AMERICAN RIVER

ROTARY SCREW TRAP PROTOCOL

October 2018

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INTRODUCTION

Monitoring data can provide the foundation for successful management programs if data are collected in a systematic, consistent, and comprehensive manner. The monitoring of the abundance/production of juvenile salmonids on the lower American River is important because large sums of funding are spent restoring aquatic habitat in an effort to increase the number of juvenile Chinook salmon (*Oncorhynchus tshawytscha*) and steelhead (*Oncorhynchus mykiss*) in that watershed. Rotary screw traps (RSTs) are one of the most important tools for monitoring juvenile salmonids. When data acquired with these tools is collected in conjunction with other monitoring data, there is a substantially improved ability to track the status of those salmonids and assess their response to past management activities. That data in turn can be used to adaptively manage future restoration projects so that they are more successful.

The objective of this document is to ensure that RST data from the American River in California's Central Valley is collected in a safe, systematic, consistent, and comprehensive manner. To address this objective, this protocol provides detailed descriptions for operating and maintaining RSTs, collecting and processing fish, collecting environmental data, conducting trap efficiency tests, and entering data into a RST "platform" developed by the U.S. Fish and Wildlife Service's Comprehensive Assessment and Monitoring Program (CAMP).

The American River RSTs are located 0.25 miles downstream of the Watt Avenue Bridge in Sacramento County, California. Between two and three RSTs will be operated each year, and those traps could consist of different combinations of 5 and 8 foot RSTs. Under ideal conditions, it is expected that one 5 foot RST will be operated in the South Channel of the American River, and two 8 foot RSTs will be operated in the North Channel. In descending order of abundance, the following salmonids could be captured in the American River RSTs: fall-run Chinook salmon, steelhead/rainbow trout, spring-run Chinook salmon, winter-run Chinook salmon, and late-fall-run Chinook salmon.

The CAMP has developed a general protocol for conducting RST activities. That document can be found at https://www.fws.gov/cno/fisheries/CAMP/Documents-Reports/Documents/2008_draft_CAMP_Rotary_Screw_Trap_Protocol.pdf. The general guidance in that document should serve as a companion to the more detailed guidance in this document.

Employees who are engaged in servicing the RSTs on the American River are responsible for having a firm understanding of all the information covered within this protocol.

SAFETY

Safety should always be the field biologist's primary concern. Never perform a task if it cannot be performed safely. A minimum of two crew members are required to service RSTs at any given time. At least one biologist must have a working cell phone when in the field.
RST activities occur in an environment where field biologists can be seriously injured by rotating mechanical parts, crushed between a boat and a trap, or drown if they do not wear personal protective gear. The American River is a large river in a major metropolitan area. As such, RST operations have the potential to seriously injure members of the public who use the river for recreational purposes if those individuals become caught in the trap. The proximity of the American River RST site to the city of Sacramento also creates the potential that field biologists servicing the traps could be exposed to discarded hypodermic needles or pathogens that may be present in the river. These situations, in combination, therefore demand that field biologists servicing the American River RSTs pay attention to, and implement, measures that are designed to ensure their safety and the safety of the public.

Crew members are required to wear their personal flotation devices at all times when they are on a boat or a trap.

Proper communication is essential when operating a motor vessel. When piloting a boat, the boat captain should make sure their intentions are clear to boat passengers. The captain should give clear warnings before they are about to engage or disengage the throttle, or make a turn. This will give boat passengers proper time to sit down and become stable. The small boat used on this project can be very unstable especially when standing or kneeling, and may be easy to fall off of when an unexpected move is made.

Great care should always be taken when working on a RST. Be cautious to always keep hands, loose clothing, and other items away from the cone, shaft and other moving parts during trap operations. Be cautious when moving around on a trap because numerous hazards exist, e.g., the winch, cleats, cables, frayed cable, etc. Familiarize yourself with these hazards and use caution when moving about. Never move across the number one crossbeam (in front of the trapping cone) when the trap is fishing. If traps have been modified by installing catwalks in the front of the trap, biologists should use caution when they are on the catwalk and avoid the potential that they could accidentally end up inside the trap cone.

Always be aware of other crewmember locations and activities on the trap. Keep alert for boat traffic and boat wakes, and during high flow conditions watch for large debris that may collide with the RST or boat.

When pulling the boat up to a trap, all crew members should give this part of the operation their full attention. Do not place any part of your body in between the boat and a trap during an approach or while moored to a trap; together, the boat and trap can crush and cause severe injury to your body. If available, put the boat fenders over the side before pulling alongside a trap. The boat operator should drive the boat slowly when approaching a trap. The boat operator should carefully maneuver the boat alongside the trap pontoon so a crew member can step, not jump, from the boat to the pontoon. Once someone is safely on the trap and the boat has been secured to the trap, the boat operator can shut down the boat motor. The crew should make sure that the fenders are adjusted properly to prevent the boat and trap from rubbing together and that the boat is securely tied to the trap. The boat should never be operated directly in front of the trap; if the boat loses power, the current will push the boat into a trap cone and possibly damage and/or sink the boat. Assume the jet boat can lose the ability to propel itself when debris gets caught into the intake of the jet pump, and plan accordingly.

Transferring gear or persons between the boat and trap should occur with the full knowledge of all crew members. One person should be on the boat and another on the dock/trap and gear should be transferred from crew member to crew member. When stepping on or off the boat, be aware that the boat will shift. Furthermore, be very careful when stepping on or off the trap or walking on the trap. The pontoons and live-box lid may be slippery any time they are wet or biologist's boots/shoes are wet, but they can be especially slippery due to frost or ice in the winter or algal growth in the spring and summer.

Check the winch cable and mooring cables for fraying. Use caution when handling cables to avoid punctures to hands from frayed cable. Check the following for damage: cone mesh, quick links, cleats, and eye bolts. If damage is found, notify the entire field crew of the damage and take steps to promptly repair that damage. When raising or lowering the trap cone or live-box door, all crew members should know each other's whereabouts on or off the trap and everyone should be aware this procedure is taking place. One person should observe the trap cone while another person is raising or lowering the cone. Remember that it can be difficult to see the front of the cone when operating the winch. Crew members should look to make sure trap components are functioning properly, there are no obstructions in the pulleys and the #2 beam, collars are secure, debris has not accumulated on the trap components, winch cables are not damaged, etc. The person initiating a procedure should make it known by saying aloud that the trap cone or live-box door is about to be moved, and all others should acknowledge they are aware of what is about to take place. When the trap cone is being lowered, keep toes clear of the cone to prevent them from being crushed between the #2 crossbeam and the pontoon. Always secure the live-box door if it is in an open position to preclude the potential of being hit by the live-box door.

The crew should observe weather and river conditions prior to their day in the field. Utilize the guidance plots on the Department of Water Resources CDEC website to see if a forecasted increase of river rise and flow may occur when out in the field. On days when the river may rise, the crew must go to the field with waders and vest PFD's. Such days tend to coincide with heavier and larger debris that may get caught on or in the traps.

COMPLETING DATA SHEETS

Properly completing data sheets is critical to project success; this aspect applies to every data sheet used during the American River RST project. Data sheets should be clear, legible, and contain all information needed to accurately interpret data at a later date, i.e., a data recorder should ask themselves if someone could accurately and completely infer what data were collected five years after the form was filled out. If there is more than one data sheet for a particular site, make sure they are labeled appropriately (e.g., site name, page 1 of 2, etc.). Make all information clear enough so someone not familiar with the field activities can interpret the data accurately (i.e., use standard abbreviations, no omitted data). There should never be any empty spaces for relevant data on a data sheet. If data are not taken, draw a line through the appropriate box and write a short explanation in the "Notes" section of the Trap Visit data sheet.

Additional comments regarding any variations in procedure, notable field conditions or other pertinent information should be recorded on the Trap Visit data sheet, e.g., any river conditions affecting trap operation or changes in a trap's deployed position should be noted.

Use the following conventions when filling out data sheets:

1. A data sheet will be filled out every time a trap is set and every time a trap is checked. Use a pencil, and your best and clearest non-cursive handwriting.

2. Corrections can be made by erasing a mistake if the sheet is dry, or putting a line through the mistake and clearly writing correct information nearby.

3. Completely fill out each portion of a data sheet. If a section of the data sheet is left blank, draw a line through it and explain why it wasn't filled out in the "Notes" section of the data sheet.

4. **NEVER ESTIMATE DATA**, i.e., record measured values only. If a value cannot be measured, put a line in the box where that value would be recorded and provide an explanation in the "Notes" section of the data sheet.

5. **Zeros and lines are not interchangeable.** Zeros should be used if the value was measured and found to be zero, or if zero fish were captured. Lines should only be used if the measurement was not taken or the section was left blank.

6. If there were logistical or operational conditions that occurred and resulted in an atypical sampling period, completely and clearly explain what the conditions were in the "Notes" section on the data sheet. Keep explanations professional and organized for clarity. (Ex: if the trap was stopped on arrival, explain in the "notes" section what appeared to have stopped it.)

7. If a site was sampled and no salmonids were caught, fill in all of the relevant fields on the data sheet with trap check and environmental data, and mark the boxes for salmonid catch with zeros. If no fish of any species were caught, put a note on the data sheet explicitly stating no fish were caught. The occurrence of situations with no catch data is critical because it is used in the calculations of juvenile salmon production estimates.

8. For all fish species, the lengths of dead fish should be recorded separately from live fish on the data sheet, and the appropriate mortality status noted.

9. Plus counted fish need to be clearly labeled as "Live unmeasured" or "Morts unmeasured." Those numbers should then be totaled on the Trap Visit data sheet.

10. The presence and number of marked juvenile Chinook salmon that are captured (or recaptured) should be recorded on the Trap Visit data sheet in the special section reserved for those fish. If more than one kind of mark is observed in the fish captured on a given day, take care to segregate the data from fish with each kind of mark.

TRAP STATUS, ENVIRONMENTAL DATA, AND FISH CATCH DATA COLLECTION

The procedures described below are presented in the sequential order that would be implemented in the field. This work flow has been designed to make field activities as simple, efficient, and complete as possible.

When traps are deployed in a "cone-down" position and are actively fishing, they will be checked at least once every 24 hours, and more frequently on days when there are high river discharge levels, heavy debris loads, or the capture of thousands of salmon that could adversely affect the health of fish sequestered in RST live-boxes. On days when traps will not be checked within a 24-hour period, trap cones will be raised out of the water and placed in a "cone-up" position to preclude fish capture.

Trap Status and Environmental Data

When the field crew initially arrives at the trap, they should inspect the trap for any signs of trespass or damage before they exit the boat and step on the RST. If no signs of trespass or damage are found, the crew can board the trap and collect and record data on the Trap Visit data sheet that characterizes the operational status of the trap and environmental parameters at the time of the trap visit. A separate data sheet should be prepared for each trap cone. The following data should be recorded on each Trap Visit data sheet prior to processing the trap livewells:

- Date
- Trap ID
- Visit type ID
- Trap functioning ID
- Cone intakes status
- Before cleaning cone revolutions per minute (RPM)
- After cleaning RPM (taken after the trap cleaning process detailed below)
- Water velocity
- River depth
- Staff gauge and time
- Water temperature
- Water dissolved oxygen
- Water sample taken indication
- Weather (including air temperature)

If the trap is stopped upon arrival, record the total number of revolutions on the counter and explain the circumstances in the "Notes" section of the Trap Visit data sheet.

Refer to Appendix C for instructions on how to collect and record data pertaining to the trap status and environmental parameters.

Cleaning the Trap

Before all the fish have been removed from a RST during a day time check, the trap should be cleaned so it can operate as efficiently as possible.

After cone intake status has been assessed, the cone intakes should be cleared of debris. Extreme caution should be exercised when attempting to remove small or loose debris from a rotating cone or shaft. If debris cannot be removed while keeping hands well clear of the rotating intakes,

lock the cone in a non-rotating configuration before attempting to remove the debris. Always inform all present crew members before stopping the rotation of a cone.

Check for and remove any large debris from the front of the trap, stopping the cone if necessary. Remove any large debris caught inside the trap by stopping the trap, and opening a cone door to access the inside of the cone. **Never, under any circumstance, crawl or climb inside the RST cone while the trap is on the river.**

Clean the rear live-box screen with a scrub brush and rinse the debris off as best as possible. Under no circumstances should the live-box screen be removed unless sampling has been terminated. If the live-box screen needs to be removed, all fish and debris should be removed first and a new time should be recorded for the Visit Time 2 field on the data sheet. Sweep silt/debris out of the live-box, rinse debris off the trap deck, and check/clean pontoons for algae growth.

If a trap cone needs to be raised or lowered for cleaning purposes (or if the trap needs to be moved on or off the river), always be cautious when using the winch crank. When raising the cone, keep a hand on the winch crank handle at all times and make sure the latch is caught in the gear securely. Latches tend to wear and if not secure, the winch handle may spin quickly and cause injury. Make no attempt to stop a winch handle that is unsecure and spinning quickly. If the trap cone needs to be lowered, one person will lower the trap cone, while another guides the A frame. Be sure both individuals are aware of the other person's actions and coordinate their respective activities. The person on the winch should announce that the trapping cone is coming down while the other person should watch for problems as the trap cone lowers.

After all debris has been removed from the cone intakes, the inside of the cone and the front of the cone, the cone exteriors should be scrubbed to remove built up algae. Cones can also be lightly tapped with a broom end to remove leaf litter and other small debris.

After the trap has been cleaned and is rotating in the water, the rotation rate of the cone should be assessed again and the RPMs are recorded in the, "After Cleaning RPM" field on the Trap Visit data sheet.

Fish Catch Data Collection

Weather and river conditions will dictate the order of the trap cleaning and fish processing activities. When the weather is cool and the potential that temperatures could be a stress factor for fish is minimal, trap maintenance activities should occur first, and then fish processing. This approach maximizes the amount of sampling to the fullest extent possible. If the weather is

warm or fish could be adversely affected if they are held for a substantial period of time, the fish should be processed first, and then trap maintenance activities should occur. The text below assumes that trap maintenance activities will occur first since weather and river conditions will most commonly be benign.

If at all possible, the trap cone should not be raised before the fish are removed from the live-box. Raising the trap cone creates a gap through which fish can escape, so it is best to keep the trap cone in the fully down position until the live-box has been cleared.

Setting Up and Maintaining Buckets, Insulated Coolers, and Live Cars

Prepare to remove fish from the live-box by filling buckets with river water. Live cars or insulated coolers will also be prepared for fish sequestration if more than 500 fish are observed in the live-boxes when they are first checked. When fish are being held in buckets, place the buckets in the shade and place lids on top of the buckets when they are unattended.

Use the dissolved oxygen (DO) meter to periodically check the water temperature and dissolved oxygen levels in the containers used to sequester fish. Make sure the difference in water temperatures and dissolved oxygen levels between the buckets/coolers and river does not exceed a 2° Celsius or 7–10 milligrams/liter difference, respectively. Add fresh river water to the buckets and coolers if they become too warm or experience depleted dissolved oxygen levels. If necessary, use an aerator to help maintain DO levels that are equal to, or greater than, the river water. Frozen water bottles may be added to containers used to hold fish on warmer days to help maintain cool water temperatures.

Collecting Fish

Before clearing the trap live-box, set up a work station. Fill a large 18 gallon tote halfway with fresh water, and set up buckets filled with water within easy reach. Begin the process of clearing the trap live-box by scooping larger debris out of the live-box with a pitchfork, making sure to search that debris for fish. If fish are found with the large debris, remove the fish and place them in a bucket with fresh water. After the larger debris is removed, use the pitchfork to scoop debris from the surface of the live-box, shaking the pitchfork lightly to dislodge any fish trapped within the debris. Place the pitchforks of debris into the 18 gallon tote until the tote contains only as much debris as can be completely submerged by gently tamping down. Then, grab about a quart of debris from the tub at a time, and place on a flat surface such as a large fish measuring board. Debris can then be spread out and sorted through to find any fish. Carefully sort through the debris using a stick, salad tongs, or other probe, **DO NOT use your hands;** hypodermic needles or other sharp objects could be present.

When debris is on the sorting surface, removed from the water, it is important to sort the fish out as quickly as possible. Carefully find and remove all fish, remembering that some will be very small. Place fish in buckets filled with water according to the conventions listed below.

After any fish have been sorted out, place the debris remaining on the sorting surface into a five gallon bucket, making sure to pack down the debris to get an accurate amount. When the five gallon bucket is full, discard the debris behind the trap, and keep tally of the number of buckets that have been filled to quantify the total amount of debris in the livewell. Collect man-made trash and dispose of it properly.

When a majority of debris has been removed from the live-box using the pitchfork, replace the water in the 18-gallon tub. Then, use a large net to scoop smaller debris and fish out of the live-box. Scoop no more than 1/2 a net of fish/debris at a time, and gently empty the nets to place the contents in the fresh 18-gallon tub of water.

When removing fish from the live-box, be careful not to smash fish between the rim of the dip net and the wall of the live-box. The live-box corners are typically where fish get killed. If feasible, chase fish out of the live-box corners before attempting to scoop them with the net.

Fish should be placed in separate buckets as follows:

a) All steelhead, late-fall-, spring-, and winter-run Chinook salmon.

b) Marked fall-run Chinook salmon.

c) Unmarked fall-run Chinook salmon.

d) Non-salmonid species, including larger piscivorous fish that could potentially feed on smaller fish as fish are held and processed.

Field biologists who have received adequate training should be able to recognize juvenile steelhead based on morphological features; Appendix F provides reference material that can be used to disseminate between steelhead and Chinook salmon. **The presence of marked fall-run Chinook salmon can be assessed by looking for fish with a colored mark or Bismark brown dye; it is especially important to examine every salmon to see if they have these marks since their detection will drastically affect the ability to develop salmon production estimates.** The presence of non-fall-run Chinook salmon can be ascertained by referring to the length-at-date charts developed by Fisher and Greene, i.e., salmon that have a fork length that is outside the length range for a given sample day could therefore be spring-, winter-, or late-fall-run Chinook salmon.

Make sure fish are not over-crowded (i.e., < 50 smolts or < 100 fry per 5 gal bucket; 1,000individuals per standard-size cooler (18 gal)). If fish exhibit strange behavior, transfer them to another bucket/cooler to replenish oxygen and gently lower water temperatures. Fish that flare their gills or start to gather along the surface of the water are signs of reduced oxygen levels. With a large quantity of fish in the bucket, this can happen very quickly, especially when the weather is warm. Water in the 18-gallon tote should also be refreshed as necessary to ensure fish health.

At the moment the live-box is clear of fish and debris, two measurements must be taken and recorded immediately on the Trap Visit data sheet: (1) enter the time in the Visit Time 2 field and (2) record the Total Revolutions Since Last Trap Check on the counter. The Visit Time 2 field reflects the time that the trap was completely cleared of fish and debris for one day, and represents the start of the next sampling period that ends on the following day. The Visit Time 1 field should be filled out from the previous day's Visit Time 2 field.

When finished, the total amount of debris captured in the trap should also be recorded in the "Debris Volume" field on the Trap Visit data sheet, and the type of debris caught (aquatic or terrestrial) should be recorded under "Dominant Debris Type."

Random-Sampling Protocol

During peak emigration periods, the RSTs capture more Chinook salmon than can be individually processed. On these occasions a sub-sampling protocol is used to randomly select 100 fish that are measured and weighed. A random sample is statistically representative of the non-sampled fish, therefore the information gathered from the sampled fish (FL measurements, run designation, etc.) can be generalized or expanded to describe the unmeasured fish. The following procedure pertains to the random selection of 100 Chinook salmon that are assessed for fork length, weight, and life stage. All Chinook salmon captured in excess of the measured 100 are referred to as "plus counts." If less than 100 Chinook salmon are captured, every fish is assessed for fork length, and life stage, and >40 mm fish are measured for weight.
Typically, the first 120 or so Chinook salmon encountered will comprise the random sample. However, these 120+ salmon should not be completely composed of salmon found while sorting through debris, as this may bias the random sample. Instead, the majority of the random sample should be obtained by using the net after most of the debris has already been cleared from the live well. Furthermore, the random sample should not contain spring- or winter-run Chinook salmon, since the "plus count" will not contain these runs. The protocol for the random sample is as follows:

1. As much debris as possible should be cleared out of live well to facilitate counting fish and to avoid crushing fish in debris when lifting out of the water with a net.

2. Refresh the water in the 18 gallon tub.

3. Using the large dip net, gently net out random groups of fish from the live box and place them into the tub of water.

4. From the tub, take a small dip net and randomly collect and count out at least 120 Chinook salmon and place them in an aerated holding bucket. These fish will be saved to weigh and measure. If estimating, it is better to err on the side of too many fish than not enough.

5. Fall-run Chinook salmon in excess of the random sample that remain in the tub or trap live well are not measured and weighed, but "plus counted" (i.e. enumerated and immediately released downstream of the traps.) However, each of the "plus count" salmon must still also be checked for marks and observed for length-at-date (LAD) run designation.
    a. If a "plus count" salmon appears to be a spring-, or winter-run salmon by LAD criteria, it must be counted separately and assessed for fork length, life stage, and mark status, and a fin clip taken. Since Central Valley spring- and winter-run Chinook salmon are federally listed as threatened or endangered taxa, the trapping activities must attempt to identify every spring- and winter-run Chinook salmon that is captured so that data can be reported to NMFS.
    b. Late-fall run salmon are not listed as threatened or endangered, so LAD late fall-run Chinook salmon do not need to be separated out of the "plus count." However if a "plus count" includes both LAD late fall- and fall-run Chinook salmon, this should be specifically noted on the datasheet.

Note: If a mark-recapture trap efficiency trial is scheduled to occur within the next 48 hours following capture, "plus counted" fish may be enumerated and retained for use in the trial, instead of released immediately.

Processing Fish

After the trap has been cleaned and fishing resumed, the collected fish should be processed in the following order:

1. Spring- and winter-run Chinook salmon (natural or hatchery)
2. All steelhead

3. Unmarked Chinook salmon random sample
4. Marked fall-run Chinook salmon
5. Non-salmonid species

The table below identifies how each group of fish should be processed. The data from those individuals should be recorded on their respective data sheets.

Sampling Strategy For Different Fish Species Collected During Rotary Screw Trap Operations				
Spring and Winter-run Chinook Salmon	**Steelhead**	**Unmarked Chinook Salmon (Random sample)**	**Marked Fall-run Chinook Salmon**	**Non-Salmonid Species**
• Count	• Count	• Count	• Count	• Count
• Assess for mortality status and check for marks	• Assess for mortality status and check for marks	• Assess for mortality status and check for marks	• Assess for mortality status and check for marks	• Assess for mortality status and check for marks
• Measure up to 100 randomly-selected fish for fork length and assess for life stage	• Measure up to 100 randomly-selected fish for fork length and assess for life stage	• Measure up to 100 randomly-selected fish for fork length and assess for life stage	• Measure up to 100 randomly-selected fish for fork length and assess for life stage	• Measure up to 50 randomly-selected fish for fork or total length and assess for life stage (adult/juvenile)
• Weigh the first 25 with fork length ≥ 40 mm	• Weigh the first 25 with fork length ≥ 40 mm	• Weigh the first 25 with fork length ≥ 40 mm	• No weight taken	• No weight taken
• take fin clip (upper lobe of caudal fin) from each fish		• take fin clip (upper lobe of the caudal fin) from two late fall-run per day as applicable		
• If more than 50 of one run, “plus count” remainder	• If more than 100, “plus count” remainder	• If more than 100, “plus count” remainder	• If more than 100, “plus count” remainder	• If more than 50 of one species, “plus count” remainder

Following the above table, fish will be evaluated for species and salmon run type (if applicable), counted, checked for marks and mortality status, measured for fork length, assessed for life stage, weighed, and will be clipped for genetic run assessment (spring-, winter- and a selection of late fall-run Chinook salmon only). Fish that are measured for fork length, weighed and/or clipped for genetic analysis should be anesthetized prior to processing using the procedures described in the "Anesthetizing Fish" section below. When processing, hands, dip nets, and measuring boards should always be wetted before coming in contact with fish.

Fish species identification can be accomplished using various keys that include fish found in the Central Valley; Appendix E provides a species list for fishes that are likely to be caught in the American River based on previous RST work, and the appendix identifies three references that can be used to identify fish species in California's Central Valley. If a fish is collected and biologists are not sure of the species identification of that individual, several close up pictures of the fish should be taken with a digital camera. Biologists should then refer to the species list and references in Appendix E in an effort to determine the species ID. If a fish cannot be identified to species, then the data sheet should reflect a more general taxonomic name for that individual. This situation may be especially true for various groups that include lampreys, Cottids (sculpins), Centrarchids (bass and sunfish), Catastomids (suckers) and Cyprinids (minnows). Individuals pertaining to these groups should receive special scrutiny in an effort to make taxonomic assignments as accurate as possible.

For fish identified as Chinook salmon, a salmon run designation will be assigned using Fisher's length-at-date table. For each specific date, the table will be used to determine a maximum and minimum fork length for each salmon run. Salmon measured to have fork lengths between the maximum and minimum range for a given day will be given an "at-capture" run designation accordingly. Salmonids such as Chinook salmon and steelhead should also be checked for hatchery produced marks (i.e. a clipped adipose fin) or marks that could have been applied as part of a trap efficiency test described in the "Mark/Recapture Trials" section below. Salmonid life stages will be assessed according to the morphological features described and illustrated in Appendix B.

All fish lengths will be measured to the nearest 1.0 millimeter using a measuring board. For fish species with a forked tail, fork length will be measured laterally along the mid-line from the tip of the snout with closed mouth to the center of the fork in the tail. For species without a forked tail (i.e., lamprey, sculpins, mosquitofish, threespine sticklebacks and some bullheads), total length will be measured laterally along the mid-line from the tip of the snout with closed mouth to the posterior edge of the tail.

Fish weights will be measured to the nearest 0.1 gram using a scale. When weighing, fish should be placed into a weigh-boat filled with fresh water instead of placed directly onto the scale

surface. This will minimize the time the fish is out of water, limit stress and reduce fish movement while weighing. When placing the fish into a tared weigh-boat, care should be taken to minimize the loss of water, as this will affect the accuracy of the weight.

If river temperatures exceed 21°C, enumerate and release all listed species; do not hold for processing. On a case by case basis, if temperatures are high, and even with frequent water changes, air bubblers and frozen water bottles, fish health is a concern, enumerate the fish and release them. Additionally, if individual fish appear to have diminished health (obvious wounds, extended trouble staying upright, etc.) minimize handling of these fish; enumerate and release them immediately.

All fish species should be released below the RSTs after they have been processed, unless the fish will be used for an efficiency trial or euthanized and retained for study purposes.

Anesthetizing Fish

Fish that are assessed for fork length, total length, and/or weight, should always be anesthetized prior to measuring. To anesthetize fish, a solution with Alka-Seltzer is used. In general, fish are immersed in a bath of Alka-Seltzer at a concentration of one tablet for each liter of water. The action of the anesthesia is readily reversed when fish are transferred to fresh water.

The effectiveness and effect of premixed solutions is related to a variety of factors including concentration, fish size, water temperature and stock solution age. Overexposure (in time or concentration) to the Alka-Seltzer solution will lead to death of fish. Biologists should always observe the gill activity of fish immersed in an anesthesia solution; fish with markedly reduced gill activity should be transferred immediately to fresh water for recovery.

Fish should be placed in the Alka-Seltzer solution in batches of ~25 individuals to avoid anesthetizing more fish than can be processed. Fish size and the crew member's quickness in measuring fish are factors that should be considered when determining how many fish to anesthetize at once.

After fish have been measured they should immediately be placed in a 5 gallon bucket of fresh water for recovery. This bucket should contain 1 teaspoon of Poly Aqua to aid in recovery. Poly Aqua will aid in the regeneration of their slime coat that may have been shed during capture and handling. Once fish have fully recovered, they can be released back in the river.

Collection of Fin Clips

Fin clips will be collected from all juvenile salmon that key out to be spring- or winter-run Chinook salmon according to the length-at-date criteria and from a selection of salmon that key out to be late fall-run by LAD criteria. These fin clips will ultimately be used to assess the salmon run of each clipped individual. The fin clips should be collected after the fish has been anesthetized, measured and weighed, by taking a small pair of surgical scissors and removing not more than ¼ of the upper lobe of the caudal fin. The fin clip should then be placed in a vial with 200 proof ethanol. The vial number should be recorded on the datasheet next to the data describing the clipped individual. The vial should then be stored in the office to avoid contamination or accidental use for additional clips.

Field Quality Check

The first step of data quality assurance/quality check (QA/QC) happens in the field. After all the data have been collected during a sampling visit, each data sheet should be reviewed before the biologists leave the trap site to make sure all information is complete, and any missing values are collected. Common errors include leaving blanks on the data sheet, illegible entries, clarity of plus counts, incorrect species or station codes, and unclear comments. The field quality check should occur before leaving the site so additional data can be collected if necessary. Do not leave data sheets in vehicles or in clipboards as they may get lost or damaged, and return the completed data sheets to the office the same day they are filled out.

Trap Maintenance

Before the field crew leaves the traps at the end of a sample period, they should inspect:

1. The live-box seal for any cracks and proper seating around the trap cone.

2. The trap cone shaft and bushings for cracks and abnormal or excessive wear.

3. The cone's screen for any tears, separation from the cone frame, and the access doors for proper closure. Rivets that attach the screen to the frame often need replacing throughout the season.

4. The winch system, including the cable and pulley, for proper function.

5. The counter system for proper function.

6. The anchor points and cabling system for weaknesses/non-secure attachment.

7. That the collars are firmly attached and the collar bolt is tight. The collar should not spin independently of the axle.

MARK/RECAPTURE TRIALS

RSTs only capture a small fraction of the total number of fish migrating past a trap. To estimate the total number of fish migrating past the RSTs on the American River, it is necessary to conduct mark/recapture trials to quantify trap efficiency; i.e. the percentage of the total fish population sampled by the traps. These trials should, under ideal circumstances, be conducted in a manner that reduces sampling bias, and should be conducted as often as possible, or whenever there are substantial environmental changes that could affect the efficiency of the traps, such as a marked increase in stream discharge. Potential sources of bias that could affect the accuracy of the trap efficiency tests are as follows:

1. The behavior of the fish that are captured on a daily basis is different than that of the fish used in trap efficiency trials.
2. The trap efficiency test fish are not recognized as they are recaptured.
3. Predation of released fish
4. Schooling of released fish
5. The environmental factors during the efficiency test period change dramatically

The following describes the procedures that should be taken to avoid the aforementioned sources of bias for each trap efficiency test.

Under ideal circumstances, wild salmon should be used instead of hatchery salmon when conducting trap efficiency tests. Wild salmon that are caught with the RSTs should therefore be used to conduct trap efficiency tests whenever possible. With that sampling in mind, field staff should retain captured wild fish and sequester them in live cars that are held in the RST live-boxes until such time that a sufficient number of salmon have been collected to conduct a trap efficiency test. Based on historical trap efficiency results, field staff should strive to release at least 1,000 fish during a given efficiency test. Releasing a smaller number of fish has historically resulted in too few recaptures to make the trap efficiency test worthwhile.

To conduct the trap efficiency trials, fish are marked with a colored Visual Implant Elastomer (VIE), photonic dye and/or a Bismark brown *Y* stain (BBY). Photonic dye and/or VIE is the preferred method of marking fish, as they are typically less stressful for the fish and may be less likely to affect predation. These tagging methods can be difficult to apply to fry and are therefore used on larger salmon, greater than 50 mm in fork length, as described in Appendix H: Process for Marking Chinook Salmon with Photonic Dye and the VIE Project Manual from Northwest Marine Technology https://www.nmt.us/wp-content/uploads/2017/11/VIE-Project-Manual-Nov-2017-1.pdf. Fish less than 50 mm in fork length must be dyed with the BBY whole body stain as described in Appendix G: Process for Staining Chinook Salmon with Bismark Brown Dye.

To create the ability to discriminate between different groups of marked salmon that were marked as part of a trap efficiency test, it is critical that the marking patterns be applied in a manner and combination where biologists can successfully discriminate between different groups of marked fish. Combinations of marking patterns that could cause confusion in proper identification, e.g., applying a green mark to the upper caudal fin one week and then applying a blue mark to the upper caudal fin the following week should also be avoided.

Complete the Marking Data Sheet and Marked Chinook Salmon Data Sheet and be sure to accurately quantify and record the number of salmon that were successfully dyed or stained. Take a random sample of 100 of the successfully marked salmon and measure and record their fork lengths. Record any mortalities that occurred during the marking process.

Fish will then be transported to the release site at approximately one pound of fish per gallon of water; therefore the amount of coolers/aerated containers will vary depending on the size of the fish. The appropriate dosage of slime coat protectant should be added to each aerated cooler to ensure fish health. On warmer days, ice may need to be added to fish holding containers to keep the holding water from becoming too warm. The DO and water temperature in the transport containers should be noted and recorded before leaving the hatchery.

Releases should occur as close to twilight/dusk to reduce the risk of predation on marked salmon. Therefore, field staff should plan accordingly to ensure they can conduct all the necessary activities to release fish by sunset. There are two release distribution methods used depending on river flow. If the current river flow is below 1,500 cfs, fish will be transported to the release site via truck and set in the river in an appropriate amount of live cars to acclimate. Then wading across the width of the river, fish should be released in small net fulls (piecemeal) so that they don't have an opportunity to "school" as they move downstream. If flows are above, 1,500 cfs, the same distribution method is used via boat rather than wading. If a boat is used to release fish and must travel downstream after a release, remain at the release site for ~15 minutes, then float or row downstream. Prior to release, record the number of dead or weak swimming fish and remove them from the live marked fish; these fish will not be released at the site rather released downstream and excluded from the trap efficiency trial.

It is important to note that fluctuating river flows will impair the accuracy of a trap efficiency trial. Therefore, releases should occur when discharges from Nimbus Dam are stabilized. Additionally, for more accurate passage estimates, an effort should be made to conduct as many trap efficiency trials as possible at various river flows.

COMPUTER DATA ENTRY AND MANAGEMENT

Data sheets need to be delivered to the data manager or placed in the "Completed Datasheets" paper tray before the end of each work day.

Data Entry

Data will be stored and analyzed in the Comprehensive Assessment and Monitoring Program's rotary screw trap platform (Platform). Data should be entered in the Platform as soon as possible after collection. Care should be taken to assure data are entered correctly.

QA/QC Procedure

Ensuring that field data is entered into the Platform accurately and completely is essential to data management.

First, data sheets will be checked as described in Appendix I to make sure the data sheets have been completely filled out and there are no errors before data are entered into the CAMP Platform. Any corrections made during this process will be made in red ink. Datasheets that have been checked for quality assurance should be indicated by initials and date. Corrected data will be entered into the CAMP Platform by the data lead and then QA/QC'd by crew members to ensure that data has been entered correctly.

The verification process will check for entry errors by comparing data sheets with queries that produce hard copy reports of data entered into the Platform. If errors are found, they will be noted on the QA/QC Datasheet with the appropriate correction. **To minimize the possibility that entered errors are overlooked, the QA/QC process of entered data should never be done alone.** After data is checked, QA/QC data sheets will be signed with initials of the persons checking data and the date verified. The data lead will then correct entries in the CAMP Platform.

The Platform and its associated QA/QC database have a number of tools that were developed to look for problems in the quality of the data and the data entry process. Staff that enters data into the Platform should refer to, and become familiar with, the user manuals that were prepared for the Platform and the QA/QC database; doing so will provide the ability to detect and then correct problems with the RST data.

Data entry error example: in the course of reviewing the measurements of the randomly selected juvenile salmon that were measured on day X, a salmon is found that is outside the typical size range for a fall-run Chinook salmon on day X based on the length-at-date criteria, the record for that salmon needs to be changed to reflect the appropriate salmon run according to the length-at-date criteria for the day that fish was captured. The person who finds this error should report it on the QA/QC data sheet with their initials, and date verified. Then return the QA/QC data sheet to the data crew lead so that the CAMP database can be updated accordingly.

An effort should be made to verify data on a weekly basis. The QA/QC routines in the platform should be executed and the reports associated with those QA/QC routines should be checked to look for missing data, out of sequence records, and biological attributes that are unusual or abnormal.

After the data has been verified by the crew, the data crew lead will use the QA/QC database provided by Connie Shannon to further check for any additional data entry errors that may have occurred during the data entry process.

APPENDIX A: Field Data Sheets

Trap Visit Data Sheet. Used to record environmental data, trap data, and summarize catch totals.

LOWER AMERICAN RIVER, WATT AVE

DATE: ____/____/____ **Trap ID:** _____ **Pg** ____/____

Field Crew:
Recording Data: _____
Measuring Fish: _____

Effort:
Visit Time: ____/____ @____:____ **AM / PM**
Start
Visit Time 2: ____/____ @____:____ **AM / PM**
Stop
Visit Type ID: _____

Debris:
Trap Functioning ID:_____
(1: Normal, 2: Functioning but not normal, 3: Stopped functioning, 4: Not in service)
Total clicker revs if trap stopped: _____
Dominant Debris Type:_____
Debris Volume:_____(gal)
(Very heavy (>61), Heavy (40-61), Medium (40-21), Light (20-1), None)
Intakes:_____/_____/_____
(3=Completely blocked; backed up into cone, 2=Blocked, 1=Partially blocked, 0=Clear)

Revolutions:
Before Cleaning RPM: _____, _____, _____ Avg:____
After Cleaning RPM: _____, _____, _____ Avg:____
Total revs from clicker: _____

Velocity:
Velocity (nearest 0.01 m/s): _____
(Measured @ 2 ft depth in front of cone on 8 ft trap)

Conditions:
River Depth:_____cm Cone Depth:122 + -____cm
Staff Gage:_____cm @ ____:____ **AM / PM**
River Temp:_____°C DO:_____(mg/L)
Checked Thermograph: _____(0=No 1=Yes)
Water sample taken:_____(0=No 1=Yes)
NTU: _____ & _____ Avg:_____
Weather: **clear partlycloudy overcast sunny foggy sprinkle rain heavyrain slightlywindy windy**
(Circle what best describes the conditions for the day)
Air Temp High: _____°F and Low: _____°F
(weather.com)
Notes:

1. Today's Catch of UNMARKED juvenile Chinook Salmon

Chinook	Live Measured	Live Unmeasured	Morts Measured	Morts Unmeasured	Total
Fall					
Spring					
Winter					
Late fall					
CS Total					

2. Today's Catch of MARKED Chinook Salmon

Chinook	Live Measured	Live Unmeasured	Morts Measured	Morts Unmeasured	Total
CS ad-clipped					
CS BBY recap					
CS Photonic Mark Color_____					

3. Today's Catch of UNMARKED Steelhead

Steelhead	Live Measured	Live Unmeasured	Morts Measured	Morts Unmeasured	Total
YOY					
Yearling					
Adult					
SH Total					

4. Today's Catch of MARKED Steelhead

Steelhead	Live Measured	Live Unmeasured	Morts Measured	Morts Unmeasured	Total
SH ad-clipped					

Today's Chinook Salmon Race Designation Chart

Race	Minimum	Maximum
Fall		
Spring		
Winter		
Late Fall		

Unmarked Chinook Salmon Data Sheet. Used to record a random sample of 100 Chinook salmon.

Randomly Selected Unmarked Chinook Salmon

DATE:_____

TRAP ID:_____ PG:____ / _____

Fall-run: (_____-_____) Spring-run: (_____-_____) Winter-run: (_____-_____) Late-fall-run: (_____-_____)

#	FL	WW	STAGE	MORT	ID #	#	FL	WW	STAGE	MORT	ID #
1			1 2 3 4 5	Y N		51			1 2 3 4 5	Y N	
2			1 2 3 4 5	Y N		52			1 2 3 4 5	Y N	
3			1 2 3 4 5	Y N		53			1 2 3 4 5	Y N	
4			1 2 3 4 5	Y N		54			1 2 3 4 5	Y N	
5			1 2 3 4 5	Y N		55			1 2 3 4 5	Y N	
6			1 2 3 4 5	Y N		56			1 2 3 4 5	Y N	
7			1 2 3 4 5	Y N		57			1 2 3 4 5	Y N	
8			1 2 3 4 5	Y N		58			1 2 3 4 5	Y N	
9			1 2 3 4 5	Y N		59			1 2 3 4 5	Y N	
10			1 2 3 4 5	Y N		60			1 2 3 4 5	Y N	
11			1 2 3 4 5	Y N		61			1 2 3 4 5	Y N	
12			1 2 3 4 5	Y N		62			1 2 3 4 5	Y N	
13			1 2 3 4 5	Y N		63			1 2 3 4 5	Y N	
14			1 2 3 4 5	Y N		64			1 2 3 4 5	Y N	
15			1 2 3 4 5	Y N		65			1 2 3 4 5	Y N	
16			1 2 3 4 5	Y N		66			1 2 3 4 5	Y N	
17			1 2 3 4 5	Y N		67			1 2 3 4 5	Y N	
18			1 2 3 4 5	Y N		68			1 2 3 4 5	Y N	
19			1 2 3 4 5	Y N		69			1 2 3 4 5	Y N	
20			1 2 3 4 5	Y N		70			1 2 3 4 5	Y N	
21			1 2 3 4 5	Y N		71			1 2 3 4 5	Y N	
22			1 2 3 4 5	Y N		72			1 2 3 4 5	Y N	
23			1 2 3 4 5	Y N		73			1 2 3 4 5	Y N	
24			1 2 3 4 5	Y N		74			1 2 3 4 5	Y N	
25			1 2 3 4 5	Y N		75			1 2 3 4 5	Y N	
26			1 2 3 4 5	Y N		76			1 2 3 4 5	Y N	
27			1 2 3 4 5	Y N		77			1 2 3 4 5	Y N	
28			1 2 3 4 5	Y N		78			1 2 3 4 5	Y N	
29			1 2 3 4 5	Y N		79			1 2 3 4 5	Y N	
30			1 2 3 4 5	Y N		80			1 2 3 4 5	Y N	
31			1 2 3 4 5	Y N		81			1 2 3 4 5	Y N	
32			1 2 3 4 5	Y N		82			1 2 3 4 5	Y N	
33			1 2 3 4 5	Y N		83			1 2 3 4 5	Y N	
34			1 2 3 4 5	Y N		84			1 2 3 4 5	Y N	
35			1 2 3 4 5	Y N		85			1 2 3 4 5	Y N	
36			1 2 3 4 5	Y N		86			1 2 3 4 5	Y N	
37			1 2 3 4 5	Y N		87			1 2 3 4 5	Y N	
38			1 2 3 4 5	Y N		88			1 2 3 4 5	Y N	
39			1 2 3 4 5	Y N		89			1 2 3 4 5	Y N	
40			1 2 3 4 5	Y N		90			1 2 3 4 5	Y N	
41			1 2 3 4 5	Y N		91			1 2 3 4 5	Y N	
42			1 2 3 4 5	Y N		92			1 2 3 4 5	Y N	
43			1 2 3 4 5	Y N		93			1 2 3 4 5	Y N	
44			1 2 3 4 5	Y N		94			1 2 3 4 5	Y N	
45			1 2 3 4 5	Y N		95			1 2 3 4 5	Y N	
46			1 2 3 4 5	Y N		96			1 2 3 4 5	Y N	
47			1 2 3 4 5	Y N		97			1 2 3 4 5	Y N	
48			1 2 3 4 5	Y N		98			1 2 3 4 5	Y N	
49			1 2 3 4 5	Y N		99			1 2 3 4 5	Y N	
50			1 2 3 4 5	Y N		##			1 2 3 4 5	Y N	

Live Unmeasured Plus Count

Total Live Unmeasured

Morts Unmeasured Plus Count

Total Morts Unmeasured

Unmarked Steelhead Data Sheet. Used to record a random sample of 100 steelhead.

Unmarked Steelhead (Random)

DATE:_____

TRAP ID:_____ Pg:____ / _____

	Steelhead			
#	FL	WW	STAGE	MORT
1			1 2 3 4 5 6	Y N
2			1 2 3 4 5 6	Y N
3			1 2 3 4 5 6	Y N
4			1 2 3 4 5 6	Y N
5			1 2 3 4 5 6	Y N
6			1 2 3 4 5 6	Y N
7			1 2 3 4 5 6	Y N
8			1 2 3 4 5 6	Y N
9			1 2 3 4 5 6	Y N
10			1 2 3 4 5 6	Y N
11			1 2 3 4 5 6	Y N
12			1 2 3 4 5 6	Y N
13			1 2 3 4 5 6	Y N
14			1 2 3 4 5 6	Y N
15			1 2 3 4 5 6	Y N
16			1 2 3 4 5 6	Y N
17			1 2 3 4 5 6	Y N
18			1 2 3 4 5 6	Y N
19			1 2 3 4 5 6	Y N
20			1 2 3 4 5 6	Y N
21			1 2 3 4 5 6	Y N
22			1 2 3 4 5 6	Y N
23			1 2 3 4 5 6	Y N
24			1 2 3 4 5 6	Y N
25			1 2 3 4 5 6	Y N
26			1 2 3 4 5 6	Y N
27			1 2 3 4 5 6	Y N
28			1 2 3 4 5 6	Y N
29			1 2 3 4 5 6	Y N
30			1 2 3 4 5 6	Y N
31			1 2 3 4 5 6	Y N
32			1 2 3 4 5 6	Y N
33			1 2 3 4 5 6	Y N
34			1 2 3 4 5 6	Y N
35			1 2 3 4 5 6	Y N
36			1 2 3 4 5 6	Y N
37			1 2 3 4 5 6	Y N
38			1 2 3 4 5 6	Y N
39			1 2 3 4 5 6	Y N
40			1 2 3 4 5 6	Y N
41			1 2 3 4 5 6	Y N
42			1 2 3 4 5 6	Y N
43			1 2 3 4 5 6	Y N
44			1 2 3 4 5 6	Y N
45			1 2 3 4 5 6	Y N
46			1 2 3 4 5 6	Y N
47			1 2 3 4 5 6	Y N
48			1 2 3 4 5 6	Y N
49			1 2 3 4 5 6	Y N
50			1 2 3 4 5 6	Y N

Live Unmeasured Plus Count

Total Live Unmeasured

	Steelhead			
#	FL	WW	STAGE	MORT
51			1 2 3 4 5 6	Y N
52			1 2 3 4 5 6	Y N
53			1 2 3 4 5 6	Y N
54			1 2 3 4 5 6	Y N
55			1 2 3 4 5 6	Y N
56			1 2 3 4 5 6	Y N
57			1 2 3 4 5 6	Y N
58			1 2 3 4 5 6	Y N
59			1 2 3 4 5 6	Y N
60			1 2 3 4 5 6	Y N
61			1 2 3 4 5 6	Y N
62			1 2 3 4 5 6	Y N
63			1 2 3 4 5 6	Y N
64			1 2 3 4 5 6	Y N
65			1 2 3 4 5 6	Y N
66			1 2 3 4 5 6	Y N
67			1 2 3 4 5 6	Y N
68			1 2 3 4 5 6	Y N
69			1 2 3 4 5 6	Y N
70			1 2 3 4 5 6	Y N
71			1 2 3 4 5 6	Y N
72			1 2 3 4 5 6	Y N
73			1 2 3 4 5 6	Y N
74			1 2 3 4 5 6	Y N
75			1 2 3 4 5 6	Y N
76			1 2 3 4 5 6	Y N
77			1 2 3 4 5 6	Y N
78			1 2 3 4 5 6	Y N
79			1 2 3 4 5 6	Y N
80			1 2 3 4 5 6	Y N
81			1 2 3 4 5 6	Y N
82			1 2 3 4 5 6	Y N
83			1 2 3 4 5 6	Y N
84			1 2 3 4 5 6	Y N
85			1 2 3 4 5 6	Y N
86			1 2 3 4 5 6	Y N
87			1 2 3 4 5 6	Y N
88			1 2 3 4 5 6	Y N
89			1 2 3 4 5 6	Y N
90			1 2 3 4 5 6	Y N
91			1 2 3 4 5 6	Y N
92			1 2 3 4 5 6	Y N
93			1 2 3 4 5 6	Y N
94			1 2 3 4 5 6	Y N
95			1 2 3 4 5 6	Y N
96			1 2 3 4 5 6	Y N
97			1 2 3 4 5 6	Y N
98			1 2 3 4 5 6	Y N
99			1 2 3 4 5 6	Y N
100			1 2 3 4 5 6	Y N

Morts Unmeasured Plus Count

Total Morts Unmeasured

Spring-run and Winter-run Chinook Salmon Fin Clip Data Sheet. Used to record data on spring-run and winter-run Chinook salmon when fin clip samples are taken.

Spring/Winter Chinook Salmon Upper Caudal Fin Clips (Not Random) DATE:_____

U.M.= Unmeasured

TRAP ID: _____ PG: ____/____

	RACE		Upper Caudal Fin Clips		
#	FL	WW	STAGE	MORT	ID#
1			1 2 3 4 5	Y N	
2			1 2 3 4 5	Y N	
3			1 2 3 4 5	Y N	
4			1 2 3 4 5	Y N	
5			1 2 3 4 5	Y N	
6			1 2 3 4 5	Y N	
7			1 2 3 4 5	Y N	
8			1 2 3 4 5	Y N	
9			1 2 3 4 5	Y N	
10			1 2 3 4 5	Y N	
11			1 2 3 4 5	Y N	
12			1 2 3 4 5	Y N	
13			1 2 3 4 5	Y N	
14			1 2 3 4 5	Y N	
15			1 2 3 4 5	Y N	
16			1 2 3 4 5	Y N	
17			1 2 3 4 5	Y N	
18			1 2 3 4 5	Y N	
19			1 2 3 4 5	Y N	
20			1 2 3 4 5	Y N	
21			1 2 3 4 5	Y N	
22			1 2 3 4 5	Y N	
23			1 2 3 4 5	Y N	
24			1 2 3 4 5	Y N	
25			1 2 3 4 5	Y N	
26			1 2 3 4 5	Y N	
27			1 2 3 4 5	Y N	
28			1 2 3 4 5	Y N	
29			1 2 3 4 5	Y N	
30			1 2 3 4 5	Y N	
31			1 2 3 4 5	Y N	
32			1 2 3 4 5	Y N	
33			1 2 3 4 5	Y N	
34			1 2 3 4 5	Y N	
35			1 2 3 4 5	Y N	
36			1 2 3 4 5	Y N	
37			1 2 3 4 5	Y N	
38			1 2 3 4 5	Y N	
39			1 2 3 4 5	Y N	
40			1 2 3 4 5	Y N	
41			1 2 3 4 5	Y N	
42			1 2 3 4 5	Y N	
43			1 2 3 4 5	Y N	
44			1 2 3 4 5	Y N	
45			1 2 3 4 5	Y N	
46			1 2 3 4 5	Y N	
47			1 2 3 4 5	Y N	
48			1 2 3 4 5	Y N	
49			1 2 3 4 5	Y N	
50			1 2 3 4 5	Y N	
Live U.M. Plus Count				Morts U.M. Plus Count	
Total Live U.M.=				Total Morts U.M.=	

	RACE		Upper Caudal Fin Clips		
#	FL	WW	STAGE	MORT	ID#
1			1 2 3 4 5	Y N	
2			1 2 3 4 5	Y N	
3			1 2 3 4 5	Y N	
4			1 2 3 4 5	Y N	
5			1 2 3 4 5	Y N	
6			1 2 3 4 5	Y N	
7			1 2 3 4 5	Y N	
8			1 2 3 4 5	Y N	
9			1 2 3 4 5	Y N	
10			1 2 3 4 5	Y N	
11			1 2 3 4 5	Y N	
12			1 2 3 4 5	Y N	
13			1 2 3 4 5	Y N	
14			1 2 3 4 5	Y N	
15			1 2 3 4 5	Y N	
16			1 2 3 4 5	Y N	
17			1 2 3 4 5	Y N	
18			1 2 3 4 5	Y N	
19			1 2 3 4 5	Y N	
20			1 2 3 4 5	Y N	
21			1 2 3 4 5	Y N	
22			1 2 3 4 5	Y N	
23			1 2 3 4 5	Y N	
24			1 2 3 4 5	Y N	
25			1 2 3 4 5	Y N	
26			1 2 3 4 5	Y N	
27			1 2 3 4 5	Y N	
28			1 2 3 4 5	Y N	
29			1 2 3 4 5	Y N	
30			1 2 3 4 5	Y N	
31			1 2 3 4 5	Y N	
32			1 2 3 4 5	Y N	
33			1 2 3 4 5	Y N	
34			1 2 3 4 5	Y N	
35			1 2 3 4 5	Y N	
36			1 2 3 4 5	Y N	
37			1 2 3 4 5	Y N	
38			1 2 3 4 5	Y N	
39			1 2 3 4 5	Y N	
40			1 2 3 4 5	Y N	
41			1 2 3 4 5	Y N	
42			1 2 3 4 5	Y N	
43			1 2 3 4 5	Y N	
44			1 2 3 4 5	Y N	
45			1 2 3 4 5	Y N	
46			1 2 3 4 5	Y N	
47			1 2 3 4 5	Y N	
48			1 2 3 4 5	Y N	
49			1 2 3 4 5	Y N	
50			1 2 3 4 5	Y N	
Live U.M. Plus Count				Morts U.M. Plus Count	
Total Live U.M.=				Total Morts U.M.=	

Photonically Marked Chinook Salmon Data Sheet. Used to record data on hatchery Chinook salmon that have been marked with photonic fluorescent dye used for a trap efficiency trial.

Nimbus Hatchery Fall-run Chinook Salmon DATE:____/____/____

Photonic Marking Data Sheet

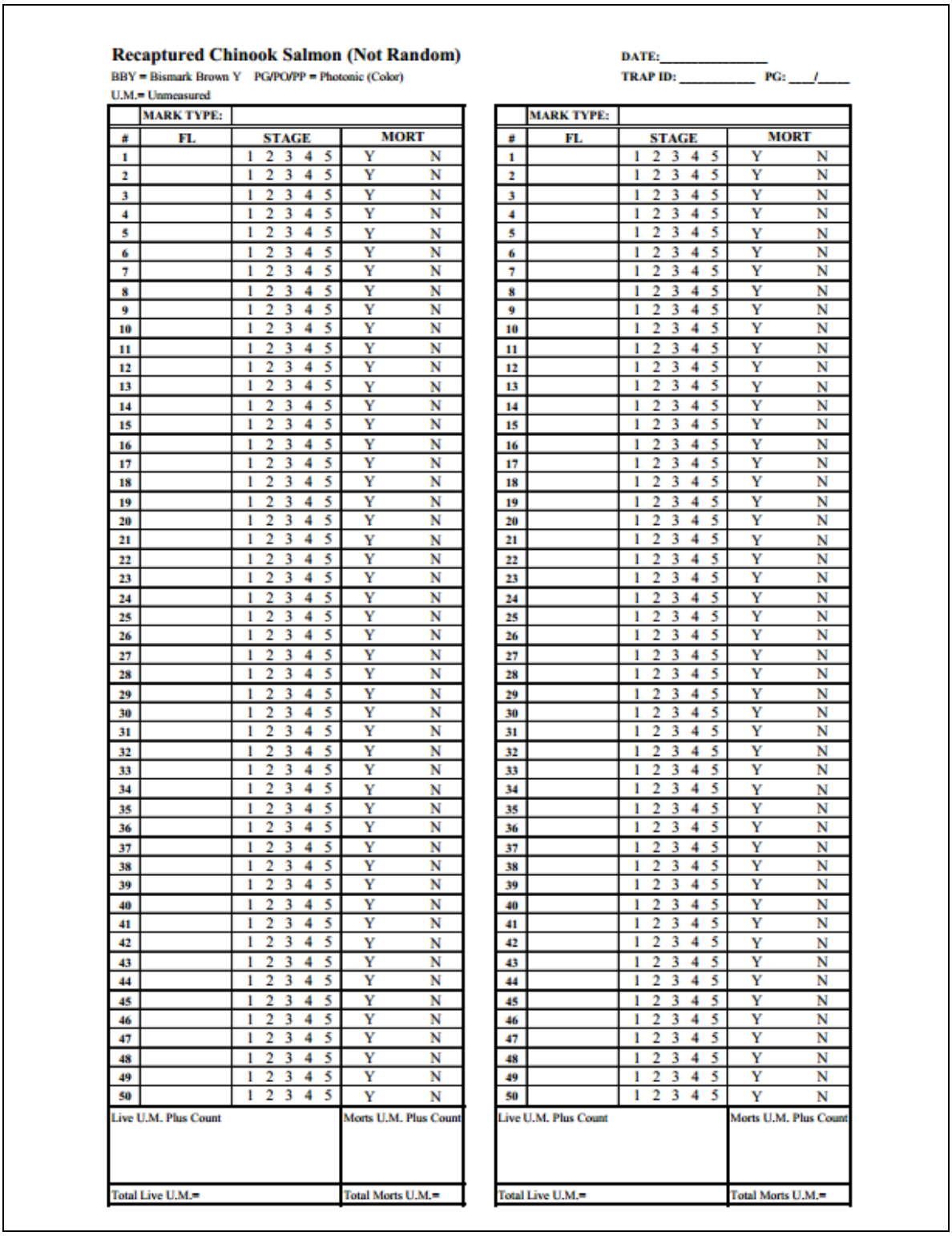
Photonic Color: Photonic Green=PG Photonic Pink=PP Photonic Orange=PO

	Photonic Color:											Photonic Color:										
#	FL	STAGE					MORT		#	FL	STAGE					MORT				
1		1	2	3	4	5	Y	N	51		1	2	3	4	5	Y	N			
2		1	2	3	4	5	Y	N	52		1	2	3	4	5	Y	N			
3		1	2	3	4	5	Y	N	53		1	2	3	4	5	Y	N			
4		1	2	3	4	5	Y	N	54		1	2	3	4	5	Y	N			
5		1	2	3	4	5	Y	N	55		1	2	3	4	5	Y	N			
6		1	2	3	4	5	Y	N	56		1	2	3	4	5	Y	N			
7		1	2	3	4	5	Y	N	57		1	2	3	4	5	Y	N			
8		1	2	3	4	5	Y	N	58		1	2	3	4	5	Y	N			
9		1	2	3	4	5	Y	N	59		1	2	3	4	5	Y	N			
10		1	2	3	4	5	Y	N	60		1	2	3	4	5	Y	N			
11		1	2	3	4	5	Y	N	61		1	2	3	4	5	Y	N			
12		1	2	3	4	5	Y	N	62		1	2	3	4	5	Y	N			
13		1	2	3	4	5	Y	N	63		1	2	3	4	5	Y	N			
14		1	2	3	4	5	Y	N	64		1	2	3	4	5	Y	N			
15		1	2	3	4	5	Y	N	65		1	2	3	4	5	Y	N			
16		1	2	3	4	5	Y	N	66		1	2	3	4	5	Y	N			
17		1	2	3	4	5	Y	N	67		1	2	3	4	5	Y	N			
18		1	2	3	4	5	Y	N	68		1	2	3	4	5	Y	N			
19		1	2	3	4	5	Y	N	69		1	2	3	4	5	Y	N			
20		1	2	3	4	5	Y	N	70		1	2	3	4	5	Y	N			
21		1	2	3	4	5	Y	N	71		1	2	3	4	5	Y	N			
22		1	2	3	4	5	Y	N	72		1	2	3	4	5	Y	N			
23		1	2	3	4	5	Y	N	73		1	2	3	4	5	Y	N			
24		1	2	3	4	5	Y	N	74		1	2	3	4	5	Y	N			
25		1	2	3	4	5	Y	N	75		1	2	3	4	5	Y	N			
26		1	2	3	4	5	Y	N	76		1	2	3	4	5	Y	N			
27		1	2	3	4	5	Y	N	77		1	2	3	4	5	Y	N			
28		1	2	3	4	5	Y	N	78		1	2	3	4	5	Y	N			
29		1	2	3	4	5	Y	N	79		1	2	3	4	5	Y	N			
30		1	2	3	4	5	Y	N	80		1	2	3	4	5	Y	N			
31		1	2	3	4	5	Y	N	81		1	2	3	4	5	Y	N			
32		1	2	3	4	5	Y	N	82		1	2	3	4	5	Y	N			
33		1	2	3	4	5	Y	N	83		1	2	3	4	5	Y	N			
34		1	2	3	4	5	Y	N	84		1	2	3	4	5	Y	N			
35		1	2	3	4	5	Y	N	85		1	2	3	4	5	Y	N			
36		1	2	3	4	5	Y	N	86		1	2	3	4	5	Y	N			
37		1	2	3	4	5	Y	N	87		1	2	3	4	5	Y	N			
38		1	2	3	4	5	Y	N	88		1	2	3	4	5	Y	N			
39		1	2	3	4	5	Y	N	89		1	2	3	4	5	Y	N			
40		1	2	3	4	5	Y	N	90		1	2	3	4	5	Y	N			
41		1	2	3	4	5	Y	N	91		1	2	3	4	5	Y	N			
42		1	2	3	4	5	Y	N	92		1	2	3	4	5	Y	N			
43		1	2	3	4	5	Y	N	93		1	2	3	4	5	Y	N			
44		1	2	3	4	5	Y	N	94		1	2	3	4	5	Y	N			
45		1	2	3	4	5	Y	N	95		1	2	3	4	5	Y	N			
46		1	2	3	4	5	Y	N	96		1	2	3	4	5	Y	N			
47		1	2	3	4	5	Y	N	97		1	2	3	4	5	Y	N			
48		1	2	3	4	5	Y	N	98		1	2	3	4	5	Y	N			
49		1	2	3	4	5	Y	N	99		1	2	3	4	5	Y	N			
50		1	2	3	4	5	Y	N	100		1	2	3	4	5	Y	N			

Live Unmeasured Plus Count

Morts Unmeasured Plus Count

Recaptured Chinook Salmon Data Sheet. Used to record data on Chinook salmon after they've been recaptured from a trap efficiency trial.



Recaptured Chinook Salmon (Not Random)

BBY = Bismark Brown Y PG/PO/PP = Photonic (Color)

U.M.= Unmeasured

DATE:_____

TRAP ID: _____ PG: ___/____

	MARK TYPE:		
#	FL	STAGE	MORT
1		1 2 3 4 5	Y N
2		1 2 3 4 5	Y N
3		1 2 3 4 5	Y N
4		1 2 3 4 5	Y N
5		1 2 3 4 5	Y N
6		1 2 3 4 5	Y N
7		1 2 3 4 5	Y N
8		1 2 3 4 5	Y N
9		1 2 3 4 5	Y N
10		1 2 3 4 5	Y N
11		1 2 3 4 5	Y N
12		1 2 3 4 5	Y N
13		1 2 3 4 5	Y N
14		1 2 3 4 5	Y N
15		1 2 3 4 5	Y N
16		1 2 3 4 5	Y N
17		1 2 3 4 5	Y N
18		1 2 3 4 5	Y N
19		1 2 3 4 5	Y N
20		1 2 3 4 5	Y N
21		1 2 3 4 5	Y N
22		1 2 3 4 5	Y N
23		1 2 3 4 5	Y N
24		1 2 3 4 5	Y N
25		1 2 3 4 5	Y N
26		1 2 3 4 5	Y N
27		1 2 3 4 5	Y N
28		1 2 3 4 5	Y N
29		1 2 3 4 5	Y N
30		1 2 3 4 5	Y N
31		1 2 3 4 5	Y N
32		1 2 3 4 5	Y N
33		1 2 3 4 5	Y N
34		1 2 3 4 5	Y N
35		1 2 3 4 5	Y N
36		1 2 3 4 5	Y N
37		1 2 3 4 5	Y N
38		1 2 3 4 5	Y N
39		1 2 3 4 5	Y N
40		1 2 3 4 5	Y N
41		1 2 3 4 5	Y N
42		1 2 3 4 5	Y N
43		1 2 3 4 5	Y N
44		1 2 3 4 5	Y N
45		1 2 3 4 5	Y N
46		1 2 3 4 5	Y N
47		1 2 3 4 5	Y N
48		1 2 3 4 5	Y N
49		1 2 3 4 5	Y N
50		1 2 3 4 5	Y N
Live U.M. Plus Count			Morts U.M. Plus Count
Total Live U.M.=			Total Morts U.M.=

	MARK TYPE:		
#	FL	STAGE	MORT
1		1 2 3 4 5	Y N
2		1 2 3 4 5	Y N
3		1 2 3 4 5	Y N
4		1 2 3 4 5	Y N
5		1 2 3 4 5	Y N
6		1 2 3 4 5	Y N
7		1 2 3 4 5	Y N
8		1 2 3 4 5	Y N
9		1 2 3 4 5	Y N
10		1 2 3 4 5	Y N
11		1 2 3 4 5	Y N
12		1 2 3 4 5	Y N
13		1 2 3 4 5	Y N
14		1 2 3 4 5	Y N
15		1 2 3 4 5	Y N
16		1 2 3 4 5	Y N
17		1 2 3 4 5	Y N
18		1 2 3 4 5	Y N
19		1 2 3 4 5	Y N
20		1 2 3 4 5	Y N
21		1 2 3 4 5	Y N
22		1 2 3 4 5	Y N
23		1 2 3 4 5	Y N
24		1 2 3 4 5	Y N
25		1 2 3 4 5	Y N
26		1 2 3 4 5	Y N
27		1 2 3 4 5	Y N
28		1 2 3 4 5	Y N
29		1 2 3 4 5	Y N
30		1 2 3 4 5	Y N
31		1 2 3 4 5	Y N
32		1 2 3 4 5	Y N
33		1 2 3 4 5	Y N
34		1 2 3 4 5	Y N
35		1 2 3 4 5	Y N
36		1 2 3 4 5	Y N
37		1 2 3 4 5	Y N
38		1 2 3 4 5	Y N
39		1 2 3 4 5	Y N
40		1 2 3 4 5	Y N
41		1 2 3 4 5	Y N
42		1 2 3 4 5	Y N
43		1 2 3 4 5	Y N
44		1 2 3 4 5	Y N
45		1 2 3 4 5	Y N
46		1 2 3 4 5	Y N
47		1 2 3 4 5	Y N
48		1 2 3 4 5	Y N
49		1 2 3 4 5	Y N
50		1 2 3 4 5	Y N
Live U.M. Plus Count			Morts U.M. Plus Count
Total Live U.M.=			Total Morts U.M.=

Adipose Fin Clipped Salmonid Data Sheet. Used to record data on ad-clipped (hatchery origin) Chinook salmon or steelhead.

Adipose Fin Clipped Salmonid **(Not Random)**

U.M. = Unmeasured

DATE:_____

TRAP ID: _____ PG: ____/____

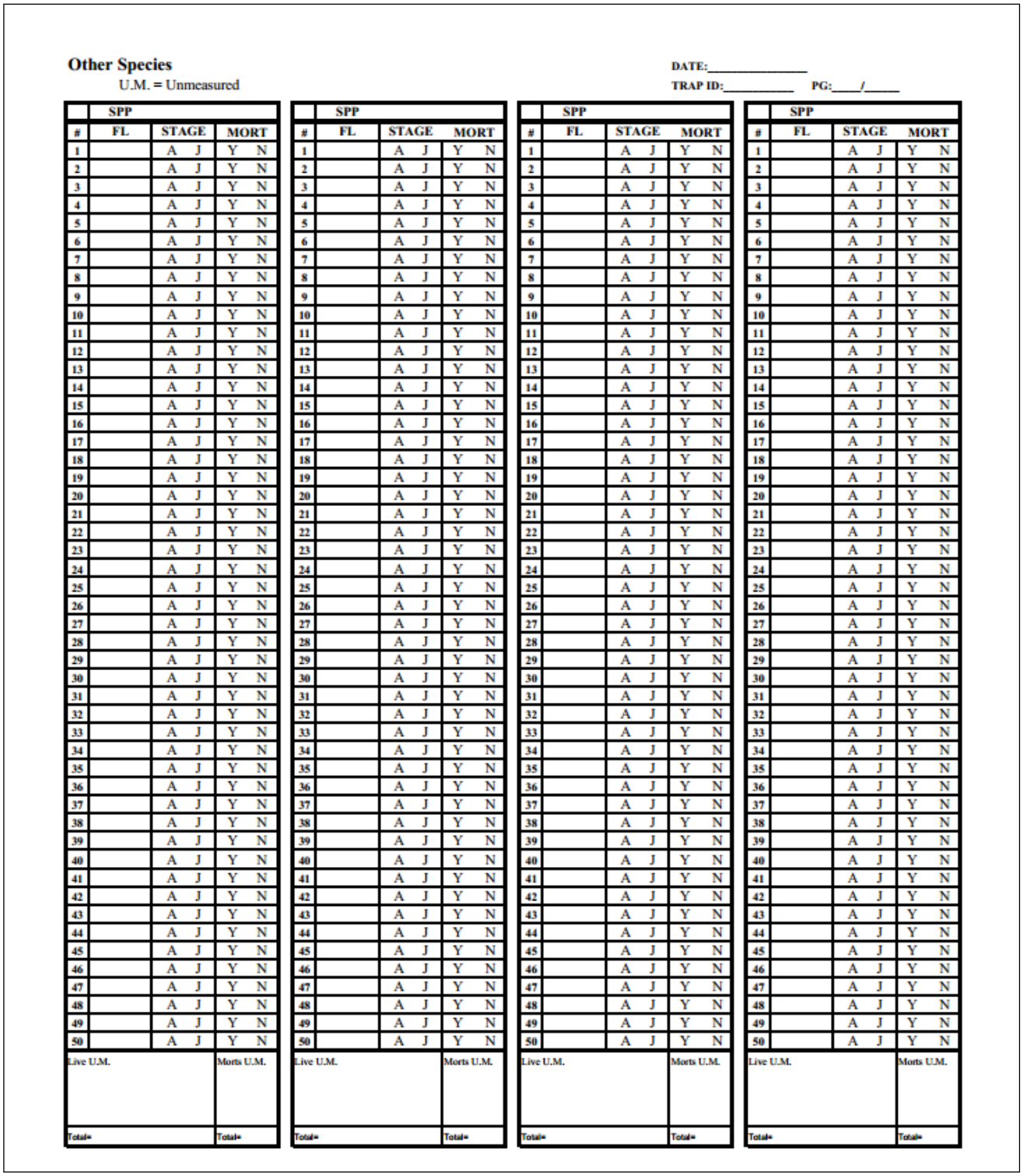
	Spp		Ad-Clipped			
#	FL	WW	STAGE	RACE	MORT	ID#
1			1 2 3 4 5	F S W L	Y N	
2			1 2 3 4 5	F S W L	Y N	
3			1 2 3 4 5	F S W L	Y N	
4			1 2 3 4 5	F S W L	Y N	
5			1 2 3 4 5	F S W L	Y N	
6			1 2 3 4 5	F S W L	Y N	
7			1 2 3 4 5	F S W L	Y N	
8			1 2 3 4 5	F S W L	Y N	
9			1 2 3 4 5	F S W L	Y N	
10			1 2 3 4 5	F S W L	Y N	
11			1 2 3 4 5	F S W L	Y N	
12			1 2 3 4 5	F S W L	Y N	
13			1 2 3 4 5	F S W L	Y N	
14			1 2 3 4 5	F S W L	Y N	
15			1 2 3 4 5	F S W L	Y N	
16			1 2 3 4 5	F S W L	Y N	
17			1 2 3 4 5	F S W L	Y N	
18			1 2 3 4 5	F S W L	Y N	
19			1 2 3 4 5	F S W L	Y N	
20			1 2 3 4 5	F S W L	Y N	
21			1 2 3 4 5	F S W L	Y N	
22			1 2 3 4 5	F S W L	Y N	
23			1 2 3 4 5	F S W L	Y N	
24			1 2 3 4 5	F S W L	Y N	
25			1 2 3 4 5	F S W L	Y N	
26			1 2 3 4 5	F S W L	Y N	
27			1 2 3 4 5	F S W L	Y N	
28			1 2 3 4 5	F S W L	Y N	
29			1 2 3 4 5	F S W L	Y N	
30			1 2 3 4 5	F S W L	Y N	
31			1 2 3 4 5	F S W L	Y N	
32			1 2 3 4 5	F S W L	Y N	
33			1 2 3 4 5	F S W L	Y N	
34			1 2 3 4 5	F S W L	Y N	
35			1 2 3 4 5	F S W L	Y N	
36			1 2 3 4 5	F S W L	Y N	
37			1 2 3 4 5	F S W L	Y N	
38			1 2 3 4 5	F S W L	Y N	
39			1 2 3 4 5	F S W L	Y N	
40			1 2 3 4 5	F S W L	Y N	
41			1 2 3 4 5	F S W L	Y N	
42			1 2 3 4 5	F S W L	Y N	
43			1 2 3 4 5	F S W L	Y N	
44			1 2 3 4 5	F S W L	Y N	
45			1 2 3 4 5	F S W L	Y N	
46			1 2 3 4 5	F S W L	Y N	
47			1 2 3 4 5	F S W L	Y N	
48			1 2 3 4 5	F S W L	Y N	
49			1 2 3 4 5	F S W L	Y N	
50			1 2 3 4 5	F S W L	Y N	

Live U.M. Plus Count	Morts U.M. Plus Count
Total Live U.M.=	Total Morts U.M.=

	Spp		Ad-Clipped			
#	FL	WW	STAGE	RACE	MORT	ID#
1			1 2 3 4 5	F S W L	Y N	
2			1 2 3 4 5	F S W L	Y N	
3			1 2 3 4 5	F S W L	Y N	
4			1 2 3 4 5	F S W L	Y N	
5			1 2 3 4 5	F S W L	Y N	
6			1 2 3 4 5	F S W L	Y N	
7			1 2 3 4 5	F S W L	Y N	
8			1 2 3 4 5	F S W L	Y N	
9			1 2 3 4 5	F S W L	Y N	
10			1 2 3 4 5	F S W L	Y N	
11			1 2 3 4 5	F S W L	Y N	
12			1 2 3 4 5	F S W L	Y N	
13			1 2 3 4 5	F S W L	Y N	
14			1 2 3 4 5	F S W L	Y N	
15			1 2 3 4 5	F S W L	Y N	
16			1 2 3 4 5	F S W L	Y N	
17			1 2 3 4 5	F S W L	Y N	
18			1 2 3 4 5	F S W L	Y N	
19			1 2 3 4 5	F S W L	Y N	
20			1 2 3 4 5	F S W L	Y N	
21			1 2 3 4 5	F S W L	Y N	
22			1 2 3 4 5	F S W L	Y N	
23			1 2 3 4 5	F S W L	Y N	
24			1 2 3 4 5	F S W L	Y N	
25			1 2 3 4 5	F S W L	Y N	
26			1 2 3 4 5	F S W L	Y N	
27			1 2 3 4 5	F S W L	Y N	
28			1 2 3 4 5	F S W L	Y N	
29			1 2 3 4 5	F S W L	Y N	
30			1 2 3 4 5	F S W L	Y N	
31			1 2 3 4 5	F S W L	Y N	
32			1 2 3 4 5	F S W L	Y N	
33			1 2 3 4 5	F S W L	Y N	
34			1 2 3 4 5	F S W L	Y N	
35			1 2 3 4 5	F S W L	Y N	
36			1 2 3 4 5	F S W L	Y N	
37			1 2 3 4 5	F S W L	Y N	
38			1 2 3 4 5	F S W L	Y N	
39			1 2 3 4 5	F S W L	Y N	
40			1 2 3 4 5	F S W L	Y N	
41			1 2 3 4 5	F S W L	Y N	
42			1 2 3 4 5	F S W L	Y N	
43			1 2 3 4 5	F S W L	Y N	
44			1 2 3 4 5	F S W L	Y N	
45			1 2 3 4 5	F S W L	Y N	
46			1 2 3 4 5	F S W L	Y N	
47			1 2 3 4 5	F S W L	Y N	
48			1 2 3 4 5	F S W L	Y N	
49			1 2 3 4 5	F S W L	Y N	
50			1 2 3 4 5	F S W L	Y N	

Live U.M. Plus Count	Morts U.M. Plus Count
Total Live U.M.=	Total Morts U.M.=

Other Species Data Sheet. Used to record data on bycatch (species of fish other than our target taxa).



Other Species

U.M. = Unmeasured

DATE:_____

TRAP ID:_____ PG:____/_____

	SPP				SPP				SPP				SPP			
#	FL	STAGE		MORT	FL	STAGE		MORT	FL	STAGE		MORT	FL	STAGE		MORT	
1		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
2		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
3		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
4		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
5		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
6		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
7		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
8		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
9		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
10		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
11		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
12		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
13		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
14		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
15		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
16		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
17		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
18		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
19		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
20		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
21		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
22		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
23		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
24		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
25		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
26		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
27		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
28		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
29		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
30		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
31		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
32		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
33		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
34		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
35		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
36		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
37		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
38		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
39		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
40		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
41		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
42		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
43		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
44		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
45		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
46		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
47		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
48		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
49		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
50		A	J	Y N		A	J	Y N		A	J	Y N		A	J	Y N
Live U.M.				Morts U.M.	Live U.M.			Morts U.M.	Live U.M.			Morts U.M.	Live U.M.			Morts U.M.
Total=				Total=	Total=			Total=	Total=			Total=	Total=			Total=

Marked Data Sheet. Used to record data during marking on

LOWER AMERICAN RIVER, WATT AVE Pg ____/____
Camp Release ID:

Marking

Marking Date: ____ /____/____ Field Crew: _____
Marking Start Time: _____ Marking End Time: _____

Marking Species: _____ Marking Stock Rearing Type: Natural Hatchery

Mark Type: Fin Clip Pigment/dye Photonic Dye

Mark Color: Yes: _____ No

Mark Position: Whole Body Adipose fin Anal Fin Pelvic Fin Caudal Fin
Caudal Fin (top) Caudal fin (bottom)

Number of Fish Marked	Number of Marking Mortalities	Number of Successfully Marked Fish

How many hours will fish be held at release site before release: _____ hours
Holding Temp: _____°C Holding Method: _____

Notes:

Release

Release Date: ____/____/____ Release Time: _____
Release Site: _____ Release Site Temp: _____°C

Release Light Conditions: Twilight/Dusk Daylight Day (Overcast) Night (Dark) Night (Moonlit)

Field Crew: _____

Number Successfully Marked Fish	Number of Holding Mortalities	Total Number Fish Released

Release Distribution Method: _____
_____

Notes:

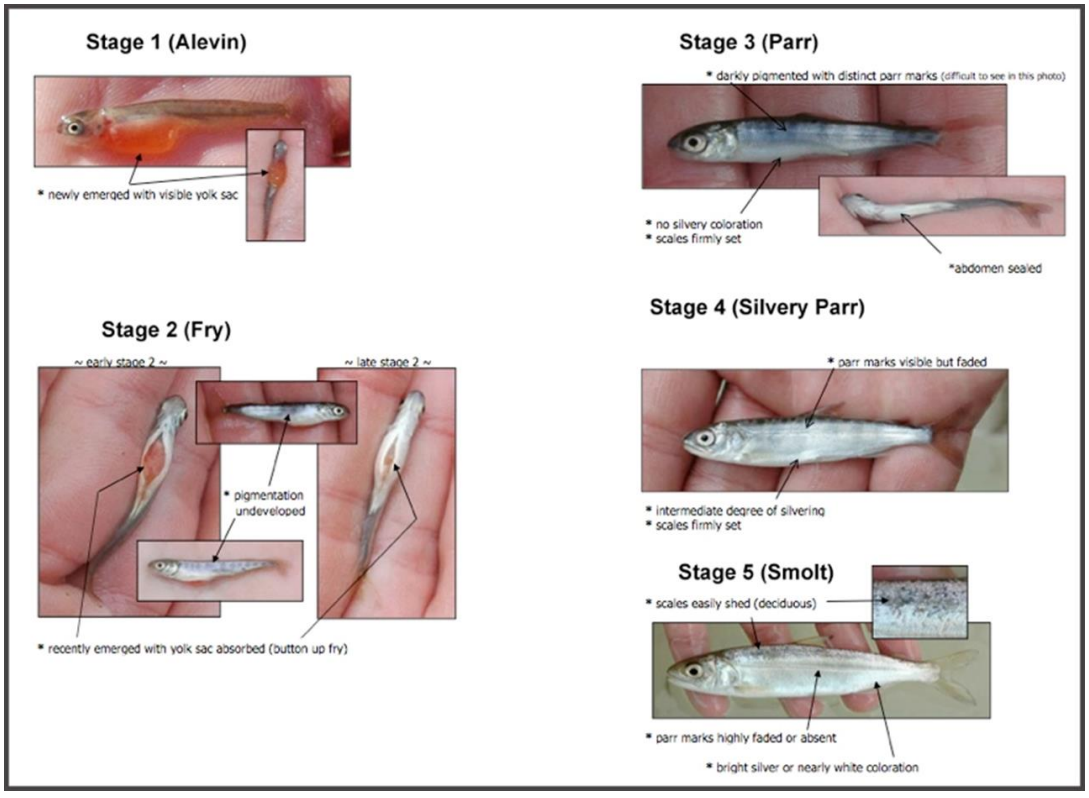
Marked Chinook Salmon Data Sheet. Chinook salmon after they've been marked for a trap efficiency trial.

Marked Chinook Salmon Pg / **Trap Origin:** 8.1 8.2 Both

#	FL	WW	#	FL	WW	#	FL	WW	#	FL	WW
1			51			101			151		
2			52			102			152		
3			53			103			153		
4			54			104			154		
5			55			105			155		
6			56			106			156		
7			57			107			157		
8			58			108			158		
9			59			109			159		
10			60			110			160		
11			61			111			161		
12			62			112			162		
13			63			113			163		
14			64			114			164		
15			65			115			165		
16			66			116			166		
17			67			117			167		
18			68			118			168		
19			69			119			169		
20			70			120			170		
21			71			121			171		
22			72			122			172		
23			73			123			173		
24			74			124			174		
25			75			125			175		
26			76			126			176		
27			77			127			177		
28			78			128			178		
29			79			129			179		
30			80			130			180		
31			81			131			181		
32			82			132			182		
33			83			133			183		
34			84			134			184		
35			85			135			185		
36			86			136			186		
37			87			137			187		
38			88			138			188		
39			89			139			189		
40			90			140			190		
41			91			141			191		
42			92			142			192		
43			93			143			193		
44			94			144			194		
45			95			145			195		
46			96			146			196		
47			97			147			197		
48			98			148			198		
49			99			149			199		
50			100			150			200		

APPENDIX B: Chinook Salmon and Steelhead Life Stages

Smolt Index	Life Stage	Criteria
1	Yolk-sac Fry	∗ Newly emerged with visible yolk sac
2	Fry	∗ Recently emerged with yolk sac absorbed (button-up fry) ∗ Seam along mid-ventral line visible ∗ Pigmentation undeveloped
3	Parr	∗ Seam along mid-ventral line not visible ∗ Scales firmly set ∗ Darkly pigmented with distinct parr marks ∗ No silvery coloration
4	Silvery Parr	∗ Parr marks visible but faded ∗ Intermediate degree of silvering
5	Smolt	∗ Parr marks highly faded or absent ∗ Bright silver or nearly white coloration ∗ Scales easily shed (deciduous) ∗ Black trailing edge on caudal fin ∗ Body/head elongating
6	Adult	∗ ≥ 300mm



APPENDIX C: Trap Visit Data Sheet Terminology

This appendix defines how particular terms on the field data sheets are defined, and how they should be viewed as data are entered on the field data sheets.

Before cleaning (RPM): the number of revolutions the cone makes in one complete minute, measured *before* the trap is cleaned. Take three separate RPM readings and then calculate and record the average. If the trap is stopped on arrival then the before cleaning revs will be zeros.

The determination of when a trap makes a complete revolution is made by observing a specific location on the trap, e.g., a colored dot or bolt present on the trap cone. On most 8-foot RST trap cones, there is one weld line on the base of cone and 10 equally sized screen sections which makes it simple to reference a full rotation and 1/10 of a rotation. A different, but similar, practice will be used for a 5-foot RST depending on how the weld lines and screen sections appear on that trap.

After cleaning (RPM): the number of revolutions the cone makes in one complete minute, as measured *after* the trap is cleared of any debris and all fish are removed from the live-box. Take three separate RPM readings and then calculate and record the average.

Debris Volume (gallons): a description of the total amount of debris in the trap live-box. The amount of debris should be measured using a 5-gallon bucket, and the debris volume on the Trap Visit data sheet should be recorded as the total number of gallons of debris present.

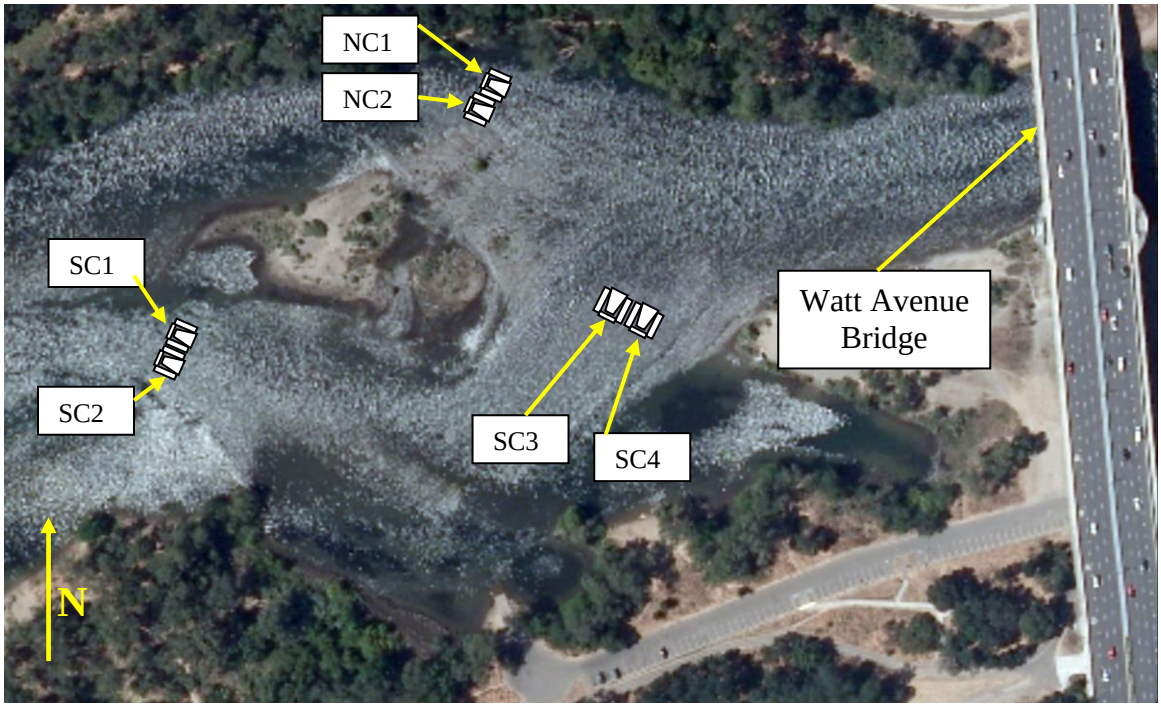
Recorder/crew: initials of the names of the personnel operating the trap. The first set of initials is the data recorder during the trap visit. The subsequent initials represent the individuals that were collecting biological or environmental data.

Sample Gear ID (feet): reflects the cone diameter of a RST at a subsite.

Sample Gear ID	Description
5	if the trap is a 5-foot diameter RST
8	if the trap is a 8-foot diameter RST

Subsite code: a code describing the location of a position within the sampling area below the Watt Avenue Bridge. The two river channels below the Watt Avenue bridge (a north channel and a south channel) and the potential for multiple subsite locations in each of those channels results in the existence of six subsites as they are defined in the table below.

River channel	CAMP Subsite code	Trap Visit Data Sheet Subsite Code	Notes
North Channel	NC1	8.1	The more northerly of the two subsites in the north channel.
North Channel	NC2	8.2	The more southerly of the two subsites in the north channel.
South Channel	SC1	SC5.1	The more northerly of the two subsites in the south channel.
South Channel	SC2	SC5.2	The more southerly of the two subsites in the south channel.
South Channel	SC3	Not used	Subsite location previously used by CDFG between 1996 and 2008.
South Channel	SC4	Not used	Subsite location previously used by CDFG between 1996 and 2008.



Total revolutions since last trap check: a lever actuated mechanical counter is mounted on each RST, and records the number of revolutions the trap has been made since the last time the

counter was set to a value of 0. The total revolutions since last trap check reflects the reading on the rotation counter at the end of the trap visit before it is reset for the next sampling period. The counter is set to 0 when the crew has determined the live well has been completely cleared of all fish and debris.

Trap Functioning ID: code for how well the trap was functioning when the visit to the trap began. Answer the question, "Did the trap function correctly since the last visit to the trap?"

Trap Functioning ID	Description
1	Trap functioning normally
2	Trap functioning, but not normally (trap has some debris or other impediment that may affect its ability to collect fish, or the trap is not rotating properly)
3	Trap stopped functioning (trap is packed with debris so it can not collect fish, or the trap is not rotating)
4	Trap not in service

Trap Visit Date: the date when the visit to a trap occurred. E.g., if the field crew arrived at a trap on January 1, 2010 to service a trap, the Trap Visit Date would be 01/01/2010.

Visit Time: represents the start of a sample period. The time entered on the data sheet reflects the moment a trap begins fishing.

Visit Time2: represents the time a trap is emptied and is put back in service after it has been cleared of fish. The VisitTime2 field therefore represents the end of a sample period. In most cases when a trap fishes without problems and there is no break in sampling, the VisitTime2 of one day is also the VisitTime for the next day.

For example and when there is no break in sampling, if biologists clear the live box of fish at 1:00 PM on Tuesday, that 1:00 PM Tuesday time is the VisitTime2 data entry for Tuesday's catch, and it is also the time for the VisitTime of the Wednesday catch period.

An example when there is discontinuous sampling is as follows. If biologists clear a live box of fish at 1:00 PM on Tuesday, and then do not resume trapping until 5:00 PM on Tuesday, then the 1:00 PM time on Tuesday is the VisitTime2 data entry representing the end of the sampling period on Tuesday, and the 5:00 PM time on Tuesday represents the VisitTime of the Wednesday catch period.

Visit Type ID: code for the work that was done during a trap visit. This field is used to help characterize when a trap is started, restarted in the same position and configuration after a malfunction, adjusted, and stopped. Using this field, it is possible to reconstruct the operational history of the trapping at a subsite.

Visit Type ID	Description
1	Start trap and begin trapping. Used when trap had not been operating, or when it is moved or reconfigured. Defines the beginning of a sampling period. Fish are never processed during this type of visit.
2	Continue trapping in same position and configuration without interruption. Used when there is no break in trap operations. Defines the break between two sampling periods. Fish are usually processed during this type of visit.
3	Unplanned restart of trap after malfunction (in same position and configuration). Used when the trap had stopped operating. Defines the break between two sampling periods. Fish are usually processed during this type of visit.
4	End trapping in current position or configuration. Used when trap is moved or stopped. Defines the end of a sampling period. Fish are usually processed during this type of visit.
5	"Drive by", i.e., trap is scanned to ensure it is functioning, but fish are not processed and trap is not adjusted. Environmental measures may be taken. If a "drive by" results in fish being sampled or trap being serviced, then use an alternative code as appropriate. Does not define the beginning or end of a sampling period.
6	Service / adjust / clean trap. Adjustment is made to trap during a sampling period, such as returning it to desired sampling position or removing debris. Does not define the beginning or end of a sampling period. Fish are not processed during this type of visit.

Water dissolved oxygen (milligrams per liter): dissolved oxygen levels in the American River will be measured with a YSI® 55 Dissolved Oxygen Meter. Measure the dissolved oxygen levels in each of the two stream channels, i.e., if two traps are operating in the north channel and two traps are operating in the south channel, there is only a need to measure the dissolved oxygen levels at one location in the north channel and one location in the south channel. The location where dissolved oxygen is measured will be at a location where river water is moving past the side of the RST. The measurement should be recorded in milligrams per liter. Refer to dissolved oxygen meter manual for more information about the use, calibration and maintenance of the dissolved oxygen meter.

Water temperature (Celsius): water temperatures in the American River will be measured with a YSI® 55 Dissolved Oxygen Meter. Measure the water temperatures in each of the two stream channels, i.e., if two traps are operating in the north channel and two traps are operating in the south channel, there is only a need to measure the water temperature at one location in the north channel and one location in the south channel. The location where water temperature is measured will be at a location where river water is moving past the side of the RST. The measurement should be recorded in Celsius units, and be recorded to the nearest tenth of a degree. Water temperature should be consistently taken around the same time every day.

Water turbidity (nephalometric turbidity units): turbidity levels in the American River will be measured with an Oakton® T-100 Waterproof turbidity meter. Collect a water sample for turbidity analysis from each of the two stream channels, i.e., if two traps are operating in the North Channel and two traps are operating in the south channel, there is only a need to collect one water sample in the North Channel and one sample in the south channel. Water samples should be collected from the river water moving past the side of the RST. When taking this sample, submerge the bottle entirely and allow it to fill completely (no air). Place the appropriate pre-labeled top for the trap location on the bottle from where the sample was taken. Place bottles into the cooler immediately and keep cool to preserve organics which may create added turbidity in sample. Take the bottles back to the office and quantify and record the turbidity on the Daily Trap Visit data sheet to the nearest tenth of a nephalometric turbidity unit (NTU). Refer to turbidity meter manual for more information about the use, calibration and maintenance of the turbidity meter.

Water velocity (meters per second): water velocities in the American River will be measured with a Hach FH950 portable velocity meter. Measure the average water velocity in front of each screw trap, approximately halfway between the right pontoon and shaft and half the radius of the trap cone below the surface; record the value on the corresponding data sheet for that RST. Make sure the flow meter is programmed to present values in meters per second, be sure to re-zero the meter to measure the average velocity before taking the next reading, and record the average water velocity to the nearest tenth of a meter per second. Refer to water velocity meter for more information about the use, calibration and maintenance of the water velocity meter.

Weather: circle any relevant weather descriptions that accurately describe the current weather conditions for that day.

APPENDIX D: Equipment Lists

Catch Visit Equipment List

The equipment that field biologists should take to the American River trap site is as follows:

Clipboard
Weight scale
Knife
Surgical scissors
Syringe
Envelopes
Stop watch (2)
First-aid kit
Flashlights/headlamps
Rescue rope
Pocketknife
WD-40
Winch handle
Waders
Wading boots
Ice chests
Measuring board
Scoop nets (2)
Dip net (1)
Car battery
Cell phone
Salmon length-at-date chart
200 proof ethanol
Poly Aqua stress coat
Trap Visit Data Sheets
Alka-Seltzer Gold
18-gallon tubs (2)
Pencils/Sharpies
Fish ID book
Thermometer/dissolved oxygen meter
Tools, screw drivers and crescent wrenches
Nylon rope
Zip ties
Hub counter bolts/nuts
Datasheets
Paddles
Personal flotation devices
Water velocity meter
Digital camera
1/2 bucket for anesthesia bath
Scrub brushes (2)
Pitch fork
Aerator
5 gallon buckets (8)
Vials for storing fish clips and whole fish
Vials for assessing water turbidity

Bismark Brown Equipment List

Large tub
Large ice chest
5-gallon buckets
Frozen water bottles/Ice Packs
Marking Data Sheets
Bismarck Brown Y stain powder
Aerator
Live cart

Anesthetizing Equipment List

Water
Funnel
1 liter container
Container for mixing
Latex gloves
Alka-Seltzer Gold

VIE Equipment List

*VIE Kit

Clipboard
Syringe
Pencils
Hardener
3–5 Buckets
Aerator
Tie downs
Card table
Chairs
Net pen
Scoop net
Elastomer dye
Alka-Seltzer Gold
Marking Data Sheets
Thermometer
Deionized Water
Latex gloves
Live cars
Ice chests
Dip net
Towels
Poly Aqua Stress coat
Tool box

APPENDIX E: Fish Species List for the American River

Common Name	Species	Family	Status in American River	Native/Non-native
American Shad	*Alosa sapidissima*	Clupeidae	Present	Non-native
Black bullhead	*Ameiurus melas*	Ictaluridae	Possibly present	Non-native
Black crappie	*Pomoxis nigromaculatus*	Centrarchidae	Possibly present	Non-native
Bluegill	*Lepomis macrochirus*	Centrarchidae	Present	Non-native
Brown bullhead	*Ameiurus nebulosus*	Ictaluridae	Possibly present	Non-native
Chinook salmon	*Oncorhynchus tshawytscha*	Salmonidae	Present	Native
Common carp	*Cyprinus carpio*	Cyprinidae	Present	Non-native
Golden shiner	*Notemigonus crysoleucas*	Cyprinidae	Present	Non-native
Goldfish	*Carassius auratus*	Cyprinidae	Present	Non-native
Green sunfish	*Lepomis cyanellus*	Centrarchidae	Present	Non-native
Hardhead	*Mylopharodon conocephalus*	Cyprinidae	Present	Native
Hitch	*Lavinia exilicauda*	Cyprinidae	Present	Native
Inland silverside	*Menidia beryllina*	Atherinopsidae	Present	Non-native
Largemouth bass	*Micropterus salmoides*	Centrarchidae	Present	Non-native
Pacific lamprey	*Entosphenus tridentatus*	Petromyzontidae	Present	Native
Prickly sculpin	*Cottus asper*	Cottidae	Possibly present	Native
Pumpkinseed	*Lepomis gibbosus*	Centrarchidae	Present	Non-native
Redear sunfish	*Lepomis microlophus*	Centrarchidae	Present	Non-native
Riffle sculpin	*Cottus gulosus*	Cottidae	Possibly present	Native
River lamprey	*Lampetra ayresii*	Petromyzontidae	Present	Native
Sacramento pikeminnow	*Ptychocheilus grandis*	Cyprinidae	Present	Native
Sacramento sucker	*Catostomus occidentalis*	Catostomidae	Present	Native
Smallmouth bass	*Micropterus dolomieu*	Centrarchidae	Present	Non-native
Splittail	*Pogonichthys macrolepidotus*	Cyprinidae	Present	Native
Steelhead	*Oncorhynchus mykiss*	Salmonidae	Present	Native
Striped bass	*Morone saxatilis*	Moronidae	Present	Non-native
Threadfin shad	*Dorosoma petenense*	Clupeidae	Present	Non-native
Threespine stickleback	*Gasterosteus aculeatus*	Gasterosteidae	Present	Native
Tule perch	*Hysterocarpus traskii*	Embiotocidae	Present	Native
Wakasagi (Japanese smelt)	*Hypomesus nipponensis*	Osmeridae	Present	Non-native
Warmouth	*Chaenobryttus gulosus*	Centrarchidae	Present	Non-native
Western mosquitofish	*Gambusia affinis*	Poeciliidae	Present	Non-native
White catfish	*Ameiurus catus*	Ictaluridae	Possibly present	Non-native
White crappie	*Pomoxis annularis*	Centrarchidae	Possibly present	Non-native

Note: Other fish species may occur in the American River. It should not be assumed the list above is a complete list.
The following references provide some of the information biologists can use to determine the species identification of unidentified fish in the Central Valley:

1. Moyle, P.B. 2002. Inland Fishes of California. University of California Press, Berkeley and Los Angeles, California, USA.

2. Wang, J.C.S. 2010. Fishes of the Sacramento-San Joaquin River Delta and Adjacent Waters, California: A Guide to Early Life Histories. Unpublished report prepared by the U.S. Department of the Interior, Bureau of Reclamation, Mid-Pacific Region and Denver Technical Service Center. Volume 44 – Special Publication. 411 pp. http://www.usbr.gov/pmts/tech_services/tracy_research///tracyreports/TracyReportsVolume44r.pdf

3. Reyes, R.C., B.W. Bird, and P.F. Raquel. 2007. Guide to the Fishes of the Tracy Fish Collection Facility. Unpublished report prepared by the U.S. Department of the Interior, Bureau of Reclamation, Mid-Pacific Region and Denver Technical Service Center. Volume 36. 38 pp. http://www.usbr.gov/pmts/tech_services/tracy_research///tracyreports/TracyReportsVolume36.pdf

4. Http://www.usbr.gov/pmts/tech_services/tracy_research/photos/fish/ReyesFishGallery.html. This website provides good photographs of some of the fishes in the Central Valley.

APPENDIX F: Key to Juvenile Chinook Salmon and Steelhead

From: Pacific States Marine Fisheries Commission
Smolt Monitoring Program
Guide To Fish Handling, Identification, And Condition
Revised April 2001

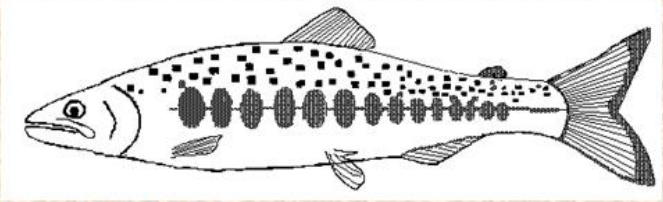
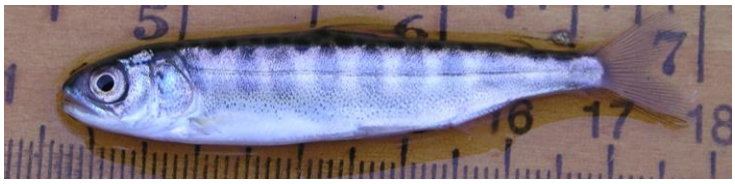


Figure 7. Distinguishing characteristics of Fall Chinook (Oncorhynchus tshawytscha).

1. Smaller eye that tends to turn down in head.
2. Deeper body, "football shape".
3. Usually more silvery in appearance.

Similar physical characteristics of Spring and Fall Chinook

1. Caudal fin forked, usually tipped in black.
2. Parr marks are large, vertically oblong, wider then the intervening spaces, and centered on the lateral line.
3. Anal fin rays are short, wedge shaped, and usually not pigmented.
4. Large, oblong spots on the back.



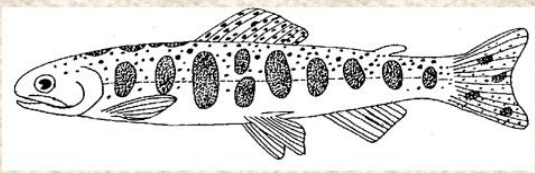


Figure 5. Distinguishing characteristics of Steelhead (Oncorhynchus mykiss).

1. Caudal fin not forked, with rounded lobes.
2. Parr marks nearly round, centered on lateral line.
3. Head more rounded than salmon when viewed from the top.
4. Dorsal fin has distinct black pigmented spots. In general, more spotting on fish.

APPENDIX G: Process for Staining Chinook Salmon With Bismark Brown Dye

Prepare Staining Solution at a Dosage of 1 packet of BBY (0.6 g) per ~20 gallons of water.

a) Using a graduated cylinder, fill a large tub with 75 liters of water (approximately 20 gallons).

b) Using a balance, measure out 0.6 gram of Bismarck Brown *Y* stain powder (this step should be prepared ahead of time in the lab).

c) Thoroughly mix the Bismarck Brown Y powder in a small bottle with screw tight lid and shake to ensure powder is thoroughly mixed, and then add to the tub of water with fish to be stained.

d) Place aerator and thermometer in tub.

e) Keep water well oxygenated; use ice to maintain water temperatures within 2 °C of river water.

Immerse Salmon in the Stain Solution

a) Count out fish to be stained with Bismarck Brown Y and place into dye solution.

b) DO NOT anesthetize fish or add stress coat prior to immersion in dye solution.

c) Record the number of fish placed in the stain solution.

d) Set lid over tub to prevent fish from escaping and to protect fish from direct sunlight.

e) Observe water temperature and fish activity regularly (every 5 to 10 minutes).

f) Gently stir water while observing fish.

Monitor the fish, aeration, and water temperature in the tub during the staining period to detect signs of stress and possible causes. Fish will initially behave erratically; flare gills, and appear sluggish while in solution, this is normal. However, immediately remove individual fish displaying prolonged abnormal behavior and place into well-aerated recovery water.

Remove the Salmon From the Stain Solution

a) Remove fish from the dye solution after two hours of immersion time in the solution and transfer them to a flow-through live cart to allow excess dye to drain out. Immediately submerse the live cart with lid in fresh river water to recover and wash out excess dye.

b) Record the end time when fish were removed from the stain solution.

c) Hold the stained salmon overnight. Prior to their release, remove and count all latent mortalities, and record the number of mortalities in the Mark and Release datasheet.

APPENDIX H: Process for Marking Chinook Salmon with Photonic Dye

Fish can be marked with photonic dye using a needle-less photonic injector (PWR'Ject System Gun, NewWest Technologies) that places a small, semi-permanent colored mark between fin rays (Figure 1). Photonic dye marks are usually placed on the caudal fin for fry-size fish; however, the dorsal and anal fins can also be marked when fish are larger than 45 mm. Photonic dye marks may last for several weeks, and allow for unique batch marks where field staff can correlate the recapture of fish to a particular trap efficiency test (thereby drastically reducing the potential that that fish is assigned to the wrong trap efficiency release group).

Figure 1: Anal fin marked with needle-less gun using photonic pink dye.

A marking station is defined as the workspace used by one biologist who is marking fish. Under normal circumstances, two biologists will mark fish, and a third biologist will record data and/or provide support to the two biologists marking fish.

Establish a work space

1. Set up marking station including table, chairs and canopy (if needed).
2. Start a new Marking Data Sheet and record: Date, Project Location, Crew Member Names, Origin of Fish Stock (wild vs. hatchery), Release Code, Mark Applied, and record 100 fork lengths. Include life stage, and mortality for all 100 fork lengths taken.
3. To prepare CO_2 tank, tap the bottom of tank against the ground softly 5 times and release a little CO_2 before attaching gun. This will clear out dry powder in CO_2 tanks which may damage the O-rings in marking gun.
4. To prepare the marking gun, place the tube into a water bottle of deionized water and run through the detached gun using the wrench supplied with the kit, pulling and pushing the plunger on the back of the gun. Then run the cleaning solution through the gun, and then transfer the tube to the dye and continue to push through the gun using the wrench to pull and push the plunger on the back of the gun. Be sure when transferring from liquid to

liquid that no air gets into the tube. This will cause the gun power to be reduced and hinder the marking abilities. If it seems air is in the tube then repeat the marking gun preparation method.

5. Attach marking dye hose and start CO_2 flow from the CO_2 tank.
6. Place cutting board with marking tile into a shallow pan of water. Water level in pan should be about ¼ inch above the marking tile. Water level may be adjusted depending on each person's marking technique. Typically if water is too low, marking dye will splatter when applied. If water is too high, marking may be inconsistent due to image refraction in the water.
7. Fill a cooler 1/2 full with river or hatchery water, insert a working aerator in the tub, add Stress Coat to the cooler, then add up to 150 fish at a time to the cooler.
8. Fill half a bucket with an appropriate solution of Alka-Seltzer
9. Fill recovery buckets full of river or hatchery water and add Stress Coat and place an aerator in the recovery bucket.
10. Place about 10 to 20 fish per marking station in the Alka-Seltzer solution. Place only as many fish in the solution as can be handled without undue stress. Start with 5-8 fish in the solution until marking is efficient enough to reduce the amount of time the fish are in the Alka-Seltzer solution.

Mark Fish

1. Take a random sample of 100 fish and measure the fork length and determine life stages. Record those data on the backside of a Fish Marking Data Sheet.
2. After all the fish have been measured and data has been recorded, hold a fish on the plastic cutting board, so the fin targeted for marking is on the tile. This will aid in stability of the fish as well as a surface behind the fin to disperse the ink throughout the fin rays.
3. Photonic dye marks are usually placed on the caudal fin for fry-size fish; however, the dorsal and anal fins can also be marked when fish are larger than 45 millimeter in length.
4. Apply the mark by starting with one pressure key turned out on the gun. Lightly place the gun tip onto the appropriate fin and pull the trigger. Be careful to not place the marking tip too close to the body or fin margin as it can potentially injure the fish. Turn out one key at a time to increase gun pressure; test before marking. If the fin splits when marked, reduce the gun pressure or position.
5. Agitate the dye solution every couple of minutes, the microscopic elastomer beads will settle in solution quickly. Dense concentration of elastomer beads can clog marking gun and make the remaining solution nearly useless when a majority of the beads are removed from solution.
6. Always check to ensure fish are recovering normally and have visible marks.
7. If the gun jams, remove fish from the Alka-Seltzer solution before trying to fix the jam. Guns can usually be fixed by running clean water through them or reversing the tip.

NEVER put river water in the guns, they will clog! If this does not solve the problem after a few attempts, try using a different tip.

8. After 150 fish have been marked, develop a new mixture of Alka-Seltzer solution in ½ bucket to ensure that the solution maintains its potency, and continue to mark the fish until every individual has received a mark.
9. After all fish have been marked, record the total number of fish marked on the datasheet. Mortalities should be recorded on datasheet and subtracted from total count.
10. If fish are being held in river, carefully position live car(s) in a secure location in river, secure the top and reinforce with a strap.

Clean up

1. Clean and load up all supplies. Marking guns should be cleaned thoroughly with deionized water and the cleaner solution provided by NewWest. Store the gun so it can dry in a short period of time. NEVER put a gun back into its case with dye in it.
2. Field check data sheet(s) for completeness and accuracy.
3. Make sure all the equipment is ready to be used again, and return all supplies to storage. Leave items out to dry thoroughly if they are still damp.
4. Store the CO2 tank standing vertical.

APPENDIX I: QA/QC Procedure for Datasheets

1. Datasheet QAQC
    - Finished datasheets must be QAQC'd before the data can be entered into the CAMP Database.

QAQC protocol for each trap's datasheets is as follows:

- Use a fine-point red sharpie.
- If anything needs to be corrected, write a single line through it and write the correction next to it.
- If there are pages without data, ensure these have a diagonal line through them.
- If any of your calculations do not match up with what was originally written, recheck your work before correcting the datasheet.

Start from last datasheets of the day and work your way forward as follows:

By-catch page:

- Make sure each species recorded has the correct species code.
- Check that the stage (adult/juvenile) is correct according to fork length.
- Check that plus count totals were added correctly. If no plus count totals were taken make sure there are ⌀'s in the plus count totals.
- If any columns were not used, ensure these have a diagonal line through them.
- Check that by-catch datasheets are dated and numbered.

Salmonid Datasheets:

- Check that page titles accurately describe the salmon listed.
- Check that length-at-date (LAD) criteria for each race has been recorded correctly.
- Check that the race of each fish (by LAD criteria) has been accurately determined.
- Make sure plus count totals are accurate. If there were no plus counts, make sure there is a ⌀ written.
- If any columns were not used, ensure these have a diagonal line through them.
- Check that pages are dated and numbered.

RST Datasheets:

- Check RPM averages (rounded to nearest 0.1)
- Check NTU average (nearest 0.01)
- Make sure salmonid totals are accurately transferred to Today's Catch sections
- If there were no fish of a given category caught, make sure there are ⌀'s in the totals column.
- If there were no stained fish held or released, make a diagonal line through this box.

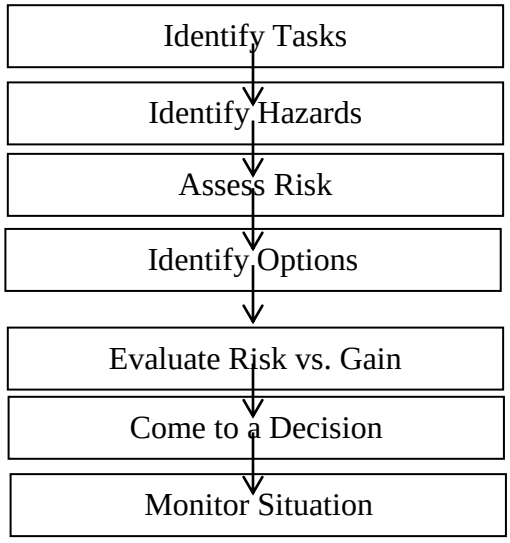
After QAQCing both trap's datasheets, write your initials and the date on the top right side of the first page for each trap.

APPENDIX J: Operational Procedure for Night Operations

Night time operations may be necessary in cases of increased river flow and/or major storm events where additional debris will likely be washed into the river and caught by the rotary screw traps. This debris can potentially cause the cones and live wells to be clogged with riparian/woody debris which can hinder trap operations. This debris can also lead to an increased mortality of salmonids being captured by the traps as they become trapped in the rotating cone instead of being directed to the live well. The traps can become clogged or blocked extremely quickly during these events. Because of this, a crew will go out during the evening and keep the traps clean and clear in order to reduce the potential for trap malfunction or fish mortality.

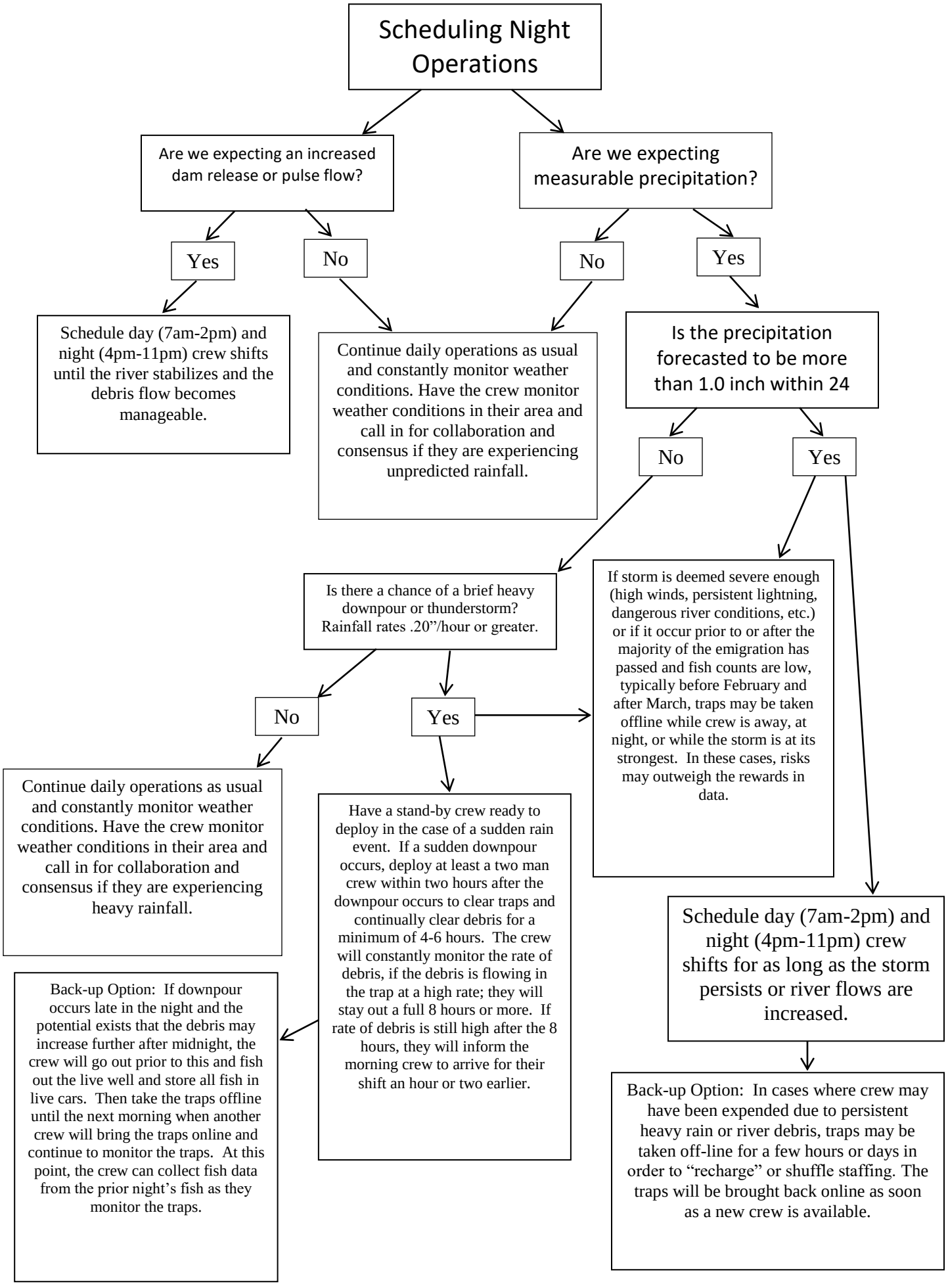
Night time trap operations will be considered on a case by case basis due to the inherent risk of operating in darkness and inclement weather. The decision will depend on the forecasted storm, amount of salmonids that may be passing the traps during this event and the potential hazards in regards to crew safety. A risk based assessment of these factors will be discussed with the field biologist, crew, and supervisors. Based on this discussion a determination will be made as to whether we believe a night time trap check is deemed warranted, unnecessary, or unsafe. The lead biologist will also determine the shift needed to perform the night time trap check depending on storm or forecasted river rise timing.

Steps for the decision making process regarding crew safety:



Hazards and risks that will be assessed:

- Storm severity
- Expected timing of storm
- River flow increase
- Wind conditions
- Proximity to trees
- Amount of debris in river
- Types of river debris
- Amount of fish expected
- Experience of crew
- Potential for injury
- Potential equipment damage
- Likelihood of emergency crews reaching crew in case of emergency


Scheduling Night Operations
Are we expecting an increased dam release or pulse flow?
Are we expecting measurable precipitation?
Yes
No
No
Yes
Schedule day (7am-2pm) and night (4pm-11pm) crew shifts until the river stabilizes and the debris flow becomes manageable.
Continue daily operations as usual and constantly monitor weather conditions. Have the crew monitor weather conditions in their area and call in for collaboration and consensus if they are experiencing unpredicted rainfall.
Is the precipitation forecasted to be more than 1.0 inch within 24
No
Yes
Is there a chance of a brief heavy downpour or thunderstorm? Rainfall rates .20"/hour or greater.
If storm is deemed severe enough (high winds, persistent lightning, dangerous river conditions, etc.) or if it occur prior to or after the majority of the emigration has passed and fish counts are low, typically before February and after March, traps may be taken offline while crew is away, at night, or while the storm is at its strongest. In these cases, risks may outweigh the rewards in data.
No
Yes
Continue daily operations as usual and constantly monitor weather conditions. Have the crew monitor weather conditions in their area and call in for collaboration and consensus if they are experiencing heavy rainfall.
Have a stand-by crew ready to deploy in the case of a sudden rain event. If a sudden downpour occurs, deploy at least a two man crew within two hours after the downpour occurs to clear traps and continually clear debris for a minimum of 4-6 hours. The crew will constantly monitor the rate of debris, if the debris is flowing in the trap at a high rate; they will stay out a full 8 hours or more. If rate of debris is still high after the 8 hours, they will inform the morning crew to arrive for their shift an hour or two earlier.
Schedule day (7am-2pm) and night (4pm-11pm) crew shifts for as long as the storm persists or river flows are increased.
Back-up Option: If downpour occurs late in the night and the potential exists that the debris may increase further after midnight, the crew will go out prior to this and fish out the live well and store all fish in live cars. Then take the traps offline until the next morning when another crew will bring the traps online and continue to monitor the traps. At this point, the crew can collect fish data from the prior night's fish as they monitor the traps.
Back-up Option: In cases where crew may have been expended due to persistent heavy rain or river debris, traps may be taken off-line for a few hours or days in order to "recharge" or shuffle staffing. The traps will be brought back online as soon as a new crew is available.

Example Scenarios:

If storm precipitation is expected to increase river flow, but wind is expected to be less than 20mph, night operations will likely occur.

If storm precipitation and wind is likely to be high, but fish counts from the previous days have been less than 100 fish, night and trap operations may be suspended during the storm.

If storm is likely to have high winds (greater than 40mph), and traps are positioned underneath trees, safety of the crew may be compromised and trap operations may be suspended.

In instances where night operations will occur, a crew will go out to the traps in the evening and clear the live well and trap of debris. Fish will either be left in the live well or set aside in an additional live cart for assessment during the next day time trap check, depending on the quantity of fish. Fish assessment will be left for day time checks where there is enough natural light to accurately assess, measure, and weigh fish. If fish count for the night time check appear to be more than roughly 2,000-5,000 fish in the live well, those fish will be placed in a separate large live cart. A best judgment estimate will be used in these cases in order to prevent additional fish handling from counting individual fish. The ultimate goal of separating the fish is to prevent overcrowding inside the live well as more fish continue to be captured throughout the night. It is thought that an influx of fish will be flushed down the system during increased flow events. Additionally, most of the fish are captured late at night or in the early morning hours. These factors should be considered when deciding whether or not to leave fish in live well or store in live cart until the next daytime check.

During Nimbus dam "pulse flows" only events, night time operations are likely to be performed by the crew. These are instances when dam operators will increase flows for a relatively short amount of time, typically less than a week, to help encourage the outward migration of salmonids from the Lower American River into the Sacramento River and delta. Typically the Bureau of Reclamation will give advanced notice of timing, duration, and magnitude of the pulse flow. Because of the importance of this data, special attention will be taken to ensure that the traps are operating during the entirety of the pulse flow. During these events, weather typically isn't a factor.

Additional equipment for night operations:

- Navigation lights for jet-boat including red/green side lights and white all-around light
- Deck lights for trap
- Deep Cycle battery to power deck lights
- Spot light
- Wearable head lights
- Flashlights
- PFD's with reflective tape and safety strobes
- US Coast Guard approved locator kit with flares
- Live cars for holding fish overnight