
DRAGONFLY & DAMSELFLY MONITORING

Protocol for Community-based Surveys



Common Green Darner pair (*Anax junius*) laying eggs. Photo by CASM Environmental.

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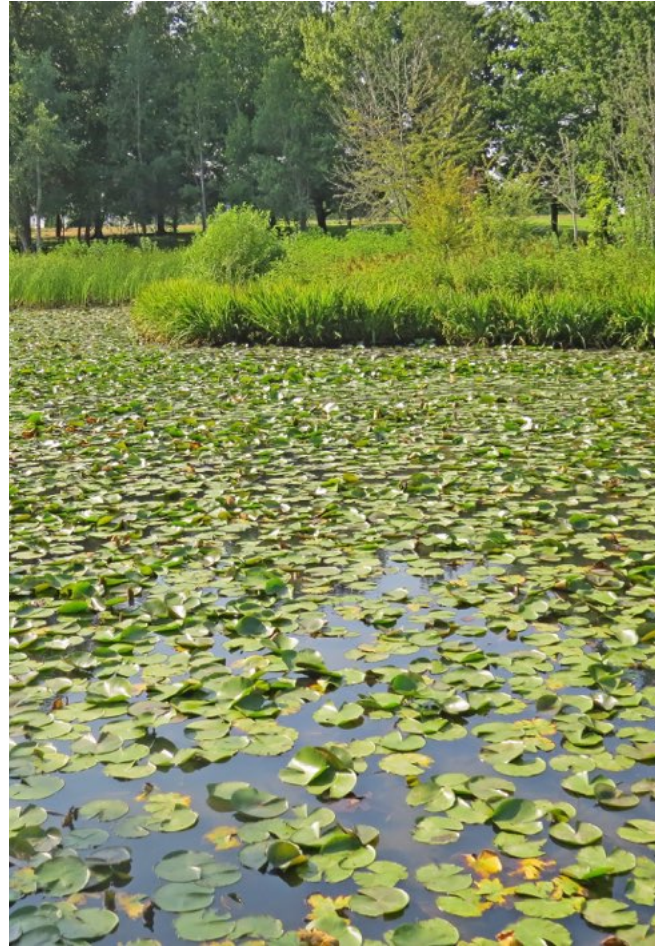
BACKGROUND

Dragonflies and damselflies (Odonata) have important ecological functions in streams and wetlands. The community of odonate species in a water body can provide information about habitat type and quality. Because immatures (nymphs) and adults prey on other insects, dragonfly nymphs can be top predators in habitats without fish, and adults provide important pest control services, eating a variety of insects including mosquitoes and midges. Odonates are also a food resource for fish, waterfowl, songbirds, lizards, and frogs.

Odonates are among the better-known insects, but there is still much to learn about their distribution, life history, and ecology, and much remains to be learned about the phenomenon of dragonfly migration in North America. Dragonflies and damselflies are excellent subjects for studying long-term impacts of climate change, as well as impacts of disturbances such as drought and wildfires. Climate-related changes have already affected early and late flight dates for many species, and some tropical species once considered vagrants in the southwest have now established breeding populations.

This project is the only systematic study of odonates that has been done in the Johnson Creek watershed. Examining odonate diversity and abundance helps us discover stressors impacting local populations, incorporate odonate habitat needs into habitat restoration and management plans, and learn the effects of restoration projects on different species.

Volunteers make huge contributions to what we know about odonates. These insects are compelling, beautiful, and easy to observe, and learning to identify most local species is fairly straightforward. This manual provides the protocols and resources needed to participate in the Johnson Creek Watershed Council (JCWC) Community-based Dragonfly & Damselfly survey.



Odonates are common denizens of freshwater habitats.

Photo by CASM Environmental.

SURVEY PROTOCOL

TIMING SITE VISITS

Selected sites are monitored by volunteer teams trained in survey methodology and odonate species identification. Adult odonates live only a few weeks, but their seasonality is much like birds, with different species on the wing at different times through spring, summer, and early fall. In our region, the first dragonflies and damselflies usually appear in late March to early April, and by the end of September few individuals are still flying. It is important to survey sites throughout the flight season to ensure a complete list of species, and to catch early and late flight dates and the arrival and departure of migratory species. Surveys should be done every 14 days during the flight season, although weekly visits can also be done if time and volunteer inclination allow. Keep in contact with your team members to work out a regular survey schedule.

Odonates are active on relatively warm, sunny days; they prefer not to fly when it is too windy or too hot or cold. Use the table below as a guideline to determine when conditions are optimum for dragonfly and damselfly activity at your site. The length of time needed to survey your site will vary depending on time of year, abundance and diversity of odonates, and number of teammates. There is no set minimum, but usually at least 60 minutes is needed to ensure an adequate search effort has been made.

When should I survey?

Time range	10:00 am - 4:00 pm			9:30 am - 4:30 pm	
Temperature	< 59°F (15°C)	59-65°F (15-18°C)	65-75°F (18-24°C)	>75°F (24°C)	>88°F (31°C)
Cloud cover >60%	No	No	Yes	Yes	No
Cloud cover <60%	No	Yes	Yes	Yes	No
Windy (small tree branches swaying)	No	No	No	No	No
Rain	No	No	No	No	No

EQUIPMENT NEEDED

A minimum of equipment is needed to survey dragonflies and damselflies. You will be working on warm sunny days in open areas, so guard against sunburn, heat exhaustion, and dehydration. Suggested survey gear includes:

- water and snacks
- brimmed hat
- boots or shoes that can get wet and muddy

- sunscreen
- binoculars (ideally focusing to 5 ft or less)
- data sheet or field notebook
- hand lens (at least 10X; some species must be examined in-hand for ID; reversing your binoculars can also provide needed magnification)
- aerial insect net (in-hand examination to facilitate ID; at least 12" diameter hoop and 3 ft handle)
- camera (a digital camera is ideal for distant or wary specimens; a phone camera suffices for in-hand or perched specimens, as long as identification can be verified from the photo)



A net helps to get a closer look.
Photo by CASM Environmental.

SPECIES IDENTIFICATION

Identification is what volunteers worry about most, but with training, field guides, and practice, you will be amazed at how quickly you can recognize your local species. Many are easy to identify, while others require close examination of markings or reproductive parts. One way to be sure your identification correct is to take a photo that can be posted on the project web page and vetted by others. When photographing, capture both a dorsal (top) and lateral (side) view if possible, so that all necessary markings and structures can be seen. Many individuals will be difficult to capture or photograph, but with familiarity, some species can be identified on the wing. There are three possible categories for vouchering observations:

V (visual ID)

Visual identification can be sufficient for common and abundant species, but take at least one photo of each species on each visit to accompany your records, when possible. Photos help you recognize different genders and life stages (i.e., teneral, immature, mature) and help us verify correct ID.

C (captured for in-hand verification of ID)

For some species, diagnostic features can only be seen when the specimen is in the hand. Once you are familiar with these features, you may be able to see some of them using binoculars, while others must always be viewed close-up. Once an individual is in hand, take some photos to verify your ID.

P (ID from photographic voucher)

Photo vouchers are best for identification, but it's important to document the parts of the specimen most needed for ID. This generally includes a view of the male genitalia or female ovipositor, as well as facial, thoracic, and/or abdominal markings. The Quick Guide to Families has a table of the most useful features for ID; think about those when taking photos. These are often easiest to document from a captured specimen, but photos of perched individuals can work as well. Be sure to keep track of the date, site name, and observers associated with all photo records.

FIELD PROTOCOLS

Capturing and holding specimens

Dragonflies and damselflies are often described as ‘gossamer’ but they are in fact tough predators, and if handled properly there is little chance of harming them. However, their strong flight and excellent eyesight make them a challenge to catch. If you are trying to net one, watch for a while to see if there is a perch it returns to, and time your swing accordingly. Try to approach from behind, as this is the one area where their vision is less complete. Don't let your shadow fall across the insect as you approach. Once you are close enough for a swing, follow these steps:

Avoid catching teneral (newly emerged adults), as handling damages their soft bodies & wings.

- For a perched dragonfly, swing the net sideways and over the top of the insect, slapping the net ring firmly to the ground as you follow through to prevent the insect from flying back out from under the rim. For an odonate in flight, swing upwards from below then immediately flip the net bag over so the excess hangs over the rim and traps the insect inside.
- Hold the net bag closed at the base with one hand and lift up the tip of the net with the other; insects usually fly up into the top portion of the net bag. If it's fluttering a lot, wait for it to settle down and cling to the net.
- Gather the net bag just below the insect into one hand, then reach in with the other and carefully grasp it at the base of its wings, holding the wings together over the abdomen with your forefinger and thumb. Holding the wings doesn't damage them (unless your hands are coated with sunscreen or insect repellent), and by grasping close to where they join the body, the insect is prevented from fluttering, which could tear the wings. Gently remove the individual from the net, and grab your hand lens or camera for a closer look.
- People often ask if they can be bitten by an odonate. Sometimes a captured specimen will open and close its mouthparts as if it would very much like to bite, but the jaws of damselflies and most dragonflies lack the strength to puncture human flesh. Large darners can give a sharp pinch, but will rarely (though not never!) draw blood. Odonates do not produce toxins or transmit any disease pathogens, so if a bite does occur, it's pretty harmless.



Darter held with wings folded & close to the body. Photo by CASM Environmental.

Recording behaviors and life stages

You will record some additional data that tells us more about odonates' local life history and ecology.

Abundances: Odonates are always on the move, so it's hard to get a count of each species you see. Knowing the exact population size isn't critical here, so abundance for each species is recorded as categories: U (uncommon, 1-4); F (frequent, 5-20); C (common, 21-100) or A (abundant, >100).

Reproductive stage: Odonates are mobile, so seeing a species at a site doesn't necessarily mean it is reproducing there; they may be visiting to hunt or mature. The best way to determine if a species is successfully reproducing is to find their exuviae (cast-off skins of the mature nymph left after adult emergence), but exuviae are easy to overlook and hard to identify. However, you can record the following reproductive behaviors:

- **W (wheel formation);** When odonates mate, the male holds the female behind the eyes (dragonflies) or head (damselflies); the female swings the tip of her abdomen up to connect with genitalia on the underside of the male's abdomen for sperm transfer. This gives a characteristic "wheel" shape, and pairs can fly or perch while in wheel. Females lay eggs soon after copulation, so seeing a pair in wheel means it's likely their eggs will be laid at that site.
- **TP (tandem pair):** Before the wheel has formed and/or after copulation is done, the male may continue to hold the female by the head, in preparation for either mating or egg-laying. Tandem pairs can travel some distance, but if you see a tandem pair at your site it is very likely they intend to breed there.
- **O (oviposition):** Females lay eggs in a variety of ways, depending on species, including inserting them into vegetation, jabbing them into muddy banks, or dabbing them onto the water. The male may hold the female in tandem as she lays her eggs to prevent other males from mating with her, or he may release her but follow along and chase off any males that approach.
- **TA (teneral adult):** Teneral (newly emerged) adults look very different from mature forms, with soft bodies, shiny wings, dull colors, and weak flight. Their presence indicates they went through development as nymphs at or very near the site. Tenerals are sexually immature and must rest and feed. Try not to net them, as they are easily injured, but be aware that since they don't have mature coloration, they are usually more difficult to ID to species.



Tule Bluets (*Enallagma carunculatum*) in wheel. Photo by CASM Environmental.



Sooty Dancers (*Argia lugens*) ovipositing in tandem. Photo by CASM Environmental.



Teneral Twelve-spotted Skimmer (*Libellula pulchella*). Photo by CASM Environmental.

Survey technique

When you reach your site, fill in the following fields on your data form: Observer names, site name, start time, air temperature, wind (calm, light, moderate, strong), and estimated percentage cloud cover.

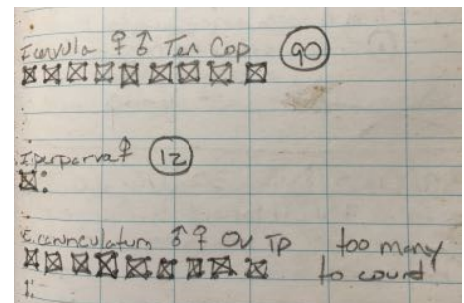
You will count odonates along a transect that runs along the water's edge, allowing you to view the water and adjacent vegetation. Walk slowly along your transect, looking from side to side as you go. Look out over the water to see patrolling males and ovipositing females; look above and in the stream-side or pond-side vegetation to see emerging, perched, feeding, and mating adults. Stopping occasionally and scanning with binoculars is helpful. Photograph and/or net individuals to confirm ID and provide vouchers.



Walking transect for a wetland site survey. Observations are made looking out over the water and in edge vegetation.

When individuals are numerous they can be hard to count. If you are in a field of flying blue damselflies, you won't know whether they are all the same species, but observing each one isn't feasible. In such cases, to make reasonable estimates of species and abundances, catch and identify a smaller subset. For example, let's say you estimate there are ~100 blue damselflies during a site count. If you capture 10 and find that eight are Pacific Forktail (*Ischnura cervula*) and two are Tule Bluet (*Enallagma carunculatum*), you would extrapolate the overall abundances as 80 Pacific Forktail (C, common) and 20 Tule Bluet (F, frequent), and record their abundance categories accordingly on the data sheet.

As you walk your transect, begin filling out the data sheet. Make marks on the sheet or in a field notebook to keep track of individuals so you can assign abundance categories at the end. Note reproductive behaviors and life stages of each different species on the data sheet as you go. In the Notes section, you can record any additional wildlife you see or changes that may have occurred at the site since your previous visit. Once you are done with your transect, record your stop time and write the final abundance categories of each species on the data sheet.



Field notebook. Genders and behaviors for each species are recorded. Boxes are a good way to count by tens (4 dots + 4 connecting lines + 2 diagonals).

After each survey, a designated team member enters the data in the JCWC iNaturalist dragonfly survey project page (<https://www.inaturalist.org/projects/dragonfly-surveys-in-johnson-creek-watershed>). **Carefully transfer all information from the data**

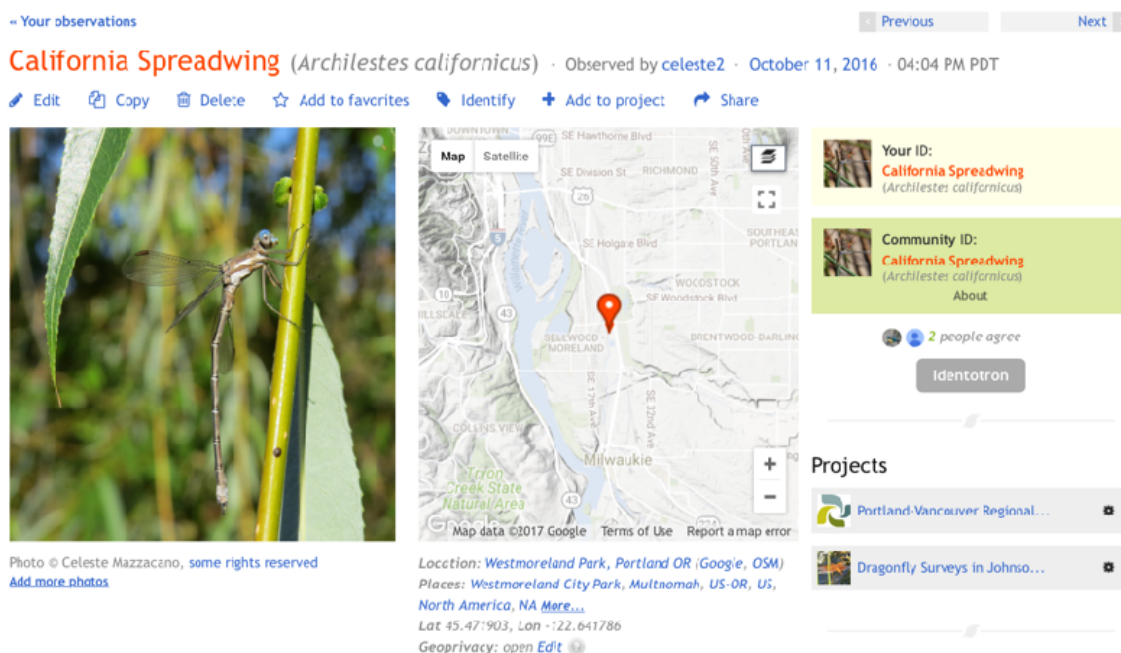
sheet or field notebook to each corresponding field on the iNaturalist project page. Report **one observation** for each species you saw (i.e., if you saw 3 male Pacific Forktails, 2 females, and 3 pairs in wheel, it is **ONE** species record, with a single abundance category [11 individuals = F, frequent] and any behaviors noted) and upload any corresponding photos you took at the same time. If you have a smartphone, you can use the iNaturalist app to upload data and photos in the field if you prefer (see “*Entering Records in iNaturalist*” below for detailed instructions). If using data sheets, keep them until

the end of the season to maintain a hard copy record and then mail them to Johnson Creek Watershed Council (Attn: Marissa Eckman) at 4033 SE Woodstock Blvd., Portland, OR 97202.

Depending on the weather, surveys will continue into late September/early October. When a site has been surveyed twice in succession and no dragonflies or damselflies are found, it is assumed that the odonate flight season has ended for the year.

ENTERING RECORDS IN iNATURALIST

Whether you record data in the field using the data sheet or a field notebook, you must enter each of your species observations into the iNaturalist “Dragonfly Surveys in Johnson Creek” project. iNaturalist is a global community-based project to record biodiversity around the planet. Observations of any living thing can be reported via desktop computer or mobile app and identification is crowdsourced, i.e. the huge user community confirms or corrects identifications. New observations are “casual” grade; once ID is confirmed (or corrected) by another user, the record becomes “research” grade. Observations can be submitted without photos, but the record will always be “casual” grade, as the ID cannot be confirmed.



The screenshot shows an iNaturalist observation page. At the top, it says "Your observations" and "Previous Next". The observation is titled "California Spreadwing (*Archilestes californicus*)" and was observed by "celeste2" on "October 11, 2016" at "04:04 PM PDT". Below the title are links for "Edit", "Copy", "Delete", "Add to favorites", "Identify", "Add to project", and "Share". The main content area features a photo of a dragonfly on a green stem, a map showing the location in Westmoreland Park, Portland, OR, and a list of projects it was added to: "Portland-Vancouver Regional..." and "Dragonfly Surveys in Johnson Creek". The page also shows the user's ID, community ID, and a list of projects.

« Your observations Previous Next

California Spreadwing (*Archilestes californicus*) · Observed by celeste2 · October 11, 2016 · 04:04 PM PDT

Edit Copy Delete Add to favorites Identify Add to project Share

Photo © Celeste Mazzacano, some rights reserved
[Add more photos](#)

Location: Westmoreland Park, Portland OR (Google, OSM)
Places: Westmoreland City Park, Multnomah, US-OR, US, North America, NA [More...](#)
Lat 45.471903, Lon -122.641786
Geoprivacy: open [Edit](#)

Your ID: California Spreadwing (*Archilestes californicus*)

Community ID: California Spreadwing (*Archilestes californicus*)
[About](#)

2 people agree
Identotron

Projects

- Portland-Vancouver Regional...
- Dragonfly Surveys in Johnson Creek

Observation added to Dragonfly Surveys in Johnson Creek project, with ID confirmed by user community. Note that this observation has also been picked up by another ongoing iNaturalist project (Portland-Vancouver Bioblitz).

[Getting started with iNaturalist](#)

The first step is to create an account. Visit www.inaturalist.org and click on “Sign up” in the upper right corner of the screen. You will create a username and enter your e-mail and a password for your account. You can download the mobile app, which works on both iOS and Android platforms, for free.

Once you are logged in to your account, go to the top of the home page, mouse over Community, and select “Projects”, then type “Dragonfly Surveys in Johnson Creek” into the search box that appears. Click on the JCWC project link and then click “Join this project” on the upper right side of the project home page. You will now be able to enter observations directly into this project in the future, from either a desktop computer or a mobile device. **Be sure to add this project to your account, including on your phone, and subsequently enter all dragonfly and damselfly observations to the project!!!** If you simply enter observations without the project association, we won’t be able to find or collate them to analyze the data.

[Entering observations into the iNaturalist project](#)

Once you add a project to your account, it appears in a dropdown list under the Community tab at the top each time you log in via a desktop computer, and you can click on it to be taken to the JCWC project page. From there, you will see a large blue button at the upper right that says “Add observations to this project”. When you click that button, a new screen appears. At the top are the fields for the general information that must accompany all iNaturalist observations: species, date, and location. You can also upload photos for the observation here on the upper right of the page. **Please use the official name for your site location!** You don’t need to enter the latitude and longitude; you can type the site name or address into the search box under “Where were you?” and the interactive Google map will zoom to the location. If desired, you can drag the thumbtack on the map to a more precise location within the site, but you don’t need to move it for every odonate that you saw in a slightly different spot—the center of your survey area is fine.

To enter a species name you can type either the scientific or common name into the box; once you type a few letters, a dropdown menu appears from which you can select the desired name (this prevents entering mis-spelled names). The program has multiple levels of resolution; for example, you can select an ID as general as “skimmer” or as specific as “Common Whitetail” depending on your level of certainty.



Common Whitetail (*Plathemis lydia*).
Photo by CASM Environmental.

On the lower half of this same screen are all the data fields specific to this project, exactly as they appear on the data sheet. You must fill these in for every observation, even though several (start and end times, temperature) are the same for all observations made on a single day at the same site. We know this is a pain, but after consulting with iNaturalist staff, this is the only way to do it. A survey generally has only 8-12 species, so it won’t take too long to do. Once you fill in all the data fields and upload any photos that accompany the record (multiple photos can be uploaded for a single observation), hit “save and add another” if you

have multiple observations to record (the bonus here is that the site data will all be saved and appear automatically on the next screen), or simply hit “save observation” to save the final species of the day.

If you enter observations via a phone or tablet, first be sure you’ve added the project to your account. To do this, open the iNaturalist app, log in, tap the “More” icon at the lower right of the screen, and then tap “Projects” on the screen that appears. On the next screen, you will see the names of any projects you have joined. Be sure the JCWC project shows up on this screen! If you don’t see it in the list, type the project name into the search box at the top of the screen to find and add it. To add records, either without photos or with photos you took on your phone, tap the “plus” icon at the bottom corner of the screen. On the next screen, you can tap “no photo” for an observation without an image; tap the camera shutter button in the center to take a new photo; or tap the photo icon at to load an image from your device’s photo library. Once an image is selected, you can enter the species name. The app AI will also provide suggestions based on the photo and nearby species, but never assume the AI is always correct! At the bottom of that same screen (you may have to scroll down) is a line that says “Add to project(s)”; tap that to activate the JCWC dragonfly project, and you will see a new screen with all the different data items to be entered, just as they appear on the data sheet and the desktop version of iNaturalist. Be sure the slider button for the JCWC project is in the “on” position. As soon as it is turned on, the screen will show all the same fields as the data sheet, and you can enter each one for that observation.

Data entry screen in the iNaturalist phone app

Don’t be embarrassed if you get an ID wrong! The database of identified photos provides a terrific image gallery for comparison, and the friendly user community is always happy to provide a confirmation or correction, usually within a very short time. The project coordinator also checks observations on a regular basis and may leave a comment if there are any questions. Observers and identifiers can post comments along with their identifications, so discussion can also happen among the user community.

[« Projects](#)

Dragonfly Surveys in Johnson Creek Watershed

[Terms & Rules](#) | [Leave this project](#)

[Add Observations to This Project](#)

Stats

Totals <div>1321</div> Observations » <div>31</div> Species » <div>47</div> People »	Most Observations <ul style="list-style-type: none"> zee-sm 438 observations dnewberry 91 observations philnosler 89 observations cbeckel 55 observations blcomegys 52 observations 	Most Species <ul style="list-style-type: none"> zee-sm 25 species philnosler 22 species zv Kemp 21 species ddeck 19 species dnewberry 16 species 	Most Observed Species <ul style="list-style-type: none"> Pacific Forktail 154 observations Tule Bluet 132 observations Cardinal Meadowhawk 106 observations Common Green Darner 102 observations Blue-eyed Darner 102 observations
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RESOURCES

Field Guides

Dragonflies and Damselflies of Oregon. Cary Kerst & Steve Gordon. Oregon State University Press, 304 pp.

Dragonflies and Damselflies of the West. Dennis Paulson. Princeton Field Guides, 535 pp.

Dragonflies through Binoculars. Sidney Dunkle. Oxford University Press, 266 pp.

Stokes Beginner's Guide to Dragonflies. Blair Nikula, Jackie Sones, Donald Stokes and Lillian Stokes. Little, Brown and Company, 159 pp.

OdonataCentral ID app, <https://www.odonatacentral.org/#/> , for iOS and Android; free

Equipment

Forestry Suppliers, www.forestry-suppliers.com

Carolina Biological, <http://www.carolina.com>

Acorn Naturalists, <http://www.acornnaturalists.com>

Web Sites

OdonataCentral, <http://www.odonatacentral.org>

Dragonfly Society of the Americas, <https://www.dragonflysocietyamericas.org>

Western Odonata Facebook page, <https://www.facebook.com/groups/WesternOdonata/>



Tule Bluet (*Enallagma carunculatum*).
Photo by CASM Environmental.

JCWC Dragonfly and Damselfly Community-based Monitoring Project Data Sheet

DATE _____ SITE NAME _____ START TIME _____ END TIME _____

OBSERVER NAME(S) _____

WEATHER: Temperature _____ °C / °F Wind (calm, light, moderate, strong) % cloud cover _____

Species List: Record the species observed; circle 'M' and/or 'F' to indicate whether males and/or females were present. Record all ID methods and reproductive stages observed using the appropriate letter codes, and indicate abundance stage after all counts are done.

Identification method

(record all that apply)

V (visual)
C (captured)
P (photograph)

Abundance category

U (uncommon, 1-4)
F (frequent, 5-20)
C (common, 21-100)
A (abundant, >100)

Reproductive stage

(record all that apply)

W (wheel)
TP (tandem pair)
O (ovipositing)
TA (teneral adult)

Species Name	ID Method	Reproductive stages	Abundance
	M F		
	M F		
	M F		
	M F		
	M F		
	M F		
	M F		
	M F		
	M F		
	M F		
	M F		

NOTES: