

# *ASPIDOSCELIS VELOX* (PLATEAU STRIPED WHIPTAIL) IN JEFFERSON COUNTY, OREGON, USA: PERSISTENCE OF AN INTRODUCED TRIPLOID PARTHENOGENETIC SPECIES OF LIZARD

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**Abstract.**—We have studied the triploid parthenogenetic Plateau Striped Whiptail (*Aspidoscelis velox*) in many parts of its natural distribution area in Arizona, Colorado, New Mexico, and Utah, USA. In 1983 it was reported to have become established in Cove Palisades State Park in Jefferson County, Oregon, USA. That introduction is believed to have occurred before 1970. The species also has been identified at newly discovered sites of introduction east of the Continental Divide in Colorado. Most parthenogenetic species of whiptail lizards in the USA have been discovered in areas beyond their natural distributions. Establishment of a parthenogen requires survival of successive generations of young-of-the-year, minimally starting with a single introduced lizard or egg, to found a new array. In July 2023 we undertook a survey to assess the status of *A. velox* in Cove Palisades State Park, Jefferson County, Oregon, 55–60 years after its introduction. We observed 10 whiptail lizards over 2 d. We mapped these observations as well as verifiable records from iNaturalist.org. Recent observations south of Cove Palisades State Park suggest this introduced array not only has persisted, but is continuing to expand its local distribution.

**Key Words.**—State Park; Oregon; introduced array; triploid; parthenogenetic; whiptail lizards

## INTRODUCTION

The triploid parthenogenetic Plateau Striped Whiptail (*Aspidoscelis velox*) has a natural distribution area on and near the Colorado Plateau in Arizona, Colorado, New Mexico, and Utah, USA. Apparently, it was first reported in the herpetofauna of Oregon by Nussbaum et al. (1983), who suggested the species had been introduced at least six years previously. Subsequently, Storm et al. (1995) stated that the lizard was introduced to central Oregon sometime prior to 1970. They reported that it inhabited rocky juniper-grown areas on the west side of Lake Billy Chinook in Cove Palisades State Park. Halvorson (2004) suggested the species expanded its range in the park after an individual escaped from a recreational vehicle. The gonochoristic Great Basin Whiptail (*Aspidoscelis tigris tigris*), which has a natural distribution that includes eastern Oregon, is the only species of its genus in the state in addition to *A. velox*. We provide an update on the status of the array (i.e., we reserve the term population for gonochoristic species) of triploid parthenogenetic *A. velox* that we think has persisted in Oregon for as long as 55–60 y after its deliberate or accidental introduction in the state. As of this writing, 16 observations (with images) of *A. velox* from Oregon also have been reported on iNaturalist.org between 1999 and August 2024.

## MATERIALS AND METHODS

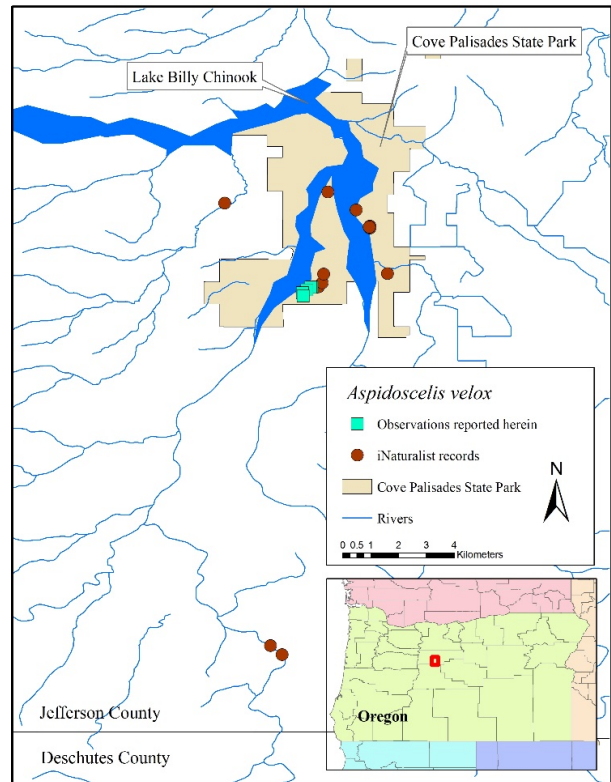
We studied images of whiptail lizards from Oregon posted on iNaturalist.org through August 2024 and agree that images identified as either the Western Whiptail (*Aspidoscelis tigris*) or Great Basin Whiptail (*A. tigris tigris*) were correctly identified as either of these two taxa based on distinctive dorsal color patterns. Similarly, all posted images identified as the Plateau Striped Whiptail (*Aspidoscelis velox*) on iNaturalist.org were correctly identified based on distinctive dorsal color patterns. The dorsal color pattern of *A. velox* includes six distinct light dorsal stripes (when present, a seventh stripe is less distinct and located mid dorsally) against a dark background. In contrast, *A. tigris tigris* has variation in dorsal pattern that often includes light stripes (often obscured) and brownish or gray spots, bars, or other markings on a dark background (Stebbins 2003). All 16 of the postings of Plateau Striped Whiptail were unquestionably from Jefferson County, where the species was previously known to have been introduced in the state (Nussbaum et al. 1983; Stebbins 1985; Storm et al. 1995). We have included additional details in Fig. 1 and the Appendix. Two records on iNaturalist.org had obscured coordinates so, although the county was listed, the location could not be pinpointed. Of the remaining 14 postings, only three

images of *A. velox* from Jefferson County seemed to be from outside of Cove Palisades State Park; namely two from northwest of the city of Terrebonne and one from Crooked Creek River National Grassland. The latter record had a large estimated coordinate error (11.73 km) so that the precise location of the record relative to Cove Palisades State Park is uncertain.

Our field survey to determine the current status of the descendants of an introduced array of *A. velox* in Cove Palisades State Park was conducted by CMK and KLU at the request and support of JMW. Other authors were recruited based on their abilities to contribute in various components of the study. The state park, located in north-central Oregon, encompasses the Deschutes and Crooked River Canyons. A prominent feature of the park is its proximity to Lake Billy Chinook (Fig. 1). The areas surveyed in the park from about 0900–1400 during 17–18 July 2023 were in the vicinity of the Deschutes Campground and the Tam-a-láu Trail (Fig. 2).

The survey method used was similar to time constrained Visual Encounter Surveys (VES) (Campbell and Christman 1982; Corn and Bury 1990). Surveys were one hour each, and sites were surveyed twice per day at: (1) B loop campground; (2) Tam-a-láu trail; and (3) area south of the Tam-a-láu trail. At each site, observers walked 5–10 m apart. At the B loop campground, the road through the campground was used as a transect, with observers walking on opposite sides of the road. On the Tam-a-láu trail, each observer walked approximately 1–5 m on each side of the trail. On the area south of the trail, observers walked in straight lines as the area was somewhat rectangular and flat. When a lizard was encountered, a single observation was conducted by two observers from approximately 5 m away, allowing for unbroken visual contact.

Areas that were found to be inhabited by whiptail lizards were characterized by a relatively flat landscape with openings among an abundance of shrubs, grasses, and woody debris. Sections of the Tam-a-láu Trail were found to be especially productive for *A. velox*, though steeply inclined sections of the trail were not searched (Fig. 2). We recorded the following data when an individual *A. velox* was spotted: (1) air temperature from NOAA National Weather Service (<https://www.weather.gov/>) for Jefferson County, Oregon; (2) whether the sky was clear or cloudy; (3) time of day; (4) estimated age class of the lizard based on snout-vent length (SVL) with lizards > 70 mm SVL classified as adults and smaller individuals classified as juveniles (Persons and Wright 2009); (5) dominant plant species (identified subsequently); and (6) general habitat structure. Habitat structure parameters included (1) anthropogenic structures (e.g., bathrooms, road, picnic table), (2) shrubs, (3) trees, (4) grasses, (5) dead wood fragments on the ground, and (6) topography (e.g., flat versus steep slope by visual assessment). We also noted predation attempts. The general locations of the observations were also assessed

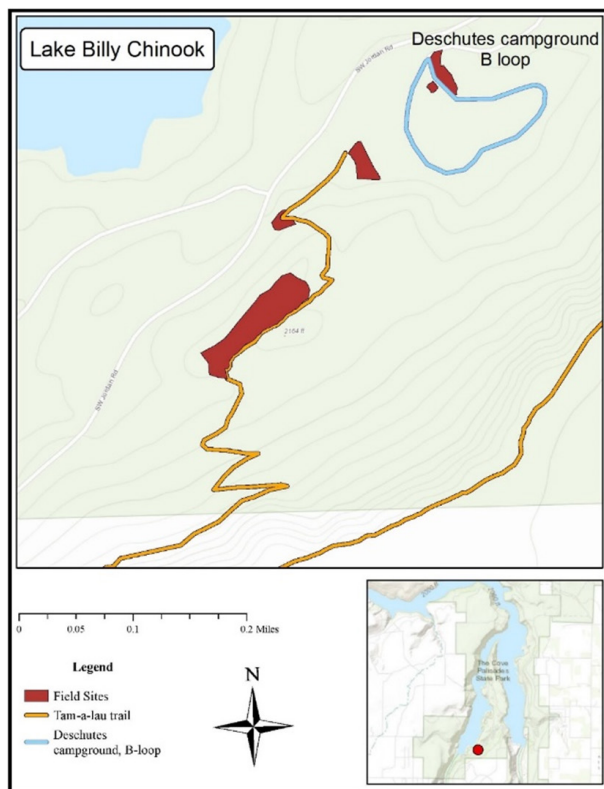


**FIGURE 1.** Distribution of 14 of 16 triploid parthenogenetic Plateau Striped Whiptail (*Aspidoscelis velox*) reports on iNaturalist.org in Jefferson County, Oregon, and the location of observations reported in this article. Some iNaturalist.org records occurred in close enough proximity for the records to overlap, and two reports had obscured coordinates and are not mapped. The westernmost iNaturalist observation, plotted outside Cove Palisades State Park, had an 11.73 km coordinate error and was thus possibly also from within the park.

relative to the location of the Deschutes Campground. We captured several lizards using a lasso attached to an extendable pole, after which we photographed each lizard with a digital camera. We removed a small sample of tissue from the end of the tail of captured lizards and immediately immersed the sample in 95% ethanol in a separate vial for each lizard for a separate analysis. We released all captured individuals of *A. velox* within 10 min of capture near the point of their initial observation.

## RESULTS

Whiptail lizards observed and captured in the complex landscape in Cove Palisades State Park were readily identifiable as *A. velox* based on distinctive color patterns (Figs. 3–4). In addition, all images posted prior to September 2024 on iNaturalist.org from Oregon under the names *A. velox*, *A. tigris*, and *A. t. tigris* were correctly identified. The six captured individuals examined and photographed had ventral colorations of pale blue (Fig. 3A) to darker blue with a slight grayish tinge in the central parts of the scales in the eight longitudinal rows (Fig. 3B). We attributed differences



**FIGURE 2.** Map of the Deschutes campground, relative to Lake Billy Chinook, and the Tam-a-lau Trail (orange), Cove Palisades State Park, Jefferson County, Oregon. The red polygons represent the flat areas of habitat surveyed where adults of triploid parthenogenetic Plateau Striped Whiptail (*Aspidoscelis velox*) were observed (some were lassoed). The Cove Palisades State Park and the Deschutes campground (red dot) can be seen in the map in the bottom right corner.

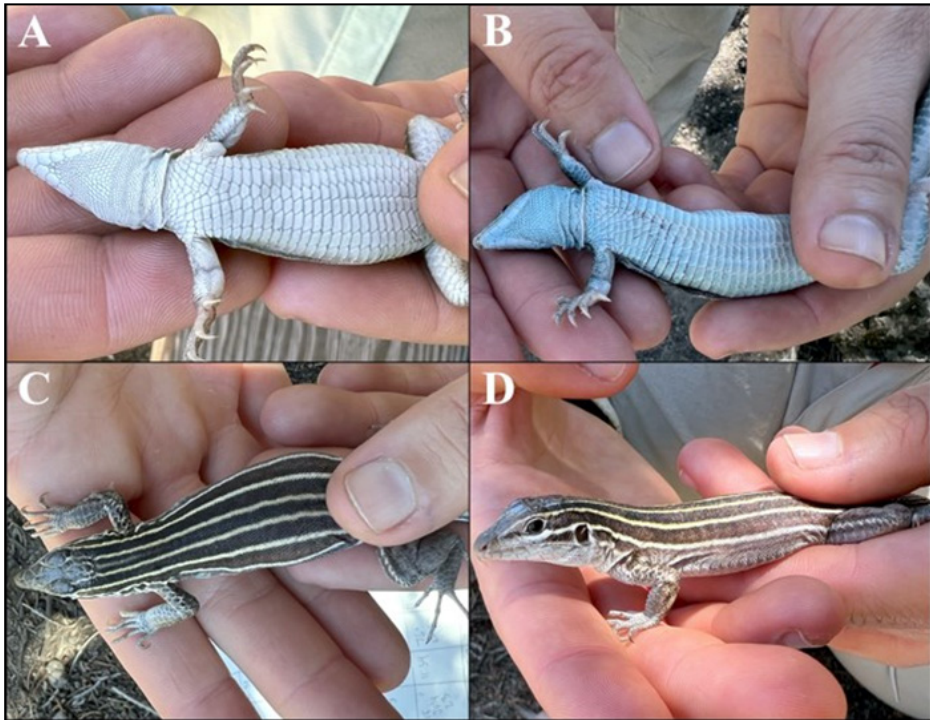
in the hues of the ventral coloration of adult lizards to ontogenetic variation, with the blue intensifying with age. All individuals both observed and captured had six distinct primary dorsal stripes arranged on the trunk in ventral to dorsal bilateral pairs of whitish laterals, cream-white dorsolaterals, and slightly darker hued cream-white paravertebrals (Figs. 3–4). The only indication of development of a seventh stripe (= secondary middorsal line) between the paravertebrals was a barely visible vestigial vertebral fragment from the occipital scales on the head posteriorly to near the level of the forelimbs (Fig. 3C) and a ghost-like vertebral (= middorsal) line along the length of the trunk (Fig. 4C). Though interrupted by the hindlimbs, bilateral stripes equivalent to the laterals of the trunk were present on the tail, as were extensions of the paravertebrals extending from the trunk (Fig. 4D). The longitudinal fields between the stripes on the trunk and basal third of the tail were black in juveniles and young adults (Fig. 4D). Older adults had slightly less vividly contrasting stripes and fields though there was no evidence of stripe disruption into spots (Figs. 4B–C). None of the lizards had distinct spots in the longitudinal dark-hued fields between the stripes although the central

regions of the fields in older lizards were slightly lighter in color than the outer regions. The largest adults did possess fields between the stripes that trended toward a dark brown coloration which contributed to reduced contrast between stripes and fields. We have examined data for large numbers of specimens of *A. velox* from Arizona, Colorado, New Mexico, and Utah, and have found significant geographic variation in the development of a middorsal line ranging from a dash of a few mm extending from the occipital scales (e.g., from several sites in Arizona) to presence of a distinct seventh stripe (e.g., specimens of all sizes from Kane County, Utah, and Cibola County, New Mexico; Walker 1986; Cordes and Walker 2013; Sullivan et al. 2018; Cole et al. 2019; Livo 2020). Taylor (1965) also reported ontogenetic variation in this character in specimens from Colorado.

The landscape in Cove Palisades State Park was primarily populated by conifers, juniper trees (*Juniperus* sp.), Great Basin Sagebrush (*Artemisia tridentata*), Gray Rabbitbrush (*Ericameria nauseosa*), Green Rabbitbrush (*Chrysothamnus viscidiflorus*), and various grasses (Fig. 5). On 17–18 July 2023, weather conditions were clear and sunny. The earliest time of observation of an adult whiptail lizard was 0853 at an air temperature of 17.2° C (63° F) in a shrub dominated area near the Tam-a-lau trailhead. One individual *A. velox*, which was captured by lasso, was shedding, indicating significant prior growth. The other nine individuals (one juvenile, two young adults, and six older adults) were invariably initially observed near environmental structures such as shrubs, juniper or other trees, and piles of deadwood, rather than in more open areas. Other details of the encounters were that air temperatures were between 23.3° and 26.1° C (74° and 79° F), and lizards were found between 1115 and 1251 with cloudless skies. Behaviorally, individuals of *A. velox* were not especially wary and typically could be followed, photographed, or lassoed with relative ease. Individual *A. velox* did not hesitate to enter debris-strewn microhabitat for foraging, concealment, and escape (i.e., areas without exposed substrate; Fig. 4).

## DISCUSSION

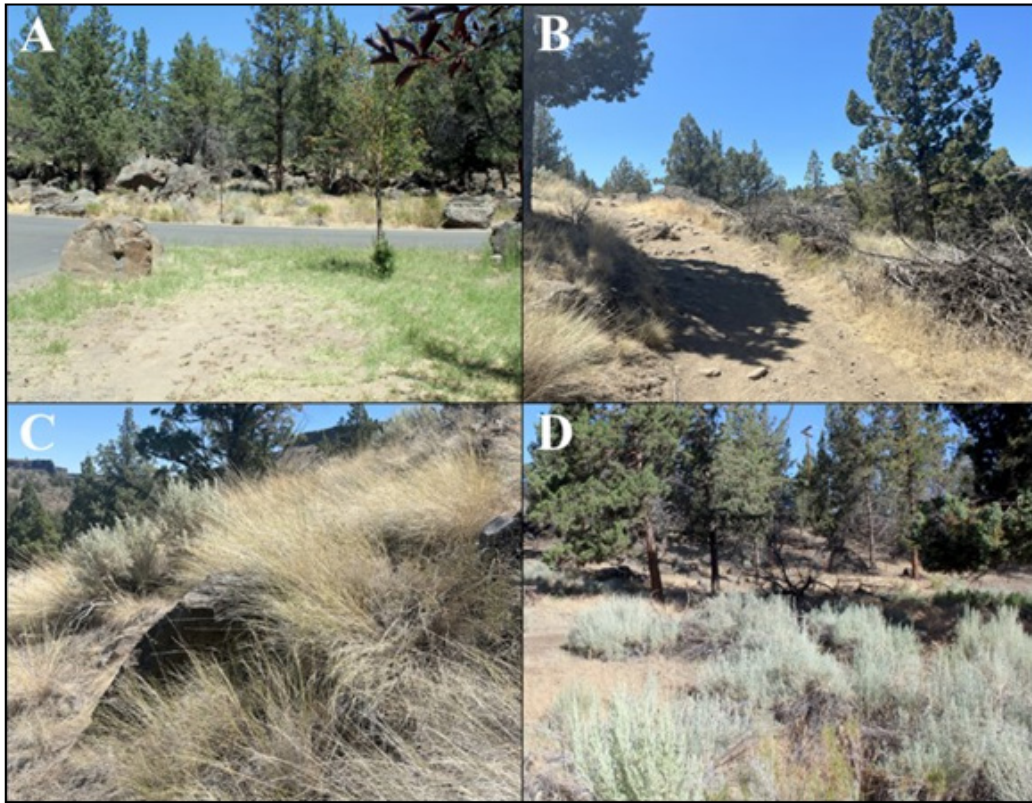
We have known that *A. velox* is a triploid species since the report of Pennock (1965), and that it reproduces asexually by parthenogenesis based on analyses and experiments conducted by Maslin (1962, 1964, 1966). The lizard evolved via a two-stage hybridization process many generations apart as reported by Dessauer and Cole (1989), Moritz et al. (1989), and Barley et al. (2021). Cole et al. (2019) found that *A. innotatus* described by Burger (1950) from Kane County, Utah, was triploid, and not the diploid, parthenogenetic maternal progenitor in the second stage of hybridization leading to *A. velox* as suspected by Wright (1993). Consequently, the name *A. innotatus* was returned to the synonymy of *A. velox* by Cole et al. (2019).



**FIGURE 3.** Captured and released adult females of triploid parthenogenetic Plateau Striped Whiptail (*Aspidoscelis velox*) in Cove Palisades State Park, Jefferson County, Oregon, photographed 17–18 July 2023: (A) pale blue-white coloration from ventral perspective of head and trunk; (B) darker blue to blue-gray coloration from ventral perspective of head and trunk; (C) dorsal pattern of six distinctive primary stripes, black intervening fields, and faint vertebral (= middorsal) secondary line from occipital scales to near level of forelimbs; and (D) color pattern from left lateral perspective showing ghost-like markings in the two lowest longitudinal dark fields. (Photographed by Carina M. Kusaka).



**FIGURE 4.** Adult females of triploid parthenogenetic Plateau Striped Whiptail (*Aspidoscelis velox*) photographed in situ in Cove Palisades State Park, Jefferson County, Oregon, 17–18 July 2023: (A) part of dorsal pattern on right side of body of an alert lizard in substantial ground cover; (B) dorsal pattern of an older adult lizard showing reduced contrast between longitudinal stripes and fields and gray-blue coloration of distal part of tail; (C) older adult showing semblance of organization of a vertebral (= middorsal) stripe; and (D) part of dorsal pattern from left side of body of young adult with strongly contrasting longitudinal stripes and fields on trunk and tail. (Photographed by Carina M. Kusaka).



**FIGURE 5.** Complex landscapes inhabited by triploid parthenogenetic Plateau Striped Whiptail (*Aspidoscelis velox*) in Cove Palisades State Park, Jefferson County, Oregon, photographed 17–18 July 2023. (A) Habitat within Deschutes campground. (B) Loop B approximately 0.48 km into the Tam-a-láu trail where an adult whiptail lizard was found in pile of dead wood on the right side of the trail. (C) Habitat adjacent to the Tam-a-láu trail characterized by various species of grasses among junipers (*Juniperus* sp.) and Great Basin Sagebrush (*Artemisia tridentata*). (D) habitat located south of the Tam-a-láu trailhead with complex vegetational association of *Juniperus* sp., *Artemisia tridentata*, Grey Rabbitbrush (*Ericameria nauseosa*), and Green Rabbitbrush (*Chrysothamnus viscidiflorus*). (Photographed by Carina M. Kusaka).

The identification of the diploid parthenogenetic maternal progenitor of *A. velox* has been an elusive quest. It is thought by some herpetologists to be extinct, although the progenitor may be the species recently described as *Aspidoscelis preopatae* (no common name) from a restricted area in Sonora, México (Barley et al. 2021). The presence of *A. velox* in Cove Palisades State Park is approximately 1,000 km northwest from its natural distribution areas in Arizona, Colorado, New Mexico, and Utah (Nussbaum et al. 1983; Stebbins 1985, 2003; Storm et al. 1995). Oregon, however, does not contain the only extralimital introduced arrays of *A. velox*. Johnson et al. (2020) reported that one or more introductions likely accounts for the presence of the species in the Arkansas River drainage in Chaffee and Fremont counties, Colorado, the only known areas of occurrence for the species in the state east of the Continental Divide.

*Aspidoscelis velox* is not the only parthenogenetic whiptail lizard species that has been introduced outside its natural distribution. Three other triploid species, the Colorado Checkered Whiptail (*A. neotesselatus*), Chihuahuan Spotted Whiptail (*A. exsanguis*), and Sonoran Spotted Whiptail (*A. sonorae*), are known to have been

introduced to Washington State (Weaver et al. 2011), Colorado (Livo and Wilcox 2021), and California (Fisher et al. 2022), respectively. The diploid parthenogenetic New Mexico Whiptail (*A. neomexicanus*) is also known to have become established in Arizona (Persons and Wright 1999; Persons et al. 2021) and Utah (Oliver and Wright 2007; Vicente Fernandez, pers. comm.). Some biologists suggest that *A. neomexicanus* has also been introduced to several areas in New Mexico, including the vicinity of Conchas Lake in San Miguel County (Manning et al. 2005; but see Leuck et al. 1981). Moreover, introduced arrays of the diploid parthenogenetic Gray Checkered Whiptail (*A. dixonii*; Chad Montgomery, pers. comm.), Laredo Striped Whiptail (*A. laredoensis*; Matthew Fujita, pers. comm.), and Common Checkered Whiptail (*A. tessellatus*; Gregory Pauly, pers. comm.) have been found in various parts of the USA west of the Mississippi River.

We note that few groups of vertebrates better illustrate the distinction between ecology and biogeography than species of parthenogenetic whiptail lizards (i.e., constrained to an area by local and/or intervening ecological conditions though able to thrive when introduced to new areas). The array of *A. velox* in Oregon and those of maternal progenitor *A. preopatae* in Sonora

are separated by > 2,000 km of habitats that include woodlands and deserts, which may be the ultimate incongruent relationship between a triploid parthenogen and its diploid maternal progenitor. The geographical closest triploid parthenogenetic species derived from *A. preopatae* as maternal progenitor is the Opata Whiptail (*Aspidoscelis opatae*; Wright 1967), which is also restricted to Sonora.

We have examined samples of *A. velox* from each of the four states within its natural distribution and are reluctant to offer more than a tentative hypothesis on the origin of the pioneers that founded the Oregon array pending examination of genetic samples. The nearest arrays with similar six striped dorsal color patterns, however, are found in Arizona. We note that the nearest arrays of the species, which are in Utah, have seven distinct stripes. Although we will probably never know the circumstances that resulted in the introduction of *A. velox* to Cove Palisades State Park, likely only one or a very small number of individuals initiated this array, which now has endured 55–60 y. Recent observations from more than 12 km south of Cove Palisades State Park suggest that these lizards continue to expand their distribution in the area and land managers should consider surveying these and nearby areas to determine the full current extent of their range in Oregon.

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#### APPENDIX

We examined several online sources for records of *Aspidoscelis velox*: iNaturalist, Herpetological Education and Research Project (H.E.R.P), Herpmapper (HM), VertNet, and ARCTOS.

No Oregon records were available from VertNet or ARCTOS.

HM: record 128623 from Jefferson County, Oregon cross-listed below as iNaturalist 38392343 and H.E.R.P. 216441.

H.E.R.P.: Four records, all from Jefferson County, Oregon: 198271, 198270, 198269, and 216441 (duplicated as iNaturalist record 38392343 and HM 128623).

In iNaturalist there are 16 observation records for *Aspidoscelis velox* in Jefferson County, Oregon, as of August 2024 (estimated coordinate errors follow record numbers in parentheses): 186498355 (1.36 km), 182533701 (coordinate error not recorded), 162526113 (coordinates obscured), 150897815 (15 m), 150834526 (158 m), 128481093 (32 m), 128102636 (coordinates obscured), 103066603 (50 m), 70019066 (22 m), 51863304 (22 m), 38392343 (15 m), 33111300 (11 m), 32817591 (7 m), 27673680 (11.73 km), 7543674 (coordinate error not recorded), 236619173 (25 m).

Tables in appendices of reports by Schuller and Halvorson (2008a, b) on the Horse Ridge Research Natural Area (Deschutes County) and the Powell Butte Research Natural Area (Crook County), Oregon, list *Aspidoscelis velox*. The presence of species in these tables, however, does not indicate that they are documented for the areas, but as listed are only known or expected to occur.

Schuller, R., and R. Halvorson. 2008a. Horse Ridge Research Natural Area: guidebook supplement 37. General Technical Report PNW-GTR-771, U.S. Forest Service, Pacific Northwest Research Station, Portland, Oregon. 25 p.

Schuller, R., and R. Halvorson. 2008b. Powell Butte Research Natural Area: guidebook supplement 38. General Technical Report PNW-GTR-773, U.S. Forest Service, Pacific Northwest Research Station, Portland, Oregon. 20 p.



**CARINA M. KUSAKA** is a Graduate Research Assistant from Oregon State University in Corvallis, Oregon, USA. Her current research focuses on spatial analyses in the breeding habitat of Tufted Puffins (*Fratercula cirrhata*). She received a B.S. degree in Fish, Wildlife, and Conservation Biology from Colorado State University, Fort Collins, Colorado, where she worked with Erell Insitute to study the behavioral and movement ecology of reptiles. Carina is primarily interested in understanding the effects of climate change on species of greatest conservation need, and using art to help foster excitement and education in communities for their local ecosystems. (Photographed by Donna Grippa).



**KAERA L. UTSUMI** is a Behavioral Ecologist specifically interested in reptile behavior. She is currently a Research Assistant at Erell Institute, Lawrence, Kansas, and has worked with the organization on multiple research projects in several countries engaging women and underrepresented groups in science. Some of the lizards she has studied include the Atacamen Pacific Iguana (*Microlophus atacamensis*), the Colorado Checkered Whiptail (*Aspidoscelis neotesselatus*), and the Namib Web-footed Gecko (*Pachydactylus rangei*). When Kaera is not working on writing papers for publication, she enjoys reading, crocheting, rock climbing, and playing basketball. (Photographed by Maria Eifler).



**JAMES E. CORDES** is a Professor of Biology at Louisiana State University Eunice (LSUE), Louisiana. He received B.S and M.S. degrees from Texas State University, San Marcos, and Ph.D. from the University of Arkansas, Fayetteville. He has been the recipient of 16 annual Endowed Professorships funded by Opelousas General Hospital and awarded by LSU, Eunice, to study the genetic relationships of parthenogenetic teiid lizards through skin-graft experiments. Since 1984, he has undertaken > 100 field expeditions to México, Arizona, Colorado, New Mexico, Oklahoma, Texas, and Utah, USA, to collect live parthenogenetic whiptail lizards for laboratory experiments and preserved voucher specimens of numerous species for ecological and systematic studies. He is author of > 90 publications on lizards in the genus *Aspidoscelis*. (Photographed by Travis Webb).



**ANTHONY J. BARLEY** is an Assistant Professor in the School of Mathematical and Natural Sciences at Arizona State University (ASU), Glendale. He grew up in California, earned a B.S. degree from California State University, Sacramento, and a Ph.D. from the University of Kansas, Lawrence, where he studied the systematics and evolution of Philippine lizards. Before starting his faculty position at ASU in 2022, he was a postdoctoral researcher at the University of Hawai‘i, Honolulu, and the University of California, Davis, where he began research on the evolution of North American whiptail lizards, which has involved fieldwork and collaboration with scientists from across the southwestern U.S., Mexico, and Guatemala. (Photographed by Armand Saavedra).



**ROBERT C. THOMSON** is a Professor in the School of Life Sciences at the University of Hawai‘i, Honolulu. He earned a B.S. at the Rochester Institute of Technology, Rochester, New York, followed by a Ph.D. at the University of California, Davis, that focused on the evolutionary history and conservation biology of amphibians and reptiles. Robert works with a network of students, scientists, and conservation managers to understand the generation and maintenance of biodiversity, and to conserve natural populations of amphibians and reptiles. His recent work has focused on the evolution of whiptail lizards, the diversification of turtles, and statistical methods for inferring evolutionary history. (Photographed by Anthony Barley).



**LAUREN J. LIVO** for several years conducted research on the Boreal Toad (*Anaxyrus boreas*) in collaboration with the Colorado Division of Wildlife. After receiving a Ph.D. from the University of Colorado, Boulder, she continued her work on the Boreal Toad as a post-doctoral fellow at the University of Colorado. Subsequent to retiring, she has been documenting the geographic distribution, phenology, and natural history of amphibian and reptile species in Colorado, especially that of various introduced species including the Pond Slider (*Trachemys scripta*), the Colorado Checkered Whiptail (*Aspidoscelis neotesselatus*), *A. velox*, and the Chihuahuan Spotted Whiptail (*A. exsanguis*). (Photographed by Steve Wilcox).



**JAMES M. WALKER** is Professor of Biological Sciences, University of Arkansas, Fayetteville. Since earning B.S. and M.S. degrees from Louisiana Tech University, Ruston, and a Ph.D. from the University of Colorado, Boulder. James has engaged in teaching, research, and service at the University of Arkansas (1965–present) and has collaborated with numerous scientists on the biology and systematics of whiptail lizards (genera *Aspidoscelis* and *Cnemidophorus*: Family Teiidae). His graduate students have completed theses and dissertations on a variety of amphibian and reptile species. (Photographed by Shilpa Iyer).