

Grant County Public Utility District Implementation Plan 2022-2023 Priest Rapids Hatchery Monitoring and Evaluation

Introduction

The Public Utility District No. 2 of Grant County (GCPUD) has guiding principles and approaches for the monitoring and evaluation (M&E) of all of its hatchery programs that are provided in an overarching M&E plan that encompasses all of its programs (Pearsons and Langshaw 2009, Hillman et al. 2013, Hillman et al. 2017). The first comprehensive sampling for Monitoring and Evaluation of Priest Rapids Hatchery fall Chinook salmon production began in the fall of 2010. Though the comprehensive M&E programs are relatively recent, the Washington Department of Fish & Wildlife (WDFW) has been conducting monitoring and evaluation of Up River Bright (URB) fall Chinook in the Hanford Reach dating back to the early 1980's monitoring the sport fishery, hatchery returns, and escapement for run reconstruction which includes coded wire tag (CWT) returns. This implementation plan summarizes the Tasks and Objectives specified in the M&E Plan for GCPUD hatchery programs. The M&E Plan approach is also included in Section 11 of the Priest Rapids Hatchery (PRH) Hatchery and Genetic Management Plan (HGMP). Meeting the Objectives as well as accomplishing the Tasks listed in the M&E Plan requires the assemblage of data and analysis from numerous Programs. This implementation plan identifies all Tasks that must be accomplished to meet the M&E Objectives as well as the Agency responsible for funding, staffing, supervision, and data collection.

Project Coordination

WDFW M&E staff dedicated to PRH will work in conjunction with fish culture staff from PRH, the Columbia River Coded Wire Tag Recovery Program (CRCWTP), Region 3 Fish Management, the WDFW District 4 Fish Biologist, UCR Steelhead Monitoring and Evaluation, and the GCPUD Research Science team and the United States Army Corps of Engineers (USACE) to complete all tasks included in the M&E Plan. In addition, samples collected at PRH and in the field will be transported and analyzed by WDFW Labs including the WDFW Scale Reading Lab, and the WDFW Otolith Lab. PRH M&E staff will process all coded-wire tag samples. Data collection and analysis associated with the PRH M&E and Hanford Reach population monitoring is incorporated into the WDFW Traps, Weirs, and Spillways (TWS) data base for use in M&E analyses, forecasting and managing fall Chinook salmon. WDFW will secure and hold all environmental permits necessary for work that is described in this statement of work. Data collection design, review, analysis, and reporting will be completed as a combined effort between GCPUD and WDFW Biologist(s). The performance period of this implementation plan is from July 1, 2022 – June 30, 2023.

Objectives

The objective of the PRH M&E plan is to evaluate the performance of the PRH program relative to the goals and objectives of the PRH program. The overarching goal of the PRH program is to meet GPUD's hatchery mitigation by producing fish for harvest while keeping genetic and ecological impacts within acceptable limits.

- Objective 1:** Determine if the PRH program has affected abundance and productivity of the Hanford Reach Population.
- Objective 2:** Determine if the run timing, spawn timing, and spawning distribution of both the natural and PRH components of the Hanford Reach population are similar.

- Objective 3:** Determine if genetic diversity, population structure, and effective population size have changed in natural spawning populations as a result of the PRH program. Additionally, determine if PRH programs have caused changes in phenotypic characteristics of the Hanford Reach population.
- Objective 4:** Determine if the PRH adult-to-adult survival (i.e., hatchery replacement rate) is greater than the Hanford Reach adult-to-adult survival (i.e., natural replacement rate) and equal to or greater than the program specific hatchery replacement rate (HRR) expected value based on survival rates listed in the BAMP (1998).
- Objective 5:** Determine if the stray rate of PRH fish is below the acceptable levels to maintain genetic variation between stocks.
- Objective 6:** Determine if PRH fish were released at the programmed size and number.
- Objective 7:** Determine if harvest opportunities have been provided using PRH returning adults.
- Objective 8:** Determine if the PRH has increased pathogen type and/or prevalence in the Hanford Reach population.
- Objective 9:** Determine if ecological interactions attributed to PRH fish affect the distribution, abundance, and/or size of non-target taxa of concern that were deemed to be at sufficient risk.

Methods

The PRH M&E plan is primarily organized in tables to facilitate review and provide clear direction for implementation. This plan was designed to be consistent with M&E plans that were designed and are currently being implemented by Chelan and Douglas Public Utility Districts. A variety of field methods will be used to collect the data necessary to achieve M&E objectives. Methods include redd surveys, carcass surveys, adult trapping, data collection at the hatchery during spawning, data collected at the hatchery during rearing, juvenile collection and tagging in the natural environment, disease monitoring, and NTTOC) monitoring in the natural environment, if identified as necessary in a risk assessment.

Tagging and marking will be an essential component of apportioning hatchery and natural origin production and stray rate. All of the hatchery origin fish will be marked prior to release from PRH. Two mass marking techniques have been proposed, otolith marking and adipose fin clipping. Currently, all hatchery origin fish will continue to be otolith marked. Otolith marking was initiated during brood year 2007.

WDFW and GPUD will refine subsample size estimates for submission of otolith samples to the WDFW Otolith Lab after the ages of the fish sampled have been determined by the WDFW Scale Lab (typically during the winter). The size of the subsamples by age and gender is based on number of samples collected and the relationship between sample size and deviation of the estimated variable from the cumulative estimate of a variable.

Passive Integrated Transponder (PIT) tag observations will be inventoried at the PIT-tag arrays located at Bonneville, McNary, Ice Harbor, and Priest Rapids dams and the PRH discharge channel.

The following Tasks are necessary to meet the Objectives of the M&E Plan (some of these tasks are funded wholly or in part by other organizations):

Task 1. PRH sampling of adult returns at the trap.

Task 2. PRH sampling of adult returns during spawning.

Task 3. Compilation of PRH origin URB fall Chinook salmon in the sport harvest including the Hanford Reach, Yakima River, Wanapum Tribal Fishery, ocean, and lower Columbia commercial and tribal harvest.

Task 4. Redd surveys in the lower Yakima River.

Task 5. Adult counts at dams and hatcheries.

Task 6. Carcass surveys in the Hanford Reach, Hatchery Discharge Channel, Priest Rapids Dam Pool, and Yakima River downstream of Prosser Dam.

Task 7. Pre-release sampling of juveniles at PRH

Task 8. Juvenile marking and tagging of the Hanford Reach natural population.

Task 9. Operation and evaluation of PIT tag detections at the PRH discharge channel and derived estimates from dams.

Task 1. Sampling Information, Methods, and Metrics for Data Collected at the Priest Rapids Hatchery Volunteer Trap (Hatchery Genetic Management Plan (HGMP), Attachment 5, Table 7)

Objectives: 1, 2, 3, 4, & 5

Frame: Population of fish collected at the PRH trap.

Sample Unit: Fish surplused. Fish transported from the trap and ponded for broodstock are included in Task 2.

Sample Size: Sample all Chinook salmon regardless of external marks or fin clips that are not used for broodstock to identify the presence of CWT. The sample rate for detailed biological data collection will be set in September after WDFW updates the run forecast for fall Chinook salmon returns to PRH to accommodate a sample goal of 1,000 fish surplused from the PRH volunteer trap.

Schedule: September 1 through December 15.

Methods: All Chinook salmon surplused or found as a mortality will be scanned for the presence of a CWT.

All in-sample Chinook salmon will be sampled for age (scale sample), gender, fork length and post orbital hypural plate (POHP) length. In-sample fish will also be sampled for origin by either the collection of CWT if present or otoliths. The CWT fish from the in-sample group will have their snout removed, bagged and labeled for processing at either the PRH wet lab or the WDFW Pasco office. Non-CWT fish will have their otoliths removed, placed in pre-labeled vials filled with a preservative, and cataloged for processing. Select otoliths will be sent to the WDFW Otolith Lab to determine if they are PRH origin.

The collection of scales from in-sample fish in conjunction with CWT recoveries is necessary to validate age reading and to provide a cross reference for data collections. To reduce the workload of processing “out-of-sample” CWT fish, scale samples will not be collected. These fish will still be sampled for gender, fork length, and the snout removed, bagged, and labeled for processing.

Data Collected: Scale (age), otolith (PRH origin), fork length, POHP length, gender, and CWT (origin).

Personnel and Equipment: A team of M&E technicians with oversight by a lead M&E technician and the M&E biologist, transport vehicles, and standard sampling gear. Staff will sample PRH returns from the volunteer trap. Staff will be responsible for biological sampling, data entry, and reading of CWT. These activities will occur at both the PRH wet lab and the WDFW Pasco office. The WDFW Otolith Lab will process otoliths to determine if they are PRH origin. The WDFW Scale Lab will read all scales to age including years in freshwater.

Task 2. Sampling Information, Methods, and Metrics for Data Collected at the Priest Rapids Hatchery during Holding and Spawning (HGMP, Attachment 5, Table 8)

Objectives: 1, 2, 3, 4, 5, & 8

Frame: Spawning population of PRH.

Sample Unit: PRH Broodstock.

Sample Size: Sample all Chinook salmon for CWT recovery. The sample rates (in-sample) for detailed biological data collection will be set in September after WDFW updates the run forecast for fall Chinook salmon returns to PRH to accommodate an in-sample goal of 1,000 ponded fish originating from the PRH volunteer trap. In-sample rates for other sources of broodstock (e.g., ABC fishery) will be set after the collection sizes are determined.

Schedule: October 26 through early December, two or more days per week.

Methods: All fish ponded, regardless of source will be scanned for the presence of CWTs after they are spawned, surplused, or found as a mortality. All in-sample Chinook salmon will be sampled for age (scale sample), gender, fork length and POHP length. In-sample fish will also be sampled for origin by either the collection of CWT if present or otoliths. The CWT fish from the in-sample group will have their snout removed, labeled, and bagged for processing at either the PRH wet lab or the WDFW Pasco office. Non-CWT fish will have their otoliths removed, placed in pre-labeled vials filled with a preservative, and cataloged for processing. Select otoliths will be sent to the WDFW Otolith Lab to determine if they are PRH origin.

The collection of scales from in-sample fish in conjunction with CWT recoveries is necessary to validate age reading and to provide a cross reference for data collections. To reduce the workload of processing out-of-sample CWT fish, scales will not be collected. These fish will only be sampled for gender, fork length, and the snout removed, bagged, and labeled for processing. Fecundity will be collected during sampling of spawned fish. Ovarian fluid will be drained from the egg takes of females sub-sampled for fecundity, eggs will then be weighed, and the requisite number of eggs based on 2013 sampling (e.g., 100 eggs) will be collected and weighed to estimate fecundity for the female. Scales, otoliths, and fork length will be collected for each female in the fecundity sample. Attempts will be made to measure fecundity on presumptive hatchery origin (collected from volunteer trap) and natural origin fish (collected from fish captured in the ABC fishery possessing no marks or tags such as an adipose clip or CWT). The goal will be to get 100 samples from each of the two origins (total 200) and to cover the full range of female size.

Data Collected: Scale (age), otolith (PRH origin), fecundity, egg weight, fork length, POHP length, gender, and CWT (origin).

Personnel and Equipment: Up to six WDFW M&E technicians with M&E Biologist oversight, transport vehicles, and standard sampling gear. The WDFW Otolith Lab will process otoliths to determine if they are PRH origin. The PRH M&E staff will process CWT samples to determine origin. The WDFW Scale Lab will read all scales to age including years in freshwater. The WDFW Fish Health Specialist will follow disease testing protocols established for WDFW hatcheries.

Task 3. Sampling Information, Methods & Metrics for Harvest Sampling (HGMP, Attachment 5, Table 9)

Objectives: 1, 2, 4, 5, & 7

Frame: Harvest of natural origin Hanford Reach fall Chinook salmon and fall Chinook salmon released from PRH (e.g., Wanapum Tribal Harvest, Yakima River Fall Chinook salmon Sport Harvest, Hanford Reach fall Chinook salmon sport harvest).

Sample Unit: All Chinook salmon observed during the Hanford Reach salmon fishery.

Task 3.1. Hanford Reach Sport Fishery, Phenotypic Metrics

Sample size: All Chinook salmon sampled are scanned for the presence of CWTs. A minimum of 350 Chinook salmon from the sport harvest will be sub-sampled at the appropriate rate (e.g., every 10th carcass) to determine origin and other phenotypic metrics; age, gender, and length at age.

Schedule: Daily from August 16 through October 31.

Methods: Staff will be stationed at primitive boat launches throughout the Hanford Reach including Vernita Bridge, Waluke, and Ringold. All anglers encountered will be interviewed to determine catch and estimate harvest. Harvested Chinook salmon from these anglers will be sampled to determine origin (CWT), age (scales), gender, and length. Methods are fully described in the WDFW Annual Report (Hoffarth, 2008).

Data Collected: Species harvested and released, location, number of boats, number of anglers, effort (angler hours and trailer index counts), catch per unit effort, harvest per unit effort, incidental catch. Biological data will include age (scale), fork length, gender, and origin (CWT).

Personnel and Equipment: WDFW will provide four staff for monitoring the sport harvest. PRH M&E will provide one additional staff for sport harvest monitoring. Staff start dates are staggered to match angler effort and reduce costs. First staff member starts August 16, second staff member, funded by GCPUD, begins September 1, third staff member begins September 15, and the final staff member starts when the Hanford Reach opens for steelhead, typically October 1. All data collected during the sport fishery will be processed by WDFW staff. The WDFW District 4 Fish Biologist is responsible for analyzing the data, generating weekly harvest and ESA impact estimates, and evaluating if current harvest is within the harvest guidelines of the Hanford Reach Fall Chinook Harvest Management Plan. PRH M&E staff will process CWT samples to origin and age. The WDFW Scale Lab will read all scale to age including years in freshwater.

Task 3.2. *Yakima River Fall Salmon Sport Fishery*

Sample Size: All Chinook salmon observed in the harvest are scanned for the presence of a CWT and sampled for run reconstruction.

Schedule: Five days per week from September 1 through October 31.

Methods: Staff monitors bank and boat anglers from the Duportail Access Area upstream to Prosser. All anglers encountered will be interviewed to determine catch and estimate harvest. Harvested Chinook salmon from these anglers will be sampled to determine origin (CWT), age (scales), gender, and length. Methods are fully described in the WDFW Annual Report (Hoffarth, 2008).

Data Collected: Species harvested and released, numbers of boats, number of anglers (bank & boat), effort (angler hours), catch per unit effort, harvest per unit effort, incidental catch, scale (Chinook, coho, and steelhead), fork length, gender, and origin (CWT).

Personnel and Equipment: WDFW provides one technician for monitoring the sport. The WDFW District 4 Fish Biologist is responsible for entering all data, analyzing the data, and generating weekly harvest and ESA impact estimates. The PRH M&E staff will process CWT samples to origin and age. The WDFW Scale Lab will read all scale to age including years in freshwater.

Task 3.3. *Wanapum Tribal Fall Chinook Salmon Fishery*

Sample Size: All Chinook salmon harvested are sampled.

Schedule: September 1 through October 15.

Methods: All Chinook salmon and Coho harvested are sampled to determine origin (CWT), age (scales), gender, and length. All Chinook salmon and coho harvested will be scanned for the presence of a CWT. All snouts with a positive signal will be transported to the WDFW District 4 Office for processing. Methods are fully described in the WDFW Procedures for Sampling the Wanapum Fishery (Hoffarth, 2009).

Data Collected: Species harvested, incidental catch, number of nets, mesh size, age (scale), fork length, gender, and origin (CWT).

Personnel and Equipment: GCPUD Cultural staff will sample the fishery and provide the data and samples to the WDFW District 4 Fish Biologist. The WDFW District 4 Fish Biologist enter all data from the fishery. The PRH M&E staff will process CWT samples to origin and age. The WDFW Scale Lab will read all scale to age including years in freshwater.

Task 4. Sampling Information, Methods, and Metrics for Redd Surveys (HGMP, Attachment 5, Table 4)

Objectives: 1 & 4

Frame: Redds in the lower Yakima River.

Sample Unit: Visible redds located in the Yakima River below Prosser (Rkm 13 – 74). Sample unit is partitioned into four reaches:

- 1 – Chandler Powerplant to Prosser Dam
- 2 – Benton City Boat Launch to Chandler Dam
- 3 – Horn Rapids Park to Benton City Boat Launch
- 4 – Duportail St. Boat Launch to Snively Rd. Boat Launch

Sample size: Total count of visible redds.

Schedule: Weekly between October 22 and November 30.

Methods: Foot and boat surveys will be conducted as generally described by Gallagher et al. (2007) and Murdoch et al. (2008). Redds will be identified based upon their relatively clean substrate and a bowl and tail spill morphology. All four reaches of river surveyed weekly by boat (cataraft).

Data Collected: Counts of redds and live fish by reach.

Personnel and Equipment: Two WDFW staff persons funded by CRCWTRP, cataraft, two tow vehicles, and standard sampling gear.

Task 5. Sampling Information, Methods, and Metrics for Adult Counts at Dams and Hatcheries

Objectives: 1, 2, 3, 4

Frame: Fall Chinook salmon in the Hanford Reach.

Sample Unit: Fall Chinook salmon counted at dams or weirs (McNary, Priest Rapids, Ice Harbor, Prosser, PRH trap, Ringold Hatchery trap).

Sample Size: Total count or subsample.

Schedule: Daily from August 9 through November 15.

Methods: Dam counts using observers or video as generally described by Wagner (2007). All returns to hatchery volunteer traps will be enumerated prior to removal from the hatchery.

Data Collected: Fall Chinook salmon are recorded into two categories based on fork length, adults and jacks. Adults are all Chinook salmon greater than 22 inches in fork length.

Personnel and equipment: Counts of salmonid returns to PRH and Ringold Springs Hatchery (RSH) volunteer traps will be provided by M&E Staff. Adult salmonid passage counts at dams are provided by the United States Army Corp of Engineers (USACE), Yakama/Klickitat Fisheries Project (YKFP), and GCPUD.

Notes for Task 5.

Adult Chinook Salmon Counts at Mainstem Hydroelectric and Diversion Projects. Fish counts at mainstem Projects including the Columbia, Snake, and Yakima Rivers necessary to meet PRH M&E objectives are funded by non-related programs by GCPUD, WDFW, the USACE, and the Yakama Indian Nation. These data are readily available on the internet and will be downloaded at frequent intervals by the WDFW District 4 Fish Biologist.

Adult Chinook Salmon Counts at Priest Rapids Hatchery. Hatchery returns to Priest Rapids are enumerated by hatchery staff in coordination with M&E staff.

Adult Chinook Salmon Counts at Ringold Springs Hatchery. Hatchery returns to Ringold Springs Hatchery are enumerated by hatchery staff in coordination with the Ringold Springs Hatchery M&E Program.

Task 6. Sampling Information, Methods, and Metrics for Carcass Surveys in the Natural Environment (HGMP, Attachment 5, Table 6)

Objectives: 1, 2, 3, 4, & 5

Frame: Hanford Reach, Hatchery Discharge Channel, Priest Rapids Pool, and Yakima River

Task 6.1. Hanford Reach Stream Surveys

Sample Unit: Salmon carcasses partitioned by reach; five river reaches have been established in the Hanford Reach:

- 1 - Vernita Bridge to Priest Rapids Dam
- 2 - Island #2 to Vernita Bridge
- 3 - Wooden Powerline Towers to Island #2
- 4 - Wooded Island to Wooden Powerline Towers
- 5 - Richland to Wooded Island

Carcasses recovered in the Columbia River immediately downstream of the PRH discharge channel will be included with those Chinook salmon recovered in the discharge channel but will be tracked separately should additional analysis of these fish be necessary.

Sample Size: All carcasses observed in the surveys will be sampled for the presence of a CWT. Approximately 2,500 carcasses will be sampled in the Hanford Reach for origin based on CWT and otoliths. These sampled fish will be used to determine other phenotypic metrics; age, gender, fork length, egg retention, in addition to the determination of origin.

Schedule: October 27 through December 12.

Methods: All carcasses that are encountered will be collected with a gaff or by hand. Surveys will occur by boat or foot. Methods will generally follow Crawford et al. (2007), Murdoch et al. (2008); and Hoffarth et al. (2008). All Chinook salmon will be wanded for the presence of a CWT. All Chinook salmon with a CWT present will be sampled for age (scale sample), gender, fork length, and the snout will be bagged and labeled for processing by M&E staff at the PRH wet lab or WDFW Pasco office. Otoliths will be collected from in-sample fish, placed in a vial, and stored with an appropriate index number. Otoliths will be sent to the WDFW Otolith Lab for decoding to determine if they are PRH origin. Chinook salmon sub-sampled for run reconstruction will be sampled for age (scale samples), gender, fork length, and spawning success. Fish will be identified to gender based on morphology. Female Chinook salmon in the sub-sample will be

dissected to determine spawn success based on the percentage of egg retention (e.g., 0.0-10%, 11-37%, 38-62%, 63-87%, 88-100%). The percent of egg retention will be first visually estimated and then calculated by dividing the count of eggs retained by an estimated fecundity based on length versus fecundity regressions. In addition, retained eggs will be quantified by counting in the field or bagged and later estimated in the office. Carcasses will be cut in half to avoid duplicate sampling in future surveys.

Data Collected: Scale (age), otolith (PRH origin), fork length, gender, spawn success, CWT (origin), location.

Personnel and Equipment: Three boat crews with a three-person crew operating seven days per week. PRH M&E staff, RSH M&E staff, and WDFW staff to perform field sampling, collect CWTs and otoliths, and enter data into the data base. This will require a total of 13 (three WDFW staff, three RSH M&E staff, and seven PRH M&E staff), three boats, three vehicles and standard sampling equipment. The WDFW Otolith Lab will process otoliths to determine if they are PRH origin. The PRH M&E staff will process CWT samples to origin and age. The WDFW Scale Lab will read all scale to age including years in freshwater.

Task 6.2. Priest Rapids Hatchery Discharge Channel Stream Surveys

Sample Unit: PRH Discharge Channel, approximately one-quarter mile in length from the Columbia River to the PRH trap.

Sample Size: Sample all carcasses recovered in the survey for CWT. In addition, carcasses will be sub-sampled at the same rate as Chinook salmon in the Hanford Reach stream survey listed above to determine other demographic; age, gender, length, spawn success (including counts of retained eggs).

Schedule: October 25 through December 8.

Methods: All carcasses that are encountered will be collected with a gaff or by hand. Surveys will occur by foot. Methods will generally follow Crawford et al. (2007), Murdoch et al. (2008); and Hoffarth et al. (2008). All fish will be wanded for the presence of CWT.

All Chinook salmon with a CWT present will be sampled for age (scale sample), gender, fork length, and the snout will be bagged and labeled for processing at the WDFW CWT Lab. Chinook salmon sub-sampled for run reconstruction will be sampled for age (scale samples), gender, fork length, CWT, otoliths, and spawning success. Otoliths will be collected at the same sample rate as Hanford Reach natural origin otolith collections. Otoliths will be sent to the WDFW Otolith Lab for decoding to determine if they are PRH origin. Fish will be identified to gender based on morphology. Female Chinook salmon in the sub-sample will be dissected to determine spawn success based on the percentage of egg retention (i.e., 0.0-10%, 11-37%, 38-62%, 63-87%, 88-100%). The percent of egg retention will be first visually estimated and then calculated by dividing the count of eggs retained by an estimated fecundity based on length versus fecundity regressions. In addition, retained eggs will be quantified by counting in the field or bagged and later estimated in the office. Carcasses will be cut in half to avoid duplicate sampling in future surveys.

Data Collected: Scale (age), otolith (PRH origin), fork length, gender, spawn success, CWT (origin), otoliths (origin) and location.

Personnel and Equipment: Two PRH M&E staff and standard sampling equipment.

Task 6.3. Priest Rapids Pool Stream Surveys

Sample Unit: Priest Rapids Dam upstream to Wanapum Dam.

Sample Size: All Chinook salmon recovered in the survey will be sampled for a CWT. The in-sample rate for biological data collection will be set on October 31 based on escapement size.

Schedule: November 1 through December 12, two days per week.

Methods: All carcasses that are encountered will be collected with a gaff or by hand. Surveys will occur by boat and foot. All Chinook salmon will be wanded for the presence of a CWT. Chinook salmon with a CWT present will be sampled for age (scale sample), gender, fork length, and the snout will be bagged and labeled for processing at the PRH wet lab or WDFW Pasco Office. Biological data collected from in-sample collections will include scale samples (age), gender, fork length, CWT or otoliths, and spawning success. Fish will be identified to gender based on morphology. Otoliths will be collected, placed in a vial, and stored with an appropriate index number. Otoliths will be sent to the WDFW Otolith Lab for decoding to determine if they are PRH origin. Female Chinook salmon in the sub-sample will be dissected to determine spawn success based on the percentage of egg retention (i.e., 0.0-10%, 11-37%, 38-62%, 63-87%, 88-100%). The percent of egg retention will be first visually estimated and then calculated by dividing the count of eggs retained by an estimated fecundity based on length versus fecundity regressions. In addition, retained eggs will be quantified by counting in the field or bagged and later estimated in the office. Carcasses will be cut in half to avoid duplicate sampling in future surveys.

Data Collected: Scale (age), otolith (PRH origin), fork length, gender, spawn success, CWT (origin), location.

Personnel and Equipment: Two field staff dedicated to the Hanford Reach stream surveys will accomplish this task as a component of the scope of work for technicians assigned to M&E for the natural environment funded by GCPUD and USACE (Listed in this Task above).

Task 6.4. Yakima River Stream Surveys

Sample Unit: Yakima River downstream of Prosser Dam. Sample unit is partitioned into four reaches:

- 1 – Chandler Powerplant to Prosser Dam
- 2 – Benton City Boat Launch to Chandler Dam
- 3 – Horn Rapids Park to Benton City Boat Launch
- 4 – Duportail St. Boat Launch to Snively Rd. Boat Launch

Sample Size: All Chinook salmon recovered in the survey will be sampled for CWT. The in-sample rate for biological data collection will be set on October 15 based on escapement size.

Schedule: October 22 through November 30, all four sections of river completed weekly, one section per day, boat survey (cataraft).

Methods: All carcasses that are encountered will be collected with a gaff or by hand. Surveys will occur by boat. Methods will generally follow Crawford et al. (2007), Murdoch et al. (2008); and Hoffarth et al. (2008). All Chinook salmon will be wanded for the presence of CWTs. Chinook salmon with a CWT present will be sampled for age (scale sample), gender, fork length, and the snout will be bagged and labeled for processing at the PRH wet lab or Pasco Office. Chinook salmon sub-sampled for run reconstruction will be sampled for age (scale samples), gender, fork length, and spawning success. Fish will be identified to gender based on morphology. Female Chinook salmon in the sub-sample will be dissected to determine

spawn success based on the percentage of egg retention (e.g., 0.0-10%, 11-37%, 38-62%, 63-87%, 88-100%). The percent of egg retention will be first visually estimated and then calculated by dividing the count of eggs retained by an estimated fecundity based on length versus fecundity regressions. In addition, retained eggs will be quantified by counting in the field or bagged and later estimated in the office. Carcasses will be cut in half to avoid duplicate sampling in future surveys.

Data Collected: Scale (age), fork length, gender, spawn success, CWT (origin), location.

Personnel and Equipment: One boat (cataraft) with a two person crew funded by Columbia River Coded-Wire Tag Regional Program (CRCWTRP) standard sampling equipment (funded by CRCWTRP).

Task 7. Sampling Information, Methods, and Metrics for Data Collected to Monitor Fish Culture of Juveniles

Objectives: 6 & 8

Frame: Abundance, size, adipose clip rate, CWT rate, rate of precociousness, and disease occurrence of smolts at PRH at the time of release.

Task 7.1. Abundance and Size at Release

Sample Unit: Juveniles prior to release from PRH

Sample Size: Approximately 300 fish from each rearing vessel (five total) to determine size metrics.

Schedule: Prior to release in late May and mid-June.

Methods: Estimate abundance each life stage: egg, transfer to raceways, transfer to ponds, and release. Estimates of abundance will be generated by subtracting mortalities at subsequent life stages from estimates of green eggs. Use cast net to collect juveniles for each of the final rearing ponds (five total). Size and length data will be collected calculate CVs for both matrixes. Each fish will be weighed (grams) and measured to fork length (millimeters).

Data Collected: Abundance, fish per pound, length of individual fish, and weight of individual fish.

Personnel and Equipment: Two PRH M&E staff, cast nets, fish transport tank, holding vessels, scale, measuring board, and tally counter.

Task 7.2. Determination of adipose clip rate and CWT rate

Sample Unit: Juveniles prior to release from PRH.

Sample Size: Approximately 1,000 fish from each final rearing vessel (five total) to determine mark and tag rates.

Schedule: Prior to release in late May and mid-June.

Methods: Use cast net to collect juveniles from each final rearing pond. Estimate the proportions of juveniles that fall into one of four categories: (not adipose clipped and not CWT tagged), (adipose clipped and not CWT tagged) (not adipose clipped but possess CWT) and (adipose clipped and possess CWT). Estimates of these proportions by category will be obtained by visually inspecting individual fish for the

presence or absence of an adipose fin and scanning it for a CWT using a V-detector (NW Marine Tech).
Data Collected: Adipose mark rate and CWT rates for each final rearing pond

Personnel and Equipment: Two PRH M&E staff, cast nets, fish transport tank, holding vessels, CWT V-detector, tally counter.

Tasks 7.3. *Rate of precociousness*

Sample Unit: Juveniles prior to release from PRH

Sample Size: Approximately 300 fish from each final rearing vessel (five total) to determine presence and absence of precocious juveniles.

Schedule: Prior to release in late May and mid-June.

Methods: Use cast net to collect juveniles from each final rearing pond. Estimate the presences of precocious of juveniles for each pond by non-lethal visual inspection of each juvenile for the presence of milt.

Data Collected: Number of precocious juveniles within the sample for each final rearing pond.

Personnel and Equipment: Two PRH M&E staff, cast nets, fish transport tank, holding vessels, and tally counter.

Tasks 7.4. *Monitoring of diseases outbreaks*

Sample Unit: Specific life stages of fall Chinook Salmon at PRH.

Sample Size: Variable

Schedule: September through late-June.

Methods: Summarize reports provided by WDFW Fish Health staff for inclusion into the annual M&E report.

Data Collected: Number of fish sampled and occurrence of diseases

Personnel and Equipment: One PRH M&E staff for reporting.

Task 8. *Sampling Information, Methods, and Metrics to Monitor Natural Origin Juvenile Fish Abundance and Size*

Objective(s): 1

Frame: Naturally produced juveniles in the Hanford Reach.

Sample Unit: All Chinook salmon collected by beach seine in the Hanford Reach during the CWT tagging program.

Sample Size: Appropriate samples will be taken from both the marked and unmarked Chinook salmon.

Schedule: Late May to Early June (typically 10 day marking program).

Methods: Chinook salmon collected during the CWT marking program will be routinely sampled by length. Mark groups and tag codes will be enumerated. Goal of the marking program is to tag and adipose clip 200,000 of the natural production of fall Chinook salmon in the Hanford Reach.

Data Collected: Total numbers of Chinook salmon collected size at marking, mark numbers.

Personnel and Equipment: CWT trailer, technicians, supervision by both Columbia River Intertribal Fish Commission (CRITFC) and WDFW, collection is conducted by the Yakama Indian Nation, Umatilla Indian Nation, and CRITFC. This project is funded by the Bonneville Power Administration. collection nets.

Task 9. Operation and Data Analysis of PIT tag Detections at the Priest Rapids Hatchery Discharge Channel

Frame: PRH Juvenile Releases and Adult Returns.

Sample Size: Up to 43,500 PIT juvenile fall Chinook salmon released from PRH. The number and origin of adult returns likely to be detected at the array is unknown.

Schedule: May 10 to December 15.

Methods: The PIT-tag antennae arrays provide PIT tag detection of juveniles at release as well as returning adults. The PRH M&E staff will monitor PIT detections and analyze results to determine the abundance of both juvenile and adult PRH fall Chinook salmon, travel time and speed of juvenile fish, re-ascension of mini-jacks, and identification of non-PRH origin fish. PIT tag detections will be compared against adult detections at hydroelectric projects in the Columbia and Snake rivers to estimate interdam loss, smolt to adult survival to the hatchery, juvenile downstream survival, as well as adult re-ascension and fall back rates at McNary, Ice Harbor and Priest Rapids dams. WDFW maintenance crews will conduct routine maintenance of the PIT tag arrays as needed. An in-depth inspection of the arrays will occur during May prior to the hatchery release of juvenile Chinook salmon and again during late August for preparation for the adult Chinook salmon return.

The volitional releases of juveniles from rearing ponds needs to be staggered by several days or the PIT-tag antennae array system will be overwhelmed by the high numbers of out-migrants and the data lost. The juvenile release strategy will be coordinated with hatchery staff.

Data Collected: Total numbers and timing of Chinook salmon PIT detections collected.

Personnel and Equipment: The PRH M&E staff.

Expected Results and Applicability

Data collected from the 2022 return will be reviewed to determine if URB fall Chinook salmon production from PRH met all of the Objectives/Goals of the M&E Plan. In 2023, all PRH brood year returns will possess an otolith mark which will allow for determination of pNOB, pHOS, and PNI at a high level of confidence.

Data Compilation and Analysis

Data will be maintained at the WDFW District office in Pasco and backed up on the WDFW Network (S:drive) and a dedicated thumb drive. The data is backed up weekly during the field season and each day the database is proofed. Data will be routinely entered into an Access or Excel data base in-season. The TWS Access database is the primary means of organizing and storing biological data. Some data associated with carcass recovery is entered into Excel spreadsheets. Age, CWT, and otolith information will be entered into the data base when it returns from the WDFW Labs. Scale cards are the primary means of recording data in the field. The scale cards will be proofed for obvious errors by staff at the end of each field day and again prior to entering data into the TWS which occurs routinely September through December. Staff will proof the data entered into the TWS mid-December and again in early January as scale age and CWT results becomes available. The otolith data is entered into the TWS and proofed as results become available generally in March and April. Proofing the TWS generally requires two staff; one to read aloud the data on scale cards and data sheets while another verifies the data in the TWS.

The Historical data as well as current data will be incorporated into the analysis and reporting for the PRH M&E Program. Historical data will be mined and presented to the maximum extent possible so that the longest data set can be evaluated. This will include mining data from other WDFW sources and from Battelle.

Summary of New Activities

Brief descriptions of alterations to existing Tasks or new tasks associated with PRH M&E during 2022-2023 are given in Table 1.

Table 1. New activities for Priest Rapids Monitoring and Evaluation for 2022.

Activity	Associated Task
None	

Table 2. Summary of project timelines for data entry, analysis, and reporting July 1, 2022 – June 30, 2023

Activity	Dates
Priest Rapids Hatchery	
Trapping, Broodstock Collection, and Surplus Operations	September 1 – December 15
Spawning	October 26 – December 10
Hatchery Discharge Channel Stream Surveys	October 15 – December 8
PIT tag Array Maintenance and Evaluation	July 1 – June 30
Hanford Reach	
Hanford Reach Fall Chinook salmon Fishery	August 1 – October 31
Hanford Reach Stream Survey	November 1 – December 12
Priest Rapids Pool	
Priest Pool Stream Surveys	November 1 – December 12
Yakima River downstream of Prosser Dam	
Yakima stream surveys for redds and carcasses	October 22 – November 30
Data Entry & Analysis	
Data Entry Return Year	September 1 – March 31
Data Review and Analysis	January 1 – June 30
Reporting	
Draft Monitoring and Evaluation Report	May 15

Summary of Sample Sizes

Sample size of each Task associated with PRH M&E during the performance period is given in Table 3.

Table 3. Sample size goals by Task. The sample size for otolith decoding will be determined after the age distribution data is available.

Task	Sample Size
Task 1. Priest Rapids Hatchery sampling of adult returns at the trap	100% for CWT, 1,000 for other
Task 2. Priest Rapids Hatchery sampling of adult returns during spawning	100% for CWT, 1,000 for other
Task 3. Compilation of Priest Rapids Hatchery origin URB fall Chinook salmon in the sport harvest including the Hanford Reach, Yakima River, Wanapum Tribal Fishery, ocean, and lower Columbia commercial and tribal harvest	All Encountered
<i>Task 3.1</i> Hanford Reach Sport Fishery, Phenotypic Metrics	350
<i>Task 3.2.</i> Yakima River Fall Salmon Sport Fishery	All Encountered
<i>Task 3.3</i> Wanapum Tribal Fall Chinook Salmon Fishery	All Encountered
Task 4. Yakima River Redd Surveys (Rkm 13 – 74)	All Observed
Task 5. Adult counts at dams and hatcheries	
<i>Task 5.1. Adult Chinook Salmon Counts at Mainstem Hydroelectric and Diversion Projects</i>	All Returns
<i>Task 5.2 Adult Chinook Salmon Counts at Priest Rapids Hatchery</i>	All Returns
<i>Task 5.3. Adult Chinook Salmon Counts at Ringold Springs Hatchery</i>	All Returns
Task 6. Carcass surveys in the Hanford Reach, Hatchery Discharge Channel, and Yakima River	
<i>Task 6.1. Hanford Reach Stream Surveys</i>	100% for CWT, 2,500 for other demographic data.
<i>Task 6.2. Hatchery Discharge Channel Stream Surveys</i>	All Encountered
<i>Task 6.3. Priest Rapids Pool Stream Surveys</i>	All Encountered
<i>Task 6.4. Yakima River Stream Surveys</i>	All Encountered
Task 7. Sample Information, Methods, and Metrics for data collected to monitor fish culture of Juveniles	1,500 (300 x 5 Ponds) juveniles individually weighed and measured, and rate of precocious fish; 5,000 (1,000 x 5 ponds) juveniles for CWT tag rate, adipose clip rate
Task 8. Juvenile marking and tagging of the Hanford Reach natural population	200,000 natural origin juvenile fall Chinook
Task 9. Operation and evaluation of PIT tag detections at the Priest Rapids Hatchery discharge channel and derived estimates from dam observations.	43,000 PIT Juvenile Release All PIT Adult Returns

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