APPENDIX G
SPECIFIC SAMPLING PROTOCOLS AND PROCEDURES FOR CONDUCTING ADULT CHINOOK SALMON CARCASS SURVEYS

ADULT CHINOOK SALMON CARCASS SURVEYS

Background

Since 1953, the lower Yuba River adult Chinook salmon carcass surveys have been conducted annually to estimate the number of adult Chinook salmon returning from the ocean (Massa 2008). Survey methods were inconsistent (i.e., survey duration and survey area) until about 1994. The carcass surveys use a mark and recapture technique to estimate the abundance of spawning adult Chinook salmon. The annual abundance estimates are essential for monitoring trends in population size. Reconnaissance carcass surveys are initiated during September, before the first carcass is observed and the complete carcass surveys are terminated when the recovery rate of fresh carcasses falls to zero. Specific marking schedules allow for assessing the spatial and temporal distribution of carcasses. In addition, biological data is collected from observed Chinook salmon carcasses (i.e., length, sex, spawning status, genetic tissue samples, scales, otoliths, and coded wire-tags) to monitor the populations.

Carcass surveys provide an opportunity to collect data vital to population level management. Carcass surveys throughout the California's Central Valley play a key role in establishing annual Chinook salmon fishing regulations. Run size estimates are derived from summing estimates of harvest, hatchery returns, and spawning fish for each tributary of the Central Valley that supports Chinook salmon. The age structure of each of these run size estimates can be determined through information gained from coded wire tag (CWT) recoveries and scale analysis.

Goals of the annual carcass surveys in conjunction with data collected from the Vaki Riverwatcher, and acoustic tagging survey include: (1) use the genetic tissue samples collected during the carcass survey and the acoustic tagging survey to differentiate spring-run and fall-run Chinook salmon; (2) use the coded-wire tags and otoliths collected to determine the origin of Chinook salmon (i.e., hatchery-origin, natural-origin and river of origin); (3) estimate the total, weekly, monthly and seasonal abundances of spring-run and fall-run Chinook salmon; (4)

estimate the abundance of natural-origin and hatchery-origin spring-run and fall-run adult Chinook salmon; (5) use length data to examine the size structure of the spring-run and fall-run Chinook salmon populations; (6) use scale samples to examine the age structure of the spring-run and fall-run Chinook salmon populations; and (7) examine multi-year trends in the annual run sizes of spring-run and fall-run Chinook salmon (i.e., total population, hatchery-origin and natural-origin).

1.0 Survey Location

The study area for the carcass survey is the lower Yuba River. The lower Yuba River extends 39 kilometers (24.2 miles) from Englebright Dam, the first impassible fish barrier, downstream to the confluence with the Feather River near Marysville, California. The study area is divided into three survey reaches (**Table 1**).

Table 1. Yuba River adult Chinook salmon carcass survey reaches

Reach	Location	Kilometers	Miles
1	Narrows Pool to HWY 20 Bridge	6.4	4.0
2	HWY 20 Bridge to Daguerre Point Dam	9.7	6.0
3	Daguerre Point Dam to Simpson Lane Bridge	16.1	10.0
Total		**32.2**	**20.0**

2.0 Survey Period

The annual Chinook salmon carcass surveys will be a long-term monitoring effort of the lower Yuba River spring-run and fall-run adult Chinook salmon populations. Annual Chinook salmon carcass surveys will occur from the beginning of the spawning season (September) through the end of the spawning season (late-January). Begin and end dates of the annual carcass survey will vary depending on when Chinook salmon redds are observed and when the recapture rate of tagged carcasses in January approaches zero. Field reconnaissance teams begin to monitor Chinook salmon spawning in mid-August. The first carcass survey will begin about 10 to 14 days after the first Chinook salmon redds are observed.

3.0 Sampling Frequency

All survey reaches will be surveyed once a week. The weekly adult Chinook salmon carcass surveys will be classified as stratum, with each stratum consisting of seven days. Sampling the survey reaches will occur during the same 2-3 day time period each week.

4.0 Sample Size

The sample size is all observed Chinook salmon carcasses from the beginning to the end of the survey period. Heads of all adipose fin-clipped carcasses will be removed for collection of coded-wire tags and otoliths. All fresh carcasses will be sampled for genetics tissues, scales, and biological data (i.e., sex and total length). Otoliths will be removed from the

heads of all fresh non-adipose fin-clipped carcasses. All fresh female carcasses will be examined for spawning status.

5.0 Survey Protocols and Procedures

5.1 Preseason Planning - Lead Biologist Responsibilities and Coordination Activities

The lead biologist is responsible for the following preseason planning activities: (1) obtaining and readying all equipment and materials (Section 6.4); (2) training personnel with the survey protocols and procedures (Section 6.1.2); (3) acquiring permits required for specimen collection and sampling, (4) organizing the logistics of the survey.

5.2 Data Collection and Sampling Techniques

The weekly carcass survey will be conducted by a crew of 4-6 people and will be executed *via* jet boat and walking. Two crews will be utilized during the years that additional effort is needed for collecting scale samples, tissue samples, otoliths and heads for coded-wire tag recovery (i.e., 2008/2009 through 2013/2014).

During the weekly carcass survey, personnel will collect, count, and record data for: (1) fresh carcasses (carcass with red or pink gills, or at least one clear eye); (2) non-fresh carcasses (no clear eyes and gills are not red or pink); and (3) tagged carcasses. All observed non-fresh carcasses and adipose fin-clipped carcasses will be counted and chopped in half to prevent recounting during subsequent surveys. Tagged carcasses (recaptures from previous surveys) will be counted and chopped. Fresh carcasses that have an adipose fin will be counted and tagged. All carcasses will be released into the river. Fresh adult carcass data will be used in the Schaefer mark-recapture model (Schaefer 1951) with modifications referenced to Taylor (1974) to estimate abundance.

The following procedures describe the steps taken to process carcasses and to collect required data.

5.2.1 Processing Carcasses

- Collect carcasses using a gaff
- Determine and record the freshness of the carcass (i.e., fresh or non-fresh)
- Chop non-fresh carcasses
- Determine and record the sex of a fresh carcass (i.e., female or male)
- Examine the carcass for the presence of a tag or mark (i.e., hog ring tag, floy tag, adipose fin) and record observation for carcass
- Measure and record the total length of fresh carcasses to the nearest millimeter and determine approximate age of the Chinook salmon (i.e., adult or grilse)
- Determine and record the spawning status of female fresh carcasses (i.e., spawned or not spawned)

- Collect tissue samples from fresh carcasses (i.e., caudal fin tissue, scales, and otoliths) and record corresponding identification numbers
- Apply a hog ring tag to the jaw of non-adipose fin-clipped fresh carcasses according to the flagging schedule (i.e., lower jaw for grilse and the upper jaw for adults)
- Recover coded-wire tags from all adipose fin-clipped carcasses (i.e., remove the head)
- Collect and record data on data sheets

5.2.1.1 Determining freshness of a carcass

Determine freshness of each carcass and record information on the data sheet (**Attachment 1**).

Fresh carcass: A fresh carcass has at least one clear eye (no milky color) and gills that are entirely red or pink.

Non-fresh carcass: A decomposed carcass that has no clear eyes or no red or pink gills.

5.2.1.2 Sex determination

Examine the sex of each carcass. Record the sex of the carcass on the data sheet (Attachment 1).

Males: Longer hooked jaws with large canine teeth, a less rounded body than females, usually larger, sometimes red in color (**Figure 1**).

Females: Symmetrical upper and lower jaws, may appear more plump or rounded than males, will often have eroded tails and vents from recent redd construction and egg deposition (Figure 1).

5.2.1.3 Examining the carcass for the presence of a tag or mark

Inspect and roll the carcass using the gaff, look for jaw tags in the lower and upper jaw from the previous weeks' surveys, for floy tags from other scientific studies (i.e., Acoustic Tagging Survey), and for the presence of adipose fins due to the California Department of Fish and Game's (CDFG) constant fractional marking program of hatchery fish and other studies. The entire carcass will be inspected from the jaw to the caudal fin. Record tag status on the data sheet (Attachment 1). If a floy tag is found, record the floy tag number for that carcass on the data sheet in the comments section with the identification number (i.e., Date – number),.

Figure 1. Male (top), Female (middle), and Grilse (bottom) Chinook salmon carcasses

5.2.1.4 Measuring length and age determination (adult vs. grilse)

Before the start of the annual carcass survey, examine the modalities of length frequency distributions of the Chinook salmon returning to the Feather River Hatchery and those observed on the Vaki Riverwatcher to establish cut-off lengths for grilse (≤2 years old) and adult Chinook salmon (> 2 years old). Length is measured for Chinook salmon entering the Feather River Hatchery. Length of Chinook salmon is estimated using Vaki Riverwatcher system data collected from March 1 to September 15 (**Appendix F** - *Specific sampling protocols and procedures for the Vaki Riverwatcher*).

For the 2008 carcass surveys, Chinook salmon adults and grilse were defined as:

Adult: An adult carcass had a fork length ≥ 65 cm.

Grilse: A grilse was a carcass that measured < 65 cm (Figure 1). A grilse or undersized salmon is sexually mature, but not considered an adult salmon.

Total length will be measured for all fresh carcasses. Total length is the distance from the nose of the carcass to the tip of the caudal fin. Total length will be recorded to the nearest millimeter

5.2.1.5 Determining the degree of spawning in female salmon

Visually examine all fresh female Chinook salmon carcasses for the degree of spawning. Characterize the fresh female Chinook salmon carcasses as spawned or unspawned. An unspawned female will be easily recognized as gravid and will often eject eggs from vent when lifted. A spawned female can be characterized as appearing emaciated, the visceral cavity will seem evacuated, and will exhibit folds of skin on the ventral side. Record the data on the data sheet (Attachment 1).

5.2.1.6 Collecting tissue samples

5.2.1.6.1 Genetics tissue samples

Refer to **Appendix E** (*Specific Sampling Protocols and Procedures for Genetic Sampling*). Record the ID number of the genetic tissue scale envelope on the data sheet (Attachment 1).

5.2.1.6.2 Scale samples

If possible, all observed fresh Chinook salmon carcasses will have scale samples and associated data collected. For the CDFG Age Scale Program, a minimum goal of 550 scale samples is needed for each run of Chinook salmon being sampled (Kormos 2007). In addition, scale samples are needed for all coded-wire tagged fish and all grilse. Scale samples will be collected using a sampling scheme that obtains a proportionally representative sample of the populations' run timing and temporal size distributions. Scale samples are only collected from fresh Chinook salmon carcasses (i.e., non-fresh carcasses are not sampled). If sub-sampling of fresh carcasses is needed, scale samples will be collected by systematically sampling every n^{th} fresh carcass to meet at least the minimum sample size requirements. Personnel will determine the n^{th} sampling interval for the survey week that is needed for reaching the minimum sample size goal by the end of the survey period. The n^{th} sampling interval will be recorded on the data sheet in the comments section (Attachment 1).

Scale samples will be collected from a key scale area, located on the left side of the fish, diagonally down from the posterior insertion of the dorsal fin and just slightly above the lateral line (**Figure 4**). Consistency in collecting scales is important because the growth rates of scales differ on different parts of a fish's body, which can influence the analysis of the scale pattern (Bugaev 2004).

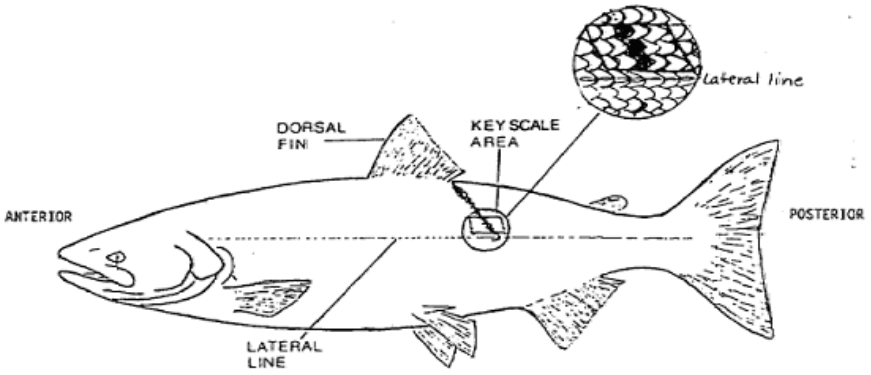

Figure 4. Key scale area of Chinook salmon carcass for collecting scale samples (Kormos 2007)

Scale sample procedure (Kormos 2007):

1) For fresh Chinook salmon carcasses, lay them on the boat or ground with their left side facing up. Next record the following information of the data sheet (Attachment 1) and scale envelope:

   - ❑ Date (i.e., mm-dd-yy)
   - ❑ Location (i.e., river mile)
   - ❑ Total length (i.e., nearest mm, if tail eroded then to nearest ½ cm and round up)
   - ❑ Sex (i.e., male or female)
   - ❑ Adipose-fin clip status (i.e., present, absent or unknown)
   - ❑ Headtag number (i.e., adipose fin-clipped carcasses)

2) Locate the key area on the left side of the fish's body (Figure 4). If scales cannot be collected from this area, use the right side; if scale sampled cannot be taken from the desired area on the right side, then gather scales from up to two inches outside the key area but above the lateral line.

3) Wipe the sample site clean of mucus and dirt with a fillet knife. Remove a 3-4 cm square patch of skin from the key area by thinly slicing away the skin patch from the fish with the fillet knife. Be careful to eliminate as much muscle and fat as possible while removing the skin patch (quality of the sample is better during processing).

4) Slide off the skin patch from the knife blade between wax paper inside the scale envelope, with the skin patch laying flat in the envelope.

5) Record the unique ID number of the scale envelope on the data sheet (Attachment 1).

6) Thoroughly clean all scale sampling equipment, make sure all scales are removed from the equipment before sampling the next carcass.

7) Keep all scale sample envelopes organized and stored together. Scale sample envelopes should be stored in a dry location with adequate ventilation (e.g., bucket, plastic bag, back-pack, etc.).

Drying the scale samples is an important part of the sampling process and can affect the quality and usefulness of the samples. Immediately after collecting all of the scale samples, dry the samples for preservation and for prevention of rotting or deterioration. In the office, dry the samples by placing the scale samples on a clean dry surface in a well ventilated area that is kept at ~70 °F. Lay the samples out individually without any overlapping or stacking of the envelopes. Air drying the samples will take 24-48 hours (depending on the size of the sample and environmental conditions).

Once scales are dry, data can be entered into the database and scale envelopes can be stored in a box for eventual processing. Scale sample envelops should be organized numerically and

temporally to ease processing. Scale samples will be provided to the Central Valley Scale Aging Program for reading.

5.2.1.6.3 Otolith samples

In the field, an attempt will be made to remove otoliths from all fresh non-adipose fin-clipped Chinook salmon carcasses. In addition, in the laboratory, otoliths will be removed from all of the heads collected from adipose fin-clipped carcasses. The minimum sample size of otoliths needed for otolith microstructure and microchemistry analysis is uncertain at this time.

If all fresh non-adipose fin-clipped carcasses cannot be sampled for otoliths, personnel will sub-sample for otoliths in the field during a survey week by systematically sampling every n^{th} fresh Chinook salmon carcass (adipose fin-clipped or non-adipose fin clipped) to get a representative sample of the population. Therefore, if the n^{th} carcass is an adipose fin-clipped carcass, the otoliths will be removed in the field (instead of in the laboratory). Personnel will determine the n^{th} sampling interval at the beginning of the survey week and record the sampling interval on the data sheet in the comments section (Attachment 1). Based on the 2009 results from sampling and microchemistry analyses, these protocols and procedures will be refined to incorporate sub-sampling and minimum sample size targets for surveys during subsequent years.

A "flip top" approach for removing otoliths will be used, so the fresh non-adipose fin-clipped fresh carcasses can be tagged for the mark-recapture study (**Figure 2**). Procedures are described below (ADFG 2005).

1) Wear cotton gloves and use butcher knife to remove the top of the head by first starting to cut at the top of both eyes.

2) Then slice back towards the body, but not beyond a line extending above the gill cover.

3) With a twist of the knife, cut back towards the top of the head removing a wedge of tissue and bone. This will expose the cranial cavity.

4) Remove the brain tissues so that both pairs of otoliths of can be extracted with forceps.

5) Extract otoliths using the forceps and put the otoliths in uniquely labeled vials.

6) Record the vial number on the data sheet (Attachment 1).

Otoliths will be extracted from the heads of adipose fin-clipped Chinook in the lab unless a subsampling procedure is used (i.e., every n^{th} fresh carcass).
Otolith microchemistry analyses are anticipated to be performed *via* a contract with the Barnett-Johnson Fisheries and Otolith Laboratory at the University of California – Santa Cruz. Otolith microchemistry analyses conducted are expected to be similar to those used by Barnett-Johnson *et al.* (2007 and 2008).

A chain of custody form will be filled out to track possession of the otolith samples. The chain of custody form will include information such as otolith sample number, sample location, dates and time of collection, and the name of person(s) who collected the otolith sample(s). On each occasion when the otolith sample(s) changes possession, the person relinquishing the sample and the person receiving the sample(s) must sign and date/time the chain of custody form.

Figure 2. The "flip top" approached used to extract otoliths from Chinook salmon carcasses (Steve Tsao, CDFG, 2009).

5.2.1.7 Applying jaw tags to non-adipose fin-clipped fresh carcasses

All fresh, non-adipose fin-clipped fresh carcasses will be tagged with a jaw tag. The jaw tag is a strip of colored flagging on a hog ring. Each day, different colored jaw tags will be used for tracking the movement of carcasses between survey reaches and survey periods. The jaw tag will be applied to the mandible (lower jaw) for grilse, and the maxillary (upper jaw) for adults using a pair of hog ring pliers (**Figure 3**). After tagging the carcass and collecting all biological data, the carcass will be placed in the nearest moving water or within three meters of the original site of capture. All appropriate data will be recorded on the data sheet (Attachment 1).

Figure 3. Placement of hog ring tag on adult (top) and grilse (bottom) fresh Chinook salmon carcasses

5.2.1.8 Recovering coded wire tags from adipose fin-clipped carcasses

All carcasses with a missing adipose fin (i.e., adipose fin-clipped) will be identified as having a coded-wire tag (CWT) in its rostrum, and the head will be removed for retrieving the CWT. If the status of the adipose fin is unknown, a CWT wand will be used to detect the presence of a CWT. The head of all carcasses identified as having a CWT will be removed (**Figure 4**) for CWT recovery in the laboratory. In addition, otoliths will be removed from the collected heads in the laboratory (Section 5.2.1.6.3). Required data will be recorded on a head tag and on the data sheet (Attachment 1). The head tag will be secured to the head of the carcass for identification. The tagged head will be placed in a plastic bag for storage. The remaining carcass will be chopped in half and recorded as a fresh chop (Attachment 1).

Heads collected during the survey will be stored in a chest freezer located in the office until the tags and otoliths can be extracted. A chain of custody form will be filled out to track possession of the heads. The chain of custody will include information such as head number, sample location, dates and time of collection, and name of person who collected the head(s). Every time the heads change possession, the person relinquishing the sample and the person receiving it must sign and date/time the chain of custody form.

In the laboratory, coded-wire tags and otoliths will be removed from the heads collected during the survey, and analyzed. Heads will be removed from the freezer and thawed. Personnel will quarter a recovered head containing a coded wire tag. Each quarter of the head will be scanned to determine which portion contains a coded wire tag. Once the section with a coded wire tag is identified, the tag will be extracted and placed in a plastic bag with the recovery information. Each extracted tag will be read under a microscope. The decoded number of the tag will be added to the recovery information that came with the individual head.

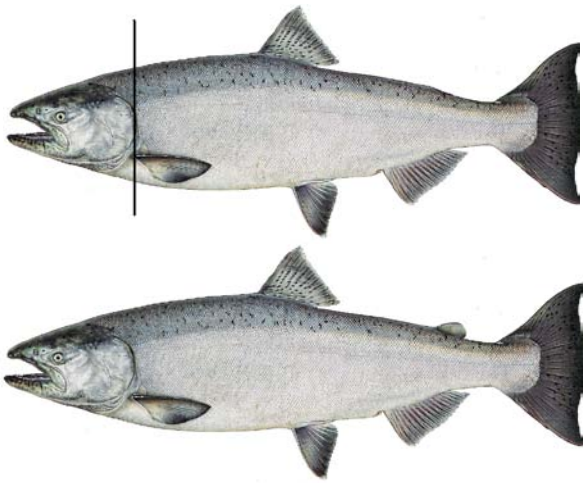

Figure 4. Chinook salmon with adipose fin missing (top) and the location to remove the head (black line), and a Chinook salmon with an adipose fin (bottom).

5.3 Field Gear Decontamination

New Zealand mudsnails (*Potamopyrgus antipodarum*, NZMS) were first discovered in California (Owens River) in 1999. The NZMS has the ability to adapt to new ecosystems and alter food web dynamics. Controlling the spread of the NZMS is a top priority for the California Department of Fish and Game (CDFG). CDFG needs to ensure that their employees are not spreading NZMS in the course of carrying out their duties. Therefore, a field gear decontamination protocol for NZMS has been developed and will be used for gear used in the lower Yuba River.

The following procedures for decontaminating field gear (i.e., waders, wading boots, boot insoles, nets, wading sticks, or anything else that comes into contact with the water) and boats will be followed prior to entering a new body of water or at the end of the day, whichever occurs first using protocols established by CDFG (2008). Freezing field gear will be the first option if a freezer is available. Freezing has no adverse effect on field gear or on the environment, and is the most cost effective means of decontamination.

5.3.1 Freezing Procedure

1) Place field gear into a new large plastic bag and seal before placing into the vehicle. Any surface that comes in contact with field gear can become contaminated.

2) Upon returning to a CDFG office, place the plastic bag containing the field gear into a freezer (<0 °C) for a minimum of six hours.

5.3.2 Immersion Procedure

1) If field gear is not going to be decontaminated on site, place the field gear into a new large plastic bag and seal before placing into the vehicle.

2) Place all field gear that came in contact with water into a container of sufficient size to allow gear to be completely immersed in decontamination solution.

3) Pour decontamination solution (5% Sparquat) into container to allow complete immersion of all field gear. If necessary, weigh down the gear to ensure the gear is completely immersed. To make the decontamination solution, use a ratio of 7 oz of Sparquat to 1 gallon of water.

4) Soak field gear in decontamination solution for a minimum of 15 minutes.

5) Remove field gear from the decontamination solution and inspect gear to ensure that all debris that could contain NZMS has been removed. Use a stiff brush to remove any debris that remains on the field gear.

6) Rinse field gear with fresh water. Do not use water from the sampling site. Using water from the sampling site will contaminate your field gear. Rinse water should not be allowed to enter a storm drain or water body.

7) Decontamination solution must be disposed of into a sanitary fill for proper waste treatment. Decontamination solution cannot be dumped on the ground under any circumstances. Decontamination solution cannot be disposed into a septic system. Five-gallon disposal containers will be provided to staff for use in disposing decontamination solution. Decontamination solution can be disposed of at the CDFG Regional office.

5.3.3 Spray Bottle Procedure

1) Create a decontamination solution that contains 10% Sparquat (900ml of water and 100ml of Sparquat).

2) Liberally spray field gear until gear is completely saturated. Ensure that hard to reach areas are sprayed thoroughly.

3) Allow decontamination solution to remain on field gear for a minimum of 15 minutes.

4) Rinse sampling gear with fresh water. Do not use water from the sampling site. Using water from the sampling site will contaminate the field gear.

5) Rinse water should not be allowed to enter a storm drain or water body.

The spray bottle procedure should not be used except under very extreme circumstances when freezing or immersion procedures cannot be completed. Contact time and concentration of decontamination solution from spray bottle procedures cannot be guaranteed, which does not ensure 100% mortality of NZMS.

5.4 Watercraft Decontamination

California's waterways currently face the challenge of invasion by quagga mussels *(Dreissena bugensis)* and zebra mussels *(Dreissena polymorpha)*. Zebra mussels, a species native to Eastern Europe, were first introduced in the United States through ballast water released into the Great Lakes in the late 1980s. Quagga mussels soon followed.

In January 2007, quagga mussels were discovered in Lake Mead and later in the Colorado River. They now infest water bodies in Riverside, San Diego and Orange counties. In January 2008, zebra mussels were discovered in the San Justo Reservoir in San Benito County.

Preventing the spread of quagga and zebra mussels is a top priority for CDFG. CDFG needs to ensure that their employees are not spreading quagga and zebra mussels in the course of carrying out their duties. Therefore, the following watercraft decontamination protocol for quagga and zebra mussels has been developed for immediate implementation by all CDFG employees.

1) Prior to leaving the launch facility; remove all plants and mud from the watercraft, trailer, and equipment. Dispose of all material in the trash.

2) Prior to leaving the launch facility; drain all water from the watercraft and dry all areas, including the motor, motor cooling system, live wells, bilges, and lower end unit.

3) Upon return to Regional facilities or local office, pressure wash the watercraft and trailer with 140 °F water, including all of the boat equipment (i.e., ropes, anchors, etc.) that came into contact with the water. (Pressure washers are available at the Region office for boat decontamination.)

4) Flush the engine with 140 °F water for at least 10 minutes and run 140 °F water through the live wells, bilges, and all other areas that could contain water.

5) For areas that cannot be washed, but have come into contact with the water, spray or wipe the areas with a solution of 4% muriatic acid.

6) Wash all field gear with 140 °F water or a decontamination solution that contains a 6% chlorine solution.

7) To ensure 100% mortality the water needs to be 140 °F at the point of contact or 155 °F at the nozzle.

Anyone with questions regarding the acquisition of chemicals, require proper training to implement these protocols, or need a field gear decontamination kit, call (916) 358-2895 (Mr.

Jason Roberts; CDFG; Environmental Scientist) or (916) 358-2943 (Mr. Joseph Johnson; CDFG; Senior Environmental Scientist).

5.5 Quality Assurance/Quality Control Processes

To facilitate accurate data collection out in the field, each surveyor will be in continuous radio contact with crew leads. All data will be relayed directly to crew leads for data recording. Raw data sheets will be initially QA/QC'ed in the field. Carcass survey data entered into the database will be QA/QC'ed with the raw data sheets. Additional QA/QC will be determined by the lead biologist.

6.0 Logistics

6.1.1 Personnel

Carcass survey personnel will be responsible for conducting the carcass survey, data collection, and data management described in this protocols and procedures. In the field, experienced survey staff will train newly hired survey staff in carcass survey techniques.

6.1.2 Qualifications

To successfully complete the carcass survey protocols and procedures, lead staff conducting the work will have the following minimum requirements: (1) related 4-year college degree (e.g., fisheries biology or biology); and (2) minimum of 2 years of professional experience in fisheries field surveys.

The data collection methods will be conducted by 4-5 person monitoring teams to facilitate safe and efficient data collection. When monitoring is being conducted, at least one team member will have the minimum qualifications as stated above.

6.1.3 Training

This protocols and procedures will be made available to all carcass survey personnel to promote consistency among data collection and to address safety concerns. New hires will be scheduled to conduct surveys with experienced carcass survey staff and receive training in the office and in the field. Crew members will be trained on the carcass survey protocols and procedures by reading and becoming familiar with each component of data collection and management. Safety, aspects of landowner relations, trespassing regulations, and carcass survey protocols and procedures training will be scheduled and conducted prior to initiating the field season for all survey crew members. Safety training for field crews should include first aid, wilderness medicine, swift water rescue training, boat safety, and wader safety training. Specialized training for operating all-terrain vehicles, four-wheel drive vehicles, boats, or other equipment needed for conducting the carcass surveys will occur during the pre-field season period.

6.2 Schedule

The timing of conducting the field surveys is important for collecting, managing, and analyzing the data and for writing the annual report. The following is a schedule outline for preparatory efforts, for collecting, managing, and analyzing the data and for writing the annual report, which will be completed over the course of an annual period.

Pre-Season

- ❑ Conduct pre-season preparation and planning (i.e., hire field crews, coordinate logistics, scheduling and costs with laboratories that will be conducting genetics, otolith, and scale analyses, test equipment)
- ❑ RMT Planning Group coordination
- ❑ Conduct Field Crew Technical Training
- ❑ Conduct Field Crew Safety Training

Late-August through September

- ❑ Conduct Initial Redd Reconnaissance Surveys
- ❑ Initiate Carcass Surveys (i.e., conduct this protocols and procedures)

October through January

- ❑ Continue Carcass Surveys (i.e., conduct this protocols and procedures)

January through May

- ❑ Finalize Data QA/QC and Compilation
- ❑ Data Analysis
- ❑ Prepare Draft Annual Carcass Survey Report
- ❑ RMT Planning Group Review of Draft Annual Carcass Survey Report
- ❑ Prepare Final Annual Carcass Survey Report

6.3 Costs

Costs for the Annual Yuba River Carcass Survey

LABOR	weeks	days/wk	total days	hrs/day	total hrs	labor rate/hr	# technicians	
Technicians	16	3	48	10	480	$25.34	4	$48,652.80
Crew Lead	16	3	48	10	480	$30.49	1	$14,635.20
								Subtotal
								$63,288.00

TRANSPORTATION	weeks	days/wk	total days	miles/day	total miles	rate	# vehicles	Subtotal
Vehicles	16	3	48	110	5280	$0.51	2	$5,332.80

VESSELS	weeks	days/wk	total days	gal/day	total gals	price/gal	# boats	Subtotal
Fuel	16	3	48	2.5	120	$3.50	2	$840.00

Maintenance	item	price	number	
	engine (prorate @ 150hrs/yr)	$525.00	2	$1,050.00
	hull (prorate @ 5yrs)	$700.00	2	$1,400.00
	impeller (prorate @ 3yrs)	$167.00	2	$334.00
	wear ring	$150.00	2	$300.00
	gate	$160.00	2	$320.00
	hardware	$40.00	2	$80.00
	lube	$7.00	2	$14.00
	misc. trailer	$100.00	2	$200.00
	yearly service	$250.00	2	$500.00
				Subtotal
				$4,198.00

	Subtotal Vehicles/Vessels	$10,370.80

EQUIPMENT	Item	Price	Quantity	
	5mm Stocking Foot Waders	$64.99	5	$324.95
	Guidewear Felt Sole Wading Boots	$69.99	5	$349.95
	Comfort Mesh Vest Type III PFD	$39.95	3	$119.85
	Large Roll Top Dry Bags	$24.99	5	$124.95
	FV 700R/GMRS Motorola Radios	$49.99	2	$99.98
	Helly Hansen Rain Gear	$51.99	5	$259.95
	OD Green Handheld Knife Sharpener	$8.60	6	$51.60
	Ontario 22" D-Handle Machetes	$23.20	2	$46.40
	Ontario 18" D-Handle Machetes	$21.70	2	$43.40
	22" Machete Sheaths	$23.50	2	$47.00
	18" Machete Sheaths	$21.40	2	$42.80
	Small First Aid Kit	$24.50	2	$49.00
	Stearns Neoprene Cold Water Gloves	$17.10	6	$102.60
	Rite in the Rain Copier Paper	$26.20	2	$52.40
	Redi-Rite Clipboard	$25.40	2	$50.80
	Flagging	$2.50	15	$37.50
	Polarized Sunglasses	$50.00	6	$300.00
	Hog Rings	$32.95	1	$32.95
	Hog Ring Pliers	$26.98	4	$107.92
	Gaffs	$50.00	4	$200.00
	Files	$15.00	2	$30.00
MISC.	misc. supplies			$400

	Subtotal Equipment	$2,874.00
Grand Total:		$76,532.80

6.4 Equipment List

Carcass Surveys	
• Jet Boat	• Hog Rings/Colored Tags
• Trimble Geoexplorer GPS unit, with data dictionary loaded	• Thermometer
• Chest Waders or Wading Boots	• Data Forms
• Knives	• Pliers
• Buckets	• Machetes
• CWT Scanner	• Gaffs
• Survey Protocol	• Data forms
• Clipboards	• Aerial Photographs
• Pens, Pencils, Sharpies (permanent marker)	• Field Notebook
• Hach 2100P Turbiditimeter	• Polarized Sunglasses
• Brimmed Hat	• Watch
• Dry Cloth (to dry off equipment, etc.)	• Swift Water Safety Gear
• Cellular or satellite phone	• First Aid Kit
• Backpack or surveyor's vest	• Lifejackets/Other Personal Floatation Devices (inflatable)
• Contact and emergency phone numbers	• Digital Camera
• Extra Batteries	• Rain Gear
• Food and Water	• Sun Screen
• Butcher Knives with deep 6-8" blades	• Forceps (fine point)
• Cotton gloves	• Small vials
• Vial labels	• Microscope

7.0 Data Management

7.1 Data Entry and Data Processing

A daily data form held by the crew leads will be used to collect the following information.

- ❑ Crew
- ❑ Date
- ❑ Section number
- ❑ Tag color
- ❑ Number and sex of carcasses tagged (adults and grilse)
- ❑ Number and sex of chopped carcasses (adults and grilse)
- ❑ Spawning status of fresh female carcasses (see Attachment 1)
- ❑ Recovered tag numbers according to weekly color code (adults and grilse)
- ❑ CWT data
- ❑ Water turbidity taken at 12:00 p.m.

Crew leads will carry the data sheets (Attachment 1) for recording all data and are responsible for all data being recorded properly. Each crew member will be in radio contact with crew leads *via* two-way radio. Crew members are required to relay all data for each carcass observed to a crew lead. At the end of the day, the crew lead will be responsible for summing the tallies for each group on the data sheets (Attachment 1) and for circling the totals for each group.

Weekly, data will be entered into database. A relational database will be developed using Microsoft Access to manage all of the data collected during the redd surveys. A metadata document will be developed for the database that contains at least: 1) a data dictionary and description of all of the codes; 2) a list of all of the fields in each table; 3) units of measure for each field; 4) description of how the tables are related; 5) description of the purpose of each table; and 6) step-by-step explanation of the process to enter data and use any developed queries.

7.2 Data Storage and Archival Procedures

All original data will be well organized, clearly labeled, and archived. Reports will be prepared annually and archived. Digital versions of the data sets, as well as hardcopies of reports, will be submitted to the RMT Planning Group.

- Raw Data Electronic Storage Format (Software): Microsoft Access
- Processed Data Electronic Storage Format (Software): Microsoft Excel/Access

Electronic files and print copies of the field data sheets will be located at:

California Department of Fish and Game
2545 Zanella Way, Suite F
Chico, Ca. 95928

And

Yuba County Water Agency
1220 F Street
Marysville, CA 95901-4226

Data Retrieval Contact: M&E Lead Biologist – Colin Purdy
Telephone Number: (530) 895 - 5522
Email Address: CPurdy@dfg.ca.gov

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ATTACHMENT 1

Data sheet A (front side of data sheet) used in the carcass survey.

Yuba River Carcass Survey Datasheet A (Chops/Recoveries)						
		Date:	Samplers:		Recorder:	
		Time of Arrival:		Time of Departure:		
		Survey Section:		Weather (Clear, Cloudy, Rain, Wind):		
		Jack Cutoff:		Turbidity NTU:		
Tags		Fresh Tags (Circle totals in each section and record data on sheet B)				
		Male		Female		
	Adult					
	Grilse					
Chops		Chops: All decayed carcasses and CWT Chops (Circle totals in each section)				
		Fresh Carcasses (CWT)		Decayed Carcasses		
	Adult					
	Grilse					
Recoveries		Recoveries (Indicate tag color and circle totals in each section)				
		Color:	Color:	Color:	Color:	Color:
	Adult					
	Grilse					
Comments:						

Page _____ of _____ for the day.

ATTACHMENT 2

Data sheet B (front side of data sheet) used in the carcass survey.

Yuba River Carcass Survey Datasheet B (Tags/Ad-clip Chops)									
Date:	**No. Crews**	**Crew (A or B):**	**Surveyors initals:**					**Recorder:**	
Survey Section:					**Section Tag Color:**				
Sample I.D. (Date - #) Example 082909-001	River Mile	Sex ♂ / ♀	Total Length Length (mm)	Female Spawning Status (circle): Spawn/No Spawn		Tag/CWT Chop (circle one): Tag / Chop		Tissue sample (circle relevant): Head/Scale/Fin/Otoliths	CDFG Head-tag #	Scale #
		M F	(mm)	S	NS	T	C	H S F O		
		M F	(mm)	S	NS	T	C	H S F O		
		M F	(mm)	S	NS	T	C	H S F O		
		M F	(mm)	S	NS	T	C	H S F O		
		M F	(mm)	S	NS	T	C	H S F O		
		M F	(mm)	S	NS	T	C	H S F O		
		M F	(mm)	S	NS	T	C	H S F O		
		M F	(mm)	S	NS	T	C	H S F O		
		M F	(mm)	S	NS	T	C	H S F O		
		M F	(mm)	S	NS	T	C	H S F O		
		M F	(mm)	S	NS	T	C	H S F O		
		M F	(mm)	S	NS	T	C	H S F O		
		M F	(mm)	S	NS	T	C	H S F O		
		M F	(mm)	S	NS	T	C	H S F O		
		M F	(mm)	S	NS	T	C	H S F O		
		M F	(mm)	S	NS	T	C	H S F O		
		M F	(mm)	S	NS	T	C	H S F O		
		M F	(mm)	S	NS	T	C	H S F O		
		M F	(mm)	S	NS	T	C	H S F O		
		M F	(mm)	S	NS	T	C	H S F O		
		M F	(mm)	S	NS	T	C	H S F O		
		M F	(mm)	S	NS	T	C	H S F O		
		M F	(mm)	S	NS	T	C	H S F O		
		M F	(mm)	S	NS	T	C	H S F O		
		M F	(mm)	S	NS	T	C	H S F O		
		M F	(mm)	S	NS	T	C	H S F O		
		M F	(mm)	S	NS	T	C	H S F O		
		M F	(mm)	S	NS	T	C	H S F O		
		M F	(mm)	S	NS	T	C	H S F O		
Comments:										
Note: If multiple crews are out per day, **Crew A will use Sample I.D. Number 001- 499** and **Crew B will use Sample I.D. Number 500- 999**.										

Page ___ of _____ for the day.