Herpetofauna and Fish Surveys in Northern California High-elevation Aquatic Habitats 2021 Field Protocols and Data Recording Instructions

California Department of Fish and Wildlife, Northern Region, Inland Fisheries

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2021-2022 Goals: This survey is designed to estimate current amphibian and nonnative sportfish occupancy patterns, relative abundances, and long-term distributions and population trends of these species across montane northern California. This information will be used to identify climate-resilient habitats and the recovery of sensitive aquatic amphibians while informing current and future management of widespread nonnative sportfish populations.

iPad-Survey123 Data Capture Procedures

Survey Header (main survey form) Methods

The Survey Header is the main data from and contains all elements of the survey including site-level information and the three survey Subforms: Visual Encounter Survey, Cascades Frog Mark-recapture, and Fish Survey. Survey headers must be filled out thoroughly for each site. All survey forms need to be reviewed for accuracy after the survey to ensure all the relevant fields are filled in and the data are accurate. Most visual encounter and fish survey sites in this survey were surveyed around 20 years ago. This effort will duplicate the previous effort across hundreds of survey locations so long-term comparisons can be made across the landscape. Many habitat attributes collected during the original survey 20 years ago will not need to be repeated if the site hydrology is stable and the site has changed little between survey visits.

Basin ID: Numeric code (integer) labeled on topographic map identifying the unique basin a given site is located. Record the **Basin ID** for every site that is surveyed. Use "999" if survey is outside of a mapped basin.

Site ID: The unique numeric Site ID (decimal) found on reference maps (e.g. 827.01). Use "999" for surveys of sites located outside of study area (not in a mapped basin) or for incidental observations of animals that are not in sites (e.g. rubber boa on road, cascades frog at road crossing etc.)

Site Name: (Text) Name of site on topographic map. If unnamed enter "NA".

Survey Date: The date of the survey visit.

Site Location: An expandable map used to pinpoint and adjust the surveys XY location. It's extremely important to get accurate site coordinates for every survey location (site) whenever a header is filled out. For meadows, get a location in the center of the site, for lakes/ ponds get either the center if dry, or the outlet location of larger ponds and lakes as its furthest from the cirque headwall and has better satellite coverage.

UTM Easting: Easting coordinate (6 digits) automatically populated from **Site Location** map with adjustable curser. Also allows user to delete auto-populated coordinates from **Site Location** with those from another GPS (Inreach) device. All spatial projections for all devices will be set to UTM-NAD83-Zone10.

UTM Northing: Northing coordinate (7 digits) automatically populated from **Site Location** map with adjustable curser. Also allows user to delete auto-populated coordinates from **Site Location** with those from another GPS (Inreach) device. All spatial projections for all devices will be set to UTM-NAD83-Zone10.

Site Type: (Lookup List) Enter the appropriate category that best defines the wetland type. On a 7.5' map, a lake with a surface area of 0.5 hectares is approximately 3 mm x 3 mm viewed at 100%. (0.5 hectares= 50 x 50 meters). If the site is a waterbody >0.5 hectares (ha) and >2 m deep, select: **Lake**. If the site is a shallow waterbody <2 meters deep and <0.5 ha select **Pond**. For meadows and large meadow ponds see table below and select the most appropriate meadow type. If the site is along a stream lacking meadow habitats then select **Stream**; if the site is a constructed water drafting location next to a road, select **Drafting Pond**; if the site is an artificial reservoir of any size, select **Reservoir**; for other site types, select **Other**, and add description to the **Site Visit Notes**.

Meadow Type	Description
Basin Peatland	Meadow occurs along edge of lake and includes floating vegetation mats on top of water.
Depressional Seasonal	A meadow or pond surrounded by peaty soils that occurs in a topographic depression and dries up most years
Depressional Perennial	A meadow or waterbody surrounded by peaty soils that occurs in a topographic depression and retains some water all year.
Discharge Slope	Dominant source of water is from ground water that emerges at or near the meadow surface in the form of springs or seepage areas.
Lacustrine Fringe	Meadow occurs along edge of lake, but not floating/ entering the water. Meadow has discrete isolated lentic habitats that could be used for amphibian breeding.
Riparian High Gradient	Stream Slope >4%
Riparian Middle Gradient	Stream Slope > 2-4%
Riparian Low Gradient	Stream Slope < 2%

Site Length (m): Estimate or pace the maximum length of the site to 0.1 meters. Not required if the length is listed in the FieldMaps site attribute table AND if water levels are stable. If the site is drying, record current site length.

Site Width (m): Estimate or pace the average width of the site to 0.1 meters. Not required if the width is listed in the FieldMaps site attribute table AND if water levels are stable. If the site is drying, record current average site width.

Lotic (m sq.): Decimal (00.0) Reserved for Meadows. Estimate the total lotic (flowing) habitat in meters squared available during the survey visit.

Lentic (m sq.): Decimal (0.00) Reserved for Meadows and Ponds or Lakes that are experiencing drawdown (drying) during the survey visit. Estimate the total lentic (standing) habitat in meters squared available during the survey visit.

Hydrology: (Lookup List) What is the hydroperiod of the site? Determine the best category that describes the sites persistence.

Hydrology	Persistence	Attributes
Short	<1 year	Temporary or no inlets/ outlets. Shallow often <1 meter deep. No aquatic vegetation. Fairy shrimp but few other invertebrates. Not spring-fed. Submerged cracked mud bottom indicating annual drying. Usually dries within weeks to mid-summer after snowmelt disappears.
Intermediate	1 to 5 years	Temporary or no inlets/ outlets. Shallow often <1.5 meters. Little/ no aquatic vegetation. Rarely spring-fed. Drawdown/ bathtub ring evidence prominent. Dries often in drought years.
Perennial	Decades	Often has perennial inlets/ outlets. Often >1 meter deep. Aquatic vegetation/ lily. Robust invert diversity. Fish present. Often spring-fed. Could dry in exceptional multi-year droughts.
Permanent	Centuries	Often has perennial inlets/ outlets. Deep, often greater than 5 meters. Aquatic vegetation/ lily. Robust invert diversity. Fish present. Large watershed area. Never dries.
Artificial	Unknown	Man-made reservoir or highly modified/ dammed natural site used for water storage.
Unknown	NA	

Turbidity: (Lookup List) What is the turbidity of the site? If the water is clear, select **Clear**; if the water is transparent, but tea-colored with tannins, select **Stained**; if the water is not transparent and turbid, select **Cloudy**.

Inlets: (Integer) How many significant flowing inlets enter the site during your survey?

Outlets: (Integer) How many significant flowing outlets exit the site during your survey?

Drainage: (Lookup List) What is the drainage class for the site? If the site has at least one inlet and one outlet with flowing surface water that you estimate will flow all summer long, select **Permanent**; if the site only has dry inlet and outlet channels, or the inlets and outlets have low surface water flow that you estimate will go completely subsurface before the end of the summer, select **Occasional**; if the site has no evidence of inlet or outlet channels, select **None**.

Max Depth (m): Decimal (00.00) What is the maximum depth of the site during your visit? For lakes and ponds, find the deepest location in the waterbody. For meadows, find the deepest feature in the wetland complex—lotic or lentic. Lakes and ponds with stable water-levels that have depths from previous surveys listed in the FieldMaps site attribute table are not required to have new depths recorded—record depth listed from previous survey. For shallow ponds, measure depths with a tape measure. Lakes and large ponds require soundings (electronic or gill net rope with rock bag) from a float tube.

Depth Category: (Lookup List) Select the appropriate depth category for all survey sites in addition to recording maximum depth. Select **Dry** if the site is dry during the survey visit. If you are not able to obtain a maximum depth for a waterbody or meadow-complex then use your best visual judgement for depth category t characterize the site.

- <1 Meter
- 1-2 Meters
- >2-<5 Meters
- >5 Meters
- Dry

Drawdown (m): Decimal (00.00) Record the vertical distance (height) from the water surface at the time of your visit up to the bank-full line or bathtub ring where the site is expected to be completely full in the spring.

% Silt Transects: (Integer) (lentic waters only) What is the littoral zone silt substrate composition? Not required if Littoral Zone substraight is listed in the FieldMaps site attribute table. If the site is small or has lots of amphibians, estimate silt after the VES is complete.

Sites <100-meter wetted perimeter: estimate % of the total littoral zone that is made up of silt.

Sites with >100-meter wetted perimeter: conduct littoral transect surveys and convert to a percentage silt.

Meadow sites: estimate the % silt of all wetland features combined as we do not conduct transects in meadows.

Transect method: While walking around the lake/ pond perimeter during the VES, stop after a set number of paces and categorize the substrate at the lake edge in your field notebook using the dot method (pace count is related to obtaining 50 evenly distributed transects at a site depending on its estimated perimeter [e.g. the pace count for a site perimeter of 200m is 4m]). Determine if silt is the dominant substrate along a 1 m wide imaginary transect line starting at the lake edge, extending perpendicular from shore 3 m out along the lake/ pond bottom. Silt particles are classified as being <0.06mm. When at a transect where there is less than 3 m of water from the

shore to the center of the lake, categorize the transect using whatever length is present from shore to the center of the lake. Tally silt when it's the greatest proportion over all other types (i.e. pebble, gravel, cobble, boulder, bedrock). Tally "other" when silt is not the dominant substraight. After the survey, calculate the % silt out of the total transects and record answer in field forms.

Surveyors: (Lookup List) Select all surveyors that helped collect any data at the site (i.e. VES, CMR, Fish, Habitat).

Wind: (Lookup List) Enter the appropriate letter to represent current wind conditions at the site. If there is no breeze present, select **Calm**. If there is an intermittent or steady light breeze present, select **Light**. If there is an intermittent or steady moderate wind present, select **Moderate**. If there is an intermittent or steady heavy wind present, as evidenced by white-capped waves on the surface of a waterbody, select **Strong**.

Weather: (Lookup List) Select the appropriate category to represent the weather condition during your VES. If the sky has less than 5 percent cloud cover, select **Clear**. If the sky has 5-50 percent cloud cover, select **Partly Cloudy**. If the sky has 51-95 percent cloud cover, select **Mostly Cloudy**. If the sky has 100 percent cloud cover, select **Overcast**. If it is raining, select **Rain**. If it is snowing, select **Snow**. If wildfire smoke is substantial, widespread, with poor distant visibility, select **Smoke**.

Air Temp (°C): Measure air temperature at the start of your VES survey from the shore at 1 m above the water surface.

Water Temp (°C): Measure the water temperature at the start of your VES survey approximately 0.5 m out from shore and 10 cm under the water surface. For meadows, record the water temperature in a location that best characterizes the meadow temperature (pond or stream).

Survey Type: (Lookup List) What type of survey was conducted during the site visit? Select **Formal GRTS** at basins/ sites drawn for VES censuses; select **Formal Incidental** when a formal VES was completed but occurred within basins not drawn for VES censuses; select **Incomplete Survey** when a partial VES or incidental observation was recorded at a site or at a random location such as a trail or road etc; select **CMR Only** for Cascades Frog capture-mark-recapture surveys; select **Fish Survey Only** when a site was only surveyed for fishes.

Disturbance (Lookup List): Select all disturbance categories observed at the site during your visit. Disturbance can be natural or artificial. Pay special attention to site outlets to see if they have small rock dams influencing hydrology or head cutting in meadows caused by livestock or OHV tracks. Although VES surveys should be avoided during high recreational activity, record **Other** and add a comment in the **Site Visit Notes**. Add emphasis for any significant site disturbance in the **Site Visit Notes.**

- Beaver
- Elk
- Bear
- Wildfire
- OHV tracks
- Passenger Vehicle Tracks
- Dam on Natural Site
- Water Diversion
- Camp Development
- Recreation Trail
- Road Through Site
- Livestock Grazing
- Livestock Wetland Damage
- Channel Incision
- Landslide
- Logging
- Boat
- Dock
- Farm
- Cannabis Farm
- Homestead
- Mining
- Tree Cutting
- Trash
- Other (specify)

Site Visit Notes (Text): Any important notes related to the site and your survey visit.

Site Drawing: (Freehand) Draw the site perimeter. Add prominent inlets, outlets and streams. For meadows, add ponds that are of interest; also add ponds and edge meadows of interest that were surveyed along with a main large pond or lake. Indicate deep spot for ponds and lakes. Label with SiteID.

Site Photo: Take a photo that best captures the sites overall habitat and setting. This is usually achieved from a vantage point above the site. Make sure the lens on the iPad is clean of dirt or residue.

Visual Encounter Survey Methods

We will be conducting amphibian and reptile (herp) surveys at all bodies of water shown on the FieldMaps application. We will also potentially survey new sites not shown on the map but are found during surveys or while traveling between sites. You will need a notebook, datasheet, and or iPad/GPS, pencils, thermometer, dip net, and timepiece for determining total survey duration. Time of day, temperature, and weather are important factors affecting the quality of any VES survey. Time your surveys to occur during the warm portions of the day (roughly 9am – 5pm), however, the time window can vary depending upon time of year and local favorable conditions. If the weather is too cold or stormy, VES surveys can be very inaccurate, so you should not conduct surveys during inclement weather.

To conduct an amphibian/reptile survey at lakes and ponds, start your timer and walk **slowly** around the perimeter of the site, visually scouting for amphibians and reptiles near the shoreline while counting the number of adults, sub-adults, YOPY (young-of-previous-year), metamorphs (neonates [snakes]), larvae, and egg masses you find of each species. Pause often to look ahead for basking animals. Use your net to sweep habitat and banks to spook hidden animals. If its windy enough to obscure the water column with surface ripples, wait for water surface to clear between gusts. If humans are recreating along the shore or in the water then request if they could pause until you move through. Depending on the number of campers at the site, choose a time in advance when the site is likely to be less busy (mid-morning). For meadows, do a timed herp survey focusing on shorelines and aquatic and wadable habitats. Do not completely ignore the rest of the meadow (e.g. zig-zag through moist areas that are near open water features). Run the stopwatch throughout the meadow survey to determine survey duration.

For prominent inlet and outlet streams at lakes and meadows, survey channels where they meet the feature for up to 50 meters for amphibians, reptiles, and fishes. If the stream connects to another survey site in under 50 meters, survey half the distance to the other site so the inlet/ outlet survey can be done at each site.

Use a dip net to catch herps for identification if necessary and record in field notebook, iPad, or data sheet. All data needs to be entered into Survey123 during the same day of the survey regardless of how it was recorded. Each species/life stage/survey method combination detected should be recorded in a separate rows (e.g., treefrog adults detected **Visually** during the timed survey in one row, and adults detected **Aurally** during the timed survey in another row). In addition, each species/life stage/survey method combination detected incidentally (e.g., detected before or after the timed survey) also should be recorded in a separate row under **Incidental**. For large Lakes/ ponds and meadows, record UTMs for all spatially separate habitat features having reproductive stages (Egg, Larvae, Metamorph).

Visual Encounter Survey Subform

If the site is being surveyed with two passes for determining species detection rates, then each surveyor fills out their own **Visual Encounter Survey** subform under the same Header. If the site is large and is being surveyed by multiple observers during each pass, then each surveyor fills out their own Visual Encounter subform under the same header form.

VES Surveyor: (Lookup List) indicate the surveyor doing the VES pass.

VES Observer: (Lookup List) Choose **Single** for a site that is only surveyed with one pass. For resurvey sites used to calculate species detection rates, choose **Primary** (first observer), or **Secondary** second observer depending on which VES is being done (first or second). If the site is large, requires only a single pass but is split between two surveyors, each surveyor each surveyor fills out their own **Visual Encounter Survey** subform under the same Header and selects **Single.** If the site has 2 passes with two surveyors splitting the effort, both surveyors fill out a VES for the first pass under **Primary**. After the primary survey, both surveyors switch sides and complete the second survey under **Secondary**.

Start Time: (12-hour) The time when the VES is initiated.

End Time: (12-hour) The time when the VES is completed.

VES Duration: (Minutes) Record the total time spent searching by using a stopwatch while searching for amphibians and reptiles. Do not include time spent surmounting lake-side obstacles (e.g., cliffs), identifying specimens in hand, or recording extensive notes. The duration is used to calculate observations based on effort. If two people survey the same site by walking in opposite directions around the lake perimeter, each person enters their own survey duration in their own **Visual Encounter Survey** subform.

VES Details

UTM Easting: Easting coordinate (6 digits) of observation location automatically populated from **Observation Location** map with adjustable curser. Also allows user to delete auto-populated coordinates with those from another GPS (Inreach) device. All spatial projections for all devices will be set to UTM-NAD83-Zone10.

UTM Northing: Northing coordinate (7 Digits) of observation location automatically populated from **Observation Location** map with adjustable curser. Also allows user to delete auto-populated coordinates with those from another GPS (Inreach) device. All spatial projections for all devices will be set to UTM-NAD83-Zone10)

Species: (Lookup List) Select the species you have detected. If you cannot determine species, identify to the lowest level (e.g. Anura Sp.).

- Cascades Frog
- Pacific Chorus Frog
- Western Toad
- Coastal Tailed Frog
- Foothill Yellow-legged Frog
- Bullfrog
- Anura sp.
- Long-toed Salamander

- Rough-skinned Newt
- Sierra Newt
- Coastal Giant Salamander
- Northwestern Salamander
- Salamander sp.
- Southern Alligator Lizard
- Northern Alligator Lizard
- Elgaria sp.
- Common Garter Snake
- Aquatic Garter Snake
- Terrestrial Garter Snake
- Sierra Garter Snake
- Thamnophis sp.
- Racer
- Gopher Snake
- Rubber Boa
- Northwestern Pond Turtle
- Red-eared Slider
- Fairy Shrimp sp.
- Rainbow Trout
- Brook Trout
- Brown Trout
- Trout sp.
- American Dipper
- Spotted Sandpiper
- Osprey
- Bald Eagle
- River Otter
- Mink
- American Beaver
- Elk
- Mountain Beaver
- Cattle
- Other (specify)

Life Stage: (Lookup List) Select the life stage you have detected for a given species: **Egg, Larvae, Metamorph** (first fall), **YOPY** (young of previous year)**, Subadult, Adult, Neonate (snakes).**

Detection Type: (Lookup List) Select the method used to detect a given species.

- Visual
- Trapped
- Hand
- Net
- Aural
- Gill Net
- Incidental
- Found Dead
- Scat
- Tracks
- Den
- Nest
- Dam
- Chews

Breeding Waterbody Type: (Lookup List) Reserved for reproductive stages. Select the type of waterbody where age 0 juvenile stages of amphibians are present. Stages include eggs, larvae, and metamorphs.

- Lake
- Permanent Pond
- Temporary Pond
- Stream
- Stream Backwater
- Reservoir

Total Detected: (Integer) Record the total number of detections for a specific data entry group.

Total Swabbed: (Integer) Record the total number of animals swabbed for Bd (amphibians) or OO (snakes) from a specific data entry group. (*see* Bd and OO sampling Appendices)

Time at Detection: (12-hour) The time of the given species observation and age class. This field is largely reserved for recording the time at first detection for a given species at each site relative to the total survey duration. These data will be used to determine detection probabilities for species/ age classes. Record the first observation of any amphibian reproductive stage (egg, larvae, metamorph) and the first for any post-reproductive stage (YOPY, subadult, adult).

Observation Notes: (Text) Notes related to the specific species/ age class data entry group.

Fish Survey Subform

Fish Detection Methods: (Lookup List) What methods were used to detect fish? Select all that applied to the visit regardless if fish were seen or not.

- Visual
- Gill Net
- Hook and Line
- Carcass

Fish Species Present: (Lookup List) What species of fish were observed at the site? Select all species observed across all survey methods. If there are no fish present in at the site enter **None**.

- Brook Trout
- Rainbow Trout
- Brown Trout
- Golden Trout
- Trout sp.
- Golden Shiner
- Goldfish
- Other (Specify)

Fry Seen: (Lookup List) Were fry seen at the site? (yes, no, unknown)

Redds Seen: (Lookup List) Were redds seen at the site? (yes, no, unknown)

Fish Locations: (Lookup List) If fish were detected at the site, select all habitat types where fish were observed based combined methods (e.g., gill net, VES, redds etc.).

- Lake/Pond
- Inlet
- Outlet

Fish Survey Notes: (Text) Specific notes related to the fish survey, fish observations, and sign.