

Passerine Migration Patterns in Davis, Yolo County — 2000-2010

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Although passerine migration may conjure images of Point Reyes for many local birders, the Central Valley, with its north-south orientation, is believed to be the primary migration corridor through California for most species, surpassing the coastline in this regard (Humble and Geupel 2002). Nevertheless, data on passerine migration through the Central Valley are largely limited to studies conducted in remnant patches of riparian habitat at well-known conservation sites. At the same time, stopover habitat use by neotropical migrants remains largely undescribed (Petit 2000). This paper provides an analysis of spring and fall migration for 27 passerine species (Table 1), spanning a ten-year period, from a small patch of relatively unremarkable habitat in a residential area of Davis, Yolo County.

Table 1. Passerine migrants regularly observed at the Davis, Yolo County, study area.

Olive-sided Flycatcher (*Contopus cooperi*)
Western Wood-Pewee (*Contopus sordidulus*)
Willow Flycatcher (*Empidonax traillii*)
Hammond's Flycatcher (*Empidonax hammondii*)
Dusky Flycatcher (*Empidonax oberholseri*)
Pacific-slope Flycatcher (*Empidonax difficilis*)
Ash-throated Flycatcher (*Myiarchus cinerascens*)
Cassin's Vireo (*Vireo cassinii*)
Warbling Vireo (*Vireo gilvus*)
House Wren (*Troglodytes aedon*)
Blue-gray Gnatcatcher (*Polioptila caerulea*)
Swainson's Thrush (*Catharus ustulatus*)
Orange-crowned Warbler (*Oreothlypis celata*)
Nashville Warbler (*Oreothlypis ruficapilla*)
Yellow Warbler (*Dendroica petechia*)
Black-throated Gray Warbler (*Dendroica nigrescens*)
Townsend's Warbler (*Dendroica townsendi*)
Hermit Warbler (*Dendroica occidentalis*)
MacGillivray's Warbler (*Oporornis tolmiei*)
Common Yellowthroat (*Geothlypis trichas*)
Wilson's Warbler (*Wilsonia pusilla*)
Yellow-breasted Chat (*Icteria virens*)
Western Tanager (*Piranga ludoviciana*)
Chipping Sparrow (*Spizella passerina*)
Black-headed Grosbeak (*Pheucticus melanocephalus*)
Lazuli Bunting (*Passerina amoena*)
Bullock's Oriole (*Icterus bullockii*)

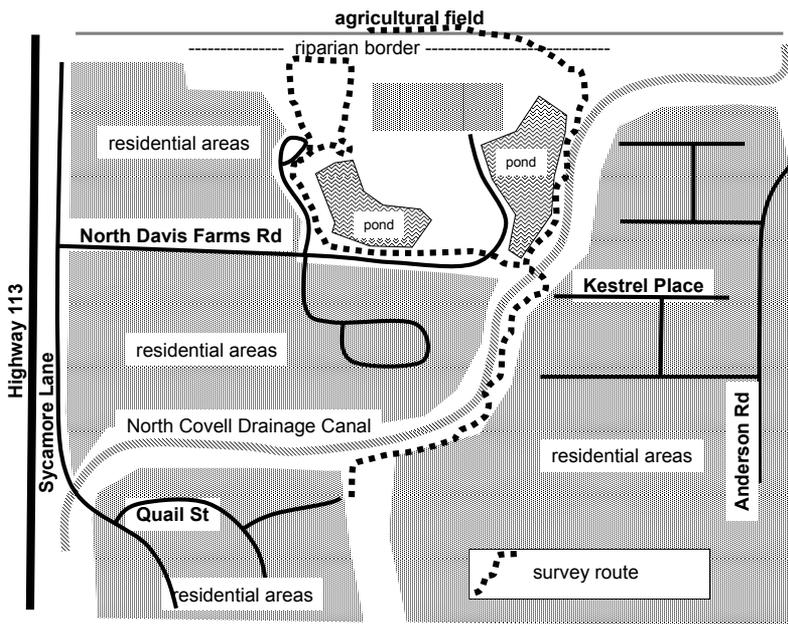


Figure 1. Survey route and prominent features of the North Davis study area.

STUDY AREA

I conducted surveys in north Davis, Yolo County, recording all migrant passerine species heard and seen, from fall 2000 through spring 2010. The survey route is 1.2 km (0.7 mi) in length. The area is mostly suburban residential, with some rural features (Figure 1). It is located on the northern edge of the city of Davis, with many miles of open agricultural land to the north and dense residential areas to the south. The route follows a portion of the North Covell Drainage Canal, partially circles two constructed stormwater detention ponds in the North Davis Farms subdivision, and covers the edge of an agricultural field bordered by trees and shrubs. Private homes border much of the route, which is used daily by joggers, dog-walkers, and bicyclists.

The North Covell Drainage Canal usually has some flowing water, as it is used to convey agricultural water supply, as well as drain rain water. It is bordered by trees, especially eucalyptus. During fall migration, several of these trees were typically infested with lerps (protective coatings) produced by larvae of a psyllid, a small insect that feeds on eucalyptus leaves. The infestations were heavier in the first few years, but remained at a level sufficient to attract many birds that fed on the psyllids and their lerps throughout the years of the surveys. There are significant plantings of native trees and shrubs around the ponds in North Davis Farms, and in

the riparian border adjacent to the agricultural field. These include elderberry (*Sambucus mexicana*), oak (*Quercus* sp.), cottonwood (*Populus* sp.), willow (*Salix* sp.), coyote bush (*Baccharis pilularis*), and rose (*Rosa* sp.). Additionally, there are many non-native species, most prominently pines (*Pinus* sp.) and Chinese pistache (*Pistacia chinensis*), in addition to the eucalyptus. The agricultural field is variously planted in alfalfa, tomatoes, corn, or wheat, from year to year.

Resident nesting birds include Mourning Dove (*Zenaida macroura*), American Robin (*Turdus migratorius*), Northern Mockingbird (*Mimus polyglottos*), Western Scrub-Jay (*Aphelocoma californica*), and House Finch (*Carpodacus mexicanus*). Blue Grosbeak (*Passerina caerulea*) nested in some years, and California Towhee (*Melospiza crissalis*) moved into the area and nested in 2009. Of the 27 migrant species, none have nested successfully, although Orange-crowned Warbler and House Wren have each over-summered in one year.

METHODS

I conducted surveys in the morning, usually within the first hour or two after sunrise. Each survey lasted about 35 minutes. They were done using a combination of bicycle and foot. A total of 618 surveys were conducted spanning ten spring and ten fall migration periods. Spring surveys spanned 21 March to 10 June, while “fall” surveys spanned 21 July to 20 October. A few surveys conducted before and after these periods yielded very few migrants and were excluded from this analysis. An average of 28 surveys were conducted each spring, for an average of 2.3 surveys per week, while 34 surveys were conducted each fall, for an average of 2.7 surveys per week. Surveys were limited to favorable weather and were not conducted during strong wind or rain.

For analysis, months were divided into three parts: early = 1st through 10th; mid = 11th through 20th; and late = 21st through the end of the month. This arrangement follows the convention of the Yolo County checklist (Yolo Audubon Society Checklist Committee 2004).

RESULTS

Surveys revealed a significant movement of passerine migrants through residential Davis in both spring and fall. Wilson’s, Yellow, and Orange-crowned Warblers; Western Tanager; and Black-headed Grosbeak were recorded almost daily through much of the survey period in both spring and fall. These were joined by Willow Flycatcher, House Wren, and MacGillivray’s Warbler, which, though nearly absent in the spring, were recorded daily through much of August and September. Excel spreadsheets of the raw data are available upon request.

Spring surveys (N = 277) averaged 10.2 individuals. At its peak in early

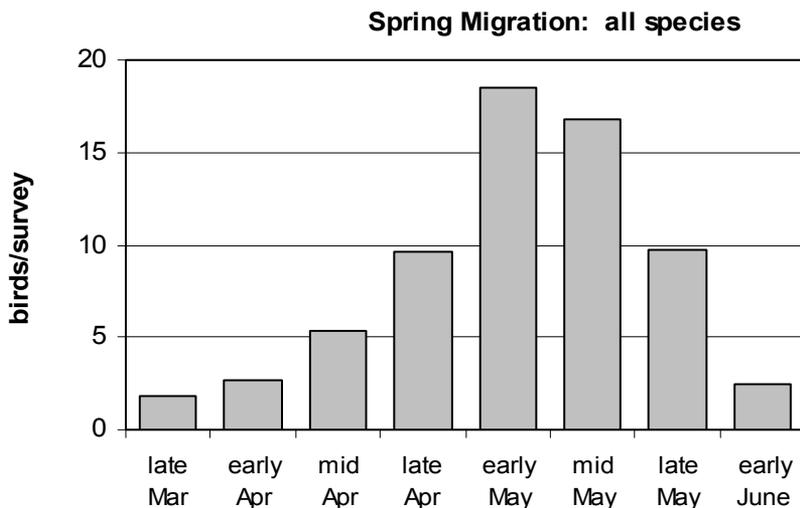


Figure 2. Relative abundance of all migrants during spring.

May, the surveys averaged 18.5 individuals (Figure 2). The most frequently recorded species was Wilson’s Warbler, which averaged 1.6 individuals per survey. Five species (Wilson’s Warbler, Yellow Warbler, Western Tanager, Orange-crowned Warbler, and Black-headed Grosbeak) comprised 65.5% of the recorded birds.

Fall surveys (N = 341) averaged 19.6 individuals. At its peak in mid-September, the number of migrants averaged 29.5 individuals. Yellow Warblers, however, made up 47% of individuals during this peak period, so species diversity was actually greatest in late August and early September (Figure 3). Even as early as mid-August, numbers averaged 15 individuals per survey, close to the maximum levels during spring migration. The most frequent species was Yellow Warbler, which averaged 6.7 individuals per survey (and over 13 individuals per survey during mid- and late September). Five species (Yellow Warbler, Western Tanager, House Wren, Orange-crowned Warbler, and Wilson’s Warbler) comprised 74% of the recorded birds. Yellow Warblers alone accounted for 34% of all individuals seen during fall migration.

Species Accounts

This section summarizes species occurrence patterns. Species are characterized as rare if they averaged less than 0.10 birds/survey, uncommon if they averaged 0.10-0.50 birds per survey, and common if they averaged greater than 0.50 birds/survey. Graphs are provided for common and uncommon species (see Figures 4-12). Note that vertical (y axis) scales vary among species.

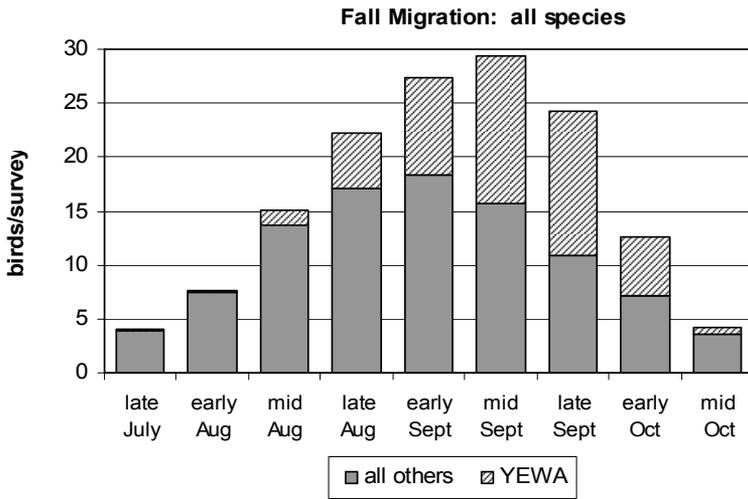


Figure 3. Relative abundance of all migrants during fall, with distribution of the most abundant species, Yellow Warbler.

Olive-sided Flycatcher --

Spring: Rare; 0.07 birds/survey; all from early May through early June; 53% (from N = 19) in early May.

Fall: Rare; 0.01 birds/survey; only recorded twice (late August and early September).

Western Wood-Pewee --

Spring: Uncommon; 0.26 birds/survey; all from early May through early June (Figure 4).

Fall: Uncommon; 0.11 birds/survey; all from early August through late September (Figure 5).

Ash-throated Flycatcher --

Spring: Rare; 0.03 birds/survey; all from mid April through late May.

Fall: Rare; 0.04 birds/survey; all from early through late August; none after September.

Willow Flycatcher --

Spring: Rare; 0.01 birds/survey; only recorded four times (mid May through early June).

Fall: Common; 0.89 birds/survey; from mid August through early October (Figure 5); recorded on 86% of 91 surveys between 25 August and 10 September.

Dusky Flycatcher --

Spring: Rare; 0.03 birds/survey; all from mid-April through early May.

Fall: Rare; 0.01 birds/survey; only recorded five times (four in late August, one in early September).

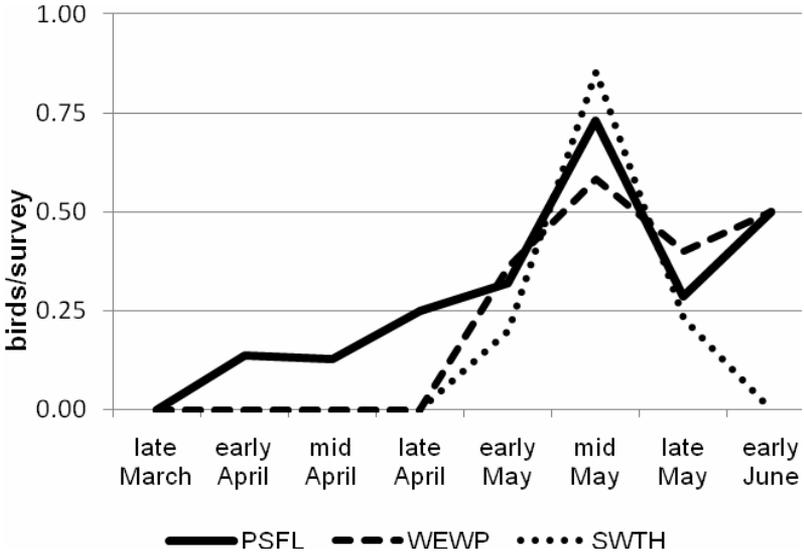


Figure 4. Number of birds/survey in spring for Pacific-slope Flycatcher (PSFL), Western Wood-Pewee (WEWP), and Swainson's Thrush (SWTH).

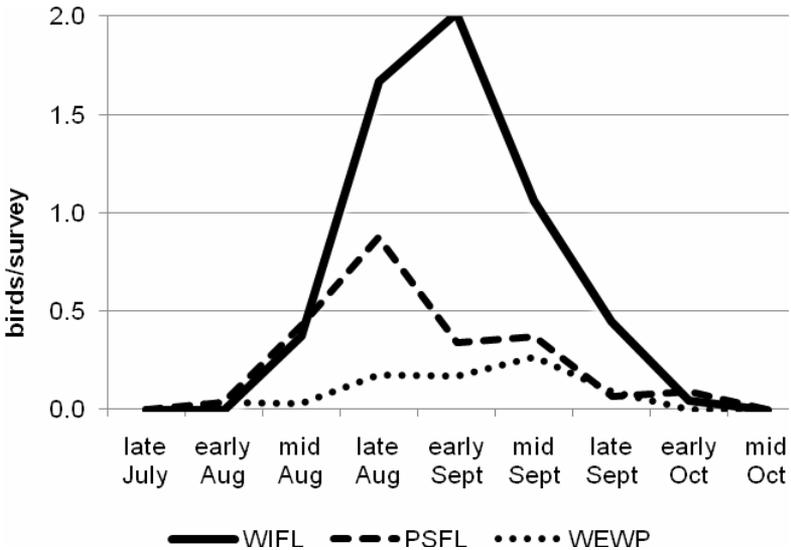


Figure 5. Number of birds/survey in fall for Willow Flycatcher (WIFL) Pacific-slope Flycatcher (PSFL), and Western Wood-Pewee (WEWP).

Hammond's Flycatcher --

Spring: Rare; 0.04 birds/survey; all from late April through early June.

Fall: Rare; 0.00 birds/survey; only recorded once (late August).

Pacific-slope Flycatcher --

Spring: Uncommon; 0.33 birds/survey; from early April through early June (Figure 4).

Fall: Uncommon; 0.34 birds/survey; from early August through early October (Figure 5).

Swainson's Thrush --

Spring: Uncommon; 0.21 birds/survey; only recorded in May, with 69% (from N = 55) from mid May (Figure 4).

Fall: Rare; 0.01 birds/survey; only recorded twice (late August and late September).

House Wren --

Spring: Rare; 0.00 birds/survey; only recorded once (early April).

Fall: Common; 2.02 birds/survey; recorded in every period; recorded on 94% of 253 surveys from late August through mid October; present in lower numbers into November but rarely detected over-wintering (Figure 7).

Blue-gray Gnatcatcher --

Spring: Rare; 0.03 birds/survey; from late March through late April; not recorded in May.

Fall: Uncommon; 0.17 birds/survey; from early August through late September (Figure 7).

Cassin's Vireo --

Spring: Uncommon; 0.10 birds/survey; from mid April through late May (Figure 6).

Fall: Rare; 0.03 birds/survey; from mid August through late September, but with no records from early September.

Warbling Vireo --

Spring: Common; 0.60 birds/survey; from mid April through late May, with one record from late March (Figure 6).

Fall: Uncommon; 0.29 birds/survey; from late July through late September (Figure 7).

Wilson's Warbler --

Spring: Common; 1.63 birds/survey; from early April through early June; 70% (N = 451) from early and mid May (Figure 8).

Fall: Common; 1.71 birds/survey; from late July through early October (Figure 9).

Yellow Warbler --

Spring: Common; 1.56 birds/survey; from late April through early June; 80% (N = 431) from mid and late May (Figure 8).

Fall: Common; 6.72 birds/survey; recorded in every period (Figure 9).

Orange-crowned Warbler --

Spring: Common; 1.23 birds/survey; from late March through late May; 56% (N = 340) from mid and late April; birds from the early periods may include

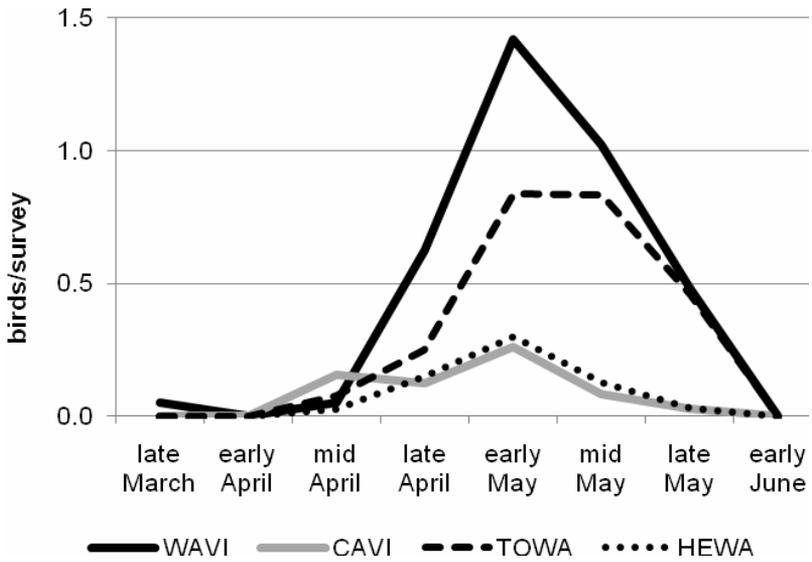


Figure 6. Number of birds/survey in spring for Warbling Vireo (WAVI), Cassin's Vireo (CAVI), Townsend's Warbler (TOWA), and Hermit Warbler (HEWA).

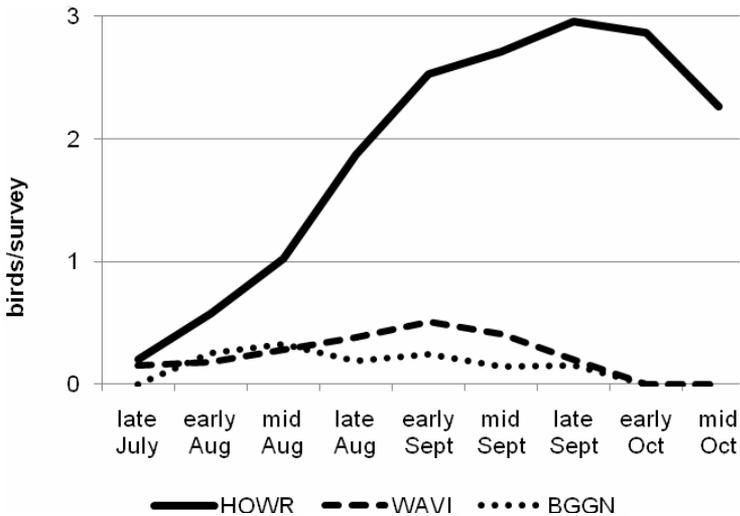


Figure 7. Number of birds/survey in fall for House Wren (HOWR), Warbling Vireo (WAVI) and Blue-gray Gnatcatcher (BGGN).

over-wintering individuals (Figure 8).

Fall: Common; 1.84 birds/survey; recorded in every period; birds from the late periods may include over-wintering individuals (Figure 9).

MacGillivray's Warbler --

Spring: Rare; 0.03 birds/survey; from late April through late May; 56% (N = 9) from early May.

Fall: Common; 0.81 birds/survey; from early August through early October (Figure 10).

Nashville Warbler --

Spring: Rare; 0.07 birds/survey; from early April through mid May.

Fall: Uncommon; 0.11 birds/survey; from late July through mid September, with one observation from early October (Figure 10).

Black-throated Gray Warbler --

Spring: Rare; 0.09 birds/survey; from early April through early May.

Fall: Uncommon; 0.33 birds/survey; from early August through mid October (Figure 10).

Hermit Warbler --

Spring: Uncommon; 0.10 birds/survey; from mid April through late May (Figure 6).

Fall: Rare; 0.03 birds/survey; from early August through mid September.

Townsend's Warbler --

Spring: Uncommon; 0.40 birds/survey; from mid April through late May; 74% (from N = 90) from early and mid May (Figure 6).

Fall: Rare; 0.04 birds/survey; from early August through late September.

Common Yellowthroat --

Spring: Rare; 0.04 birds/survey; from late March through early May; 64% (from N = 11) from early and mid April.

Fall: Uncommon; 0.49 birds/survey; from late August through early October; 65% (from N = 156) from mid and late September (Figure 10).

Yellow-breasted Chat --

Spring: Rare; 0.00 birds/survey; only recorded once (early May).

Fall: Rare; 0.01 birds/survey; recorded four times (late August through late September).

Western Tanager --

Spring: Common; 1.40 birds/survey, from late April through early June; 75% (from N = 389) from early and mid May (Figure 11).

Fall: Common; 2.25 birds/survey; recorded in every period (Figure 12).

Black-headed Grosbeak --

Spring: Common; 0.86 birds/survey; from mid April through early June; 74% (from N = 239) from early and mid May (Figure 11).

Fall: Common; 0.60 birds/survey; from late July through late September (Figure 12).

Lazuli Bunting --

Spring: Uncommon; 0.41 birds/survey; from mid April through late May; 83% (from N = 114) from early and mid May (Figure 11).

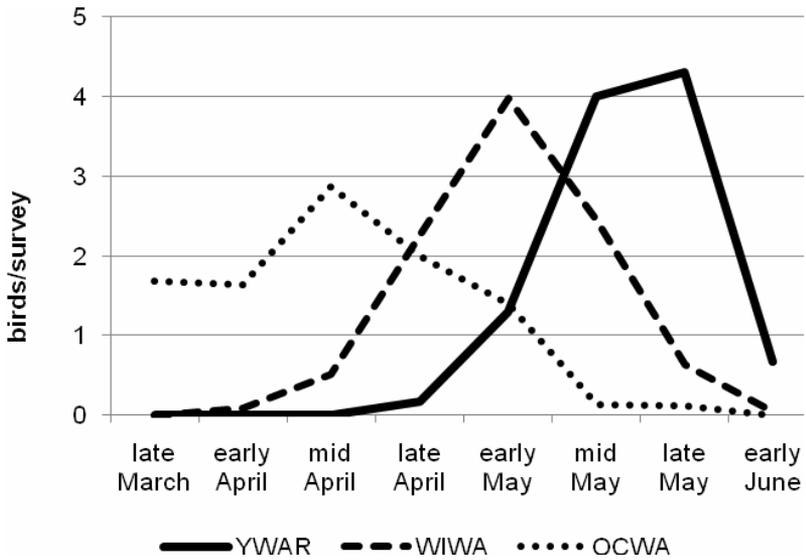


Figure 8. Number of birds/survey in spring for Yellow Warbler (YWAR), Wilson's Warbler (WIWA) and Orange-crowned Warbler (OCWA).

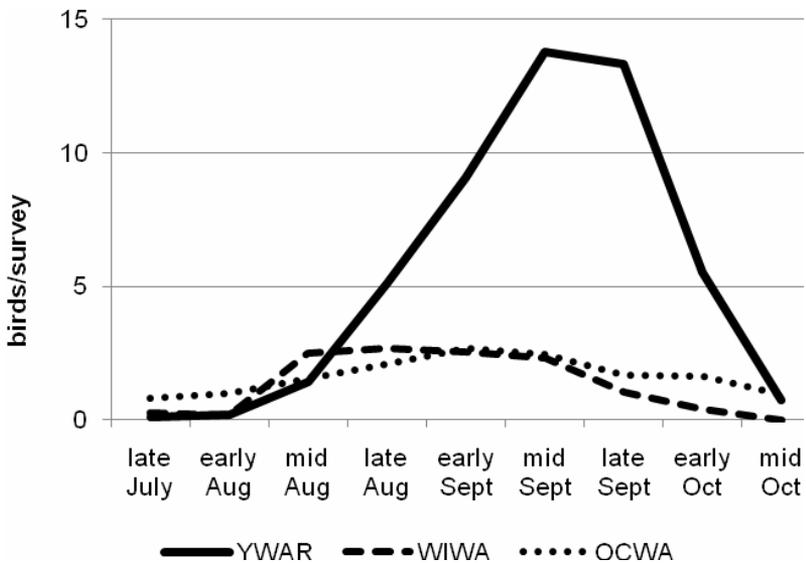


Figure 9. Number of birds/survey in fall for Yellow Warbler (YWAR), Wilson's Warbler (WIWA) and Orange-crowned Warbler (OCWA).

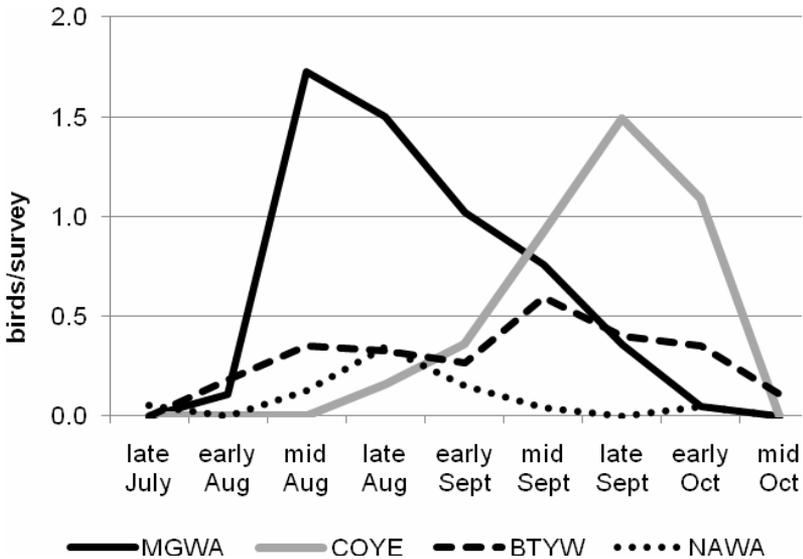


Figure 10. Numbers of birds/survey in fall for MacGillivray's Warbler (MGWA), Common Yellowthroat (COYE), Black-throated Gray Warbler (BTYW), and Nashville Warbler (NAWA).

Fall: Uncommon; 0.49 birds/survey; from late July through late September (Figure 12).

Chipping Sparrow --

Spring: Rare; 0.04 birds/survey; from mid April through mid May.

Fall: Rare; 0.08 birds/survey; from late August through mid October.

Bullock's Oriole --

Spring: Common; 0.62 birds/survey; from early April through early June; 63% (from N = 171) from late April and early May (Figure 11).

Fall: Uncommon; 0.16 birds/survey; from late July through early September (and one record from late September) (Figure 12).

Peak Migration Periods

Figures 13 and 14 show the peak migration period and abundance for each species (in birds/survey for the peak time period).

The figures show that spring migration is more condensed, while fall migration is more extended. In spring, all but five of the species reach their peak migration density during the same period in early May. In fall, the species peaks are much more varied, usually with no more than three species migrating at their peak densities in any one period. Condensed migration during spring also occurs within species, as illustrated by the species-

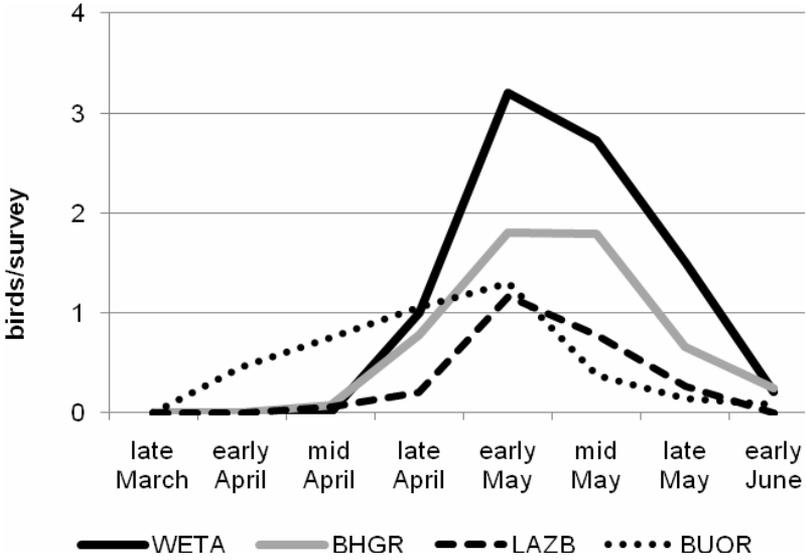


Figure 11. Numbers of birds/survey in spring for Western Tanager (WETA), Black-headed Grosbeak (BHGR), Lazuli Bunting (LAZB), and Bullock's Oriole (BUOR).

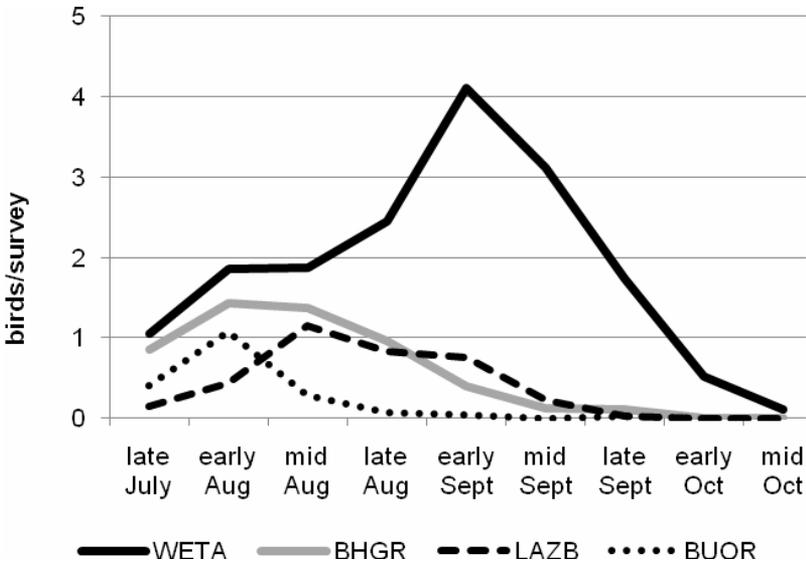


Figure 12. Numbers of birds/survey in fall for Western Tanager (WETA), Black-headed Grosbeak (BHGR), Lazuli Bunting (LAZB), and Bullock's Oriole (BUOR).

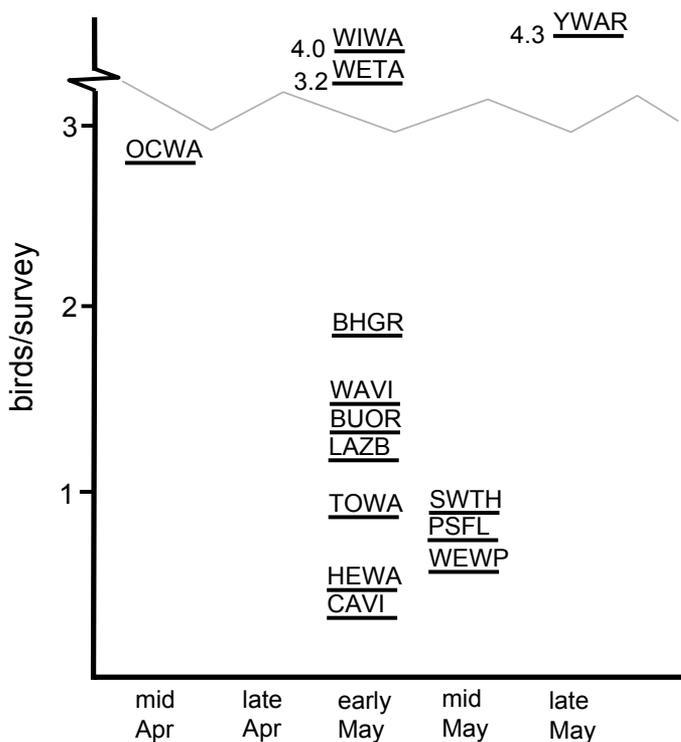


Figure 13. Peak migration period and abundance (# birds per survey) for selected migrant species (see previous figures) in spring. Species with peak abundances <0.10/survey are not shown.

specific graphs above. In the spring, many of the migrants are primarily detected in just one or two time periods, while the individuals are more spread out during the fall.

Examination of trends and variability across the 10-year time period is beyond the scope of this paper. Such a review would be limited to the most common species, as the data for the less common ones for any one year are limited and subject to high standard errors.

Other Passerine Migrants

The surveys also recorded small numbers of the following migrants:

Gray Flycatcher (*Empidonax wrightii*) -- Two birds on 28 April 2010.

Red-eyed Vireo (*Vireo olivaceus*) -- One on 28 May 2004.

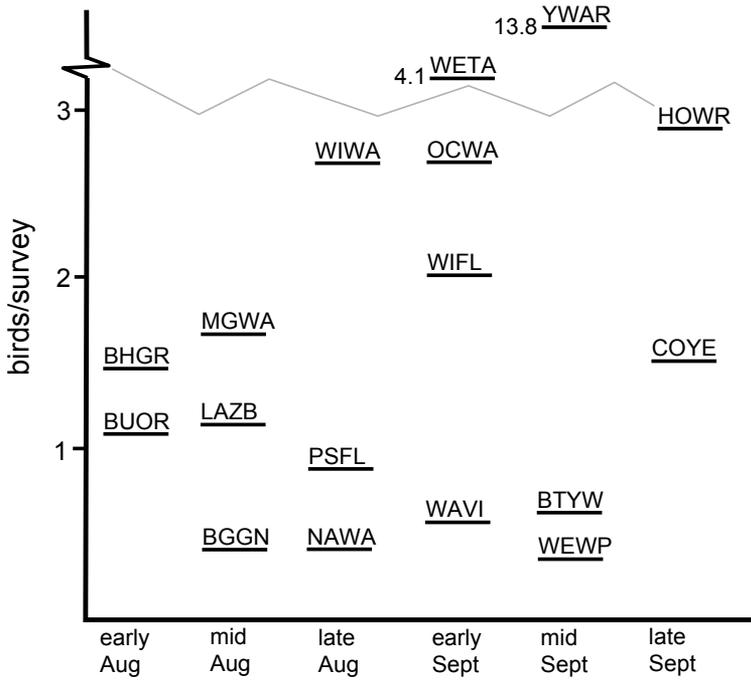


Figure 14. Peak migration period and abundance (# birds per survey) for selected migrant species (see previous figures) in fall. Species with peak abundances <0.10/survey are not shown.

Tennessee Warbler (*Oreothlypis peregrina*) -- Single birds on 21 September 2001 and 28 September 2009.

Chestnut-sided Warbler (*Dendroica pensylvanica*) -- One on 5 October 2008.

Blackpoll Warbler (*Dendroica striata*) -- Single birds on 23 September 2001 and 6 October 2006.

Summer Tanager (*Piranga rubra*) -- One on 17 May 2009.

Hooded Oriole (*Icterus cucullatus*) -- Observed sporadically in 2009 when breeding pair present; seen twice in 2010.

Favored Habitats

While quantitative data were not recorded for the precise location of each bird, most birds were detected either in the eucalyptus trees along the North Covell Drainage Canal, in the riparian plantings north of the eastern pond where there are multiple canopy layers, or in the weeds and trees along the

edge of the agricultural field (see Figure 1). They also favored certain fruiting elderberry bushes that are located adjacent to tall trees. A large row of exposed elderberry bushes, with no overhanging tall trees, was used primarily by House Finches and rarely by migrants.

Comparison with Other Studies

Opportunities to compare these results to other data sources are limited by the scarcity of studies, differing methodologies, and the way in which data are summarized and reported when published. For example, Lindgren et al. (2006) provide data on bird abundances along Putah Creek, but the data regarding migration periods is too limited to provide a meaningful comparison. Humple and Guepel (2002) provide details on the same species for autumn migration from three sites: Sacramento National Wildlife Refuge,

Table 2. Comparison of species composition (percent of total migrant observations) from this study with fall migration results from three other Central Valley sites observed by Humple and Geupel (2001).

SPECIES	Humple and Geupel (2002) (N = 1558)	This Study (N = 6685)
Western Wood-Pewee	1.3%	0.6%
Willow Flycatcher	9.4%	4.5%
Pacific-slope Flycatcher	8.0%	1.7%
Ash-throated Flycatcher	0.4%	0.2%
Cassin's Vireo	0.3%	0.2%
Warbling Vireo	0.7%	1.5%
House Wren	9.6%	10.3%
Blue-gray Gnatcatcher	0.4%	0.9%
Orange-crowned Warbler	21.8%	9.4%
Nashville Warbler	1.5%	0.6%
Yellow Warbler	22.8%	34.3%
Black-throated Gray Warbler	0.3%	1.7%
MacGillivray's Warbler	4.7%	4.1%
Common Yellowthroat	9.8%	2.5%
Wilson's Warbler	6.4%	8.7%
Yellow-breasted Chat	0.5%	0.1%
Western Tanager	0.5%	11.5%
Black-headed Grosbeak	0.3%	3.1%
Lazuli Bunting	1.0%	2.5%
Bullock's Oriole	0.1%	0.8%
Other	0.3%	0.9%

Cosumnes River Preserve, and San Luis National Wildlife Refuge. Their studies, however, report birds mist-netted and banded, rather than all birds detected. Nevertheless, some similarities with this study are evident, as indicated in the comparison in Table 2.

The Yellow Warbler is the dominant species in both studies. Many of the other common species are also similar in rank abundance: Willow Flycatcher, House Wren, Orange-crowned Warbler, and Wilson's Warbler. Virtually all of the rarer species are also similar among studies. Humple and Geupel (2002) captured all flycatcher species at a rate higher than was detected in Davis. This result is consistent with my observations that flycatchers are, in general, easier to find along the Sacramento River corridor than in Davis during migration. Another noteworthy difference is with respect to Western Tanager, which was recorded at a relatively low frequency by Humple and Guepel (2002). This difference may result from the different methodologies: mist-netting verses visual and aural detection. Common Yellowthroat also differed markedly between studies, likely due to the limited availability of suitable habitat in the Davis study area.

DISCUSSION

These results are notable primarily because the study area is not pristine habitat or part of a protected preserve, nor is it adjacent to any. The area is not part of any restoration project and the habitat is highly modified and, in general, unremarkable. To this extent, these results suggest these species make use of a wide range of available habitat during migration.

The study area is not along a well-defined geographic feature that may define a migration corridor, such as the Sacramento River or the foothills, but is halfway between the two and approximately 18 km (11 miles) from each. Indeed, the city of Davis is surrounded on all sides by agricultural fields that offer limited vegetative structure for migrant passerines. Thus, the town may be something of an oasis, but one that would only attract birds migrating across open land mid-way between the Sacramento River and the foothills. To the extent that these species migrate in a broad front, as opposed to funneling along defined corridors, these results provide a snapshot of that movement.

The results suggest that significant numbers of migrant passerines move through the city of Davis. A cursory review of reported sightings from Cosumnes River Preserve, the Wood Duck Ponds, or Babel Slough in Yolo County (all close to the Sacramento River corridor), and other more pristine sights along the Sacramento River, suggests that the bird numbers observed in Davis are often comparable, on a per-hour or per-km basis, with those areas. Comparison with other data sets, such as that illustrated by the difference in flycatcher detection by Humple and Geupel (2002), may shed additional light on the migration habits and the migration habitat requirements of these species.

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