Project Specific Health & Safety Plan for the Clifton Court Forebay Predator Study

Delta Conveyance Biotelemetry and Special Investigations Section
Delta Conveyance Branch
Bay-Delta Office
California Department of Water Resources

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1. Introduction

This document is intended to serve as a project specific addendum to the safety policy and procedures established for Delta Conveyance Branch (DCB) field operations. This Project Specific Safety Plan (PSSP):

1. Identifies the specific roles and responsibilities of staff working on the Clifton Court Forebay Predator Study,
2. Documents project specific policies and procedures, and
3. Evaluates the hazards associated with the activities we are conducting as part of this project.

The PSSP should be used to conjunction with these DCB and DWR safety documents (available from the Principal Investigator (PI) or DCB Safety Officer):

1. Injury Illness Prevention Program for DCB Field Operations—January 2013 revision
2. Safety Guidelines, Policies, and Procedures for DCD Field Operations—January 2013 revision
3. Hazard Communication Plan for DCB Field Operations—January 2013 revision
4. Fire Prevention Plan for DCB Field Operations—January 2013 revision
5. Emergency Action Plan for DCB Field Operations—January 2013 revision
6. DWR Heat Illness Prevention Plan—July 2012 revision
7. DWR Injury and Illness Prevention Program—May 2012 revision
8. Project O&M Instruction No. OP-2—June 2012 revision

All personnel and visitors on a project site must comply with the requirements of these safety documents. All project personnel also have the right and duty to stop work when conditions are unsafe and to assist in correcting these conditions.

2. Roles and Responsibilities

Program Manager

The Program Manager for the Clifton Court Predator Study is:

Matthew Reeve—Program Manager II, DWR

The Program Manager must ensure that all safety policies are implemented in areas that fall under their control. They report to the Branch and Office Chiefs. They are responsible for the following:

1. Communicating management's commitment to health and safety of employees
2. Coordination with other DWR offices and divisions
3. Ensuring that areas under the their control comply with internal and external regulations and guidelines including DWR and SWP policies
4. Providing subordinate staff and supervisors with the authority and resources to develop and implement appropriate health and safety programs, practices and procedures

Supervisors

The responsible supervisor for this project is:

Kevin Clark – Senior Environmental Scientist, DWR

The Supervisor has the responsibility to oversee all work operations. The Supervisor coordinates safety and health functions with the Program Manager and the DCB Safety Officer. The Supervisor has the authority to oversee and monitor the performance of the workers as well as bearing ultimate responsibility for the proper implementation of this site-safety plan and compliance with Cal/OSHA regulations. The specific duties of the supervisor are:

1. Encouraging safe working practices by ensuring that employees are properly trained to complete all assigned tasks;
2. Ensuring periodic inspection of workspaces under their authority;
3. Stopping work that poses an imminent hazard to any employee;
4. Implementing measures to eliminate or control workplace hazards;
5. Overseeing the development of safe work procedures such as Standard Operating Procedures (SOP) and Job Hazard Analyses (JHA);
6. Providing appropriate safety training and personal protective equipment to employees under their supervision;
7. Reporting and investigating work related injuries and illnesses;
8. Encouraging employees to report health and safety issues without fear of reprisal;
9. Disciplining employees that do not comply with safe work practices; and
10. Documenting employee training and departmental safety activities.

Principal Investigators

The Principal Investigators (PI) for the overall Clifton Court Forebay Predator Study are:

Veronica Wunderlich – Environmental Scientist, DWR
Curtis Yip – Environmental Scientist, DWR

The PI has the full responsibility and authority to develop and implement this project-specific safety plan and to verify compliance. The PI reports to the Supervisor. The PI is readily accessible to the site during all work operations and has the authority to halt site work if unsafe conditions are detected. The specific responsibilities of the PI are:

1. Encouraging safe working practices by being role models of safe working practices and techniques,
2. Conducting periodic inspection of workplaces and work activities under their direction;
3. Stopping work that poses an imminent hazard to any employee;
4. Implementing measures to eliminate or resolve workplace hazards;
5. Developing safe work procedures and documenting Standard Operating Procedures (SOP's);
6. Conducting Job Hazard Analyses (JHA's) for all work tasks and locations under their direction;
7. Ensuring that all employees under their direction have appropriate work training and safety training to complete their work duties;
8. Ensuring that personal protective equipment is available and in good working condition.
9. Reporting and investigating work related injuries, illnesses, and safety incidents;
10. Ensuring that employees under their direction properly conduct work activities utilizing the procedures documented in the SOP's.

Job Managers

The Job Managers for this study are:

Salmonid Survival: **Curtis Yip** – Environmental Scientist, DWR

Avian Surveys: **TBD**

Creel Surveys: **Donald Santos**—Fish and Wildlife Technician, DWR

Tagging (PIT, Floy, Acoustic): **Bryce Kozak**—Fish and Wildlife Technician, DWR

Predatory Fish Sampling: **Veronica Wunderlich** —Environmental Scientist, DWR

Acoustic Receiver Deployment, Maintenance, and Retrieval: **TBD**

PIT Detection System: **Javier Miranda**—Senior Environmental Scientist (Specialist), DWR

Genetics: **TBD**

Fish Husbandry: **Virginia Afentoulis**—Environmental Scientist, DWR

Job Managers have the responsibility and authority to direct specific components of the overall study in close coordination with the PI. The Job Manager reports to the PI. The specific responsibilities of the Job Manager are:

1. Training other employees on the specific activities under their direction.
2. Ensuring that employees under their direction properly conduct work activities utilizing the procedures documented in the SOP's.
3. Conducting Job Hazard Analyses (JHA's) for all work tasks and locations under their direction when conditions merit.
4. Coordinating staffing needs with the PI.
5. Ensuring that all employees under their direction have appropriate work training and safety training to complete their work duties.
6. Stopping work that poses an imminent hazard to any employee.

DCB Safety Officer

The DCB Safety Officer is:

Javier Miranda—Senior Environmental Scientist (Specialist), DWR

The DCB Safety Officer plays a key role in the implementation of field activities for the Delta Conveyance Branch. The DCB Safety Officer reports to the Program Manager. The DCB Safety Officer is readily accessible to the site in the event of an emergency and has the authority to halt site work if unsafe conditions are detected. The specific responsibilities of the DCB Safety Officer are:

1. Assisting the Program Manager with inter-division safety coordination
2. Aiding with emergency response and coordination
3. Aiding in investigations of accident, incidents, and near misses to identify and implement corrective actions
4. Ensuring regular inspections are conducted
5. Reporting to management any unsafe or unhealthy conditions which cannot be corrected at the staff level
6. Reviewing project specific safety policies and procedures

CHTR/FSB Laboratory Manager

The Laboratory Manager is:

Virginia Afentoulis—Environmental Scientist, DWR

The CHTR/FSB Laboratory Manager (Manager) has primary responsibility for implementation of safety policies at the CHTR and FSB Laboratories (Lab). The Lab is a special hazard location due to the presence of significant quantities of chemicals and gasses, pathogens, electrical, and mechanical hazards.

The Manager supports the PI, oversees day to day activities at the Lab, and has the authority and responsibility of a PI for activities occurring at the Lab. The Manager reports to the Supervisor. They are responsible for the following:

1. Coordinating and implementing safety activities at the Lab
2. Conducting periodic inspection of workplaces and work activities at the Lab
3. Stopping work that poses an imminent hazard to any employee at the Lab;
4. Implementing measures to eliminate or resolve workplace hazards at the Lab;
5. Maintaining on-site records of chemical hazards at the Lab;
6. Coordinating safety activities with the UC Davis Fish Conservation and Culture Laboratory (FCCL)

Site Workers

All Site Workers are responsible for complying with this PSSP, all DCB Safety Policies and Procedures, using the proper PPE, reporting unsafe acts and conditions, and following the lines of authority established for this project. Site workers are to comply with all Cal/OSHA and DWR regulations.

The work at the site will be carried out by a team consisting of DWR and consultant staff. Multiple staff from these organizations will work in and around the site conducting experiments. Daily safety tailgate sessions will be conducted at the onset of each day's activities, and all personnel working on the project that day will be required to attend. Additionally, weekly team meetings will be conducted to disseminate any new project safety information that has been raised at any of the daily tailgate meetings.

The Department of Water Resources, Bay Delta Office is the controlling employer and should be identified as such at the coordination meetings.

Employee Notification of Hazards

All employees will be notified of work place hazards through daily tailgate sessions and weekly team meetings conducted by the site supervisor. All employees working on site will be required to attend the tailgate sessions and weekly meetings and sign an attendance sheet.

3. Project Specific Safety Policies and Procedures

Basic Project Procedures:

- ALWAYS use the BDO truck when available for use.
- ALWAYS keep a state sedan/fuel efficient vehicle at the West Sacramento yard for project use (this will need to be checked out and turned back in on a two week cycle).
- If a second vehicle is required to accomplish work, then always ensure that the second vehicle selected for use is appropriate to the task:
    - For boat based work where a truck in addition to or instead of (in cases where the BDO truck is unavailable, or not task appropriate) the BDO truck, ensure that a truck with a tow hitch and ball is selected.
    - When conducting surveys such as avian or creel, a fuel efficient vehicle is fine (such as a sedan from the state garage).
- ALWAYS ensure that all vehicles that was used for the day are left in the West Sacramento Yard with a MINIMUM of ½ tank of gas, and in good working order for the next crew.
- When two or more people are travelling from Sacramento to Byron, and are working compatible shifts, arrange to meet at the West Sacramento yard and travel together from that location.
- When working a shift that is outside of normal working hours, which are defined as 5 am until 6 pm for the purposes of this study, the survey crew must call in to a pre-designated person when leaving the West Sacramento Yard and upon returning to the West Sacramento Yard.
    - The time at which the phone call is anticipated should be pre-designated as well. If there is a change in field plans, or circumstances, the field crew should ensure that they call the pre-designated person at the designated time and let them know of the change.
    - If the pre-designated person has not heard from the field crew by 30 minutes past the designated time, they will make one attempt to reach the field crew, by phone and one attempt by text.
    - If the field crew is successfully reached and their safety ensured then no further action need be taken.
    - If the field crew is unreachable, emergency services will be activated to locate the crew and ensure their safety.
    - If the field crew is having difficulty calling the pre-designated person due to cell signal issues, they will attempt to send a text, and await a reply. If no reply is received, send a follow up text and a secondary text to the backup pre-designated contact person. Do not assume the contact person(s) know you are safe until a reply is received.
- When surveys are completed, ALWAYS ensure that all elements are in good working order and return COMPLETE survey kits to a pre-designated location (specific to each survey type) for use by the next survey crew.
- If ANY item in a survey kit becomes damaged, immediately alert the PI so that a replacement can be arranged for prior to the next needed use.
- If any field crew member needs to call in sick, alert the PI and the crew members as soon as possible so that a replacement crew member can be secured for the work. It is the responsibility of the crew member to secure a replacement.
- ALWAYS leave early enough to allow for unexpected travel delays.

Coordination with Delta Field Division:

OP-2 Compliance Protocol for conducting field work at **all** Delta Field Division Facilities

The following procedures must be followed when conducting field activities outside of normal operations at **all** Delta Field Division (DFD) facilities:

1. DFD requires BDO (and all other non-DFD groups) staff to receive a formal "OK to Work", or clearance by an OP-2 certified individual.

   - An OK to work is a statement from the Operations Supervisor permitting work on or near energized equipment, circuits, or piece of equipment that does not require isolating or de-energizing the equipment for BDO staff to safely perform the work authorized.

   - A clearance is a statement from the Operations Supervisor with documentation declaring that the equipment to be worked on has been de-energized and isolated from all sources of hazardous energy with safety tags and appropriate locking devices placed; and, in that respect, is safe. Additionally, it permits the BDO staff to proceed with the work authorized.

   - Authorized work may include any activities beyond the access gates to the Forebay such as fishing, birding, creel surveys, fish releases, etc.

2. All requests for an OK to work should be done with an "Equipment Request Order Form" (EROF) (attached).

   - The EROF form is filled out jointly by BDO staff and the Operations Supervisor for work authorizations and is part of the Work Clearance Application (WCA). The EROF is a one page form requesting the following information:
     - date of request,
     - equipment involved
     - between points
     - detail of work
     - name of requestor

   - The WCA is an SAP/WCM software application used to document requests for the scheduling and approval of Clearances, Orders, Tests, Special Conditions, OKs to Work (when applicable), etc. The WCA includes information regarding the specific equipment, scope of work to be performed, clearance limits for clearances, duration, and all administrative approvals.

3. The EROF must be submitted by an OP-2 certified staff, according to the following timelines for either a clearance or an OK to Work:

- A **minimum** of two weeks ahead of time for OK's to Work
- A **minimum** of four weeks ahead of time for Clearances
- Submit a job scope with the request
- Submit a safety plan or Job Hazard Assessment (JHA) with the request

One completed and approved EROF is sufficient for field work that last several days. An OP2 trained person is required to check in daily with ACC (209-833-2180). The same procedure applies for longer term studies.

4. Copies of completed EROF forms must be submitted to the following DFD personnel (as of 2/12/13): notification (Equipment Request Order Forms) to Delta Field Division should be made to the following personnel:
    - Arnold Over, Assistant Lead Planner/Scheduler, 209-833-2058 Arnold.Over@water.ca.gov
    - Donna Cruz, Planner/scheduler and Senior Operator, 209-833- 2180 Donna.cruz@water.ca.gov

    CC to:
    - Doug Thompson, HEP Operations Superintendent, 209-833-2044 Doug.Thompson@water.ca.gov
    - Amber Candela-Cooney, (Assistant UCW Superintendent) 707-437-5101 Amber.Candela-Coony@water.ca.gov
    - John Wilson, Chief Operator, 209-833-2180, John.Wilson@water.ca.gov
    - Andy Guzman, Chief Operator, 209-833-2048, Andy.Guzman@water.ca.gov
    - Rhett Cotter, Utility Craftworker Superintendent, 209-833-2077, Rhett.Cotter@water.ca.gov
    - Jim Odom, Water Services Supervisor, 209-833-2043, Jim.Odom@water.ca.gov

5. DFD requires that at least one OP-2 certified individual be present for any activities conducted on or in the water at the Forebay. This includes all boat operations in the Forebay, installation of acoustic receivers, etc. The operation of the radial gates does not follow a routine schedule and can often be opened or closed without notice.

6. DFD does not require that an OP-2 certified individual be present for activities conducted on the shoreline of the Forebay **as long as these activities do not interfere in any way with the day to day operations of the State Water Project.** These activities include:

    - creel surveys,
    - avian surveys
    - fish releases that do not occur within the vicinity of the radial gates
    - shore based predator collection that does not occur within the vicinity of the trash racks

- photographing birds or fish (no photos may be taken of SWP facilities without prior DFD authorization)

Activities conducted on the shoreline of the Forebay at sites that are inaccessible to the public will require the presence of an OP-2 aware individual and an OK to work.

7. Consultants, contractors, federal employees, and other non-DWR employees are required to complete the OP-2 Awareness Training course. The course is now 45 minute video instead of the four hour course offered in the past. There is no final exam for the Awareness course.

DWR employees however, are encouraged to attend an 8 hour OP-2 certification class including receiving a passing score of 80% on the final exam to be placed on the OP-2 certification list This will allow them to receive "OKs to Work" and to sign onto clearances.

8. All employees need to sign in/out at the Fish Facility and notify ACC when work on or around Clifton Court Forebay.

4. Project Element Characterization and Job Hazard Analysis

This section of the site-specific safety plan identifies and describes standard operating procedures (SOP), as well as safety and health hazards via a job hazard analysis (JHA) associated with project work. The purpose of characterization and job hazard analysis is to identify and quantify the health and safety hazards associated with each site task and operation, and to evaluate the risks to workers. With this information, risks are then eliminated if possible, or effectively controlled. The information contained in this section of the site-specific safety plan is essential to the effective preparation of all other sections of the site-specific safety plan. This section addresses:

1. Salmon Transport
2. Salmon Tagging
3. Salmon Release
4. Acoustic Equipment Deployment, Maintenance and Retrieval
5. Predator Sampling
6. Predator Tagging
7. Avian Surveys
8. Creel Surveys
9. Genetics Sampling

4.1 Salmon Transport Standard Operating Procedures and Job Hazard Analysis

Task Lead: Curtis Yip

Large groups of juvenile Chinook salmon and/or Steelhead smolts will be periodically collected and transported from a hatchery to the CHTR building at the Skinner Fish Facility.

PPE: 2 orange traffic cones, high visibility vests, cell phone, gloves, wet weather gear, closed toed shoes, appropriate field clothes for the weather conditions.

Day before transport:

1. Find out from a Project Lead how many fish will be transported.
2. Make sure haul tank/trailer is clean and operable (lube trailer wheels if necessary)
3. Make sure the following equipment is in the haul trailer or available:
    a. YSI Dissolved Oxygen Meter
    b. Large Adjustable wrench
    c. 2 ¼" ball hitch
    d. 2 carabineers or locks for the fish hauling tank lid
    e. 2 oxygen regulators
    f. 2 oxygen flow manifolds
    g. 2 micro-diffusers
    h. Extra air tubing and fittings
    i. 1 net
    j. Bottle of stress coat
    k. 2 ratcheting straps (for emergencies)
    l. Bottle of oxygen with at least 1500 psi and safety cap
    m. Leatherman or similar multi-tool (for emergency repairs to air lines)
    n. Key's to locks on the fish hauling trailer and hitch
    o. Fish Transport log sheet or notebook

Day of transport:

1. Meet team at the designated location.
2. Check in with pre-designated contact person, tell them you are leaving for hatchery.
3. Travel to hatchery.
4. Check in with pre-designated contact person, tell them you have arrived at hatchery.
5. Find designated contact at hatchery.
6. Follow hatchery personnel instructions for getting fish and filling the trailer with water.
7. Pour 180 ml (a little less than a cup) of stress-coat into the transport tank.
8. Start and adjust Oxygen supply. Typically the oxygen regulator need only be cracked open a very small amount
9. Before closing up tank, check water quality and record on log (Temperature, DO).
10. Check in with pre-designated contact person, tell them you are leaving hatchery.
11. Travel to CHTR building.

12. Stop every hour, check and record water quality (Temp and DO), adjust Oxygen flow as necessary to try and make DO 100%.
13. Arrive at CHTR building.
14. Check in with pre-designated contact person, tell them you have arrived at CHTR.

Unloading:

1. Make sure the designated holding tank(s) are ready (tank full, flow and air on)
2. Check water quality in holding tank and transport tank. If temperature is more than 2C different, follow tempering procedures before unloading fish.
3. Scoop fish into clean, white, 5-gallon buckets. Place no more than ~50 salmon or ~10 steelhead in a bucket at a time.
4. Gently release into holding tanks using water-to-water release method.
5. Record new fish on tank log.

Tempering Procedure:

1. Drain 1/3 to 1/2 of the water in the tank (use discretion based on the number of fish in the tank; don't drain the tank too low if there are a large number of fish.
2. Use buckets or an alternate source of suitable water to add warmer water to the fish hauling tank. Add enough water to increase the water temperature in the tank by 0.5°C.
3. Wait ½ hour, monitoring the Dissolved Oxygen and fish health as necessary.
4. Repeat steps 1 through 3 until the temperature in the fish hauling tank is within 1°C of the destination tank.

Water Quality Parameters:

Water Quality in the fish hauling tank should be maintained as close as possible to the following parameters during transport:

1. Dissolved Oxygen
    a. Maintain 90% to 120% Oxygen saturation
2. Temperature
    a. Temperature should not increase by >1°C/hour during transport.
    b. Ice may be purchased and placed in the tank to cool the water. If ice is used, be sure that stress coat has been added to the tank as well (for chlorine neutralization).

Proper Operation of the Fish Hauling Tank:

The BDO fish hauling tank is an approximately 400 gallon, insulated aluminum tank mounted on a flatbed trailer with an oxygen aeration system.

Lid

The lid of the tank is actuated by 2 levers, one on each of the tank. Staff should ensure that the levers are properly engaged in the locked position each time the lid is closed by lifting on the tank lid. Once sure that the lever is engaged, the lid should be secured by placing a carabineer or lock through the hole in the lever. When the lid is lifted off the tank, care should be taken to avoid smashing and/or cutting the air line on one end of the tank.

Drain

The fish hauling tank is equipped with a large drain at the bottom of one end of the tank. The drain is covered by a large plate with a plastic gasket that attaches to a bracket on the outside of the tank. When the plate is shut closed, staff should ensure that the plate is firmly secure against the drain by tapping it down with their foot or a hammer (do not over tighten!). Flow out of the drain can be manipulated by either 1) loosening the drain plate or 2) actuating the inner plate on the drain. The inner plate is a flat piece of metal covering the drain that attaches to a rod and handle on the top of the tank. The handle can be pulled to lift the plate, increasing the opening on the drain.

Aeration (Oxygen) System

Aeration of the fish hauling tank is provided by a mounted Oxygen tank with regulator and micro diffuser. The oxygen tank is secured by two brackets with tightening nuts onto the fish hauling trailer. The micro-diffuser and aeration lines are permanently installed into the tank. One end of the aeration line is equipped with a quick connect fitting that can be used to attach it to the regulator. The regulator is also equipped with a quick connect fitting. The regulator should be used by1) Installing the safety cap on the cylinder, 2) Securing the regulator onto the tank using a wrench to tighten the regulator 3) Opening the main valve on the cylinder, and 4) Using the small black knob on the regulator to adjust the flow of oxygen. Typically, the flow rate need only be set at an extremely low rate. **The small ball in the regulator usually only needs to be 1-2 mm above zero.**

4.2 Salmon Tagging Standard Operating Procedures and Job Hazard Analysis

Lead: Curtis Yip

The following is a standard operating procedure for PIT tagging salmon in the CHTR building.

Salmon PIT tagging SOP

PPE: Nitrile gloves, closed toed shoes, appropriate field clothing.

SETUP:

1) Setup the tagging station with the following items:
    a. Laptop w/AC power Supply—**BDODCTB-02**
    b. 2001F-ISO datalogger with serial cable
    c. Racket antenna
    d. Nitrile Gloves
    e. Knockout Bucket (10 L water with 5cc stock MS222, 5cc Sodium Bicarb, and 5cc stresscoat)
    f. Recovery Bucket with aeration and 5cc Stresscoat
    g. Reject bucket or tank
    h. Scale
    i. Measuring board
    j. Data sheet-"*Smolt PIT tagging Log*"
    k. Timer
    l. Pre-loaded needles with PIT tags
    m. PIT tag injector Gun
    n. Dissecting scissors
    o. Sharps Container
    p. Disinfectant solution (70% isopropyl alcohol)
2) Connect the laptop to the 2001F-ISO datalogger using the serial cable.
3) Power on the datalogger and laptop
4) Scroll through the datalogger settings, the settings should be as follows:
    a. Continuous mode : ON

b. Unique Mode: On;
c. Send Tag ID to CommPort Form1
d. Send Alarms to CommPort On

5) Open DF Direct (Desktop>>PIT Tagging)
6) Select “Open Existing Template”
7) Navigate to: Desktop>>PIT Tagging >>2013>>2013 tagging template
8) Select “Open”
9) Excel should load up
10) Scan the test tag to ensure that the system is operating correctly, write “test” under the comments
11) Go to “Save as” and create a new excel file with the following naming scheme:
    a. TAG_MM-DD-YYYY
    b. For example, TAG_12-16-2010
    c. Record the file name in the “PIT Tagging Data Sheet”
12) Fill out remainder of “PIT Tagging Data Sheet” information
13) Commence tagging session
14) Click Save when done tagging
15) Fill out the remainder of the “PIT Tagging Data Sheet”
    a. The Tagger and Data Recorder should review all the tagging data at the end of each tagging session.

Tagging:

1) Be sure that food was withheld for 24hours prior to implantation of the tags.
2) Set up scale, measuring board, and tagging station. Wipe down and disinfect the tagging station, weigh boat, and measuring board using 70% alcohol solution. Immediately prior to tagging the first fish, apply stress coat to weigh boat, and measuring board to reduce damage to fish skin or mucus layer.
3) Fill the anesthesia bucket with 10L of water. Set the initial concentration in collaboration with the tagging coordinator. Suggested starting concentration is 50mg/L. To achieve the suggested starting concentration add 5mL (1mL=1cc) of MS-222 stock solution, 5mL of sodium bicarb, and 5mL of stress coat to 10 L of water. This will yield an anesthetic concentration of 50 mg/L. Any changes in concentration should be recorded on the tagging datasheet.

4) Prepare recovery bucket by filling with water, adding 5mL stress coat, and placing an air stone in the bucket.
5) Prepare tagging data sheet. Note the starting time of the tagging session and fill in all data fields.
6) The tagger should wear nitrile exam gloves during all fish handling and tagging procedures.
7) Using a net, gently add 1 fish to the knockout bucket and start a timer. This first fish will be used to determine the necessary concentration of MS-222. We will start with 5mL/10L H20, and either increase the concentration in 1cc increments or dilute with fresh water.
8) Time of sedation for a fish should normally be 2 - 4 minutes, with an average time of about 3 minutes. If loss of equilibrium takes less than 1 min or greater than 5 min, reject that fish. If after sedating a few fish, they are consistently losing equilibrium in more or less time than typical, adjust the concentration of the anesthetic (up or down) in 1cc increments of stock MS-222 solution, make sure to add an equal amount of sodium bicarbonate for any MS-222 you add.
9) Insert a clean needle w/PIT tag onto the tagging gun; scan the tag
10) Once fish has reached the desired level of anesthesia (Stage 3 or 4[1]), remove the fish from the anesthesia bucket and transfer the fish to the scale and weigh the fish to the nearest 0.1 g.
11) Remove the fish from the anesthesia, Weigh (g) and Measure (TL,mm) the fish and record the data in the appropriate location in the Excel Sheet. Data must be vocally relayed to the data recorder to avoid data errors. The data recorder should then record this information and repeat numbers back to avoid any miscommunication.
12) Visually screen the fish for tags, fin clips, fungus, disease, descaling, bloated belly, or any obvious abnormalities. Relay any information to the data recorder to note in the Excel Comments field.
13) If for any reason the fish must be rejected at this point, enter **S** in the comments field of the excel sheet. This code indicates that this data entry line is being skipped and the tag code was reused.
14) Inspect the fish's adipose fin—It should be clipped. If not clipped, use the dissecting scissors to clip the fin.
15) The tagger should position the fish in his/her hand with the belly of the fish up, with the tail toward their thumb and the head towards their little finger. The fish should be positioned in their hand so that the point of injection is even with their middle finger. Slight pressure may be applied

[1] Stages of anesthesia as defined in Woods et al 2008; Stage 1 – slight loss of responsiveness to visual and tactile stimuli, equilibrium normal; Stage 2 – Total loss of responsiveness to visual stimuli, only strong tactile pressure causes reaction, equilibrium normal; Stage 3 – Reaction only to very strong tactile pressure, partial loss of equilibrium; and Stage 4 – No response to external stimuli, total loss of equilibrium.

with the middle finger by pressing on the side of the fish's belly, this will tighten the belly tissue so the needle will penetrate more easily (Figure 1).

16) The needle should penetrate through the fish's belly between the posterior tip of the pectoral fin and the anterior point of the pelvic girdle. Avoid placing the point of the needle too far posterior. The puncture should be made 1-2 mm off the mid-ventral line (Figure 2).
17) The bevel of the needle should be open toward the belly of the fish so the point of the needle is away from the internal organs. The puncture is made with a short, quick, jabbing motion. Maximum control is needed because the tip of the needle should move forward only about 1-2mm. Once the needle has penetrated the abdominal wall, and with about 2-3 mm of the needle inside the fish, the tag can be injected.
18) Any fish that is dropped on the floor during this process must be rejected. A fish dropped on the table during tagging may still be tagged. If a fish is dropped on the floor after it is tagged, reject the fish, euthanize, and remove the tag.
19) If at this point, the tag pops out of the fish (tag gun "misfire") quickly scan another tag and insert the new tag. The data recorder should transfer the tagging information from the previous tag ID to the new one. Insert the code **RT** in the comments field for the rejected tag.
20) Retract the needle and eject the spent needle into a sharps container.
21) Massage the injections site gently using your finger. The puncture wound should be a straight incision about 1-2 mm in length. The wound may be difficult to see immediately after tagging, and will heal quickly.
22) Gently place the fish in the recovery bucket and monitor its recover. The fish should recover its equilibrium with 2 minutes. When all fish in a recovery bucket have spent 10 minutes in the bucket and gained equilibrium, transfer the fish to swim into the holding tank.
23) Once you have established an appropriate anesthesia dosage, you can begin tagging fish more quickly. You may place up to 10 fish in the knockout bucket at once, but be sure that no fish is under anesthesia for more than 5 minutes.
24) When finished with the tagging session, save file and back file up to appropriate USB drive
25) Record the appropriate end data on the tagging datasheet.
26) Clean up and wipe down station

Reference:

PIT Tag Marking Procedures Manual; prepared by Columbia Basin Fish and Wildlife Authority PIT Tag Steering Committee, 1999.

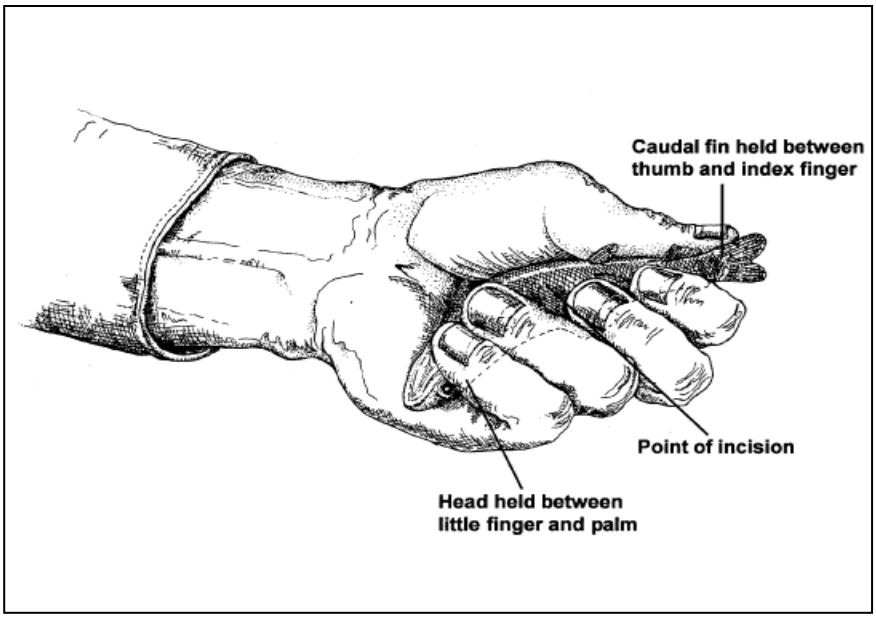


Figure 1- Position of the fish in the hand of the tagger

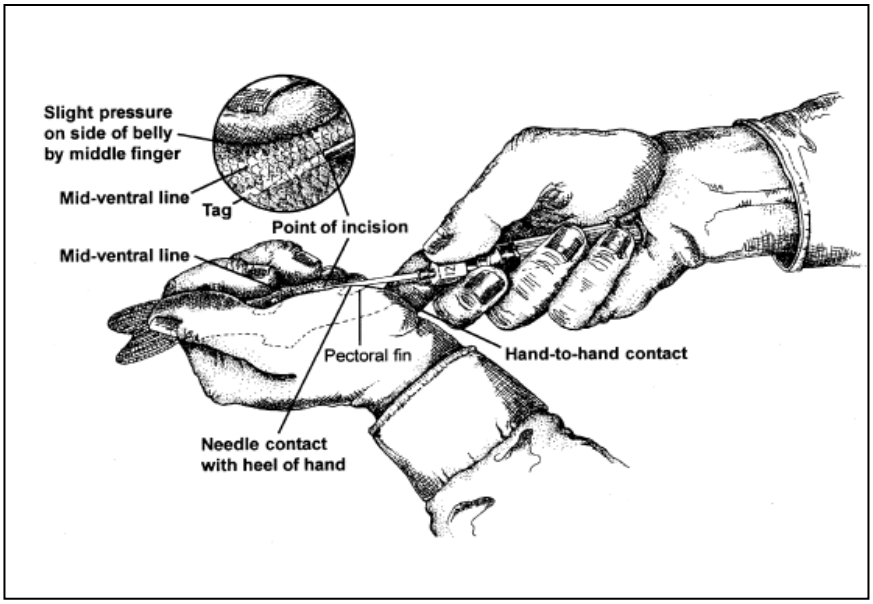


Figure 2- Tag injection location

Salmon Acoustic Tagging SOP

PPE: Nitrile gloves, closed toed shoes, appropriate field clothing.

Materials Needed:

- YSI ProODO meter (Thermometer and DO meter)
- Acoustic tags and acoustic tag activation and monitoring equipment
- Chlorhexidine solution (30mL/L D-H_20)
- Distilled or de-ionized water (D-H_20)
- Tricaine methanesulfonate (MS-222; 100g/L) or Aqui-S
- Sodium bicarbonate solution (buffer; 100g/L)
- Stress coat – stock concentration and 25% solution (250 mL/L D-H_20)
- Disinfectant solution (70% ETOH)
- 19 L bucket marked at 10 L and clearly labeled "anesthesia"
- 19 L bucket clearly labeled "reject" for fish not selected for tagging procedures
- Two gravity feed containers marked at 10L, and connected by rubber tubing with in-line shut-off valves (one labeled 'anesthesia" and one labeled "freshwater")
- Syringes (10 mL) for measuring anesthetic, buffer, and stress coat
- Oxygen delivery system (cylinder, regulator, airline, air diffusers)
- Dip nets
- Nitrile gloves
- Scale measuring to the nearest 01 g
- Large plastic weigh boats
- Measuring board with ruler to the nearest millimeter
- Surgical platform
- Trays for holding solutions used to disinfect surgical tools
- Needle drivers
- Forceps
- Scalpel handle and blades
- Sutures: Vicryl plus 5-0 with an RB-1 needle
- 2 Spray bottles for disinfectant solution and stresscoat
- Timer(s)
- Sharps container
- Datasheets and writing tools

Equipment Set Up:

1) Fill surgical instrument disinfection trays with chlorhexidine (brand name Nolvasan)
2) Autoclave instruments such that each tagging event begins with sterile instruments
3) Activate/ program transmitters, disinfect, rinse
4) Fill rinse tray with de-ionized or distilled water

5) Set up scale, measuring board, and surgical platform/foam
6) Apply stress coat to weigh boat, measuring board, and platform to reduce damage to fish skin or mucus layer
7) Fill gravity feed carboys. Add 2 mL of the MS-222 stock solution and 2 mL of the sodium bicarbonate stock solution to the 10 L of water in the MS-222 carboy. Concentration may be increased upon group consensus and in consultation with coordinator. For each mL of MS-222 added to the container, add the same amount of bicarbonate stock solution (buffer).
8) Fill the anesthesia bucket with 10L of water. Set the initial concentration in collaboration with the tagging coordinator. Suggested starting concentration is 70mg/L. To achieve the suggested starting concentration add 7mL (1mL=1cc) of MS-222 stock solution to 10 L of water. This will yield an anesthetic concentration of 70 mg/L. Any changes in concentration should be recorded on the tagging datasheet.
9) Prepare recovery containers by filling with water, adding stress coat, and supersaturating with oxygen.
10) Immediately following surgery, transfer the fish gently into the recovery container for a minimum of 10 minutes. The recovery container should provide 130% to 150% DO.
11) Prepare tagging data sheet. Note the starting time of the tagging session and fill in all data fields.
12) The tagger should wear medical-grade exam gloves during all fish handling and tagging procedures.
13) Be sure that food was withheld for 24hours prior to surgical implantation of the transmitter.

Surgery:

1) Net one fish from the pre-tag holding source and place directly into an anesthesia bucket. Secure the lid as soon as the fish is in the bucket. Start a timer to keep track of how long a fish has been in the anesthesia bucket.
2) Time of sedation for a fish should normally be 2 - 4 minutes, with an average time of about 3 minutes. If loss of equilibrium takes less than 1 min or greater than 5 min, reject that fish. If after sedating a few fish, they are consistently losing equilibrium in more or less time than typical, adjust the concentration of the anesthetic (up or down) in 0.5 ml increments of stock MS-222 solution.
3) Remove the lid after one minute to observe the fish for loss of equilibrium. Once the fish loses equilibrium, visually screen the fish for fin clips, fungus, disease, descaling, bloated belly, or any

obvious abnormalities. Make sure to keep the fish submerged during this examination. Relay any information to the data recorder.

4) Keep the fish in the water for an additional 30 - 60 sec after it has lost equilibrium.
5) Rejects - If the fish is unacceptable for tagging, place the fish in the bucket labeled Rejects, and relay the information to the data recorder.
6) Recording fish length and weight
7) Transfer the fish to the scale and weigh the fish to the nearest 0.1 g.
8) Transfer the fish to the measuring board and measure the fork length to the nearest millimeter (mm).
9) Data must be vocally relayed to the data recorder to avoid data errors. The data recorder should then record this information and repeat numbers back to avoid any miscommunication.
10) Any fish that is dropped on the floor during this process must be rejected. A fish dropped on the table during surgery may still be tagged. If a fish is dropped on the floor after it is tagged, remove the tag and reject the fish.
11) Place the fish on the surgery table ventral side up. Anesthesia should be administered through the gravity feed tubing as soon as the fish is on the surgery table. The tubing must be placed just inside the mouth so the water flows across the gills. If the flow is too low, the fish will flare its opercula and become agitated. Adjust the flow so that the gilling rate of the fish is steady. Use the in-line valve to control the flow of anesthesia, fresh water, or a mixture of both. Start with a constant flow of anesthesia and monitor the condition of the fish.
12) Using a scalpel, make an incision, approximately 5 mm in length (dependent on tag size), about 3 mm away from and parallel to the mid-ventral line. Start your incision a few millimeters in front of the pelvic girdle, approximately 20% of the distance from the base of the pelvic fins to the base of the pectoral fins, and draw the blade toward the head of the fish. (For example, in Figure 1, the distance between the base of the pelvic and pectoral fins is ~45 mm, so the incision should start ~9 mm in front of the base of the pelvic fins.) The incision should be just deep enough to penetrate the peritoneum (the thin membrane separating the gut cavity from the musculature), avoiding the internal organs. The spleen is generally near the incision point, so pay close attention to the depth of the incision. Refer to Figure 1 for location of internal organs and Figure 2 for placement of incision. Avoid getting anesthesia water in the incision.

Figure 1. Lateral view of a juvenile salmonid, showing the location of internal organs.

Figure 2. Ventral view of a juvenile salmonid, showing the location external organs and proper placement of incision and antenna exit (if applicable). This view corresponds to a left-handed surgeon's view and placement of the incision. For right-handed surgeons, the fish would be facing the right and the incision and antenna exit would be on the opposite side of the midline.

13) Use a 3 mm scalpel blade for Chinook salmon. Use a 5mm sclpel blade for steelhead.
14) One scalpel blade can be used on about seven fish before it becomes dull. We will be tagging 5 fish per tagging session. Following the tagging session, dispose of the scalpel in the sharps container.
15) Use forceps to open the incision to ensure you did not damage any internal organs or cause excessive bleeding. If you observe damage or think you damaged an organ, do not implant the tag, and reject that fish. Excessive bleeding should be noted on the datasheet.
16) Gently push the tag into the body cavity, and position it so that it lies directly under the incision. This positioning will provide a barrier between the suture needle and internal organs. Through time the tag location will naturally move posterior in the fish.
17) Begin suturing the incision. Two or three interrupted stitches are used to close the incision, depending on the size of the tag and incision.
18) To make a stitch, lock the needle (at the end of the suture) in the needle drivers so the needle point faces you. Enter the outside edge of the incision on the side farthest from you and exit through the other edge of the incision, pulling the suture perpendicular through the two edges. The needle should enter and exit the skin as close to the edge of the incision as possible without tearing the skin (~ 2 mm from edge of incision). Pull the needle and suture through the skin to leave a tag end of about 2 - 3 cm of suture material protruding from the needle entrance location, then release the needle from the needle drivers. With your non-dominant hand, grasp the long end of the suture material (usually with thumb and forefinger) at or below the needle, and make two forward wraps (i.e., away from your body) around the tip of the needle driver, which should be held in your dominant hand. With the two wraps still around the needle driver, grasp the short tag end of suture material with the needle driver and tighten the stitch by pulling the wraps off the needle driver and pulling both ends of suture material perpendicular to the incision. On the first knot, the dominant hand holding the needle driver should pull toward your body and the non-dominant hand should pull away from your body. Tighten the suture lightly, just so the edges of the incision meet, but do not overlap, pucker, or bulge the edges of the incision. The second knot is the same as the first, but in reverse order. On the second knot, grasp the long end of suture material with your non-dominant hand, make two reverse wraps (i.e., toward you body) around the end of the needle driver, grasp the short end of suture with the needle driver, and tighten the stitch. This time, the knot should be tightened by pulling your dominant hand (holding the needle drivers) away from you and your non-dominant hand toward you. The second knot can be slightly tighter than the

first, again taking care not to overlap, pucker, or bulge the edges of the incision. The third knot is a repeat of the first and should be tightened snug to prevent the stitch from coming loose. This completes one stitch. Cut the suture with the needle drivers, leaving ends approximately 5 mm in length.

19) An alternative stitch consists of two knots, each with three wraps around the needle driver. The first knot consists of three forward wraps around the needle driver, and then is tightened by pulling the needle driver toward your body. The second is the same as the first, but in reverse order as described above.
20) When pulling a knot tight, be sure the knot lays flat and does not twist onto itself into a "balled-up" knot
21) Generally, a good time to switch the in-line valve on the gravity feed buckets to untreated river water is just prior to the last stitch. This initiates recovery from anesthesia as early as possible. However, if the fish appears to be inadequately gilling, provide a mixture or all fresh water as soon as possible. If the fish is too active to finish the surgery safely do not switch to fresh water, but maintain sedation.
22) If the incision is too long to close with two stitches, it is acceptable to add a 3rd stitch. Relay this information to the data recorder so they can note the extra stitch on the datasheet.
23) Transfer the fish from the surgery table directly to a labeled recovery container.
24) Between surgeries, the surgeon should replace the tools that were just used into the disinfectant bath. Each surgeon will have at least three (3) sets of surgical instruments to rotate through to ensure that tools get a thorough soaking in disinfectant for between uses. Once disinfected in cold sterile, rinse the tools thoroughly with distilled or de-ionized water and ensure that the scalpel blade and suture are acceptable to use on the next fish. Organic debris in the disinfectant bath reduces its effectiveness, so be sure to change the bath regularly. Keep a toothbrush handy to clean tools. If necessary, replace the scalpel blade.
25) When all fish in a recovery bucket have spent 10 minutes in the bucket and gained equilibrium, transfer the fish to swim into the holding tank.

Sample Salmon Tagging and Release Schedule

	Monday	Tuesday	Wednesday	Thursday	Friday
Tagging	PIT tag 60 fish	Acoustically Tag 10 fish			PIT tag 60 fish
Releases	Release ½ of previous Friday's tagged fish (20 fish at the radial gates; 10 fish at the fish facility)	Release ½ of previous Friday's tagged fish (20 fish at the radial gates; 10 fish at the fish facility)		Release ½ of Mondays tagged fish (20 fish at the radial gates; 10 fish at the fish facility)	Release ½ of Mondays tagged fish and all of Tuesday's tagged fish (20 PIT tagged fish and 10 acoustic tagged fish at the radial gates; 10 PIT tagged fish at the fish facility)

4.3 Salmon Release Standard Operating Procedures and Job Hazard Analysis

Lead: Curtis Yip

The following is a standard operating procedure for releasing pit and/or acoustic tagged salmon at the radial gates or in front of the louvers utilizing buckets and the Spitzlift.

Fish Release SOP

PPE: PFDs, nitrile gloves, work gloves, hard hats, closed toed shoes, appropriate field clothing for weather conditions, head lamps for night work, cell phone

This SOP is intended to create an outline of events that must take place in order to reduce the risk of injury while performing the release of tagged salmon just upstream of the radial gates and in front of the louvers, utilizing buckets and a spitzlift. Attention to the details of this SOP is of utmost importance, as any field work conducted around the radial gates can be extremely dangerous given the high velocity water flows moving through the gates. If an emergency situation arises during the release process immediately call 911 and then call ACC at **(209)-833-2180** to notify them of the situation.

1) The release schedule will be prepared based upon the "Clifton Court Forebay Gate Closure Times" document provided via email monthly, and confirmed prior to each individual release via phone call.
2) The release crew will consist of a minimum of three staff members, one of which will be "OP-2" certified.
3) When arriving at the facility sign in all personnel at the Skinner Fish Facility office and call the ACC at the number above to notify them that a release will be conducted just upstream of the radial gates and that a return call will be made at the conclusion of the release process.
4) Check that all ropes and equipment used to conduct the release are in good condition and in good working order. If any defects are found, replace the item(s) needing attention. If the item can't be fixed or replaced, cancel the release and reschedule after the item(s) are fixed or replaced.
5) At the CHTR building, fill four green, fish transport buckets with water and 5 mL stress coat. Setup a small bait bubbler to bubble oxygen into the fish transport buckets. Place lids on the buckets.
6) Set up the Connect the Setup the following items:
7) Panasonic Toughbook w/AC power Supply—BDODCTB-02
8) 2001F-ISO datalogger with serial cable

9) Racket antenna
10) Nitrile Gloves
11) Transport buckets with 5mL stress coat (1 bucket/5 salmon) and lids
12) Data sheet
13) Connect the laptop to the 2001F-ISO datalogger using the serial cable.
14) Power on the datalogger and laptop
15) Scroll through the datalogger settings, the settings should be as follows:
16) Continuous mode : ON
17) Unique Mode: On;
18) Send Tag ID to CommPort Form1
19) Send Alarms to CommPort On
20) Open DF Direct (Desktop>>PIT Tagging)
21) Select “Open Existing Template”
22) Navigate to: Desktop>>PIT Tagging >>2013>>2013 tagging template
23) Select “Open”
24) Excel should load up
25) Scan the test tag to ensure that the system is operating correctly, write “test” under the comments
26) Go to “Save as” and create a new excel file with the following naming scheme:
27) REL_MM-DD-YYYY_GroupX
28) For example, REL_12-16-2010_Group5
29) Record the file name on the fish release data sheet
30) Fill out remainder of the fish release datasheet information
31) Using a dip net, select the PIT and/or acoustic tagged salmon from the pre-designated tank for release.
32) Capture fish in a net one at a time
33) Scan each fish with the antenna before gently placing the fish in the transport bucket.
34) Repeat for each fish, ensuring that each fish’s tag is scanned.
35) Click Save when done with each release group.
36) After each release group’s fish are counted, close the file and repeat steps 5-14 for each release group.
37) Place all salmon to be released into the fish transport buckets in groups of 5 for transport to the radial gates.

38) Load the Spitzlift, release ropes, and all other release equipment located in a marked, plastic container from the CHTR building, load the fish transport buckets, and drive to the radial gates.
39) Upon arrival at the release site, all personnel must put on appropriate PPE (Personal Protective Equipment) including a personal floatation device (PFD) and hard hat.
40) Position the truck for releasing fish and place orange cones in front of and behind the parked truck.
41) After the PPEs are put on, unload all release equipment. Set up the Spitzlift and check that the ropes and lifts are in good working order. If conducting a night release, put on head lamps, and setup a portable generator and tripod halogen light bars.
42) Double check the length of the rope that will attach to the bottom of the bucket to ensure that it is short enough to prevent the bucket from contacting the water at the point of tipping. Attach the end of the rope to the guardrail to prevent it from becoming dislodged and allowing the bucket to contact the water.
43) Attach the Spitzlift hook to the handle of the first release bucket. Swing the bucket out of the truck and attach the release rope to the wire loop on the bottom. Remove the bubbler and lid from the bucket and swing the bucket over the railing and lower the bucket towards the water surface.
44) The bucket should be lowered over the guard rail (see diagram below) to a point just above the water surface by one person. At this point, a second person should pull the second rope attached to the bottom of the bucket in order to tip the bucket over and release the tagged salmon into the water flow moving through the radial gates. All release personnel must not climb on or lean over the guard rail. A third person should be present in order to watch the entire process and should be ready to step in and stop the release if he or she sees a dangerous situation arising.
45) Bring the bucket back up to the top of the guard rail bring back to the rear of the truck. Disconnect the rope from the bottom loop and remove the bucket from the Spitzlift hook.
46) After finishing the first 5 gallon bucket repeat the above steps with the rest of the buckets
47) At the conclusion of the releases at the radial gates, dismantle the Spitzlift and lighting (if used) and put back into truck. Drive to the louver release area and set up the Spitzlift. Conduct the final release following the same methods as above.
48) At the conclusion of the last release at the louvers, dismantle the Spitzlift, and place in truck and return to the CHTR building.
49) Unload the release equipment at the CHTR building.

50) Return to the fish facility office and call the ACC at the number above to notify them that the release is finished and everything is ok. Before leaving the facility, everyone must sign out and locate a DFD staff member in person to let them know the release crew is leaving.

Sample Salmon Tagging and Release Schedule

	Monday	Tuesday	Wednesday	Thursday	Friday
Tagging	PIT tag 60 fish	Acoustically Tag 10 fish			PIT tag 60 fish
Releases	Release ½ of previous Friday's tagged fish (20 fish at the radial gates; 10 fish at the fish facility)	Release ½ of previous Friday's tagged fish (20 fish at the radial gates; 10 fish at the fish facility)		Release ½ of Mondays tagged fish (20 fish at the radial gates; 10 fish at the fish facility)	Release ½ of Mondays tagged fish and all of Tuesday's tagged fish (20 PIT tagged fish and 10 acoustic tagged fish at the radial gates; 10 PIT tagged fish at the fish facility)

4.4 Acoustic Equipment Deployment, Maintenance, and Retrieval Standard Operating Procedures and Job Hazard Analysis

*This is an excerpt from the *Standard Operating Procedure Biotelemetry Equipment Deployment, Maintenance, and Retrieval* Feb 2013 revision, K Clark. The portion of the plan included below only applies to the CCFPS.

Biotelemetry Site Characterization

Fish tracking receivers will be located at various locations throughout the Delta. Each location is different and will require site specific deployment equipment and techniques. The fish tracking receiver locations will be accessed by boat or from levee roads using a 4x4 vehicle. Boat operations will follow the Delta Conveyance Branch Boating Policy as set forth in the "Safety guidelines, policies, and procedures for Delta Conveyance Branch Field Operations."

Equipment

Equipment needs will vary from location to location and the fish tracking receiver type to be deployed or retrieved. A site evaluation for each fish tracking receiver location will need to be performed before determining the necessary equipment for deployment or retrieval. Below is a list of potential equipment and is not meant to be all inclusive.

- First Aid Kit
- Personal Floatation Device (PFD)
- Safety glasses
- Cellphone
- Fish tracking receiver
- I/O box
- Hydrophone
- Hydrophone cable or data cable
- Solar panel
- Solar panel charge controller
- Metal security box
- 12 volt or 6 volt batteries
- Stainless steel cable
- Electrical conduit
- Multimeter
- Black electrical tape
- Pipe wrap tape
- Drill
- Sawzall
- Leatherman multitool
- Stainless wire
- Stainless shackles
- Bolt cutters
- Cable cutters
- Wire cutters
- Fishtape
- Wire strippers
- Float
- Receiver bubble
- Bubble frame
- Plastic safe electrical cleaner
- Swedgers
- Swedges
- T-posts
- T-post pounder
- Tape measure
- Electric wire
- Cable ties
- Anchors

- Nuts and bolts
- Shovel
- Handheld radios
- Test tag
- Beacon tag
- GPS unit
- Atomic watch
- Laptop
- Communication cable
- Aircard
- Rope

General Procedure Overview

Staff will wear PFDs during all biotelemetry station deployment, maintenance, and retrieval activities. All other personal protective equipment (PPE) will be used as outlined in the Job Hazard Analysis (JHA) for this activity.

HTI Biotelemetry Stations

Deployment

When deploying a HTI biotelemetry station, staff will set up a metal security box containing batteries, datalogger, communication equipment, and solar panel controller on the levee (Figure 1). The receiver cable is then attached to the datalogger and extended down the levee bank to a boat at the water's edge. This cable should be run through electrical conduit in areas where there is a high likelihood of vandalism. Once at the boat, staff will attach the hydrophone cable to a hydrophone. The hydrophone will be attached to a float line or a bubble frame (Figure 2). Staff will continue to lay the cable along the bottom of the river channel by slowly backing the boat away from shore as the cable is unwound. Once the boat is sufficiently far from shore the hydrophone is carefully lifted over the side rail of the boat and lowered into the water using a guideline. The guideline is used to guide the hydrophone into position. Once the hydrophone is in position the guideline is retrieved and the location is noted using a handheld GPS unit.

In order to deploy fish tracking receiver equipment, staff will be required to carry the datalogger, batteries, and other equipment up and down levees, requiring walking over rip-rap and on steep, uneven terrain in all weather conditions. Heavy or bulky items will be moved by team lifting.

After physically deploying the HTI biotelemetry station, the station should be setup and tested following the procedures outlined in Appendix A: Setup and Testing of a HTI Datalogger.

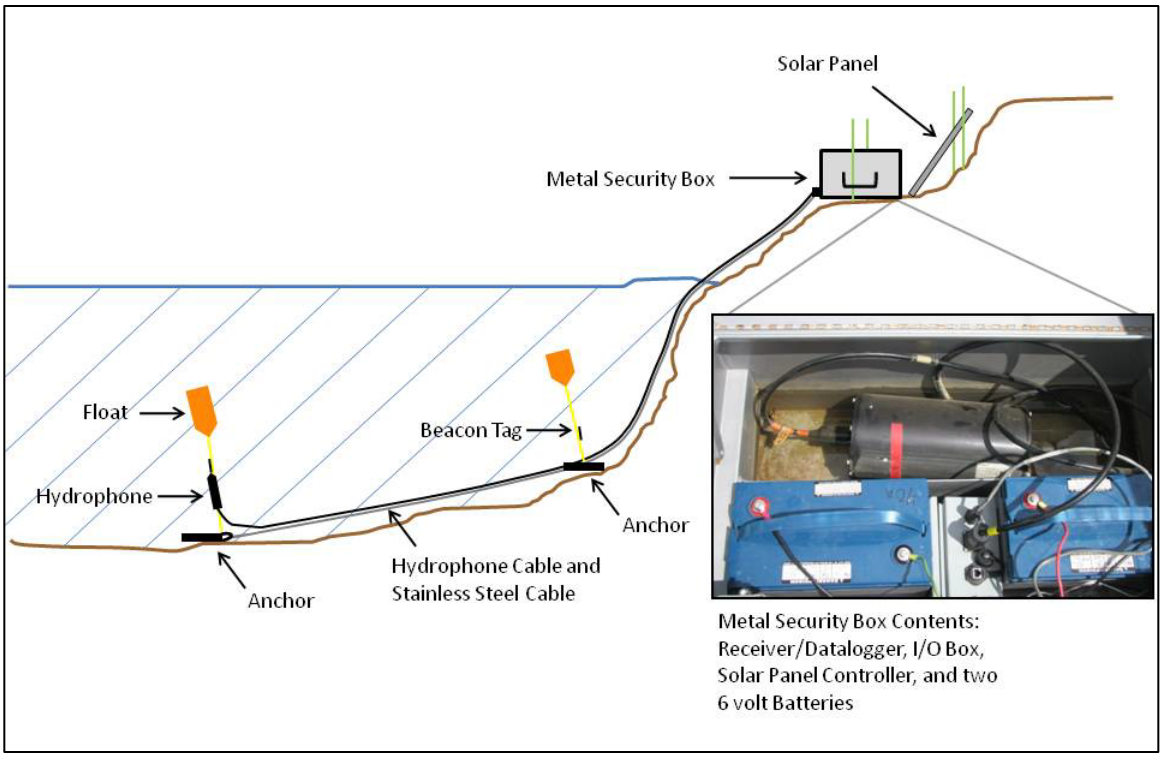


Figure 1. Schematic of a deployed HTI biotelemetry station using a float and anchor.

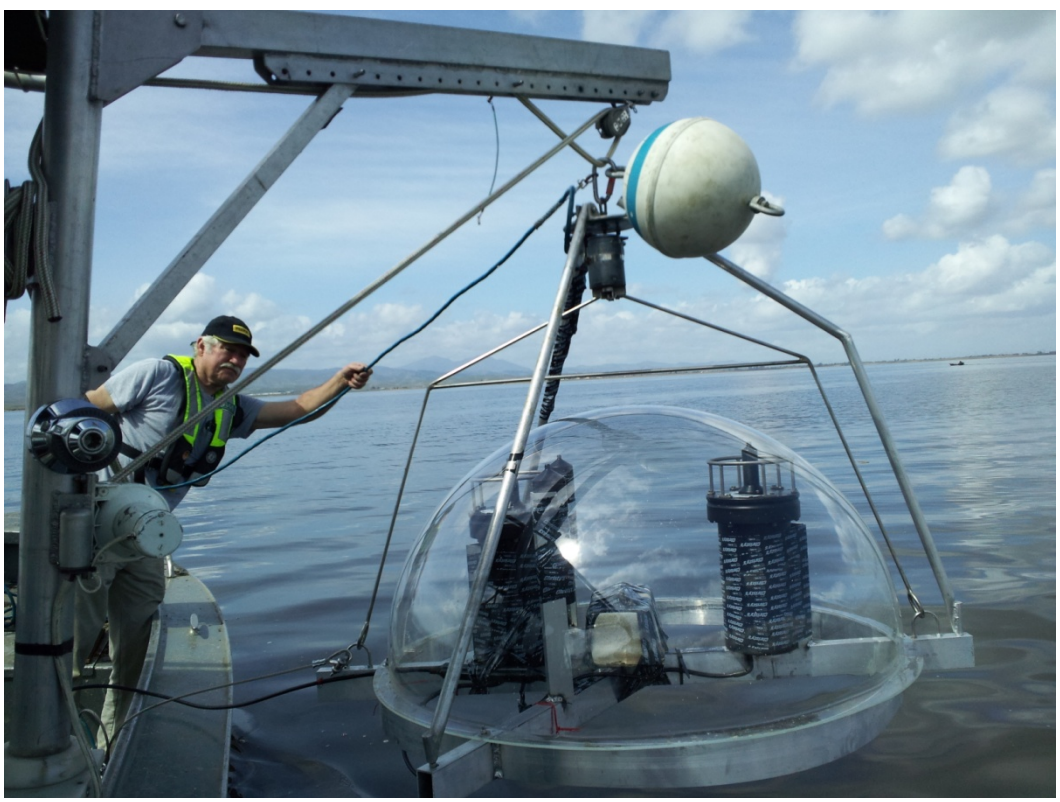


Figure 2. Bubble frame used to protect the hydrophone or receiver from debris.

Maintenance

The equipment will be inspected and maintained at set intervals of time depending on a number of factors, including location of the equipment, history of issues, remote access, etc. Equipment will need to be replaced on an as need basis.

If an issue arises with the receiver's electrical system and replacement of the batteries is required, staff will be required to carry replacement batteries on levees in all weather conditions. Proper battery handling and lifting technique should be used when moving batteries (see Appendices B and C). The batteries are sealed and will not leak toxic chemicals, such as acid, unless the battery casings are physically broken. Each battery will be inspected for cracks in the plastic prior to deployment and upon recovery. Staff will also check to see that the datalogger is still recording and conduct a visual inspection of the site, noting any changes or damage to the batteries and equipment.

Retrieval

Equipment retrieval and removal will occur on an as need basis based on DWR scientific study needs. The receiver cable will removed from the levee and will be flaked into a container located on the boat. The boat operator will then slowly move the boat along the receiver cable while staff flake the cable into the container until tension is felt on the receiver cable. A cable gripper will be used to pull the receiver and anchor into the boat by pulling on the stainless steel cable that backbones the hydrophone/data cable. Once pulled to the surface the receiver or hydrophone will be lifted over the side rail of the boat and placed on the deck of the boat.

In order to remove or replace fish tracking receiver equipment, staff will be required to carry the datalogger, batteries, and other equipment up and down levees, requiring walking over rip-rap and on steep, uneven terrain in all weather conditions. Heavy or bulky items will be moved by team lifting.

Biotelemetry Stations Located within the State Water Project

There are special requirements that need to be followed when deploying, maintaining, and retrieving biotelemetry equipment within SWP facilities (Figures 5, 6, 7, and 8). When working at any of these locations communication with DWR Delta Field Division must be performed in accordance with DWR and SWP safety policies. Refer to the "Injury Illness Prevention Program for Delta Conveyance Branch Field Operations" document **and** your supervisor for the most recent policies and procedures prior to planning work at any of these facilities.

Figure 5. In-water biotelemetry equipment locations within the intake canal to the Skinner Fish Protective Facility and the California Aquaduct.

Figure 6. In-water biotelemetry equipment locations around the Clifton Court Forebay radial gates.

Figure 7. In-water biotelemetry equipment locations in West Canal and Old River.

Upstream of the CCF Radial Gates

Any field work conducted around the radial gates can be extremely dangerous given the high velocity water flows moving through the gates. If an emergency situation arises during the deployment, maintenance, or retrieval process immediately call 911 and then call ACC at **(209)-833-2180** to notify them of the situation.

<u>Deployment</u>

Deployment of receiver equipment located immediately upstream of the Clifton Court Forebay radial gates will require a scheduled outage of the radial gates before deployment of the in-water equipment can occur at that location. A clearance must be issued and the CCF radial gates must be locked out and tagged out before beginning in-water work.

No staff are permitted to be in the water at this location and no boats are allowed in the area between the debris boom and the radial gates.

When deploying a HTI or VEMCO fish tracking receiver with a data cable, staff will set up a metal security box containing batteries, communication equipment, and solar panel controller on the levee (Figure 9). The data cable is then attached to the datalogger and extended down the levee bank to the concrete wall. Once at the wall, staff will attach the data cable to a receiver or hydrophone. Two stainless steel cables will be attached to the bubble frame and then attached to two anchor points located on the top of the concrete wall. Then, the bubble frame is carefully lifted over the concrete wall and lowered into position using the two stainless steel cables as guidelines. Once the bubble frame is in position the location is noted using a handheld GPS unit.

In order to deploy fish tracking receiver equipment, staff will be required to carry the receiver, batteries, and other equipment up and down levees, requiring walking over rip-rap and on steep, uneven terrain in all weather conditions. Heavy or bulky items will be moved by team lifting.

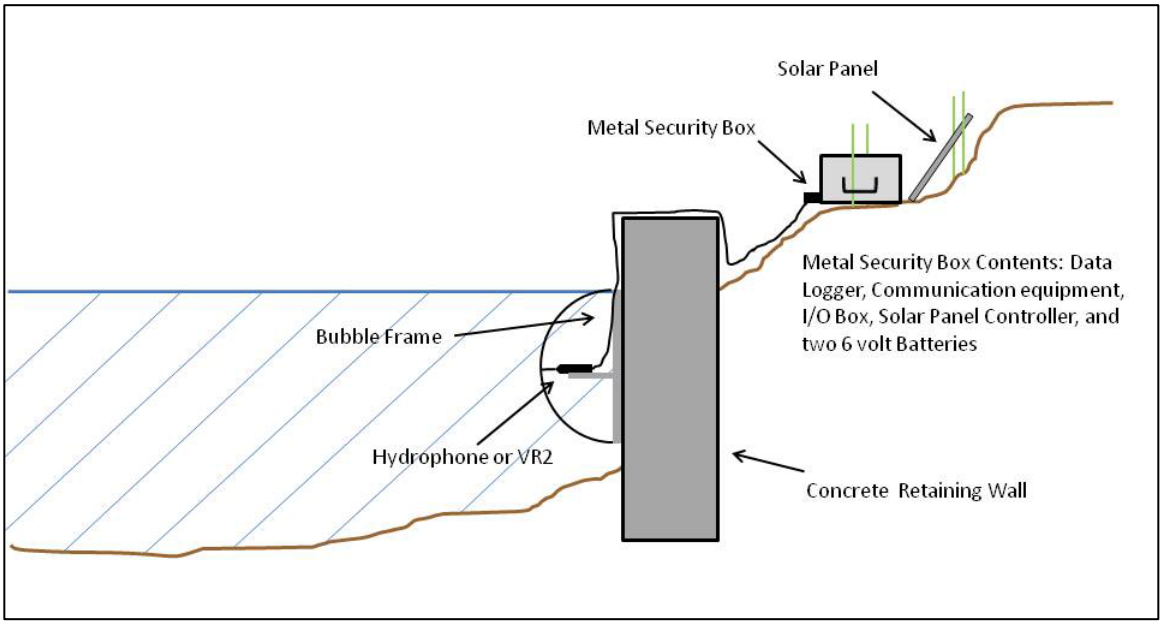


Figure 8. Schematic of the radial gate upstream biotelemetry station.

Maintenance

The equipment will be inspected and maintained at set intervals of time depending on a number of factors, including location of the equipment, history of issues, remote access, etc. Equipment will need to be replaced on an as need basis. In water receiver equipment located immediately upstream of the radial gates will require a scheduled outage of the radial gates before replacing equipment.

If an issue arises with the receiver's electrical system and replacement of the batteries is required, staff will be required to carry replacement batteries on levees or into the generator room in all weather conditions. Proper battery handling and lifting technique should be used when moving batteries (see Appendix A). The batteries are sealed and will not leak toxic chemicals, such as acid, unless the battery casings are physically broken. Each battery will be inspected for cracks in the plastic prior to deployment and upon recovery. Staff will also check to see that the datalogger is still recording and conduct a visual inspection of the site, noting any changes or damage to the batteries and equipment.

Retrieval

Retrieval of receiver equipment located immediately upstream of the Clifton Court Forebay radial gates will require a scheduled outage of the radial gates before retrieval of the in-water equipment can occur at that location. A clearance must be issued and the CCF radial gates must be locked out and tagged out before beginning in-water work.

No staff are permitted to be in the water at this location and no boats are allowed in the area between the debris boom and the radial gates.

Equipment retrieval and removal will occur on an as need basis based on DWR scientific study needs. Two cable grippers will be attached to the two stainless steel cables that tether the bubble frame to the concrete wall. The bubble frame will then removed by two people pulling on the stainless steel cables using the cable grippers. Once pulled to the surface the bubble frame will be lifted over the concrete wall and placed on the ground. The equipment will be dissembled and then loaded into a 4x4 vehicle located on the levee.

In order to remove or replace fish tracking receiver equipment, staff will be required to carry the datalogger, batteries, and other equipment up and down levees, requiring walking over rip-rap and on steep, uneven terrain in all weather conditions. Heavy or bulky items will be moved by team lifting.

Downstream of the CCF Radial Gates

Any field work conducted around the radial gates can be extremely dangerous given the high velocity water flows moving through the gates. If an emergency situation arises during the deployment, maintenance, or retrieval process immediately call 911 and then call ACC at **(209)-833-2180** to notify them of the situation.

Deployment

When deploying a HTI or VEMCO fish tracking receiver with a data cable, staff will set up a metal security box containing batteries, communication equipment, and solar panel controller on the levee or in the radial gate generator room. The data cable is then attached to the datalogger and extended down the levee bank through an electrical conduit to a boat at the water's edge. Once at the boat, staff will attach the data cable to a receiver. The receiver will be attached to a float line or a bubble frame. Staff will continue to lay the cable along the bottom of the forebay by slowly backing the boat away from shore as the cable is unwound. Once the boat is sufficiently far from shore and in the shallow area (2 ft to 10 ft depth) surrounding the scour hole, the receiver is carefully lifted over the side rail of the boat and lowered into the water using a guideline. The guideline is used to guide the receiver into position. Once the receiver is in position the guideline is retrieved and the location is noted using a handheld GPS unit.

In order to deploy fish tracking receiver equipment, staff will be required to carry the receiver, batteries, and other equipment up and down levees, requiring walking over rip-rap and on steep, uneven terrain in all weather conditions. Heavy or bulky items will be moved by team lifting.

Maintenance

The equipment will be inspected and maintained at set intervals of time depending on a number of factors, including location of the equipment, history of issues, remote access, etc. Equipment will need to be replaced on an as need basis.

If an issue arises with the receiver's electrical system and replacement of the batteries is required, staff will be required to carry replacement batteries on levees or into the generator room in all weather conditions. The batteries are sealed and will not leak toxic chemicals, such as acid, unless the battery casings are physically broken. Each battery will be inspected for cracks in the plastic prior to deployment and upon recovery. Staff will also check to see that the datalogger is still recording and conduct a visual inspection of the site, noting any changes or damage to the batteries and equipment.

Retrieval

Equipment retrieval and removal will occur on an as need basis based on DWR scientific study needs. The receiver cable will removed from the levee and will be flaked into a container located on the boat. The boat operator will then slowly move the boat along the receiver cable while staff flake the cable into the container until tension is felt on the receiver cable. A cable gripper will be used to pull the receiver and anchor into the boat by pulling on the stainless steel cable that backbones the hydrophone/data cable. Once pulled to the surface the receiver or hydrophone will be lifted over the side rail of the boat and placed on the deck of the boat.

In order to remove or replace fish tracking receiver equipment, staff will be required to carry the datalogger, batteries, and other equipment up and down levees, requiring walking over rip-rap and on steep, uneven terrain in all weather conditions. Heavy or bulky items will be moved by team lifting.

Intake Canal to the Skinner Fish Protective Facility

Any field work conducted around the Skinner Fish Protective Facility can be extremely dangerous given the high velocity water flows in the channel. If an emergency situation arises during the deployment, maintenance, or retrieval process immediately call 911 and then call ACC at **(209)-833-2180** to notify them of the situation.

Deployment

When deploying a HTI or VEMCO fish tracking receiver with a data cable in the intake canal, staff will set up a metal security box containing batteries, communication equipment, and solar panel controller on the levee. The data cable is then attached to the datalogger and extended down the levee bank through an electrical conduit to a boat at the water's edge. Once at the boat, staff will attach the data cable to a receiver or hydrophone. The receiver or hydrophone will be attached to a float line or a bubble frame. Staff will continue to lay the cable along the bottom of the forebay by slowly backing the boat away from shore as the cable is unwound. Once the boat is sufficiently far from shore the bubble frame is carefully lifted over the side rail of the boat and lowered into the water using a guideline. The guideline is used to guide the bubble frame into position. Once the bubble frame is in position the guideline is retrieved and the location is noted using a handheld GPS unit.

In order to deploy fish tracking receiver equipment, staff will be required to carry the receiver, batteries, and other equipment up and down levees, requiring walking over rip-rap and on steep, uneven terrain in all weather conditions. Heavy or bulky items will be moved by team lifting.

Maintenance

The equipment will be inspected and maintained at set intervals of time depending on a number of factors, including location of the equipment, history of issues, remote access, etc. Equipment will need to be replaced on an as need basis.

If an issue arises with the receiver's electrical system and replacement of the batteries is required, staff will be required to carry replacement batteries on levees or into the generator room in all weather conditions. The batteries are sealed and will not leak toxic chemicals, such as acid, unless the battery casings are physically broken. Each battery will be inspected for cracks in the plastic prior to deployment

and upon recovery. Staff will also check to see that the datalogger is still recording and conduct a visual inspection of the site, noting any changes or damage to the batteries and equipment.

Retrieval

Equipment retrieval and removal will occur on an as need basis based on DWR scientific study needs. The receiver cable will removed from the levee and will be flaked into a container located on the boat. The boat operator will then slowly move the boat along the receiver cable while staff flake the cable into the container until tension is felt on the receiver cable. A cable gripper will be used to pull the receiver and anchor into the boat by pulling on the stainless steel cable that backbones the hydrophone/data cable. Once pulled to the surface the receiver or hydrophone will be lifted over the side rail of the boat and placed on the deck of the boat.

In order to remove or replace fish tracking receiver equipment, staff will be required to carry the datalogger, batteries, and other equipment up and down levees, requiring walking over rip-rap and on steep, uneven terrain in all weather conditions. Heavy or bulky items will be moved by team lifting.

California Aquaduct

Any field work conducted around the California Aquaduct can be extremely dangerous given the high velocity water flows moving through the channel. If an emergency situation arises during the deployment, maintenance, or retrieval process immediately call 911 and then call ACC at **(209)-833-2180** to notify them of the situation.

Deployment

Deployment of receiver equipment located in the California Aquaduct will require a scheduled outage of the Banks Pumping Plant before deployment of the equipment can occur at that location. A clearance must be issued before beginning work.

No staff are permitted to be in the water at this location and no boats are allowed in the California Aquaduct.

When deploying a HTI or VEMCO fish tracking receiver with a data cable in California Aquaduct, staff will set up a metal security box containing batteries, communication equipment, and solar panel controller on the levee. The data cable is then attached to the datalogger and extended down the levee bank to the water's edge. Once at the water's edge, staff will attach the data cable to a receiver or hydrophone. The receiver or hydrophone will be attached to a float line and small piece of railroad tie. The railroad tie will then be tossed into the water approximately 5 ft from shore.

In order to deploy fish tracking receiver equipment, staff will be required to carry the receiver, batteries, and other equipment up and down levees, requiring walking over rip-rap and on steep, uneven terrain in all weather conditions. Heavy or bulky items will be moved by team lifting.

Maintenance

The equipment will be inspected and maintained at set intervals of time depending on a number of factors, including location of the equipment, history of issues, remote access, etc. Equipment will need to be replaced on an as need basis.

If an issue arises with the receiver's electrical system and replacement of the batteries is required, staff will be required to carry replacement batteries on levees or into the generator room in all weather conditions. Proper battery handling and lifting technique should be used when moving batteries ((see Safety Guidelines, policies, and procedures for Delta Conveyance Branch Field Operations)). The batteries are sealed and will not leak toxic chemicals, such as acid, unless the battery casings are physically broken. Each battery will be inspected for cracks in the plastic prior to deployment and upon recovery. Staff will also check to see that the datalogger is still recording and conduct a visual inspection of the site, noting any changes or damage to the batteries and equipment.

Retrieval

Retrieval of receiver equipment located in the California Aquaduct will require a scheduled outage of the Banks Pumping Plant before deployment of the equipment can occur at that location. A clearance must be issued before beginning work.

No staff are permitted to be in the water at this location and no boats are allowed in the area between the debris boom and the radial gates.

Equipment retrieval and removal will occur on an as need basis based on DWR scientific study needs. A cable gripper will be attached to the stainless steel cable which backbones the hydrophone or data cable. The railroad tie will then removed by two people pulling on the stainless steel cables using the cable gripper. Once pulled to the water's edge the raildroad tie will be lifted out of the water and placed on the ground. The equipment will be dissembled and then loaded into a 4x4 vehicle located on the levee.

In order to remove or replace fish tracking receiver equipment, staff will be required to carry the datalogger, batteries, and other equipment up and down levees, requiring walking over rip-rap and on steep, uneven terrain in all weather conditions. Heavy or bulky items will be moved by team lifting.

Setup and Testing of a HTI Datalogger

Initiate connection with model 295 through vnc viewer

A VNC client or viewer is necessary to initiate a visual connection to the Model-295 desktop. This will allow a user to control the Windows CE operating system and software running on the datalogger.

Open a VNC viewer.

Under "Connection details", type the IP address of the datalogger.
HTI default IP is 10.0.0.40.

Click “Options”.

Check “Raw” box.

Click “OK”.

Verify IP address and left click “OK” again.

Configure model 295 through vnc viewer session

A window will open showing a Windows CE desktop with a “Model 295-v3.01” window open in the center of the screen.

Configuration changes cannot be performed and saved when logging data.
Click "Stop" under the “Data logging” section of the window to stop the datalogger.

Click “Hydrophone” under “Settings”.

Set the parameters to a gain = 36, minVolts = 0.10, SNR = 3.0, and SNR Filter = 1.

Click “Tag Encoding” under “Settings”.

Set tag pulse width = 2.0 msecs and encoding = none.

Click “OK”.

It is critically important that the programmed pulse width used for the receivers match the pulse width of tags implanted in fish. Otherwise, the receivers will not detect those tags. If you don’t know the pulse width of the tags contact the principal investigator.

Click "Pulse Levels" under "Settings".
The only box checked in this window should be “Use 3dB”. Do not change any of the numeric settings.

Click “OK”.

Under ATDL Identifiers enter “Log ID” according to predetermined study protocol to identify data files recorded by this acoustic receiver.

Under ATDL Identifiers enter “Prefix” according to predetermined study protocol to identify data files recorded by this acoustic receiver.

Under ATDL Identifiers enter “System” according to predetermined study protocol to identify data files recorded by this acoustic receiver.

Click “File Types” in the “Settings” section of the window.

Ensure the "Raw File", "CF Disk", and “Status File” boxes are all checked.

“GPS File” should only be checked on the 295G receivers used for mobile monitoring.

Set the update interval to 5 (minutes).

Set date and time within the windows CE window (ensure that proper time zone is selected). Also, make sure that the “automatically adjust clock for daylight saving” is UNCHECKED. To do this, double click the windows clock in the right hand corner of the VNC window. Use a watch that receives the Fort Collins atomic clock, or use the official US time provided by NIST at http://nist.time.gov/ clock, or use a GPS time clock. Set the VNC windows clock to match one of the clocks above.

It is critically important that the date and time be set correctly. Otherwise, the receivers will record incorrect date/time stamps for the data collected.

Click “Settings” under “System”.

Click “Windows” to save windows settings to system registry.

Click “OK”.

Click “Program” to save datalogger program settings.

Ensure that the settings displayed under "Current Settings" reflect your intended parameter settings.

If at anytime you accidentally close the “Model 295-v3.01” window you will need to click on “My Device” on the Windows CE desktop and click on “FlashDisk”. Then click on “HTI” folder and then click on “datalogger.exe“.

Setup Realtime Display, determine background noise, and Conduct Tag Drags

Within the “Datalogger.exe” window, click “Display” under “System”.

There are two “Enable” checkboxes within this window. Ensure both of the checkboxes are checked.

Make sure the “Network Computer” “Name” is set to: \\(insert laptop name)\binary\

Click “Ok”.

Depending on the security settings of the laptop a window may popup “logon failed”. You must enter the “User Name” and “Password” that is used to logon to the laptop and then hit enter on the keyboard.

Click “Start” under the “Data logging” section of the window and verify that the receiver is recording “Echoes” and “Noise”. Don’t close the “Model 295-v3.01” window.

Record the echoes and noise level under the comments section of the node deployment data sheet.

Open the Acoustic Tag program from the start menu, all programs, HTI, Datalogger, AcousticTag Icon.

In the AcousticTag Window click “Command” and then click “Process Datalogger”.

Click the display realtime data icon in the graph window.

Click on “View” and then click “colorbar” and then click volts.

Drag the left side of the graph window to the right to show the voltage colorbar.

Right Click the graph window and enter the tag period for the test tag that will be dragged in the water.

Verify that the tag can be seen across the entire river channel.

Record the approximate range of detection (upstream and downstream) under the comments section of the node deployment data sheet.

Verify to make sure the beacon tag is also being detected by the hydrophone.

Verify that the noise level is not too high and adjust the gain to the lowest gain setting that allows the tag to still be visible across the entire channel.

Record the noise level in volts under the comments section of the node deployment data sheet.
To adjust the gain you will need to close the AcousticTag program.

Close the AcousticTag program by checking the X.

Configuration changes cannot be performed and saved when logging data.
Click "Stop" under the “Data logging” section of the window to stop the datalogger.

Click “Hydrophone” under “Settings”.

Adjust the gain level either higher or lower depending on the desired result. Increasing the gain will increase the range for detecting tags but will also amplify noise. Lowering the gain will decrease the range for detecting tags but will reduce noise.

For example, a 6 dB reduction in gain will reduce the noise by a factor of 2 in volts. Thus if the noise spikes are roughly 0.1 volts to 0.2 volts, then a reduction in gain of 6 dB from 48 dB to 42 dB will most likely remove the noise.

Record the new gain setting and noise level under the comments section of the node deployment data sheet.

After adjusting the gain you will need to conduct another tag drag.

Click “Start” under the “Data logging” section of the window and verify that the receiver is recording “Echoes” and “Noise”. Don’t close the “Model 295-v3.01” window.

Open the Acoustic Tag program from the start menu, all programs, HTI, Datalogger, AcousticTag Icon.

In the AcousticTag Window click “Command” and then click “Process Datalogger”.

Click the display realtime data icon in the graph window.

Click on “View” and then click “colorbar” and then click volts.

Drag the left side of the graph window to the right to show the voltage colorbar.

Right Click the graph window and enter the tag period for the test tag that will be dragged in the water.
Verify that the tag can be seen across the entire river channel.
Record the approximate range of detection (upstream and downstream) under the comments section of the node deployment data sheet.
Verify to make sure the beacon tag is also being detected by the hydrophone.

Verify that the noise level is not too high.

If the noise level is still too high repeat the procedure above to adjust the gain and reduce the noise level.
If the observed noise spikes are too high then the gain may need to be reduced to a point where tag detection across the entire channel is not achievable.

If this is the case, contact Kevin Clark to determine if the hydrophone or receiver can be moved to a less noisy location.

Once an appropriate noise level is achieved, the tag used for the tag drag is detected across the entire channel width, and the beacon tag is visible, then you are ready to move on to the next step.

Record the final gain setting and the highest observed noise level in volts for the final gain setting under the comments section of the node deployment data sheet.

Close the AcousticTag program.

Click "Stop" under the “Data logging” section of the window to stop the datalogger.

Configuration changes cannot be performed and saved when logging data.

Click “Display” under “System”. Uncheck the “Enable Realtime Display” check boxes.

Click “Start” under the “Data logging” section of the window and verify that the receiver is recording “Echoes” and “Noise”. Don’t close the “Model 295-v3.01” window.
However, close the Windows CE window by clicking on the red x.

Verify that the green light is blinking in the grey I/O box. Close and lock the Metal security box.

4.5 Predator Sampling Standard Operating Procedures and Job Hazard Analysis

Lead: Veronica Wunderlich

PPE: Closed-toed waterproof shoes, appropriate field clothing for weather conditions, PFD, sunscreen, change of clothes, wet weather gear, gloves, leatherman, water, food, cell phone, radio.

Predators such as striped bass, largemouth bass, white catfish, channel catfish, and Sacramento pikeminnow will be collected primarily by gill netting and hook and line sampling in Clifton Court Forebay. Predatory fish will be sampled two or more times per week throughout the year, beginning in February 2013, to document movement and behavior, shifts in demographics, and to collect gut contents for genetic analysis. If possible, sampling will be conducted at a variety of times throughout a 24-hr period, to account for a variety of activity patterns.

Any incidental ESA listed species caught alive will be measured, recorded, and immediately released at the location caught. Field staff will be trained to quickly identify listed species and release live fish to minimize handling stress. Any dead listed species will be disposed according to procedures listed under the take authorization, and appropriate regulatory agencies will be notified. Take information will be detailed in a supplemental report at the end of the sampling season. If sampling is likely to exceed expected take, project staff will notify and consult with the appropriate regulatory agencies. If actual take exceeds estimated take, project staff will cease sampling and consult with the agencies regarding how to proceed.

Predatory fish that are of a size capable of consuming juvenile salmonids will either be sacrificed and preserved for use in the genetic analysis study, or tagged for use in biotelemetry studies or mark/recapture studies. During sampling efforts, detailed information will be gathered regarding any ephemeral cover availability, such as floating aquatic vegetation, deposition of new snags, or large woody debris. Environmental and physical conditions will be recorded, including water temperature, dissolved oxygen, and general position of radial gates (when possible).

Prior to Sampling- Shore Based

Make sure that the CDFW Scientific Collection Permit is on hand during the sampling effort, and fax intent to work form to CDFW a minimum of 24hr prior to effort.

Assemble the equipment that will be needed for the days sampling effort.

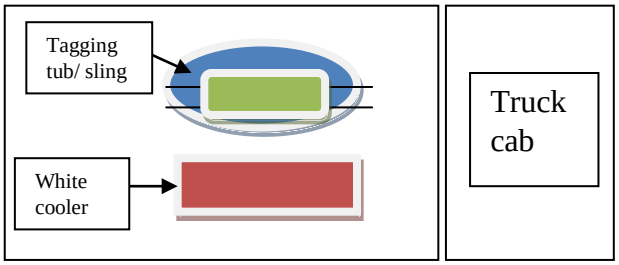
- ***For shore sampling*** via hook and line collect the following equipment:
  - Sampling gear:
    - Rods (minimum one for each staff member)
    - Tackle box(es)
    - Bait (if used)
    - Multitool (Leatherman)

- Large landing net
- YSI
- Gloves (Puncture resistant)
- Camera

- Tagging Equipment
  - Acoustic tags (already activated and sorted; there should be 4 trays, 3 for SB and one for CF/BB)
  - Clip board:
    - Floy Tags
    - Scale envelopes
    - Data sheets
    - Fish identification key
    - SCP
    - Pencils
    - Tagging schematic
    - SOP
    - Tailgate sheets
  - AQUI-S (with syringe)
  - Tagging trays
    - Rinse tray with Distilled or de-ionized water
    - Disinfecting tray with Disinfectant solution (Novalsan)
  - Stress coat – stock concentration and 25% solution (250 mL/L D-H_20)
  - Black tagging tub, with tagging sling installed, positioned in truck with white cooler as a bench
  - Pump for recirculation of water in tagging tub, with charged battery
  - Portable scale measuring to the nearest .01 lb
  - Measuring board with ruler to the nearest millimeter
  - Tagging box:
    - Nitrile gloves
    - boga grip
    - Surgical tools (needle drivers, forceps, scalpel handle and blades, sutures dissecting scissors)
    - Timer(s)
    - Sharps container
    - PIT tag reader
    - Pre-loaded needles with PIT tags
    - PIT tag injector Gun
    - Measuring tape

- Check in with Delta Field Division and the Area Control Center following the approved methods (refer to Section 3 page 3.2 of this document for these procedures)

- Load the equipment into the truck, fill tagging tub to the 200L line, and drive to the sampling location.
  The truck bed should be laid out in this manner:



Sampling:

Hook and line sampling will be conducted using standard rod and reel fishing equipment and in accordance with standard DFW regulations for hook and line fishing. Make sure everything is set up for tagging prior to the first cast. **No one should be fishing before the tubs are full of water and the tagger is completely ready to receive a fish.** Whenever anyone gets a fish on the line, all other samplers should reel in so as to not overwhelm the tagger with multiple fish to tag at once. In the case of a multiple fish hookup, hold one fish in water until the other fish is undergoing surgery. Then place the second fish into the anesthesia, so as not to over-anesthetize the second fish.

At Conclusion of Sampling:

- Return to CHTR
- Contact DFD and ACC and let them know that the days activities have been concluded.
- Unload and clean equipment so that it is ready for use again.
- Review datasheets to ensure nothing was missed.
- Back up computer files to portable drive.
- Scan data sheets into appropriate file.
- Download photos into appropriate file.

Prior to Sampling- Boat Based

Make sure that the CDFW Scientific Collection Permit is on hand during the sampling effort, and fax the intent to work form to CDFW 24hr prior to effort.

- ***For boat-based sampling*** gather the following equipment:

  - Sampling Gear:
    - Gill net (If using for sampling that day)
    - Tub for gillnet to be stored Rods (one for each staff member)
    - Tackle box
    - Bait (if used)
    - Multitool (Leatherman)
    - Gloves (Puncture resistant)
    - Camera

- YSI ProODO meter (Thermometer and DO meter)

- Safety Equipment:
  - PFD's
  - Rain/wet weather gear
  - Radios (for communicating between boats/ to shore)
- Tagging Equipment
  - Acoustic tags (already activated and sorted; there should be 4 trays, 3 for SB and one for CF/BB)
  - Clip board:
    - Floy Tags
    - Scale envelopes
    - Data sheets
    - Fish identification key
    - SCP
    - Pencils
    - Tagging schematic
    - SOP
    - Tailgate sheets
  - AQUI-S (with syringe)
  - Tagging trays
    - Rinse tray with Distilled or de-ionized water
    - Disinfecting tray with Disinfectant solution (Novalsan)
  - Stress coat – stock concentration and 25% solution (250 mL/L D-H_20)
  - Black tagging tub, with tagging sling installed, positioned in truck with white cooler as a bench
  - Pump for recirculation of water in tagging tub, with charged battery
  - Portable scale measuring to the nearest .01 lb
  - Measuring board with ruler to the nearest millimeter
  - Tagging box:
    - Nitrile gloves
    - boga grip
    - Surgical tools (needle drivers, forceps, scalpel handle and blades, sutures dissecting scissors)
    - Timer(s)
    - Sharps container
    - PIT tag reader
    - Pre-loaded needles with PIT tags
    - PIT tag injector Gun
    - Measuring tape

- Check in with Delta Field Division and the Area Control Center following the approved methods (refer to Section 3 page 3.2 of this document for these procedures)
- Go through the Pre-operational checklist for the boat(s) prior to launch to ensure they are in good running order
- Evaluate the conditions and ensure that they are safe for boat based activities.
- Load equipment onto boat
- Tow boat to launch ramp near the trash rack and launch.
- Phone or email the designated person and let them know you are on the water. (Normally this will be Kevin Clark or Javier Miranda. If they are not available, anoth BERP will be designated)
- Once launched, navigate to the chosen sampling location.

Sampling:

Hook and line sampling will be conducted using standard rod and reel fishing equipment and in accordance with standard DFW regulations for hook and line fishing. Make sure everything is set up for tagging prior to the first cast. **No one should be fishing before the tub(s) are full of water and the tagger is completely ready to receive a fish.** Whenever anyone gets a fish on the line, all other samplers should reel in so as to not overwhelm the tagger with multiple fish to tag at once. In the case of a multiple fish hookup, hold one fish in water until the other fish is undergoing surgery. Then place the second fish into the anesthesia, so as not to over-anesthetize the second fish.

Gill netting will be conducted at locations within Clifton Court Forebay using a monofilament gill net, measuring 100 feet or less, with variable mesh sizes ranging from .5 inch to 6 inches. Gill-nets shall be deployed for as short a duration as possible to avoid excessive mortality and shall not be deployed for more than 15 minutes at a time. Gill netting will be conducted 1) near the radial gates and 2) in the SDFPF intake canal upstream of the debris boom. Ensure that the tagger has everything set up and is ready to receive fish prior to deploying the gill net.

At Conclusion of Sampling:

- Trailer boat and return to CHTR.
- Phone or email the designated person and let them know you are off the water.
- Contact DFD and ACC and let them know that the days activities have been concluded.
- Unload and clean equipment so that it is ready for use again.
- Review datasheets to ensure nothing was missed.
- Back up computer files to portable drive.
- Scan data sheets into appropriate file.

JOB HAZARD ANALYSIS (JHA) Continued		
Job Steps	**Potential Hazard**	**Precaution/PPE**
Predator Sampling from Boat	Injury or drowning, accident or collisions with floating objects or other boats	All boating activities will be conducted in accordance with Section 5 of this document. Only qualified and approved employees may drive/operate a boat or watercraft. Buddy systems will be used at all times. All boat operators must attend boat orientation, prior to operations. A float plan will be prepared and filed prior to any motorized boating activities and check-in and check-out procedures will be followed for all boating activities. Prior to departure, a boat operation checklist will be reviewed and discussed with all boat crew. A Coast Guard approved personal floatation devices must be worn at all times for any work on or near water. A type III life jacket is recommended. The boat operator will routinely conduct weather checks, aborting activity anytime weather or river conditions affect the operator's ability to pilot the watercraft in a safe manner. The boat operator has absolute final authority over operation of the watercraft. When deploying or retrieving gill nets stay alert and aware of surrounding to avoid entanglement.
Predator Sampling from shore	Physical hazards: Slips/Trips/Falls	Field crews will pay special attention when surveying in areas with uneven ground, rocks, ditches, and loose or wet soils. Field crews will follow "good housekeeping" elements: orderly placement of materials, tools and equipment; removal and secure storage of items that are not needed to perform the immediate task at hand; awareness to walk around, not over or on, equipment onsite; and, identify a path that is clear of obstructions.

Job Steps	Potential Hazard	Precaution/PPE
Predator Sampling from shore	Falling from the bank into the water	While on the banks, a Coast Guard approved (type I, II. or III) personal floatation devices must be worn. Use caution when traveling overland near rivers with steep cut banks as the ground can give way causing injury. Be aware of uneven ground surface, and ropes and cables that may be lying on the ground. Be aware of loose gravel and slippery surface when walking down embankments or boat ramps.
Predator Sampling from shore	Physical injury: Strenuous and repetitive motions	Field crew members will practice safe moving, lifting, and carrying techniques Employees must be physically conditioned for strenuous tasks. A rest work cycle will be established to prevent exhaustion, but at a minimum 10-minute break should be taken each hour for all strenuous activities. Stretching will be done before, during and after activity to prevent sore muscles and injuries. Field crew members will wear all appropriate PPE for specific tasks.Pain or soreness associated with specific routine tasks should be reported to the PM and SSO.
Predator Sampling from shore	Biological hazards: Potential contact with poisonous or stinging animals or plants, including a sting/bite from a poisonous animal (e.g., rattle snake, black widow, bees and wasps) or contact with a poisonous plant (e.g., poison oak, stinging nettles)	Field crews will wear full body protective clothing and are trained to detect and avoid potentially poisonous animals and plants. Field personnel are trained in first aid and first aid kits are kept in all field vehicles. Field crews will visually inspect objects before picking them up and will not disturb insect nests or agitate insects. Field crews should check for ticks each day at the end of field activities. In the event of a poisonous bite/sting or contact with poisonous plant, employees are advised to administer first aid and seek medical treatment immediately.

JOB HAZARD ANALYSIS (JHA)

Job Hazard Analysis for Use During the Pre-Job Safety Meeting

Work Area/Facility: Clifton Court Forebay		Start Date: 10/3/2013
Supervisor Kevin Clark	Phone No. 916-653-4018	Finish Date: 10/31/2014
ACC	Phone No. 209-833-2180	Emergency No. 911
Work to be completed with	☐ OK to work: Eligible Worker	☐ Clearance Holders

Description of Work: Hook and Line, gill net predator sampling in the Clifton Court Forebay

Potential Hazards (Check those that apply)

	Flooding		Confined Spaces		Fire or Explosion Potential
✓	Skin Irritants		High Noise Levels		Compressed Gasses/Liquid
	Fall Potential		Ionizing Radiation		**Welding/Burning Operations
	Toxic Material		Excavation Hazard	✓	Pinch, Crush or Striking Hazards
✓	Adjacent Work		Elevated Load or Work	✓	Sharp Edges or Hot/Cold Surfaces
✓	Lifting Hazards		Inadequate Ventilation	✓	Hazardous Chemical Exposures/MSDS
	Difficult Access	✓	Water/Drowning Hazard	✓	Electrical Shock/Energized Equipment
	Shoring/Sloping	✓	Environmental Extremes		Potential Release of Energy Kinetic/Gravity
	Traffic/Vibration	✓	Employees/New or Temp		Lead Exposure

Other: fishing hooks, knives, fish spines

**A Supplemental HOT WORK Permit is required for all Welding and Burning Operations

Applicable Safe Work Practices (OPS and other Codes and Regulations) (Check those that apply)

✓	First Aid		Energy Isolation Procedure	✓	Standard Operating Procedures
	Lock-out Tag Out		Confined Space Entry Permit		Review of Emergency Action Plans
	Use of Barricades		Rescue/Retrieval Equipment	✓	Special Pre-Job Safety Discussions
	Approved Lighting	✓	Use of Specialized Equipment		Hot Work Permit: Electrical/Welding
✓	Site/Job Orientation		Specialized Training Required		Communications: Visual/Audio
	Use of Specialized PPE				

Other:

Special Precautions (OP2 and other Codes and Regulations) (Check those that apply)

					Electrical Powerline Issue
	Simultaneous Operations		Near Miss Reports/Incidents		Overhead or Underground power lines
	Pollution Prevention Measures		Hazardous Waste Disposal		Overhead Power lines within 100 feet if work site
	Redundant Protection Measures		Dig Alert		(If yes, develop a plan to address hazard)
	Special Pre-Job Safety Discussions				

Other:

Personal Protective Equipment (PPE) (Check those that apply)

	Hard Hats	✓	Safety Foot Wear	✓	Standard Operating Procedures
	Respirators		Ear Protection		Review of Emergency Action Plans
	Eye Protection		Personal Grounds	✓	Special Pre-Job Safety Discussions
	Air Lines/Hood		Coveralls/Clothing		Hot Work Permit: Electrical/Welding
	Face Protection		SCBA		

Other:

If an Accident occurs during this job, a copy of the JHA should be in the investigation report.

JOB HAZARD ANALYSIS (JHA)

Job Hazard Analysis for Use During the Pre-Job Safety Meeting

(1) List and discuss the basic job steps. (2) Identify the potential hazards of each step. (3) Provide recommendations to eliminate or reduce hazards (4) Revise as conditions change during the course of the day's activities (i.e., weather, lighting changes, etc.)

Sequence of Basic Job Steps	Potential Hazards & Consequences	Recommendations to Eliminate or Reduce Hazards
Hook and Line Sampling	Bodily injury from fish tackle and line casting	When choosing a site for fishing, always consider safety factors. All fishing tackle will be handled and stored responsibly.
		Prior to casting a line, field crews will look behind them to ensure that the hook will not catch a power line, tree, or another person.
		If a cast lure becomes entangled in a tree or other stationary object, remove carefully so as to not have the lure return in a rapid, uncontrollable
		manner.Never grab a fish where it is hooked. If a hook is deep inside of a fish's mouth and cannot be easily removed by hand, use a hook remover
		or pliers to carefully remove the hook. Hooks and lures will be appropriately stowed at the end of each workday.
Boat - based sampling	Encounter with marine life (sea lions, otters)	Do not approach marine life or attempt to make them leave the area. When possible, keep a minimum distance of 100 yards from animal.
		If approached while boating, put the engine in neutral and allow the animal to continue uninterrupted. Avoid sudden alterations in speed
		or direction and never steer toward marine mammals. If marine life is interfering with other operations, staff should wait for marine life to
		move before continuing work.

Notes: Continued on separate page.

Job Briefing-Hazard Analysis Conducted by: Veronica Wunderlich

Personnel Attending

All near-misses/hazards found or created along with incidents must be reported.
Send a copy of this form to the Safety Office.

4.6 Tagging Procedures for Predators Standard Operating Procedures and Job Hazard Analysis

Lead: Bryce Kozak/ Veronica Wunderlich

PPE: Closed-toed waterproof shoes, appropriate field clothing for weather conditions, PFD, sunscreen, change of clothes, wet weather gear, gloves, leatherman, water, food, cell phone, radio.

Predators such as striped bass, largemouth bass, white catfish, channel catfish, and Sacramento pikeminnow will be collected primarily by hook and line sampling in Clifton Court Forebay for the purposes of acoustic tagging. Predatory fish will be sampled two or more times per week throughout the year. Predatory fish that are of a size capable of consuming juvenile salmonids that are within the needed size-class ranges for each month will be tagged for use in biotelemetry studies or mark/recapture studies. Predator fish that are not within the needed size classes will be PIT tagged.

Tagging Procedures:

Assemble the equipment that will be needed for the days sampling effort.

- YSI dissolved oxygen (DO) meter with temperature function YSI Pro ODO
- Programmed Acoustic tags
- Clean water for rinsing
- Aqui-S®
- Stress coat - stock concentration and 25% solution (250mL/L D-H2O)
- DWR Bay Delta Office North River Jet boat or other appropriate boat (ie the Mudsucker)
- 200 gallon black plastic tote with 200L water level mark
- Surgery stretcher (both cloth part and metal support rods)
- Clamps
- bilge pump with approximate 5 feet of clear hose
- smaller circulation (inline bilge) pump
- Charged 12V batteries to run the bilge pumps
- Nolvasan
- Syringes for measuring anesthetic and stress coat
- Oxygen delivery system or bubblers
- Dip nets
- Nitrile gloves
- Leatherman or pliers for removing hooks
- Portable hanging scale measuring to the nearest 0.1 g
- Boca Grip tm
- Measuring board with ruler to the nearest centimeter
- Trays for holding solutions used to disinfect surgical tools
- Needle drivers

- Forceps
- Scalpel handle and blades
- Sutures (size: 4-0, 3-0 and 2-0) with an RB-1 needle
- Floy tags
- Floy tagging gun
- 2 landing nets (one for landing and one for recovery)
- Timer(s)
- Sharps container
- Scale collection envelopes
- Datasheets and writing tools

Acoustic Tagging Procedures:

1) **Fish Size Criteria**

A. Size of fish tagged is dependent on the type of tag being used. A maximum tag weight to body weight ratio of 2% is used to calculate minimum fish size. Please see Appendix 1 for tag size to fish size requirements.

2) **Pre-Tag Preparations**

A. Environmental conditions

i. Dissolved oxygen (DO): will be measured as ppm in the anesthetic and recovery tanks during each tag session.
   1. Measurements will be taken using a YSI Pro ODO.
   2. DO concentrations in holding tanks should be above 6.0 mg/L.

ii. Temperature: will be measured in °C in the anesthetic tank and water body during each tag session.
   1. A difference in water temperature between the water body and the anesthetic tote exceeding +/- 2°C should be avoided. If the temperature exceeds 2°C, the anesthetic tote should be dumped and replaced.
   2. If replacing the anesthetic tote is not an option, the situation requires a tempering step (Kelsch and Shields 1996). "Tempering" means "to bring to a suitable state by mixing in or adding a usually liquid ingredient". Therefore, prior to exposing fish to a new water source the fish holding temperature and the temperature of the new water source need to be measured to ensure that the difference between the two water sources is ≤ 2°C. If the temperature difference is > 2°C then water in the container holding fish should be tempered at a rate of 0.5°C/15 min until the temperature difference between the two water sources is ≤ 2°C. New source water should be added in small amounts multiple times over 15 min to gradually change the temperature by 0.5°C. Once the temperature difference between the two water sources is ≤ 2°C fish can be transferred to the new water source.

B. Setup of equipment

i. Tags should be programmed and prepared for implantation as per SOP.
ii. Each day prior to predator sampling, the tags should be "sniffed" to ensure they are still functioning (See SOP for this procedure)
iii. Disinfect all tags in cold sterile solution (Nolvasan) and **thoroughly** rinse in clean water. Use pillboxes or other compartmentalized containers to segregate tags. Each tag will be labeled with its tag code.
iv. Prepare surgical area and equipment for use.
v. All surgical instruments will begin a tagging session sterile.
vi. Setup measuring board and scale

1. Ensure the scale is functioning properly. Scales should be calibrated at the start of each month using the standardized weight method, checked each day for accuracy, and recalibrated as necessary.

C. Administration of anesthetic: The effectiveness of Aqui-S 20E as an anesthetic varies with factors such as temperature and fish density. Adjustments of the anesthesia concentration should be based on the amount of time it takes for a fish to lose equilibrium (induction time).

i. Fill the black tote (tagging container) with **200 L** of water from the Clifton Court Forebay using the portable bilge pump (to the bottom of the duct tape label). As a starting concentration, add **35 mL** (1 mL= 1 cc) of Aqui-S. This will yield an anesthetic concentration of **17.5 mL/L**.
ii. The tagging container should be filled and prepared just prior to tagging to avoid temperature changes. The container should be checked periodically to ensure temperature has not changed +/- 2°C from the Forebay.

3) **Implantation of tags**

A. Anesthetizing fish

i. Place the fish directly into the black anesthesia tote. Start a timer to keep track of how long a fish has been in the anesthesia tote.
   1. Time of sedation for a fish should normally be 1 - 4 minutes, with an average time of about 2.5 minutes. If loss of equilibrium takes less than 1 minute, immediately tag that fish and ensure fish fully recovers from surgery before release. Fish will be more or less sensitive to anesthesia based on stress from landing the fish, fish size and water temperature. The concentration of 17.5 mL/L of Aqui-S 20 E has been derived from observations of fish in this setting.
   2. Once the fish loses equilibrium, visually screen the fish for floy tags, fungus, disease, descaling, bloated belly, or any obvious abnormalities.

B. Recording fish length and weight

A. Start the surgery time stopwatch while the tagger starts to process the fish(weight/length measurements).
B. Scan the fish with the PIT tag reader to see if has been PIT tagged. Make sure to keep the fish submerged during this examination. Relay any information to the data recorder. If the fish has a PIT tag and is a recapture, follow the steps below to weigh and measure the fish then release. Do not implant an acoustic tag.
i. Hang the Boca Grip from the hanging scale and tare it out.
ii. Use the Boca Grip to pick up the fish by grabbing the lower jaw. Hang the Boca Grip off the scale to get the fish weight to the nearest 0.01 lb.
iii. Transfer the fish to the measuring board and measure the fork length to the nearest half centimeter (cm).

iv. Data must be vocally relayed to the data recorder to avoid data errors. The data recorder should then record this information and repeat numbers back to avoid any miscommunication.
v. Care should be taken to avoid dropping of fish.

C. Surgery

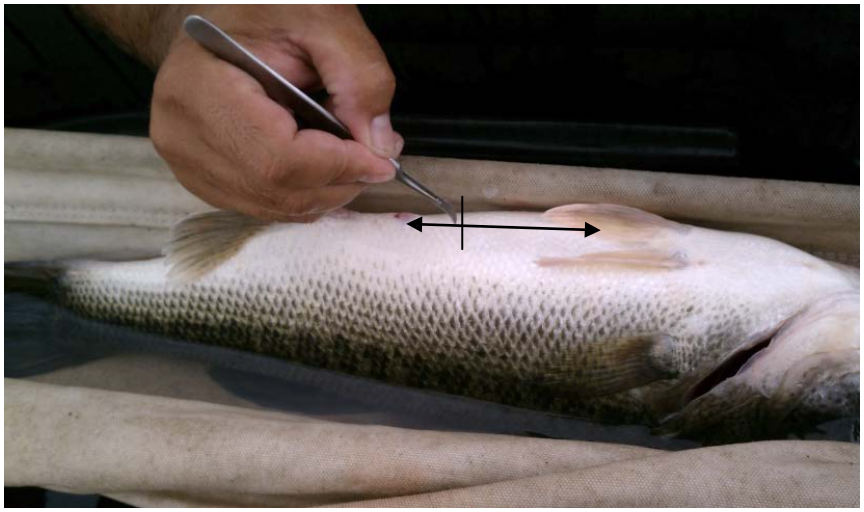
i. The acoustic tags we are using have an integrated PIT ID. Scan the tag using the Biomark PIT tag reader. Record the PIT ID. Ensure the PIT ID is new and is not the previous ID.
ii. The acoustic tags have been programmed with a specific acoustic tag ID. This is located on a label attached to the activated tag. Remove the label and attach to the comments section on the datasheet. Also record the acoustic tag ID on the datasheet.

Striped Bass (see photo below)

(i) Using a scalpel, make an incision, appropriate to the size of the tag, parallel to the mid-ventral line. On fish with thick scales, use the tip of your scalpel to pull off individual scales in the area you will make your incision.
(ii) Start your incision roughly 1/2 of the distance from the anal opening to the pelvic girdle, and draw the blade toward the anal opening of the fish. The incision should be just deep enough to penetrate the peritoneum (the thin membrane separating the gut cavity from the musculature), avoiding the internal organs. The spleen is generally near the incision point, so pay close attention to the depth of the incision.
(iii) Avoid getting anesthesia water in the incision.

Large Mouth Bass (see photo below)

(i) Using a scalpel, make an incision, appropriate to the size of the tag, parallel to the mid-ventral line. On fish with thick scales, use the tip of your scalpel to pull off individual scales in the area you will make your incision.
(ii) Start your incision roughly 1/3 of the distance from the anal opening to the pelvic girdle, and draw the blade toward the anal opening of the fish. The incision should be just deep enough to penetrate the peritoneum (the thin membrane separating the gut cavity from the musculature), avoiding the internal organs. The spleen is generally near the incision point, so pay close attention to the depth of the incision.
(iii) Avoid getting anesthesia water in the incision.



Catfish (see photo below)

(i) Using a scalpel, make an incision, appropriate to the size of the tag, parallel to the mid-ventral line. The mid-ventral line can be difficult to see on catfish. Imagine a line that extends from the anal opening up to the frenulum.
(ii) Start your incision anterior of the pelvic girdle, and draw the blade toward the anal opening of the fish. Catfish have very tough skin and the surgeon may find it easier to pierce the skin with a #12 hooked blade.
(iii) The incision should be just deep enough to penetrate the peritoneum (the thin membrane separating the gut cavity from the musculature), avoiding the internal organs. The spleen is generally near the incision point, so pay close attention to the depth of the incision.
(iv) Avoid getting anesthesia water in the incision.

1. There is no exact specification for what size scalpel blade to use for each fish. We have a variety of blades and styles to choose from depending on the species and size.
2. One scalpel blade can be used multiple times. It is good practice to start each day with new scalpel blades. If the blade is pulling roughly or making jagged incisions, it needs to be changed prior to tagging the next fish.
3. Use forceps to open the incision to ensure you did not damage any internal organs or cause excessive bleeding. If you observe damage or think you damaged an organ, do not implant the tag, and reject that fish. Excessive bleeding should be noted on the datasheet.

iii. Refer to Appendix 1 for tag type to size designations. Gently push the tag into the body cavity, and position it so that it lies directly under the incision. This positioning will provide a barrier between the suture needle and internal organs. Through time the tag location will naturally move posterior in the fish.

iv. Begin suturing the incision. Two or three interrupted stitches are used to close the incision, depending on the size of the tag and incision.
   1. There is no exact specification for what size suture to use. The following is a guideline:
      - 2-0 for fish over 3lb
      - 3-0 for fish from 1.5 - 3lb
      - 4-0 for fish 0.5 - 1.5 lb
   2. To make a stitch, lock the needle (at the end of the suture) in the needle drivers so the needle point faces you.
   3. Enter the outside edge of the incision on the side farthest from you and exit through the other edge of the incision, pulling the suture perpendicular through the two edges. The needle should enter and exit the skin as close to the edge of the incision as possible without tearing the skin (~ 2 mm from edge of incision).
   4. Pull the needle and suture through the skin to leave a tag end of about 2 - 3 cm of suture material protruding from the needle entrance location, then release the needle from the needle drivers.
   5. With your non-dominant hand, grasp the long end of the suture material (usually with thumb and forefinger) at or below the needle, and make two forward wraps (i.e., away from your body) around the tip of the needle driver, which should be held in your dominant hand. With the two wraps still around the needle driver, grasp the short tag end of suture material with the needle driver and tighten the stitch by pulling the wraps off the needle driver and pulling both ends of suture material perpendicular to the incision.
   6. On the first knot, the dominant hand holding the needle driver should pull toward your body and the non-dominant hand should pull away from your body.
   7. Tighten the suture lightly, just so the edges of the incision meet, but do not overlap, pucker, or bulge the edges of the incision.
   8. The second knot is the same as the first, but in reverse order. On the second knot, grasp the long end of suture material with your non-dominant hand, make two reverse wraps (i.e., toward you body) around the end of the needle driver, grasp the short end of suture with the needle driver, and tighten the stitch. This time, the knot

should be tightened by pulling your dominant hand (holding the needle drivers) away from you and your non-dominant hand toward you. The second knot can be slightly tighter than the first, again taking care not to overlap, pucker, or bulge the edges of the incision.

9. The third knot is a repeat of the first and should be tightened snug to prevent the stitch from coming loose. This completes one stitch. When pulling the knot tight, be sure the knot lays flat and does not twist onto itself into a "balled-up" knot. Cut the suture with the needle drivers, leaving ends approximately 0.5 mm in length.

10. If the incision is too long to close with two stitches, it is acceptable to add a 3rd stitch. Relay this information to the data recorder so they can note the extra stitch on the datasheet.

11. Because sutures are long, each individual suture (one packet) can be used on 2-4 fish. Rinse the suture material and the needle in the sanitizing solution used for instruments between fish.

v. Turn the fish dorsal side up on the stretcher and attach two floy tags, one on either side of the dorsal fin, using the floy tagging gun. Be sure to read the floy tag numbers off to the data recorder.

vi. Collect a minimum of 5 scales from the area above the lateral line and below the dorsal fin. Place the scales in a prepared scale envelope.
vii. Transfer the fish from the surgery stretcher directly to a recovery net and stop the stopwatch to record surgery time.
viii. Between surgeries, the surgeon should replace the tools that were just used into the disinfectant bath. Each surgeon will have at least two (2) sets of surgical instruments to rotate through to ensure that tools get adequate contact time (20 minutes) in disinfectant for between uses. Once disinfected in cold sterile, rinse the tools thoroughly with distilled or de-ionized water and ensure that the scalpel blade and suture are acceptable to use on the next fish. Organic debris in the disinfectant bath reduces its effectiveness, so be sure to change the bath regularly. If necessary, replace the scalpel blade.
ix. When fish in the recovery net have gained equilibrium, allow the fish to swim into the Clifton Court Forebay.

PIT tagging procedures:

A. Recording fish length and weight

i. Scan the fish with the PIT tag reader to see if has been PIT tagged. Relay any information to the data recorder. If the fish has a PIT tag and is a recapture, record it as such on the data sheet. NOTE: Fish PIT tagged prior to November 26, 2013 were not secondarily tagged with FLOY tags.
ii. Hang the Boca Grip from the hanging scale and tare it out.
iii. Use the Boca Grip to pick up the fish by grabbing the lower jaw. Hang the Boca Grip off the scale to get the fish weight to the nearest 0.01 lb.
iv. Transfer the fish to the measuring board and measure the fork length to the nearest half centimeter (cm).
v. Place the fish in the tagging cradle, ventral side up.
vi. Insert a clean needle w/PIT tag onto the tagging gun
vii. Scan the tag and hand the scanner to the data recorder for recording
viii. Align the tip of the needle so that it is located between the posterior tip of the pectoral fin and the anterior point of the pelvic girdle. Avoid placing the point of the needle too far posterior. The puncture should be made 1-2 mm off the mid-ventral line
ix. The bevel of the needle should be open toward the belly of the fish so the point of the needle is away from the internal organs. The puncture is made with a short, quick, jabbing motion.
x. Once the needle has penetrated the abdominal wall, and with about 2-3 mm of the needle inside the fish, the tag can be injected.
xi. Retract the needle and eject the spent needle into a sharps container.
xii. Turn the fish dorsal side up on the stretcher and attach two floy tags, one on either side of the dorsal fin, using the floy tagging gun.
xiii. Be sure to read the floy tag numbers off to the data recorder.
xiv. Collect a minimum of 5 scales from the area above the lateral line and below the dorsal fin. Place the scales in a prepared scale envelope.
xv. Release the fish
xvi. Data must be vocally relayed to the data recorder to avoid data errors. The data recorder should then record this information and repeat numbers back to avoid any miscommunication.
xvii. Care should be taken to avoid dropping of fish.

Cleanup at the end of the tagging day:

A. Clean all weigh scales, Boca Grips and measuring boards.

B. To ensure sterilization, scrub surgical tools with a small brush to remove organic debris. Then spray the tools with 70% ethanol and allow to dry

C. Rinse tagging stretcher with clean water. Scrubbing of the canvas may be required to remove debris/fish blood/fish slime. Hang to dry.

D. Rinse out anesthetic tote and allow to dry.

Appendix 1
Fish Tag Type by Size and Species

Fish Species	Fish Size	Tag Type	Subcode
Striped bass	Between 0.5 and 1.5	LG	22
Striped bass	Greater than 1.5 and less than 3.0 lb	LY	6
Striped bass	Greater than 3.0 lb	LZ	6
Black Bass	Greater than 1.5 lb	LY	1
Catfish	Greater than 1.5 lb	LY	1

Appendix 2
Monthly Fish Quota Targets

	Striped Bass	Striped Bass	Striped Bass	Black Bass	Catfish
>0.5lb, <1.5lb	7 fish				
>1.5 lb < 3.0lb		7 fish		5 fish (min 1.5lb with no max weight)	5 fish (min 1.5lb with no max weight)
>3.0 lb			7 fish		

JOB HAZARD ANALYSIS (JHA)

Job Hazard Analysis for Use During the Pre-Job Safety Meeting

Work Area/Facility: Clifton Court Forebay		Start Date: 10/3/2013
Supervisor Veronica Wunderlich	Phone No. 916-471-9161	Finish Date: 10/31/2014
ACC	Phone No. 209-833-2180	Emergency No. 911
Work to be completed with	☐ OK to work: Eligible Worker	☐ Clearance Holders

Description of Work: Acoustic tagging of predator species in the Clifton Court Forebay

Potential Hazards (Check those that apply)

	Flooding		Confined Spaces		Fire or Explosion Potential
✓	Skin Irritants		High Noise Levels		Compressed Gasses/Liquid
	Fall Potential		Ionizing Radiation		**Welding/Burning Operations
	Toxic Material		Excavation Hazard	✓	Pinch, Crush or Striking Hazards
	Adjacent Work		Elevated Load or Work	✓	Sharp Edges or Hot/Cold Surfaces
✓	Lifting Hazards		Inadequate Ventilation	✓	Hazardous Chemical Exposures/MSDS
	Difficult Access	✓	Water/Drowning Hazard	✓	Electrical Shock/Energized Equipment
	Shoring/Sloping	✓	Environmental Extremes		Potential Release of Energy Kinetic/Gravity
	Traffic/Vibration		Employees/New or Temp		Lead Exposure

Other: Sharps, Bloodborne Pathogens

**A Supplemental HOT WORK Permit is required for all Welding and Burning Operations

Applicable Safe Work Practices (OPS and other Codes and Regulations) (Check those that apply)

✓	First Aid		Energy Isolation Procedure	✓	Standard Operating Procedures
	Lock-out Tag Out		Confined Space Entry Permit		Review of Emergency Action Plans
	Use of Barricades		Rescue/Retrieval Equipment	✓	Special Pre-Job Safety Discussions
	Approved Lighting	✓	Use of Specialized Equipment		Hot Work Permit: Electrical/Welding
✓	Site/Job Orientation		Specialized Training Required		Communications: Visual/Audio
	Use of Specialized PPE				

Other:

Special Precautions (OP2 and other Codes and Regulations) (Check those that apply)

	Simultaneous Operations		Near Miss Reports/Incidents		Electrical Powerline Issue
	Pollution Prevention Measures		Hazardous Waste Disposal		Overhead or Underground power lines
	Redundant Protection Measures		Dig Alert		Overhead Power lines within 100 feet if work site
✓	Special Pre-Job Safety Discussions				(If yes, develop a plan to address hazard)

Other:

Personal Protective Equipment (PPE) (Check those that apply)

	Hard Hats	✓	Safety Foot Wear	✓	Standard Operating Procedures
	Respirators		Ear Protection		Review of Emergency Action Plans
	Eye Protection		Personal Grounds	✓	Special Pre-Job Safety Discussions
	Air Lines/Hood		Coveralls/Clothing		Hot Work Permit: Electrical/Welding
	Face Protection		SCBA		

Other: nitrile gloves, sharps containers

If an Accident occurs during this job, a copy of the JHA should be in the investigation report.

JOB HAZARD ANALYSIS (JHA)

Job Hazard Analysis for Use During the Pre-Job Safety Meeting

(1) List and discuss the basic job steps. (2) Identify the potential hazards of each step. (3) Provide recommendations to eliminate or reduce hazards (4) Revise as conditions change during the course of the day's activities (i.e., weather, lighting changes, etc.)

Sequence of Basic Job Steps	Potential Hazards & Consequences	Recommendations to Eliminate or Reduce Hazards
Motorboat operation	drowning, weather/temperature extremes, small work area, slips trips and falls	wear PFD at all times, proper clothing, good communication, limit equipment to what is required onboard
Tagging station setup	chemical exposure, insect bites, heavy buckets	Wear nitrile gloves when handling all chemicals. Be aware of spiders and other stinging insects that may be hiding in equipment or in the work
		area. Use proper lifting technique when moving containers of water.
acoustic tag surgery	needle stick injuries, fish spine stick injuries, chemical exposure	Wear nitrile gloves at all times to prevent chemical exposure. Use a small net to retrieve fish from container rather than submerging arm.
		Be cautious when handling fish and scalpels. Use proper tagging techniques as outlined in the SOP to prevent scalpel cuts. Ensure that fish
		are appropriately anesthetized before attempting to handle them.
Clean up	chemical exposure, sharps	Use gloves when handling any chemicals used to clean up the tagging station. Ensure that all sharps are placed in a sharps container.

Notes: In the event of a scalpel cut, wash the wound thoroughly with clean soap and water. Dress the wound appropriately using the first aid kit. Complete an accident report and visit the hospital as necessary for severe injuries.

Job Briefing-Hazard Analysis Conducted by: Bryce Kozak

Personnel Attending

All near-misses/hazards found or created along with incidents must be reported.
Send a copy of this form to the Safety Office.

JOB HAZARD ANALYSIS (JHA)

Job Hazard Analysis for Use During the Pre-Job Safety Meeting

Work Area/Facility: Clifton Court Forebay		Start Date: 10/15/2013
Supervisor Veronica Wunderlich	Phone No. 916-471-9161	Finish Date: 10/15/2014
ACC	Phone No. 209-833-2180	Emergency No. 911
Work to be completed with	☐ OK to work: Eligible Worker	☐ Clearance Holders

Description of Work: Avian Surveys at the Clifton Court Forebay

Potential Hazards (Check those that apply)

	Flooding		Confined Spaces		Fire or Explosion Potential
	Skin Irritants	✓	High Noise Levels		Compressed Gasses/Liquid
	Fall Potential		Ionizing Radiation		**Welding/Burning Operations
	Toxic Material		Excavation Hazard	✓	Pinch, Crush or Striking Hazards
✓	Adjacent Work		Elevated Load or Work	✓	Sharp Edges or Hot/Cold Surfaces
✓	Lifting Hazards		Inadequate Ventilation		Hazardous Chemical Exposures/MSDS
	Difficult Access	✓	Water/Drowning Hazard		Electrical Shock/Energized Equipment
	Shoring/Sloping	✓	Environmental Extremes		Potential Release of Energy Kinetic/Gravity
✓	Traffic/Vibration	✓	Employees/New or Temp		Lead Exposure

Other: Intoxicated public

**A Supplemental HOT WORK Permit is required for all Welding and Burning Operations

Applicable Safe Work Practices (OPS and other Codes and Regulations) (Check those that apply)

✓	First Aid		Energy Isolation Procedure	✓	Standard Operating Procedures
	Lock-out Tag Out		Confined Space Entry Permit		Review of Emergency Action Plans
	Use of Barricades		Rescue/Retrieval Equipment	✓	Special Pre-Job Safety Discussions
	Approved Lighting		Use of Specialized Equipment		Hot Work Permit: Electrical/Welding
✓	Site/Job Orientation		Specialized Training Required		Communications: Visual/Audio
	Use of Specialized PPE				

Other:

Special Precautions (OP2 and other Codes and Regulations) (Check those that apply)

					Electrical Powerline Issue
	Simultaneous Operations		Near Miss Reports/Incidents		Overhead or Underground power lines
	Pollution Prevention Measures		Hazardous Waste Disposal		Overhead Power lines within 100 feet if work site
	Redundant Protection Measures		Dig Alert		(If yes, develop a plan to address hazard)
	Special Pre-Job Safety Discussions				

Other:

Personal Protective Equipment (PPE) (Check those that apply)

	Hard Hats		Safety Foot Wear	✓	Standard Operating Procedures
	Respirators		Ear Protection		Review of Emergency Action Plans
	Eye Protection		Personal Grounds	✓	Special Pre-Job Safety Discussions
	Air Lines/Hood		Coveralls/Clothing		Hot Work Permit: Electrical/Welding
	Face Protection		SCBA		

Other:

If an Accident occurs during this job, a copy of the JHA should be in the investigation report.

JOB HAZARD ANALYSIS (JHA)

Job Hazard Analysis for Use During the Pre-Job Safety Meeting

(1) List and discuss the basic job steps. (2) Identify the potential hazards of each step. (3) Provide recommendations to eliminate or reduce hazards (4) Revise as conditions change during the course of the day's activities (i.e., weather, lighting changes, etc.)

Sequence of Basic Job Steps	Potential Hazards & Consequences	Recommendations to Eliminate or Reduce Hazards
Walking on levees to conduct surveys	Physical hazards: Slips/Trips/Falls	Field crews will pay special attention when surveying in areas with uneven ground, rocks, ditches, and loose or wet soils.
		Field crews will follow "good housekeeping" elements: orderly placement of materials, tools and equipment; removal and secure storage of
		items that are not needed to perform the immediate task at hand; awareness to walk around, not over or on, equipment onsite;
		and, identify a path that is clear of obstructions.
Driving route	Automobile problems, other traffic on levee;limited shoulders will be used for site access	Field crews will follow check-in and check-out procedures when on the project site. When parking along the levee, traffic cones shall be
		placed 30 feet in front of and behind the vehicle. Field personnel are instructed to avoid wet or muddy areas, especially on the peninsula.
		If a vehicle is stuck in the mud, all field personnel have cell phones to call for assistance. This levee is frequently driven on by DFD personnel.
		Do not block the thoroughfare.
Walking on levees	Biological hazards: Encounter with threatened or aggressive animal.	Field crews will not approach or touch any animal encountered during surveying. If a potentially aggressive animal is encountered
		Field crews will move away from the animal. In the event of an animal attack, administer first aid and seek medical treatment immediately.

Notes: Field crews will wear hats, sunscreen, sunglasses, and appropriate clothing and shoes/boots based on weather conditions. Field personnel carry plenty of water, and water is kept in field vehicles at all times. All field personnel have cell phones and/or long-range radios to call for assistance in case of an emergency.

Job Briefing-Hazard Analysis Conducted by: Veronica Wunderlich

Personnel Attending

All near-misses/hazards found or created along with incidents must be reported.
Send a copy of this form to the Safety Office.

4.7 Avian Studies Standard Operating Procedures and Job Hazard Analysis

PPE: appropriate clothing for weather conditions, closed toed shoes, sunscreen, water.

Point/Use Counts

A pilot study to determine seasonal composition of the avian community at the Forebay will be initiated in the Winter/Spring of 2013, with point/use counts conducted two times per week in the early morning (from just before sunrise until 0900), midday (1000 until 1200) or afternoon (from 1300 until 1600), and birds observed within 1,000 feet of the radial gates and within 1,000 feet of the trash boom will be identified to species. Point counts will be conducted by teams of two biologists for a minimum of 20 minutes per survey point using a spotting scope or binoculars from three predetermined vantage points to ensure adequate coverage.

Birds observed within the survey area, including entering or leaving, will be counted and recorded to species. Environmental and physical conditions will be noted including weather, beginning and ending time, the stage of the radial gates, and presence or absence of any potential disturbance factor such as fishermen or any work activities in the vicinity. Detailed notes regarding observed behavior will be taken.

Prior to Initiation of Surveys

- Gather needed field equipment
    - Binoculars
    - Scope
    - Kestrel Weather meter
    - Bird guides
    - Bird identification cheat sheets
    - Timer
    - Datasheets
    - Writing instrument
    - Clipboard

Survey

- Check in with Delta Field Division and the Area Control Center following the approved methods (Refer to Section 3 page 3.2 of this document)

- Drive to the survey location
- Set up scope
- Fill out data sheet basic information
- Record beginning weather conditions/ gate postions
- Begin Survey (start timer)
- Count and Record all birds to species (or as close as possible) observed in a 20 minute period in the target location.
- End Point count survey
- Record ending weather and gate position (if possible)
- Load gear into truck and return to CHTR
- Contact DFD and ACC and let them know that the days activities have been concluded.
- Review data sheets to ensure all data recorded

Camera Traps

In addition to the point/use counts, surveys will be conducted to observe foraging behavior using static camera traps designed for remote wildlife observation, placed in strategic locations near the radial gates and trash rack. Data will be downloaded from the cameras daily.

Placement of these cameras is not yet determined. A detailed SOP will be written regarding data retrieval following installation of the camera.

A camera trap is expected to be installed on a large stable snag in the Forebay for preliminary testing. During the preliminary testing phase, the camera will be checked on daily and the data downloaded. Once the placement has been confirmed as providing useful data, and the amount of data collected per 24 hours has been determined, and final schedule of data retrieval will be constructed.

It is anticipated that the position will require frequent adjusting during this period, to provide the most data possible.

JOB HAZARD ANALYSIS (JHA) continued		
Job Steps	**Potential Hazard**	**Precaution/PPE**
Avian Studies	Falling from the bank into the water	Staff should me careful when walking on the levee bank to avoid falling in. Be aware of uneven ground surface. Be aware of loose gravel and slippery surface when walking down embankments or boat ramps.
Avian Studies	Physical injury: Strenuous and repetitive motions	Field crew members will practice safe moving, lifting, and carrying techniques Employees must be physically conditioned for strenuous tasks. A rest work cycle will be established to prevent exhaustion, but at a minimum 10-minute break should be taken each hour for all strenuous activities. Stretching will be done before, during and after activity to prevent sore muscles and injuries. Field crew members will wear all appropriate PPE for specific tasks. Pain or soreness associated with specific routine tasks should be reported to the PM and SSO.

4.8 Creel Surveys Standard Operating Procedures and Job Hazard Analysis

PPE: Appropriate field clothes for weather conditions, sunscreen, water, closed toed shoes.

Two surveyors will conduct creel surveys two - three days per week (one or two randomly selected weekday, one randomly selected weekend), in a roving manner beginning at the peninsula adjacent to the levee road entrance and ending adjacent to the radial gates. Data collected will include fish length, sex (if possible), scale samples (bass sp only), weather conditions encountered, and duration of fishing efforts. A short paragraph explaining the survey and what information is requested will be translated into the languages of the non-English speaking fishermen that frequent the area, as needed. Anticipated languages include Spanish, Vietnamese, and Hmong.

Prior to Conducting the Survey

Assemble the equipment that will be needed for the days survey effort.

- Collect the following equipment:
  - Clipboard
  - Fish species flip guide
  - Form with standard paragraph explaining survey
  - Data sheets
  - Writing instrument
  - Kestrel weather meter
  - Collection envelopes for scales
  - Portable scale and measuring board
  - Camera

Survey

- Check in with Delta Field Division and the Area Control Center following the approved methods (Refer to Section 3 page 3.2 of this document)
- Drive to the peninsula adjacent to the levee road entrance from CHTR along the CCF levee road
- Count and record the number of the fisherman observed during the drive.
- Record the general data sheet information and begin survey when you reach the end of the peninsula.
- Work your way back to the radial gates interviewing as many fisherman as possible.
- When possible take measurements and scale samples
- At the conclusion of the survey review the data sheet to ensure nothing was missed and return to CHTR
- Contact DFD and ACC and let them know that the days activities have been concluded.
- Scan data sheets into appropriate folder
- Put the equipment back so that it is ready for the next survey crew.

JOB HAZARD ANALYSIS (JHA) continued		
Job Steps	**Potential Hazard**	**Precaution/PPE**
Creel Surveys	Physical hazards: Exposure to the elements (i.e., sunburn, heat stroke, hypothermia, dehydration)	Field crews will wear hats, sunscreen, sunglasses, and appropriate clothing and shoes/boots based on weather conditions. Field personnel carry plenty of water, and water is kept in field vehicles at all times. Spare clothing should also be kept in field vehicle. While on-site, all field personnel have cell phones and/or long-range radios to call for assistance in case of an emergency. Where cell phones or radios are not available or effective due to poor reception, check-in and check-out procedures will be used.
Creel Surveys	Encounter with dangerous persons that may have guns, knives, etc. Hunting/Fishing activities	Field crews will make personal safety their first priority. In the event of a life threatening situation, field crews will cease work activity and remove themselves from the threat, and then call 911. Field crews will perform work as a buddy system and will carry a cell phone or means of communication. Field crews will always be aware and alert of the site conditions and use visual and auditory cues at all times. Field crews will not initiate or provoke confrontational situations.
Creel Surveys	Falling from the bank into the water	Use caution when walking up and down banks to conduct survey. Do not enter the water for any reason. Be aware of uneven ground surface, and ropes and cables that may be lying on the ground. Be aware of loose gravel and slippery surface when walking down embankments or boat ramps.

JOB HAZARD ANALYSIS (JHA)

Job Hazard Analysis for Use During the Pre-Job Safety Meeting

Work Area/Facility: Clifton Court Forebay		Start Date: 10/15/2013
Supervisor Veronica Wunderlich	Phone No. 916-471-9161	Finish Date: 10/15/2014
ACC	Phone No. 209-833-2180	Emergency No. 911
Work to be completed with	☐ OK to work: Eligible Worker	☐ Clearance Holders

Description of Work: Creel Surveys at the Clifton Court Forebay

Potential Hazards (Check those that apply)

	Flooding		Confined Spaces		Fire or Explosion Potential
	Skin Irritants	✓	High Noise Levels		Compressed Gasses/Liquid
	Fall Potential		Ionizing Radiation		**Welding/Burning Operations
	Toxic Material		Excavation Hazard	✓	Pinch, Crush or Striking Hazards
✓	Adjacent Work		Elevated Load or Work	✓	Sharp Edges or Hot/Cold Surfaces
✓	Lifting Hazards		Inadequate Ventilation		Hazardous Chemical Exposures/MSDS
	Difficult Access	✓	Water/Drowning Hazard		Electrical Shock/Energized Equipment
	Shoring/Sloping	✓	Environmental Extremes		Potential Release of Energy Kinetic/Gravity
✓	Traffic/Vibration	✓	Employees/New or Temp		Lead Exposure

Other: Intoxicated public

**A Supplemental HOT WORK Permit is required for all Welding and Burning Operations

Applicable Safe Work Practices (OPS and other Codes and Regulations) (Check those that apply)

✓	First Aid		Energy Isolation Procedure	✓	Standard Operating Procedures
	Lock-out Tag Out		Confined Space Entry Permit		Review of Emergency Action Plans
	Use of Barricades		Rescue/Retrieval Equipment	✓	Special Pre-Job Safety Discussions
	Approved Lighting		Use of Specialized Equipment		Hot Work Permit: Electrical/Welding
✓	Site/Job Orientation		Specialized Training Required		Communications: Visual/Audio
	Use of Specialized PPE				

Other:

Special Precautions (OP2 and other Codes and Regulations) (Check those that apply)

	Simultaneous Operations		Near Miss Reports/Incidents		Electrical Powerline Issue
	Pollution Prevention Measures		Hazardous Waste Disposal		Overhead or Underground power lines
	Redundant Protection Measures		Dig Alert		Overhead Power lines within 100 feet if work site
	Special Pre-Job Safety Discussions				(If yes, develop a plan to address hazard)

Other:

Personal Protective Equipment (PPE) (Check those that apply)

	Hard Hats		Safety Foot Wear	✓	Standard Operating Procedures
	Respirators		Ear Protection		Review of Emergency Action Plans
	Eye Protection		Personal Grounds	✓	Special Pre-Job Safety Discussions
	Air Lines/Hood		Coveralls/Clothing		Hot Work Permit: Electrical/Welding
	Face Protection		SCBA		

Other:

If an Accident occurs during this job, a copy of the JHA should be in the investigation report.

JOB HAZARD ANALYSIS (JHA)

Job Hazard Analysis for Use During the Pre-Job Safety Meeting

(1) List and discuss the basic job steps. (2) Identify the potential hazards of each step. (3) Provide recommendations to eliminate or reduce hazards (4) Revise as conditions change during the course of the day's activities (i.e., weather, lighting changes, etc.)

Sequence of Basic Job Steps	Potential Hazards & Consequences	Recommendations to Eliminate or Reduce Hazards
Walking on levees to conduct surveys	Physical hazards: Slips/Trips/Falls	Field crews will pay special attention when surveying in areas with uneven ground, rocks, ditches, and loose or wet soils.
		Field crews will follow "good housekeeping" elements: orderly placement of materials, tools and equipment; removal and secure storage of
		items that are not needed to perform the immediate task at hand; awareness to walk around, not over or on, equipment onsite;
		and, identify a path that is clear of obstructions.
Driving route	Automobile problems, other traffic on levee;limited shoulders will be used for site access	Field crews will follow check-in and check-out procedures when on the project site. When parking along the levee, traffic cones shall be
		placed 30 feet in front of and behind the vehicle. Field personnel are instructed to avoid wet or muddy areas, especially on the peninsula.
		If a vehicle is stuck in the mud, all field personnel have cell phones to call for assistance. This levee is frequently driven on by DFD personnel.
		Do not block the thoroughfare.
Walking on levees	Biological hazards: Encounter with threatened or aggressive animal.	Field crews will not approach or touch any animal encountered during surveying. If a potentially aggressive animal is encountered
		Field crews will move away from the animal. In the event of an animal attack, administer first aid and seek medical treatment immediately.

Notes: Field crews will wear hats, sunscreen, sunglasses, and appropriate clothing and shoes/boots based on weather conditions. Field personnel carry plenty of water, and water is kept in field vehicles at all times. All field personnel have cell phones and/or long-range radios to call for assistance in case of an emergency.

Job Briefing-Hazard Analysis Conducted by: Veronica Wunderlich

Personnel Attending

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