
**Vernal pool fairy shrimp survey on public lands on the
Agate Desert landform, Jackson County, Oregon**

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Abstract

We surveyed for *Branchinecta lynchi* (vernal pool fairy shrimp)—a federally listed threatened species in vernal pools on 1550 acres of predominantly public land ownership on 20 sites across the Agate Desert Landform between January and April 1999. *Branchinecta lynchi* were found to occupy 114 pools on 14 of the surveyed sites. Based on one or a few visits, these results may under-represent the abundance and distribution of *B. lynchi*. Extensive acreage of additional habitat remains unsurveyed on private land.

For tracts with a vernal pool fairy shrimp occurrence, the average patch size likely to contain at least one occupied vernal pool ranged from a 2 acres patch on the Agate Desert Preserve, up to a 120 acre patch on a tract of the Oregon Department of Fish and Wildlife Denman Wildlife Area. The greatest abundance of occupied pools occurred on the Whetstone Savanna and Agate Desert preserves with 31 and 26 occupied pools, respectively. An additional four pools on Agate Desert Preserve were occupied in 1998, but with *B. lynchi* absent in 1999. Two survey areas on the Whetstone Industrial Park followed closely in abundance of occupied pools. While the several tracts of the ODFW Denman Wildlife Management Area contains over 600 acres of vernal pool complex habitat, only nine pools were found occupied.

Vernal pool fairy shrimp were most abundant in pool systems where the density of pooling is greatest and least disturbed in terms of water quality. Livestock grazing appears to be neutral in regard to fairy shrimp occurrence. The combination of timber industry wood debris and dense plantings of intermediate wheatgrass (a common trait of the Denman Wildlife Area) appears to have a negative impact on the vernal pool fairy shrimp. Other conditions which appear to negatively impact pool health, decreasing the likelihood of a fairy shrimp occurrence include heavy off-road vehicle use (Hoover Ponds tracts), trash dumping, disruption of the pool hydrology, and, the accumulation of dead organic matter in the pools and surrounding mounds in areas lacking disturbance. The application of sewage biosolids appears to be associated with strongly eutrophic conditions in at least some pools. However, the relationship between the fairy shrimp population and livestock grazing, wood waste, ORV disturbance, biosolids and vegetation dynamics is not well understood.

Introduction

The Oregon Natural Heritage Program (ORNHP) entered into an agreement with the U.S. Fish and Wildlife Service (USFWS) in 1997 to conduct invertebrate inventories in vernal pools in Jackson County. That original work was completed by May Consulting Services in a final report entitled *Aquatic macro-invertebrate assemblages occurring in selected vernal pools on the Agate Desert and nearby sites in Jackson County* (Helm and Fields, 1998). Students from Southern Oregon University hired for the project first collected *Branchinecta lynchi* (vernal pool fairy shrimp) in Oregon. Prior to completion of the agreement ORNHP and USFWS augmented the agreement to include additional surveys for the vernal pool fairy shrimp on public lands covering the Agate Desert vernal pool system. The Nature Conservancy conducted the work under this extended agreement for the ORNHP, under the supervision of Darren Borgias. The primary objective of this study was to assess the distribution of *Branchinecta lynchi* occurring in vernal pools on public lands on the Agate Desert in Jackson County, Oregon. This report summarizes the findings of this effort along with the ongoing survey work on the two Nature Conservancy preserves within the study area.

Study Area

Agate Desert Vernal Pool Ecosystem

The "Agate Desert" is located in the Rogue/Illinois Valley sub-region of the Klamath Mountains Ecoregion, where the vegetation and land use is similar to those of northern California's inland valleys (Pater et al. 1998). The vernal pools of the Agate Desert occur on an extensive Pleistocene alluvial fan terrace (Parsons and Herriman 1976), supported by the mounded topography and duripan associated with the Agate-winlo soil complex (USDA-NRCS 1993). The Natural Resources Conservation Service (NRCS) classifies the upland matrix soils as Fine-loamy, mixed, mesic Typic Durochrepts. The vernal pool soils—the winlo soil—is classified as a Clayey-skeletal, montmorillonitic, mesic, shallow Typic Duraquolls, and give a range of soil depth over the hardpan from 7-15 inches. The landform occupies portions of the valley floor at roughly 1,300 feet in elevation, and is influenced by a mesic-xeric climatic regime, receiving approximately 20 inches of precipitation annually. The terrain has been described as mounded prairie or patterned ground. Indicator plant species for the Agate Desert vernal pool type include *Limnanthes floccosa grandiflora*, which is restricted to the Agate Desert, and *Lomatium cookii*, restricted to the Agate Desert landform in the Rogue basin and vernal wet habitat on Pleistocene terraces of the Illinois River basin. The Agate Desert landform covers over 21,000 acres, however much of that acreage has been severely altered by conversion to agricultural, commercial and residential use (ORNHP 1997).

Vernal Pools

Vernal pools and swales are rain-fed, seasonal wetlands, which occur in Mediterranean climates, where shallow depressions underlain by impervious substrate collect water by limiting run-off or percolation. Vernal pools worldwide have been classified by the features of the substrate that cause the pooling, along with hydrologic and biotic features. The Agate Desert vernal pool ecosystem is differentiated from related vernal pools on the Table Rocks, which occur in the Siskiyou Foothill sub-region of the Klamath Mountain Ecoregion, north of Medford. Table Rock vernal pools are associated with the flat summits of the prominent horseshoe-shaped buttes, capped by the Miocene andesite of Table Rock (Hladky 1998), on soils mapped at Randcore-Shoat with pooling supported by the impervious lava bedrock. The Agate Desert vernal pools are also differentiated from andesite flow vernal pool systems that occur in or near the Cascade Range-- systems found at the boundary between the Southern Cascades sub-region of the Cascades Ecoregion and the Siskiyou Foothill sub-region of the Klamath Mountains Ecoregion, and the western fringe of the Southern Cascade Slope sub-region of the Eastern Cascades Slopes and Foothills Ecoregion (Pater et al 1998).

The distinct and yet variable habitat offered by vernal pools in combination with the geographic isolation of pool systems produces many distinct natural communities with high levels of species endemism. While endemic species of animals and plants adapted to

vernal pools in California have been well documented, much less has been known about endemism in the vernal pools on the Agate Desert. Previous botanical surveys in Oregon identified four vernal pool endemic plant species, including *Limnanthes floccosa* ssp. *grandiflora* and *Lomatium cookii*, from the Agate Desert vernal pools, considered species of concern by the U.S. Fish and Wildlife Service (USFWS). The invertebrate fauna of the vernal pools was largely unknown prior to the work Helm and Fields (1998).

On the Agate Desert landform, vernal pools tend to vary in size from 1 to 30 meters across and are often oriented linearly in swales where the surface has sufficient slope. The maximum depth of water is about 30 cm, but many vernal pools never fill deeper than a few centimeters. Duration of inundation is also variable. Striking patterns of plant associations conform to, and highlight the micro-topography of the intermound depressions, with species blooming in successive rings toward the deepest part of the pools as soil moisture recedes through the spring. The Nature Conservancy developed a preliminary classification of 17 vernal pools types based on quantitative assessment of the patterns of plant associations on two preserves and on public lands (Huddleston and Borgias 1999, see also Ferren and Feidler 1999).

Fairy Shrimp

Fairy shrimp are freshwater crustaceans of the order Anostraca. They swim on their back, using eleven sets of swimming legs which also function for gas exchange, like gills. They inhabit temporary bodies of water that typically dry at some time during the year. Fairy shrimp are able to complete a life cycle—to “hatch” from a dormant cyst, mature, and reproduce in a matter of weeks. The cysts are able to tolerate desiccation, extreme heat and cold, and to remain dormant for decades until appropriate conditions occur to trigger emergence. The vernal pool fairy shrimp (*Branchinecta lynchi*) is one of numerous species of fairy shrimp, each differentiated by unique patterns of structures on the enlarged second antennae of males. Most can be identified with a hand lens in the field. In California, the vernal pool fairy shrimp generally occurs in small, ephemeral wetlands (<200 m²) that are shallow (mean of 5 cm) with a wide range of variation (Helm 1998). The species has a short maturation period (mean of 26 days), and is found free swimming during the cold months of the year (Helm 1998).

Throughout its range in California, habitat for the vernal pool fairy shrimp is in decline. Similar circumstances are also found in southwestern Oregon. *Branchinecta lynchi* was listed as a threatened species in 1993 by the USFWS under the Endangered Species Act (ESA) as amended (59 Federal Register 48136). The species is the only known listed species of fairy shrimp to occur in Oregon, however 12 other species are known or suspected to occur in the state.

Methods

Determination of Survey Sites and securing permission for access

The Oregon Natural Heritage Program's *Preliminary Mapping and Assessment of the Agate Desert Vernal Pools* was used as the basis for identifying suitable lands to survey (ORNHP 1997). The tax lot and ownership GIS layer from Jackson County was superimposed over the habitat map, and all suitable public lands were identified. The USFWS mailed out formal requests to each of the managers responsible for administering the public lands to gain permission for access for the purposes of conducting the survey. Permission was later granted by Oregon Department of Transportation and the private C2 Cattle Ranch. The public land sites surveyed are listed in Table 1 and the contacts in Table 2.

Survey Methods

The survey methods employed here were designed after those called for in the wet season portion of the survey protocol issued by the USFWS for the purposes of determining the absence of fairy shrimp. Because this study was designed to help determine the extent and nature of vernal pool fairy shrimp distribution, only limited attempts were made to visit sites on more than a single occasion. The methods therefore fall short of determining with any certainty where the species does not occupy potential habitat.

We walked across most sites extensively, inspecting and sampling 75- 100% of the pools on site. In general pools were sampled using a fine-mesh dip-net to sweep in 5-meter intervals across the entire length of the pool, zigzagging between pool margins. Pools that displayed the characteristics we found increasingly associated with the vernal pool fairy shrimp were sampled more intensively. Pools occupied by *Branchinecta lynchi* were marked with striped flagging and a pin flag (labeled with pool identification) placed at the deepest point in the pool. To aid in tracking coverage of a site, unoccupied pools were marked with solid color flagging tied to nearby vegetation. Voucher specimens were collected and preserved in 70% ethanol. Collections were made from all pools where the vernal pool fairy shrimp was observed, except where voucher specimens and positive identification had already been made in nearby pools on an individual site. All collected specimens were mature individuals and are stored at the entomology lab at Southern Oregon University.

Consistent weekly observations were made of 103 pools on the two Nature Conservancy Preserves. Fairy shrimp were sampled with a fine-mesh dip-net along two perpendicular transects from the edges, intersecting at the deepest part of the pool. In a standard subset of the pools visited, and all other pools in which *B. lynchi* eventually were detected, environmental data was also collected. Numerous additional pools were checked for presence of *Branchinecta lynchi* periodically, with no additional measurements taken, until or unless fairy shrimp were detected.

Results

A summary of the survey effort and number of pools occupied by *Branchinecta lynchi* is shown in Table 3a and 3b. Weekly observations on environmental factors and abundance of *B. lynchi* in pools occupied on the two Conservancy Preserves are provided in Table 4. A subset of the data from *Branchinecta lynchi*-occupied pools on the preserves, from the dates on which the maximum number of *B. lynchi* were encountered, is provided in Table 5. The results of the public land surveys are summarized in Table 6. Two maps, one an overview, the other a close up of the White City/Central Point area, show the location of the occupied pools and the extents of the habitat sampled on the surveyed tracts.

We surveyed 1549 acres of habitat with vernal pools of variable quality spread across 20 sites. *Branchinecta lynchi* occurred in 114 pools across 14 of the 20 sites. For tracts with a *Branchinecta lynchi* occurrence, the range in the mean patch-size necessary to encounter at least one occupied vernal pool ranged from a 2 acres patch on the Agate Desert Preserve, up to a 120 acre patch on a tract of the Oregon Department of Fish and Wildlife Denman Wildlife Area (Table 3). The greatest abundance and concentration of pools was observed on the Whetstone Savanna and Agate Desert preserves with 31 and 26 pools, respectively. The portion of the Whetstone Industrial Park off Newland Road followed closely in abundance and density of occupied pools with 24. The portion of the industrial park south of Antelope Road also had a relatively high concentration of occupied pools. While the several tracts of the Oregon Department of Fish and Wildlife Denman Wildlife Management Area provided over 600 acres of vernal pool complex habitat, only a total of nine pools were found to be occupied by *B. lynchi*.

Occupied pools on the two preserves supported peaks in the abundance of *Branchinecta lynchi* that occurred on average at February 22, with the peak occurring as early as January 17 and as late as March 20. At peak abundance, *Branchinecta lynchi* occurred at a mean density of 1.8 animals/m³, with a range from 0.1 to 13 animals/m³. Females and males were encountered in equal numbers overall at the peak period of abundance. Occupied pools during the peak abundance of *Branchinecta lynchi* had a mean area of 175 square meters, ranging from 10 to 600 m². The mean depth was 20 cm (range 8.5-43 cm), and a mean volume of water at 40 cubic meters (range 2.2-167 m³).

While public land and other private sites were visited over the period when peak observations were being made at the two preserves, the pool specific peaks on the public lands surveyed may not have been encountered with the single or few visits afforded. *Branchinecta lynchi* density could not be determined from the data collected. Females and males were encountered in roughly equal numbers overall, but with greater variation than observed for the peak period observations made on the two preserves. Occupied pools had a mean area of 483 square meters, ranging from 84 to 2700 m². The mean depth was 23.4 cm, ranging from 11 to 38.5 cm), and a mean volume of 63 cubic meters (range 7-402 m³).

Results by Site

The Nature Conservancy of Oregon

While not public land, results of the private survey effort on two natural area preserves owned by The Nature Conservancy are reported here to provide context for the findings of the public land effort. The private survey effort on the preserves far exceeded that for the public lands. On both sites we conducted weekly surveys from January to April. The weekly surveys reveal that the peak period for vernal pool occupancy by *Branchinecta lynchi* occurred between February 26 and March 14th, 1999, however vernal pool fairy shrimp occupied pools on both sites on every visit between January and March 25th, 1999.

The Nature Conservancy—Agate Desert Preserve: Weekly surveys of most of the pools on the preserve were initiated on January 17 and continued through April 4, 1999. The site has been under ecological restoration management since 1987, but was formerly under grazing management. Vernal pools are numerous and varied in habitat quality across the site. *Branchinecta lynchi* occupied 26 pools on the 53-acre site, although not all were occupied at any one time. Some pools coalesced into single larger pools at times during the wettest parts of the season. Other occupied pools remained isolated. *Branchinecta lynchi* were already present in eight pools on the first visit. There were two peaks in pool occupancy, 15 pools on February 14, 1999 and second peak on month later—with 17 pools on March 14th. Pool occupancy dropped off precipitously after that date. Some pools supported shrimp, including several generations, over most of the sample period, the longest for 10 weeks. Other pools supported shrimp for only several weeks, still others had two generations of fairy shrimp separated by a period of no occupancy.

The Nature Conservancy—Whetstone Savanna Preserve. Weekly surveys of most of the pools on the preserve were initiated on January 18 and continued through April 3, 1999. This site has been under ecological restoration management since 1996, but was formerly under livestock grazing. Vernal pools are numerous and varied in habitat quality across roughly 70 acres of surveyed habitat on the preserve. Some of the pools are imbedded in upland prairie, other surrounded by chaparral of wedgeleaf ceanothus, and still others are found under the canopy of Oregon white oak. *Branchinecta lynchi* occupied 31 pools on the site. The single peak in pool occupancy occurred on February 26, 1999 with 20 pools occupied. Vernal pool fairy shrimp were found in all types of pools, including pools with water colored brownish, presumably by tannins leached from oak leaf litter, under the canopy of oaks. Many of the pools occupied by the vernal pool fairy shrimp were also occupied by the Oregon fairy shrimp, *Eubranchipus oregonus*. Some pools supported shrimp including several generation over the most of the sample period, the longest for 9 weeks.

State of Oregon

Oregon Department of Fish and Wildlife (ODFW), Denman Wildlife Management Area

The Denman Wildlife Management Area contains the largest known area of vernal pools in the Rogue Valley, however much of the habitat is naturally fragmented habitat. The area was surveyed and reported in three map units. A fourth unit, though not formally part of Denman-- the newly acquired mitigation tract north of Rogue Disposal west of the ODOT weigh station-- was also sampled. Uplands at Denman commonly had plantings of intermediate wheatgrass, often associated with deposits of timber industry wood waste (log deck debris) exported from nearby log storage yards. Pools with high concentrations of timber-industry wood waste appear to have distinct water quality (e.g., waters are darkly stained with what appear to be dissolved humic substances) and altered biological composition, lacking *B. lynchi*. *B. lynchi* occurred in areas lacking the wood debris and intermediate wheatgrass. Occupied pools were found in areas dominated by star thistle and non-native annual grasses. The survey work at Denman was conducted in January, preceding by a couple of weeks the likely peak period for shrimp occupancy, based on observation at the preserves.

ODFW- Hall Tract Unit: This survey unit is located between Table Rock Road and Agate Road, and between East Gregory Road, north to Avenue A and the Jackson County Road Maintenance shops. A 280-acre block of habitat stretches east to west, including a major portion north of Whetstone Creek, and minor portions along short stretches of East Gregory Road and Elmhurst Rd., south of Whetstone Creek. Other habitat types in the tract include developed ponds and the floodplain of the Creek. The area of potential habitat, with the exception of a 15 acre area, was surveyed over 6 days between January 7 and January 29, 1999. The northeastern portion of the Hall Tract Unit accessed by Avenue A has a large number of pools, however the area is dominated by plantings of cultivated, non-native intermediate-wheatgrass. Some areas have been recently mowed in linear patterns. Deposits of log deck debris are spread widely across the site. Many pools appeared eutrophic, with a dense growth of algae and few aquatic invertebrates. The western extent of the Hall Tract Unit has an extensive pool system, but is also dominated by plantings of intermediate wheatgrass. Incidental habitat degradation across the unit included trash, tire tracks and dirt/gravel piles near pools under the power lines. *Branchinecta lynchi* were observed in three pools, each with minimal impacts from log deck debris and plantings of wheatgrass.

The portion of the Hall Tract Unit accessed at East Gregory Road has few pools. Some of the pools found appear to be ephemeral in hydrology, as they were covered by stands of non-native wheatgrass plantings. Mowed swaths, tire tracks, and trash were observed in some pools. The portion of the Hall Tract Unit accessed at Elmhurst is part of the low-lying floodplain of Whetstone Creek and associated wetlands. The area was flooded with overflow from Whetstone Creek following precipitation events, and supports dense stands of the non-native canary reedgrass (*Phalaris sp.*), interspersed with open

areas. These areas each had one pool occupied by the Oregon Fairy Shrimp (*Eubranchipus oregonus*) a widespread, unlisted species of fairy shrimp.

ODFW- Military Slough: The Military Slough Unit is located south of the gated Tou Velle Road off Agate Road, and north of Avenue G. The area surveyed includes nearly 240 acres of potential habitat. The area was surveyed over two days: January 18 and 24. The portion of this tract accessed at Table Rock Road (intersection with Kirtland Rd.) has an intact pool system displaying the characteristics generally found associated with *Branchinecta lynchi* as stated above. Water levels were low at the time of sampling and more pools may have developed at a later date. In general the pools appeared healthy, with living vegetation and a good assemblage of aquatic insects. The portion of this tract accessed at Avenue G is dominated by plantings of wheatgrass with mowed strips interspersed throughout. The area west of the dirt access road off Avenue G contains large amounts of log deck debris, spread in linear mounds. Many pools appeared eutrophic, the water discolored by organic acid, with large amounts of algae and few aquatic invertebrates. Less disturbed habitat was found north of the controlled seasonal creek. These areas were dominated by star thistle. Pools in this setting displayed the characteristics typically associated with *Branchinecta lynchi* elsewhere, except those closer to the dam, where they were affected by flooding. *Branchinecta lynchi* were observed in two pools.

ODFW- Creek Unit: The Creek Unit encompasses approximately 95 acres of mounded prairie and vernal pool habitat. The site was surveyed on three days: January 21, 24, 28, 1999. Pools in the portion accessed at Agate Road (at the gravel pit) were negatively impacted by berms of log deck debris, trash dumping, and extensive plantings of intermediate wheatgrass. Many pools appeared eutrophic, the water discolored by organic acids, supporting few aquatic invertebrates. The portion of the Creek Unit accessed from south of the fence line at TouVelle Road contained a healthy pool system with uplands dominated by yellow starthistle. *Branchinecta lynchi* were found in three pools at this site, two from areas lacking the woody debris, and the third from along Agate Road, in a portion of a pool less impacted by log deck debris.

ODFW- Weigh Station (WS): This unit owned by ODFW is named in reference to the ODOT facility adjacent to the site. The site was surveyed on January 29, 1999. The entire 20-acre site supports mounded prairie with vernal pools. A few areas have received minor amounts of fill, others have been bladed and trash was abundant from the adjoining roadsides. This site contains what appears to be intact mounded prairie vernal pool habitat, yet surprisingly little aquatic life was found in a majority of the pools sampled. This may be due to hydrologic losses to the surrounding ditches. Pools marked with blue flags at the southern boundary of the property were not sampled. *Branchinecta lynchi* were observed in one pool.

Oregon Department of Transportation

ODOT- Hwy 62/Dutton Rd: The site was visited on March 2, 1999. Vernal pool habitat covers approximately 6 acres of the tract. Pool quality is generally poor at this site and mounded topography is not well expressed. Many pools are shallow, eutrophic and have low aquatic invertebrate diversity (mostly copepods). Non-native grasses and weeds cover the bottom of most pools. A few duck feather were present. The larger, deeper pools near the road may have been created in part by bulldozing and ditching. An oil sheen was observed on the surface of these pools. A couple of pools on the south edge receive runoff from a livestock yard. The riparian area to the northeast on the tract is an ODOT wetland mitigation site. No *Branchinecta lynchi* were observed.

ODOT- Hwy 140: Several pools along the Highway 140 corridor were visited on during the month of March on occasion on travels to and from other pool systems, but none were found to be occupied by fairy shrimp.

White City, School District #9

White City School District #9, White City: We surveyed this 50-acre site on March 2, 1999. Overall this site is moderately to highly disturbed and has weakly expressed mounded topography. Much of the site shows evidence of former habitation, with tracks, ditches, footings, foundations, and excavations that are presumably artifacts of the historic Camp White. Ongoing off-road vehicle use resulting in deep tire ruts and garbage are evident throughout the site. Star thistle is abundant. Many pools are shallow, eutrophic, and have a paucity of aquatic insects. Non-native grasses and weeds cover the bottom of most pools. The pools with the best potential habitat are located in the north and east portions of the land north of Avenue H. A very large pool on the south side of Avenue H, in the northeast corner was too deep to thoroughly sample. An unidentified species of *Limnathes* was observed along one pool in the eastern portion of the tract north of Avenue H. This pool is marked with blue and white striped flagging. *Branchinecta lynchi* were netted in only one pool in the southeast corner of the land on the north side of Avenue H. Two males and four females were found in sweeps covering 74 meters. This pool appears to be part of a dirt bike track and contains old tires and some ruts, however, the aquatic insect and plant assemblages were similar to those found in pools containing *B. lynchi* elsewhere.

White City School District #9-- Shady Cove Area: This 19-acre patch of habitat was visited on March 2, 1999. The landform occupies a terrace above the town of Shady Cove. The site is covered in a mix of open grassland, chaparral and oak woodland and savanna. The pools appear mostly to be ephemeral in nature, although several are deeper. Tire tracks and muddy water were observed in pools near the power lines. Aquatic invertebrate diversity was low and the pools appeared short-lived. No vernal pool fairy shrimp were observed.

Jackson County

Jackson County Parks- Hoover Ponds (HP): This survey area included portions of three tax lots with 92 acres of habitat mapped in 1997. We sampled the area on January 18 and 28 and revisited the site on March 2, 1999. The entire site appears to have been partially leveled at some time in the past. Recent evidence of off-road vehicle use was abundant. All sampled pools were crisscrossed with tire tracks. Trash was observed strewn across the area (tax lot #3800). Some pool areas had been partially filled with gravel in tax lot #2800. Pools in tax lot #3800 contained little or no aquatic life. Pools in tax lots #1200 and #2800 were in marginally better condition and supported aquatic organisms. A single pool (HP-1), apparently too deep for ORV's, was the only pool occupied by *B. lynchi*.

Jackson County- Sports Park: We surveyed the site on January 15 and 18, and again on March 9, 1999. The habitat found at the Sports Park is fragmented somewhat by access roads, a ditch and development associated with the power lines. Intact pool habitat was abundant, but the pools tended to have heavy growth of grasses, much of which formed thick layers of down dead material in the pools. Some evidence of ORV use and garbage were observed in the area. *Branchinecta lynchi* were observed in one pool (SP-1) at this site.

Jackson County- Dodge Bridge: The ~4-acre habitat area was surveyed January 21, 1999. There are few pools at this site and all are severely degraded. The pools are shallow (under 10 cm), with little to no living vegetation or aquatic insect life. The site appears to have been used for off-road vehicle recreation with tire tracks through the pool areas and man-made "jumps" (piles of dirt) on site. Domestic trash is strewn across the area, including some pools. No pools were found occupied by vernal pool fairy shrimp.

Jackson County-- Given Park: The 6-acre area of habitat was surveyed on January 21, 1999. Pools near and south of the dirt road, which bisects the surveyed area, appeared to be impacted by recent vehicle use, wood debris and garbage in or near the pools. A large ponderosa pine had recently been cut on the site, with green boughs piled near the stump. Pools at the northern end of the property appeared slightly healthier than those in the southern end. Little or no living vegetation or aquatic insects were observed in the pools. No vernal pool fairy shrimp were observed.

Jackson County Parks (USBOR)-- Agate Lake (AL): The Agate Lake parcels cover about 53 acres of potential vernal pool complex habitat. The tract, bisected by Dry Creek Road was surveyed on January 15, February 15, and March 2, 1999. The area east of Dry Creek Road contains intact mounded prairie vernal pool habitat. During the initial survey (Jan. 15) several pools had low water levels, although they appeared otherwise healthy (living vegetation and an assemblage of aquatic insects). The February 15 visit found similar water levels. Garbage, wood debris, and tire tracks degrade the area west of Dry Creek Road, south of the dam. The majority of pools appeared eutrophic, with little or no aquatic insect life, large amounts of algae and dead emergent vegetation. The area north of the dam appeared fairly intact, though some pools nearest the dam under the telephone

line were eutrophic. Pools on the east side of the road were generally a swale type with a low gradient drainage that limited the number and size of pools. Many of the swales had large cobbles in the bottom. *Branchinecta lynchi* were observed in four pools, two of them on the visits in January and February. Pool depth and size were similar and a diverse assemblage of aquatic insects was present on all three dates. On March 2nd *B. lynchi* were absent from the pools previously occupied (pools AL-1 and AL-2), however two additional occupied pools were discovered (AL3 and AL4). Only a small strip of AL-4 lies on county land, with a fence running along the south edge.

Jackson County Airport Authority—Rogue Valley International—Medford Airport Runway 14-32 extension (north): The Nature Conservancy was contracted separately by the Airport Authority to follow USFWS protocol to ascertain the presence or absence of vernal pool fairy shrimp in the vicinity of the proposed runway extension. Wet season surveys were conducted over approximately 40 acres of weakly expressed and leveled habitat between 22 January and 13 April 1999, in 25 water bodies within the project area. Pool condition overall was poor compared to “reference pools” at two nearby preserves owned and managed by The Nature Conservancy. All of the target pools surveyed were characterized by altered topography or hydrology from either past grading, impounding by roads, or channelization, such that habitat conditions were altered and less than ideal for the listed species and for aquatic species diversity in general. No vernal pool fairy shrimp were observed.

Surveys were not conducted on the north and south runway approaches, nor elsewhere in suitable habitat on the airport grounds.

Jackson County Urban Renewal—White City Civic Center tract: Permission to survey the 37-acre tract was denied. This tract appears in aerial photos and from the roadside to have been partially leveled, with minor remnants of vernal pools visible.

City of Medford

City of Medford- Whetstone Industrial Park off Newland Road (“WI”): This ~70-acre corner of the industrial park was surveyed on February 7, 11, and 12, 1999. The site was under grazing management, with cattle present during later visits. The mounded topography of the site supports an extensive vernal pool system. There is scattered garbage, particularly along the northwest fence line, extensive cattle trails and a dirt track running east/west under power transmission lines. *Branchinecta lynchi* was observed in 22 pools (WI-1...WI7, WI9...WI-13, WI-15...WI-23, WI-25) at this site. In several pools, observed individuals were exclusively male or female.

City of Medford- Whetstone Industrial Park south of the railroad ("NAD"): This 20-acre site south of the railroad and north of The Nature Conservancy Agate Desert Preserve, was visited on February 15. The mounded topography is weakly expressed, and in part leveled in the northeast corner. There are a few, generally shallow pools on this site with few aquatic insects, little vegetation on the pool bottom, but abundant algae. Garbage is scattered along and north of the ditch, which crosses the northeastern corner of the tract. *Branchinecta lynchi* was observed in a single pool at this site (NAD-1), also mapped as "#26" and "JD-38" on the adjoining Conservancy preserve. The fence along the preserve boundary bisects the pool.

Whetstone Industrial Park South of Antelope Road ("SAD"): This 125-acre patch of habitat, located south of the Agate Desert Preserve was sampled on four dates: February 15, 19, 21, and 23 1999. The site was under moderate grazing with cattle were present at the time surveys were conducted. Several ditches cross the site. The permittee was observed driving across the site on each of the three survey dates and tire tracks were common across the site, though crossing few pools. Trash, old fencing and metal debris was scattered across the site. Biosolids have been applied over a period of eight years at 2.5 tons/acre/year (~40 to 50 lbs. nitrogen/acre/year) (Gail Hammond, Rogue Valley Regional Wastewater Treatment Plant, personal communication). Where bio-solids were evident on the soil surface, the pools developed high biomass of algae, which made thorough sampling difficult. *B. lynchi* did not occupy pools having high algal biomass. Pools south of the dirt track, which bisects the property (east/west), were generally less eutrophic. *Branchinecta lynchi* was observed in 14 pools at this site (SAD-1...14). Several pools at this site appear to be more productive than has been generally observed during this survey. In contrast to most pools sampled (at this site and others), between 40 and 100 individuals were observed during sampling in pools SAD-1, SAD-3 and SAD-8.

City of Medford- Whetstone Industrial Park west of Antelope Road ("WAD"): This 31-acre site lies south of the railroad tracks, west of West Antelope Road in the Medford Whetstone Industrial Park. The site was visited on March 9, 1999. The mounded topography is weakly expressed at this site, and partially leveled. The westernmost portion on the terrace has been severely graded in the reclamation of a historic dump. There are few pools at this site, and they are generally small and shallow with few aquatic insects, little vegetation on the pool bottom, but abundant algae. A dirt road enters from the north. Garbage is scattered across the property, to the northern boundary. *Branchinecta lynchi* was observed in three pools near the gated entrance to the tract, near the railroad tracks. There is a large pool impounded in part by the recent clearing around the historic dump that lacked invertebrates, suggesting that some environmental toxin may be affecting water quality in the pool

Other Private Land

C2 Ranch—Although not public land, C2 ranch agreed to allow survey effort on their holdings on the Agate Desert landform, located on the north side of Highway 140 at Lake Creek. The site was visited on March 19, 1999. We did not survey the northeast portion of the mapped potential habitat that has been leveled and is under irrigation. The bulk of the intact habitat, 197 acres, is characterized by east west trending linear drainage swales, where pooling is uncommon. A mapped 21-acre unit at the west end of the tract supports larger and more abundant vernal pools surrounded by stands of wedgeleaf ceanothus. These appeared suitable for fairy shrimp, however the pools were in a rapid dry down phase and no fairy shrimp were found. An earlier season (February) survey should be conducted at the site.

Discussion

This survey improved knowledge about the distribution of *Branchinecta lynchi* across the Agate Desert Landform from east to west, from Whetstone Industrial Park across the Denman Wildlife Area, through the Hoover Ponds, Sports Park, to Agate Lake and out to Lake Creek. To the north and south, our survey covered only minor fragments of habitat on public land (e.g. Dodge Bridge), or habitat that was severely degraded (e.g. the airport runway extension project area). Additional survey work conducted by the Conservancy with permission on the C2 ranch in Lake Creek failed to find any occupied pools and pools were scarce on the site, except for in one small corner. Extensive acreage of additional habitat on private land remains un-surveyed.

It appears that vernal pool fairy shrimp are most likely to be abundant in pool systems where density of pooling is greatest, and least disturbed in terms of water quality. Several conditions tend to be associated with pools in which *B. lynchi* were found. These include living vernal pool vegetation covering the pool bottom, a diverse assemblage of aquatic insects (*Daphnia* sp. particularly), pool depth generally between 12-30cm (mean: ~20 cm), intact mounded topography, and evidence of visitation by waterfowl (feathers, dropping, and floating mats of vegetation pulled from pool bottom).

The capacity of pools to support *Branchinecta lynchi* ranged widely in terms of peak abundance of *Branchinecta lynchi* for pools on the two preserves. Future studies should investigate the cyst banks and variation in cyst and adult abundance from year to year due to climatic and hydrologic variation. The possibility of meta-populations "source/sink" relationships among pools should also be investigated. Pools with the greatest abundance such as SAD-1, SAD-3, SAD-8, and WHE-72, WHE-8, and ADP-A15 may act as "source" pools from which cysts may be transferred to others. Pools at the lowest end of the fairy shrimp abundance spectrum (e.g. WHE-70, ADP-32), as observed in 1999, may be "sink" pools that rely on an inflow of transferred cysts from a nearby source. Females and males were encountered in roughly equal numbers overall at the peak period of abundance, however the ratio deviated somewhat in early and late observations. Occupied

pools on the preserves tended to include a greater number of smaller area, and shallower pools than was observed on the public lands investigated.

The effects of cattle grazing appear to be neutral. The combination of log deck debris and dense plantings of intermediate wheatgrass, common across the Denman Wildlife Area, appears to have a negative impact on *Branchinecta lynchi*. Other conditions which appear to negatively impact pool health, decreasing the likelihood of finding pools occupied by fairy shrimp include: heavy off-road vehicle use, trash dumping, disrupted pool hydrology, and the accumulation of dead organic matter (annual grass thatch) in the pools and surrounding mounds in areas lacking disturbance. The application of biosolids appears to be associated with strongly eutrophic conditions in at least some pools in the area of application. However, the relationship between these factors and the fairy shrimp population is not well understood.

Since each site was visited only once or several times over a short period during the season, these findings may under-represent *B. lynchi* distribution at the surveyed sites. In areas with intact topography, aquatic vegetation, and insect assemblages, the species may be present in a greater number of pools than detected.

Acknowledgements

We wish to thank the USFWS, particularly Judy Jacobs for securing the funding to complete this survey. We are grateful to the public land managers and to Jim Coonan of the C2 Ranch who graciously permitted surveys on their lands. Thanks are in order for Dr. Michael Parker of the Southern Oregon University for his input and guidance on the work conducted by Jay Doino on the two Nature Conservancy preserves, and also for the use of his lab and materials. We also thank Cam Patterson and Terry Ayers of Siskiyou Resource Geographics for their assistance in the field and for completing GIS products for this report.

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Table 1. Public lands with potentially intact Agate Desert vernal pools

Jackson County:

Urban Renewal	361W21B tax lot 1000
Roads and Parks	
Hoover Ponds	361W21C tax lot 3800, 361W21D tax lot 2800, 361W22C tax lot 1200.
Sports Park	361W22D tax lot 800, and 361W27 tax lot 100
Dodge Bridge area,	351W17 tax lot 101
Given Park, Agate Rd	351W32 tax lot 1700
Airport Authority	
Grounds	372W01A tax lot 1400, 371W07 tax lot 402, 371W18BA tax lot 200 371W18BA tax lot 300, 371W18A tax lot 2900
Airport approach (Whittle Ave Property)	371W18A tax lot 4200 371W18DB tax lot 100 371W06 tax lot 2400

City of Medford

Regional Wastewater Reclamation Plant	362W14 tax lot 800 362W14 tax lot 801
Medford Water Commission (water treatment plant)	362W13 tax lot 1300
Whetstone Industrial Park	362W23 tax lot 103 362W24 tax lot 305 362W24 tax lot 304

State of Oregon

ODFW Denman Wildlife Management Area	362W13 tax lot 1200 361W18 tax lot 100 361W07 tax lot 200 361W19 tax lot 300 362W24 tax lot 600 361W30 tax lot 2800
School District #9	
Shady Cove Area	341W09 tax lot 300
White City Area	361W16C tax lot 100 361W16C tax lot 200

United State of America (Bureau of Reclamation/Jackson County Roads and Parks

Agate Lake	361W25 tax lot 402 361W25 tax lot 500
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Table 2. Contacts for public land surveys.

Cathy Conlow

Jackson County Urban Renewal
10 S. Oakdale, Medford OR 97501,
541-776-7033

Paul Korbolic, Parks Manager

Jackson County Roads and Parks
400 Antelope Rd.
White City OR 97503
541-776-7001

Hoover Ponds, Sports Park, Dodge Bridge area, Given Park, Agate Rd Agate Lake (USBOR)

Bern Case, Director

Jackson County Airport Authority
3650 Biddle Rd.
Medford OR 97504
541-776-7222

Airport Grounds—Runway 14-32 extension project area

Harley James Plant Superintendent (Jim Hill)

Regional Wastewater Reclamation Plant
1100 Kirtland Rd, Central Point OR 97502
541-826-7943

See for results of Parametrix survey

Bob Noelle, Water Quality Superintendent

Medford Water Commission
200 S Ivy St. RM 177
Medford OR 97501
541-774-2434

See Jim Hill for results of Parametrix survey

Michael Dyal, City Manager (Jim Hill)

Medford City Hall
411 W 6th RM 312
Medford OR 97501
541-774-2000

Whetstone Industrial Park

Simon Wray, Asst. District Wildlife Biologist

ODFW
Denman Wildlife Management Area
541-826-8774)

Denman, Rogue Disposal Mitigation site

Ted Adams, Superintendent

School District #9
11 N. Royal, Eagle Point OR 97524
541-830-1200 (Jim Falk, Maintenance Supervisor is at 830-1241)
Shady Cove Area , White City Area

Table 3a. Results of the vernal pool fairy shrimp survey on public lands on the Agate Desert landform, January through March 1999.

Tract Owner	Tract Description	Acres Habitat	# pools # acres /	
			occupied by BRLY	occupied pool
The Nature Conservancy	Agate Desert Preserve	53	26	2.0
The Nature Conservancy	Whetstone Savanna Preserve	70	31	2.3
Oregon Department of Fish and Wildlife	Denman Wildlife Area-- Creek	95	4	23.8
Oregon Department of Fish and Wildlife	Denman Wildlife Area--Hall	280	3	93.3
Oregon Department of Fish and Wildlife	Denman Wildlife Area--Military Slough	240	2	120.0
Oregon Department of Fish and Wildlife	Weigh Station (Rogue Disposal mitigation site)	20	1	20.0
Oregon Department of Transportation	Highway 62/Dutton (ODOT mitigation site)	6	0	na
State of Oregon	White City School Dist. #9 (White City)	50	1	50.0
State of Oregon	White City School Dist. #9 (Shady Cove)	19	0	na
City of Medford	Whetstone Industrial Park South of Antelope Rd (SAD)	125	14	8.9
City of Medford	Whetstone Industrial Park North of Agate Desert Preserve (NAD)	20	1	20.0
City of Medford	Whetstone Industrial Park West of Antelope Rd (WAD)	31	3	10.3
City of Medford	Whetstone Industrial Park North of Newland Rd, (WI)	70	23	3.0
Jackson County	Urban Renewal (not surveyed)	37	N.D.	na
Jackson County	Agate Lake	53	4	13.3
Jackson County	Given Park	6	0	na
Jackson County	Dodge Bridge	4	0	na
Jackson County	Sports Park	20	1	20.0
Jackson County	Hoover Ponds	92	1	92.0
Jackson County	Airport Authority Runway 14-32 extension project	40	0	na
Other Private	C2 Cattle Ranch	218	0	na
		1549	115	13.5

Table 3b. Results, sorted by abundance of occupied pools, of the vernal pool fairy shrimp survey on public lands on the Agate Desert landform, January through March 1999.

Tract Owner	Tract Description	Acres Habitat	# pools # acres /	
			occupied by BRLY	occupied pool
The Nature Conservancy	Agate Desert Preserve	53	26	2.0
The Nature Conservancy	Whetstone Savanna Preserve	70	31	2.3
City of Medford	Whetstone Industrial Park North of Newland Rd, (WI)	70	23	3.0
City of Medford	Whetstone Industrial Park South of Antelope Rd (SAD)	125	14	8.9
City of Medford	Whetstone Industrial Park West of Antelope Rd (WAD)	31	3	10.3
Jackson County	Agate Lake	53	4	13.3
Oregon Department of Fish and Wildlife	Weigh Station (Rogue Disposal mitigation site)	20	1	20.0
City of Medford	Whetstone Industrial Park North of Agate Desert Preserve (NAD)	20	1	20.0
Jackson County	Sports Park	20	1	20.0
Oregon Department of Fish and Wildlife	Denman Wildlife Area-- Creek	95	4	23.8
State of Oregon	White City School Dist. #9 (White City)	50	1	50.0
Jackson County	Hoover Ponds	92	1	92.0
Oregon Department of Fish and Wildlife	Denman Wildlife Area--Hall	280	3	93.3
Oregon Department of Fish and Wildlife	Denman Wildlife Area--Military Slough	240	2	120.0
Jackson County	Dodge Bridge	4	0	na
Oregon Department of Transportation	Highway 62/Dutton (ODOT mitigation site)	6	0	na
Jackson County	Given Park	6	0	na
State of Oregon	White City School Dist. #9 (Shady Cove)	19	0	na
Jackson County	Urban Renewal (not surveyed)	37	N.D.	na
Jackson County	Airport Authority Runway 14-32 extension project	40	0	na
Other Private	C2 Cattle Ranch	218	0	na

Table 4. *Branchinecta lynchi* and associated environmental observations from occupied pools on the Agate Desert (ADP) and Whetstone Savanna (WHE) preserves, January to April, 1999. Data from J. Doino

site	pool id	date	time	air temp C	Water depth		Branchinecta lynchi		Eubranchipus oregonus			
					max (cm)	water tempC	male	female	male	female	unk instars	sweep (m)
ADP 15		2/7/99	11:26	7	24	6	1	0	0	0	0	7
ADP 15		2/14/99	1:42	9	22	10	0	1	0	0	0	8
ADP 16		2/21/99	2:17	8	14	10	2	3	0	0	0	11
ADP 16		2/28/99	12:05	9.5	13.5	10	2	2	0	0	0	8
ADP 16		3/6/99	10:34	3.5	13.5	7.5	0	2	0	0	0	8
ADP 16		3/14/99	10:49	5	11	7	5	5	0	0	0	5
ADP 18		2/7/99	10:24	6	13	6	1	0	0	0	2	6
ADP 18		2/14/99	10:37	6.5	11	7	5	4	0	0	0	6
ADP 18		2/21/99	10:57	5	13	6	0	2	0	0	0	6
ADP 18		2/28/99	9:51	8.5	13	8.5	4	8	0	0	0	15
ADP 18		3/6/99	11:13	5	10.5	9.5	2	3	0	0	0	8
ADP 18		3/14/99	8:43	4	8	5.5	1	6	0	0	0	8
ADP 21		1/17/99	2:35	9	14	8	1	2	0	0	0	10
ADP 25		3/6/99	12:36	5	12	11.5	1	0	0	0	0	15
ADP 26		1/17/99	3:42	9	21	8	1	2	0	0	0	6
ADP 26		2/28/99	10:57	9	18	9.5	0	2	0	0	0	15
ADP 26		3/6/99	12:15	5	16	10.5	0	1	0	0	0	15
ADP 26		3/14/99	9:39	4.5	13	6	2	1	0	0	0	10
ADP 26.5		1/23/99	10:48	4	23	3	1	0	0	0	0	6
ADP 26.5		1/31/99	9:48	5.5	19	4	1	1	0	0	0	6
ADP 26.5		2/14/99	9:32	6	23	6	0	1	0	0	0	5
ADP 26.5		3/14/99	9:35	4.5	18	6	1	0	0	0	0	8
ADP 27		1/17/99	3:18	9	19	8	0	6	0	0	0	7
ADP 27		1/23/99	11:13	4	34	2.5	0	1	0	0	0	10
ADP 27		1/31/99	10:35	5	32.5	5.5	0	2	0	0	0	10
ADP 27		2/7/99	10:35	6.5	35	5.5	1	1	0	0	0	9
ADP 27		2/21/99	10:03	5	34	4.5	4	3	0	0	0	10
ADP 27		2/28/99	10:36	9	36	9	5	7	0	0	0	11
ADP 27		3/6/99	12:01	6	28	9.5	0	2	0	0	0	25
ADP 27		3/14/99	9:27	4.5	26.5	6.5	1	3	0	0	0	10
ADP 27		3/19/99	1:17	13.5	21	16	1	3	0	0	0	9
ADP 28		1/23/99	11:19	4	26	3	1	2	0	0	3	10
ADP 28		2/7/99	10:31	6.5	24.5	5.5	3	5	0	0	2	5
ADP 28		2/14/99	10:44	6.5	24	7	2	12	0	0	0	5
ADP 28		2/21/99	10:28	5	24.5	6	2	4	0	0	0	10
ADP 28		2/28/99	10:14	8.5	26	9	5	11	0	0	0	20
ADP 28		3/6/99	11:21	5	23	8.5	1	7	0	0	0	12
ADP 28		3/14/99	8:53	4.5	15.5	6	1	2	0	0	0	9
ADP 28		3/19/99	1:32	14	10	21	3	3	0	0	0	4
ADP 32		1/17/99	12:07	8.5	17	7	1	0	0	0	0	19
ADP 33		1/17/99	12:35	8.5	16	7	0	1	0	0	0	6
ADP 35		1/31/99	12:00	5	19	6	3	5	0	0	0	14
ADP 35		2/14/99	11:58	9	23	9	0	6	0	0	0	15
ADP 35		2/21/99	1:02	7	23	8	0	1	0	0	0	15
ADP 35		2/28/99	1:13	11	25	11	0	1	0	0	0	15
ADP 35		3/6/99	2:19	7	22	10	2	4	0	0	0	18
ADP 35		3/14/99	12:24	7.5	17.5	8.5	0	3	0	0	0	12

site	pool id	date	time	air temp C	Water depth		Branchinecta lynchi		Eubranchipus oregonus		unk instars	sweep (m)
					max (cm)	water tempC	male	female	male	female		
ADP 38		1/17/99	3:54	9		8	1	3	0	0	0	
ADP 38		1/23/99	1:20	3.5	25.5	4.5	2	4	0	0	0	12
ADP 38		1/31/99	11:40	5	22.5	6	5	7	0	0	0	10
ADP 38		2/7/99	1:17	5.5	29	7	1	2	0	0	0	12
ADP 38		2/21/99	1:15	6	26.5	8	2	5	0	0	0	12
ADP 38		2/28/99	11:46	9	27	10.5	0	3	0	0	0	20
ADP 38		3/6/99	9:48	2.5	23	6.5	1	1	0	0	0	22
ADP 38		3/14/99	10:18	5	21.5	6.5	0	2	0	0	0	15
ADP 38		3/19/99	2:50	13	18	19.5	0	1	0	0	0	15
ADP 39		1/23/99	1:27	3.5	29	4.5	1	4	0	0	0	7
ADP 39		1/31/99	11:28	5	23	6	0	2	0	0	0	7
ADP 39		2/7/99	1:22	5.5	29	7	1	0	0	0	0	8
ADP 39		2/14/99	11:43	7	25.5	7.5	1	4	0	0	0	13
ADP 39		2/14/99	11:31	6.5	27	7.5	1	2	0	0	0	7
ADP 39		2/21/99	1:21	6	29	8	1	6	0	0	0	9
ADP 39		2/28/99	11:56	9.5	30	10	0	1	0	0	0	18
ADP 39		3/14/99	10:30	5	26	7	1	2	0	0	0	10
ADP 39		3/19/99	2:32	15	2.5	19	0	1	0	0	0	19
ADP 39		3/25/99	2:17	13	20.5	16	0	1	0	0	0	20
ADP 40		1/17/99	3:48	9		8	1	1	0	0	0	
ADP 40		1/23/99	2:00	5	16	5	0	2	0	0	0	8
ADP 40		1/31/99	11:34	5	24	6	1	2	0	0	0	8
ADP 40		2/7/99	1:42	6	29	7	1	1	0	0	0	7
ADP 40		2/14/99	11:37	7	27.5	7.5	1	0	0	0	0	7
ADP 40		2/21/99	1:40	7	28	9	0	1	0	0	0	13
ADP 40		3/14/99	10:00	5	22.5	6.5	0	1	0	0	0	30
ADP 41		2/14/99	11:12	7.5	16.5	8	2	1	0	0	0	9
ADP A1		2/7/99	12:10	5.5	29	7	1	2	0	0	0	12
ADP A1		3/6/99	2:08	7	21	11	0	3	0	0	0	11
ADP A1		3/14/99	11:59	7.5	15	9	0	2	0	0	0	14
ADP A1		3/19/99	3:21	13	8	20.5	0	1	0	0	0	7
ADP A13		1/23/99	1:51	4.5	14	5	0	1	0	0	0	10
ADP A13		2/14/99	11:21	7	11	7.5	0	1	0	0	0	10
ADP A15		2/7/99	10:40	6	17.5	5.5	2	0	0	0	0	6
ADP A15		2/14/99	10:48	6.5	16	7	2	1	0	0	0	7
ADP A15		2/21/99	10:23	5.5	17	6	0	3	0	0	0	7
ADP A15		2/28/99	10:19	8.5	15.5	9	1	0	0	0	2	12
ADP A15		3/6/99	11:27	5	15	8.5	2	4	0	0	0	9
ADP A15		3/14/99	8:58	4.5	8.5	6	6	3	0	0	0	5
ADP A16		2/21/99	10:11	5	26	5	3	1	0	0	0	8
ADP A16		2/28/99	10:23	8.5	30	9	0	5	0	0	0	10
ADP A16		3/6/99	11:42	5.5	24	9.5	0	2	0	0	0	8
ADP A16		3/14/99	9:09	4	18	5.5	3	0	0	0	0	6
ADP A17		3/14/99	9:13	4.5	10.5	6	4	0	0	0	0	4
ADP S		2/21/99	9:53	4	24.5	5	2	3	0	0	0	7
ADP S		2/28/99	10:46	9	30	9	1	8	0	0	0	6
ADP S		3/6/99	12:07	6	23.5	9.5	2	4	0	0	0	10
ADP S		3/14/99	9:30	4.5	14	6	0	4	0	0	0	4
ADP T		1/17/99	3:27	9	21	8	0	1	0	0	0	9
ADP T		1/23/99	11:06	4	32	2.5	1	6	0	0	0	10
ADP T		1/31/99	10:00	6	29	4	0	5	0	0	0	9
ADP T		2/7/99	9:51	5.5	33	5.5	1	1	0	0	0	10

site	pool id	date	time	air temp C	Water depth		Branchinecta lynchi		Eubbranchipus oregonus		unk instars	sweep (m)
					max (cm)	water tempC	male	female	male	female		
ADP T		2/14/99	9:51	6	31	6.5	10	0	0	0	0	13
ADP T		2/21/99	9:57	4	31	5	0	1	0	0	0	11
ADP T		2/28/99	10:43	9	36	9	1	3	0	0	0	13
ADP T		3/6/99	11:52	6	31	9	1	2	0	0	0	18
ADP T		3/14/99	9:20	4.5	25	6.5	0	1	0	0	0	25
ADP T		3/19/99	1:24	14	20	17	0	4	0	0	0	8
ADP V		2/28/99	12:09	9.5	15.5	10	1	0	0	0	0	6
ADP W		1/23/99	1:32	3.5	24	4	0	4	0	0	0	11
ADP W		1/31/99	11:24	5	18.5	6	1	4	0	0	0	7
ADP W		2/7/99	1:29	6	24	7	2	3	0	0	0	7
ADP W		2/14/99	11:26	6.5	21.5	7.5	1	5	0	0	0	8
ADP W		2/28/99	11:53	9.5	25	10	0	3	0	0	0	17
ADP W		3/6/99	9:35	2.5	21	5.5	0	1	0	0	0	20
ADP W		3/14/99	10:34	5	18.5	6.5	0	1	0	0	0	19
ADP Z		2/21/99	2:34	7	16	10	0	1	0	0	0	12
WHE 7		2/26/99	12:34	4.5	30	5.5	0	1	3	3	0	11
WHE 8		2/19/99	9:32	5	18	6	2	1	3	4	0	10
WHE 8		2/26/99	12:27	4.5	14.5	6	1	1	0	0	0	9
WHE 8		3/5/99	1:36	6.5	17	12	4	2	2	3	0	7
WHE 8		3/12/99	2:31	7.5	15.5	9	5	5	5	5	0	2
WHE 12		2/19/99	10:01	6	27.5	7	10	5	0	0	0	15
WHE 12		2/26/99	12:03	4	22.5	5	10	10	0	1	0	9
WHE 12		3/12/99	1:56	8	20.5	9.5	20	20	0	2	0	10
WHE 12		3/20/99	12:26	11	14.5	12	1	2	2	2	0	5
WHE 12		3/25/99	12:52	14	11	17.5	1	1	1	1	0	6
WHE 23		2/26/99	12:14	4.5	24	5	2	2	0	0	0	12
WHE 23		3/5/99	1:15	4.5	26	11	0	4	0	0	0	12
WHE 23		3/12/99	2:16	8	22	10	0	1	0	0	0	15
WHE 24		2/26/99	12:10	4.5	14.5	6	1	0	0	0	0	8
WHE 25		3/5/99	1:42	7	20	12	1	4	0	0	0	7
WHE 25		3/12/99	2:04	8	19	9.5	1	4	0	0	0	10
WHE 26		3/12/99	2:27	7.5	18.5	9	3	1	2	3	0	10
WHE 26		2/26/99	12:22	4.5	25	5	1	0	7	5	0	4
WHE 29		2/19/99	11:36	6	24.5	7	4	4	4	5	0	4
WHE 29		2/26/99	1:03	5	23	6.5	10	10	10	10	0	4
WHE 29		3/5/99	2:50	10	24	13	20	20	20	20	0	8
WHE 29		3/12/99	3:02	7.5	23	10	10	10	10	10	0	4
WHE 29		3/20/99	1:44	11.5	18	13.5	10	10	10	10	0	4
WHE 29		3/25/99	1:15	14	18	16	1	3	10	10	0	8
WHE 37		3/12/99	12:33	6	23	7.5	0	2	0	0	1	10
WHE 37		3/20/99	1:59	11.5	13.5	12	1	1	0	0	0	4
WHE 44		2/26/99	1:49	5	23.5	6.5	3	2	2	4	0	7
WHE 44		3/5/99	3:29	8	30	12	5	4	2	3	0	9
WHE 44		3/12/99	11:26	5.5	22.5	7.5	10	10	1	2	0	6
WHE 44		3/20/99	2:31	12	14.5	14	5	5	5	5	0	5
WHE 51		3/12/99	11:12	4.5	22	7.5	0	1	0	0	0	12
WHE 54		2/19/99	2:05	10	22.5	11.5	9	12	0	0	0	8
WHE 54		2/26/99	9:23	3.5	19.5	4.5	10	0	0	3	0	15
WHE 54		3/5/99	10:33	2.5	22.5	6.5	2	6	1	2	0	5
WHE 54		3/12/99	10:56	4.5	20	7.5	3	5	0	0	0	8
WHE 54		3/20/99	10:51	10	13	12	4	1	0	0	0	8
WHE 54		3/25/99	12:33	13	0	16.5	1	2	0	0	0	2

site	pool id	date	time	air temp C	Water depth		Branchinecta lynchi		Eubranchipus oregonus			
					max (cm)	water tempC	male	female	male	female	unk instars	sweep (m)
WHE 55		2/26/99	9:19	3.5	20	4.5	0	2	10	0	0	10
WHE 56		2/19/99	1:11	8	24.5	8	5	5	5	5	0	10
WHE 56		2/26/99	9:14	3.5	26	4.5	10	10	10	10	0	10
WHE 56		3/5/99	11:08	3.5	29	5	3	3	5	10	0	4
WHE 56		3/12/99	1:45	5.5	24	6.5	5	7	3	4	0	9
WHE 56		3/20/99	11:04	10	21	12	1	0	4	3	0	6
WHE 56		3/25/99	12:09	13	19.5	13	0	1	3	3	0	5
WHE 56		4/3/99	11:04	8	10	11	8	1	2	2	0	5
WHE 57		2/19/99	2:00	9	26	10	1	0	1	0	0	8
WHE 57		2/26/99	9:47	3.5	24	5	10	0	0	2	0	6
WHE 57		3/5/99	10:58	3.5	25	7.5	0	2	1	4	0	8
WHE 57		3/12/99	12:01	7.5	24	8	3	4	1	0	0	12
WHE 57		3/20/99	10:59	10	19.5	12	1	2	0	0	0	12
WHE 57		3/25/99	12:12	13	19	15	2	0	0	0	0	2
WHE 57		4/3/99	10:57	8	11.5	11	1	0	2	0	0	6
WHE 61		3/20/99	10:25	10	11	12	1	2	0	0	0	8
WHE 61		3/25/99	11:59	13	16.5	16	1	0	0	0	0	10
WHE 62		2/26/99	11:54	4	19.5	5	3	0	3	0	0	10
WHE 70		3/12/99	11:18	4.5	30	8	0	1	0	0	0	20
WHE 70		3/20/99	2:47	14	21	15	0	1	2	0	0	30
WHE 70		3/25/99	12:21	13	12	15	0	1	0	0	0	2
WHE 72		2/19/99	3:31	11	16.5	12	1	2	0	0	0	6
WHE 72		2/26/99	3:40	6	15	6.5	5	7	0	0	0	2
WHE 72		3/5/99	4:28	6	20.5	13.5	4	3	0	0	0	6
WHE 72		3/12/99	5:21	7.5	12	10	2	2	0	0	0	2
WHE 73		2/19/99	3:29	11	22	12	2	3	0	0	0	6
WHE 73		2/26/99	3:44	6	16	6.5	3	1	0	0	0	6
WHE 73		3/5/99	4:24	6	20	14	4	6	0	0	0	8
WHE 73		3/12/99	5:19	7.5	13	10	0	3	0	0	0	4
WHE 75		2/19/99	9:40	6	29	6	1	3	3	3	0	12
WHE 75		3/5/99	1:26	5	43	11	10	10	10	10	0	6
WHE 75		3/12/99	2:20	7.5	25	9	5	4	2	2	0	3
WHE 75		2/26/99	12:17	4.5	29	5	6	6	0	1	0	4
WHE A15		2/26/99	4:14	5.5	22	6.5	0	1	0	0	0	15
WHE A15		3/5/99	4:44	6	23	12	0	1	0	0	0	20
WHE A6		1/18/99	9:50	5	24.5	4	0	2	0	0	0	8
WHE A6		1/22/99	7:20	4	27	2	0	2	0	0	0	6
WHE A6		2/5/99	3:02	5	19	4	1	1	0	0	0	6
WHE A6		2/13/99	4:10	8	24.5	8	0	1	0	0	0	10
WHE B14		2/13/99	3:06	7	23	7	0	1	0	0	0	10
WHE B14		2/26/99	2:50	5.5	19.5	6.5	0	2	0	0	0	9
WHE B15		1/18/99	12:00	8	22	6	1	1	0	0	0	4
WHE B15		1/22/99	7:58	4	26	2	0	1	0	0	0	5
WHE B15		2/5/99	1:56	3	25	3	0	2	0	0	0	5
WHE B15		2/13/99	2:25	7	23.5	7.5	0	1	0	0	0	10
WHE B17		2/13/99	2:15	7	25	7.5	0	2	0	0	0	6
WHE C16		2/13/99	2:01	7	20.5	7.5	0	1	0	0	0	7
WHE C16		2/26/99	2:31	5.5	21.5	6.5	0	1	0	0	0	15
WHE C16		3/20/99	3:14	14	14	15	0	1	0	0	0	15
WHE C17		3/5/99	9:51	2.5	16.5	5.5	1	0	0	0	0	5
WHE C17		3/12/99	4:55	7.5	15.5	10	1	0	0	0	0	20
WHE C9		2/26/99	3:13	6	16	6.5	1	0	0	0	0	10

site	pool id	date	time	air temp C	Water depth		Branchinecta lynchi		Eubbranchipus oregonus		unk instars	sweep (m)
					max (cm)	water tempC	male	female	male	female		
WHE	C9	3/5/99	4:11	7	17	14	2	0	0	0	0	12
WHE	C9	3/12/99	4:17	7.5	15.5	10.5	0	3	0	0	0	11
WHE	C9	3/20/99	3:35	14	10.5	16	0	2	0	0	0	11
WHE	C9	3/25/99	11:40	13	11	15.5	0	1	0	0	0	8
WHE	D1	1/18/99	12:41	8	20	6.5	0	1	0	0	0	4
WHE	D1	1/22/99	8:32	4	20	3	0	1	0	0	0	4
WHE	D1	2/5/99	1:21	2	10	3	1	0	0	0	0	4
WHE	D1	2/13/99	12:55	7	11	7.5	0	1	0	0	0	4
WHE	N	2/26/99	9:51	3.5	20.5	4	1	6	0	0	0	6
WHE	N	3/5/99	10:42	2.5	22	6	0	5	0	0	0	5
WHE	N	3/12/99	10:48	4.5	19.5	7.5	4	3	0	0	0	6
WHE	N	3/20/99	10:42	10	13.5	12	1	2	0	0	0	5
WHE	N	3/25/99	12:04	13	12	16	3	1	0	0	0	2

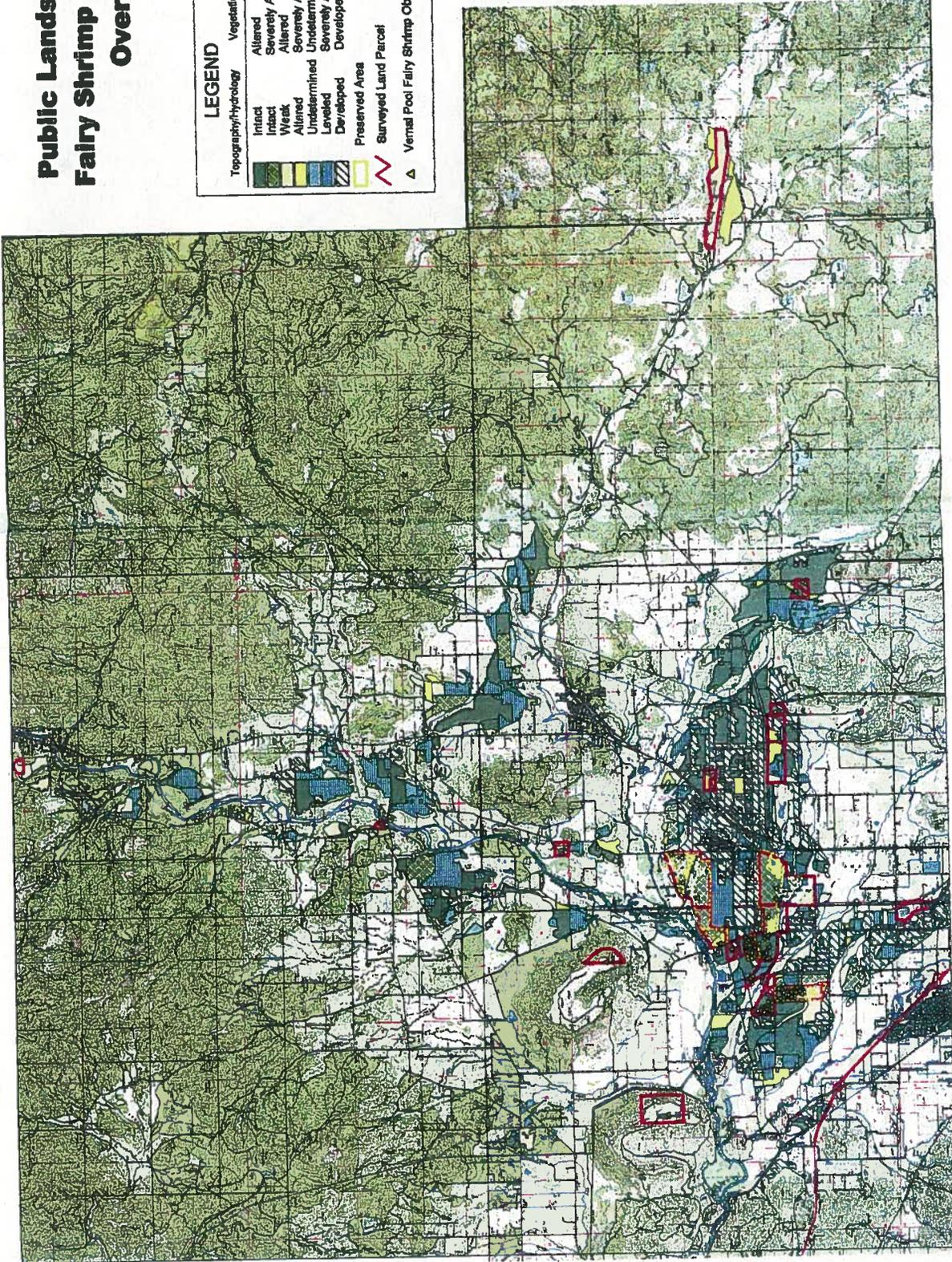
Table 5. Vernal pools occupied by *Branchinecta lynchi* (BRLY) at Agate Desert (ADP) and Whetstone Savanna (WHE) preserves, 1999. BRLY count data shown are from date on which maximum number of BRLY were encountered. Pool dimensions for occupied pools taken on two consecutive days one week post peak hydrologic period for pools in 1998-1999 (Data from J. Doينو).

site	pool ID	date	time	air temp		Water depth		Branchinecta lynchi			Eubranchipus oregonus		unk instars		date		Primary			secondary			tertiary		
				C	max	tempC	max (cm)	total	male	female	sweep (m)	BRLY/ m3	male	female	length	width	L	W	L	W	L	W	Area	Maxd	vol
ADP 15		2/7/99	11:26	7	24	6	1	1	0	7	0.20	0	0	0	3/6/99	15	5	8	4	107	20	21			
ADP 16		3/14/99	10:49	5	11	7	10	5	5	5	6.06	0	0	0	3/6/99	16	13			208	13.5	28			
ADP 18		2/28/99	9:51	8.5	13	8.5	12	4	8	15	2.05	0	0	0	3/6/99	11	7			77	10.5	8			
ADP 21		1/17/99	2:35	9	14	8	3	1	2	10	0.71	0	0	0	3/6/99	35	6			210	9.5	20			
ADP 25		3/6/99	12:36	5	12	11.5	1	1	0	15	0.19	0	0	0	3/6/99	23	12			276	12	33			
ADP 26		3/14/99	9:39	4.5	13	6	3	2	1	10	0.77	0	0	0	3/6/99	10	7			70	16	11			
ADP 26.5		1/31/99	9:48	5.5	19	4	2	1	1	6	0.58	0	0	0	3/6/99	5	2			10	22	2			
ADP 27		2/28/99	10:36	9	36	9	12	5	7	11	1.01	0	0	0	3/6/99	15	11	60	7	585	28	164			
ADP 28		2/28/99	10:14	8.5	26	9	16	5	11	20	1.03	0	0	0	3/6/99	17	7			119	23	27			
ADP 32		1/17/99	12:07	8.5	17	7	1	1	0	19	0.10	0	0	0	3/6/99	20	7			140	22.5	32			
ADP 33		1/17/99	12:35	8.5	16	7	1	0	1	6	0.35	0	0	0	3/6/99	10	6			60	12	7			
ADP 35		1/31/99	12:00	5	19	6	8	3	5	14	1.00	0	0	0	3/6/99	19	16			304	22	67			
ADP 38		2/21/99	1:21	6	29	8	7	1	6	9	1.78	0	0	0	3/6/99	19	19			361	23	83			
ADP 39		2/21/99	1:40	5	24	6	3	1	2	8	0.89	0	0	0	3/6/99	20	7	18	9	302	29	88			
ADP 40		1/31/99	11:34	5	24	6	3	2	1	9	0.52	0	0	0	3/6/99	18	10	20	9	598	27	161			
ADP 41		2/14/99	11:12	7.5	16.5	8	3	2	1	9	0.67	0	0	0	3/6/99	18	16			288	18	52			
ADP A1		2/7/99	12:10	5.5	29	7	3	1	2	12	0.29	0	0	0	3/6/99	14	8			112	21	24			
ADP A13		1/23/99	1:51	4.5	14	5	1	0	1	10	0.24	0	0	0	3/6/99	44	9			396	10	40			
ADP A15		3/14/99	8:58	4.5	8.5	6	9	6	3	5	7.06	0	0	0	3/6/99	11	13			143	15	21			
ADP A16		2/28/99	10:23	8.5	30	9	5	0	5	10	0.56	0	0	0	3/6/99	17	15			255	24	61			
ADP A17		3/14/99	9:13	4.5	10.5	6	4	4	0	4	3.17	0	0	0	3/6/99	11	5			55	15	8			
ADP S		2/28/99	10:46	9	30	9	9	1	8	6	1.67	0	0	0	3/6/99	13	6			78	23.5	18			
ADP T		2/14/99	9:51	6	31	6.5	10	10	0	13	0.83	0	0	0	3/6/99	27	20			540	31	167			
ADP V		2/28/99	12:09	9.5	15.5	10	1	1	0	6	0.36	0	0	0	3/6/99	6	4	14	4	140	15.5	22			
ADP W		2/14/99	11:26	6.5	21.5	7.5	6	1	5	8	1.16	0	0	0	3/6/99	22	8	17	8	312	21	66			
ADP Z		2/21/99	2:34	7	16	10	1	0	1	12	0.17	0	0	0	3/6/99	25	6	25	10	400	15	60			
WHE 7		2/26/99	12:34	4.5	30	5.5	1	0	1	11	0.10	3	3	0	3/5/99	22	9			198	32	63			
WHE 8		3/12/99	2:31	7.5	15.5	9	10	5	5	2	10.75	5	5	0	3/5/99	12	5			60	17	10			
WHE 12		3/12/99	1:56	8	20.5	9.5	40	20	20	10	6.50	0	2	0	3/5/99	32	8			256	27	69			
WHE 23		2/26/99	12:14	4.5	24	5	4	2	2	12	0.46	0	0	0	3/5/99	14	9	8	4	158	26	41			
WHE 24		2/26/99	12:10	4.5	14.5	6	1	1	0	8	0.29	0	0	0	3/5/99	9	8			72	17	12			
WHE 25		3/5/99	1:42	7	20	12	5	1	4	7	1.19	0	0	0	3/5/99	10	10			100	20	20			
WHE 26		3/12/99	2:27	7.5	18.5	9	4	3	1	10	0.72	2	3	0	3/5/99	8	4			122	24	29			
WHE 29		3/5/99	2:50	10	24	13	40	20	20	8	6.94	20	20	0	3/5/99	14	5	18	5	70	26	18			
WHE 37		3/20/99	1:59	11.5	13.5	12	2	1	1	4	1.23	0	0	0	3/5/99	14	8			112	30	34			
WHE 44		3/12/99	11:26	5.5	22.5	7.5	20	10	10	6	4.94	1	2	0	3/5/99	14	8								
WHE 51		3/12/99	11:12	4.5	22	7.5	1	0	1	12	0.13	0	0	0	3/5/99	14	6	15	8	204	22.5	46			
WHE 54		2/19/99	2:05	10	22.5	11.5	21	9	12	8	3.89	0	0	0	3/5/99	11	5			55	20	11			
WHE 55		2/26/99	9:19	3.5	20	4.5	2	0	2	10	0.33	10	0	0	3/5/99	11	8			88	29	26			
WHE 56		2/26/99	9:14	3.5	26	4.5	20	10	10	10	2.56	10	10	0	3/5/99	18	6			108	25	27			
WHE 57		2/26/99	9:47	3.5	24	5	10	10	0	6	2.31	0	2	0	3/5/99	16	5	17	4	148	19	28			
WHE 61		3/20/99	10:25	10	11	12	3	1	2	8	1.14	0	0	0	3/5/99	16	6			96	20.5	20			
WHE 62		2/26/99	11:54	4	19.5	5	3	3	0	10	0.51	3	0	0	3/5/99	16	6								

Table 6. Vernal Pool Data from pools with *Branchinecta lynchi* on public land sites over January through March 1999 (includes data from additional occupied pools found in 1998)

Tract Owner	Site	Pool ID	Observer	Date	Time	H2O Depth oC (cm)	Max	Pool Area measurements						Area notes	~Area m2	Vol m3	ruts	Habitat condition (disturbance)						Land Use	Voucher collection		Duck evid.	Instars	males	females	number observed	Notes					
								Primary Area (m)		Second Area (m)		Tertiary Area (m)						blading	mowing	garbage	wood debris	mod graze	heavy graze		males	females							Instars	males	females	number observed	
								l	w	l	w	l	w																								l
ODFW	Hall Tract H-1		S.Nyoka	1/10/99	1500	8	16	20	20						358	29	X						refuge		3	3	yes	na									
ODFW	Hall/Ave A H-5		S.Nyoka	1/14/99	1700	8	19.5	14	21					294	29	X							refuge		3	1	yes	na									
ODFW	Hall/Truck Rd H-7		S.Nyoka	1/22/99	1345	5	27	44	22					968	131	X							refuge	X	1	1	yes	na									
ODFW	Military Slough MS-1		S.Nyoka	1/18/99	1620	8	21.5	15	30					450	48	X							refuge	X	4	3	yes	4	3	7	many immature shrimp						
ODFW	Military Slough MS-2		S.Nyoka	1/24/99	958	4	22	25	10					250	28	X		X					refuge	X	1	1	yes	5	low aquatic insect abund								
ODFW	Creek Unit C-1		S.Nyoka	1/21/99	1145	6	20	10	20					200	20	X							refuge	X	1	2	yes	1	2	2	5	usual good pool conditions					
ODFW	Creek Unit C-1		S.Nyoka	1/28/99			15.6																refuge	X	1	1	yes	5	5	15	part w/woodchips eutrophic						
ODFW	Creek Unit C-2		S.Nyoka	1/24/99	1205	5	22	50	20					1000	110								refuge	X	2	2	yes	10	10	15	part w/woodchips eutrophic						
ODFW	Creek Unit C-3		S.Nyoka	1/24/99	1445	7	19.9	10	12					120	12	X							refuge	X	2	2	yes	2	2	4							
ODFW	Weigh Station WS-1		S.Nyoka	1/29/99	1210	6.5	16.2	5	18					90	7	X							refuge	X	2	2	yes	10	5	15	Intact mounded topography						
JACO Parks	Sports Park SP-1		S.Nyoka	1/15/99	1600	10	22	40	13					520	57	X		X					Co Park	X	3	3	yes	3	3	6	under powerlines						
JACO Parks	Sports Park SP-1		D.Borgias	3/9/99	1555	16	24									X							Co Park				n/a			0	good insect assemblage						
JACO Parks	Hoover Ponds HP-1		S.Nyoka	1/28/99	1120	6	38	40	15					600	114	X							Co Park				yes	1	1	1	very deep pool with lots of aquatic insects						
JACO Parks	Hoover Ponds HP-1		D.Borgias	3/9/99	1653	12	38									X							Co Park				n/a		0	Loco N of pool							
JACO Parks	Agate Lake AL-1		S.Nyoka	1/15/99	1130	8	13.8	12	12					144	10	X							Co Park	X	3	3	yes	3	3	6	good insect assemblage						
JACO Parks	Agate Lake AL-1		S.Nyoka	2/15/99	1010	4.5	23.6	15	38	2			arm	570	67	X							Co Park	X	1	1	yes	1	3	4	good insect assemblage						
JACO Parks	Agate Lake AL-1		D.Borgias	3/2/99	1540	13	24	33	15	6			arm	495	59	X							Co Park	X	3	3	n/a		0	entire pool sampled							
JACO Parks	Agate Lake AL-2		S.Nyoka	1/15/99	1352	10	15	9	25					225	17	X							Co Park	X	3	3	yes	3	3	6							
JACO Parks	Agate Lake AL-2		S.Nyoka	2/15/99	920	4.5	25	13	27	2	10			371	46	X							Co Park	X	1	1	yes	2	2	2							
JACO Parks	Agate Lake AL-3		D.Borgias	3/2/99	1600	12	28	22	12					336	47	X							Co Park				yes	1	1	1	not surveyed previously						
JACO Parks	Agate Lake AL-4		D.Borgias	3/2/99	1655	13	21	22	15				estimated	330	35								Co Park				yes	2	1	3	7/8 pool pvt, not sampled						
Medford	WIP Newland WI-1		S.Nyoka	2/7/99	1130	7.5	26.5	12	16					192	25								Co Park	X	1	1	yes	2	1	0	good insect assemblage						
Medford	WIP Newland WI-2		S.Nyoka	2/7/99	1155	7.5	33.3	45	24					1080	180								grazing	X	1	1	yes	4	4	0	good insect assemblage						
Medford	WIP Newland WI-3		S.Nyoka	2/7/99	1215	8.5	24	3	5					180	22								grazing	X	1	1	yes	4	4	4	good insect assemblage						
Medford	WIP Newland WI-4		S.Nyoka	2/7/99	1240	8.5	29.6	11	11					121	18								grazing	X	1	1	yes	4	4	4	good insect assemblage						
Medford	WIP Newland WI-5		S.Nyoka	2/7/99	1425	9.5	30.4	69	9					621	94								grazing	X	2	1	yes	3	3	3	good insect assemblage						
Medford	WIP Newland WI-6		S.Nyoka	2/7/99	1510	8.5	28.3	16	9					144	20								grazing	X	1	1	yes	2	2	6	good insect assemblage						
Medford	WIP Newland WI-7		S.Nyoka	2/7/99	1610	9	18.6	15	12					180	17								grazing	X	1	1	yes	2	3	5	good insect assemblage						
Medford	WIP Newland WI-8		S.Nyoka	2/7/99	1755	19.5	13	9						117	11								grazing	X	1	1	yes	1	4	5	1	lots of garbage near pool					
Medford	WIP Newland WI-10		S.Nyoka	2/11/99	1140	6.5	26.8	34	32					1088	146								grazing	X	1	1	yes	16	16	16	good insect assemblage						
Medford	WIP Newland WI-11		S.Nyoka	2/11/99	1218	7	23.1	18	10					180	21								grazing	X	1	1	yes	1	1	1	good insect assemblage						
Medford	WIP Newland WI-12		S.Nyoka	2/11/99	1300	8	23.5	33	26	10	16			1018	120								grazing	X	1	1	yes	2	8	30	40	many insects					
Medford	WIP Newland WI-13		S.Nyoka	2/11/99	1331	8	23.8	9	26					234	28								grazing	X	1	1	yes	3	8	11	good insect assemblage						
Medford	WIP Newland WI-14		S.Nyoka	2/11/99	1450	9	16	7	12					84	7	X							grazing	X	1	1	yes	3	8	2	2	few insects					
Medford	WIP Newland WI-15		S.Nyoka	2/11/99	1515	8	22.5	19	9					171	19								grazing	X	1	1	yes	3	4	7	good insect assemblage, no						
Medford	WIP Newland WI-16		S.Nyoka	2/11/99	1540	9	25	10	16					160	20								grazing	X	1	1	yes	1	3	4	good insect assemblage						
Medford	WIP Newland WI-17		S.Nyoka	2/11/99	1605	9	18	20	25					500	45								grazing	X	1	1	yes	1	2	3	4	good insect assemblage					
Medford	WIP Newland WI-18		S.Nyoka	2/11/99	1650	8	38	100	12					1200	228								grazing	X	1	1	yes	1	1	2	big pool w/seev mounds, good insect assemb						
Medford	WIP Newland WI-19		S.Nyoka	2/12/99	1245	9	21.5	12	48					576	62								grazing	X	1	1	yes	1	1	1	good insect assemblage, 1						
Medford	WIP Newland WI-20		S.Nyoka	2/12/99	1300	11	20.5	7	15					105	11								grazing	X	1	1	yes	1	3	4	good insect assemblage						
Medford	WIP Newland WI-21		S.Nyoka	2/12/99	1315	10	24	4	5					215	26								grazing	X	1	1	yes	3	3	3	good insect assemblage						
Medford	WIP Newland WI-22		S.Nyoka	2/12/99	1400	12	21	9	14					126	13								grazing	X	1	1	yes	1	2	3	good insect assemblage						
Medford	WIP Newland WI-23		S.Nyoka	2/12/99	1420	11.5	25.5	9	12					108	14	X							grazing	X	1	1	yes	2	2	2	Intact insect assemblage						
Medford	WIP Newland WI-25		S.Nyoka	2/12/99	1515	13	20.5	21	42					882	90								grazing	X	1	1	yes	2	2	2	good insect assemblage						
Medford	WIP, N of ADP MAD-1		S.Nyoka	2/15/99	1205		24.1	16	35					560	67	X							grazing	X	1	1	yes	2	5	7	JD-38/TNC26 at ADP						
Medford	WIP, S of ADP SAD-1																																				

Public Lands Vernal Pool Fairy Shrimp Survey, 1999 Overview



LEGEND	
Topography/Hydrology	Vegetation
	Intact
	Weak
	Severely Altered
	Undetermined
	Levelled
	Developed
	Preserved Area
	Surveyed Land Parcel
	Vernal Pool Fairy Shrimp Observed



0 1 2 Miles

Projection: Lambert Conformal Conic
 Datum: NAD83
 Base Mapping: USGS EROS & DCA, 1:25K

Vernal Pool Fairy Shrimp surveys conducted by The Nature Conservancy of Oregon for the Oregon Natural Heritage Program under Contract (Final Preconstruction Report 10, 1448-18-02-97-AC257).

Habitat classification data developed by the Oregon Natural Heritage Program under Oregon Division of State Lands Contract (Final Preconstruction Report 10, 1448-18-02-97-AC257).

Data Version: July 1999
 Map Date: July 13, 1999



LEGEND

Topography/Hydrology		Vegetation	
	Contour		Intact
	Water		Slightly Altered
	Forest		Altered
	Shrubland		Severely Altered
	Wetland		Undetermined
	Developed		Levelled
	Preserved Area		Severely Altered
	Surveyed Land Parcel		Developed
	Vernal Pool Fairy Shrimp Observed		



Projection: Lambert Conformal Conic
 Horizontal Datum: NAD 83
 Base Map(s): USGS DPO & DLO, 1:24K

Vernal Pool Fairy Shrimp surveys conducted by The Nature Conservancy, Oregon Department of Fish and Wildlife, Oregon Natural Heritage Program under USFWS Contract (No. 1448-13423-97-M257).

Habitat classification data developed by the Oregon Natural Heritage Program and the Oregon Department of Fish and Wildlife under USFWS Contract (No. 10735-398). Funded by the Environmental Protection Agency, Region 10.

Data Version: July 1999
 Map Date: July 9, 1999



**Public Lands Vernal Pool
 Fairy Shrimp Survey, 1999
 White City and Central Point**

