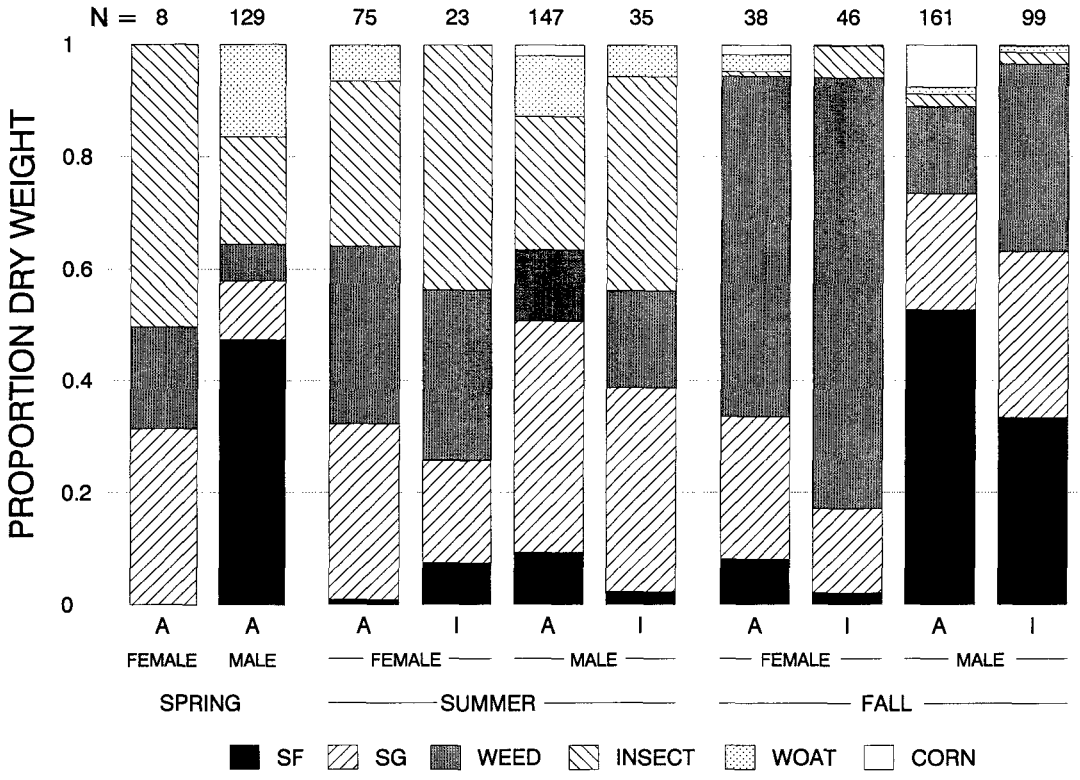

FIGURE 4. Mean proportions of dry weight of 6 dietary categories from the esophageal contents of immature (I) and adult (A), male and female Yellow-headed Blackbirds collected from north-central North Dakota within non-crop habitat during the spring, summer, and fall of 1987 and 1988. SF = sunflower seed meats, SG = small grains, WEED = weed seeds (primarily *Setaria* spp.), INSECT = insects, WOAT = wild oats, and CORN = corn.

more frequently in spring and fall but contained small grains more frequently in summer. Esophageal contents of female Yellow-headed Blackbirds followed a similar trend as that described for males except that sunflower never occurred frequently.

Esophageal contents of birds from agricultural fields. To facilitate comparison with other studies of the food habits of blackbirds collected from agricultural fields (e.g., Gartshore et al. 1982, Linz et al. 1984), we compared the esophageal contents of Yellow-headed Blackbirds collected from different croplands. For birds collected from sunflower fields, neither sex ($F = 0.46$; df = 5, 64; $P = 0.84$) nor age-class ($F = 0.32$; df = 5, 64; $P = 0.92$) influenced esophageal contents.

However, the interaction of sex and age affected esophageal contents within small grain fields ($F = 4.08$; df = 6, 717; $P < 0.001$). For Yellow-headed Blackbirds from small grain fields, esophageal contents of adult males differed significantly from immature males ($F = 4.40$; df = 6, 717; $P < 0.001$); adults contained more sunflower and corn but less weed seeds than immature males. Likewise, esophageal contents of immature females differed from adult females ($F = 8.12$; df = 6, 717; $P < 0.001$); adults contained more sunflower and small grains but less weed seeds than immature females. Differences in esophageal contents attributable to sex were evident for both adult ($F = 12.65$; df = 6, 717; $P < 0.001$) and immature birds ($F = 12.04$; df = 6, 717; $P < 0.001$). Adult males contained more sunflower, insects, wild oats, and corn but less weed seeds than adult females. Esophagi of immature males contained more sunflower and small grains but less weed seeds than immature females.

DISCUSSION

We assumed the esophageal contents of Yellow-headed Blackbirds accurately reflected their diet.

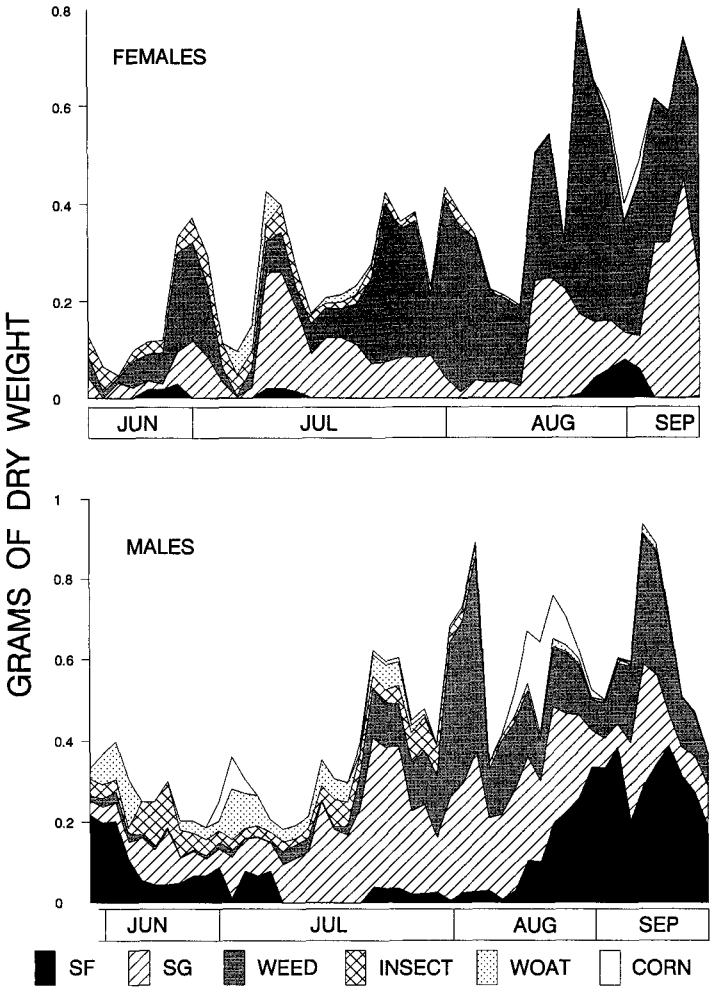

FIGURE 5. Three-collection-day moving averages of the mean gram of dry weight of 6 dietary categories from the esophageal contents of male and female Yellow-headed Blackbirds collected from north-central North Dakota within non-crop habitat during 1987 and 1988. SF = sunflower seed meats, SG = small grains, WEED = weed seeds (primarily *Setaria* spp.), INSECT = insects, WOAT = wild oats, and CORN = corn.

To minimize time and site biases, we collected birds throughout our study area during all daylight hours. However, our results indicated that specific habitats influenced esophageal contents of Yellow-headed Blackbirds. Therefore, birds collected in different habitats were not combined for analysis. Instead, only birds collected in non-crop (wetland) habitat were used for our temporal comparisons.

Wetland roosts are used by Yellow-headed Blackbirds during all seasons while in the Great Plains. Typically, Yellow-headed Blackbirds leave wetland roosts at sunrise in characteristic flight-lines. These birds forage in surrounding habitats but return to the same or different wetlands periodically throughout the day for water or to rest. Foraging radii vary from a relatively small radius during the breeding season up to several kilometers in the fall. Near sunset, Yellow-headed Blackbirds typically follow flight-

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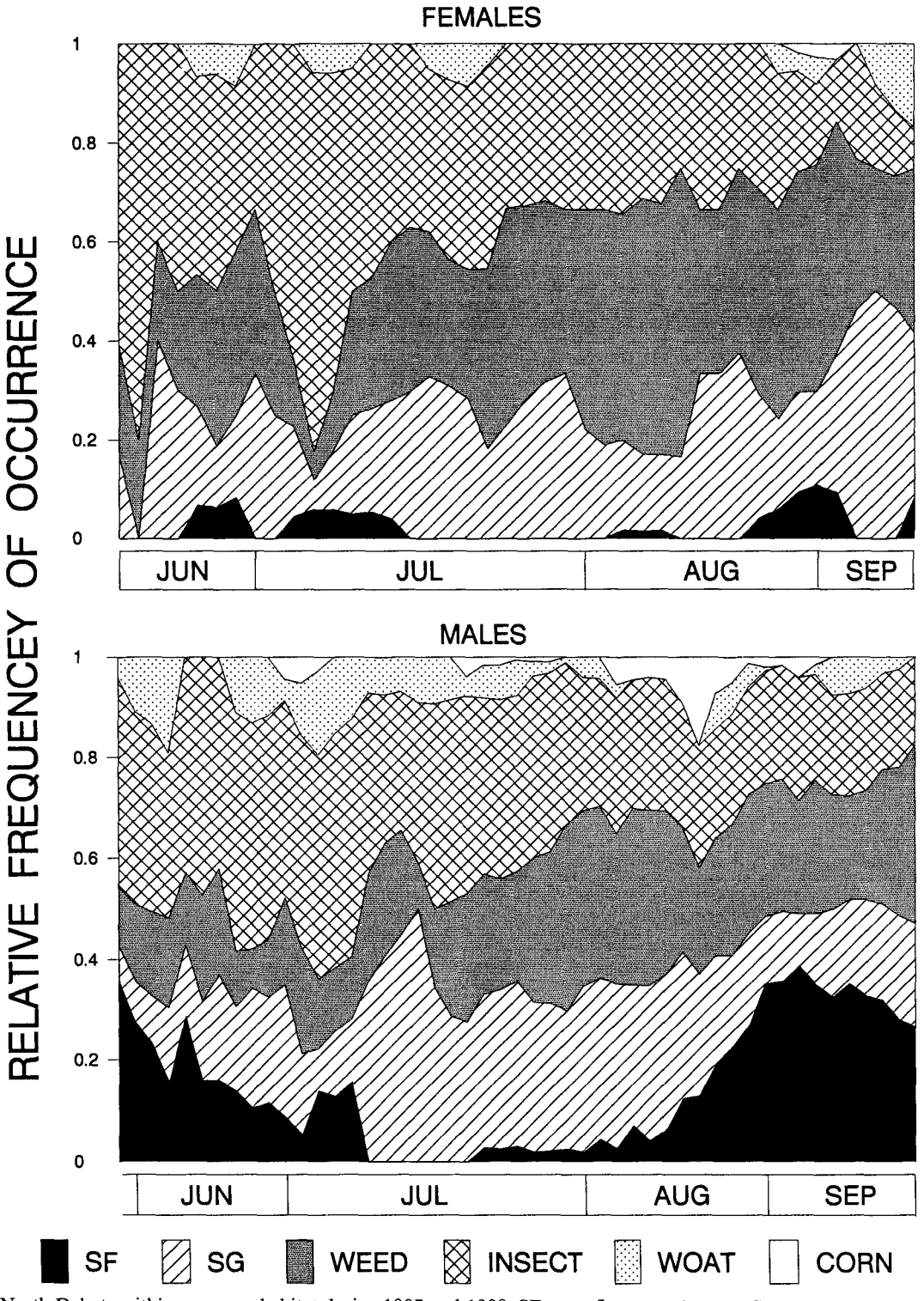
FIGURE 6. Three-collection-day moving averages of the relative frequencies of occurrence of 6 dietary categories from the esophageal contents of male and female Yellow-headed Blackbirds collected from north-central



North Dakota within non-crop habitat during 1987 and 1988. SF = sunflower seed meats, SG = small grains, WEED = weed seeds (primarily *Setaria* spp.), INSECT = insects, WOAT = wild oats, and CORN = corn.

lines to return to wetland roosts (Bent 1965:119–120). However, wetland roosts used by nonbreeding birds are dynamic; individuals may roost in different wetlands nightly and migrants may arrive or depart (Otis et al. 1986). Therefore, we felt birds collected in association with non-crop habitat best reflected foraging in all available foraging habitats.

Esophageal contents of Yellow-headed Blackbirds reflected the agricultural base of each geographic region. Esophagi of Canadian birds contained mostly small grains, whereas corn was found primarily in esophagi of South Dakota and Minnesota birds, and sunflower was found primarily in esophagi of birds from North Dakota. Millet was found only in the esophagi of birds from southeastern North Dakota and Manitoba where it was locally available. High usage of millet also has been noted for Red-winged Blackbirds (Knittle et al. 1988).

Most of the grains consumed in spring were waste grains from the harvest of the previous year. High usage of sunflower in spring by foraging Yellow-headed Blackbirds in North Dakota may have been influenced by the relative abundance of waste sunflower. Unlike small grain fields that were often plowed in the fall, sunflower fields were often not plowed until spring and, consequently, waste sunflower was more readily available.

Although insects were a minor component of the total dry weight of esophageal contents, they were consumed by many birds. We expected females to increase consumption of insects in spring when feeding young but found that both males and females increased consumption of insects in spring; high availability of insects and a limited seed base in newly plowed fields probably were responsible.

Dry weights of esophageal contents increased by the second week of July at the onset of molt in Yellow-headed Blackbirds (Twedt 1990) and remained high until these birds departed the study area in September. Presumably, the increased dry weight consumption reflects the increased nutritional demands of molt (Lustick 1970) and deposition of pre-migratory fat reserves.

We did not estimate the availability of insects or weed seeds. However, we estimated the area planted in sunflower and small grains. Although sunflower represented only about 14% of the hectares planted in Benson County, during the fall they comprised over 50% of the diet of male Yellow-headed Blackbirds. Conversely, small grains represented nearly 80% of the cropland but rarely exceeded 40% of the diet.

Chronology of crop maturation may have determined the type of food consumed by Yellow-headed Blackbirds. Insects were less common in esophageal contents when the annual crop of small grains and weed seeds became available in late summer. Sunflower consumption increased markedly, especially in males, during the third week of August as sunflower matured, and sunflower prevailed as the dominant food until birds migrated from the study area. This period of high sunflower consumption by Yellow-headed Blackbirds was nearly identical to the peak of sunflower damage in North Dakota (15 August–16 September) reported by Cummings et al. (1989). Although Yellow-headed Blackbirds migrated from this sunflower growing region considerably earlier than other blackbird species (Twedt 1990), Yellow-headed Blackbirds were present during the peak of sunflower depredation.

Crop availability and harvest also influenced the temporal availability of crops as bird forage. By late August, 75 to 90% of the small grain crop had been harvested. In contrast, by late September, only about 10% of the corn and 3% of the sunflower were harvested (North Dakota Agricultural Statistical Service 1988). Thus, the temporal availability of ripening grains probably affected the esophageal contents we observed.

We suggest that Yellow-headed Blackbirds consume less sunflower than Red-winged Blackbirds. Esophagi of male Red-winged Blackbirds collected in sunflower fields in North Dakota contained 69% sunflower and females contained 57% (Linz et al. 1984); these proportions are considerably greater than 52 and 41% found in male and female Yellow-headed Blackbirds, respectively, in our study. Similarly, esophageal contents of birds collected from non-crop habitats suggest that Yellow-headed Blackbirds consume less sunflower than Red-winged Blackbirds. Esophagi of Red-winged Blackbirds collected from non-crop habitats in late August contained 67 and 21% sunflower (total dry weight) for males and females, respectively (Linz et al. 1983); our findings suggest that during August and September, male and female Yellow-headed Blackbirds obtained about 37 and 4% (total dry weight), respectively. Because of this difference in diet and because Yellow-headed Blackbirds are far

less numerous than Red-winged Blackbirds (Besser 1985), we feel Yellow-headed Blackbirds, especially females, contribute less to overall sunflower losses than Red-winged Blackbirds. However, Yellow-headed Blackbirds are larger birds than Red-winged Blackbirds and males foraged extensively on ripening sunflower during the peak damage period. Thus, male Yellow-headed Blackbirds may contribute significantly to sunflower losses. Even so, the lesser sunflower content in esophagi of Yellow-headed Blackbirds, their smaller population, and their earlier migration when compared with Red-winged Blackbirds suggest future research to reduce blackbird depredation on sunflower should focus on Red-winged Blackbirds.

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