

# Putah Creek Nestbox Highway 2021 Annual Report

UC Davis Museum of  
Wildlife and Fish Biology



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Cover photo: Western Bluebird nestling after banding. Photo by Hanika Cook

## Acknowledgements

On behalf of the UC Davis Museum of Wildlife and Fish Biology (MWFB), we wish to thank everyone involved in the 2021 Putah Creek Nestbox Highway field season. We would especially like to thank Solano County Water Agency General Manager Roland Sanford and Putah Creek Streamkeeper Rich Marovich for their ongoing support and collaborative efforts to enhance Putah Creek. We also wish to thank the many generous private and public landowners who allowed us access to their properties. We are most grateful to Ron Ringen for donating handmade nest boxes to the project this year. We owe our gratitude to the Lloyd W. Swift family for funding several of our student field coordinators' work. We also wish to extend our gratitude to the Department of Wildlife, Fish, and Conservation Biology for project administrative support. Lastly but certainly not least, this project would not be possible without the annual dedication of our undergraduate student workforce and other UC Davis volunteers. Thanks go out to our hard-working 2021 crew, including field coordinators Alice Mathew, Maria Froelich, Alexandra Meyer, field assistants Alyssa Hayes and Mica Staus, graduate student Katherine Lauck and her field assistant Katia Goldberg, and Davis Nestbox Network field leader Alison Ke and her field assistant Rose Surdyk. Despite the challenges that came with coronavirus-related restrictions on the size of our team in 2021, our small crew worked tirelessly and carefully to monitor all of our nest boxes and gather this year's data.



Tree swallow eggs and chick in nest. Photo: Hanika Cook

## Introduction

The Putah Creek Nestbox Highway (PCNH) is an important, local conservation effort that, since its inception in 2000, has provided breeding habitat for a variety of secondary cavity nesting birds along Putah Creek (Yolo and Solano Counties, California). The PCNH consists of 200 artificial hanging nest boxes that imitate the tree cavities that hole-nesting birds use to raise their young. Nest boxes have proven invaluable since natural tree cavities in Putah Creek's narrow ribbon of habitat are limited and often usurped by non-native species such as European Starling (*Sturnus vulgaris*) and House Sparrow (*Passer domesticus*).

The Putah Creek Nestbox Highway currently comprises nine separate nest box trails arrayed along the lower 20 miles of Putah Creek from the Interdam Reach to the Yolo Bypass. As a combined conservation, research, and environmental education project, the PCNH helps augment regional bird populations while serving as a platform for collecting detailed observations on nesting activity. By monitoring sites weekly and measuring and color-banding nestlings, we are able to keep track of nest status, productivity, and fledgling dispersal. The project also provides training and field experience for university interns, our next generation of wildlife professionals.

Over the last 22 years, the PCNH has successfully fledged around 14,000 young birds, of nine different species, including: Tree Swallow (*Tachycineta bicolor*), Western Bluebird (*Sialia mexicana*), Ash-throated Flycatcher (*Myiarchus cinerascens*), House Wren (*Troglodytes aedon*), and White-breasted Nuthatch (*Sitta carolinensis*). We are particularly gratified that Western Bluebird populations and reproductive success have increased substantially in the region as a result of this project.



Western Bluebird eggs in nest. Photo: Hanika Cook



## 2021 Results

In 2021, five species of birds successfully nested between mid-March and mid-August. A total of 259 clutches were produced from 202 available boxes, excluding 16 House Sparrow nests. From these clutches, 1165 eggs were produced, hatching into 874 nestlings, resulting in 709 successful fledglings (Table 1). Tree Swallows produced the most fledglings, about 50% of the total, followed by Western Bluebirds (40%) Ash-throated Flycatchers (5%), House Wrens (3%), and White-breasted Nuthatches (2%).

TABLE 1. SUMMARY AND COMPARISON BETWEEN 2020 AND 2021

Species	Year	# Clutches	# Eggs	# Nestlings	# Fledglings	Hatching Success	% Change Hatching Success 2020-2021	Fledging Success	% Change Fledging Success 2020-2021
Ash-throated Flycatcher	2021	17	56	39	36	69.64%	+9.82%	92.31%	-4.00%
	2020	10	41	26	25	63.41%		96.15%	
House Wren	2021	6	35	24	23	68.57%	-12.49%	95.83%	+2.76%
	2020	24	146	89	83	60.96%		93.26%	
Tree Swallow	2021	119	571	462	357	80.91%	+4.21%	77.27%	-11.59%
	2020	127	644	500	437	77.64%		87.40%	
Western Bluebird	2021	115	490	337	282	68.78%	-3.00%	83.68%	+3.34%
	2020	119	519	368	298	70.91%		80.98%	
White-breasted Nuthatch	2021	2	13	12	11	92.31%	+45.05%	91.67%	+28.33%
	2020	2	11	7	5	63.64%		71.43%	
<b>TOTAL</b>	2021	259	1165	874	709	75.02%	+3.14%	81.12%	-5.29%
	2020	282	1361	990	848	72.74%		85.66%	

\*Table does not include House Sparrow clutches

Overall hatching success (# chicks hatched/# eggs laid) increased slightly in 2021 compared to 2020, while fledging success (# chicks fledged/# chicks hatched) decreased slightly. The number of nesting attempts and eggs produced were somewhat lower in 2021 as well. Tree Swallows and Ash-throated Flycatchers experienced a decrease in fledging success, though more Ash-throated Flycatcher fledglings were produced in 2021 than in 2020. Though, as usual, there were few White-breasted Nuthatches in our nest boxes, in 2021 they produced more than twice as many fledglings as in 2020.

Fewer House Wrens nested in the nest boxes than usual in 2021, but they were slightly more successful than in 2020. Western Bluebird numbers and success changed only slightly between 2020 and 2021. More eggs failed and more chicks perished in 2021 than in 2020, but fewer nests were victims of depredation. Some of the nest failures can be ascribed to the increase in House Sparrow nesting activity in the Winters area in 2021. Several nest boxes were also damaged during the breeding season due to an unexpected tree removal event in one of our orchard installations. Most of the chicks involved in this event were saved through cross-fostering into other nests.

The busiest period of nesting activity came between early April and early June (Fig. 1). Late April and early May (4/26-5/9) had the highest peak of egg-laying activity, with about 365 eggs laid. A second wave of eggs followed in mid-June (6/7-6/20), peaking at about 150 eggs. Subsequent waves of nestlings followed about one month after initial egg-laying, followed a couple of weeks later by fledglings (Figs. 1 and 2).

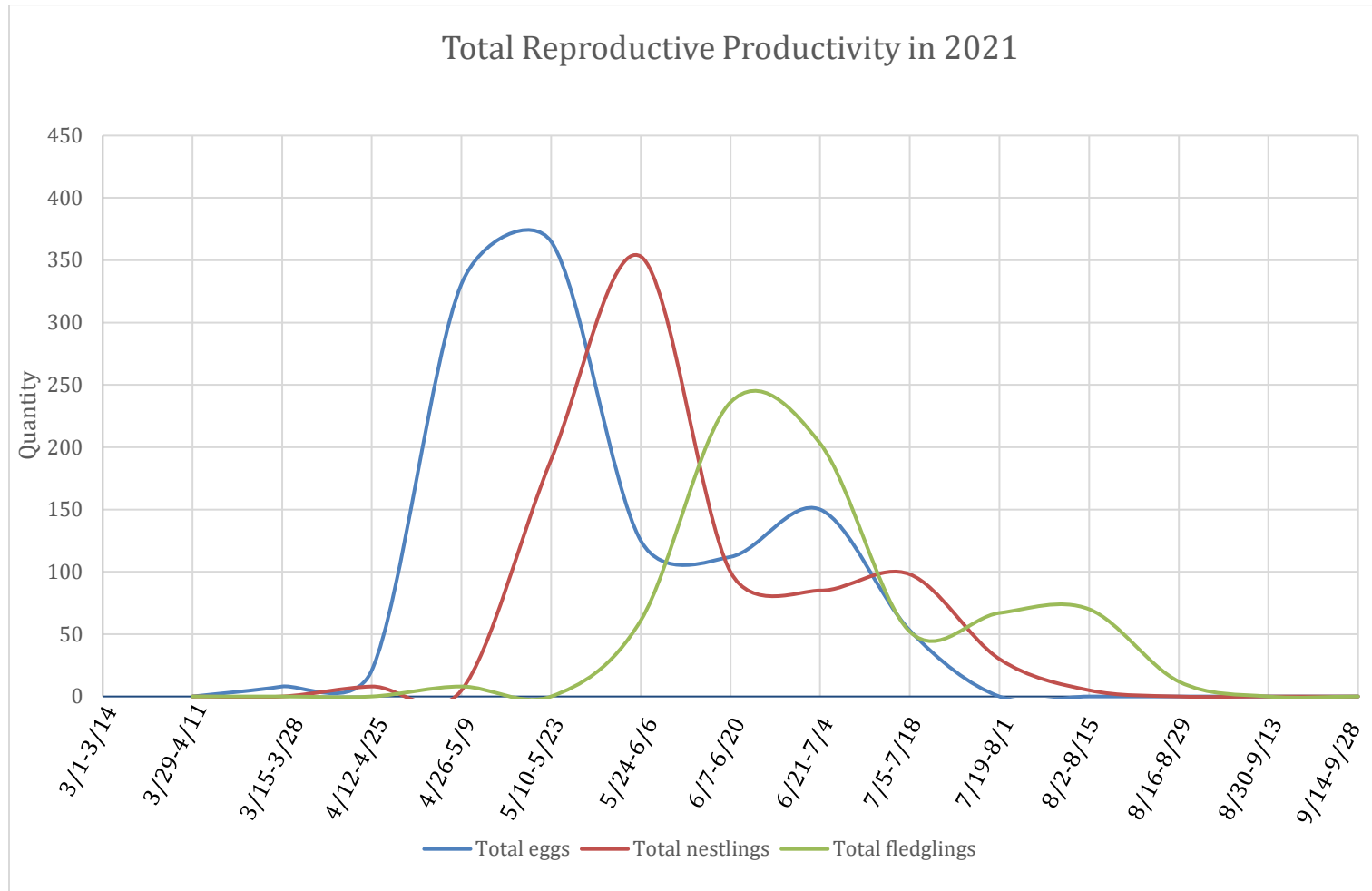


Figure 1. Overall reproductive productivity spread over biweekly segments.

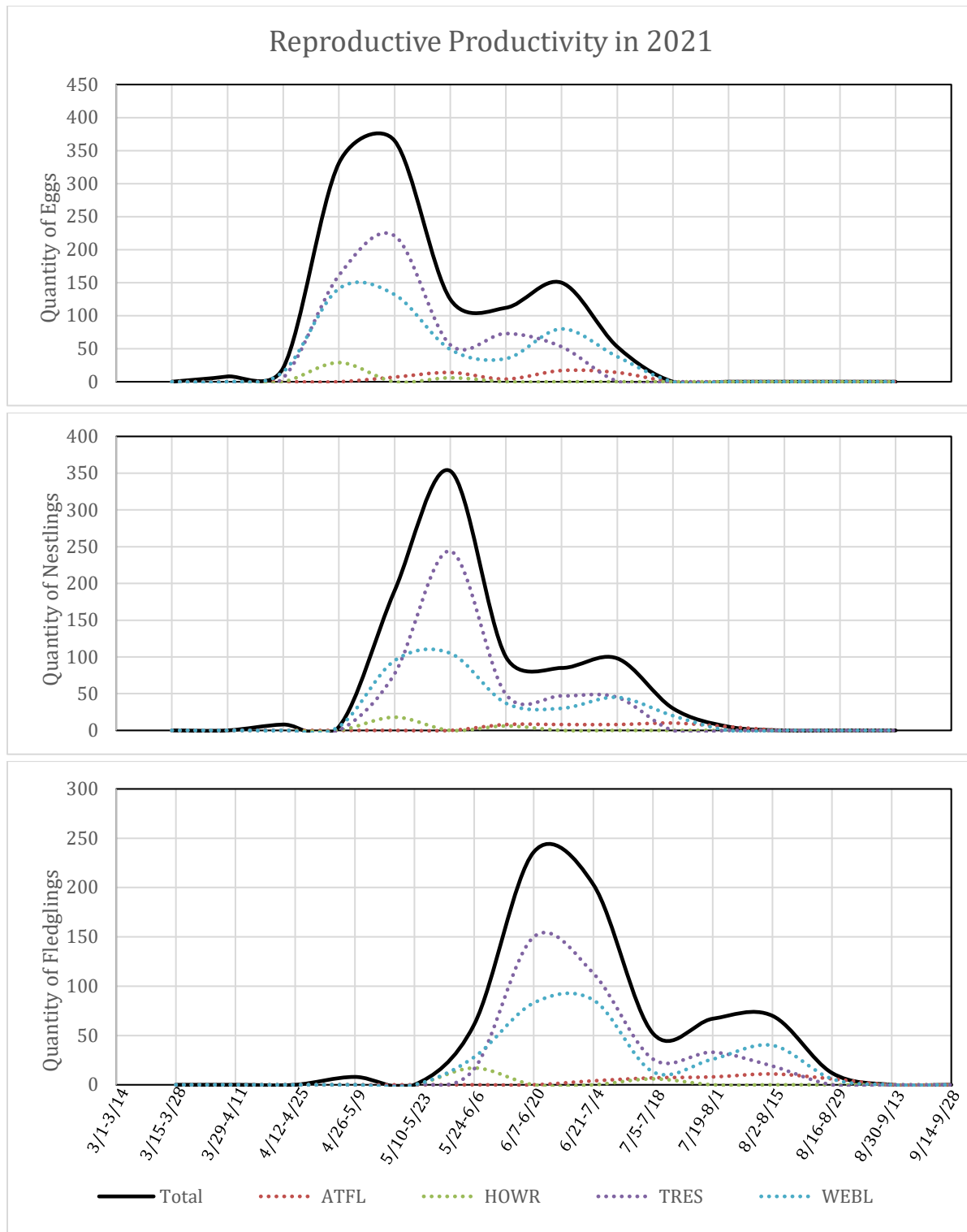


Figure 2. Reproductive productivity spread over biweekly segments, including species-level comparisons between four most productive species: ATFL=Ash-throated Flycatcher; HOWR=House Wren; TRES=Tree Swallow; WEBL=Western Bluebird.

## Species-specific Results



House wren nestling with bands.  
Photo: Hanika Cook

### House Wren

House Wrens produced 6 clutches and a total of 35 eggs (Table 1). 24 of the eggs hatched, and 23 nestlings fledged successfully. These numbers were all lower in 2021 than in 2020, though hatching and fledging success rates increased. As usual, Diversion Dam produced most of the House Wren fledglings in 2021, and a few other chicks fledged at Old Davis Road.

### White-breasted Nuthatch

There were two White-breasted Nuthatch clutches this year. They produced a total of 13 eggs of which 12 hatched (Table 1). 11 of these nestlings fledged successfully. The first clutch started in mid-March with eight successful eggs, making for a crowded but healthy nest, while the second clutch started much later at the beginning of May. White-breasted Nuthatches remain uncommon nest box users on the Putah Creek Nestbox Highway.

### Tree Swallow

Tree Swallows continued to make up about half of all nesting efforts and fledglings produced. In 2021, they produced 119 clutches, 571 eggs, and 462 nestlings (Table 1); 357 of these nestlings fledged successfully - a decrease in success of close to 12% compared to 2020. Most Tree Swallow nest attempts and successful fledglings were at Interdam, where 23 clutches produced 79 fledglings. The next highest number of Tree Swallow fledglings came from the Picnic Grounds in Davis (the site with the greatest number of nest boxes available), but the Winters Putah Creek Park site (with only 14 boxes) had the second highest ratio of Tree Swallow fledglings per nest box after Interdam (Table 2), suggesting that habitat conditions there are especially suitable for Tree Swallows.



Tree Swallow parent at nest box.  
Photo: Hanika Cook

### Western Bluebird

282 Western Bluebird fledglings were produced in 2021 (Table 1). 490 eggs were laid and 337 nestlings hatched. Between 2020 and 2021, there was little change in numbers of eggs and chicks produced or of hatching and fledging success rates. In 2021, a brood of Western Bluebirds fledged successfully from an Interdam nest box for the first time since 2013. The Mace Boulevard site produced the highest number of



Western Bluebird male (left) and female (right) nestlings.  
Photo: Hanika Cook



fledglings per nest box while the Picnic Grounds site had the highest total number of fledglings overall in 2021 (Table 2). This was also true of these two sites in 2020.

Western Bluebird fledgling production has, overall, increased year over year since the beginning of the project, helping to recover this important species throughout our region. (Fig. 3).

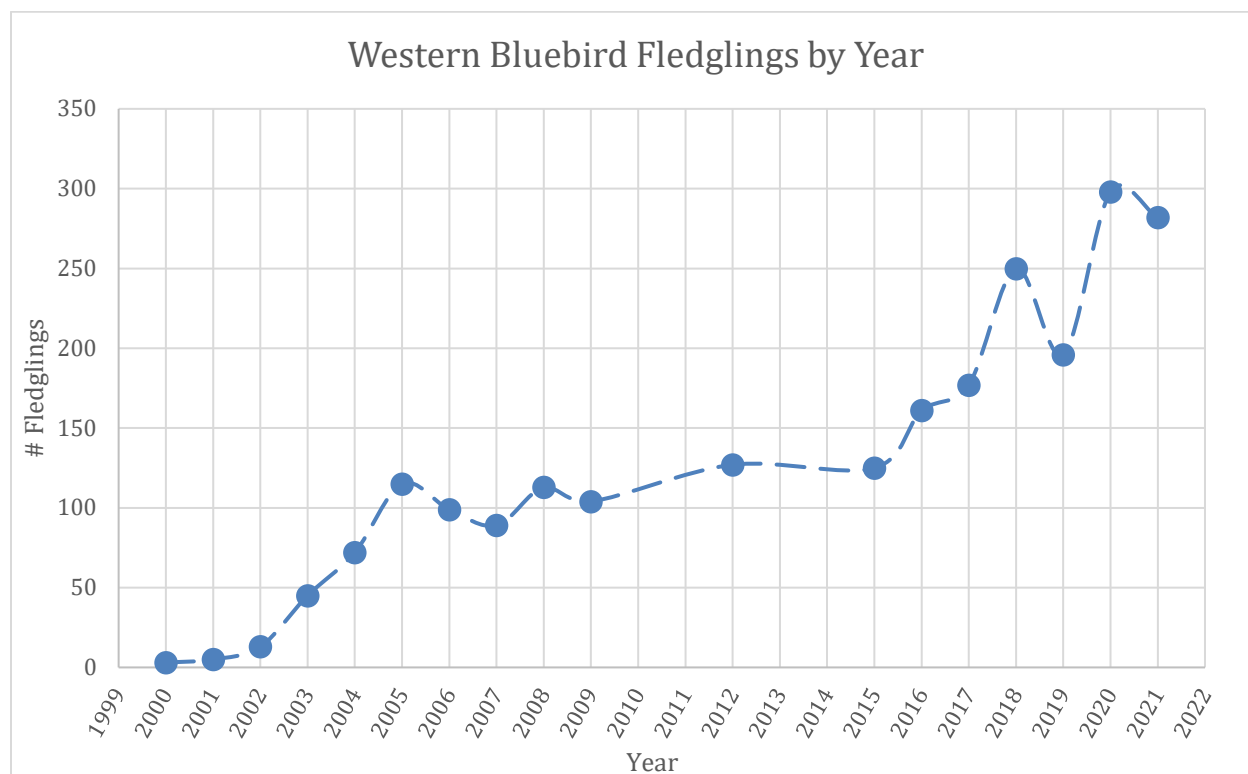


Figure 3. Number of Western Bluebird fledglings from the Putah Creek Nestbox Highway by year, 2000-2021. Note: Values for 2010, 2011, 2013, and 2014 were omitted due to limited data.



Ash-throated flycatcher nestling.  
Photo: Hanika Cook

#### Ash-throated Flycatcher

17 clutches were produced by Ash-throated Flycatchers in 2021 (Table 1). 56 eggs were laid, producing 39 nestlings and 36 fledglings. This species had not exceeded 30 fledglings per year in our nest boxes since 2016. While, as expected, Russell Ranch was the site of the most nest attempts, Old Davis Road produced the most Ash-throated flycatcher fledglings out of any site in 2021.

#### House Sparrows

House Sparrows are a non-native species that can take over territories and monopolize nest boxes across seasons. Thus, we remove House Sparrow nests when they are found in our boxes. In 2021,

many nest attempts were made at the Triangle Orchard and at the nearby Winters Putah Creek Park. The 16 total nest attempts consisted of 37 total eggs, often with repeated attempts at the same boxes, but field coordinators intervened early enough to prevent hatching. However, House Sparrow adults destroyed several Tree Swallow nestlings at the orchard and may have contributed to reduced nesting attempts and success in other boxes.

## Site-level Results

The Putah Creek Nestbox Highway currently consists of nine nest box trails (Figure 4), containing a total of 202 boxes. In 2021, birds occupied 184 of the available boxes (91% occupancy). To compare nesting activity among different segments of the creek, we grouped trails into three different reaches: upper, middle, and lower (Figure 5). The upper reach contained sites upstream of Interstate 505, the middle reach included sites between I-505 and Pedrick Road, and the lower reach included sites downstream of Pedrick Road.

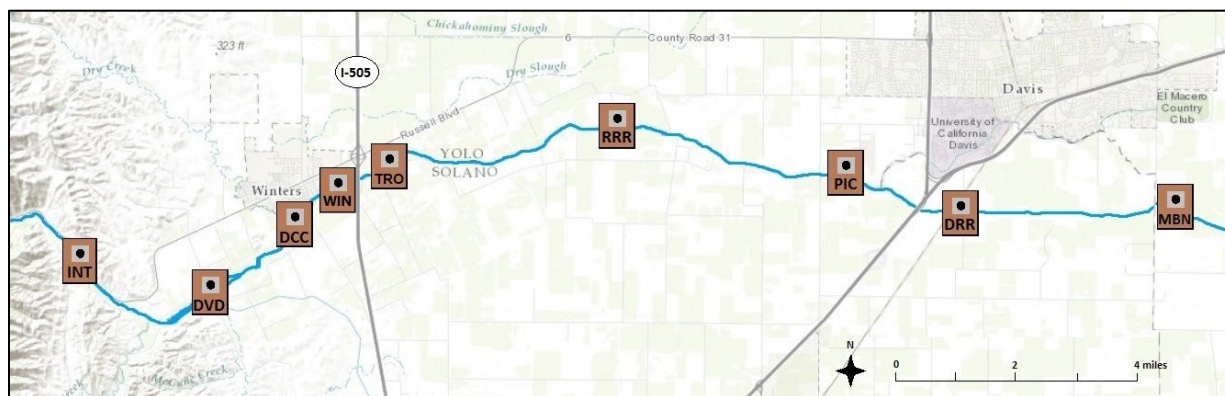


Figure 4. Map of the Putah Creek Nestbox Highway trails, 2021. INT=Interdam; DVD=Diversion Dam; DCC=Dry Creek Confluence; WIN=Winters Putah Creek Park; TRO=Triangle Orchard; RRR=Russell Ranch; PIC=Picnic Grounds; DRR=Old Davis Rd/Restoria; MBN=Mace Blvd North.

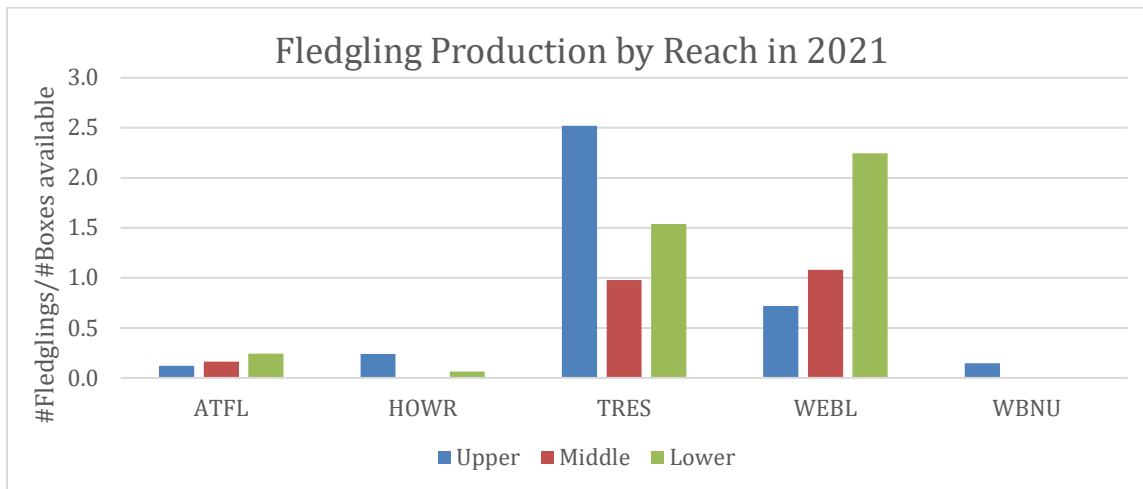


Figure 5. Distribution of fledgling production among the Upper, Middle, and Lower reaches. #Fledglings standardized by number of boxes available at a given reach. ATFL=Ash-throated Flycatcher; HOWR=House Wren; TRES=Tree Swallow; WEBL=Western Bluebird; WBNU=White-breasted Nuthatch.

Table 2 presents overall reproductivity by reach and site. While the number of fledglings produced/number of boxes available varied by reach and site, overall, the lower reach supported the greatest productivity, following by the upper and middle reaches.

TABLE 2. REPRODUCTIVE ACTIVITY BY REACH AND SITE, 2021

	Site	Boxes available	Boxes used	Clutches	Eggs	Nestlings	Fledglings	#Fledglings/ #Boxes
UPPER REACH	Interdam	17	17	27	130	102	88	5.18
	Ash-throated Flycatcher			2	6	6	6	0.35
	Tree Swallow			23	115	89	79	4.65
	Western Bluebird			2	9	7	3	0.18
	Diversion Dam	19	17	19	104	78	72	3.79
	Ash-throated flycatcher			1	4	3	3	0.16
	House Wren			3	20	18	18	0.95
	Tree Swallow			8	42	36	31	1.63
	White-breasted Nuthatch			2	13	12	11	0.58
	Western Bluebird			5	25	9	9	0.47
	Dry Creek Confluence	25	23	33	146	85	72	2.88
	Ash-throated Flycatcher			2	5	1	0	0.00
	Tree Swallow			12	54	39	32	1.28
	Western Bluebird			19	86	45	40	1.60
	Winters Putah Creek Park	14	14	23	103	79	49	3.50
	House Sparrow			6	17	0	0	0.00
	Tree Swallow			16	81	74	47	3.36
	Western Bluebird			1	5	5	2	0.14
	<b>Upper reach total</b>	<b>75</b>	<b>71</b>	<b>102</b>	<b>483</b>	<b>344</b>	<b>281</b>	<b>3.75</b>
MIDDLE REACH	Triangle Orchard	22	19	32	120	80	56	2.55
	Ash-throated Flycatcher			1	4	4	4	0.18
	House Sparrow			10	20	0	0	0.00
	Tree Swallow			13	62	52	35	1.59
	Western Bluebird			8	34	24	17	0.77
	Russell Ranch	27	21	30	116	73	53	1.96
	Ash-throated Flycatcher			6	16	5	4	0.15
	House Wren			1	6	0	0	0.00
	Tree Swallow			10	42	29	13	0.48
	Western Bluebird			13	52	39	36	1.33
	<b>Middle reach total</b>	<b>49</b>	<b>40</b>	<b>62</b>	<b>236</b>	<b>153</b>	<b>109</b>	<b>2.22</b>
LOWER REACH	Picnic Grounds	35	33	50	216	173	147	4.20
	Ash-throated Flycatcher			1	4	4	4	0.11
	Tree Swallow			18	81	67	59	1.69
	Western Bluebird			31	131	102	84	2.40
	Old Davis Rd	23	20	26	110	77	61	2.65
	Ash-throated Flycatcher			3	12	12	11	0.48
	House Wren			2	9	6	5	0.22
	Tree Swallow			6	27	15	10	0.43
	Western Bluebird			15	62	44	35	1.52
	Mace Blvd	20	20	35	157	127	111	5.55
	Ash-throated Flycatcher			1	4	4	4	0.20
	Tree Swallow			13	67	61	51	2.55
	Western Bluebird			21	86	62	56	2.80
	<b>Lower reach total</b>	<b>78</b>	<b>73</b>	<b>111</b>	<b>483</b>	<b>377</b>	<b>319</b>	<b>4.09</b>

## UC Davis Arboretum Nestbox Trail

The nest boxes at the Shields Oak Grove in the UC Davis Arboretum were set up in partnership with the UC Davis student-led conservation group “Wild Campus” but are currently monitored by MWFB staff and volunteers. This is an additional site separate from the Putah Creek Nestbox Highway. These nest boxes provide breeding habitat for campus birds and education and outreach opportunities for students and the public.

In 2021, Western Bluebirds occupied six of the 11 Arboretum boxes, producing 24 fledglings (Table 3). This is the third year in a row in which Western Bluebirds were the exclusive users of the Arboretum nest boxes. This site is often a source of bird re-sighting data, as the bluebirds here are tamer and often come close to humans, making color band combinations more easily visible.



Volunteer Alyssa Hayes retrieving a nest box at UC Davis Arboretum Nestbox Trail.

Photo: Hanika Cook

TABLE 3. NEST BOX RESULTS FOR THE ARBORETUM, 2021

Site	Boxes	Boxes used	Clutches	Eggs	Nestlings	Fledglings	#Fledglings/#Boxes
Arboretum	11	6	9	42	30	24	2.18
Western Bluebird			9	42	30	24	2.18

## Changes in Habitat at Interdam Site

The LNU Lighting Complex-Hennessey Fire removed many large trees at the Interdam site in 2020. Some boxes were replaced or moved, but three could not be replaced. With the changes in the landscape came some differences in nest box use in 2021. As mentioned above, Western Bluebirds made nesting attempts and had a few successful fledged chicks at boxes at Interdam, which had not happened for eight years prior. As usual, the majority of nest attempts at Interdam were made by Tree Swallows, but there were also two successful Ash-throated Flycatcher attempts. In 2020, before the fire, the nest boxes there were used exclusively by Tree Swallows except for two used by House Wrens. Western Bluebirds and Ash-throated Flycatchers are known to prefer open habitats so perhaps they were attracted to the habitat after the fire rendered it more open. It is also possible that Tree Swallows competed less with other species for nest boxes in the burn area. Woodpeckers became very active in the area after the burn and may have increased the number of natural cavities available for Tree Swallows.

## Research and Publications

The Putah Creek Nestbox Highway continues to supply significant long-term scientific data on cavity-nesting bird population status, reproduction, phenology, and behavior and to serve as a platform for new research. For more information on the Putah Creek Nestbox Highway project, and to view stories and photos, we invite you to visit our blog: <https://mwfb-songbird-nestbox.wordpress.com>.

New Publication: Long-term monitoring reveals the impact of changing climate and habitat on the fitness of cavity-nesting songbirds (Riggio et al. in review). In one of the first studies to link both land cover type and climate variables to reproductive success and nestling health in songbirds, this analysis combines data on reproductive markers (clutch size, fledgling number and fledgling health) with spatial and environmental data (precipitation, temperature, and vegetation cover) to explore the relative influences of habitat and climate on reproductive success.

New Research: Effects of temperature and humidity on reproductive success in cavity-nesting songbirds (Lauck et al.). In this new study, researchers are installing data-loggers on nest boxes to measure internal and external temperature and humidity, then linking these data to reproductive success for different land use classes (riparian woodlands, orchards, grasslands, and row crops).



## Literature Cited

Riggio, J. S., M. L. Truan, H. Cook, E. DeGreef, and A. Engilis, Jr. In review. Long-term monitoring reveals the impact of changing climate and habitat on the fitness of cavity-nesting songbirds. *Biological Conservation*.

## Appendix: Photos

Below are a few photos of our 2021 Putah Creek nest box field crew.



Alice Mathew, field coordinator



Maria Froelich, field coordinator



Alexandra Meyer, field coordinator



Alyssa Hayes, volunteer intern