WILLAMETTE VALLEY DOWNSTREAM FISH PASSAGE MONITORING

Biannual Report Summary

January through June 2024

Prepared for:

U.S. Army Corps of Engineers

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Prepared by:

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INTRODUCTION

For over 50 years, the U.S. Army Corps of Engineers (USACE) has managed and operated 13 dams in the Willamette River basin as part of the Willamette Valley Project (WVP). Each of these dams contributes to a system that provides flood control, power generation, and recreation. Management of the WVP is a complex process and presents challenges in meeting competing demands such as instream flows, fish passage, flood control, and recreation. Adding to the complexities are the listings of three fish species under the Endangered Species Act (ESA), spring Chinook salmon, *Oncorhynchus tshawytscha*, steelhead, *Oncorhynchus mykiss*, and bull trout *Salvelinus confluentus* (NMFS 2008; USFWS 2008). In 2008, the USACE, the U.S. Bureau of Reclamation, and the Bonneville Power Administration (BPA) (jointly known as the Action Agencies) consulted with the National Marine Fisheries Service (NMFS) to evaluate the impact of the WVP on the ESA-listed salmon and trout, which resulted in NMFS issuing the 2008 Willamette River Biological Opinion (BiOp; NMFS, 2008). In the BiOp, NMFS identified a Reasonable and Prudent Alternative (RPA) that set forth specific actions the Action Agencies could implement to satisfy their legal obligations under the ESA to "…avoid the likelihood of jeopardizing the continued existence of the ESA listed species or the destruction or adverse modification of their designated critical habitat (NMFS, 2008)."

On September 2021, the U.S. District Court for the District of Oregon issued an Interim Injunction Order directing the USACE to implement certain interim injunctive measures to improve fish passage and water quality at several WVP dam sites to benefit UWR spring Chinook salmon and winter steelhead while a reinitiated ESA consultation was completed. In the interim, the Court approved an Expert Panel to define the implementation plans of specific measures, which were required to "provide meaningful research, monitoring, and evaluation ("RM&E") of the interim injunctive measures." On February 28, 2022, the Expert Panel submitted its proposed "long term" plan for the RM&E to accompany the interim injunction measures for the remainder of the duration of the injunction. This study is a component of the RM&E measures identified by the Expert Panel.

The purpose of this project is to contribute to the understanding of downstream passage of juvenile Chinook salmon and winter steelhead in the Willamette Valley Project. Monitoring includes the North Santiam, South/Middle Santiam, South Fork McKenzie, and Middle Fork Willamette River subbasins, including Fall Creek (Figure 1). In order to understand migration timing and survival within the WVP and interim management measures hypothesized to contribute to greater survival of juvenile and adult salmonids, this project consists of interrelated studies including (1) the bulk marking of juvenile Chinook salmon with PIT (Passive Integrated Transponder) tags to aid in the evaluation of these measures, (2) rotary screw traps (RST) sampling at multiple locations across the WVP, and (3) sampling within Green Peter and Lookout Point Reservoirs to understand how water management strategies may influence migration patterns and survival.

This report summarizes the work conducted in 2024 through June 30, 2024 under contract with the U.S. Army Corps of Engineers for bulk marking and sampling in Lookout Point and Green Peter reservoirs. The summary of rotary screw trap results has been submitted separately (EAS 2024c).

Figure 1. Location of Willamette River Basin in Northwestern Oregon

PROJECT SCHEDULE

This report is the third bi-annual report of the project, covering results of the bulk marking and reservoir distribution studies from January to June 2024 and to date since the project commenced in March 2023.

The contract for this project was awarded in early March 2023, and it was anticipated that it would take approximately two months to initiate 2023 field activities associated with the bulk marking and reservoir distribution studies. The anticipated schedule for 2023 was to begin bulk marking in early April and reservoir studies in the first week in May. Due to the permitting process, availability of equipment due to continued supply chain issues, coordination with hatcheries and training of field staff, a significant amount of advance work was necessary resulting in field activities ultimately beginning later than envisioned. Bulk marking of Chinook salmon fry began in mid-May 2023 and reservoir sampling started in mid-June 2023. Bulk marking activities have continued seasonally with tagging and release of subyearlings in Fall 2023, yearlings in winter/spring 2024 and fry in spring 2024. Reservoir sampling during the 2023 field season continued through the first week of December in Lookout Point Reservoir and through the end of September in Green Peter Reservoir. Rotary screw trap (RST) sampling during 2023 was conducted both under a separate contract with Environmental Assessment Services (EAS) and as part of this contract. RST sampling under these contracts occurred up to year-round between January 1, 2023 and December 31, 2023, with specific dates of operation dependent on trap location (EAS 2024a, EAS 2024b).

Bulk marking activities for 2024 began in January. Reservoir sampling commenced the first week of February during 2024 and will continue through November if field and reservoir conditions allow. Rotary screw trapping during 2024 will be year-round, dates dependent on trap location.

Project reporting occurs bi-weekly and bi-annually. Bi-annual reporting periods cover January-June and July-December, with each report summarizing results during the reporting period as well as findings to date. RST sampling methods and results are presented separately (EAS 2024b, EAS 2024c). Future reports will expand on these results as more data is collected (e.g., PIT tagged fish released as part of this project are still potentially outmigrating, and future reports will update the analyses for efforts conducted during this reporting period).

Table 1. Summary of field sampling effort, schedule and life stage targeted as part of this project.

Activity	Year	Timing	Target Life stage (Chinook salmon)
Bulk Marking (PIT tagging) of juvenile Chinook salmon	2023 2024	Spring (starting May) and Fall Winter/Spring and Fall	Fry, parr, and yearlings
Rotary Screw Trapping*	2023 2024	Year-round Year-round	Fry, parr, and yearlings
Reservoir Sampling (littoral and limnetic)	2023 2024	June through December February through November	Fry, parr, and yearlings

*Results from rotary screw trap sampling is contained in a separate report.

BULK MARKING

Bulk marking of juvenile Chinook salmon with PIT tags offers the opportunity to evaluate how an individual behaves, survives, grows, and out-migrates to saltwater as long as the individual can be redetected or recaptured at a downstream location. The purpose of bulk marking juvenile Chinook salmon for this project is to determine how water management actions (e.g., reservoir drawdowns, surface spill) influence the passage timing and

survival of juvenile Chinook salmon. All of the Chinook salmon used in the bulk marking portion of the project originated from hatcheries operated by the Oregon Department of Fish and Wildlife in the Willamette Valley.

Methods

The following protocol provides detailed procedures for work done to mark, hold, transport, and release juvenile Chinook salmon in the Willamette River basin during 2023 and 2024.

Government Supplied Hatchery Fish

- Juvenile Chinook salmon used for bulk/batch marking were from the respective sub-basin stock associated with where they are to be released. These fish were raised and held at Willamette Valley ODFW hatchery facilities prior to PIT tagging and release by Cramer Fish Sciences.

- Fish were reared as follows:
    - Fish released in the North Santiam basin were reared at ODFW's Marion Forks hatchery near Idanha, OR.
    - Fish released in the South/Middle Santiam and Middle Fork Willamette basins were reared at ODFW's Willamette Hatchery in Oakridge, OR.
    - Fish released in the South Fork McKenzie Basin were reared at ODFW's Leaburg and McKenzie Hatcheries near Leaburg, OR.

Holding and Tagging Sites

All juvenile Chinook salmon used for this project were held and marked at the ODFW hatchery facility where they were raised. CFS coordinated with hatchery managers to ensure adequate space and water supplies were available for holding the fish both pre- and post-tagging at each site.

North Santiam Basin – Marion Forks Hatchery

Chinook salmon released in the North Santiam Basin were held pre- and post-tagging in indoor flow through ("Canadian") troughs (21 ft x 1.67 ft x 1.75 ft). After an observation period to evaluate tagging mortality and tag shed rate, they were moved to outdoor circular ponds for rearing (24ft x 2.16ft).

South/Middle Santiam & Middle Fork Willamette Basins – Willamette Hatchery

Fish released in the South Santiam, Middle Santiam, and Middle Fork Willamette basins were held pre- and post-tagging at Willamette Hatchery. Fry were held pre- and post-tagging in indoor troughs (20 ft x 4 ft x 4 ft). Yearlings and subyearlings were held pre- and post-tagging in large raceways (75 ft x 20.5 ft x 4 ft).

South Fork McKenzie – McKenzie and Leaburg Hatcheries

Fry scheduled for release in the South Fork McKenzie basin were held pre- and post-tagging at ODFW's McKenzie Hatchery indoors in flow through troughs (20 ft x 2.67 ft x 1.67 ft). Yearlings and subyearlings tagged in fall were held at Leaburg Hatchery in net pens placed within the hatchery's large outdoor ponds. Hatchery management made six outdoor ponds/cement circulars at Leaburg or McKenzie hatchery available for use by this project (20ft diameter x 3.66ft deep). Net pens were constructed (6 ft x 6 ft x 3 ft) to enable separation and containment of hatchery release groups within the large outdoor ponds.

Fish Holding Conditions and Husbandry following delivery to CFS

Fish holding conditions were consistent with ODFW hatchery management practices and each hatchery's existing protocols were followed. ODFW hatchery staff supported the project by conducting daily feedings, water quality

monitoring, observation of abnormalities, and removal of mortalities at hatchery sites. Fish were under daily observation for abnormalities including poor swimming performance, fungus, unusual feeding behavior, direct mortalities, or any unusual marks.

Bulk/Batch Marking

To date, all release groups were uniquely marked with a passive integrated transponder (PIT) tag (Biomark, Inc.). An additional 3% of fish were marked for each release group to account for tagging mortality and ensure sufficient tag numbers of fish are achieved for each release group (Table 3). Fish have been tagged within the Cramer Fish Sciences fish marking trailer, which is disinfected then moved to each basin's holding site for bulk marking events. The marking trailer is equipped with 110V electricity and flow-through fish holding tanks. Additionally, it is equipped with a system to recirculate, aerate, and chill anesthetic water. During tagging, temperature, dissolved oxygen, and water chemistry were monitored for fish tagging tanks, and the recirculated anesthetization water was aerated and cooled with ice packs when necessary. Tagging ceased when the temperature of tanks exceeded 17 degrees Celsius or deviated more than 2 deg C from source/return water (Table 3). In an instance of a delay, tagging activities resumed once water temperatures returned to within thresholds safe for fish handling and tagging activities.

Working in small batches (30-50 fish), fish were anesthetized using 50 mg/L tricaine methanesulfonate (MS-222) buffered with sodium bicarbonate. To minimize fish stress, fish anesthetic exposure did not exceed five minutes (PIT Tag Steering Committee 2014). Fish were then tagged based on fish fork length (FL). Fry greater than 45 mm but less than 65 mm were marked with 8 mm PIT tags and fry greater than 65 mm were marked with a 12 mm PIT tag. All fish >45 mm were adipose fin clipped, either by ODFW or by CFS staff with surgical scissors. All subyearlings have been and yearlings will be marked with 12 mm PIT tags. Fork length to the nearest millimeter and weight to the nearest 0.01 g were recorded for the first 3% of fish tagged for each release group. For each fish, the tag code was recorded before fish were transferred to a flow-through tank for a 30-minute recovery and observation period. Any mortalities during this period were documented. After fish had recovered, the bulk of each release group (95%) were held for a minimum of 48 hours prior to release with each uniquely tagged release group held in a separate tank or holding pen where feeding commenced. The remaining 5% were held separately to be used for tag retention/mortality holding trials, as described below under "Tag Retention and Mortality Holding Trials."

VIE Batch Marking

Before the start of the spring tagging season in 2023, we initially planned to use Visual Implant Elastomer (VIE) tags for marking fry. However, due to the timing of marking activities following contract award and setup—by which time the fry had grown to over 45mm—and after consulting experienced elastomer taggers and reviewing how marks change as the fish develop, we collaborated with the Corps to find a better solution. It became clear that handling fry smaller than 45 mm was challenging and VIE tags on small fry can become difficult to read as the fish grow. This can be particularly problematic during recapture efforts, such as in a rotary screw trap after extended rearing, where an unreadable VIE tag provides no useful information for fish that rear for extended periods in reservoirs or streams. Given these concerns, we decided to use 8 mm PIT tags on fish as small as 45 mm. This approach was chosen to enhance survival rates and maximize the value of our data by ensuring that each fish could be individually identified upon recapture, providing more reliable information throughout their life stages.

PIT Tag Bulk Marking

PIT tagging procedures followed the methods detailed in the PIT Tag Marking Procedures Manual (PIT Tag Steering Committee 2014). Prior to tagging, feeding was ceased 24-48 hours in advance of tagging and resumed 24-28 hours post tagging, in order to reduce the risk of shed tags and lower the chance of hitting vital organs when injecting the PIT tags into the peritoneal cavity (PIT Tag Steering Committee 2014). Bulk mark group fish were tagged using single-use pre-loaded injector needles, pulled from trays holding sequentially numbered PIT tags. Tags were inserted using a MK25 PIT tag implanter (Biomark, Inc.). A new needle was loaded on the implanter for each fish. Fish were held in the hand with the belly of the fish facing up with the tail oriented toward the thumb, and the insertion point lined up with the middle finger. The middle finger was used to exert a slight pressure on the side of the fish's belly to ease needle penetration. The injector was laid in the hand so that the needle bevel faced toward the body of the fish. Tags were injected into the peritoneal cavity between the posterior tip of the pectoral fin and the anterior point of the pelvic girdle 1 to 2 mm from the mid-ventral line. Care was taken to keep the needle as parallel to the body axis as possible to keep the tag against the body wall, with minimal needle penetration (approximately 1-2 mm of the needle tip for small fish). Once the needle penetrated the abdominal wall, the tag was injected by pressing the trigger. After insertion, the used needle tip was ejected, and the fish scanned to read the tag code before transfer to the recovery tank.

A tag record includes information about the tagging session (i.e., date and location of tagging event, date and location of release) and tagged fish (i.e., species, run, rearing type, PIT tag code, fork length, and weight for the 3% subsample). Data during tagging were recorded using P4 software put out by PTAGIS[1]. Prior to release, holding tanks and the fish transport truck were examined to remove mortalities and scanned with a magnet to collect any shed PIT tags. PIT tag codes from sheds and mortalities were removed from the tag record. The PIT tag data were inspected for data quality before being uploaded to PTAGIS at the time of release.

Fish Transport

Fish were transported in a 400-gallon insulated fish transport tank (Reiff Manufacturing). The tank was placed and secured in the bed of a Ford F350 truck. The tank is equipped with a water pump to circulate oxygenated water within the tank, and an oxygen tank was secured vertically in the bed of the truck and used to supply oxygen to the tank. Transport fish densities were between 20 – 50 g/L (equivalent to 0.17 – 0.42 lbs/gallon) and dissolved oxygen was monitored and maintained between 80-120%, following the juvenile Chinook salmon transport methods applied by the USGS (Kock et al. 2019). Temperature and dissolved oxygen are monitored during transport by using a water quality meter with a cable that extends to the truck cab. Prior to transport, the temperature of the release location was measured and if necessary, the temperature of tank water was manipulated during transport so that fish experience at most a 1.0 ^{o}C change in temperature at release. Water temperature manipulations during transport were made by adding either ice or warm water to the tank at a rate that ensures fish experience a targeted less than 0.5 ^{o}C change in temperature per 15 minutes (Kock et al. 2019) to stay in compliance with NMFS criteria.

The fish transport tank was disinfected when switching between basins to prevent disease transmission. The inside of the tank was disinfected through exposure to 200 ppm chlorine for 30 minutes, after which it was thoroughly flushed with clean water (IHOT 1994).

[1] https://www.ptagis.org/Software/P4/P4

Release

The following outlines the primary marking and release locations for the remainder of this study, extending through spring 2025 (Table 2). In 2023, early spring fry marking was delayed due to various challenges, as previously discussed. These included delays in the permitting process, equipment shortages stemming from ongoing supply chain issues, coordination with hatcheries, and the training of field staff, all of which required substantial preparatory work. Despite these obstacles, Chinook salmon fry were eventually marked and released, though at a later date and at a correspondingly larger size.

Table 2. Tentative (target) release schedule for brood years 2022 and 2023. Release dates are approximate and depend upon operations and conditions such as reservoir elevation, road closures, etc.

2023					
MF Willamette					
Date Estimate	Release Location	Target	Lifestage	#	Tag
Spring 2023	Fall Creek Head of Reservoir	Prior to reaching target elevation of 728 feet	fry	10000	8 mm
Spring 2023	Lookout Point Head of Reservoir	30 day spill operations	fry	10000	8 mm
Spring 2023	Hills Creek Head of Reservoir	Observed fry migration and RO operations	fry	10000	8 mm
9/15/2023	Dexter Tailrace	Fall deep drawdown	subyearling	2000	12 mm
9/15/2023	Lookout Point Head of Reservoir	Fall deep drawdown	subyearling	5000	12 mm
9/15/2023	Lookout Point Forebay	Fall deep drawdown	subyearling	5000	12 mm
10/15/2023	Fall Creek Head of Reservoir	2-3 weeks prior to drawdown	subyearling	5000	12 mm
10/15/2023	Fall Creek Tailrace	2-3 weeks prior to drawdown	subyearling	1000	12 mm
11/15/2023	Fall Creek Head of Reservoir	Midway between start of drawdown and streambed elevation	subyearling	5000	12 mm
11/15/2023	Fall Creek Tailrace	Midway between start of drawdown and streambed elevation	subyearling	1000	12 mm
11/16/2023	Hills Creek Head of Reservoir	Prior to start of fall/winter RO operations	subyearling	5000	12 mm
11/16/2023	Hills Creek Tailrace	Prior to start of fall/winter RO operations	subyearling	3000	12 mm
11/16/2023	Hills Creek Forebay or Mid-Reservoir	Prior to start of fall/winter RO operations	subyearling	5000	12 mm
SF McKenzie					
Spring 2023	Cougar Head of Reservoir	Prior to start of spring drawdown	fry	5000	8 mm
Spring 2023	Cougar Head of Reservoir	After start of drawdown but prior to reaching 1520 feet	fry	5000	8 mm
9/15/2023	Cougar Head of Reservoir	Prior to start of drawdown	subyearling	3000	12 mm
10/15/2023	Cougar Forebay	Prior to reaching target elevation of 1505 feet	subyearling	5000	12 mm
10/15/2023	Cougar Tailrace	Prior to reaching target elevation of 1505 feet	subyearling	4000	12 mm
10/15/2023	Cougar Head of Reservoir	Prior to reaching target elevation of 1505 feet	subyearling	4000	12 mm
11/15/2023	Cougar Forebay	At 1532 feet when RO is prioritized for day and night spill	subyearling	5000	12 mm
11/15/2023	Cougar Tailrace	At 1532 feet when RO is prioritized for day and night spill	subyearling	4000	12 mm
11/15/2023	Cougar Head of Reservoir	At 1532 feet when RO is prioritized for day and night spill	subyearling	4000	12 mm
South Santiam					

Spring 2023	Green Peter Head of Reservoir, Middle Santiam	Spill operation block	fry	5000	8 mm
Spring 2023	Green Peter Head of Reservoir, Quartzville Creek	Spill operation block	fry	5000	8 mm
8/30/2023	Foster Tailrace	Undefined - Late August	subyearling	1000	12 mm
8/30/2023	Foster Head of Reservoir	Undefined - Late August	subyearling	2000	12 mm
9/15/2023	Green Peter Head of Reservoir, Middle Santiam	Fall Operations at Green Peter	subyearling	2500	12 mm
9/15/2023	Green Peter Head of Reservoir, Quartzville Creek	Fall Operations at Green Peter	subyearling	2500	12 mm
10/15/2023	Green Peter Tailrace	Prior to Green Peter reaching 887 feet.	subyearling	4000	12 mm
10/15/2023	Green Peter Head of Reservoir, Middle Santiam	Prior to Green Peter reaching 887 feet.	subyearling	2500	12 mm
10/15/2023	Green Peter Head of Reservoir, Quartzville Creek	Prior to Green Peter reaching 887 feet.	subyearling	2500	12 mm
10/15/2023	Foster Tailrace	Fall operations at Foster	subyearling	4000	12 mm
10/15/2023	Foster Head of Reservoir	Fall operations at Foster	subyearling	5000	12 mm
		North Santiam			
Spring 2023	Detroit Head of Reservoir, Breitenbush	Prior to beginning of spill	fry	7500	8 mm
Spring 2023	Detroit Head of Reservoir, North Santiam	Prior to beginning of spill	fry	7500	8 mm
10/1/2023	Big Cliff Tailrace	Prior to Detroit Reservoir reaching 1520 feet	subyearling	8000	12 mm
10/1/2023	Detroit Head of Reservoir, Breitenbush	Prior to Detroit Reservoir reaching 1520 feet	subyearling	5000	12 mm
10/1/2023	Detroit Head of Reservoir, North Santiam	Prior to Detroit Reservoir reaching 1520 feet	subyearling	5000	12 mm
11/15/2023	Big Cliff Tailrace	When Detroit reaches 1465 feet	subyearling	6000	12 mm
		2024			
		MF Willamette			
2/1/2024	Hills Creek Head of Reservoir	Prior to end of fall/winter RO operations	yearling	5000	12 mm
2/1/2024	Hills Creek Tailrace	Prior to end of fall/winter RO operations	yearling	3000	12 mm
2/1/2024	Hills Creek Forebay or Mid-Reservoir	Prior to end of fall/winter RO operations	yearling	5000	12 mm
2/28/2024	Fall Creek Head of Reservoir	Prior to beginning of refill	yearling	5000	12 mm
2/28/2024	Fall Creek Tailrace	Prior to beginning of refill	yearling	1000	12 mm
2/28/2024	Lookout Point Head of Reservoir	Prior to 30-day spill	yearling	5000	12 mm
2/28/2024	Dexter Tailrace	Prior to 30-day spill	yearling	2000	12 mm
2/28/2024	Lookout Point Forebay	Prior to 30-day spill	yearling	5000	12 mm
3/31/2024	Fall Creek Head of Reservoir	After refill is completed	yearling	5000	12 mm
3/31/2024	Fall Creek Tailrace	After refill is completed	yearling	1000	12 mm
4/1/2024	Lookout Point Head of Reservoir	After 30-day spill/beginning of nighttime spill	yearling	5000	12 mm
4/1/2024	Dexter Tailrace	After 30-day spill/beginning of nighttime spill	yearling	2000	12 mm

4/1/2024	Lookout Point Forebay	After 30-day spill/beginning of nighttime spill	yearling	5000	12 mm
		SF McKenzie			
2/28/2024	Cougar Forebay	Prior to beginning of spring drawdown	yearling	2000	12 mm
2/28/2024	Cougar Tailrace	Prior to beginning of spring drawdown	yearling	1000	12 mm
2/28/2024	Cougar Head of Reservoir	Prior to beginning of spring drawdown	yearling	2000	12 mm
3/30/2024	Cougar Forebay	After start of drawdown but prior to reaching 1520 feet	yearling	2000	12 mm
3/30/2024	Cougar Tailrace	After start of drawdown but prior to reaching 1520 feet	yearling	1000	12 mm
3/30/2024	Cougar Head of Reservoir	After start of drawdown but prior to reaching 1520 feet	yearling	2000	12 mm
		South Santiam			
4/1/2024	Green Peter Head of Reservoir, Middle Santiam	At the start of the first spring spill block	fry	2500	8 mm
4/1/2024	Green Peter Head of Reservoir, Quartzville Creek	At the start of the first spring spill block	fry	2500	8 mm
4/1/2024	Green Peter Tailrace	At the start of Green Peter spring spill	yearling	1000	12 mm
4/1/2024	Green Peter Reservoir - Forebay	At the start of Green Peter spring spill	yearling	2000	12 mm
4/1/2024	Green Peter Head of Reservoir, Middle Santiam	At the start of Green Peter spring spill	yearling	1000	12 mm
4/1/2024	Green Peter Head of Reservoir, Quartzville Creek	At the start of Green Peter spring spill	yearling	1000	12 mm
4/1/2024	Green Peter Reservoir, Mid-Reservoir	At the start of Green Peter spring spill	yearling	2000	12 mm
4/1/2024	Foster Tailrace	Prior to start of Foster refill	yearling	4000	12 mm
4/1/2024	Foster Head of Reservoir	Prior to start of Foster refill	yearling	5000	12 mm
4/20/2024	Foster Tailrace	Post refill operations	yearling	2000	12 mm
4/20/2024	Foster Head of Reservoir	Post refill operations	yearling	1000	12 mm
4/15/2024	Green Peter Head of Reservoir, Middle Santiam	At the start of the second spring spill block	fry	2500	8 mm
4/15/2024	Green Peter Head of Reservoir, Quartzville Creek	At the start of the second spring spill block	fry	2500	8 mm
8/30/2024	Foster Tailrace	Undefined - Late August	subyearling	1000	12 mm
8/30/2024	Foster Head of Reservoir	Undefined - Late August	subyearling	2000	12 mm
9/15/2024	Green Peter Head of Reservoir, Middle Santiam	Fall Operations at Green Peter	subyearling	2500	12 mm
9/15/2024	Green Peter Head of Reservoir, Quartzville Creek	Fall Operations at Green Peter	subyearling	2500	12 mm
10/15/2024	Green Peter Tailrace	Prior to Green Peter reaching 887 feet.	subyearling	4000	12 mm
10/15/2024	Green Peter Head of Reservoir, Middle Santiam	Prior to Green Peter reaching 887 feet.	subyearling	2500	12 mm
10/15/2024	Green Peter Head of Reservoir, Quartzville Creek	Prior to Green Peter reaching 887 feet.	subyearling	2500	12 mm
10/15/2024	Foster Tailrace	Fall operations at Foster	subyearling	4000	12 mm
10/15/2024	Foster Head of Reservoir	Fall operations at Foster	subyearling	5000	12 mm
		North Santiam			

2/1/2024	Detroit Head of Reservoir, North Santiam	Prior to start of Detroit refill	fry	3750	8 mm
2/1/2024	Detroit Head of Reservoir, Breitenbush	Prior to start of Detroit refill	fry	3750	8 mm
4/1/2024	Detroit Head of Reservoir, Breitenbush	Prior to start of Detroit spill	fry	3750	8 mm
4/1/2024	Detroit Head of Reservoir, North Santiam	Prior to start of Detroit spill	fry	3750	8 mm
4/1/2024	Big Cliff Tailrace	Prior to Detroit reaching 1541 feet (spillway crest elevation)	yearling	2000	12 mm
4/1/2024	Detroit Head of Reservoir, Breitenbush	Prior to Detroit reaching 1541 feet (spillway crest elevation)	yearling	2000	12 mm
4/1/2024	Detroit Head of Reservoir, North Santiam	Prior to Detroit reaching 1541 feet (spillway crest elevation)	yearling	2000	12 mm
10/1/2024	Big Cliff Tailrace	Prior to Detroit Reservoir reaching 1520 feet	subyearling	8000	12 mm
10/1/2024	Detroit Head of Reservoir, Breitenbush	Prior to Detroit Reservoir reaching 1520 feet	subyearling	5000	12 mm
10/1/2024	Detroit Head of Reservoir, North Santiam	Prior to Detroit Reservoir reaching 1520 feet	subyearling	5000	12 mm
11/15/2024	Big Cliff Tailrace	When Detroit reaches 1465 feet	subyearling	6000	12 mm
		2025			
		South Santiam			
4/1/2025	Green Peter Tailrace	At the start of Green Peter spring spill	yearling	1000	12 mm PIT
4/1/2025	Green Peter Reservoir - Forebay	At the start of Green Peter spring spill	yearling	2000	12 mm PIT
4/1/2025	Green Peter Head of Reservoir, Middle Santiam	At the start of Green Peter spring spill	yearling	1000	12 mm PIT
4/1/2025	Green Peter Head of Reservoir, Quartzville Creek	At the start of Green Peter spring spill	yearling	1000	12 mm PIT
4/1/2025	Green Peter Reservoir, Mid-Reservoir	At the start of Green Peter spring spill	yearling	2000	12 mm PIT
4/1/2025	Foster Tailrace	Prior to start of Foster refill	yearling	1000	12 mm PIT
4/1/2025	Foster Tailrace	Prior to start of Foster refill	yearling	4000	12 mm PIT
4/20/2025	Foster Head of Reservoir	Post refill operations	yearling	5000	12 mm PIT
4/20/2025	Foster Head of Reservoir	Post refill operations	yearling	2000	12 mm PIT
		North Santiam			
4/1/2025	Big Cliff Tailrace	Prior to Detroit reaching 1541 feet (spillway crest elevation)	yearling	2000	12 mm PIT
4/1/2025	Detroit Head of Reservoir, Breitenbush	Prior to Detroit reaching 1541 feet (spillway crest elevation)	yearling	2000	12 mm PIT
4/1/2025	Detroit Head of Reservoir, North Santiam	Prior to Detroit reaching 1541 feet (spillway crest elevation)	yearling	2000	12 mm PIT

Release Methods

Maps of release locations are provided in Figure 2-Figure 6. The method of release from the transport truck depended on the release location and reservoir elevation. When release locations were at boat ramps, the truck was backed down to the water's edge, where fish were then volitionally released from the tank by attaching 6" collapsible tube, 6" semi-rigid tube, or 3" semi-rigid tube to the sluice gate at the bottom of the tank. Prior to fish release, the tubes were filled with water to prevent fish injury. To ensure fish were fully flushed from the tube at the end of the release, buckets of release location water were used to flush the tube after the tank emptied. A generator and trash pump were also used occasionally to pump river water into the tank to assist in flushing fish from the tank. At roadside release locations, the same methods were used, however the truck was parked at the nearest road shoulder.

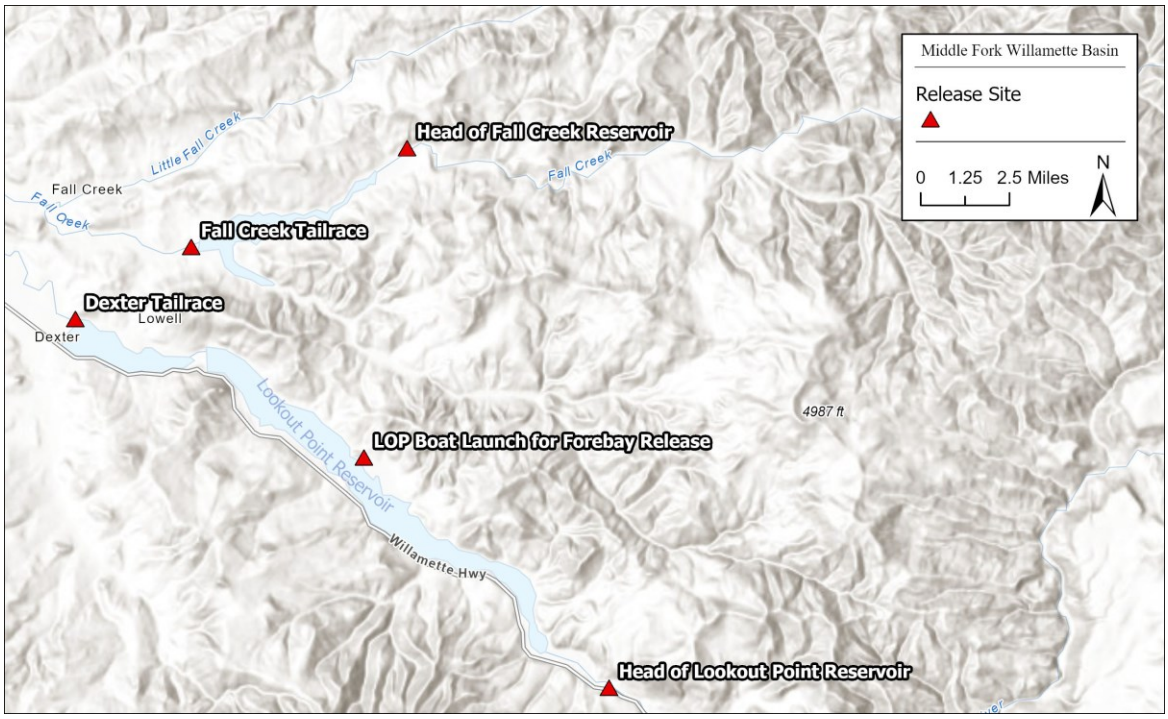

Figure 2. Map of Lookout Point, Dexter tailrace and Fall Creek release locations within the Middle Fork Willamette Basin. Head of Lookout Pt reservoir at Hampton Boat Launch (Black Canyon Campground as backup). Head of Fall Creek reservoir is at the location of the decommissioned boatramp approximately 800 meters below Dolly Varden Campground.

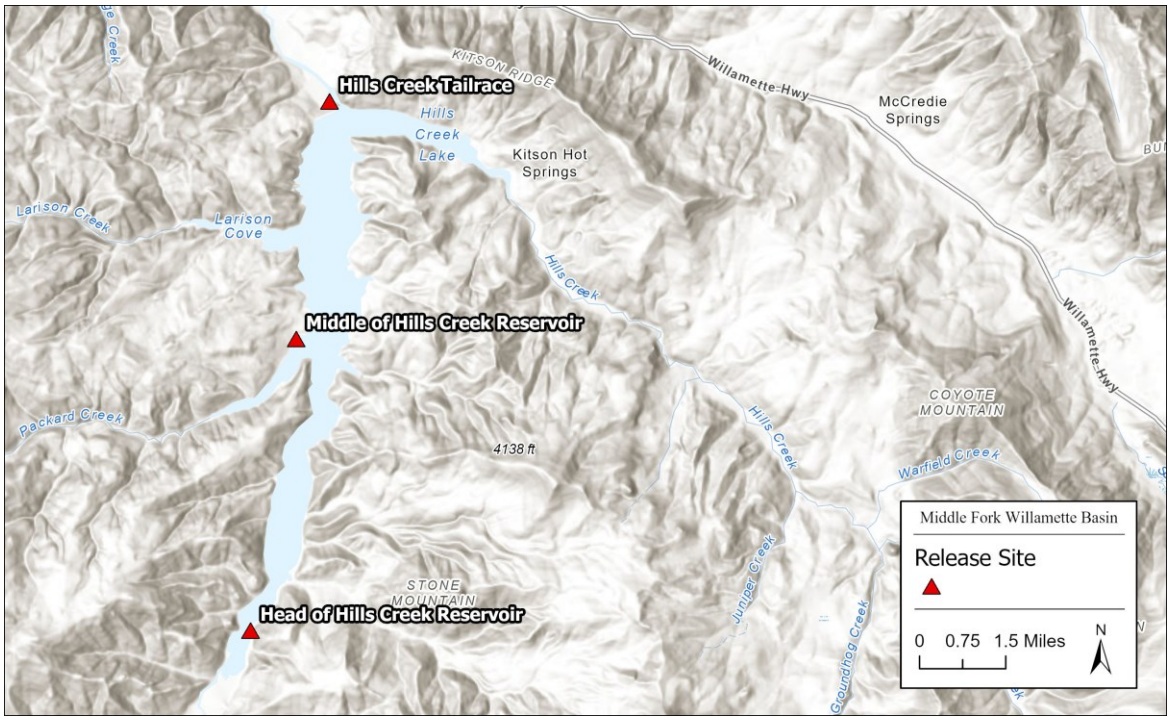

Figure 3. Map of Hills Creek Reservoir release locations within the Middle Fork Willamette Basin. The mid-reservoir release location occurs at Packard boat ramp. The Head of Reservoir release location occurs at the upper reservoir bridge crossing.

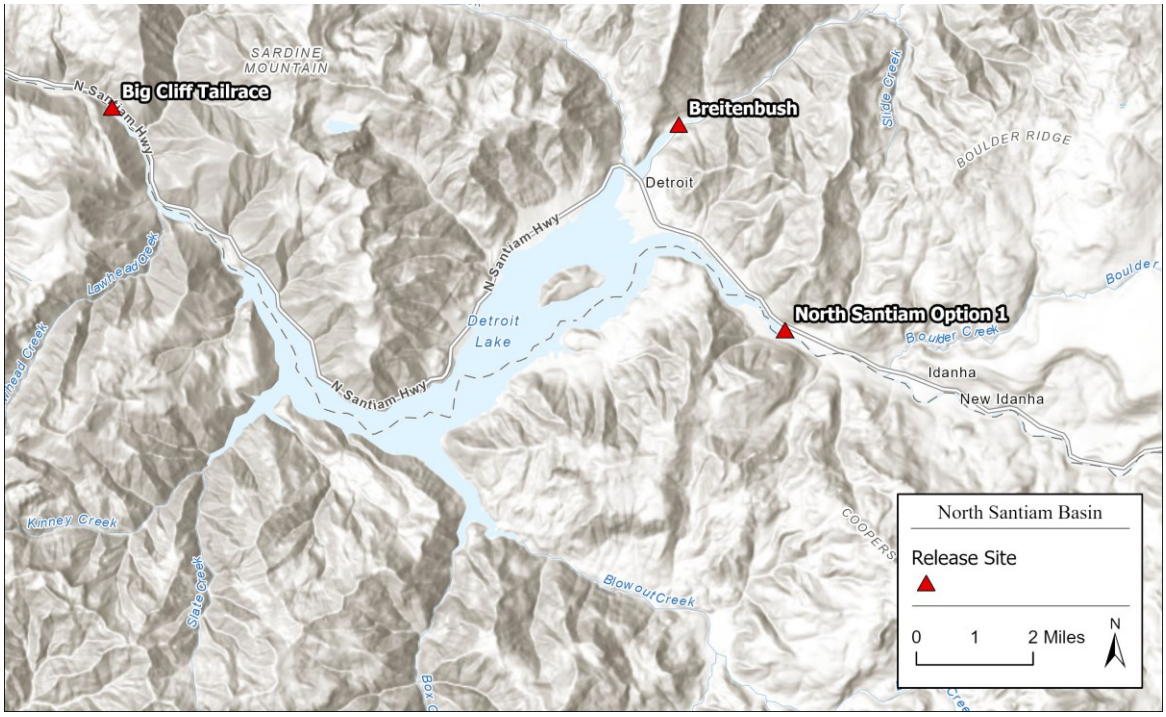

Figure 4. Map of release locations within the North Santiam Basin. The North Santiam Head of Reservoir release site is the Santiam Falls Campground or Hoover Campground. The Breitenbush release site is at the USGS gaging station.

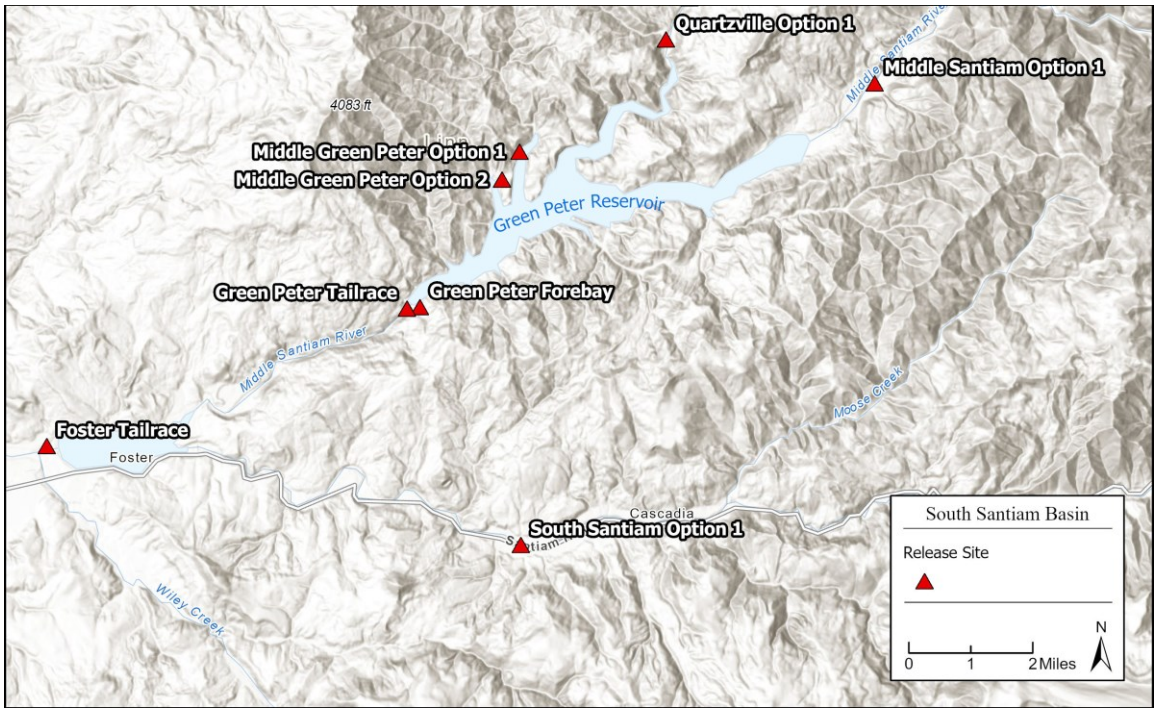

Figure 5. Map of release locations in the Middle/South Santiam basin including Green Peter Reservoir. Green Peter forebay releases are at Billings Park. Middle Santiam Head of Reservoir releases occur at the bridge crossing at the top of the reservoir. Quartzville Head of Reservoir releases occur at one of the multiple river access sites along the Quartzville Dr depending on conditions at the time of release. Whitcomb County Park and Thistle Creek boat ramp are alternate release locations.

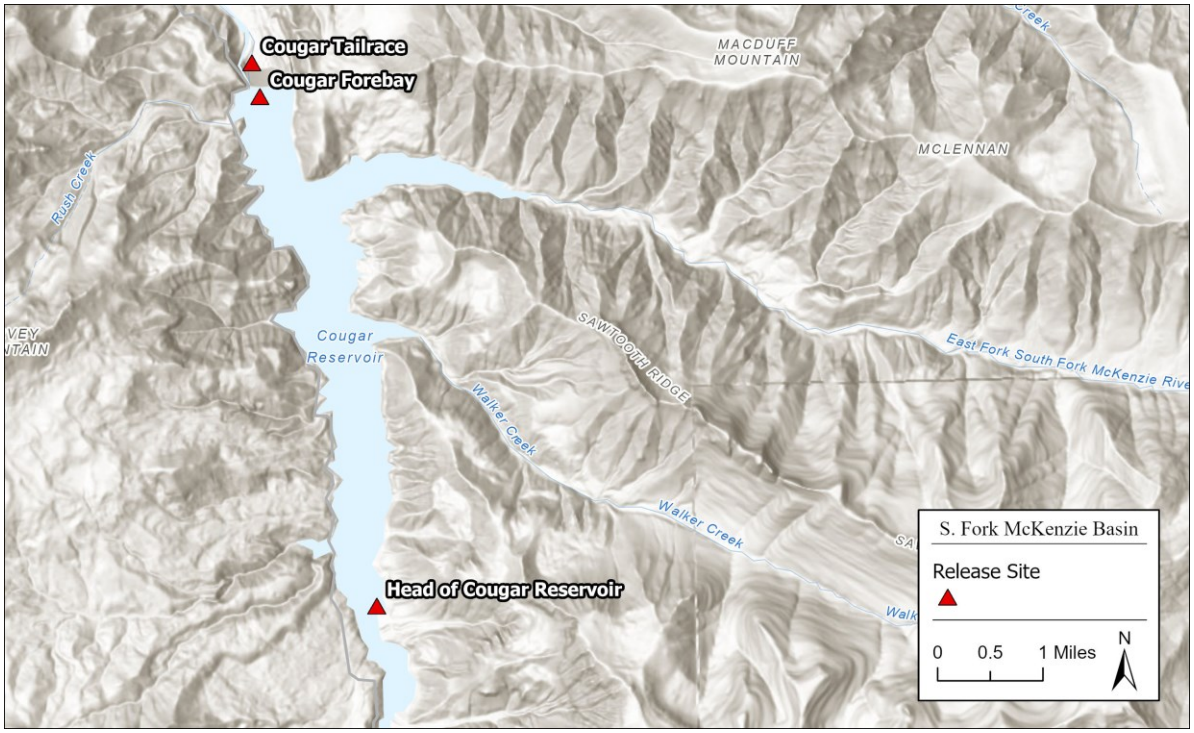

Figure 6. Map of release locations in Cougar Reservoir within the South Fork McKenzie basin. Cougar forebay releases occurred at the face of Cougar dam during drawdown periods as distances were too far for effective forebay releases elsewhere. Cougar Head of Reservoir releases were at Cougar Crossing or Slide Creek Day Use area.

Results: Bulk Marking Summary through 30 June 2024

Middle Fork Willamette

The initial objective in the Middle Fork Willamette basin was to PIT tag and release 116,000 brood year 2022 (22H) Middle Fork Willamette stock juvenile Chinook salmon during 2023 (Table 2). However, due to a surplus of brood year 2022 research fish in the Middle Fork, we were directed to tag and release an additional 51,000 fish. In total, we tagged and released 166,333 brood year 2022 juvenile Chinook salmon in the Middle Fork Willamette basin (Table 4). The mean tagging mortality rate observed was 0.44 percent, with a mean tag shed rate of 0.37 percent across all fish tagged in the Middle Fork Willamette during 2023 (Table 3). Poor broodstock returns in 2023 resulted in no brood year 2023 Middle Fork Willamette stock juveniles being available from ODFW for tagging and release in this study. A detailed overview of the specific releases in the Middle Fork Willamette basin is provided below.

Table 3. Bulk marking summary statistics. Total number of fish marked (N), mean fork length (FL), mean weight, start date of marking, end date of marking, total mortalities, mortality percentage, total shed tags, and shed tag percentage. For the "Bulk Groups", mortalities and tag shed statistics were calculated as the total number mortalities and sheds observed from Date Start through the end of 2023. For all other groups, mortalities and tag shed statistics were calculated as the total number of mortalities and shed observed from Date Start through when the fish were released. HOR denotes Head of Reservoir.

Mark Group	N	Mean FL (mm)	Mean Weight (g)	Date Start	Date End	Mort	Mort. %	Sheds	Shed %
Green Peter Head of Reservoir - Middle Santiam	5,071	56.2	NA	5/15/2023	5/16/2023	74	1.46	32	0.63
Green Peter Head of Reservoir - Quartzville Creek	5,203	58.5	NA	5/17/2023	5/18/2023	18	0.35	19	0.37
Lookout Point Head of Reservoir	10,041	63.1	2.9	5/22/2023	5/24/2023	39	0.39	53	0.53
Hills Creek Head of Reservoir	10,117	64.7	2.9	5/30/2023	6/1/2023	22	0.22	9	0.09
Fall Creek Head of Reservoir	10,040	67.4	3.2	6/1/2023	6/7/2023	68	0.68	30	0.3
Detroit Head of Reservoir Breitenbush Arm	7,530	66.9	3.6	6/13/2023	6/14/2023	82	1.09	24	0.32
Detroit Head of Reservoir - North Santiam Arm	7,528	66.9	3.6	6/14/2023	6/15/2023	83	1.10	25	0.32
Cougar Head of Reservoir	5,626	67.7	3.5	6/20/2023	6/20/2023	475	8.40	44	0.78
North Santiam – Fall 23 & Spring 24 Bulk Group	30,680	NA	NA	6/26/2023	7/20/2023	3,437	10.6	99	0.32
M.F. Willamette – Fall 23 & Spring 24 Bulk Group	85,233	NA	NA	7/26/2023	12/7/2023	380	0.45	340	0.40
South Santiam – Fall 23 &Spring 2024 Bulk Group	43,407	NA	NA	8/14/2023	12/20/2023	128	0.29	101	0.23
McKenzie– Fall 23 & Spring 24 Bulk Group	45,210	NA	NA	8/30/2023	2/14/2024	987	2.18	60	0.13
M.F. Willamette – Additional 51,000 Group	51,000	145.1	35.9	1/1/2024	1/31/2021	NA	NA	NA	NA
Green Peter Head of Reservoir	5,006	50.1	1.4	3/1/2024	3/3/2024	17	0.33	13	0.25
Green Peter Head of Reservoir	5,000	54.9	1.7	3/18/2024	3/19/2024	12	0.23	20	0.39
Detroit Head of Reservoir North Santiam Arm	7,500	46.7	1.2	5/13/2024	5/15/2024	58	0.77	70	0.93
Detroit Head of Reservoir Breitenbush Arm	7,500	46.7	1.2	5/15/2024	5/17/2024	58	0.77	63	0.84
South Santiam – Fall 24 and Spring 25 Bulk Group	13,885	NA	NA	6/26/2024	6/27/2024	TBD	TBD	TBD	TBD

Table 4. Releases of PIT-tagged juvenile Chinook salmon arranged by basin and release date. MFW – Middle Fork Willamette, MCK – McKenzie, SST – South Santiam, NST – North Santiam.

Basin	Release Location	Release Date	Brood Year	Lifestage	N	Mean FL (mm)	Mean Weight (g)
MFW	Hills Creek Head of Reservoir	5/18/2023	2022	Fry	509	55.8	1.9
	LOP Head of Reservoir - Black Canyon	5/30/2023	2022	Fry	9647	63.1	2.9
	Hills Creek Head of Reservoir	6/5/2023	2022	Fry	9784	64.7	2.8
	Fall Creek Head of Reservoir - Old Boat Ramp	6/12/2023	2022	Fry	9638	67.4	3.2
	LOP Head of Reservoir - Black Canyon	9/18/2023	2022	Subyearling	4998	122.9	23.8
	LOP Forebay - Signal Point	9/18/2023	2022	Subyearling	5002	128.3	25.1
	LOP Tailrace - Pengra	9/19/2023	2022	Subyearling	2011	128.4	25.2
	Fall Creek Head of Reservoir - Old Boat Ramp	9/28/2023	2022	Subyearling	5006	133.5	29.1
	Fall Creek Tailrace	9/28/2023	2022	Subyearling	1001	134.8	29.8
	Fall Creek Head of Reservoir - Old Boat Ramp	11/6/2023	2022	Subyearling	4999	139.4	32.2
	Fall Creek Tailrace	11/6/2023	2022	Subyearling	1000	134.9	30.2
	Hills Creek Head of Reservoir	11/7/2023	2022	Subyearling	4997	135.2	28.6
	Hills Creek Mid Reservoir - Packard Creek Boat Ramp	11/8/2023	2022	Subyearling	4998	145.3	36.9
	Hills Creek Dam Tailrace	11/9/2023	2022	Subyearling	2969	129.6	27
	LOP Head of Reservoir - Black Canyon	1/3/2024	2022	Yearling	4634	143.3	33.7
	LOP Head of Reservoir - Black Canyon	1/4/2024	2022	Yearling	4828	143.3	33.7
	LOP Head of Reservoir - Black Canyon	1/8/2024	2022	Yearling	3789	143.3	33.7
	LOP Head of Reservoir - Black Canyon	1/9/2024	2022	Yearling	5115	143.3	33.7
	LOP Head of Reservoir - Black Canyon	1/25/2024	2022	Yearling	7617	143.6	34.3
	Hills Creek Dam Tailrace	1/31/2024	2022	Yearling	24861	141.6	34.7
	Hills Creek Head of Reservoir	2/6/2024	2022	Yearling	4963	153.8	40.9
	Hills Creek Mid Reservoir - Packard Creek Boat Ramp	2/7/2024	2022	Yearling	5000	155.9	41.7
	Hills Creek Dam Tailrace	2/7/2024	2022	Yearling	2998	151.3	42.8
	Fall Creek Head of Reservoir - Old Boat Ramp	2/20/2024	2022	Yearling	4993	148.4	38.9
	Fall Creek Tailrace	2/20/2024	2022	Yearling	1002	150.5	39.9
	LOP Head of Reservoir - Black Canyon	2/28/2024	2022	Yearling	4994	141.5	34.2

Basin	Release Location	Release Date	Brood Year	Lifestage	N	Mean FL (mm)	Mean Weight (g)
	LOP Forebay - Signal Point	2/28/2024	2022	Yearling	4988	144.2	35.9
	LOP Tailrace - Pengra	2/29/2024	2022	Yearling	1998	149.7	39.2
	Fall Creek Head of Reservoir - Old Boat Ramp	4/2/2024	2022	Yearling	2500	146	37.1
	Fall Creek Head of Reservoir - Old Boat Ramp	4/3/2024	2022	Yearling	2497	154.6	43.2
	Fall Creek Tailrace	4/3/2024	2022	Yearling	999	159.5	44.5
	LOP Head of Reservoir - Black Canyon	4/9/2024	2022	Yearling	2499	150.9	41.2
	LOP Head of Reservoir - Black Canyon	4/9/2024	2022	Yearling	2499	150.9	41.2
	LOP Forebay - Signal Point	4/10/2024	2022	Yearling	2500	150.7	39.7
	LOP Forebay - Signal Point	4/11/2024	2022	Yearling	2500	150.7	39.7
	LOP Tailrace - Pengra	4/11/2024	2022	Yearling	2000	149	38.9
MCK	Cougar Head of Reservoir - Cougar Crossing Bridge	8/29/2023	2022	Fry	5198	67.9	3.6
	Cougar Head of Reservoir - Cougar Crossing Bridge	10/2/2023	2022	Subyearling	5005	117.2	18.9
	Cougar Head of Reservoir - Cougar Crossing Bridge	10/2/2023	2022	Subyearling	3006	116.7	19
	Cougar Head of Reservoir - Cougar Crossing Bridge	10/18/2023	2022	Subyearling	3977	118.4	19.8
	Cougar Forebay	10/18/2023	2022	Subyearling	5010	120.8	21
	Cougar Tailrace - USGS	10/19/2023	2022	Subyearling	4000	112.5	16.8
	Cougar Head of Reservoir - Cougar Crossing Bridge	11/13/2023	2022	Subyearling	3999	121.3	23
	Cougar Forebay	11/14/2023	2022	Subyearling	4995	124.6	23.8
	Cougar Tailrace - USGS	11/15/2023	2022	Subyearling	2411	120.1	21.5
	Cougar Head of Reservoir - Cougar Crossing Bridge	3/8/2024	2022	Yearling	4799	136.9	31
	Cougar Forebay	3/11/2024	2022	Yearling	4800	136.5	29.5
	Cougar Tailrace - USGS	3/11/2024	2022	Yearling	2081	129.5	25.4
SST	Green Peter Head of Reservoir - Quartzville Creek Arm	5/22/2023	2022	Fry	5171	58.5	NA
	Green Peter Head of Reservoir - Middle Santiam Arm	5/22/2023	2022	Fry	4961	56.2	NA
	Foster Tailrace - South Santiam Hatchery	8/23/2023	2022	Subyearling	1030	115.7	18.2
	Foster Reservoir Head of Reservoir	8/24/2023	2022	Subyearling	2059	105.6	14.5
	Green Peter Head of Reservoir - Quartzville Creek Arm	9/20/2023	2022	Subyearling	2518	113.5	19.5
	Green Peter Head of Reservoir - Middle Santiam Arm	9/21/2023	2022	Subyearling	2508	117.1	20.7

Basin	Release Location	Release Date	Brood Year	Lifestage	N	Mean FL (mm)	Mean Weight (g)
	Green Peter Head of Reservoir - Quartzville Creek Arm	10/3/2023	2022	Subyearling	2502	122.8	25.1
	Green Peter Head of Reservoir - Middle Santiam Arm	10/4/2023	2022	Subyearling	2516	119.6	23.8
	Green Peter Tailrace - Sunnyside Boat Ramp	10/9/2023	2022	Subyearling	4002	125.9	26.4
	Foster Reservoir Head of Reservoir	10/10/2023	2022	Subyearling	5000	125.8	24.5
	Foster Tailrace - South Santiam Hatchery	10/11/2023	2022	Subyearling	4000	135.2	31.8
	Green Peter Head of Reservoir - Middle Santiam Arm	2/21/2024	2022	Yearling	1004	164.4	51.6
	Green Peter Head of Reservoir - Quartzville Creek Arm	2/22/2024	2022	Yearling	1014	150.8	40.2
	Green Peter Mid Reservoir - Thistle Boat Ramp	2/22/2024	2022	Yearling	2006	153.8	42.9
	Green Peter Mid Reservoir - Thistle Boat Ramp	2/23/2024	2022	Yearling	2003	159.4	46.5
	Green Peter Tailrace - Sunnyside Boat Ramp	2/23/2024	2022	Yearling	1014	163.4	50.1
	Green Peter Head of Reservoir - Middle Santiam Arm	3/6/2024	2023	Fry	2506	50.1	1.4
	Green Peter Head of Reservoir - Quartzville Creek Arm	3/6/2024	2023	Fry	2500	51.3	1.4
	Foster Reservoir Head of Reservoir	3/26/2024	2022	Yearling	2997	156.3	44.1
	Foster Reservoir Head of Reservoir	3/27/2024	2022	Yearling	3001	145.3	38
	Foster Tailrace - South Santiam Hatchery	3/28/2024	2022	Yearling	3005	154.6	43.8
	Foster Tailrace - South Santiam Hatchery	4/1/2024	2022	Yearling	2991	156	44.3
	Green Peter Head of Reservoir - Middle Santiam Arm	4/12/2024	2023	Fry	2350	52.4	1.5
	Green Peter Head of Reservoir - Quartzville Creek Arm	4/12/2024	2023	Fry	2500	54.9	1.7
NST	Marion Forks Hatchery Escape	6/16/2023	2022	Fry	1247	66.5	3.4
	Detroit Head of Reservoir - Breitenbush River	7/13/2023	2022	Fry	7000	66.8	3.6
	Detroit Head of Reservoir - North Santiam River	7/13/2023	2022	Fry	6638	67	3.6
	Detroit Head of Reservoir - Breitenbush River	9/26/2023	2022	Subyearling	5002	106.5	11.8
	Detroit Head of Reservoir - North Santiam River	9/26/2023	2022	Subyearling	4997	102.6	10.4
	Big Cliff Tailrace - Packsaddle Boat Ramp	9/27/2023	2022	Subyearling	8009	106.5	11.9
	Big Cliff Tailrace - Packsaddle Boat Ramp	11/20/2023	2022	Subyearling	5998	112.4	16.6
	Detroit Head of Reservoir - North Santiam River	3/20/2024	2022	Yearling	2000	128.4	25.5
	Detroit Head of Reservoir - Breitenbush River	3/21/2024	2022	Yearling	2000	124	21.3
	Big Cliff Tailrace - Packsaddle Boat Ramp	3/21/2024	2022	Yearling	1998	129.4	24.1

Basin	Release Location	Release Date	Brood Year	Lifestage	N	Mean FL (mm)	Mean Weight (g)
	Detroit Head of Reservoir - North Santiam River	5/20/2024	2023	Fry	7533	47	1.2
	Detroit Head of Reservoir - Breitenbush River	5/20/2024	2023	Fry	7494	47	1.2

Hills Creek Dam

The first release of PIT tagged juvenile Chinook salmon into the Hills Creek Dam project area occurred on May 30, 2023, with the release of 9,784 fry at the head of the reservoir (Table 4; Figure 3). This release was intended to coincide with the run-of-river fry migration and to help inform how regulating outlet operations at Hills Creek Dam affect downstream movement patterns. The fish had a mean fork length of 67 mm and a mean weight of three grams.

The next releases targeted fall and winter regulating outlet operations at Hills Creek Dam. These releases took place over three days between November 7, 2023, and November 9, 2023, with 5,000 subyearlings released at the head of the reservoir (mean FL = 133 mm), 4,999 at mid-reservoir (mean FL = 145 mm), and 2,999 into the Hills Creek Dam tailrace (mean FL = 129 mm).

The subsequent release consisted of 24,861 surplus brood year 2022 Middle Fork Willamette stock research fish. These yearling Chinook salmon were released into the tailrace of Hills Creek between January 31, 2024, and February 1, 2024. This group of fish had an average fork length of 141.6 mm and an average weight of 34.7 grams.

The final group of tagged juvenile Chinook salmon released into the Hills Creek project area on February 6 and February 7, 2024, targeted the end of fall regulating outlet operations and consisted of a total of 12,961 PIT-tagged fish. Of these, 4,963 were released at the head of the reservoir, 5,000 were released mid-reservoir at the Packard Creek boat ramp, and 2,998 were released into the tailrace. These fish had an average fork length of 153.7 mm and an average weight of 42 grams.

Lookout Point and Dexter Dams

The first release of PIT tagged juvenile Chinook salmon into the Lookout Point Dam project area occurred on May 30, 2023 with the release of 9,647 fish at the head of reservoir (Table 4; Figure 2). This release was intended to target spring spill operations at Lookout Point Dam. These fish had a mean fork length of 63 millimeters and a mean weight of three grams.

The next set of PIT tagged juvenile Chinook salmon releases were intended to target the fall deep drawdown of Lookout Point Reservoir. These releases took place on September 18th and September 19th, 2023. We released a total of 4,998 fish into the head of reservoir, 5,002 fish into the forebay, and 2,011 fish into Dexter Dam's tailrace. The mean fork length of fish released at head of reservoir (123 mm) was slightly smaller than that the fork length of the fish released into the forebay (128 mm) and the tailrace of Dexter (128 mm). Similarly, fish released at the head of reservoir were on average two grams lighter than those released at the forebay and tailrace.

Between January 3 and January 25, 2024, a series of releases occurred at Lookout Point Reservoir comprising surplus study fish without a specific dam operations target. These releases aimed to disperse the fish throughout Lookout Point Reservoir to facilitate the Reservoir Distribution study. On January 3, 4,634 yearlings were released (mean FL = 143.3 mm; mean weight = 33.7 g). Subsequent releases included 4,828 yearlings on January 4 (mean FL = 143.3 mm; mean weight = 33.7 g), 3,789 yearlings on January 8 (mean FL = 143.3 mm; mean weight = 33.7 g), 5,115 yearlings on January 9 (mean FL = 143.3 mm; mean weight = 33.7 g), and 7,617 yearlings on January 25 (mean FL = 143.6 mm; mean weight = 34.3 g).

The next release targeted a 30-day period of spill at Lookout Point Dam. On February 28, 2024, 4,994 yearlings were released at the head of the reservoir (mean FL = 141.5 mm; mean weight = 34.2 g), and 4,988 yearlings

were released at Signal Point in the forebay (mean FL = 144.2 mm; mean weight = 35.9 g). This release aimed to study how the spill operations affect the movement and behavior of juvenile Chinook salmon in the reservoir.

The second set of releases in April targeted the beginning of nighttime spill at Lookout Point Dam. On April 9, 2024, 2,499 yearlings were released at the head of the reservoir (mean FL = 150.9 mm; mean weight = 41.2 g). The same day, another 2,499 yearlings were released at Signal Point in the forebay (mean FL = 150.9 mm; mean weight = 41.2 g). On April 10, an additional 2,500 yearlings were released at Signal Point in the forebay (mean FL = 150.7 mm; mean weight = 39.7 g). The final release occurred on April 11, with 2,500 yearlings at Signal Point in the forebay (mean FL = 150.7 mm; mean weight = 39.7 g) and 2,000 yearlings in the tailrace at Pengra (mean FL = 149 mm; mean weight = 38.9 g). These releases were intended to observe the impacts of nighttime spill operations on the distribution and behavior of the fish.

Fall Creek Dam

The first release of PIT-tagged juvenile Chinook salmon into the Fall Creek Dam project area took place on June 12, 2023, with the release of 9,649 fry at the head of the reservoir (Table 4; Figure 2). Our objective was to release these fish prior to the forebay water elevation reaching 728 feet above mean sea level. The forebay elevation was approximately 750 feet above mean sea level on the day of release. The fish had a mean length of 67 millimeters and a mean weight of 3 grams. They were released at the site of the decommissioned boat ramp, approximately 800 meters downstream of Dolly Varden Campground (the location of the historic rotary screw trap).

The next PIT-tag releases into Fall Creek occurred in the fall and were intended to target the fall deep drawdown of Fall Creek Reservoir. The first of these fall releases took place on September 28, 2023, consisting of 5,006 subyearlings released at the head of Fall Creek Reservoir and 1,001 fish released into the Fall Creek Dam tailrace. These groups of fish had a mean length of 134 millimeters and a mean weight of 29.4 grams. The final fall releases designed to evaluate the fall deep drawdown took place on November 6, 2023. Once again, 5,000 fish were released at the head of Fall Creek Reservoir and 1,000 fish were released into the Fall Creek Dam tailrace. These fish had average fork lengths of 137 millimeters and average weights of 31.1 grams.

The first release of PIT-tagged juvenile Chinook salmon into the Fall Creek project area in 2024 occurred on February 20, targeting pre-refill conditions at Fall Creek Reservoir. A total of 4,993 yearlings were released at the head of the reservoir (mean FL = 148.4 mm; mean weight = 38.9 g), and an additional 1,002 yearlings were released into the tailrace (mean FL = 150.5 mm; mean weight = 39.9 g). The second release group in 2024 targeted post-refill conditions at Fall Creek Reservoir and was released across two days on April 2 and April 3, 2024. On April 2, 2,500 yearlings were released at the head of the reservoir (mean FL = 146 mm; mean weight = 37.1 g). The following day, another 2,497 yearlings were released at the head of the reservoir (mean FL = 154.6 mm; mean weight = 43.2 g), and 999 yearlings were released into the tailrace (mean FL = 159.5 mm; mean weight = 44.5 g).

South Fork McKenzie

The objective in the South Fork McKenzie River basin was to PIT tag and release a total of 49,000 juvenile Chinook salmon (brood year 2022, McKenzie River stock 23H) during 2023 and the Spring of 2024 (Table 2). A total of 49,281 PIT-tagged juvenile Chinook salmon from brood year 2022 were released (Table 4, Figure 6). Tagging mortality rates ranged from 2.18% to 8.4%, and tag shed rates ranged from 0.13% to 0.78% across all groups of tagged juveniles (Table 3). Due to low returns of adult Chinook salmon to the McKenzie River in 2023, there were insufficient broodstock available from ODFW to produce juvenile Chinook salmon for the project.

The juvenile Chinook salmon that were reared at Leaburg Hatchery were subject to various pathogen outbreaks during the summer and fall of 2023. We started PIT tagging juvenile Chinook salmon at Leaburg Hatchery on June 20, 2023, aiming to tag 10,000 fish. However, on the first day, we noted high mortality rates among both tagged fish and those waiting in the staging trough. Of the 3,553 salmon tagged that day, 93 died by day's end, a rate of 2.3%. This rate was alarming to our crew, as we had been averaging a tagging mortality rate of less than 1 percent up to that point in the project. Also surprising was the discovery of several dead fish in the staging trough (i.e., fish that had not been tagged or handled yet), a situation we had not observed to this extent in the staging area earlier in the year. By this date, our crews were highly experienced, water temperatures were averaging 10.4 degrees Celsius, and we had been using the same stock solution of anesthesia that had resulted in low mortality rates in the weeks prior. The hatchery manager informed us that pathogen outbreaks, particularly Proliferative Kidney Disease (PKD), had been common at Leaburg in recent years. Consequently, we halted our tagging activities and contacted the state pathologist, Dr. Aimee Reed. Throughout the summer and into the fall, the juvenile Chinook salmon at Leaburg underwent various treatments by ODFW staff under the guidance of the state pathologist. Pathogens continued to be an issue at Leaburg well into the fall and are the likely cause of the relatively high mortality rates of our tagged fish in this basin. An overview of the specific releases that occurred in the South Fork McKenzie basin are detailed below.

Cougar Dam

The first release of PIT-tagged juvenile Chinook salmon into the Cougar Dam project area occurred on August 29, 2023, with the release of 5,198 fish at the head of Cougar Reservoir. The intended release target for this group was 10,000 fish, to be released prior to the start of the spring drawdown of Cougar Reservoir, which commenced in early March. However, the release window was missed because the project was awarded later in the year than originally anticipated, and the release number was not met due to adverse fish health conditions. Our goal was to release this group in late June or early July, but various pathogen outbreaks at Leaburg Hatchery, where the fish were being held, prevented this. This group had an average fork length of 67.9 millimeters and an average weight of 4 grams at the time of marking, but a subset was not handled and measured prior to release, so lengths and weights for this release group are not presented. This group of fish was released upstream of the rotary screw trap operated by Environmental Assessment Services. All subsequent releases at the head of Cougar Reservoir took place below the Cougar Crossing Bridge.

The next release in the Cougar Dam project area took place on October 2, 2023, when a total of 8,011 subyearling Chinook salmon were released at the head of Cougar Reservoir. The size of this release group was impacted by the pathogen outbreaks; the original intent was to release a group of 3,000 fish. However, to compensate for the 5,000 fish shortfall in the previous release, the decision was made to increase the release size to approximately 8,000. This release group was designed to target the beginning of the fall drawdown of Cougar Reservoir, which commenced on October 1, 2023. Fish in this release group had a mean fork length of 117 millimeters and a mean weight of 19 grams.

The subsequent release took place on October 18 and October 19, 2023, with the release of 3,979 subyearlings at the head of Cougar Reservoir (mean FL = 118 mm; mean weight = 20 g), 5,010 into the Cougar Dam forebay (mean FL = 121 mm; mean weight = 21 g), and 3,997 into the tailrace of Cougar Dam (mean FL = 113 mm; mean weight = 17 g). The objective was to release this group of fish prior to the Cougar Dam forebay reaching an elevation of 1505 feet, targeting reservoir conditions mid-way through the fall drawdown. The forebay elevation averaged 1563 feet above mean sea level during the releases. Cougar's forebay eventually reached 1505 feet on November 3, 2023.

The final group of subyearlings was released over three days between November 13 and November 15, 2023. This release group was designed to target fall regulating outlet operations at Cougar Dam. We released 3,999 fish at the head of Cougar Reservoir (mean FL = 121.3 mm; mean weight = 23 g), 4,995 fish into the Cougar forebay (mean FL = 124.6 mm; mean weight = 24 g), and 2,412 into the Cougar Dam tailrace (mean FL = 120.1 mm; mean weight = 21.5 g). The tailrace release was scheduled for 4,000 fish; however, disease outbreaks and subsequent mortality among the tagged fish left us short of our target.

The final two release groups of McKenzie stock brood year 2022 juvenile Chinook salmon consisted of yearlings. The first group was intended to be released prior to the beginning of the spring drawdown, and the second group was intended to be released before the reservoir forebay reached an elevation of 1520 feet. The original anticipated date for the spring drawdown was February 28, while the anticipated date for reaching 1520 feet was March 30. The spring drawdown began on February 1, and the elevation target was reached on March 1. Unaware of the dam operation schedule shift by one month, we did not release these fish until early March. We released 4,799 yearlings at the head of Cougar Reservoir on March 8, 2024; 4,800 in the forebay and 2,081 into the tailrace on March 11 (we were further delayed due to having to clear logs blocking the forebay boat ramp). These yearlings had a mean fork length of 134.3 mm and a mean weight of 28.6 grams.

South Santiam

The objective in the South Santiam River basin was to PIT tag and release 55,000 brood year 2022 South Santiam stock (24H) juvenile Chinook salmon during 2023 (Table 2). We successfully tagged and released 55,302 brood year 2022 South Santiam stock fish (Table 4) during 2023 and early 2024. The mean tagging mortality rate was 0.41%, and the mean tag shed rate was 0.28% across all brood year 2022 fish tagged for the South Santiam basin. Additionally, we have tagged and released 9,856 brood year 2023 fry to date, with a total of 36,000 brood year 2023 juvenile Chinook salmon planned for tagging and release in the South Santiam basin for this project. An overview of the specific releases that occurred in the South Santiam basin is detailed below.

Green Peter Dam

The first release of PIT-tagged juvenile Chinook salmon into the Green Peter Dam project area took place on May 22, 2023. A total of 10,132 fry were released into the head of the reservoir, split between the Quartzville Creek arm (n = 5,171) and the Middle Santiam arm (n = 4,961) of Green Peter Reservoir (Table 4; Figure 5). This release targeted surface spill operations at Green Peter Dam. Both groups of fish had a mean fork length of 58 millimeters. Weights are not presented for these release groups because the small size of the fish resulted in unreliable weight estimates. Water temperature at the release sites averaged 18 degrees Celsius.

Subsequent releases occurred on September 20 and 21, 2023. During this period, a group of 5,026 subyearlings was split between the Quartzville and Middle Santiam arms at the head of the reservoir. This release group targeted the beginning of the fall deep drawdown of Green Peter Reservoir. Fish released into the Quartzville Creek arm (n = 2,518) had a mean fork length of 114 millimeters and a mean weight of 20 grams, while the group of fish released into the Middle Santiam arm (n = 2,508) had a mean fork length of 117 millimeters and a mean weight of 21 grams. Release temperature was slightly warmer in the Quartzville Creek arm at 14.8 degrees Celsius versus 12.5 degrees in the Middle Santiam arm.

In early October 2023, the final release of PIT-tagged subyearlings targeting the Green Peter Dam project took place. On October 3 and 4, releases were made at the head of the reservoir, followed by an additional release into the Green Peter tailrace on October 9. These groups targeted conditions experienced by fish midway through the fall deep drawdown of Green Peter Reservoir. The head of the reservoir release was split between the Quartzville Creek arm (n = 2,502) and the Middle Santiam arm (n = 2,516). The Quartzville Creek group

had a mean fork length of 123 millimeters, a mean weight of 25 grams, and were released into water that was 12.5 degrees Celsius. The Middle Santiam group had a mean fork length of 120 millimeters, a mean weight of 24 grams, and were released into water that was 13.3 degrees Celsius. A total of 4,002 PIT-tagged fish with a mean fork length of 126 millimeters and a mean weight of 26 grams were released into the Green Peter Tailrace.

In February 2024, the first set of PIT-tagged juvenile Chinook salmon releases into Green Peter Reservoir targeted the start of the first spring spill block at Green Peter Dam. On February 21, 1,004 yearlings were released at the head of the reservoir in the Middle Santiam Arm (mean FL = 164.4 mm; mean weight = 51.6 g). The following day, February 22, saw the release of 1,014 yearlings at the head of the reservoir in the Quartzville Creek Arm (mean FL = 150.8 mm; mean weight = 40.2 g), and 2,006 yearlings at the Thistle Boat Ramp in the mid-reservoir area (mean FL = 153.8 mm; mean weight = 42.9 g). On February 23, another 2,003 yearlings were released at the Thistle Boat Ramp (mean FL = 159.4 mm; mean weight = 46.5 g), and 1,014 yearlings were released at the Sunnyside Boat Ramp in the tailrace (mean FL = 163.4 mm; mean weight = 50.1 g).

March 6, 2024, marked the release of the first group of fry targeting the first spring spill block at Green Peter Dam. A total of 2,506 brood year 2023 fry were released at the head of the reservoir in the Middle Santiam Arm (mean FL = 50.1 mm; mean weight = 1.4 g), and 2,500 fry were released at the head of the reservoir in the Quartzville Creek Arm (mean FL = 51.3 mm; mean weight = 1.4 g). On April 12, 2024, the second group of fry targeting the second spring spill block at Green Peter Dam was released. This included 2,350 fry released at the head of the reservoir in the Middle Santiam Arm (mean FL = 52.4 mm; mean weight = 1.5 g), and 2,500 fry released at the head of the reservoir in the Quartzville Creek Arm (mean FL = 54.9 mm; mean weight = 1.7 g).

Foster Dam

The first release of PIT-tagged juvenile Chinook salmon into the Foster Dam project area took place on August 23 and August 24, 2023. A total of 1,030 subyearlings were released into the Foster Dam tailrace, and 2,059 subyearlings were released into the head of Foster Reservoir (Table 4; Figure 5). These releases aimed to assess fish response to the initiation of fall drafting of the reservoir. The fish released into the tailrace had an average fork length and weight of 116 millimeters and 18 grams, while the fish released at the head of the reservoir had an average fork length of 106 millimeters and 15 grams.

The final release of subyearlings into the Foster Dam project occurred on October 10 and October 11, 2023. This release was designed to target fall dam operations, specifically nighttime spillway operations, at the Foster project. Tagged subyearlings were released at the head of the reservoir (n = 5,000) and into the tailrace (n = 4,000). The average fork length of fish released at the head of the reservoir was 126 millimeters and the average weight was 26 grams. The group of fish released into the tailrace had an average length of 135 millimeters and an average weight of 32 grams.

Between March 26 and April 1, 2024, a series of releases took place at Foster Dam targeting conditions prior to the spring refill. On March 26, 2,997 yearlings were released at the head of the reservoir (mean FL = 156.3 mm; mean weight = 44.1 g). The following day, March 27, saw the release of 3,001 yearlings at the head of the reservoir (mean FL = 145.3 mm; mean weight = 38 g). On March 28, 3,005 yearlings were released into the tailrace at the South Santiam Hatchery (mean FL = 154.6 mm; mean weight = 43.8 g).

North Santiam River

The first objective in the North Santiam River basin was to PIT tag and release a total of 45,000 brood year 2022 North Santiam stock (21H) juvenile Chinook salmon (Table 2). We tagged and released a total of 44,889 PIT-tagged brood year 2022 juveniles (BY2022; Table 4). We observed a mean tagging mortality rate of 7.5% and a mean tag shed rate of 0.32% across all BY2022 fish tagged for the North Santiam basin. Additionally, we have tagged and released 15,027 brood year 2023 (BY2023) fry to date, out of a total of 45,000 BY2023 juvenile Chinook salmon slated for tagging and release in the North Santiam basin for this project. Mean tagging mortality was 0.77% and the mean tag shed rate was 0.85% for the BY2023 fry.

The alarming mortality rate among brood year 2022 fish was due to an outbreak of furunculosis at Marion Forks Hatchery. Tagging for fall releases began in late June 2023. During the week of June 26, 2023, a total of 15,195 BY 2022 Chinook salmon were PIT tagged and adipose clipped by Cramer Fish Sciences staff. The tagged fish were held for recovery in indoor troughs for 2 days without feeding. On the 3rd day, they were transferred to an outdoor pond, C-10, where they were to rear until their release in the fall of 2023 or spring of 2024. Feeding resumed once they were ponded. Water temperatures were closely monitored during tagging and recorded hourly, with a maximum observed temperature of 15.2 degrees Celsius.

Of the 15,195 BY2022 Chinook salmon tagged, there were a total of 2,809 mortalities (approximately 18%) when hatchery staff arrived at work on July 3, 2023. Fearing that we might have inadvertently brought a pathogen from Leaburg, we immediately halted operations, contacted state pathology (Dr. Sarah Bjork), and disinfected all our equipment. On July 5, 2023, Dr. Sarah Bjork, ODFW Fish Health Specialist, visited Marion Forks Hatchery to examine the mortalities and take samples for culturing. Her initial suspicion was confirmed on July 7, 2023, when bacteria cultures revealed the presence of furunculosis, a pathogen previously found at Marion Forks Hatchery that typically emerges at around 12-14 degrees Celsius. Dr. Bjork recommended medicated feed for the fish. Once treated, mortality rates returned to normal, and we were able to resume tagging. We estimate that the furunculosis outbreak led to well over 3,000 mortalities.

Detroit and Big Cliff Dams

The first release of PIT tagged juvenile Chinook salmon into the Detroit-Big Cliff project area took place on July 13, 2023 with the release of a total of 13,638 BY22 fry at the head of Detroit Reservoir (Table 4; Figure 4). The original size of the release group was intended to be approximately 15,000 fish; however, we estimate that 1,247 escaped their indoor holding troughs, presumably into the effluent. The effluent from the holding troughs drains to Horn Creek approximately 100 meters upstream of the confluence with the North Santiam River around river kilometer 121. We cannot be certain of when these fish escaped into the North Santiam but we know that it had to be between June 15th (completion of tagging) and July 13th. This group of fish had an intended release target of any time prior to the start of Detroit Reservoir refill in the spring, however, due to the project's late start, that release window was missed. Furthermore, we had intended to release this group of fish on July 3, 2023 but had to hold them under observation due to the outbreak of furunculosis. The eventual release of 13,638 fish on July 13th was split between the Breitenbush River (n = 7,000) and the North Santiam River (n = 6,638). These fish all had average fork lengths of 67 millimeters and average weights of 3.6 grams.

The next release took place between September 26th and September 27th, 2023. The intended release target was prior to Detroit Reservoir reaching a forebay elevation of 1520 feet, we missed this target by six days for the head of reservoir releases (1515 feet) and by seven days for tailrace release (1514.5 feet). We released 5,002 tagged subyearlings into the Breitenbush River (mean FL = 107 mm; mean weight = 12 g), 4,997 into the North Santiam River (mean FL = 103 mm; mean weight = 10 g), and 8,009 into the tailrace of Big Cliff Dam (mean FL = 107 mm; mean weight = 12 g).

The final release of brood year 2022 subyearlings into the greater Detroit-Big Cliff project area occurred on November 20, 2023 with the release of 5,998 fish into Big Cliff Dam's tailrace. The intended release target for this group was when Detroit Reservoir forebay elevation reached 1465 feet above mean sea level. Detroit's forebay was at approximately 1478 feet on the day of release and would be at 1465 feet by November 26th, 2023. This group of fish had a mean fork length of 112 millimeters and a mean weight of 17 grams.

The first release of North Santiam stock juvenile Chinook salmon in 2024 targeted spring spill operations at Detroit Dam. On March 20, 2024, 2,000 BY2022 yearlings were released at the head of the reservoir in the North Santiam River (mean FL = 128.4 mm; mean weight = 25.5 g). The following day, 2,000 BY 2022 yearlings were released at the head of the reservoir in the Breitenbush River (mean FL = 124 mm; mean weight = 21.3 g). Additionally, 1,998 BY2022 yearlings were released into the Big Cliff Tailrace at the Packsaddle Boat Ramp (mean FL = 129.4 mm; mean weight = 24.1 g).

The most recent set of releases for the North Santiam basin involved BY2023 fry that were released as soon as they were large enough to tag with 8mm tags (45mm). On May 20, 2024, 7,533 fry were released at the head of the reservoir in the North Santiam River (mean FL = 47 mm; mean weight = 1.2 g). On the same day, 7,494 fry were released at the head of the reservoir in the Breitenbush River (mean FL = 47 mm; mean weight = 1.2 g). These releases aimed to study the early-life stage movements and survival rates of the fry as they pass through the Detroit – Big Cliff complex.

Recaptures

A total of 5,011 recaptures, recoveries, or observations of PIT tagged fish from this study have been reported to PTAGIS (Table 5). The most significant number of detections, 2,223, have occurred at Cougar Dam via screw trap. Other notable detection counts include 647 at Fall Creek Dam, 308 at Hills Creek Dam, and 203 at Lookout Point Dam, all recaptured using screw traps. The PIT tag antennas at Lebanon Dam (LD1, LD2, LD3, and LD4) on the South Santiam River collectively accounted for 324 detections. Detection counts at other locations include 118 at Green Peter Dam, 93 at Dexter Dam, and 78 at Big Cliff Dam, all via screw traps. In the Columbia River Estuary, 208 fish were detected by the TWX towed array, 201 at PD6 (rkm 68), 140 at PD5 (rkm 62), 83 at PD7 (rkm 70), and 62 at PD8 (rkm 82). The Sauvie Island Dairy Creek (SID) passive detection system recorded 24 observations. Figure 7 illustrates the location of each observation site, providing a comprehensive visual representation of the PIT tag recapture and detection locations. Table 5 presents a detailed summary of PIT tag redetections, showcasing the diverse range of observation locations and capture methods that have detected PIT tags from this study to date.

Table 5. PIT tag recaptures by release basin, observation location, and detection method.

Basin	Observation Location	Detection Method	Recaptures
MFW	Middle Fork Willamette River – Above Hills Creek	Screw Trap	41
MFW	Hills Creek Dam	Screw Trap	308
MFW	Middle Fork Willamette River – Above Lookout Point	Screw Trap	1
MFW	Lookout Point Reservoir	Research Net	9
MFW	Lookout Point Dam	Screw Trap	203
MFW	Dexter Dam	Screw Trap	93
MFW	Fall Creek Dam	Screw Trap	647
MFW	PD8 - Columbia River Estuary rkm 82	Instream Array	21
MFW	TWX - Estuary Towed Array (Exp.)	Towed Array	74

MFW	PD7 - Columbia River Estuary rkm 70	Instream Array	40
MFW	PD6 - Columbia River Estuary rkm 68	Instream Array	87
MFW	PD5 - Columbia River Estuary rkm 62	Instream Array	41
MCK	South Fork McKenzie River – Above Cougar	Screw Trap	133
MCK	Cougar Dam	Screw Trap	2223
MCK	SID - Sauvie Island Dairy Creek	Instream Array	2
MCK	PD8 - Columbia River Estuary rkm 82	Instream Array	6
MCK	TWX - Estuary Towed Array (Exp.)	Towed Array	12
MCK	PD7 - Columbia River Estuary rkm 70	Instream Array	9
MCK	PD6 - Columbia River Estuary rkm 68	Instream Array	24
MCK	PD5 - Columbia River Estuary rkm 62	Instream Array	15
SST	Middle Santiam River – Above Green Peter	Screw Trap	50
SST	Green Peter Reservoir	Research Net	7
SST	South Santiam River – Above Foster	Screw Trap	26
SST	GPD - Green Peter Dam	Screw Trap	118
SST	LD1 - Lebanon Dam South Ladder	Instream Array	77
SST	LD2 - Lebanon Dam North Ladder	Instream Array	66
SST	LD3 - Lebanon Dam Diversion Bypass	Instream Array	129
SST	LD4 - Lebanon Dam Spillway	Instream Array	52
SST	PD8 - Columbia River Estuary rkm 82	Instream Array	24
SST	TWX - Estuary Towed Array (Exp.)	Towed Array	66
SST	PD7 - Columbia River Estuary rkm 70	Instream Array	19
SST	PD6 - Columbia River Estuary rkm 68	Instream Array	51
SST	PD5 - Columbia River Estuary rkm 62	Instream Array	56
NST	Big Cliff Dam	Screw Trap	78
NST	North Santiam River – Above Detroit	Screw Trap	3
NST	North Santiam River – Stayton Canal	Bypass Sub-Sample	25
NST	SID - Sauvie Island Dairy Creek	Instream Array	24
NST	ML1 - Lower Mill Creek (MILL4C)	Instream Array	1
NST	PD8 - Columbia River Estuary rkm 82	Instream Array	11
NST	TWX - Estuary Towed Array (Exp.)	Towed Array	56
NST	PD7 - Columbia River Estuary rkm 70	Instream Array	15
NST	PD6 - Columbia River Estuary rkm 68	Instream Array	39
NST	PD5 - Columbia River Estuary rkm 62	Instream Array	28

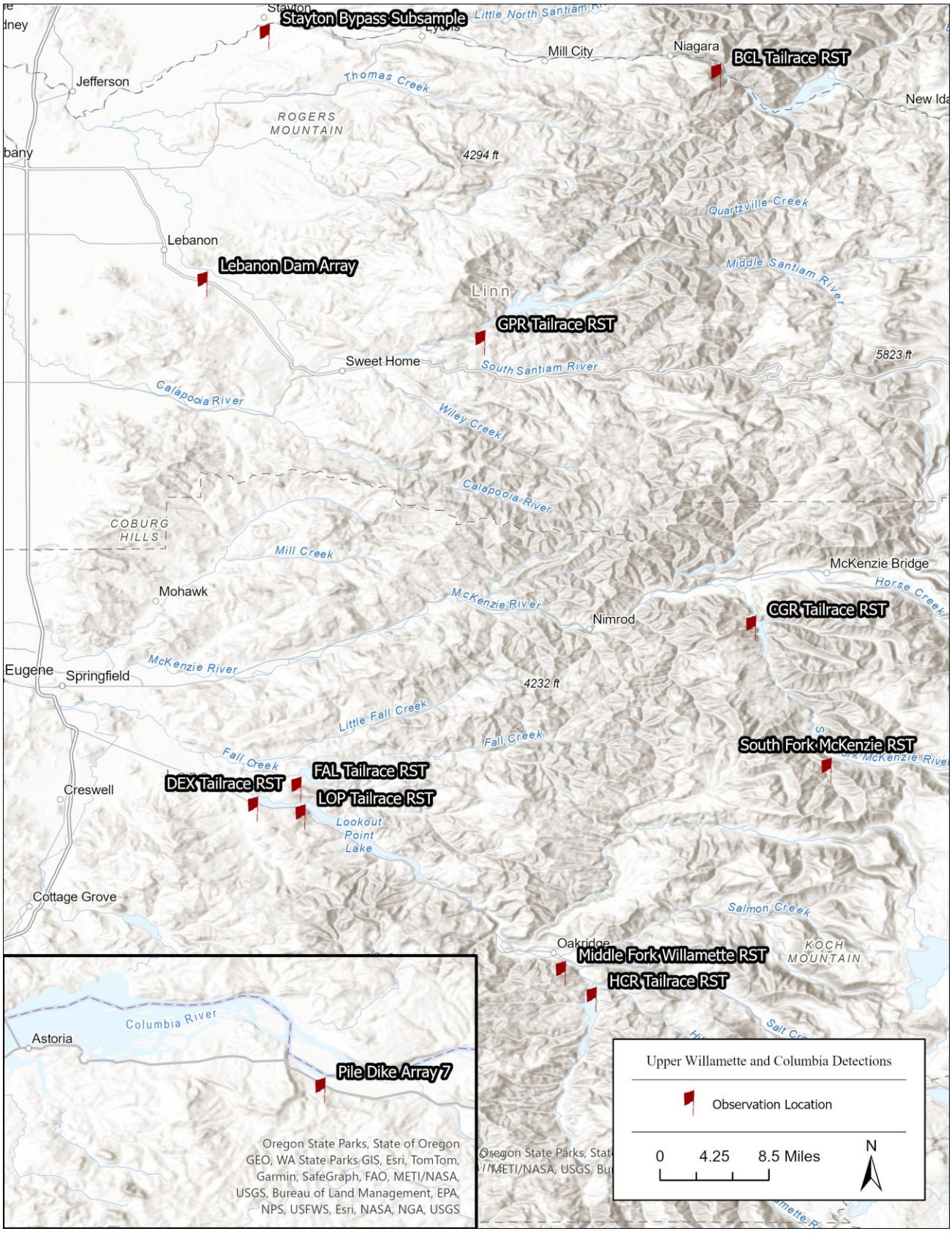

Figure 7. PIT tag redetection locations.

We calculated travel time for all migration pathways (e.g., release at Cougar Forebay and recapture at Cougar tailrace) that have been observed during this project. All recapture travel times are presented in Table 6. The following sections present data only from release groups that had subsequent recaptures or observations downstream of the release location. Specific details pertaining to fish captured in Lookout Point Reservoir can be found in the Reservoir Distribution Studies section of this report.

Middle Fork Willamette

Hills Creek

The first release at the Hills Creek project area took place on June 5, 2023, with 9,784 PIT-tagged BY2022 Chinook salmon fry released at the head of reservoir. At time of release, the forebay elevation was approximately 1513 feet, nearing its annual peak. Over the following months, the elevation gradually decreased, entering a period of fall reservoir drawdown starting mid-November and lasting through the winter, a phase punctuated by a significant rain events, as outlined in Figure 10. Hills Creek Reservoir began refilling in mid-February and the forebay elevation was 1530 feet by June 30, 2024. The dam operations outlined by the injunction plan stated that the USACE would implement regulating outlet spill daily from 6:00 PM to 10:00 PM when the reservoir elevation was less than or equal to 50 feet over the turbine intakes (i.e., 1460 feet). In 2023, consistent regulating outlet spill began in mid-November when the forebay elevation was approximately 1474 feet and would continue through early February of 2024. Unfortunately, PTAGIS data available on June 30, 2024 did not differentiate powerhouse channel or the regulating outlet channel, limiting results for this analysis. From this cohort, 74 fish were later recaptured via the Hills Creek Tailrace screw traps resulting in a recapture rate of 0.8 percent. Travel times for this release group were relatively long, with a mean of 176.8 days and a median of 185.6 days. The earliest detection in the tailrace occurred on September 16, 2023, translating to a minimum travel time of 103.1 days from release. This initial detection aligned with an active regulating outlet and a forebay elevation of about 1475 feet (depth of RO outlet of 1408-1421.25 ft). A large portion of detections, approximately 47%, were clustered between December 5 and December 15, 2023. These dates correspond to a large increase of inflow into the project, forebay elevation increasing from 1460 feet to 1475 feet, and regulating outlet spill ramping up from an average of 100 cfs per day to 2,450 cfs per day (Figure 8). In addition to the fish detected at the Hills Creek Tailrace, seven fish from this release group were detected at the Lookout Point Tailrace screw traps (mean travel time: 195.3 days) and three fish were detected at the Dexter Tailrace screw trap (mean travel time: 184.8 days).

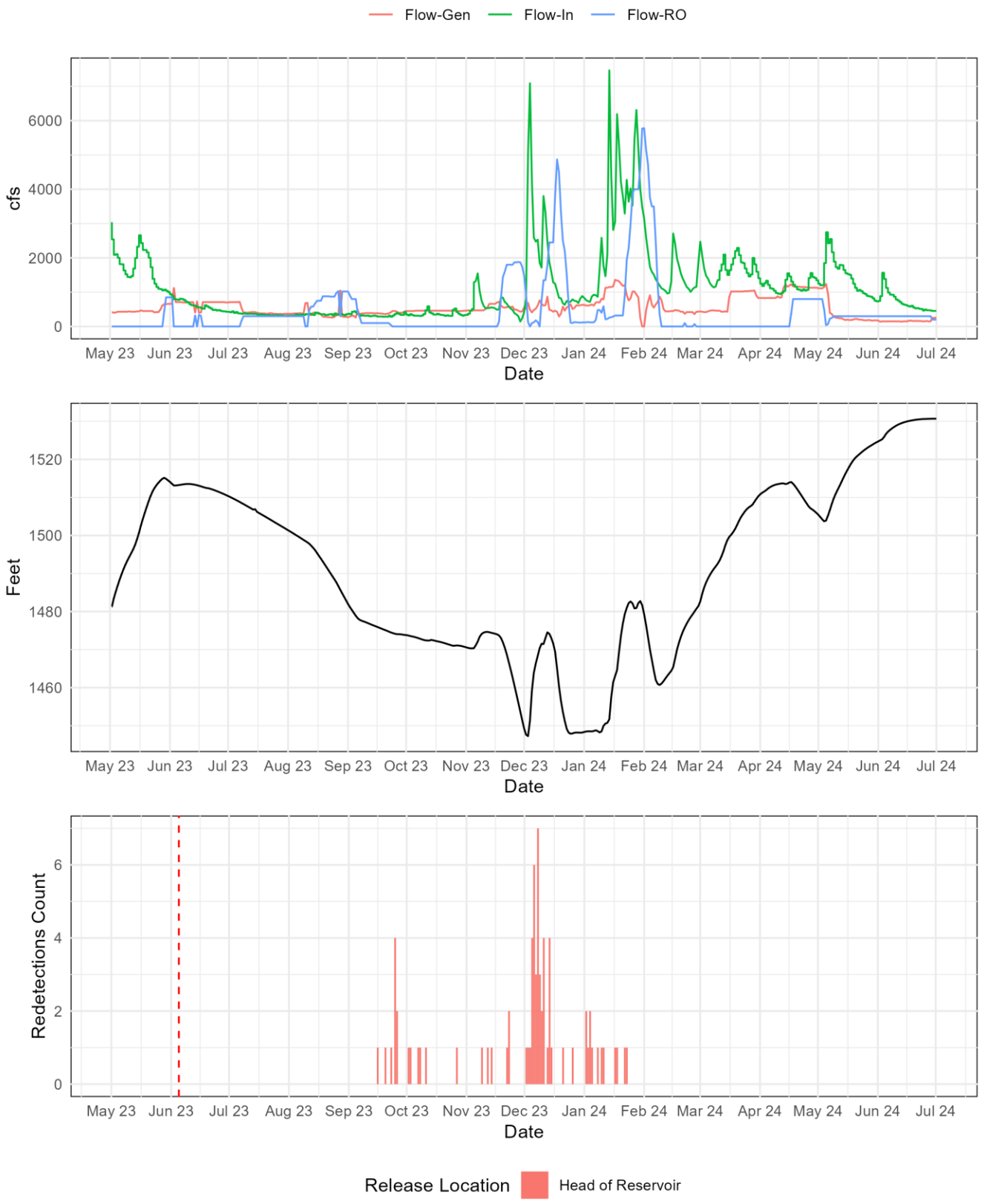

Figure 8. Hills Creek project discharge (top panel), forebay elevation (middle panel), and recaptures of PIT tagged juvenile Chinook salmon released at the head of Hills Creek on June 5, 2023 and subsequently recaptured in the Hills Creek tailrace screw traps (bottom panel). Approximate release date is represented by the dashed vertical line.

The final releases of BY2022 juvenile Chinook salmon into the Hills Creek project area in 2023 were conducted on November 7, 8, and 9, with 5,000, 4,999, and 2,999 subyearlings released at the head of reservoir, Mid-Reservoir, and Tailrace, respectively. The releases coincided with a substantial increase of inflow into the reservoir (inflow increased from 508 cfs on November 4 to 1546 cfs on November 7), an average forebay elevation of 1473 feet, and all discharge being directed through the powerhouse (Figure 9). Recaptures at the Hills Creek Tailrace included 67 fish from the head or reservoir release group (recapture rate: 1.3%) with mean and median travel times of 41.5 and 34.8 days, and 99 fish from the mid-reservoir release group (recapture rate: 2%) with mean and median travel times of 36.1 and 31.8 day, respectively. The first recapture at the Hills Creek Tailrace occurred on November 12, when the forebay elevation was approximately 1,475 feet, with all discharge still routed through the powerhouse. By January 23, 2024, the majority of recaptures had occurred (n = 162). During this period, the forebay elevation ranged between 1,447 and 1,481 feet, averaging 1,461 feet and discharge was consistently routed through both the powerhouse (daily mean = 651 cfs) and the regulating outlet (daily mean = 1066 cfs).

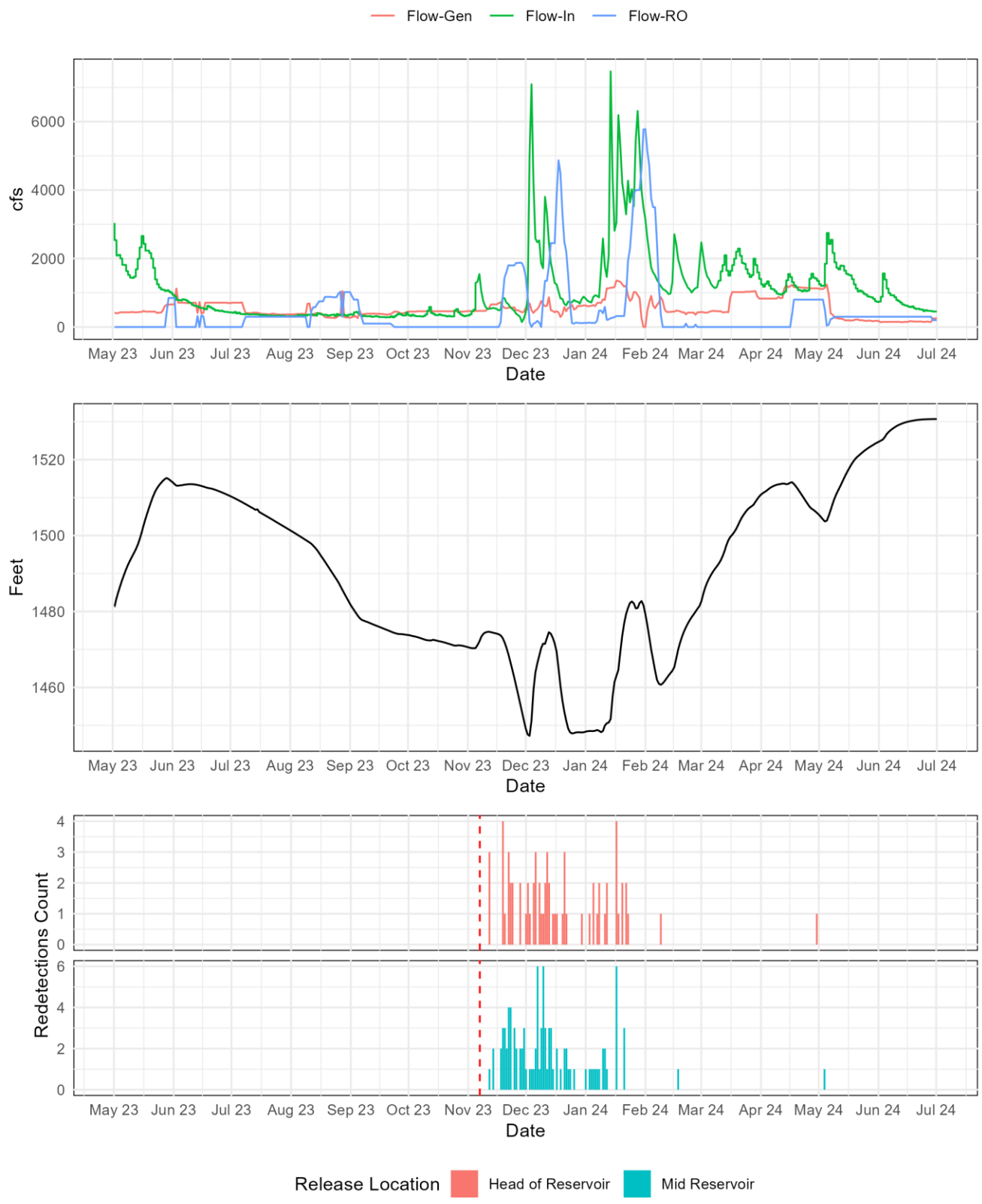

Figure 9. Hills Creek project discharge (top panel), forebay elevation (middle panel), and recaptures of PIT tagged juvenile Chinook salmon released at the head of Hills Creek on November 7 (head of reservoir) and November 8, 2023 (mid-reservoir) and subsequently recaptured in the Hills Creek tailrace screw traps (bottom panel). Approximate release date is represented by the dashed vertical line

The final release of BY2022 Middle Fork Willamette stock fish above Hills Creek Dam occurred on February 6 and 7, with releases at the head of the reservoir and mid-reservoir, respectively. At the time of release, the forebay elevation was approximately 1,463 feet, coinciding with a significant pulse of inflow and regulating outlet operations (Figure 10). The head-of-reservoir release consisted of 4,963 yearling Chinook salmon, of which 30 were recaptured in the tailrace screw traps, resulting in a recapture rate of 0.6%. The mean travel time for this group was 12.1 days, with a median travel time of 5.0 days. The mid-reservoir release involved 5,000 individuals, with 31 recaptured in the tailrace. This group exhibited slightly faster mean and median travel times of 8.8 and 3.1 days, respectively. Overall, the majority of recaptures from this release (n = 59; 97%) occurred between February 7 and February 18, during which the forebay elevation ranged from 1,461 to 1,470 feet, averaging 1,463 feet. A total of 41 individuals from both release groups were recaptured in the tailrace during regulating outlet operations (out of 61 total recaptures; 63.1%).

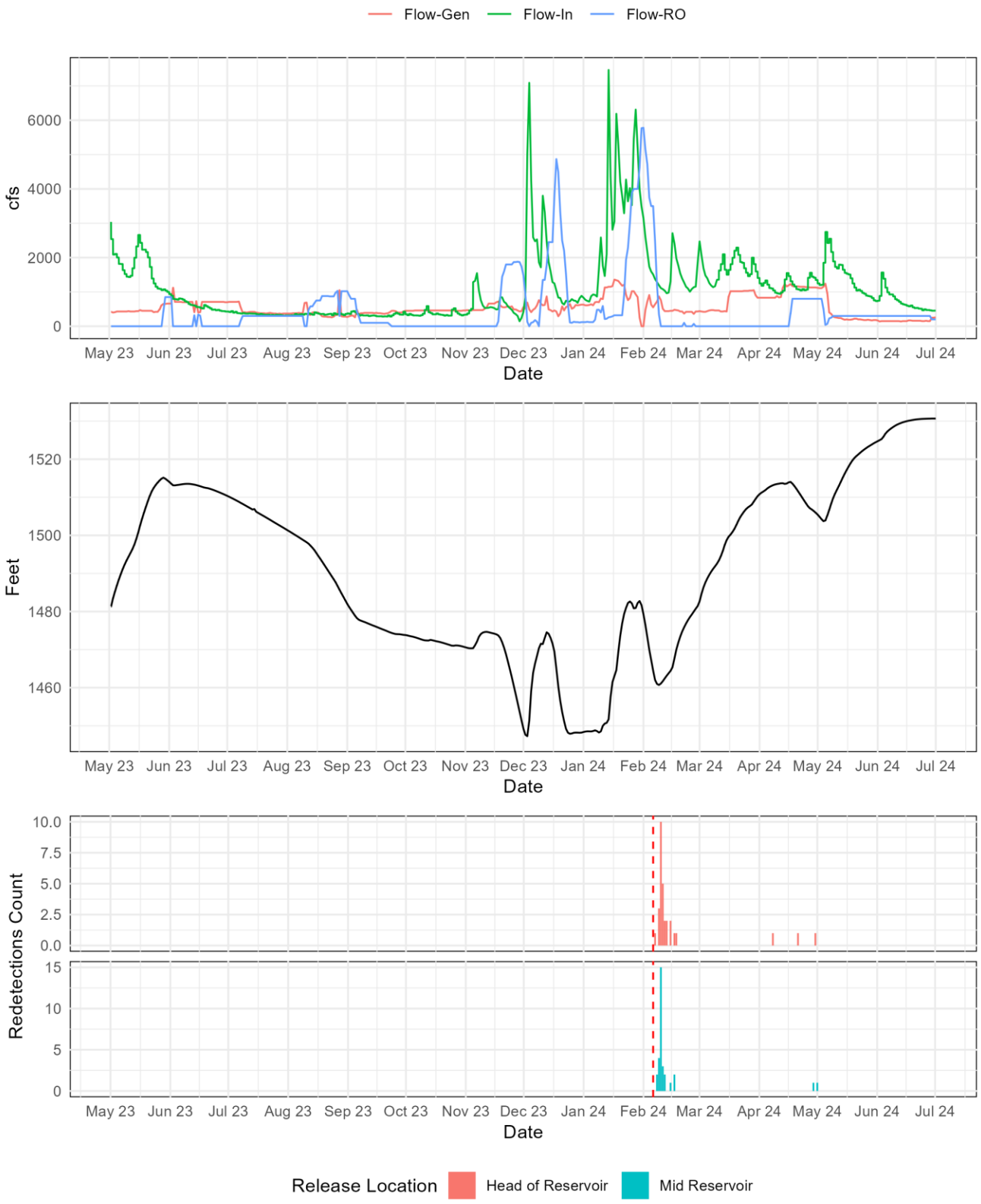

Figure 10. Hills Creek project discharge (top panel), forebay elevation (middle panel), and recaptures of PIT tagged juvenile Chinook salmon released at the head of Hills Creek on February 6 (head of reservoir) and February 7, 2023 (mid-reservoir) and subsequently recaptured in the Hills Creek tailrace screw traps (bottom panel). Approximate release date is represented by the dashed vertical line.

Lookout Point

The Lookout Point project received its first release of PIT-tagged juvenile Chinook salmon on May 30, 2023, when 9,647 BY2022 fry were liberated at the head of Lookout Point Reservoir. This release occurred when the forebay elevation was approximately 890 feet, before the start of deep drawdown dam operations in early June. The reservoir level was consistently lowered until early November, reaching a deep drawdown target of around 750 feet, as shown in Figure 10. The reservoir stayed at this level until early December, when heavy rainfall caused a rapid rise in inflow, increasing the reservoir levels. During the study period, dam flows initially came from the powerhouse, then shifted to spill gate passage by mid-September, continuing until December 20, when flows returned to the powerhouse. Redetections of fish released in the Lookout Point project area were extremely rare. Out of the 9,647 fry released, only two were redetected. One was caught in an Oneida net within Lookout Point Reservoir 82.1 days post-release, and another was captured in the Dexter Tailrace screw trap 36 days post-release.

The final releases of the 2023 at the Lookout Point project area occurred on September 18, 2023, with 4,998 BY2022 subyearlings released at the head of the reservoir and 5,002 released at the forebay. A single fish from each release site was later recaptured in the Lookout Point Tailrace RSTs, with travel times of 88.2 and 86.8 days, respectively. In-reservoir research gillnets captured three fish from the head of the reservoir release and one from the forebay group, with mean travel times of 13.1 and 30.7 days. At Dexter Tailrace, one fish from the head of the reservoir group was recaptured after 43.2 days, while five from the forebay group had a mean travel time of 36.0 days. Additionally, the PD7 array in the Columbia River detected a single fish from the head of the reservoir release 35.4 days post-release.

A total of 25,983 PIT tagged BY2022 yearling Chinook salmon were released in five groups at the head of Lookout Point Reservoir during January, 2024. These yearling were from the group of “surplus” Middle Fork Willamette study fish that were provided to us as a modification to the originally planned release groups for this project. Groups of fish were released on January 3 (n = 4,634), January 4 (n = 4,828), January 8 (n = 3,789), January 9 (n = 5,115), and January 25, 2024 (n = 7,617). A total of 132 fish from these groups were subsequently recaptured in the Lookout Point tailrace. The highest proportion of recaptures coincided with the largest increase in flow through the powerhouse during the study period which appeared to be in response to a large inflow event at Lookout Point Reservoir (Figure 11). The increase in flow through the powerhouse began on January 23, 2024 ramping up from approximately 4,590 cfs to approximately 8,110 cfs. Of the 124 fish that were recaptured from the January 3 – January 9 release groups, 87 (70%) were recaptured on January 23 and January 24 (Figure 16). The January 3 – January 9 release groups had an average recapture rate of 0.68 percent at the Lookout Point tailrace while the January 25 release group had a recapture rate of 0.1 percent (n = 8).

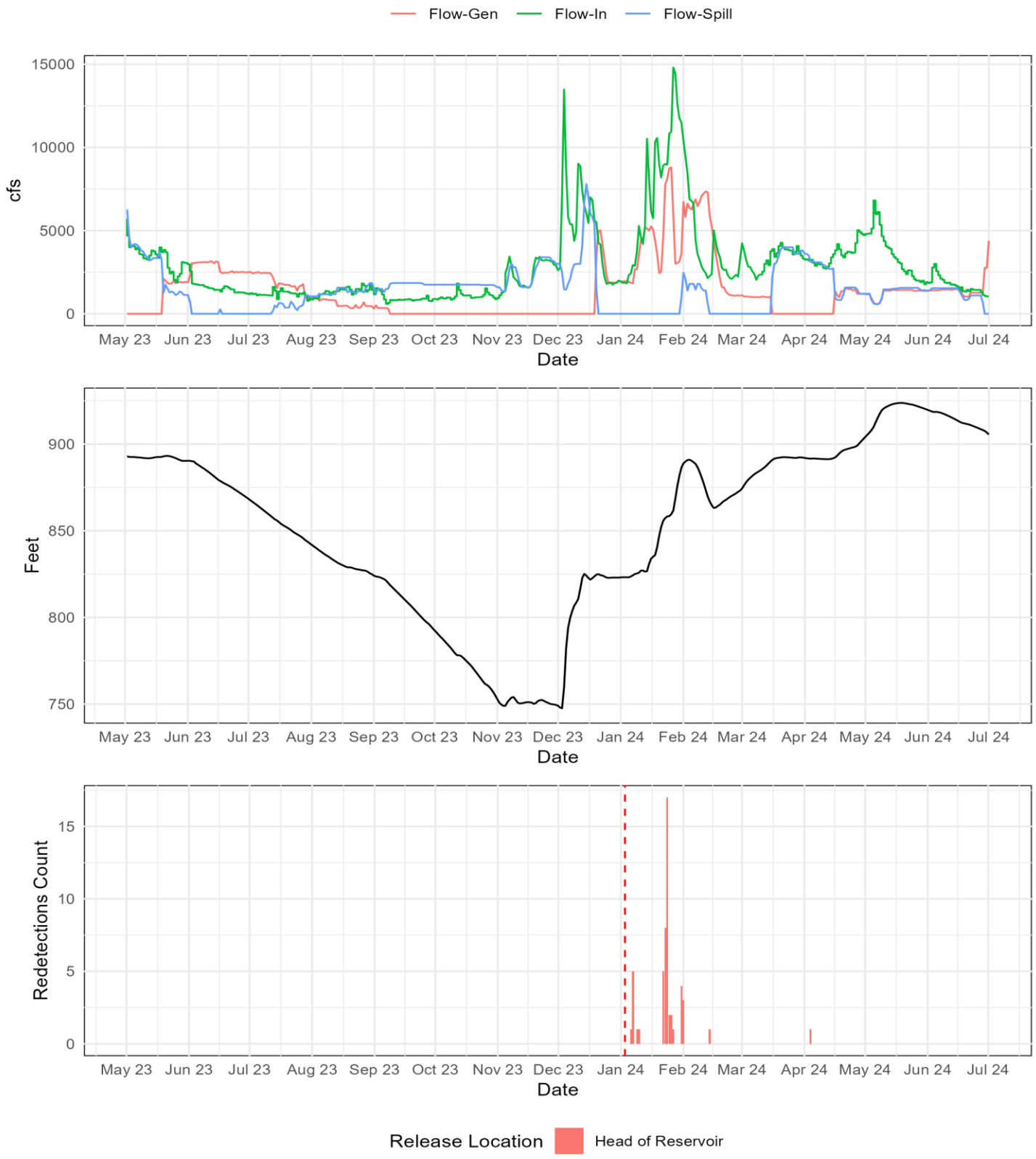

Figure 11. Lookout Point project discharge (top panel), forebay elevation (middle panel), and recaptures of PIT tagged juvenile Chinook salmon released at the head of Lookout Point in January, 2024 and subsequently recaptured in the Lookout Point tailrace screw traps (bottom panel). Spill is either surface spill, regulating outlet spill, or a combination thereof. Approximate release date of first release group is represented by the dashed vertical line.

The next releases of BY2022 yearling Chinook salmon into the Lookout Point project area occurred on February 28, 2024 with the release of 4,994 at the head of reservoir and 4,998 in the forebay. These fish were released prior to the 30-day spring spill block at Lookout Point Dam. There were only five recaptures in the Lookout Point Tailrace RSTs from these release groups in the Lookout Point tailrace (Figure 12). The final releases of brood year 2022 fish in Lookout Point occurred on April 9 (n = 4,988 at head of reservoir), April 10 (n = 2500 at the forebay), and April 11, 2024 (n = 2500 at the forebay). These yearling Chinook salmon were released at the end of the 30-day spill block and prior to nighttime spill operations beginning. Similar to the previous release of yearlings, these fish had very low recapture rates (0.13%; Figure 13).

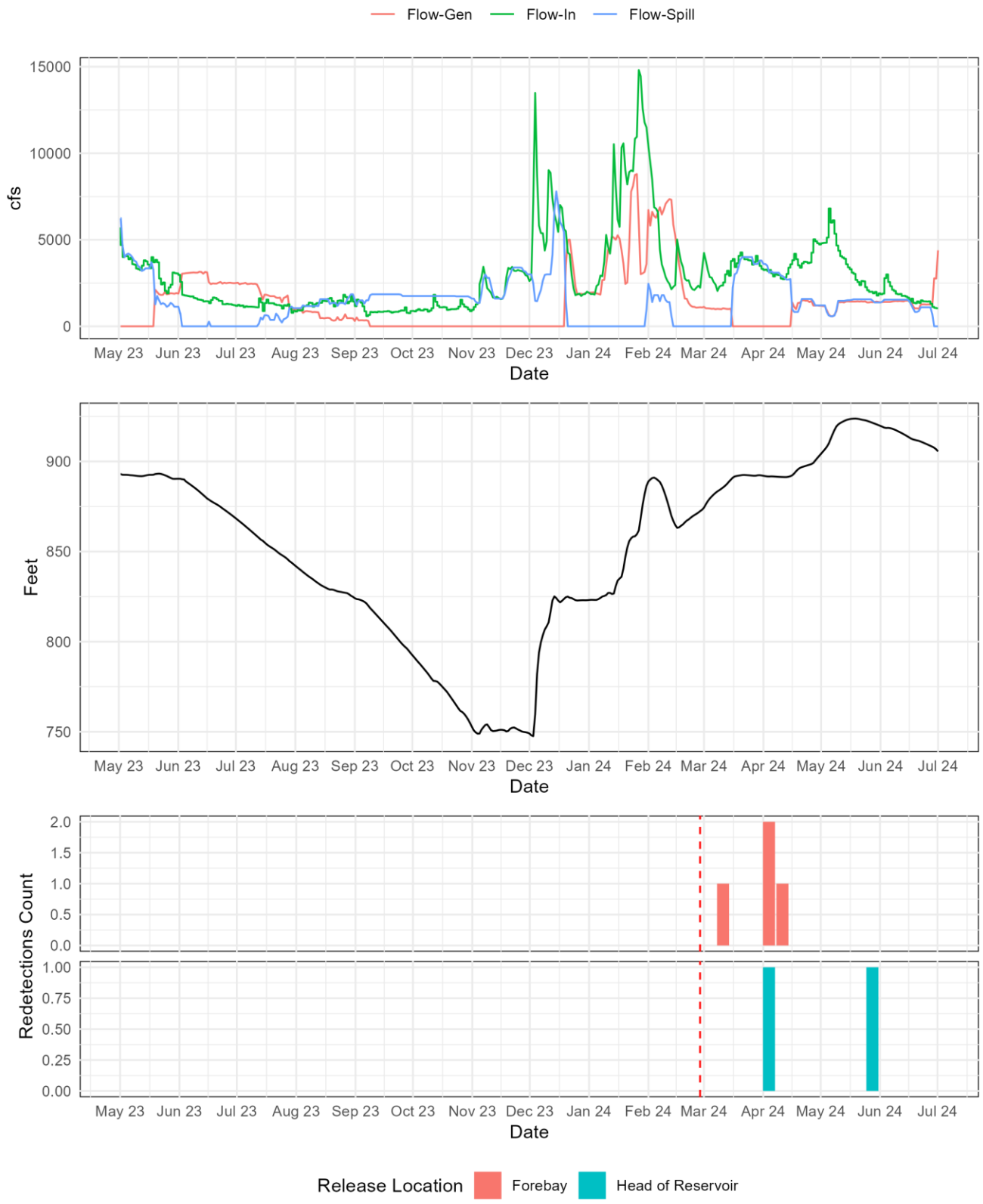

Figure 12. Lookout Point project discharge (top panel), forebay elevation (middle panel), and recaptures of PIT tagged juvenile Chinook salmon released at the head and forebay of Lookout Point on February 28, 2024 and subsequently recaptured in the Lookout Point tailrace screw traps (bottom panel). Spill is either surface spill, regulating outlet spill, or a combination thereof. Approximate release date of first release group is represented by the dashed vertical line.

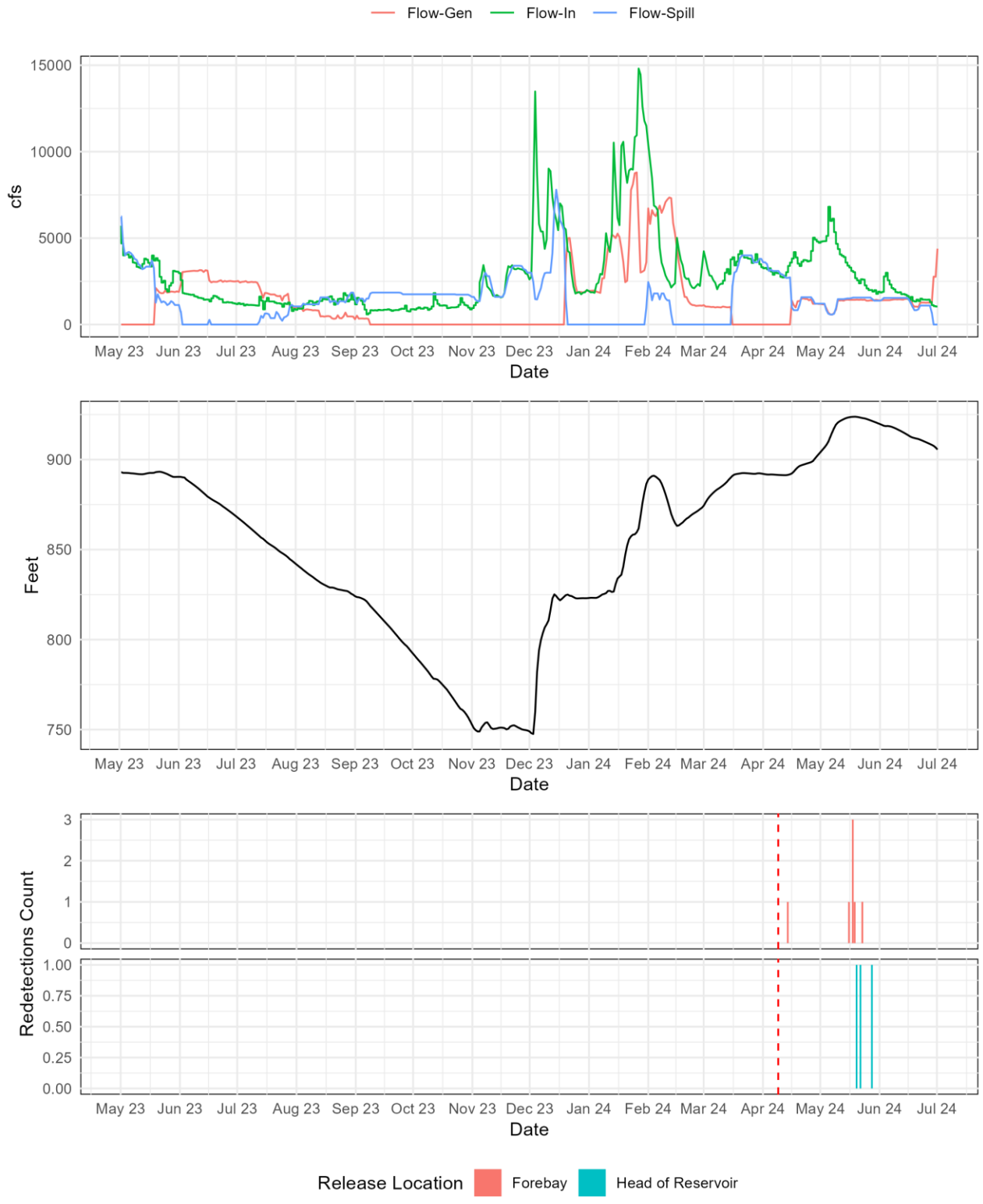

Figure 13. Lookout Point project discharge (top panel), forebay elevation (middle panel), and recaptures of PIT tagged juvenile Chinook salmon released at the head and forebay of Lookout Point on April 9, 2024 and subsequently recaptured in the Lookout Point tailrace screw traps (bottom panel). Spill is either surface spill, regulating outlet spill, or a combination thereof. Approximate release date of first release group is represented by the dashed vertical line.

Fall Creek

In the Fall Creek project area, PIT-tagged juvenile Chinook salmon were released at the head of the reservoir and recaptured in a rotary screw trap located in the Fall Creek Dam tailrace. Two Injunction Measures govern operations at Fall Creek Dam. Injunction Measure 19 mandates that reservoir operations should draw down Fall Creek Reservoir to streambed elevation (680 feet) by December 1, maintaining that level until January 15. After this, the reservoir should begin refilling to an elevation of 700 feet, which must be maintained until spring passage operations begin (Injunction Measure 20). Injunction Measure 20 specifies that the forebay elevation must be held at 700 feet until March 15, except when flood control or sediment management is required. Refill to an elevation of 728 feet should begin on March 16, and the reservoir must be maintained at this level or higher from April 15 to March 15 of the following year to ensure proper operation of the adult trap in the tailrace. It is important to note that the operation of the tailrace screw trap is often interrupted during the fall drawdown, particularly when the reservoir is at streambed elevation, due to excessive sediment accumulation in the tailrace. Relevant screw trap operation interruptions during this study period include July 15 to October 1, 2023 (no contracted sampling since juvenile salmonid passage is low from previous studies), October 16 to 17, 2023 (debris), and December 1, 2023, to January 12, 2024 (excessive sediment).

The first release in the Fall Creek sub-basin occurred on June 12, 2023, when 9,638 PIT-tagged BY2022 Chinook salmon fry were introduced at the head of Fall Creek Reservoir. At the time of release, the forebay elevation of Fall Creek Reservoir was approximately 750 feet, marking the annual peak (Figure 14). Subsequent recapture data showed that 14 of these fish were captured in the Fall Creek Tailrace RST, representing a recapture rate of 0.1%. The mean travel time from release to recapture was 138.1 days, with a median of 128.9 days (Table 6). The earliest recapture occurred on October 18, 2023, corresponding to a minimum travel time of 127.9 days post-release. The first fall drawdown began on October 16, causing outflow from the dam to rise sharply from about 61 cfs to over 2,400 cfs by October 18. This rapid increase in outflow triggered a rapid drop in the reservoir level, from approximately 741 feet to around 691 feet, with the drawdown concluding by October 22. Notably, 12 of the 14 recaptured fish were detected between October 18 and October 21, suggesting a potential correlation between the drawdown operations and fish passage through Fall Creek Dam. It is important to note from previous studies that juvenile salmonid passage is low under the dam operations during the period from July 15 to October 1, which also incfluences the rate and timing of recaptures.

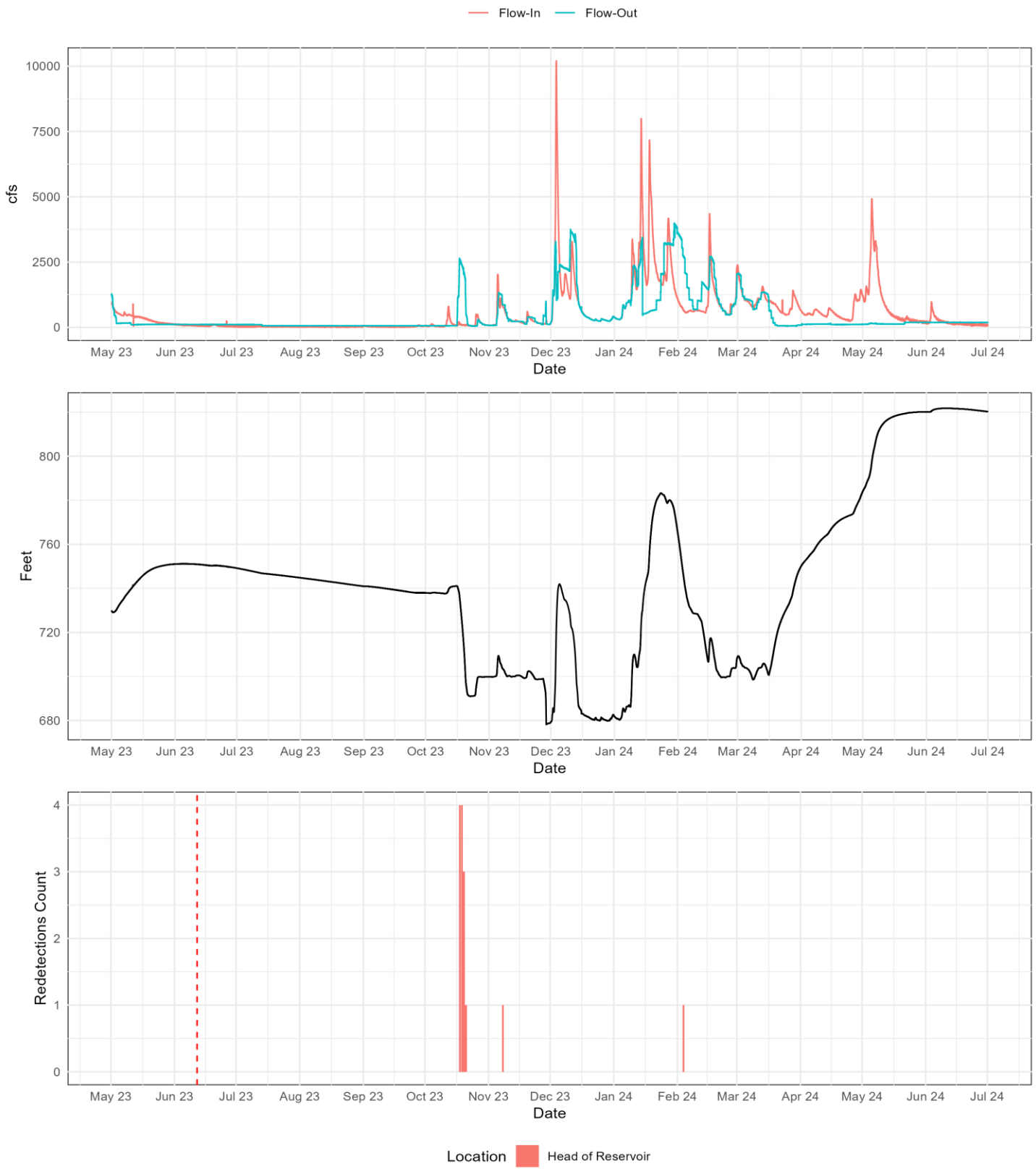

Figure 14. Fall Creek inflow and outflow (top panel), forebay elevation (middle panel), and recaptures of PIT tagged juvenile Chinook salmon released at the head of Fall Creek on July 12, 2023 and subsequently recaptured in the Fall Creek

tailrace screw trap (bottom panel). Spill is either surface spill, regulating outlet spill, or a combination thereof. Approximate release date of first release group is represented by the dashed vertical line.

The subsequent release in the Fall Creek sub-basin took place on September 18, 2023, when 5,006 PIT-tagged BY2022 subyearling Chinook salmon were introduced at the head of Fall Creek Reservoir. The forebay elevation at the time of release was approximately 739 feet. Of this cohort, 142 individuals were later recaptured in the Fall Creek Tailrace, demonstrating both faster travel times and a higher recapture rate (2.8%) compared to the previous release. The recaptured fish had a mean travel time of 24.4 days and a median travel time of 20.9 days (Table 6). The first recapture occurred on October 18, corresponding to the initiation of the first fall drawdown event. Similar to the earlier release group, a significant portion of the recaptures—113 fish—were recorded during the rapid reservoir drawdown, which occurred from October 18 to 20, further supporting evidence that fish exit the reservoir during drawdown operations (Figure 15).

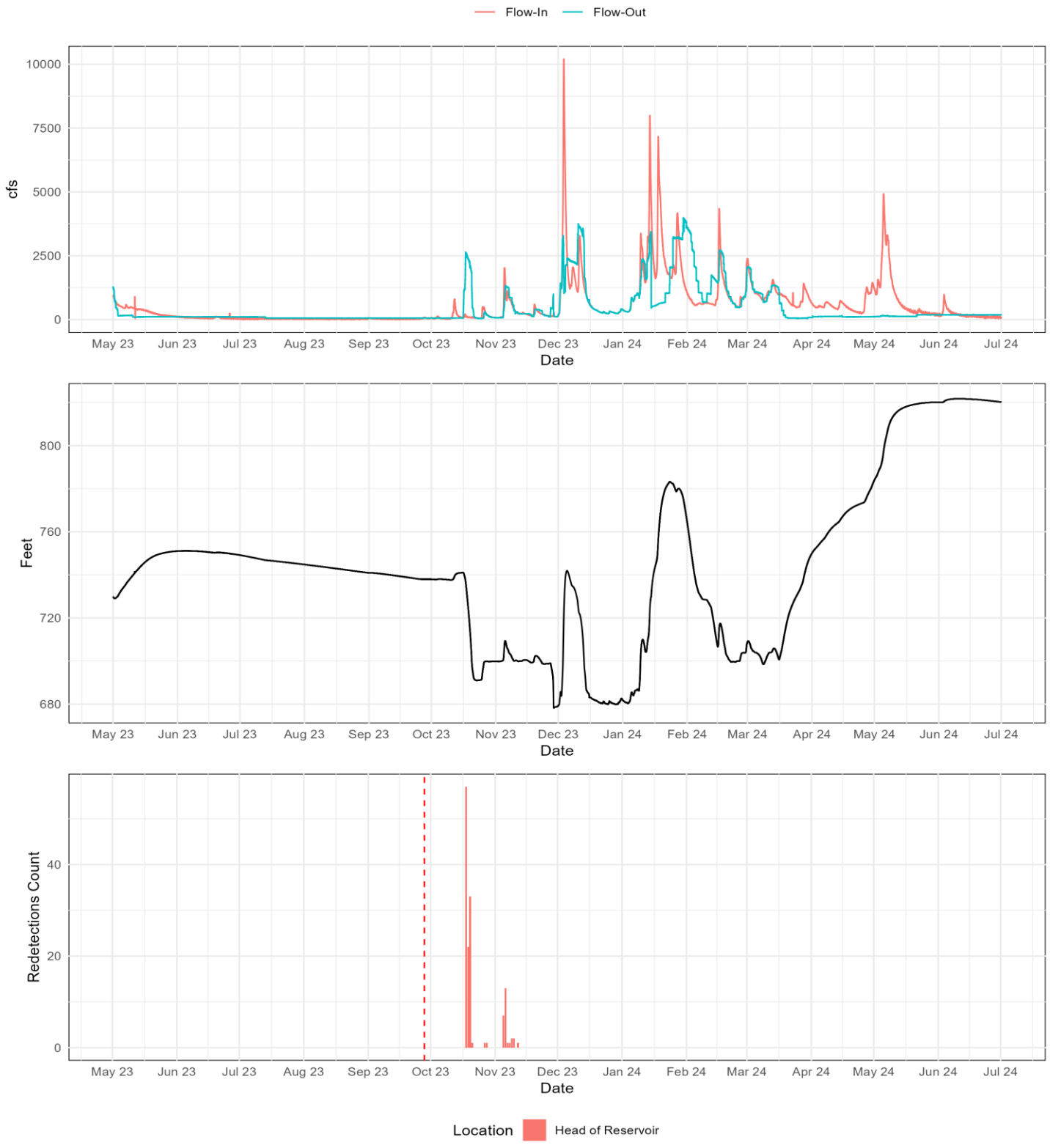

Figure 15. Fall Creek inflow and outflow (top panel), forebay elevation (middle panel), and recaptures of PIT tagged juvenile Chinook salmon released at the head of Fall Creek on September 28, 2023 and subsequently recaptured in the Fall Creek tailrace screw trap (bottom panel). Spill is either surface spill, regulating outlet spill, or a combination thereof. Approximate release date of first release group is represented by the dashed vertical line.

The final release in the Fall Creek project area in 2023 occurred on November 6, with the introduction of 4,999 PIT-tagged BY2022 subyearling Chinook salmon into the head of Fall Creek Reservoir. A significant number of recaptures from this group were observed at the Fall Creek tailrace screw traps (n = 280; recapture rate: 5.6%). This group of fish had much shorter travel times compared to the previous release groups, with a mean travel time of 1.8 days and a median travel time identical to the mean. This group exhibited rapid movement through the Fall Creek project. Almost all of the recaptured fish navigated through Fall Creek Dam within six days of their release (n = 279) indicating that these fish exited the reservoir prior to it reaching streambed elevation (680 feet). Average forebay elevation across those six days was 702 feet. Several factors likely contributed to the rapid movement of these fish. Firstly, the reservoir elevation was at fall drawdown levels, providing a more direct route for the fish to follow and easier access to passage routes once they reached the dam face. Additionally, an increase of inflow coincided with this release, potentially providing a stronger current that expedited their downstream migration (Figure 16).

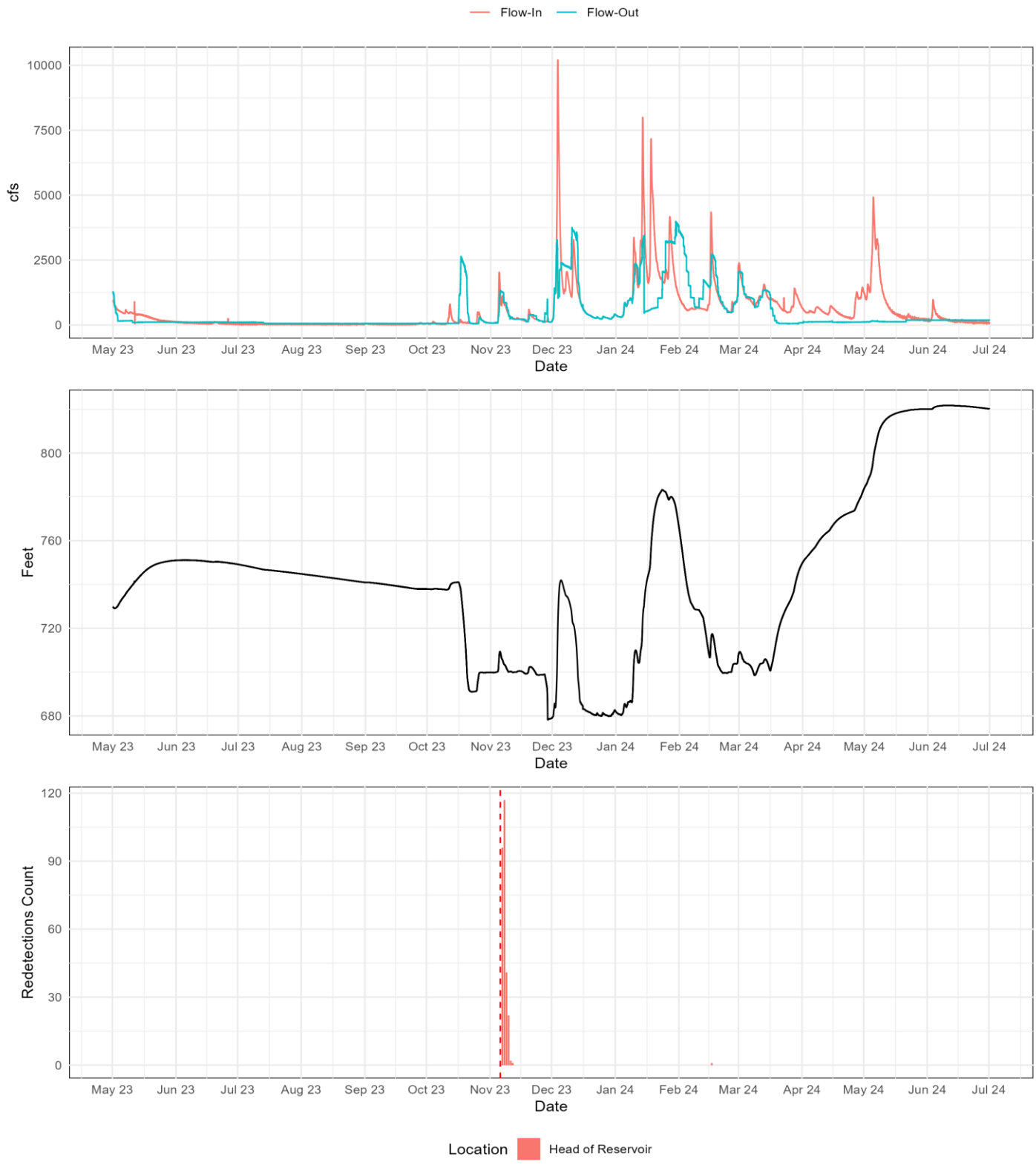

Figure 16. Fall Creek inflow and outflow (top panel), forebay elevation (middle panel), and recaptures of PIT tagged juvenile Chinook salmon released at the head of Fall Creek on November 6, 2023 and subsequently recaptured in the Fall Creek tailrace screw trap (bottom panel). Spill is either surface spill, regulating outlet spill, or a combination thereof. Approximate release date of first release group is represented by the dashed vertical line.

The next release of BY2022 juvenile Chinook salmon in the Fall Creek project consisted of 4,993 yearlings that were introduced at the head of reservoir on February 20, 2024 (Figure 17). This group was released prior to the spring refill of the reservoir while the reservoir elevation was at drawdown approximately 700 feet. Similar to the group of subyearlings released in November, these fish migrated through the Fall Creek project rapidly with mean and median travel times of 1.8 days and 2.0 days, respectively (Table 6). A total of 211 fish from this release group were recaptured in the tailrace (recapture rate: 4.2%), 210 of which were recaptured within six days of release while the Fall Creek reservoir was at a mean elevation of 700 ft (mean of 20 ft above streambed elevation). These results provide additional evidence that fish move rapidly through the project when the reservoir is drawn down even if not fully drawdown to streambed elevation.

The final release of BY2022 yearlings at the head of Fall Creek Reservoir took place on April 2 (n = 2,499) and April 3, 2024 (n = 2,499). This release was originally scheduled to occur after the spring refill was completed but had to be conducted earlier due to limited rearing space at the Willamette Hatchery. The reservoir was still refilling at the time of release, with a forebay elevation of 752 feet and an outflow of 118 cfs. Unfortunately, the outflow from the Fall Creek project was insufficient to properly operate the screw trap in the tailrace, and none of the released fish have been redetected to date.

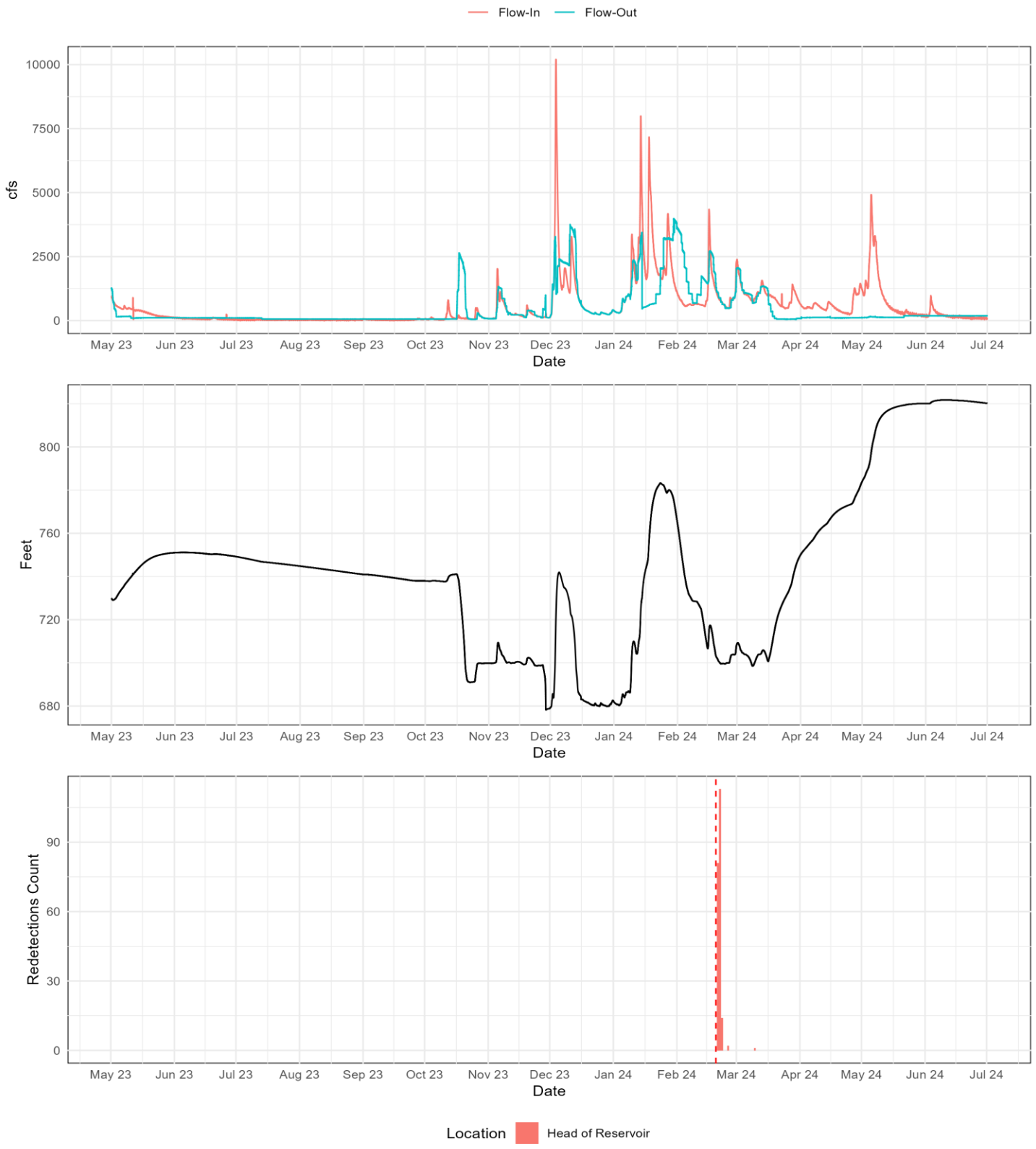

Figure 17. Fall Creek inflow and outflow (top panel), forebay elevation (middle panel), and recaptures of PIT tagged juvenile Chinook salmon released at the head of Fall Creek on February 20, 2024 and subsequently recaptured in the Fall Creek tailrace screw trap (bottom panel). Spill is either surface spill, regulating outlet spill, or a combination thereof. Approximate release is represented by the dashed vertical line.

South Fork McKenzie

Injunction measures for Cougar Dam aim to balance water management and fish passage operations. Injunction Measure 14 outlines the fall and winter operational strategy, which involves drawing down Cougar Reservoir to an elevation of 1,505 feet from early November through December 15. During this period, the regulating outlets (ROs) are prioritized for nighttime discharge once the reservoir reaches an elevation of 1,571 feet, and full priority is given to the ROs at elevations below 1,532 feet. Refilling of the reservoir begins on December 16, with nighttime RO operations until an elevation of 1,532 feet is reached. Following the winter drawdown, refilling continues with the goal of reaching a minimum conservation pool of 1,532 feet by March 1. Cougar Reservoir is then drafted to an elevation of 1,520 feet by April 1 to provide a downstream flow signal that encourages fish outmigration. Refill is delayed as long as possible, with the target of reaching 1,571 feet by July 1. Adaptive management, guided by hydrologic data and fish migration patterns, is employed to determine the optimal refill timing. Elevation of the turbine inlet is 1474 feet and elevation of the regulating outlet is 1491.5 feet.

The first release of BY2022 subyearlings in this basin occurred at the head of Cougar Reservoir on August 29, 2023 (n = 5,198; Table 4). At the time of release, the reservoir was slowly drafting (forebay elevation = 1590 feet), with all flow being directed through the powerhouse (Figure 18). A total of 31 fish from this release group were recaptured in the rotary screw traps operating in the Cougar Dam tailrace, representing a recapture rate of 0.6%. These fish had mean and median travel times of 90 and 68 days, respectively, from release to recapture (Table 6). Additionally, the 25th percentile of travel times was 63.5 days, indicating that only 25% of the fish passed the dam within 63.5 days or less. These travel times suggest that the majority of the release group did not begin to pass Cougar Dam until late October, when regulating outlet spill operations were in full effect and the forebay elevation was nearing the drawdown target. Mean forebay elevation at the time of recapture was 1523 feet (mean depth to turbine and regulating outlet intakes of 49 feet and 31.5 feet, respectively). Figure 18 further illustrates that passage of this release group coincided with both lower forebay elevations and the start of spill operations at Cougar Dam.

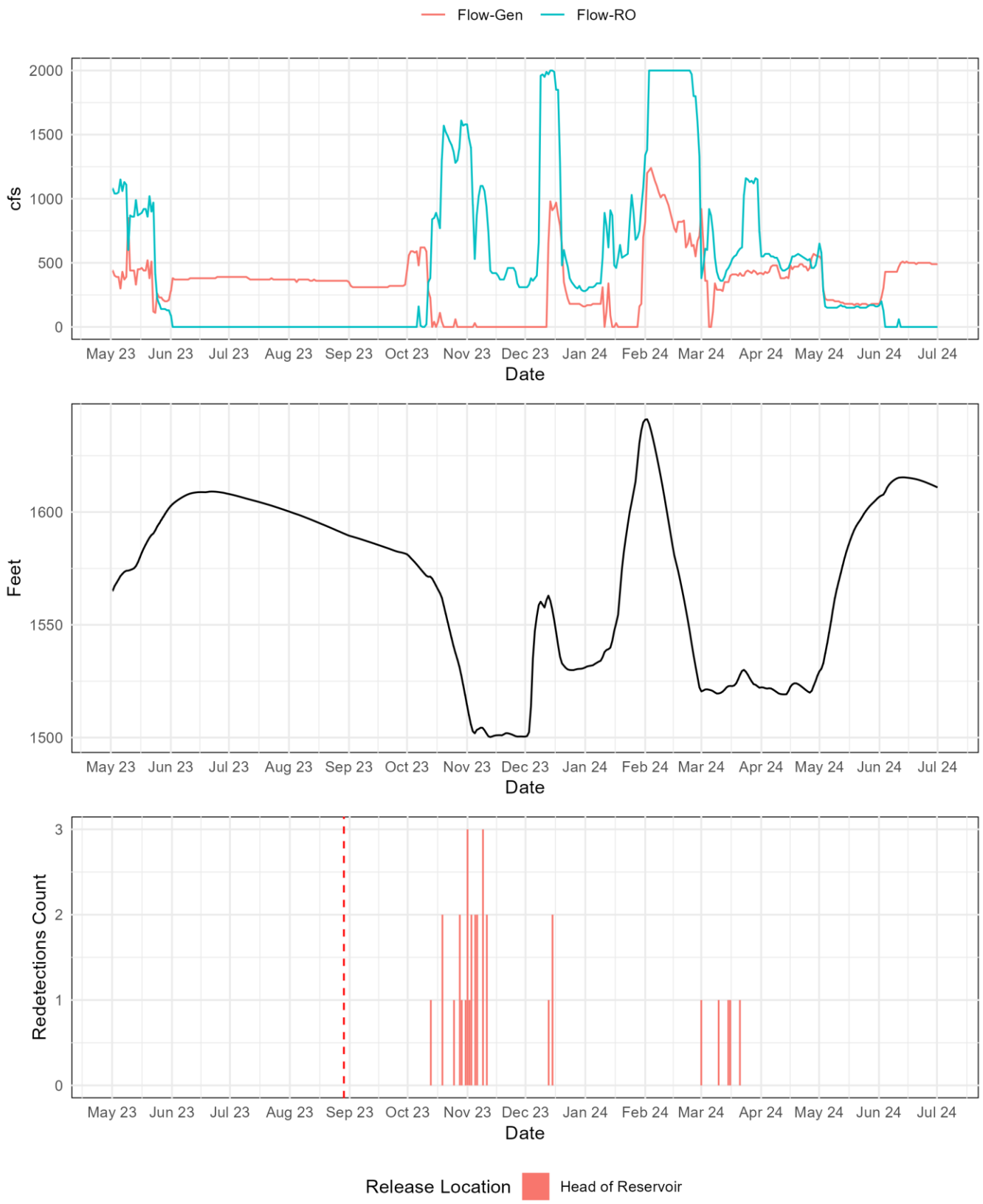

Figure 18. Cougar project discharge (top panel), forebay elevation (middle panel), and recaptures of PIT tagged juvenile Chinook salmon released at the head of Cougar reservoir on August 29, 2023 and subsequently recaptured in the Cougar tailrace screw traps (bottom panel). Release date is represented by the dashed vertical line.

The next release in the South Fork McKenzie basin occurred on October 2, 2023 at the head of reservoir (n = 8,011; Table 4). This release coincided with the beginning of the fall drawdown, which began on October 1, 2023 and reached the target forebay elevation of approximately 1505 feet November 3, 2023. Cougar reservoir would remain at that elevation until December 4, 2023 when it began to refill. All flow was directed through the regulating outlet during the fall drawdown (Figure 19). A total of 481 fish from this release group were recaptured in the Cougar Dam tailrace screw traps resulting in a recapture rate of six percent. These fish exhibited mean and median travel times from release to the tailrace of 38 and 30 days, respectively. These travel times are roughly 30 days shorter than what was experienced by first group of fish that was released on August 29th, suggesting that while the two groups were released one month apart, the majority of them passed Cougar Dam at the same time during the drawdown.

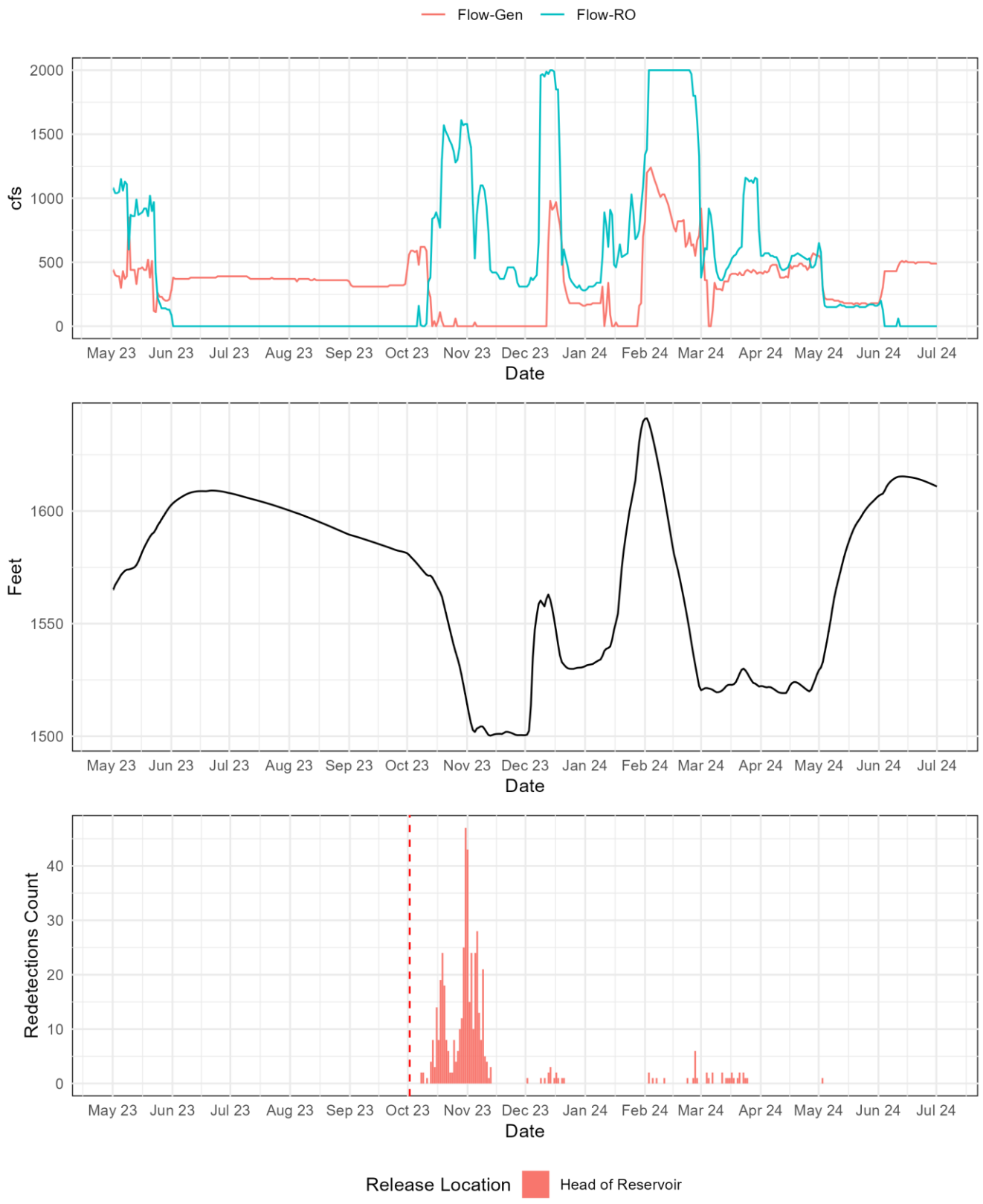

Figure 19. Cougar project discharge (top panel), forebay elevation (middle panel), and recaptures of PIT tagged juvenile Chinook salmon released at the head of Cougar reservoir on October 2, 2023 and subsequently recaptured in the Cougar tailrace screw traps (bottom panel). Release date is represented by the dashed vertical line.

The subsequent releases took place on October 18, 2023, during the drafting of the reservoir to its drawdown elevation target, as illustrated in Figure 10. Two distinct groups were released: one at the head of the reservoir (n = 3,979) and another at the forebay of Cougar Dam (n = 5,010; refer to Table 3). The travel times for both of these groups exhibited similarities. For fish released at the Cougar head of reservoir and recaptured at the Tailrace (n = 270; 6.8% recapture rate), the mean and median travel times were 28.7 days and 15.0 days, respectively. Correspondingly, for the fish released at Cougar Forebay and recaptured at the Tailrace (n = 352; 7% recapture rate), the mean and median travel times were 22.1 days and 13.8 days. Both groups of fish appeared to pass Cougar Dam during the low drawdown period when flow was being directed primarily through the regulating outlet (Figure 20). These findings indicate that, on average, the fish released at the head of the reservoir experienced a delay of only a couple of days relative to those released at the forebay. This trend further reinforces the observation that the bulk of these fish passed Cougar Dam when the forebay elevation was nearing its targeted drawdown level.

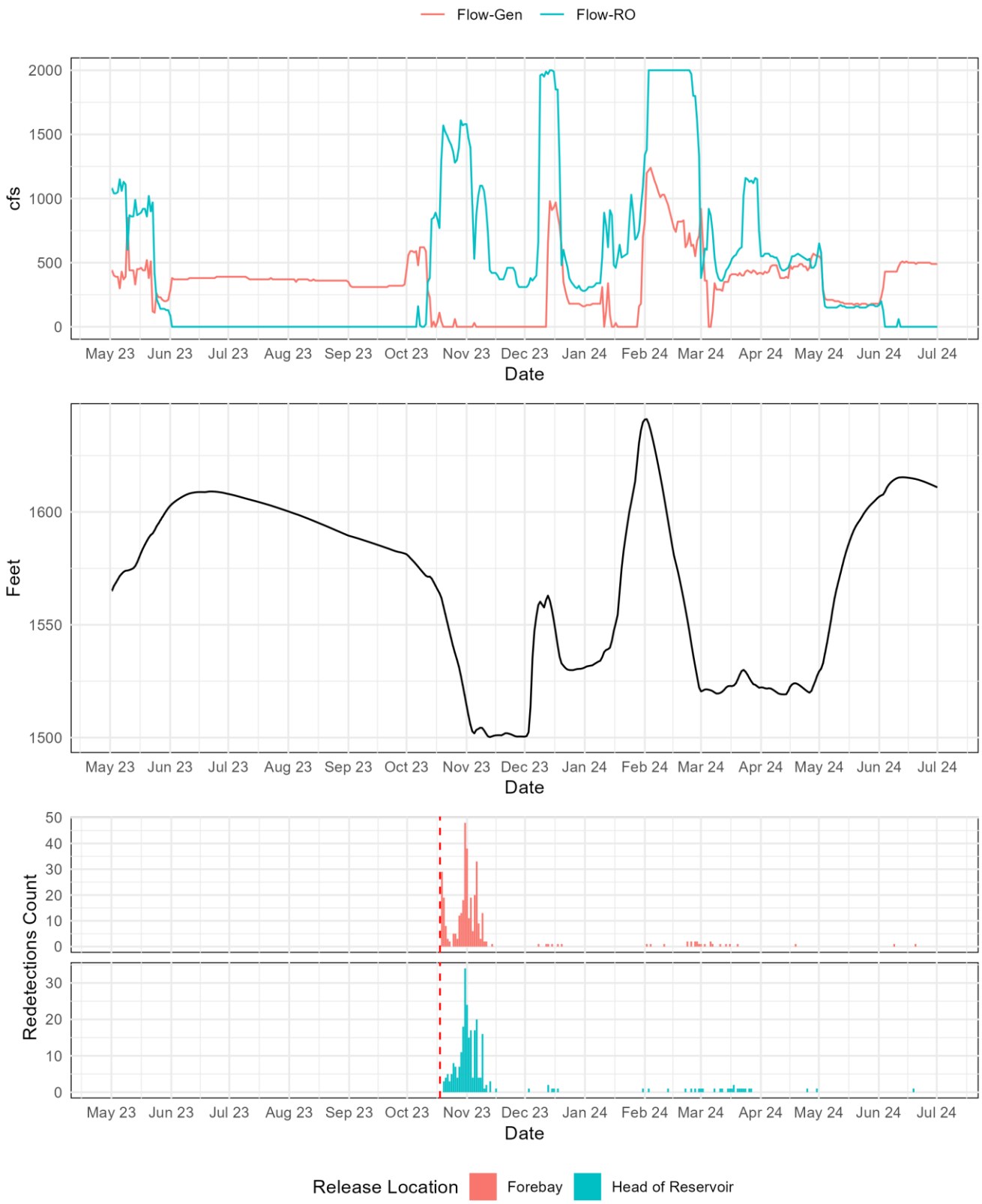

Figure 20. Cougar project discharge (top panel), forebay elevation (middle panel), and recaptures of PIT tagged juvenile Chinook salmon released at the head of Cougar reservoir and in the Forebay on October 18, 2023 and subsequently recaptured in the Cougar tailrace screw traps (bottom panel). Release date is represented by the dashed vertical line.

The final releases of BY2022 subyearlings in 2023 occurred on November 13 at the head of the reservoir (n = 3,999), and on November 14, 2023, at the forebay (n = 4,995; refer to Table 4). These releases happened while the reservoir was maintained at the full fall drawdown level, as depicted in Figure 21. During this period, the travel times for each migration pathway diverged drastically. The fish released at the Cougar head of reservoir and recaptured at the Tailrace (n = 285; 7.1% recapture rate) had mean and median travel times of 51.7 and 30.0 days, respectively. In contrast, the fish released at the Cougar Forebay and recaptured in the Tailrace (n = 485) had the highest redetection rate of any release group (9.7%) and much shorter mean and median travel times of 22.9 and 0.9 days, respectively. This discrepancy is further highlighted by the 75th percentile of travel times, where 75 percent of the fish from the Forebay group passed through within 20.9 days, whereas the head of reservoir group took approximately five times longer, with a 75th percentile travel time of 106 days. These data points underscore a substantial acceleration in passage times for the group released closer to the dam, at the forebay, compared to those released further upstream, at the head of the reservoir and also suggest that substantial proportion of the head of reservoir group overwintered in the reservoir as illustrated in Figure 21. While this PIT tag data only provides insights at discrete detection locations and detailed passage behavior of these fish is unknown, this may suggest that if subyearlings reach the forebay, then tend to pass the dam at higher rates relative to fish in the reservoir at large (i.e., those released at the head of reservoir).

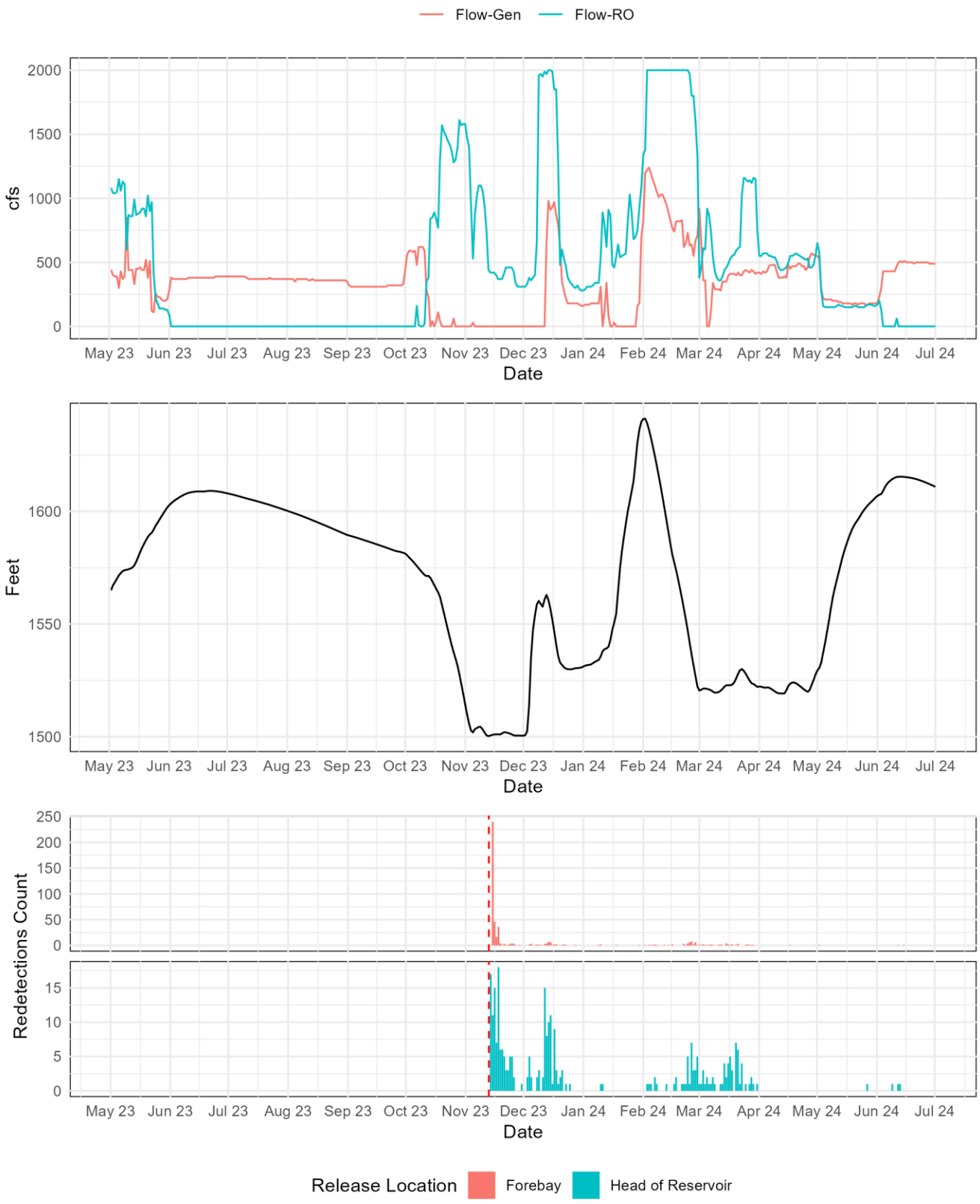

Figure 21. Cougar project discharge (top panel), forebay elevation (middle panel), and recaptures of PIT tagged salmon released at the head of Cougar reservoir and in the Forebay on November 13, 2023 and subsequently recaptured in the Cougar tailrace screw traps (bottom panel). Release date is represented by the dashed vertical line.

The final releases of BY2022 juvenile Chinook salmon in the Cougar Project area took place on March 8, 2024 at the head of reservoir (n = 4,799) and on March 11, 2024 at the forebay (n = 4,800; refer to Table 4). These releases occurred after the spring drawdown had ended and the forebay elevation was approximately 1520 feet. Flow was being directed through both the powerhouse and the regulating outlet at the time of release. The yearling Chinook salmon released at the head of reservoir and recaptured at the tailrace (n = 108; 2.3 % recapture rate) had mean and median travel times of 31.4 and 21.6 days, respectively. In contrast, those released in the forebay and recaptured in the tailrace (n = 212; 4.4% recapture rate) had much shorter mean and median travel times of 14.2 and 3.0 days, respectively. This result provides additional evidence that fish that reach the face of the dam may pass at higher rates than fish at large within the reservoir. The longer travel time of the head of reservoir release group is illustrated in Figure 22.

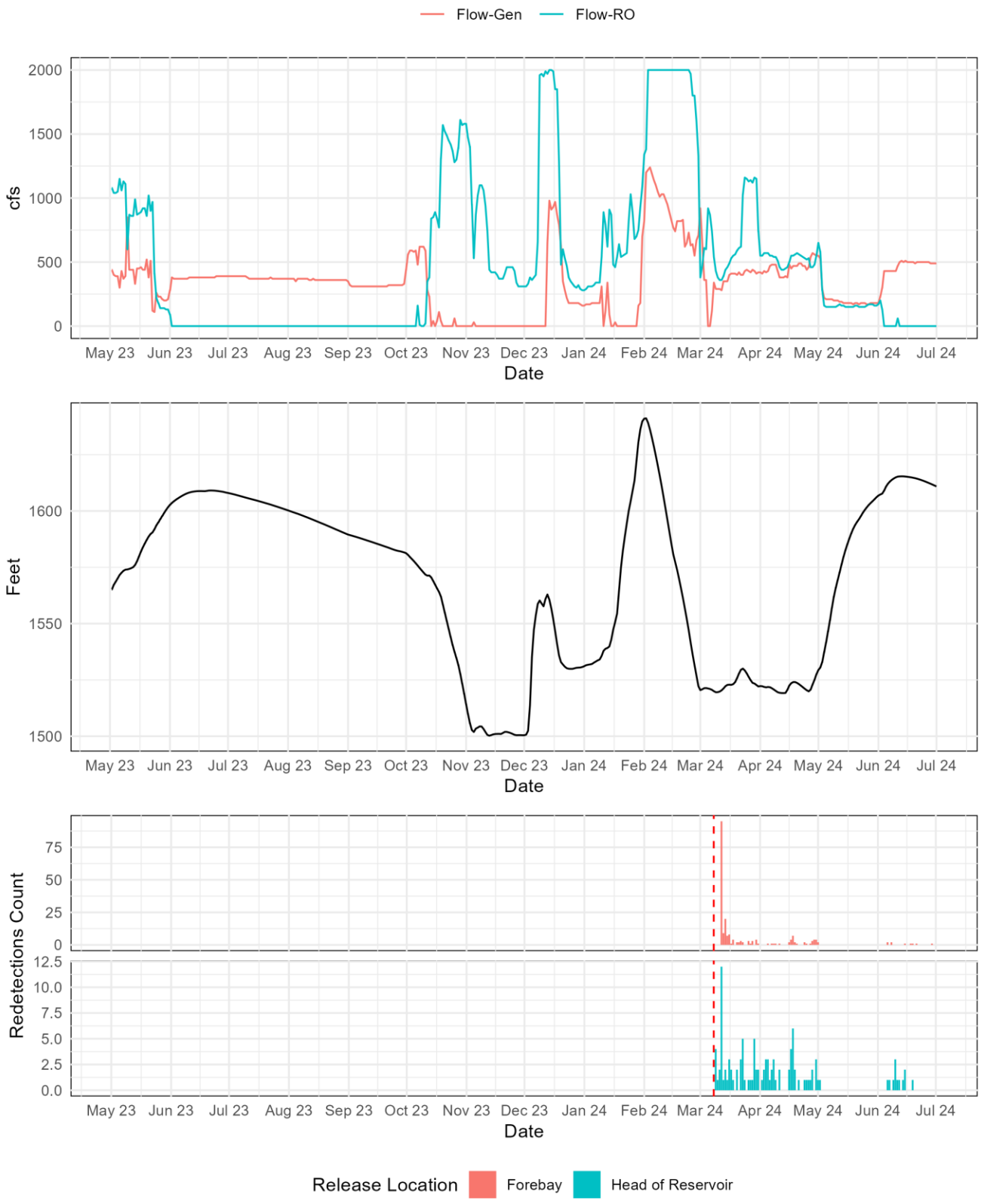

Figure 22. Cougar project discharge (top panel), forebay elevation (middle panel), and recaptures of PIT tagged salmon released at the head of Cougar reservoir and in the Forebay on March 8, and March 11, 2023 and subsequently recaptured in the Cougar tailrace screw traps (bottom panel). Approximate release date is represented by the dashed vertical line.

South Santiam

Green Peter

Injunction measures at Green Peter Dam are designed to support juvenile salmon passage and manage water levels seasonally. Injunction Measure 12(a) focuses on spring operations, requiring spill for juvenile salmon passage once the reservoir reaches an elevation of 971 feet. Spill operations must continue until May 1 or for at least 30 days, whichever is longer. Two spill strategies are tested in a block study: continuous (24/7) spill through a 1.5-foot gate opening, and nighttime spill through a 3–4-foot gate opening from one hour before sunset to one hour after sunrise. The second measure involves a deep fall drawdown, targeting a reservoir elevation of 780 feet by early to mid-November. This elevation is approximately 35 feet above the regulating outlets (ROs) at Green Peter Dam. Once the reservoir is drawn below the minimum power pool (887 feet), the powerhouse ceases operations, and all water is discharged through the ROs. The reservoir is held at or near 780 feet until December 15, after which refill begins according to the rule curve for the spring spill operation.

The initial release in the Green Peter project area was on May 22, 2023, with 10,132 fry distributed between the Quartzville Creek (n = 5,171) and Middle Santiam (n = 4,961) arms at the head of reservoir. The forebay elevation at release was approximately 1,008 feet, the highest it would be for the remainder of the year. The reservoir underwent steady drafting until late September when fall deep drawdown operations aiming for a target forebay elevation of 780 feet began. The reservoir was quickly drafted from that point and the target forebay elevation was achieved by early November. Dam operations during the 2023 study period included a spring spill block from April 10 to June 6, transitioning to powerhouse flow until October 6, when flow shifted back to the spill gates for the deep drawdown, as shown in Figure 25. Of the released fry, only one was detected downstream which occurred in the Green Peter Dam Tailrace screw trap 5.7 days after release.

On September 20 and 21, 2023, a total of 5,026 subyearlings were released at the head of Green Peter Reservoir, just before the fall deep drawdown operations began. Fourteen of these fish were later detected downstream in the Green Peter tailrace screw trap resulting in a recapture rate of 0.5 percent. The recaptures had mean and median travel times of 20.6 and 12.9 days, respectively. In addition to the recaptures in the tailrace, six fish were observed at the Lebanon Dam PIT tag array, with mean and median travel times of 63.0 and 59.3 days (Figure 23).

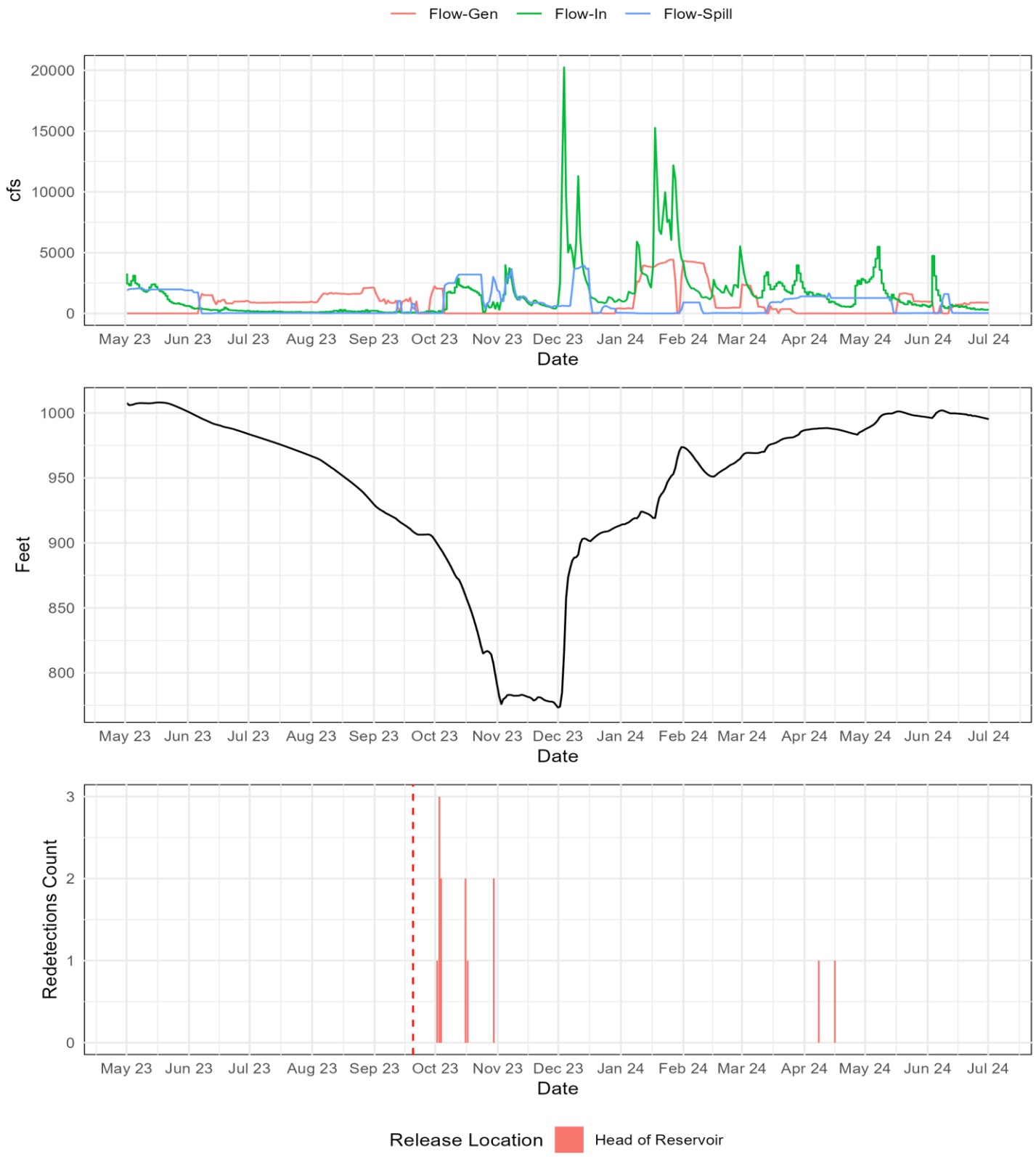

Figure 23. Green Peter project discharge (top panel), forebay elevation (middle panel), and recaptures of PIT tagged juvenile Chinook salmon released at the head of Green Peter Reservoir on September 20-21, 2024 and subsequently recaptured in the Green Peter tailrace screw trap (bottom panel). Spill is either surface spill, regulating outlet spill, or a combination thereof. Approximate release date is represented by the dashed vertical line.

The final releases of brood year 2022 subyearlings at the head of Green Peter Reservoir took place on October 3 and 4, 2023 (n = 5,018). These fish were released just prior to the beginning of spill operations at Green Peter Dam. A total of 27 fish from this release were recaptured in the Green Peter Tailrace exhibiting mean and median travel times of 61.0 and 26.4 days (Figure 24). The majority of these fish were recaptured during the low drawdown of the reservoir, but there were a few recaptures that occurred during the first spring spill block the following year. In addition to the recaptures in the tailrace, there was a total of 23 detections at the Lebanon Dam PIT tag array included nine from Quartzville Creek that had mean and median travel times of 51.8 and 36 days and 14 from Middle Santiam that had much longer mean and median travel times of 151.7 and 199 days.

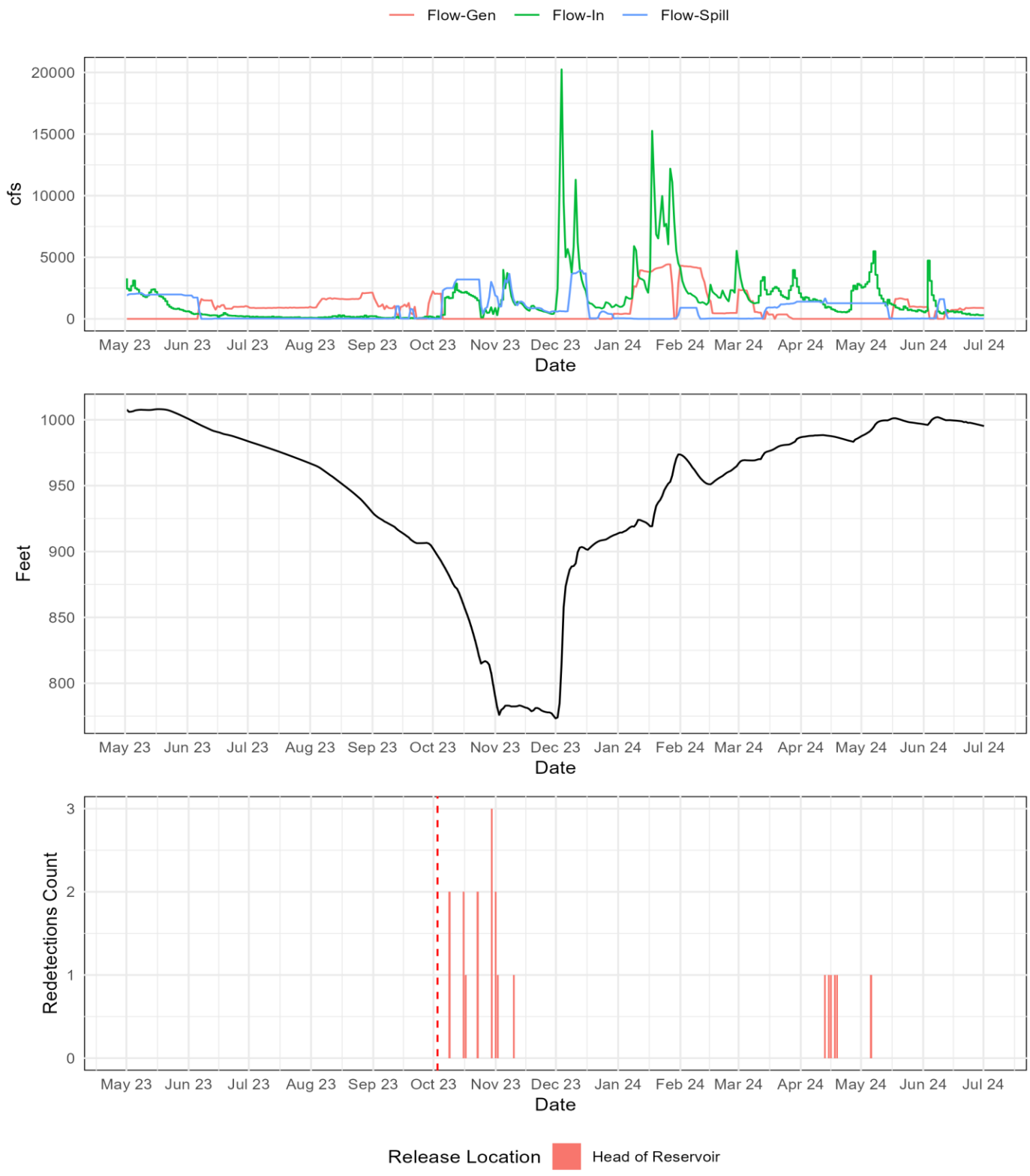

Figure 24. Green Peter project discharge (top panel), forebay elevation (middle panel), and recaptures of PIT tagged juvenile Chinook salmon released at the head of Green Peter Reservoir on October 3, and October 4, 2023, and subsequently recaptured in the Green Peter tailrace screw trap (bottom panel). Spill is either surface spill, regulating outlet spill, or a combination thereof. Approximate release date is represented by the dashed vertical line.

The last release of brood year 2022 fish into the Green Peter project area took place across three days in late February, 2024 and targeted springtime spill operations at Green Peter Dam. A total of 2,018 yearlings were released at the head of reservoir on February 21 and February 22, split evenly between the Middle Santiam and Quartzville Creek arms and a total of 4,009 yearlings were released mid-reservoir across February 22, and February 23. A total of 19 fish from the head of reservoir release group were recaptured (recapture rate: 0.9 %) with mean and median travel times from release to recapture in the tailrace of 41.3 days and 40 days, respectively. The mid-reservoir release group had 34 fish that were recaptured in the tailrace (recapture rate 0.8%). The mean travel time for the mid-reservoir release group was 47.8 days and the median travel time was 48.6 days. All but one of these fish were recaptured in the tailrace during spring spill operations with 32 recaptures taking place during nighttime spill operations (March 13 – April 11) and 20 recaptures taking place during continuous spill operations (April 12 – May 13; Figure 25).

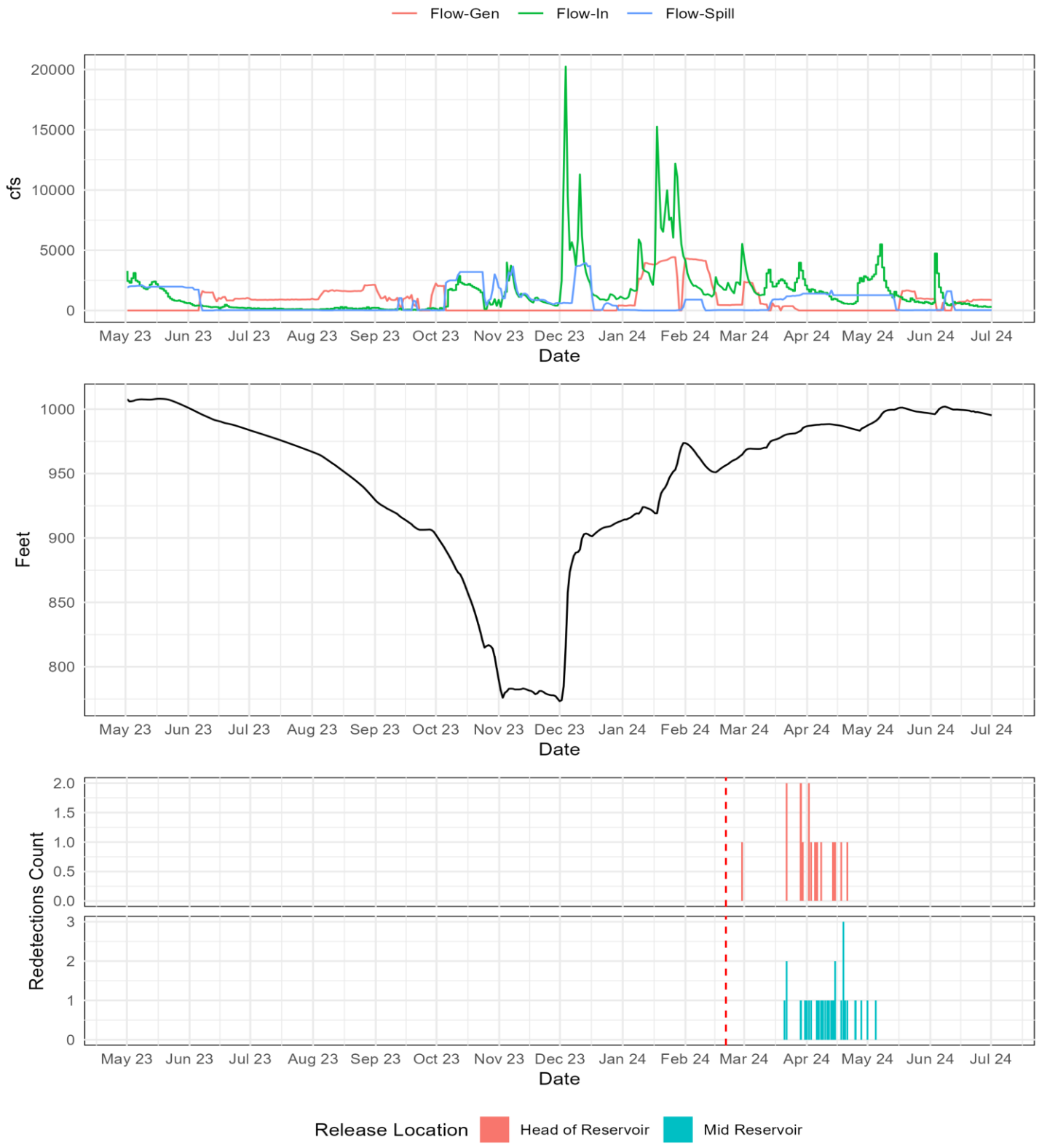

Figure 25. Green Peter project discharge (top panel), forebay elevation (middle panel), and recaptures of PIT tagged juvenile Chinook salmon released at the head of reservoir and at mid-reservoir in late February, 2024 and subsequently recaptured in the Green Peter tailrace screw trap (bottom panel). Spill is either surface spill, regulating outlet spill, or a combination thereof. Approximate release date is represented by the dashed vertical line.

The first release of BY2023 fry at Green Peter took place on March 6, 2024 at the head of reservoir (n = 5,006). This release was designed to evaluate fry passage during the first spring spill block (nighttime surface spill) at Green Peter Dam. There was an additional release of fry one month later on April 12 to evaluate passage during the second spring spill block (continuous surface spill) (n = 4,850). A total of 9 fry from the first release group were recaptured in the Green Peter tailrace and a total of 14 were recaptured from the second release group (Figure 26). Mean and median travel times for the first group were 72.6 days and 63.8 days while the same metrics for the second group were 57.8 days and 58.0 days. All of the detections from the second group occurred between June 7 and June 11, 2024 which coincided with a period of surface spill at Green Peter Dam which began on June 7 at 0900hrs and ended on June 11 at 0900hrs (Figure 27).

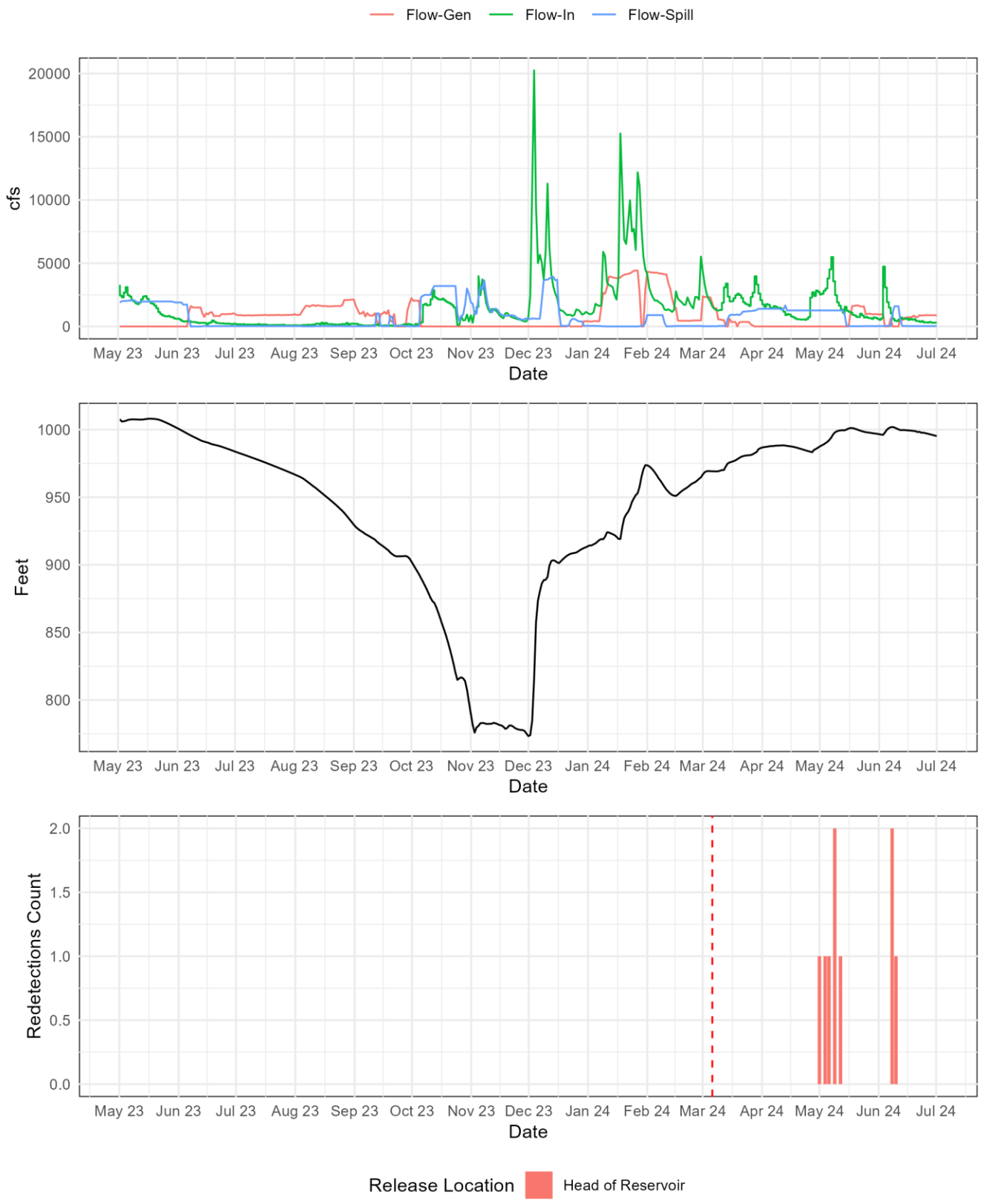

Figure 26. Green Peter project discharge (top panel), forebay elevation (middle panel), and recaptures of PIT tagged juvenile Chinook salmon released at the head of Green Peter Reservoir on March 6, 2024 and subsequently recaptured in the Green Peter tailrace screw trap (bottom panel). Approximate release date is represented by the dashed vertical line.

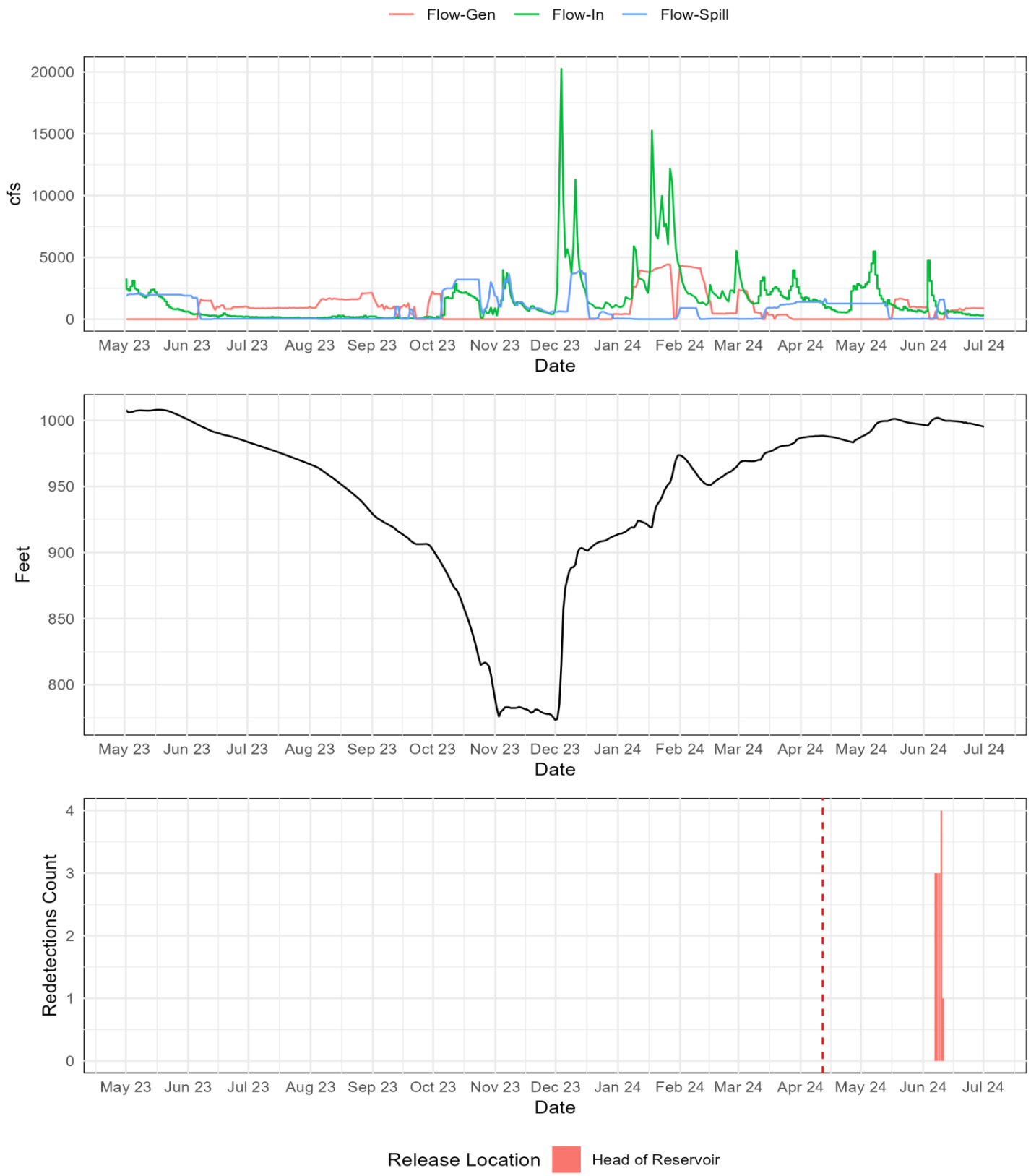

Figure 27. Green Peter project discharge (top panel), forebay elevation (middle panel), and recaptures of PIT tagged juvenile Chinook salmon released at the head of Green Peter Reservoir on April 12, 2024 and subsequently recaptured in

the Green Peter tailrace screw trap (bottom panel). Spill is either surface spill, regulating outlet spill, or a combination thereof. Approximate release date is represented by the dashed vertical line.

Foster

The first group of fish released in the Foster project area took place on August 22, 2023 and August 23, 2023 with introduction of 1,030 subyearling Chinook salmon into Foster Dam Tailrace and 2,059 into the head of reservoir. At this time, the forebay elevation was approximately 636 feet and all flow was being directed through the powerhouse as detailed in Figure 30. Forebay elevation would remain fairly stable throughout the summer and into the fall until fall drawdown operations commenced on October 1, 2023. Those operations included directing a significant proportion of the flow through the spill gates. Spill gate operations would continue until mid-December when all flow was transitioned back to the powerhouse. Of this initial release, 21 subyearlings were observed passing the Lebanon Dam PIT tag array (detection rate: 2.0%) with mean and median travel times of 22.0 and 1.3 days, respectively. This discrepancy between mean and median indicates a swift downstream movement by a large number of fish shortly after release, with 15 subyearling passing the Lebanon Dam array within the first five days. The remaining six fish observations at Lebanon Dam occurred between October 10 and November 28, a period marked by increased Foster Dam outflows (Figure 28).

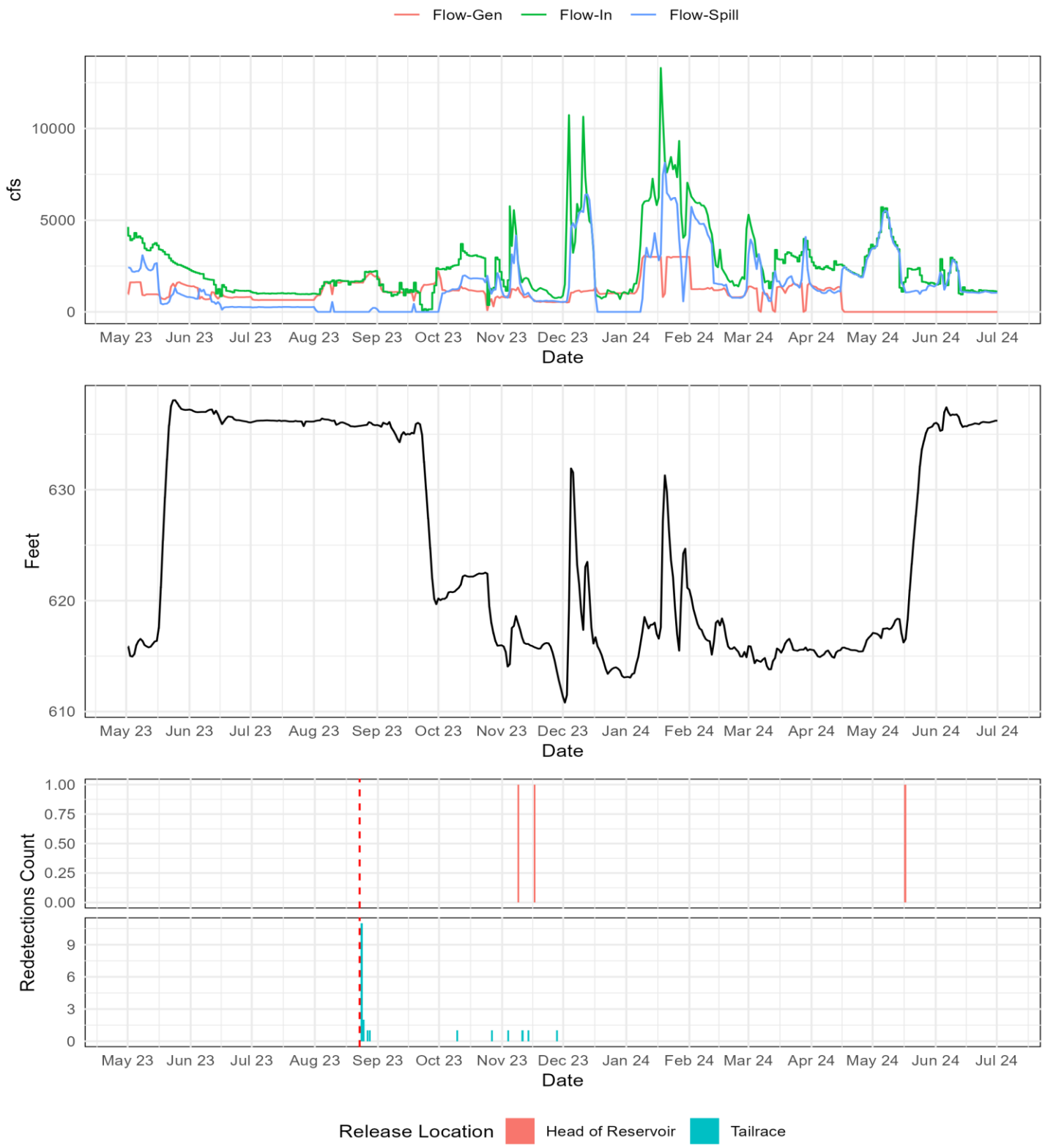

Figure 28. Foster project discharge (top panel), forebay elevation (middle panel), and recaptures of PIT tagged juvenile Chinook salmon released in late August, 2023 at the head of Foster and in the tailrace and subsequently redetected at the Lebanon Dam PIT tag array (bottom panel). Approximate release date is represented by the dashed vertical line.

The next release in the Foster project area occurred on October 10 and October 11, 2023 with 5,000 subyearlings released at head of reservoir and 4,000 subyearlings released at the Foster Dam Tailrace. This release coincided with the spill operations and a drawdown of the Foster Reservoir (Figure 29). A total of 55 subyearlings from the head of reservoir release were subsequently observed passing Lebanon Dam (recapture rate: 1.1%). The head of reservoir redetections had a mean travel time of 42.2 days and a median travel time of 37.2 days. The 25th percentile of travel times (29.9 days) indicates that the majority of these fish were observed passing Lebanon Dam after November 9, 2023 which coincided with a large increase of inflow into Foster Reservoir. Of the fish that were released into the Tailrace, a total of 74 were observed passing Lebanon Dam (recapture rate: 1.8%) with mean and median travel times of 31.9 days and 23.1 days.

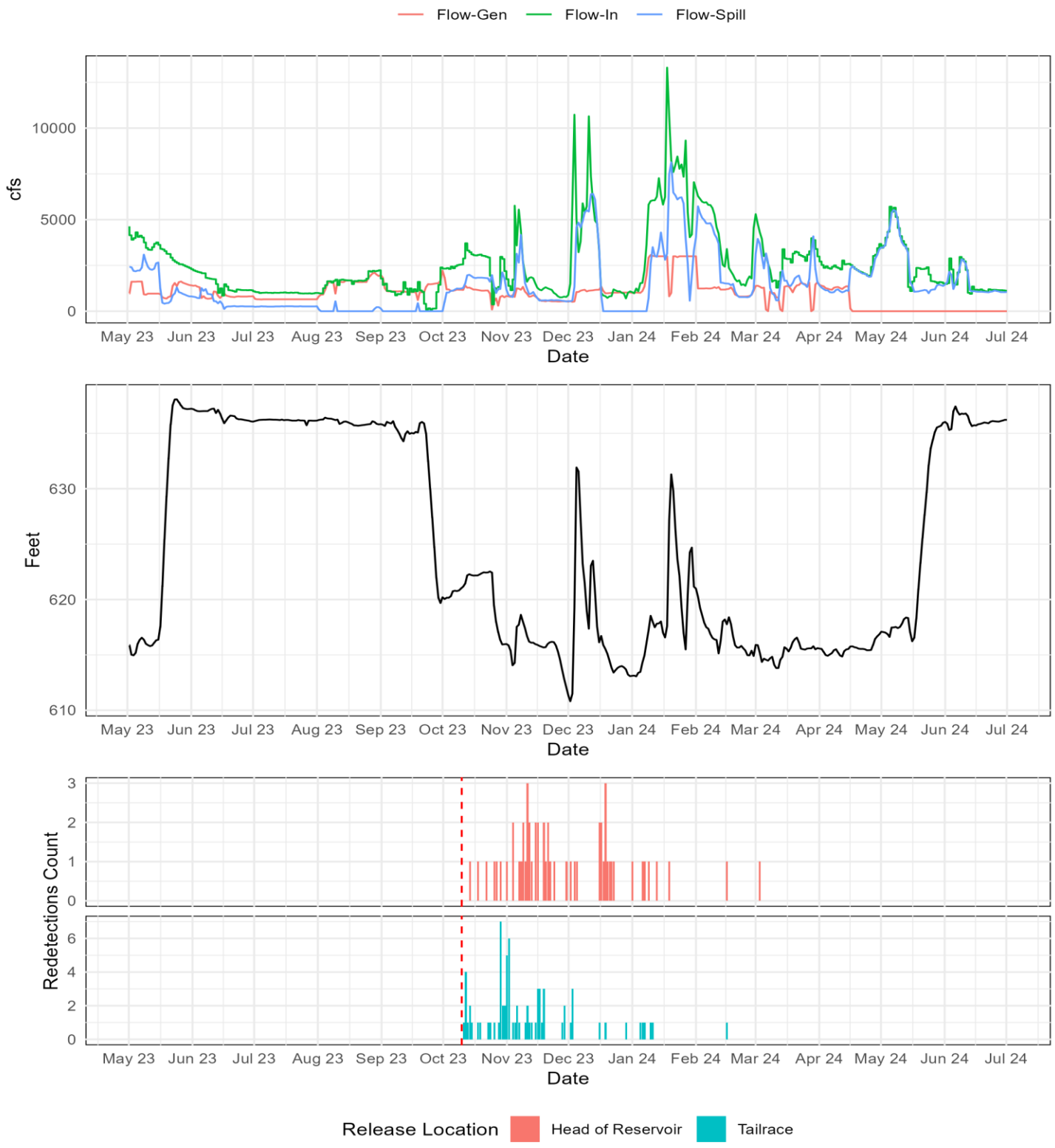

Figure 29. Foster project discharge (top panel), forebay elevation (middle panel), and recaptures of PIT tagged juvenile Chinook salmon released in October, 2023 at the head of Foster and in the tailrace and subsequently redetected at the Lebanon Dam PIT tag array (bottom panel). Approximate release date is represented by the dashed vertical line.

Brood year 2022 yearlings were released into the Foster project area on March 26 (head of reservoir; n = 2,997), March 27 (head or reservoir; n = 3,001), March 28 (tailrace; n = 3,005), and April 1, 2024 (tailrace, n = 2,991). A total of 22 fish from the head of reservoir releases were later redetected at Lebanon Dam (recapture rate: 0.4 %). These fish were released prior to the refill of Foster Reservoir (Figure 30). The fish that were redetected from the head of reservoir release had a mean travel time of 20.7 days and a median travel time of 4.7 days. There were a total of 30 redetections at Lebanon dam from the tailrace release group (redetection rate: 0.5%). The tailrace release group had much faster mean (1.0 days) and median (0.7 days) travel times compared to the head of reservoir group.

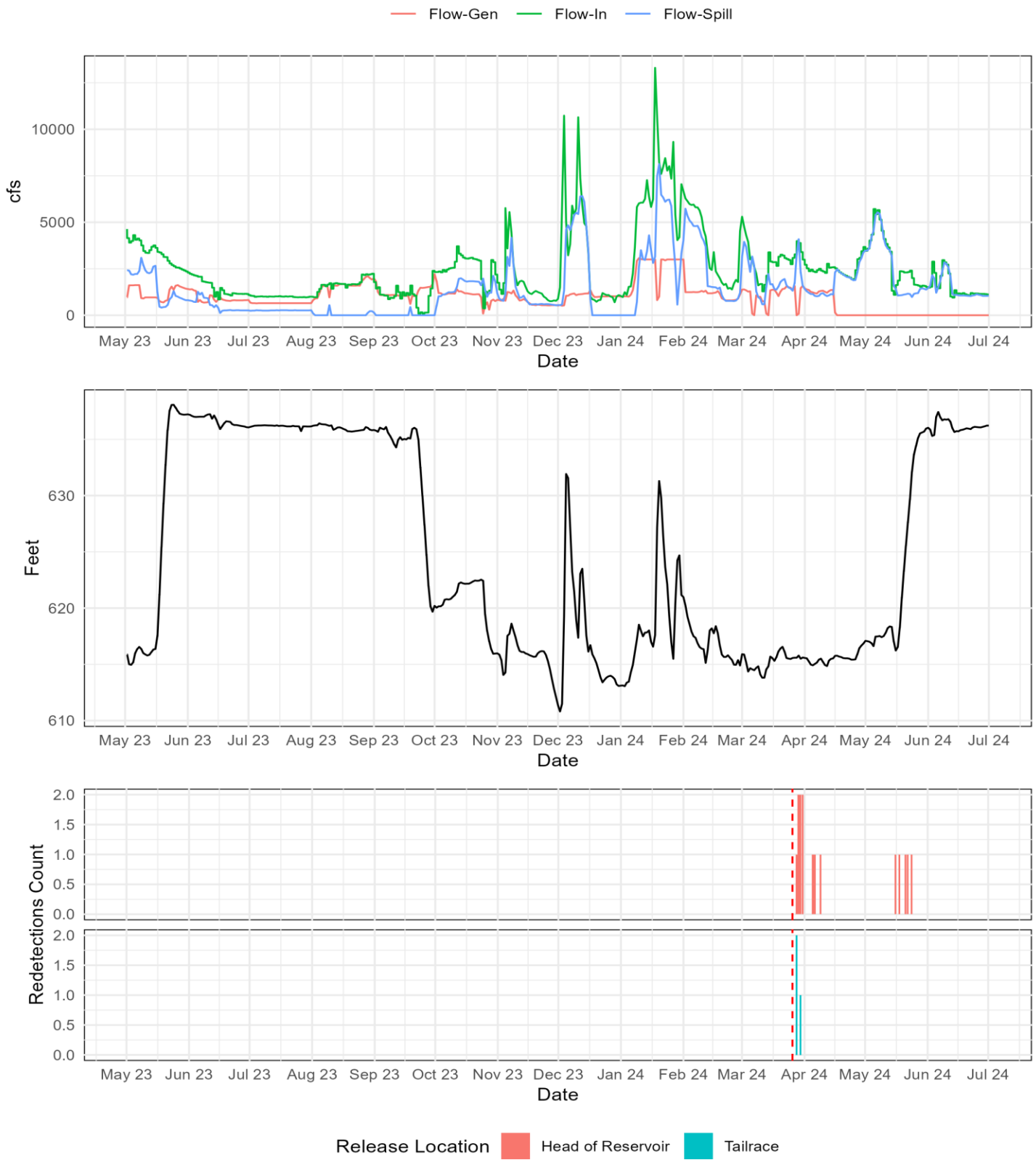

Figure 30. Foster project discharge (top panel), forebay elevation (middle panel), and recaptures of PIT tagged juvenile Chinook salmon released in March, 2024 at the head of Foster and in the tailrace and subsequently redetected at the Lebanon Dam PIT tag array (bottom panel). Approximate release date is represented by the dashed vertical line.

North Santiam

The first release of PIT tagged juvenile Chinook salmon into the head of the Detroit - Big Cliff project area occurred on July 13, 2023 with the release of 7,000 fry into the Breitenbush River and 6,638 fry into the North Santiam River. At the time of release, dam operations at Detroit were directing flow through both the powerhouse and the spill gates and the reservoir was being drafted (Figure 31). These operations continued until early August when all discharge through Detroit Dam was transitioned to the powerhouse. All discharge through Detroit was directed through the powerhouse until late September when discharge began to be transitioned to the spill gates and by late October all flow through Detroit Dam was via spill. Spill operations continued until early December when dam operations switched to a mix of both spill and powerhouse flow. Of the 13,638 fry released at the head of Detroit Reservoir, only 17 were recaptured in the Big Cliff Tailrace screw trap (recapture rate 0.1%). Those recaptured in the tailrace exhibited relatively long mean and median travel times of 221.2 and 276.0 days, respectively.

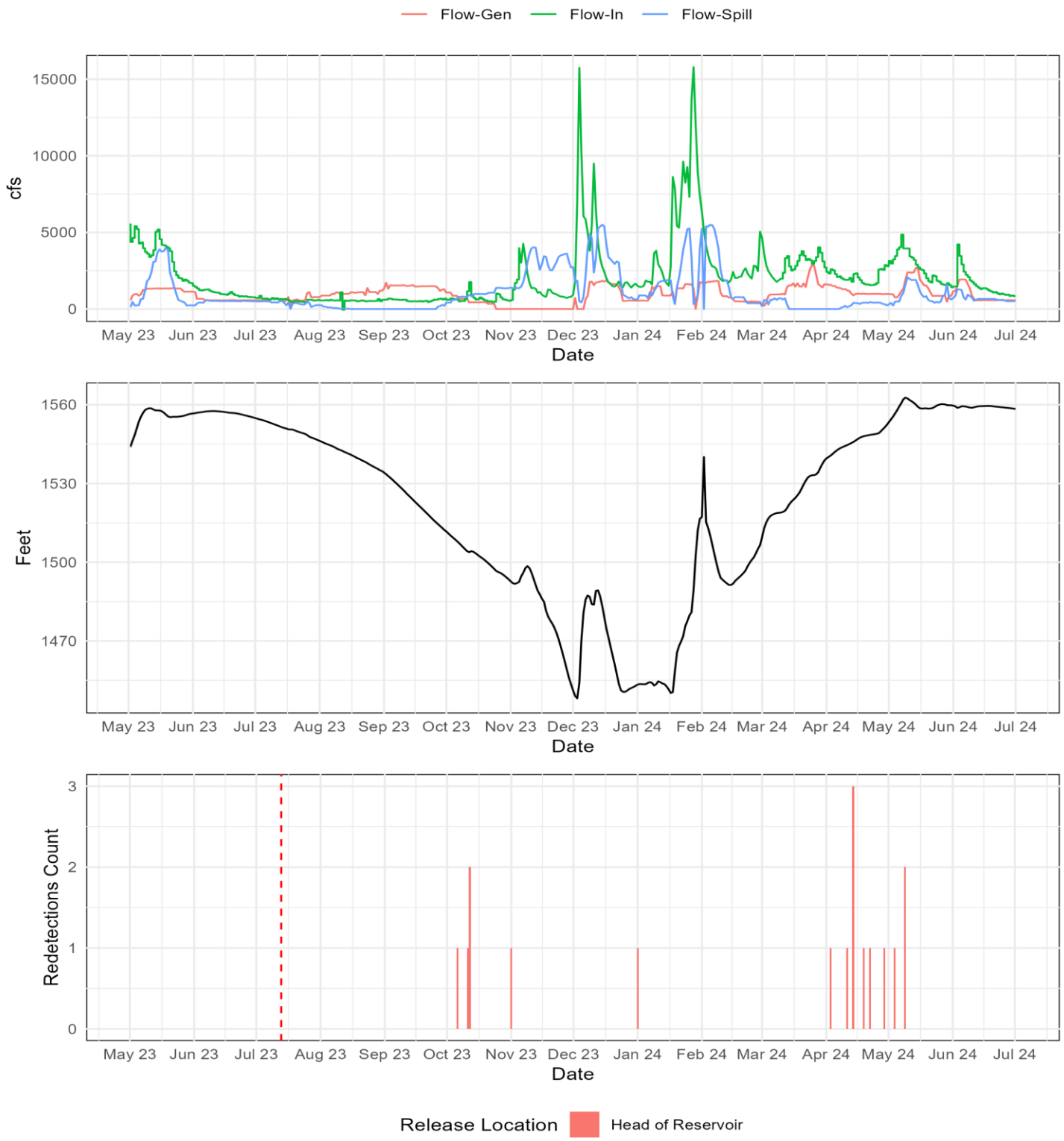

Figure 31. Detroit project discharge (top panel), forebay elevation (middle panel), and recaptures of PIT tagged salmon released on June 13, 2023 at the head of Detroit Reservoir and subsequently redetected at the Big Cliff tailrace screw trap (bottom panel). Spill is either surface spill, regulating outlet spill, or a combination thereof. Approximate release date is represented by the dashed vertical line.

The next release group consisted of 9,999 subyearlings released at the head of Detroit Reservoir (split evenly between the Breitenbush and North Santiam Rivers) on September 26, 2023. These fish were released prior to Detroit Reservoir reaching an elevation of 1520 feet (Figure 32). A total of 22 subyearlings from the head of reservoir release were recaptured at the Big Cliff Dam tailrace screw trap (recapture rate: 0.2%). Similar to the previous release group, these recapture had relatively long mean and median travel times of 195.5 days and 206.0 days, respectively.

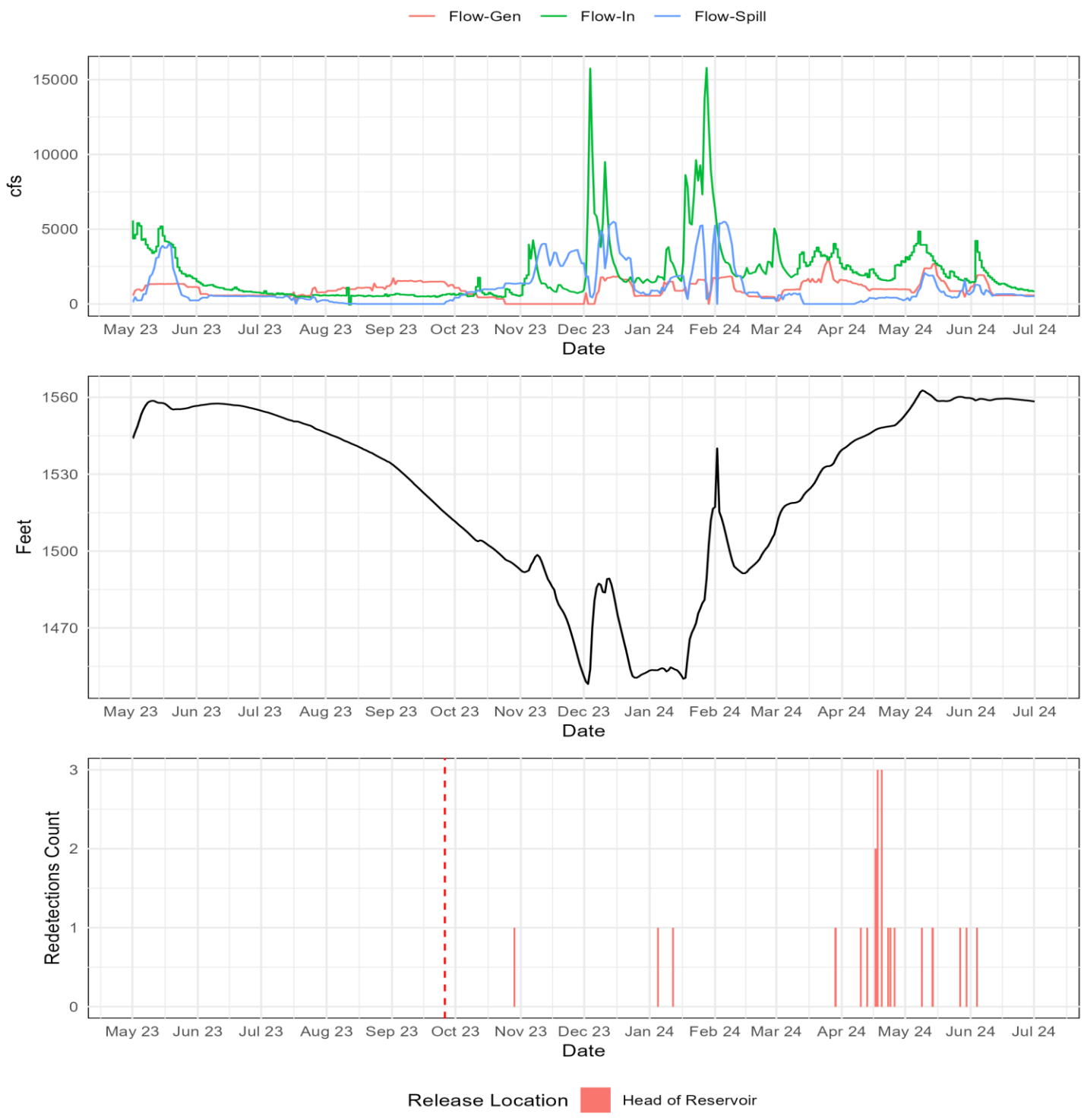

Figure 32. Detroit project discharge (top panel), forebay elevation (middle panel), and recaptures of PIT tagged salmon released on September 26, 2023 at the head of Detroit Reservoir and subsequently redetected at the Big Cliff tailrace screw trap (bottom panel). Approximate release date is represented by the dashed vertical line.

The final release of brood year 2022 fish into the Detroit-Big Cliff project area consisted of a total 4,000 yearlings released at the head of reservoir on March 20 (North Santiam Arm; n = 2,000) and March 21, 2024 (Breitenbush Arm; n = 2,000). These fish were released prior to the reservoir elevation reaching the spillway crest at Detroit Dam. A total of 37 fish from this release group were recaptured at the Big Cliff tailrace screw trap (recapture rate = 0.9%; Figure 33). Compared to the previous release groups at Detroit, these recaptures exhibited shorter mean and median travel times of 43.8 days and 77 days, respectively.

The first release of brood year 2023 was comprised of 15,027 fry that were released at the head of Detroit Reservoir on May 20, 2024. To date a single fish has been redetected in the Big Cliff Dam tailrace. Further details pertaining to recaptures of this release group will be presented in subsequent bi-annual reports.

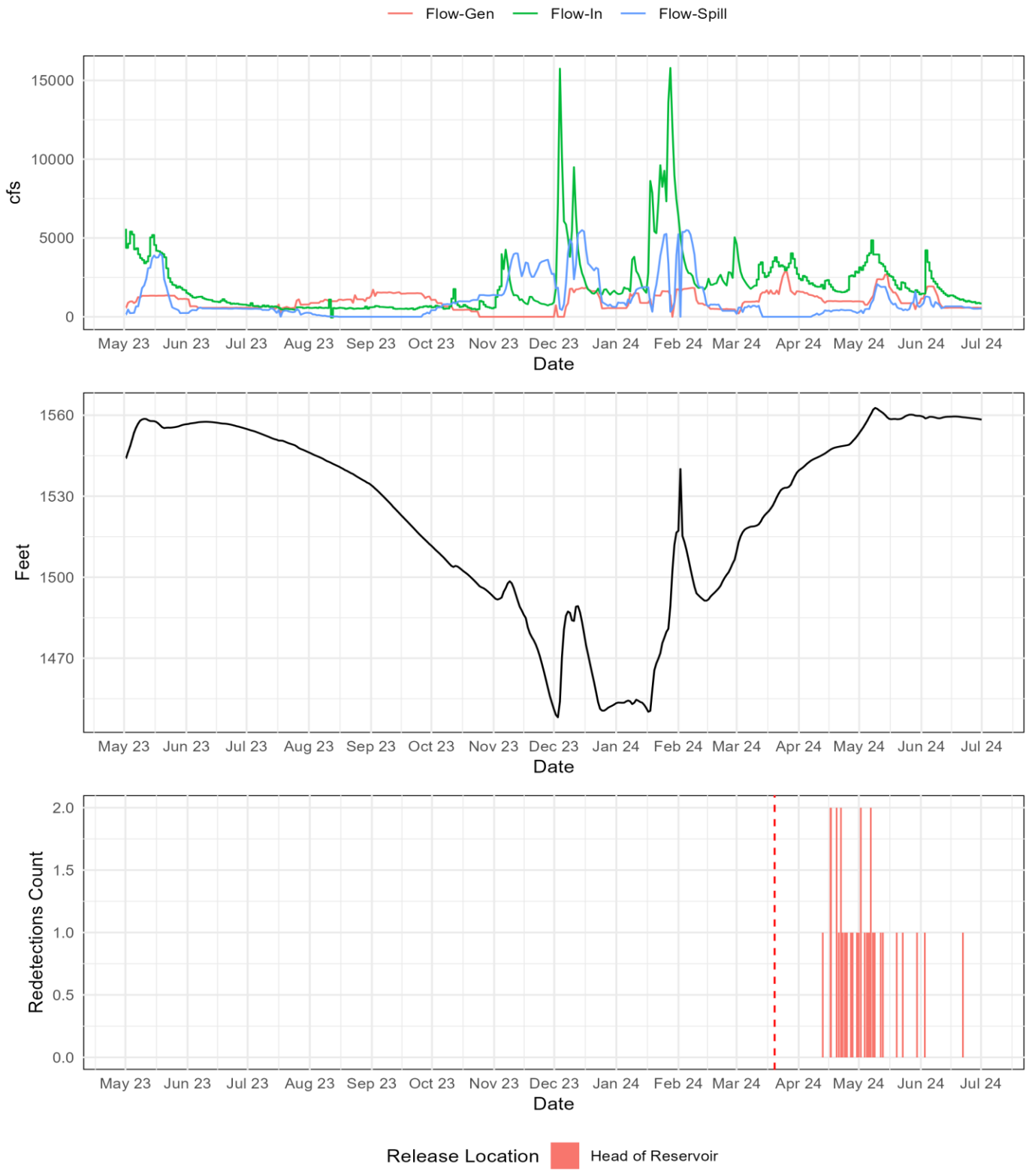

Figure 33. Detroit project discharge (top panel), forebay elevation (middle panel), and recaptures of PIT tagged salmon released on March 20, 2024 at the head of Detroit Reservoir and subsequently redetected at the Big Cliff tailrace screw trap (bottom panel). Approximate release date is represented by the dashed vertical line.

Table 6. Travel time metrics from release to observation or redetection. Travel time is presented in days. Observation Location definitions: CGR – Cougar Tailrace, DEX – Dexter Tailrace, FAL – Fall Creek Tailrace, GPD – Green Peter Tailrace, HCR – Hills Creek Tailrace, LOP – Lookout Point Tailrace, ML1 – Lower Mill Creek, NSANTR – North Santiam Stayton Power Canal Bypass, PD5 - Columbia River Pile Dike Array 5, PD7 - Columbia River Pile Dike Array 6, PD7 - Columbia River Pile Dike Array 7, PD8 - Columbia River Pile Dike Array 8, SID – Sauvie Island Dairy Creek, TWX – Columbia Towed Array, WILRMF – Middle Fork Willamette.

							Travel Time (days)					
Basin	**Project**	**Release Location**	**Release Date**	**Observation Location**	**Method**	**Count**	**Mean**	**Min**	**25%**	**Median**	**75%**	**Max**
MFW	Hills Creek	Head of Reservoir	5/18/2023	HCR	Screw Trap	3	152.2	125.8	127.8	129.8	165.4	200.9
MFW	Hills Creek	Head of Reservoir	5/18/2023	WILRMF	Screw Trap	41	1	0.8	0.8	0.8	0.8	2.8
MFW	Hills Creek	Head of Reservoir	6/5/2023	DEX	Screw Trap	3	184.8	181.1	181.6	182.1	186.6	191.1
MFW	Hills Creek	Head of Reservoir	6/5/2023	HCR	Screw Trap	74	176.8	103.1	170.4	185.6	192.1	232.1
MFW	Hills Creek	Head of Reservoir	6/5/2023	LOP	Screw Trap	7	195.3	171.1	192.1	192.1	193.1	233.1
MFW	Hills Creek	Head of Reservoir	11/7/2023	DEX	Screw Trap	3	43.2	26.8	27.3	27.8	51.3	74.8
MFW	Hills Creek	Head of Reservoir	11/7/2023	HCR	Screw Trap	67	41.5	4.8	22.3	34.8	61.3	174.8
MFW	Hills Creek	Head of Reservoir	11/7/2023	LOP	Screw Trap	10	53.9	36.8	36.8	41.3	76.8	77.8
MFW	Hills Creek	Mid Reservoir	11/8/2023	DEX	Screw Trap	4	69.1	30.9	54.9	75.9	90.1	93.9
MFW	Hills Creek	Mid Reservoir	11/8/2023	HCR	Screw Trap	99	36.1	3.9	17.9	31.9	45.4	177.8
MFW	Hills Creek	Mid Reservoir	11/8/2023	LOP	Screw Trap	19	44.5	14.9	35.9	36.9	42.9	92.9
MFW	Hills Creek	Mid Reservoir	11/8/2023	PD7	Passive	1	53.1	53.1	53.1	53.1	53.1	53.1
MFW	Hills Creek	Mid Reservoir	11/8/2023	WILRMF	Screw Trap	1	16.9	16.9	16.9	16.9	16.9	16.9
MFW	Hills Creek	Tailrace	11/9/2023	DEX	Screw Trap	6	15.4	9.9	10.4	11.9	20.9	24.9
MFW	Hills Creek	Tailrace	11/9/2023	LOP	Gillnet	2	5.9	5.9	5.9	5.9	5.9	5.9
MFW	Hills Creek	Tailrace	11/9/2023	LOP	Screw Trap	9	17.5	3.9	3.9	6.9	31.9	35.9
MFW	Hills Creek	Tailrace	11/9/2023	PD6	Passive	1	167.3	167.3	167.3	167.3	167.3	167.3
MFW	Hills Creek	Tailrace	1/31/2024	DEX	Screw Trap	15	42.2	3.9	22.9	41.9	58.9	95.9
MFW	Hills Creek	Tailrace	1/31/2024	HCR	Screw Trap	2	26.4	12.9	19.7	26.4	33.1	39.9
MFW	Hills Creek	Tailrace	1/31/2024	LOP	Screw Trap	6	79.9	63.9	64.1	69.4	97.9	106.9
MFW	Hills Creek	Tailrace	1/31/2024	PD5	Passive	8	82.1	68.2	70.5	76.6	86.9	120.7
MFW	Hills Creek	Tailrace	1/31/2024	PD6	Passive	18	68.8	54.4	55.8	57.3	82.9	97.4
MFW	Hills Creek	Tailrace	1/31/2024	PD7	Passive	7	48.2	25.8	41	52.1	54.6	68.1
MFW	Hills Creek	Tailrace	1/31/2024	PD8	Passive	3	95.4	83.3	84.3	85.2	101.4	117.7
MFW	Hills Creek	Tailrace	1/31/2024	TWX	Passive	15	85.6	62.8	72.9	92.2	93.1	107.3

MFW	Hills Creek	Tailrace	1/31/2024	WILRMF	Fyke Net	1	6.9	6.9	6.9	6.9	6.9	6.9
MFW	Hills Creek	Head of Reservoir	2/6/2024	HCR	Screw Trap	30	12.1	1	4	5	7	84
MFW	Hills Creek	Head of Reservoir	2/6/2024	LOP	Screw Trap	1	100	100	100	100	100	100
MFW	Hills Creek	Mid Reservoir	2/7/2024	HCR	Screw Trap	31	8.8	1.1	3.1	3.1	4.1	84
MFW	Hills Creek	Tailrace	2/7/2024	DEX	Screw Trap	2	74.8	65.8	70.3	74.8	79.3	83.8
MFW	Hills Creek	Tailrace	2/7/2024	HCR	Screw Trap	2	0.9	-0.1	0.4	0.9	1.4	1.9
MFW	Hills Creek	Tailrace	2/7/2024	PD5	Passive	1	91	91	91	91	91	91
MFW	Hills Creek	Tailrace	2/7/2024	PD6	Passive	3	74.6	49.3	66.8	84.3	87.2	90.2
MFW	Hills Creek	Tailrace	2/7/2024	PD7	Passive	1	35.6	35.6	35.6	35.6	35.6	35.6
MFW	Hills Creek	Tailrace	2/7/2024	TWX	Passive	3	74.7	68.7	69.7	70.8	77.8	84.7
MFW	LOP	Head of Reservoir	5/30/2023	DEX	Screw Trap	1	82.1	82.1	82.1	82.1	82.1	82.1
MFW	LOP	Head of Reservoir	5/30/2023	LOP	Fyke Net	1	27.9	27.9	27.9	27.9	27.9	27.9
MFW	LOP	Forebay	9/18/2023	DEX	Screw Trap	5	36	9.8	30.8	33.8	43.8	61.8
MFW	LOP	Forebay	9/18/2023	LOP	Gillnet	1	30.9	30.9	30.9	30.9	30.9	30.9
MFW	LOP	Forebay	9/18/2023	LOP	Screw Trap	1	86.8	86.8	86.8	86.8	86.8	86.8
MFW	LOP	Head of Reservoir	9/18/2023	DEX	Screw Trap	1	43.2	43.2	43.2	43.2	43.2	43.2
MFW	LOP	Head of Reservoir	9/18/2023	LOP	Gillnet	3	13.1	2.1	2.1	2.1	18.6	35.1
MFW	LOP	Head of Reservoir	9/18/2023	LOP	Screw Trap	1	88.2	88.2	88.2	88.2	88.2	88.2
MFW	LOP	Head of Reservoir	9/18/2023	PD7	Passive	1	35.4	35.4	35.4	35.4	35.4	35.4
MFW	LOP	Head of Reservoir	1/3/2024	DEX	Screw Trap	8	36.9	3.8	7.6	21.8	46.5	118.8
MFW	LOP	Head of Reservoir	1/3/2024	LOP	Screw Trap	33	18	2.8	19.8	20.8	20.8	21.8
MFW	LOP	Head of Reservoir	1/3/2024	PD5	Passive	1	106.9	106.9	106.9	106.9	106.9	106.9
MFW	LOP	Head of Reservoir	1/3/2024	PD6	Passive	6	86.9	84.4	84.7	85.8	86.9	94
MFW	LOP	Head of Reservoir	1/3/2024	PD7	Passive	3	40.6	29.4	35.7	41.9	46.2	50.4
MFW	LOP	Head of Reservoir	1/3/2024	PD8	Passive	1	132.4	132.4	132.4	132.4	132.4	132.4
MFW	LOP	Head of Reservoir	1/4/2024	DEX	Screw Trap	11	27.1	5.8	12.8	19.8	36.3	72.8
MFW	LOP	Head of Reservoir	1/4/2024	LOP	Screw Trap	30	17.1	2.8	18.8	19.3	19.8	26.8
MFW	LOP	Head of Reservoir	1/4/2024	PD5	Passive	3	106.3	96.5	103.3	110.1	111.1	112.2
MFW	LOP	Head of Reservoir	1/4/2024	PD6	Passive	1	92.9	92.9	92.9	92.9	92.9	92.9
MFW	LOP	Head of Reservoir	1/4/2024	PD7	Passive	1	55.6	55.6	55.6	55.6	55.6	55.6
MFW	LOP	Head of Reservoir	1/8/2024	DEX	Screw Trap	5	19.7	8.9	13.9	15.9	29.9	29.9
MFW	LOP	Head of Reservoir	1/8/2024	LOP	Screw Trap	26	15.6	13.9	14.9	15.9	15.9	23.9

MFW	LOP	Head of Reservoir	1/8/2024	PD6	Passive	5	101.4	77.3	85.4	108.1	116.6	119.5
MFW	LOP	Head of Reservoir	1/8/2024	PD7	Passive	2	50.8	44.8	47.8	50.8	53.9	56.9
MFW	LOP	Head of Reservoir	1/8/2024	PD8	Passive	1	105.1	105.1	105.1	105.1	105.1	105.1
MFW	LOP	Head of Reservoir	1/8/2024	TWX	Passive	1	100.8	100.8	100.8	100.8	100.8	100.8
MFW	LOP	Head of Reservoir	1/9/2024	DEX	Screw Trap	10	31.2	4.8	15.8	16.3	51.5	75.8
MFW	LOP	Head of Reservoir	1/9/2024	LOP	Screw Trap	35	16.7	12.8	13.8	14.8	14.8	85.8
MFW	LOP	Head of Reservoir	1/9/2024	PD6	Passive	4	78.9	78.2	78.2	78.6	79.4	80.3
MFW	LOP	Head of Reservoir	1/9/2024	PD7	Passive	3	63.3	49.8	59.6	69.4	70.1	70.9
MFW	LOP	Head of Reservoir	1/25/2024	DEX	Screw Trap	10	32.7	8	11	35.5	52.7	57
MFW	LOP	Head of Reservoir	1/25/2024	LOP	Screw Trap	8	8.2	6	6	6.5	7	20
MFW	LOP	Head of Reservoir	1/25/2024	PD5	Passive	2	82.5	75.7	79.1	82.5	85.9	89.4
MFW	LOP	Head of Reservoir	1/25/2024	PD6	Passive	9	66.6	60.5	61.7	62.7	63.5	100.2
MFW	LOP	Head of Reservoir	1/25/2024	PD7	Passive	1	42	42	42	42	42	42
MFW	LOP	Head of Reservoir	1/25/2024	TWX	Passive	3	94.1	74	89	103.9	104.2	104.4
MFW	LOP	Forebay	2/28/2024	LOP	Screw Trap	4	31.5	11.8	29.8	35.8	37.5	42.8
MFW	LOP	Forebay	2/28/2024	PD5	Passive	5	56.5	49.6	50.9	52.1	60.2	69.5
MFW	LOP	Forebay	2/28/2024	PD6	Passive	6	58.3	29.5	42.5	55.3	68	99.5
MFW	LOP	Forebay	2/28/2024	PD7	Passive	1	36.9	36.9	36.9	36.9	36.9	36.9
MFW	LOP	Forebay	2/28/2024	PD8	Passive	3	64.9	56.1	61	65.9	69.2	72.5
MFW	LOP	Forebay	2/28/2024	TWX	Passive	6	61.7	49.7	54.2	64.6	68.2	71.2
MFW	LOP	Head of Reservoir	2/28/2024	DEX	Screw Trap	4	57.5	45	47.2	48.5	58.7	88
MFW	LOP	Head of Reservoir	2/28/2024	LOP	Screw Trap	2	63	36	49.5	63	76.5	90
MFW	LOP	Head of Reservoir	2/28/2024	PD5	Passive	4	60.7	43.9	54.8	63.8	69.7	71.4
MFW	LOP	Head of Reservoir	2/28/2024	PD6	Passive	3	63.9	47	59.2	71.3	72.4	73.5
MFW	LOP	Head of Reservoir	2/28/2024	PD8	Passive	3	65.4	61.2	62.4	63.5	67.4	71.4
MFW	LOP	Head of Reservoir	2/28/2024	TWX	Passive	8	62.5	34.9	62.9	64.4	66.7	76.5
MFW	LOP	Tailrace	2/29/2024	PD5	Passive	1	52.7	52.7	52.7	52.7	52.7	52.7
MFW	LOP	Tailrace	2/29/2024	PD6	Passive	8	35.2	28.4	31.2	33.7	40.9	41.5
MFW	LOP	Tailrace	2/29/2024	PD7	Passive	2	20.9	10.6	15.7	20.9	26.1	31.2
MFW	LOP	Tailrace	2/29/2024	TWX	Passive	2	41.5	41	41.2	41.5	41.7	42
MFW	LOP	Head of Reservoir	4/9/2024	LOP	Screw Trap	3	44.3	41	42	43	46	49.1
MFW	LOP	Head of Reservoir	4/9/2024	PD5	Passive	2	31.9	29.4	30.7	31.9	33.2	34.5

MFW	LOP	Head of Reservoir	4/9/2024	PD6	Passive	4	30	15.5	19.9	22	32.1	60.3
MFW	LOP	Head of Reservoir	4/9/2024	PD8	Passive	3	32	21.6	24.2	26.9	37.2	47.6
MFW	LOP	Head of Reservoir	4/9/2024	TWX	Passive	12	29.6	23.4	24.2	27.7	29.8	54.5
MFW	LOP	Forebay	4/10/2024	DEX	Screw Trap	3	9.4	8	9	10	10	10
MFW	LOP	Forebay	4/10/2024	LOP	Screw Trap	2	23.5	4	13.8	23.5	33.3	43
MFW	LOP	Forebay	4/10/2024	PD5	Passive	2	21.4	12.9	17.1	21.4	25.6	29.9
MFW	LOP	Forebay	4/10/2024	PD6	Passive	1	43.9	43.9	43.9	43.9	43.9	43.9
MFW	LOP	Forebay	4/10/2024	PD8	Passive	3	42.9	35.8	39.9	43.9	46.4	48.9
MFW	LOP	Forebay	4/10/2024	TWX	Passive	7	35	26.4	28.6	33.6	42	43.6
MFW	LOP	Forebay	4/10/2024	WILRMF	Fyke Net	1	7	7	7	7	7	7
MFW	LOP	Forebay	4/11/2024	DEX	Screw Trap	1	25	25	25	25	25	25
MFW	LOP	Forebay	4/11/2024	LOP	Screw Trap	6	37.7	35	37	37	37.8	42
MFW	LOP	Forebay	4/11/2024	PD5	Passive	1	30	30	30	30	30	30
MFW	LOP	Forebay	4/11/2024	PD6	Passive	1	37.6	37.6	37.6	37.6	37.6	37.6
MFW	LOP	Forebay	4/11/2024	PD8	Passive	1	30.8	30.8	30.8	30.8	30.8	30.8
MFW	LOP	Forebay	4/11/2024	TWX	Passive	11	23.6	12	19.6	22.5	25.6	35.8
MFW	LOP	Tailrace	4/11/2024	PD5	Passive	2	12.4	10.6	11.5	12.4	13.4	14.3
MFW	LOP	Tailrace	4/11/2024	PD8	Passive	3	15.9	11.6	13.6	15.7	18	20.4
MFW	LOP	Tailrace	4/11/2024	TWX	Passive	3	16.5	10.6	14.9	19.2	19.4	19.6
MFW	Fall Creek	Head of Reservoir	6/12/2023	FAL	Screw Trap	14	138.1	127.9	128.1	128.9	129.9	236.9
MFW	Fall Creek	Head of Reservoir	9/28/2023	FAL	Screw Trap	142	24.4	19.9	19.9	20.9	21.9	44.9
MFW	Fall Creek	Head of Reservoir	9/28/2023	PD5	Passive	1	197.7	197.7	197.7	197.7	197.7	197.7
MFW	Fall Creek	Head of Reservoir	9/28/2023	PD7	Passive	2	28.9	28.4	28.6	28.9	29.2	29.5
MFW	Fall Creek	Head of Reservoir	11/6/2023	DEX	Screw Trap	1	7.9	7.9	7.9	7.9	7.9	7.9
MFW	Fall Creek	Head of Reservoir	11/6/2023	FAL	Screw Trap	280	2.2	0.9	0.9	1.9	1.9	102.9
MFW	Fall Creek	Head of Reservoir	11/6/2023	PD5	Passive	1	157.2	157.2	157.2	157.2	157.2	157.2
MFW	Fall Creek	Head of Reservoir	11/6/2023	PD7	Passive	2	92.4	33.9	63.1	92.4	121.6	150.9
MFW	Fall Creek	Tailrace	11/6/2023	PD7	Passive	1	152.4	152.4	152.4	152.4	152.4	152.4
MFW	Fall Creek	Head of Reservoir	2/20/2024	FAL	Screw Trap	211	1.8	1	1	2	2	18.9
MFW	Fall Creek	Head of Reservoir	2/20/2024	PD5	Passive	4	70.5	52.3	53.8	56.6	73.2	116.6
MFW	Fall Creek	Head of Reservoir	2/20/2024	PD6	Passive	12	44.3	38.4	40.2	43.2	47.5	52.4
MFW	Fall Creek	Head of Reservoir	2/20/2024	PD7	Passive	7	43.3	9	22.9	33.6	42.9	129.2

MFW	Fall Creek	Head of Reservoir	2/20/2024	TWX	Passive	3	51.6	45	48.5	51.9	54.9	57.8
MFW	Fall Creek	Tailrace	2/20/2024	PD6	Passive	3	54	45.4	49.3	53.2	58.2	63.3
MFW	Fall Creek	Tailrace	2/20/2024	PD7	Passive	3	30.7	18.7	23.6	28.6	36.8	44.9
MFW	Fall Creek	Tailrace	4/3/2024	PD5	Passive	3	15	12.5	13.9	15.3	16.2	17.1
MFW	Fall Creek	Tailrace	4/3/2024	PD6	Passive	2	14.3	13.9	14.1	14.3	14.4	14.6
MFW	Fall Creek	Tailrace	4/3/2024	PD7	Passive	2	11.8	9.3	10.6	11.8	13	14.2
MCK	Cougar	Head of Reservoir	8/29/2023	CGR	Screw Trap	31	89.7	45	63.5	68.1	90.1	205
MCK	Cougar	Head of Reservoir	10/2/2023	CGR	Screw Trap	481	37.8	5.7	21.9	29.7	34.9	213.7
MCK	Cougar	Head of Reservoir	10/2/2023	PD7	Passive	1	47.8	47.8	47.8	47.8	47.8	47.8
MCK	Cougar	Head of Reservoir	10/2/2023	PD8	Passive	1	204.6	204.6	204.6	204.6	204.6	204.6
MCK	Cougar	Head of Reservoir	10/2/2023	SID	Passive	1	121.7	121.7	121.7	121.7	121.7	121.7
MCK	Cougar	Head of Reservoir	10/2/2023	TWX	Passive	1	224.3	224.3	224.3	224.3	224.3	224.3
MCK	Cougar	Forebay	10/18/2023	CGR	Screw Trap	352	22.1	0.8	10.8	13.8	18.8	245.8
MCK	Cougar	Forebay	10/18/2023	PD6	Passive	2	173.2	171.2	172.2	173.2	174.2	175.2
MCK	Cougar	Forebay	10/18/2023	PD7	Passive	2	62.9	32.1	47.5	62.9	78.3	93.8
MCK	Cougar	Forebay	10/18/2023	SID	Passive	1	86.4	86.4	86.4	86.4	86.4	86.4
MCK	Cougar	Forebay	10/18/2023	TWX	Passive	1	176.6	176.6	176.6	176.6	176.6	176.6
MCK	Cougar	Head of Reservoir	10/18/2023	CGR	Screw Trap	270	28.7	2	12	15	19.1	245
MCK	Cougar	Head of Reservoir	10/18/2023	PD6	Passive	2	180.4	178.5	179.5	180.4	181.4	182.3
MCK	Cougar	Tailrace	10/19/2023	PD7	Passive	1	173.8	173.8	173.8	173.8	173.8	173.8
MCK	Cougar	Tailrace	10/19/2023	TWX	Passive	1	203	203	203	203	203	203
MCK	Cougar	Head of Reservoir	11/13/2023	CGR	Screw Trap	285	51.7	1	6	30	106	212.9
MCK	Cougar	Head of Reservoir	11/13/2023	PD6	Passive	2	154.8	144.3	149.5	154.8	160.1	165.4
MCK	Cougar	Head of Reservoir	11/13/2023	TWX	Passive	3	172.6	154.8	167.7	180.7	181.5	182.3
MCK	Cougar	Forebay	11/14/2023	CGR	Screw Trap	484	22.9	0.9	0.9	1.9	20.9	213.8
MCK	Cougar	Forebay	11/14/2023	PD5	Passive	1	153	153	153	153	153	153
MCK	Cougar	Forebay	11/14/2023	PD6	Passive	4	167.2	148.6	166.5	173	173.7	174.2
MCK	Cougar	Forebay	11/14/2023	PD7	Passive	1	138	138	138	138	138	138
MCK	Cougar	Forebay	11/14/2023	PD8	Passive	1	164.7	164.7	164.7	164.7	164.7	164.7
MCK	Cougar	Forebay	11/14/2023	TWX	Passive	1	173.3	173.3	173.3	173.3	173.3	173.3
MCK	Cougar	Tailrace	11/15/2023	PD5	Passive	1	149.4	149.4	149.4	149.4	149.4	149.4
MCK	Cougar	Tailrace	11/15/2023	PD6	Passive	2	152.6	148.5	150.5	152.6	154.7	156.7

MCK	Cougar	Tailrace	11/15/2023	PD7	Passive	1	146	146	146	146	146	146
MCK	Cougar	Head of Reservoir	3/8/2024	CGR	Screw Trap	108	31.4	1	9	26	41	103
MCK	Cougar	Head of Reservoir	3/8/2024	PD5	Passive	3	53.6	39.6	49.7	59.9	60.7	61.4
MCK	Cougar	Head of Reservoir	3/8/2024	PD6	Passive	1	54.5	54.5	54.5	54.5	54.5	54.5
MCK	Cougar	Head of Reservoir	3/8/2024	PD7	Passive	1	34.6	34.6	34.6	34.6	34.6	34.6
MCK	Cougar	Head of Reservoir	3/8/2024	PD8	Passive	1	46.3	46.3	46.3	46.3	46.3	46.3
MCK	Cougar	Head of Reservoir	3/8/2024	TWX	Passive	2	57.4	54.4	55.9	57.4	58.9	60.4
MCK	Cougar	Forebay	3/11/2024	CGR	Screw Trap	212	14.2	1	1	3	17	110
MCK	Cougar	Forebay	3/11/2024	PD5	Passive	3	34.5	25.7	28.8	32	38.9	45.9
MCK	Cougar	Forebay	3/11/2024	PD6	Passive	5	39.3	26.4	33.5	37.2	40.8	58.8
MCK	Cougar	Forebay	3/11/2024	PD8	Passive	1	58.8	58.8	58.8	58.8	58.8	58.8
MCK	Cougar	Forebay	3/11/2024	TWX	Passive	3	45.1	35.8	38.8	41.8	49.7	57.6
MCK	Cougar	Tailrace	3/11/2024	PD5	Passive	7	42.1	29.7	39	41.2	43	60.2
MCK	Cougar	Tailrace	3/11/2024	PD6	Passive	6	27	21.3	26.2	26.8	27.3	33.4
MCK	Cougar	Tailrace	3/11/2024	PD7	Passive	2	15.5	6.5	11	15.5	20	24.5
MCK	Cougar	Tailrace	3/11/2024	PD8	Passive	2	58.1	47.7	52.9	58.1	63.3	68.5
SST	Green Peter	Head of Reservoir	5/22/2023	GPD	Screw Trap	1	5.7	5.7	5.7	5.7	5.7	5.7
SST	Green Peter	Head of Reservoir	9/20/2023	GPD	Screw Trap	1	208.9	208.9	208.9	208.9	208.9	208.9
SST	Green Peter	Head of Reservoir	9/20/2023	LBN	Passive	4	111.1	43	54.2	76.6	133.5	248.2
SST	Green Peter	Head of Reservoir	9/20/2023	PD6	Passive	1	227.1	227.1	227.1	227.1	227.1	227.1
SST	Green Peter	Head of Reservoir	9/20/2023	TWX	Passive	1	226.9	226.9	226.9	226.9	226.9	226.9
SST	Green Peter	Head of Reservoir	9/21/2023	GPD	Screw Trap	13	48.8	10.9	11.9	24.9	38.9	207.9
SST	Green Peter	Head of Reservoir	9/21/2023	LBN	Passive	2	60.6	50	55.3	60.6	66	71.3
SST	Green Peter	Head of Reservoir	9/21/2023	PD5	Passive	2	224.4	221	222.7	224.4	226.1	227.8
SST	Green Peter	Head of Reservoir	9/21/2023	PD6	Passive	1	227.7	227.7	227.7	227.7	227.7	227.7
SST	Green Peter	Head of Reservoir	9/21/2023	TWX	Passive	1	223.3	223.3	223.3	223.3	223.3	223.3
SST	Green Peter	Head of Reservoir	10/3/2023	GPD	Screw Trap	14	61.1	13	20	27	29.7	216
SST	Green Peter	Head of Reservoir	10/3/2023	LBN	Passive	9	51.8	27.3	27.6	35.5	36.4	193.4
SST	Green Peter	Head of Reservoir	10/3/2023	TWX	Passive	2	216.8	211.4	214.1	216.8	219.6	222.3
SST	Green Peter	Head of Reservoir	10/4/2023	GPD	Screw Trap	13	60.9	4.9	18.9	25.9	36.9	197.9
SST	Green Peter	Head of Reservoir	10/4/2023	LBN	Passive	14	151.7	23.7	73.3	198.9	202.3	205.5
SST	Green Peter	Head of Reservoir	10/4/2023	PD5	Passive	1	223.5	223.5	223.5	223.5	223.5	223.5

SST	Green Peter	Head of Reservoir	10/4/2023	PD7	Passive	1	33	33	33	33	33	33
SST	Green Peter	Head of Reservoir	10/4/2023	TWX	Passive	2	199.2	181.8	190.5	199.2	207.8	216.5
SST	Green Peter	Tailrace	10/9/2023	LBN	Passive	49	36	4	22.5	33.3	48.7	83.8
SST	Green Peter	Tailrace	10/9/2023	PD5	Passive	1	189.9	189.9	189.9	189.9	189.9	189.9
SST	Green Peter	Tailrace	10/9/2023	PD6	Passive	1	184.5	184.5	184.5	184.5	184.5	184.5
SST	Green Peter	Tailrace	10/9/2023	PD7	Passive	3	60.1	14.4	14.7	15	82.9	150.8
SST	Green Peter	Tailrace	10/9/2023	TWX	Passive	1	189.6	189.6	189.6	189.6	189.6	189.6
SST	Green Peter	Head of Reservoir	2/21/2024	GPD	Screw Trap	8	44.7	30	40.2	42.5	53.2	57
SST	Green Peter	Head of Reservoir	2/21/2024	LBN	Passive	1	46.4	46.4	46.4	46.4	46.4	46.4
SST	Green Peter	Head of Reservoir	2/21/2024	MSANTR	Screw Trap	2	1	1	1	1	1	1
SST	Green Peter	Head of Reservoir	2/21/2024	PD5	Passive	3	58.8	49.3	55.8	62.3	63.6	64.8
SST	Green Peter	Head of Reservoir	2/21/2024	PD6	Passive	1	62.7	62.7	62.7	62.7	62.7	62.7
SST	Green Peter	Head of Reservoir	2/21/2024	PD7	Passive	1	60.1	60.1	60.1	60.1	60.1	60.1
SST	Green Peter	Head of Reservoir	2/21/2024	PD8	Passive	2	67.8	63.9	65.8	67.8	69.7	71.6
SST	Green Peter	Head of Reservoir	2/22/2024	GPD	Screw Trap	11	37.8	7	32.5	37	45	59
SST	Green Peter	Head of Reservoir	2/22/2024	LBN	Passive	2	53	47.2	50.1	53	55.8	58.7
SST	Green Peter	Head of Reservoir	2/22/2024	PD5	Passive	6	55.3	43.3	50.5	56.7	60	65.3
SST	Green Peter	Head of Reservoir	2/22/2024	PD6	Passive	2	49.6	43.6	46.6	49.6	52.6	55.7
SST	Green Peter	Head of Reservoir	2/22/2024	PD8	Passive	1	60.7	60.7	60.7	60.7	60.7	60.7
SST	Green Peter	Head of Reservoir	2/22/2024	TWX	Passive	2	76.7	74.5	75.6	76.7	77.9	79
SST	Green Peter	Mid Reservoir	2/22/2024	GPD	Screw Trap	20	50.7	28.7	44.2	52.2	56.7	72.7
SST	Green Peter	Mid Reservoir	2/22/2024	LBN	Passive	4	42.2	32.3	36.3	39	45	58.5
SST	Green Peter	Mid Reservoir	2/22/2024	MSANTR	Fyke Net	1	10.8	10.8	10.8	10.8	10.8	10.8
SST	Green Peter	Mid Reservoir	2/22/2024	PD5	Passive	1	58.1	58.1	58.1	58.1	58.1	58.1
SST	Green Peter	Mid Reservoir	2/22/2024	PD6	Passive	4	57.8	43.1	52.3	59.2	64.7	69.5
SST	Green Peter	Mid Reservoir	2/22/2024	PD8	Passive	1	63.2	63.2	63.2	63.2	63.2	63.2
SST	Green Peter	Mid Reservoir	2/22/2024	TWX	Passive	3	70.4	70.1	70.1	70.1	70.6	71.1
SST	Green Peter	Mid Reservoir	2/23/2024	GPD	Screw Trap	14	45	27	38.5	45	53.5	62
SST	Green Peter	Mid Reservoir	2/23/2024	LBN	Passive	6	40.7	27.2	39.6	42.6	45.5	46.4
SST	Green Peter	Mid Reservoir	2/23/2024	PD5	Passive	4	58.8	48.5	54.4	57.6	62	71.7
SST	Green Peter	Mid Reservoir	2/23/2024	PD6	Passive	4	48.2	36.5	40.4	44.1	51.9	68.3
SST	Green Peter	Mid Reservoir	2/23/2024	PD7	Passive	2	58.7	45.3	52	58.7	65.4	72.2

SST	Green Peter	Mid Reservoir	2/23/2024	PD8	Passive	1	96	96	96	96	96	96
SST	Green Peter	Mid Reservoir	2/23/2024	TWX	Passive	5	58.1	40	55	55	69.8	70.8
SST	Green Peter	Tailrace	2/23/2024	LBN	Passive	1	17.4	17.4	17.4	17.4	17.4	17.4
SST	Green Peter	Tailrace	2/23/2024	PD5	Passive	2	49	44.2	46.6	49	51.4	53.8
SST	Green Peter	Tailrace	2/23/2024	TWX	Passive	1	75.9	75.9	75.9	75.9	75.9	75.9
SST	Green Peter	Head of Reservoir	3/6/2024	GPD	Screw Trap	9	72.6	55.8	60.8	63.8	93.7	95.7
SST	Green Peter	Head of Reservoir	3/6/2024	LBN	Passive	5	89	69.4	75.9	97.9	98.1	104
SST	Green Peter	Head of Reservoir	3/6/2024	MSANTR	Fyke Net	2	41.7	7.7	24.7	41.7	58.8	75.8
SST	Green Peter	Head of Reservoir	3/6/2024	MSANTR	Screw Trap	26	0.9	0.9	0.9	0.9	0.9	0.9
SST	Green Peter	Head of Reservoir	3/6/2024	QUARTC	Fyke Net	1	20.7	20.7	20.7	20.7	20.7	20.7
SST	Green Peter	Head of Reservoir	3/6/2024	TWX	Passive	3	91	77.6	87	96.5	97.8	99
SST	Green Peter	Head of Reservoir	4/12/2024	GPD	Screw Trap	14	57.8	56	57	58	59	60
SST	Green Peter	Head of Reservoir	4/12/2024	LBN	Passive	3	58.4	40.3	51.4	62.5	67.4	72.3
SST	Green Peter	Head of Reservoir	4/12/2024	MSANTR	Fyke Net	2	52.9	52.9	52.9	52.9	52.9	52.9
SST	Green Peter	Head of Reservoir	4/12/2024	MSANTR	Gillnet	1	68.9	68.9	68.9	68.9	68.9	68.9
SST	Green Peter	Head of Reservoir	4/12/2024	MSANTR	Screw Trap	22	1.7	1	1	1	1	14
SST	Foster	Tailrace	8/23/2023	LBN	Passive	21	22	0.4	0.5	1.3	48.2	96.4
SST	Foster	Head of Reservoir	8/24/2023	LBN	Passive	3	143.2	76.9	81	85.1	176.3	267.5
SST	Foster	Head of Reservoir	10/10/2023	LBN	Passive	55	50.9	4.4	31.4	41.7	69.6	144.8
SST	Foster	Head of Reservoir	10/10/2023	PD7	Passive	3	33.4	18.7	20.7	22.6	40.8	58.9
SST	Foster	Head of Reservoir	10/10/2023	PD8	Passive	1	215.5	215.5	215.5	215.5	215.5	215.5
SST	Foster	Tailrace	10/11/2023	LBN	Passive	74	31.9	0.2	17.8	23.1	38.4	127.7
SST	Foster	Tailrace	10/11/2023	PD8	Passive	1	202	202	202	202	202	202
SST	Foster	Head of Reservoir	3/26/2024	LBN	Passive	11	19.6	2.9	3.7	5.5	33.6	58.7
SST	Foster	Head of Reservoir	3/26/2024	PD5	Passive	10	28.3	12.8	16.4	24.6	32.7	59.2
SST	Foster	Head of Reservoir	3/26/2024	PD6	Passive	7	21.5	7.5	9.8	21.5	30.8	40.3
SST	Foster	Head of Reservoir	3/26/2024	PD8	Passive	1	31.8	31.8	31.8	31.8	31.8	31.8
SST	Foster	Head of Reservoir	3/26/2024	TWX	Passive	18	33.3	9.9	24.3	37.9	43.2	52.7
SST	Foster	Head of Reservoir	3/27/2024	LBN	Passive	11	21.7	1	2.7	4	51.4	56.2
SST	Foster	Head of Reservoir	3/27/2024	PD5	Passive	9	34.9	22.3	25.7	32.5	43.4	49.7
SST	Foster	Head of Reservoir	3/27/2024	PD6	Passive	7	28.3	10.8	22.2	26.9	35.1	45.6
SST	Foster	Head of Reservoir	3/27/2024	PD7	Passive	4	17	10.9	13.1	13.9	17.9	29.3

SST	Foster	Head of Reservoir	3/27/2024	PD8	Passive	3	42	29.7	38.7	47.6	48.2	48.8
SST	Foster	Head of Reservoir	3/27/2024	TWX	Passive	10	41.7	8	37.5	39.2	47.7	69.5
SST	Foster	Tailrace	3/28/2024	LBN	Passive	3	1	0.4	0.4	0.4	1.4	2.3
SST	Foster	Tailrace	3/28/2024	PD5	Passive	7	22.7	14.3	18.5	23.3	27	30
SST	Foster	Tailrace	3/28/2024	PD6	Passive	8	20	5.7	16.5	22.7	26	28.7
SST	Foster	Tailrace	3/28/2024	PD7	Passive	5	24.6	20	21.1	23.1	26.8	31.8
SST	Foster	Tailrace	3/28/2024	PD8	Passive	4	29.4	26.4	26.7	28.6	31.2	34.1
SST	Foster	Tailrace	3/28/2024	TWX	Passive	2	13.4	5.8	9.6	13.4	17.1	20.9
SST	Foster	Tailrace	4/1/2024	LBN	Passive	27	0.9	0.5	0.5	0.6	0.7	4.3
SST	Foster	Tailrace	4/1/2024	PD5	Passive	8	18.9	7.7	13.5	16.8	24.7	30.6
SST	Foster	Tailrace	4/1/2024	PD6	Passive	8	18.1	11.4	14.8	17.6	22.1	25.4
SST	Foster	Tailrace	4/1/2024	PD8	Passive	3	25.8	22.4	22.6	22.8	27.5	32.2
SST	Foster	Tailrace	4/1/2024	TWX	Passive	11	17	6.9	9.4	15.9	19.4	39.3
SST	Foster	Head of Reservoir	4/4/2024	LBN	Passive	19	12.1	1.9	2.3	3.6	7.9	45.3
SST	Foster	Head of Reservoir	4/4/2024	PD5	Passive	2	12.2	10.4	11.3	12.2	13	13.9
SST	Foster	Head of Reservoir	4/4/2024	PD6	Passive	7	22.9	11.8	14.4	19.4	32	36.3
SST	Foster	Head of Reservoir	4/4/2024	PD8	Passive	6	26.3	18.7	19.9	25	31.3	37.3
SST	Foster	Head of Reservoir	4/4/2024	SSANTR	Screw Trap	26	1	1	1	1	1	1
SST	Foster	Head of Reservoir	4/4/2024	TWX	Passive	4	34.3	25.3	30.7	34.2	37.8	43.5
NST	Detroit	Head of Reservoir	7/13/2023	BCL	Screw Trap	17	221.3	85	111	276	284.1	301
NST	Detroit	Head of Reservoir	7/13/2023	NSANTR	Bypass	3	111	89.9	97.5	105.1	121.6	138
NST	Detroit	Head of Reservoir	7/13/2023	PD5	Passive	2	301.4	292.6	297	301.4	305.7	310.1
NST	Detroit	Head of Reservoir	7/13/2023	PD6	Passive	1	323.9	323.9	323.9	323.9	323.9	323.9
NST	Detroit	Head of Reservoir	7/13/2023	TWX	Passive	3	295	280.1	290.9	301.7	302.4	303
NST	Detroit	Head of Reservoir	9/26/2023	BCL	Screw Trap	22	195.5	32.8	201	205.9	212.4	251.8
NST	Detroit	Head of Reservoir	9/26/2023	PD5	Passive	5	221.9	210.3	211	226.2	230.6	231.3
NST	Detroit	Head of Reservoir	9/26/2023	PD6	Passive	7	212.1	200.6	206.3	208.9	217.2	228.6
NST	Detroit	Head of Reservoir	9/26/2023	TWX	Passive	5	234.3	222.4	229.8	230.2	230.6	258.7
NST	Detroit	Head of Reservoir	3/20/2024	BCL	Screw Trap	21	44.9	23.9	32.9	40.9	48.9	93.9
NST	Detroit	Head of Reservoir	3/20/2024	NSANTR	Bypass	1	48.8	48.8	48.8	48.8	48.8	48.8
NST	Detroit	Head of Reservoir	3/20/2024	PD5	Passive	4	60.9	53	53	54.2	62.1	82.3
NST	Detroit	Head of Reservoir	3/20/2024	PD6	Passive	7	54.3	42.4	47.2	51.3	59.7	72.6

NST	Detroit	Head of Reservoir	3/20/2024	PD8	Passive	3	60.3	46.2	50.9	55.6	67.4	79.1
NST	Detroit	Head of Reservoir	3/20/2024	TWX	Passive	15	55.8	43.3	49.8	54.3	56	78.4
NST	Detroit	Head of Reservoir	3/21/2024	BCL	Screw Trap	16	42.8	31	36.8	43.5	47.3	60
NST	Detroit	Head of Reservoir	3/21/2024	PD5	Passive	9	65.2	52.5	52.9	59.9	77.8	88.1
NST	Detroit	Head of Reservoir	3/21/2024	PD6	Passive	5	52.7	42.7	47.8	49.3	52.8	70.7
NST	Detroit	Head of Reservoir	3/21/2024	PD8	Passive	5	59.5	49.8	54.9	56.8	57.6	78.5
NST	Detroit	Head of Reservoir	3/21/2024	SID	Passive	1	51.1	51.1	51.1	51.1	51.1	51.1
NST	Detroit	Head of Reservoir	3/21/2024	TWX	Passive	19	54.1	41.4	48.8	53.3	57.1	80.5
NST	Detroit	Head of Reservoir	5/20/2024	BCL	Screw Trap	1	40.8	40.8	40.8	40.8	40.8	40.8
NST	NA	NA	6/16/2023	BCL	Screw Trap	1	303	303	303	303	303	303
NST	NA	NA	6/16/2023	NSANTR	Screw Trap	3	57.4	1	8	15	85.5	156
NST	NA	NA	6/16/2023	TWX	Passive	1	321.4	321.4	321.4	321.4	321.4	321.4
NST	Big Cliff	Tailrace	9/27/2023	NSANTR	Bypass	18	15.8	0.8	6.8	7.8	13.8	62.8
NST	Big Cliff	Tailrace	9/27/2023	PD5	Passive	1	195.2	195.2	195.2	195.2	195.2	195.2
NST	Big Cliff	Tailrace	9/27/2023	PD6	Passive	5	193.8	189.8	190.5	193.6	195.6	199.2
NST	Big Cliff	Tailrace	9/27/2023	PD7	Passive	8	69.5	23.2	24.6	27	73	208.1
NST	Big Cliff	Tailrace	9/27/2023	PD8	Passive	1	227.6	227.6	227.6	227.6	227.6	227.6
NST	Big Cliff	Tailrace	9/27/2023	SID	Passive	3	127.6	120.3	125	129.7	131.3	132.9
NST	Big Cliff	Tailrace	9/27/2023	TWX	Passive	5	200.3	188.8	196.7	197.7	201.8	216.4
NST	Big Cliff	Tailrace	11/20/2023	ML1	Passive	1	132.7	132.7	132.7	132.7	132.7	132.7
NST	Big Cliff	Tailrace	11/20/2023	NSANTR	Bypass	3	7.8	7.8	7.8	7.8	7.8	7.8
NST	Big Cliff	Tailrace	11/20/2023	PD6	Passive	6	143.6	133	138.9	146.1	147.2	152.4
NST	Big Cliff	Tailrace	11/20/2023	PD7	Passive	5	133.9	118.5	132.4	136	137.6	145.2
NST	Big Cliff	Tailrace	11/20/2023	SID	Passive	20	108.5	97.6	102.3	109.1	113.9	119.1
NST	Big Cliff	Tailrace	11/20/2023	TWX	Passive	1	140.6	140.6	140.6	140.6	140.6	140.6
NST	Big Cliff	Tailrace	3/21/2024	PD5	Passive	7	29.7	24.4	26.4	29.2	33.3	34.5
NST	Big Cliff	Tailrace	3/21/2024	PD6	Passive	8	31.5	19.3	27.2	31.6	35.5	42.6
NST	Big Cliff	Tailrace	3/21/2024	PD7	Passive	2	30.6	27.1	28.8	30.6	32.3	34
NST	Big Cliff	Tailrace	3/21/2024	PD8	Passive	2	41.7	34.3	38	41.7	45.4	49.1
NST	Big Cliff	Tailrace	3/21/2024	TWX	Passive	7	31.7	12.7	20.7	34.8	43.5	46.3

RESERVOIR DISTRIBUTION STUDIES

Methods

Reservoir distribution studies were conducted during 2023 and 2024 in Green Peter and Lookout Point reservoirs to understand the life history characteristics and body condition of juvenile Chinook salmon and *O. mykiss* utilizing the reservoir environment, including nearshore and longitudinal distribution of Chinook salmon and *O. mykiss* in relation to dam operations.

Data Collection

Juvenile Chinook Salmon and O. mykiss longitudinal distribution & body condition

Biological Data

Past research in Willamette reservoirs indicates that Chinook salmon fry (<50 mm fork length [FL]) are closely associated with shallow nearshore habitat in spring before beginning to move offshore in June and shifting farther offshore and into deeper waters later in summer when water temperatures are at their maximum (Monzyk et al. 2015). Fish sampling methodology was selected to be consistent with past efforts (e.g. Monzyk et al. 2015) and to account for seasonal habitat use by juvenile Chinook salmon. To capture nearshore migration, floating box minnow traps and Oneida Lake traps were used to sample shallow nearshore environments. In summer and fall, juvenile Chinook salmon were sampled using gill nets, set in the pelagic zone at depths corresponding with typical Chinook salmon thermal preferences as determined by past vertical distribution evaluations in Lookout Point Reservoir (Monzyk et al. 2013, Kock et al. 2019a).

Subyearling nearshore distribution

Sampling was conducted biweekly in nearshore habitats between mid-June and mid-July in Green Peter and Lookout Point reservoirs during 2023. Initiation of sampling in 2023 was delayed from our target of early May because our net supplier was unable to meet its delivery deadline due to unanticipated supply chain issues. In 2024, nearshore sampling began the first week of February and continued through mid-June to capture the entire spring outmigration period. Sampling events consisted of four days on each reservoir, including one day of setting traps and three days of checking and moving traps to new locations each day. Each reservoir was sampled on alternate weeks (i.e. Green Peter one week, Lookout Point the following week) for a total of two weeks of sampling effort on each reservoir per month.

Nearshore trapping was conducted following the methods of Monzyk et al. 2015. A stratified random sampling design was used for selection of daily trap locations. Each reservoir was stratified into three longitudinal zones (lower, middle and upper) where each zone represents approximately one third of the reservoir length (Figure 34; Figure 35). In Green Peter Reservoir, an additional zone was created to capture the Quartzville Creek arm of the reservoir (labeled "Quartzville" in Figure 35). Within each reservoir zone, the maximum conservation pool shoreline[2] was split into reaches of approximately 850 m. In Lookout Point Reservoir, nearshore shoreline reaches were altered slightly to be consistent with those used by ODFW in past studies (Brandt et al. 2016).

In Lookout Point Reservoir, three shoreline reaches within each longitudinal zone (lower, middle and upper) were randomly selected each sampling day for floating box trap placement (n = 9 total), and one location was randomly

[2] https://geospatialusace.opendata.arcgis.com/datasets/03e322d7e89b48a9b48e9c3f4bcaf29e_0/explore?location=34.797101%2C-97.473165%2C5.00

selected per zone for Oneida Lake trap placement (n = 3 total). These same trap allocations were used for Green Peter Reservoir, however, in addition, one Oneida trap and one floating box trap were placed in randomly selected shoreline reaches within the Quartzville zone, for a total of n=10 box traps and n=4 Oneida Lake traps per day in Green Peter Reservoir. Within each selected shoreline segment, trap placement was determined in the field based on suitability of site access and tie off locations. Traps were fished for approximately 24 hours, before being checked and moved to a new random location.

Floating box traps and Oneida Lake traps were constructed by Research Nets, Inc. following the specifications of Monzyk et al. 2015, with the exception that mesh sizes were decreased from 0.4 cm to 0.32 cm. Box traps were 0.61 x 0.61 x 0.91 m (W x H x L) and wrapped with 0.32 cm (1/8 inch) delta mesh, with a 51 mm throat opening to allow for entrance of small fish but sized to exclude larger predator fish. A 5 m lead net (0.91 m deep) was set perpendicular to shore to direct fish into the trap and a "tongue" fyke net (0.32 cm mesh) was attached below the trap opening to help direct fish into the trap. Small Oneida Lake traps consisted of a 1.2 x 1.2 x 1.2 m box wrapped in 0.32 cm delta mesh, with a 102 mm throat opening. A 20 m lead net (1.8 m deep, 0.32 cm delta mesh) was set perpendicular to shore to direct fish into the trap.

During each daily trap check, the time the trap was checked was recorded. All fish were then removed from the trap using nylon mesh dip nets and transferred to buckets filled with well-oxygenated fresh reservoir water. Non-target fish (i.e., fish other than juvenile Chinook salmon and *O. mykiss)* were identified to species and coarse size class, enumerated and the first 10 of each species and size class were measured for FL to the nearest mm and released. Non-target species were also checked for presence/absence of the ectoparasitic copepod *Salmincola californiensis* and the number of fish with copepods was recorded. Size classes were estimated in the field based on relative size differences between cohorts. When size modes were indistinct, size classes were based on 50 mm fork length bins. During 2023 sampling, *O. mykiss* were processed in the field as a non-target species, but in 2024 they were processed as a target species following the same protocol as Chinook salmon.

Captured Chinook salmon were examined for marks (adipose fin clips, PIT or VIE tags). All marked target species less than 300 mm were anesthetized in small batches using 50 mg/L MS-222 buffered with sodium bicarbonate. They then had their mark/tag information recorded and were measured for FL to the nearest mm, weighed to the nearest 0.01 g, and assessed for physical condition. The physical condition assessment included percent descaling, injuries, evidence of disease or pathogens, and parasite presence and intensity. Fish were examined systematically for *S. californiensis* infection intensity following methods used by Romer et al. (2017). Field crews examined the brachial cavity and fins for the presence of copepods and the number of copepods in each location were recorded. Following physical assessment, fish were transferred to a bucket filled with well-oxygenated fresh reservoir water to recover before release. Chinook salmon greater than 300 mm were to be checked for marks, measured for length and immediately released.

Unmarked Chinook salmon less than 300 mm and unmarked *O. mykiss* less than 200 mm were anesthetized and tagged in the field accordingly based on fork length[3]. Fish under 43 mm were tagged using visual implant elastomer (VIE) tags to distinguish fish based on capture month and reservoir zone. Fish over 43 mm were tagged with uniquely identifiable PIT tags. Fish 43-65 mm were implanted with 8 mm PIT tags, and fish over 65 mm were tagged using 12 mm PIT tags. Fish tagged in the field had their tag information recorded, fork length and weight measured, and were given a physical condition assessment. After being processed, fish recovered in buckets prior to release. Data on PIT tagged fish were uploaded to PTAGIS.

[3] 200 mm was used for *O. mykiss* to reduce the risk of anesthetizing catchable size fish.

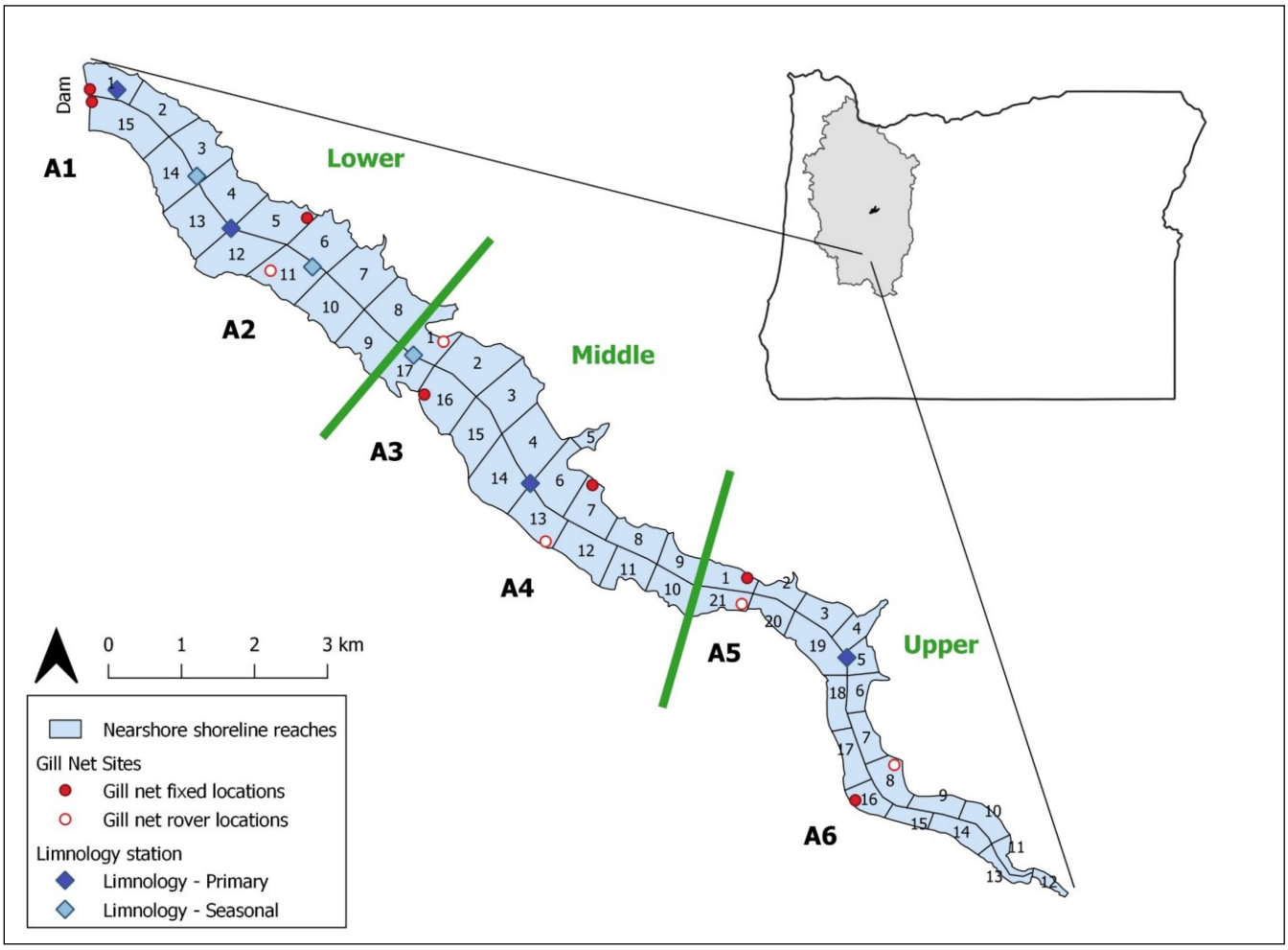

Figure 34. Map of Lookout Point Reservoir nearshore shoreline reaches, reservoir zones (lower, middle and upper), gill netting sampling areas and limnological stations.

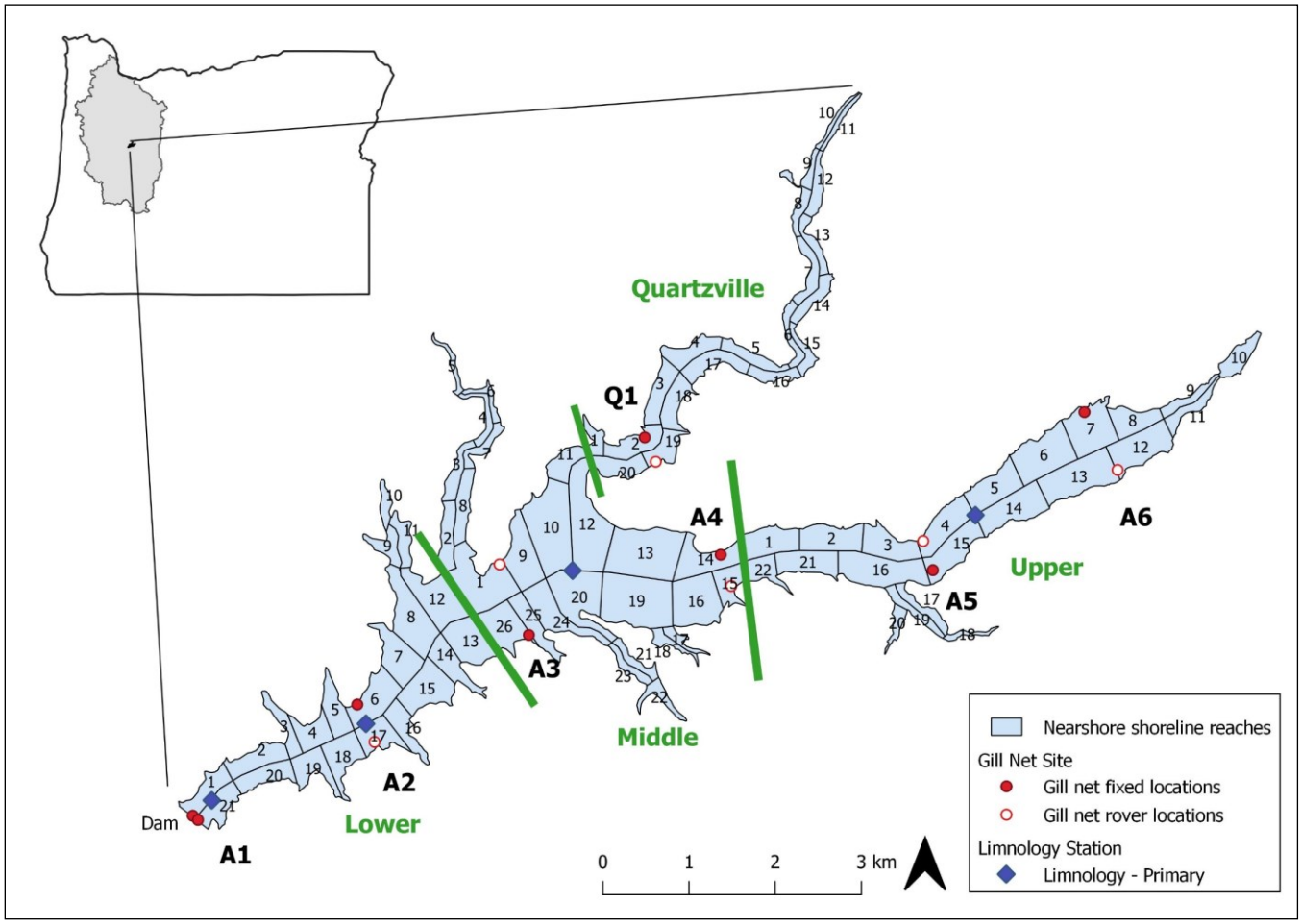

Figure 35. Map of Green Peter Reservoir nearshore shoreline reaches, reservoir zones (lower, middle, upper and Quartzville), gill netting sampling areas and limnological stations.

Parr longitudinal distribution

Biweekly gill netting was conducted between mid-June and the first week of December in 2023 to assess the longitudinal distribution of Chinook salmon parr offshore. Consistent with nearshore sampling, each sampling event consisted of four days on each reservoir, including one day of setting gill nets and three days of checking nets. Green Peter and Lookout Point reservoirs were sampled on alternate weeks for a total of two weeks of sampling effort on each reservoir per month. During the fall drawdown period, the boat ramps on both reservoirs were no longer accessible and research boats were moored in the forebay of each reservoir. The boat on Green Peter Reservoir unexpectedly sunk on 10/2/2023. Because accessing the reservoir from the shoreline on a routine basis for purposes of this study was deemed unsafe due to steeply inclined banks and deep, sinking mud, gill netting on Green Peter Reservoir was suspended for the remainder of the year and sampling effort was reallocated to Lookout Point Reservoir, which was sampled every week from mid-October through the first week of December. In 2024, gill netting commenced during mid-June and is expected to continue through November if conditions allowOctober.

Gill netting was conducted following methods modified from Monzyk et al. 2015. In each reservoir, floating gill net sampling stations were established at six fixed locations (A1-A6) evenly spaced from the head of the reservoir to the dam (Figure 34; Figure 35). A seventh fixed sampling location was used in Green Peter Reservoir within the Quartzville arm (station Q1). Our initial sampling scheme was to set a total of 8 nets each day in Lookout Point Reservoir and 9 nets in Green Peter Reservoir. In each reservoir, two nets were set off the dam face (station

A1), while one net was set at each of the remaining sites (stations A2-A6, and station Q1 in Green Peter). Lastly, each day one "rover" net was set across the reservoir from a fixed site to increase sampling effort (see Figure 34 and Figure 35 for rover locations). The rover site was selected systematically each day to ensure as close as possible to equal supplemental sampling effort among sites each month. Due to dropping reservoir elevations, upstream stations became dewatered and were not sampled when there was insufficient depth or unsafe boat access. Lost effort from upstream sites was reallocated downstream to additional rover locations and to sample additional depths. During peak drawdown, stations were also added between established stations (notated as A1.5, A2.5, and A3.5) to span the remaining reservoir footprint more evenly. Because the reservoir became very narrow during the drawdown, it also became necessary to stagger placement of nets at each station rather than having primary and rover nets directly across from each other. Lastly, after netting was suspended on Green Peter Reservoir, nets from that reservoir were taken for use on Lookout Point to try to increase both effort and catches, with up to 12 net sets per day.

Nets were set perpendicular to shore at depths corresponding to typical Chinook salmon habitat use and thermal preferences (Monzyk et al. 2015, Kock et al. 2019a, Monzyk et al. 2013). During past work in Lookout Point Reservoir, net depths used were greatest during peak thermal stratification (top of net at approximately 9.1 m July and August, 15.2 m early September), before returning to near the surface by the end of October (Monzyk et al. 2015). To capture this range, we set gill nets at 10m, 12m, 14m, 16m, 18m, and 20m at the start of the offshore season in August and early September of 2023 to try to locate the depth with greatest target fish densities. It became apparent, however, that the thermocoline was deeper in 2023 and the shallow nets were fishing in waters warmer than 20°C and unlikely to capture Chinook salmon. We modified our approach mid-season to begin selecting net depths based on the vertical temperature profile taken on the first day of each sampling week, with nets set as close as possible to 15°C, which had the highest modal catch in past studies (Kock et al. 2019a, Monzyk et al. 2013). At shallow stations where it was not possible to reach the depth of 15°C, nets were set as deep as possible while staying approximately 1-2 m off the bottom to minimize entanglement with stumps and other hazards visible on the depth sounder. With this depth selection method, net depth varied weekly and by station, with specific depths used reported in Appendix Table A3. In 2024, gill net depths were selected to target the center of the net on 15C.

In 2023, was our intent to match our gill net dimensions and mesh sizes to those used by ODFW in previous work (e.g. Monzyk et al. 2015) to enable direct comparisons of CPUE between years. We ordered a full set of custom 24.4 m long by 4.6 m (80 x 15 ft) deep[4] gill nets, comprised of four 6.1 m panels (square mesh sizes: 9.5, 12.7, 19.1 and 25.4 mm) from Research Nets, Inc., however only 2 of these nets were delivered by our supplier in time for use during the season, with supply chain issues indefinitely delaying the rest of the order. To enable sampling to commence, we ordered replacement nets from Duluth Nets that were available immediately. These nets were the AFS Experimental Gill Net Small Fish Option which are 9.1 m (30 ft) long by 1.8 m (6 ft) deep, comprised of three 3 m panels (square mesh sizes: 9.5, 12.7 and 15.9 mm). This represents a reduction in net area and a shift to smaller mesh sizes in comparison with the ODFW nets. During the first sampling week in Green Peter Reservoir, both the 30' and 80' nets were trialed, however because only two of the larger nets were available and it wasn't possible to evenly distribute them across our stations, we elected to only use the 30' nets for the duration of the 2023 field season in both reservoirs. A comparison of effort between this study and past evaluations, in terms of net area, is provided in the discussion to provide context on observed differences in CPUE. Larger nets matching the ODFW specifications were procured prior to the start of the 2024 gill net field season, which will be used for the duration of 2024 offshore sampling.

[4] Note, this is slightly larger than reported by Monzyk et al. 2015, which used 4.6 m deep nets. The net depth was increased to conform with the manufacturer's material specifications.

Net suspension methods followed Ingram and Korn (1969). For each net set, we recorded site GPS, set and pull date and time, site depth, net depth, and described the weather. Nets were fished for approximately 24 hours between pulls. All fish caught were identified to species and coarse size class, the mesh size where each fish was captured was recorded, and each fish was assessed for copepod presence. The first 10 of each non-target species (non-Chinook salmon) and size class were measured for FL before disposal/release. All mortalities were sunk after puncturing the swim bladder, while live non-target fish were immediately released after measurement. Chinook salmon captured were examined for marks (fin clips, PIT or VIE tags). Marks and tag codes were recorded, and mortalities were measured for FL and weight and assessed for physical condition, including copepod infestation prevalence and intensity. Any live target species less than 300 mm FL were handled following the same procedures as for nearshore sampling and if unmarked, were tagged. Consistent with nearshore sampling, *O. mykiss* were processed as non-target fish during 2023 offshore sampling, but are being processed as target species following the protocol for Chinook salmon in 2024.

Limnological Sampling

In each reservoir, three primary limnological stations were established. One was located in the upper third of the reservoir, one in the middle, and one in the lower third along the longitudinal axis (Figure 34; Figure 35). On the first day of each biweekly sampling effort, crews collected a vertical temperature and dissolved oxygen (DO) profile at each station using a YSI. From June through early September of 2023, a model ProODO (YSI, Inc.) with 30 m cable was used to collect profiles with readings taken every 1 m down to a maximum depth of 30 m. From September through December of 2023 and for all of 2024 sampling, a YSI model ProDSS (YSI, Inc.) equipped with a depth sensor and 100 m cable was used to collect temperature, DO and turbidity readings at one second intervals (approximately every 0.25 m) on the descent until the maximum station depth was reached. Profile data were downloaded from the YSI and saved to an electronic database. As the reservoir drawdown progressed in late summer and fall in Lookout Point Reservoir, upper and middle primary limnological stations became too shallow to access and the lower station was not deep enough to capture the entire thermocline. A primary station was added to the forebay of each reservoir in September 2023 to capture the deepest profile possible. To maintain at minimum three limnology sampling stations spread along the reservoir longitudinal axis each sampling week, seasonal stations were added over the course of the drawdown between the primary stations (Figure 34). Due to the greater depth of Green Peter Reservoir and suspension of sampling before peak drawdown was reached, seasonal limnology stations were not needed for that reservoir in 2023. For 2024, limnology is being taken at the forebay, lower, middle and upper stations in each reservoir. It is anticipated that seasonal stations will be used for both reservoirs as the drawdown progresses and the reservoir footprint shrinks.

Data Analysis

Chinook Salmon and O. mykiss Longitudinal Distribution

Nearshore Chinook salmon longitudinal distribution was evaluated by comparing catch rates between reservoir zones and distance along the reservoir axis. GPS coordinates of each trap were converted to a percent of the reservoir length along the centerline to estimate distance from the head of the reservoir (HoR 0%, at dam 100%). The centerline of each reservoir was digitized in QGIS and sampling locations were snapped to the nearest location on the centerline to determine distance. Catches and catch per unit effort (CPUE, number of fish captured per 24 hr set) were compared between reservoir zones and sampling periods to evaluate nearshore distribution. Catch was plotted versus percent of reservoir length to further evaluate patterns of catch. Sizes of Chinook salmon captured in nearshore traps were evaluated using summary statistics.

Offshore catch and CPUE were evaluated by station and net set locations were converted to percent of reservoir length to allow for evaluation of catch in relation to distance from the head of the reservoir. Catch was plotted by station and versus percent of reservoir length, as well as by month to evaluate patterns of catch. Sizes of Chinook

salmon captured in offshore traps were evaluated using summary statistics. Exploratory data analysis was completed to evaluate the relationship between water temperature, net depth and Chinook salmon catch rates. Net temperature of gill nets was estimated by taking the mean temperature of the vertical temperature profile across the range of depths spanned by the gill net. This exploratory analysis revealed that Chinook salmon were never caught in offshore nets with mean temperature greater than 20ºC, thus the nets set at those temperatures were dropped from subsequent Chinook salmon CPUE comparisons among reservoir zones. All other net depths were aggregated for analyses in this report, however detailed catch and CPUE for all net depths including those over 20ºC has been retained in the Appendix of this report (Appendix Table A3).

Chinook Salmon Abundance Index

CPUE was used as an abundance index and was compared to dam operations. Too few marked Chinook salmon were recaptured to allow for a mark-recapture based abundance estimate in 2023. Numbers of recaptures will again be evaluated at the conclusion of 2024 sampling (December) to determine if a mark-recapture based estimate is appropriate for the 2024 data. Dam operations data were downloaded from the USACE Northwestern Division Dataquery 2.0 web portal[5]. Data was obtained for percent full conservation pool, forebay elevation, and flow in and out of each reservoir.

Copepod Infestation

Copepod infestation was evaluated by calculating the prevalence rate as the number of fish with copepods present versus the total number of fish assessed. This evaluation was completed for all salmonid species captured.

Chinook Salmon Growth

Change in mean fork length and weight between early summer and fall sampling was evaluated for natural origin Chinook salmon to estimate growth in the reservoir. Growth will be evaluated for hatchery Chinook salmon in 2024 as well, however this analysis was not possible with 2023 data because only one hatchery subyearling was captured during the early summer period.

Catch Composition and Predator Bycatch

Catch composition of all sets was evaluated using both total catch and CPUE. Predator bycatch was further evaluated using total catch and CPUE but only for fish greater than 200mm and for species known to be piscivorous.

Results: Reservoir Study Summary through 30 Jun 2024

Limnological sampling

Lookout Point Reservoir

Vertical profiles of temperature, and dissolved oxygen were taken in Lookout Point Reservoir across the duration of the 2023 sampling period (late June – early December). Turbidity profiles were added later in the sampling period and were recorded starting in October. Temperature, dissolved oxygen and turbidity were measured in 2024. In 2023, thermal stratification in Lookout Point Reservoir was pronounced in June and July with surface temperatures of over 20ºC (Figure 36). As summer progressed, all depths of the reservoir warmed, with temperatures of 19-21ºC seen down to 30 m depth in August. Later in the season and as reservoir elevations dropped with the drawdown, the reservoir was well mixed with little change in temperature with depth. By the end of the 2023 sampling period in December, reservoir water temperatures had dropped to 8ºC. With

[5] https://www.nwd-wc.usace.army.mil/dd/common/dataquery/www/

temperatures optimal for juvenile Chinook salmon rearing between 12 and 17 degrees Celsius (Independent Science Panel 1996), it would suggest that Lookout Point reservoir had unsuitably warm temperatures across all depths (no thermal refuge) during August and September of 2023, except for a small pocket in the forebay where depths exceeded 30 m. However, this pocket also had low dissolved oxygen (DO) (<5 mg/L) that would have produced stressful conditions for juvenile salmonids. Juvenile salmonids begin to show symptoms of oxygen stress (reduced swimming efficiency, reduced growth and food conversion efficiency) below 6 mg/L, with most fish exhibiting impairment below 4.25 mg/L (Bjornn and Reiser 1991). All other depths and sampling periods had sufficient DO for salmonid use. Turbidity in Lookout Point Reservoir was high (exceeding 200 NTU), particularly in November of 2023 coinciding with peak drawdown and in early December during a storm event when the reservoir elevation was rapidly increased for flood control (Figure 36).

Limnological data was collected for 2024 beginning in February. During late winter the reservoirs were cold and well mixed, with high dissolved oxygen and low turbidity (< 1 NTU) (Figure 36). Lookout Point Reservoir began to warm in April with pronounced thermal stratification and surface waters > 15C beginning in June. At the completion of this biannual reporting period (June 2024), Lookout Point surface waters had reached 20C. A sensor calibration issue[6] occurred during spring 2024 affecting both reservoirs with some readings recorded as slightly negative. These values were removed as erroneous (see dark gray shading in Figure 36 and Figure 37), however concurrent secchi readings indicate high water clarity.

[6] Sensor was in need of calibration; however, turbidity standards were on backorder from the supplier and unavailable. Standards have since been obtained.

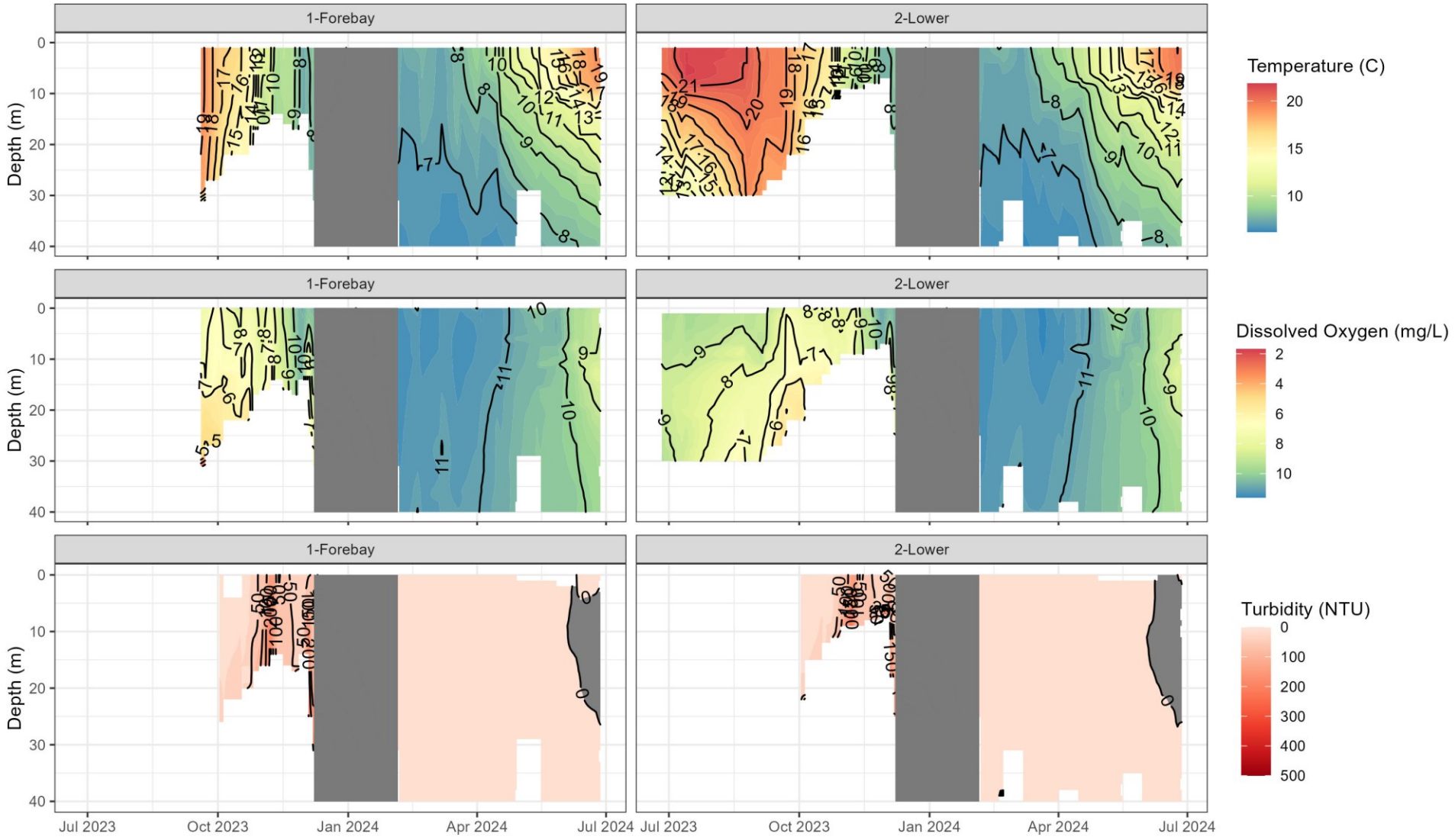

Figure 36. Lookout Point vertical temperature (°C), dissolved oxygen (mg/L) and turbidity (NTU) profiles taken at the Forebay and Lower limnology stations. Note that the Forebay location was added in mid-September of 2023 and no data were collected between Dec 2023 and Feb 2024 (dark gray). Turbidity sampling was added in October 2023. Gray turbidity values in spring 2024 represent data removed due to a sensor calibration issue.

Green Peter Reservoir

In 2023, vertical profiles of temperature and dissolved oxygen were recorded in Green Peter Reservoir from late June through early October, coinciding with fish sampling weeks. Profiles were taken down to 30m depth until mid-September, after which profiles were taken down to each station's maximum depth. Water surface temperatures during summer ranged from 20-25ºC, with pronounced thermal stratification (Figure 37). The thermocline depth varied across the season, ranging from approximately 9 m down to 25 m. Below the thermocoline, temperatures were less than 10ºC. Because Green Peter has a greater maximum depth than Lookout Point Reservoir, depths with suitable temperature and dissolved oxygen for salmonid use persisted throughout the 2023 sampling season. Turbidity profiles were not taken in Green Peter Reservoir during 2023 sampling; however, turbidity data was collected by the USGS in the Green Peter tailrace between mid-August and the end of the year[7]. The USGS data shows relatively low turbidity (<2 FNU) through early October, before drastically increasing during the fall coinciding with the drawdown, with values regularly exceeding 200 FNU and peaks of over 1,000 FNU. Turbidity data were not collected at the USGS site in previous years.

Consistent with Lookout Point Reservoir, vertical profiles taken in Green Peter during 2024 show warming and the beginning of thermal stratification in April, with surface waters reaching 20C by late June. Turbidity was low for the duration of spring sampling (Figure 37).

[7] https://waterdata.usgs.gov/monitoring-location/14186200/#parameterCode=63680&showMedian=false&startDT=2023-07-01&endDT=2023-12-31

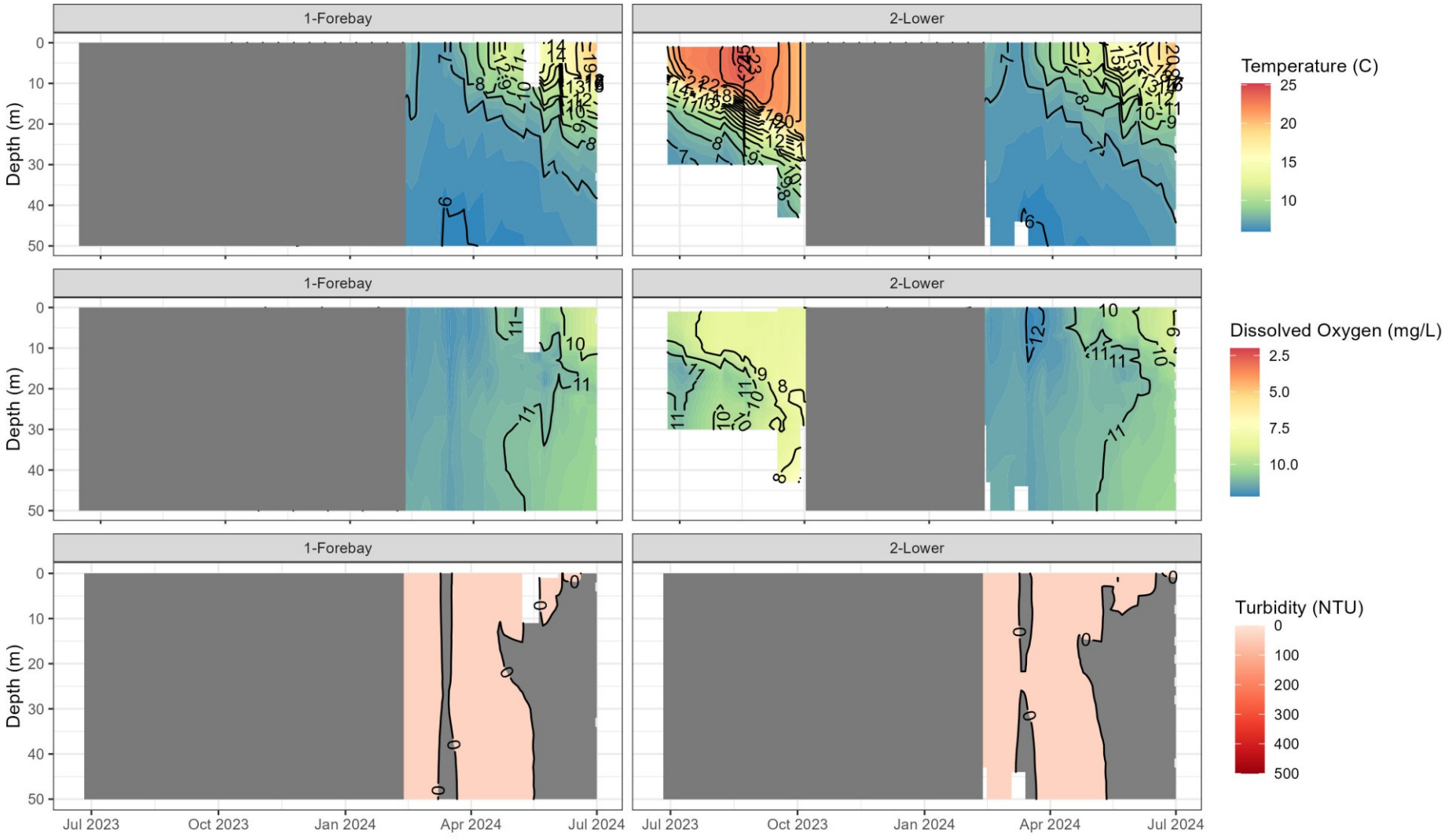

Figure 37. Green Peter vertical temperature (°C), dissolved oxygen (mg/L) profiles taken at the Forebay and Lower limnology stations. The forebay station was not consistently sampled in 2023, nor was turbidity. Gray shading indicates no data. Negative turbidity readings from spring 2024 were removed as erroneous due to a sensor issue.

Summary of fish sampling effort

While fish sampling was initially planned to begin in early May of 2023, initiation of sampling in 2023 was delayed until mid-June because our net supplier had supply chain issues and missed their delivery deadline. We received our first shipment of nets during the 24th week of the year (June 11 – June 17, 2023), and immediately conducted test deployments in Green Peter Reservoir to work out any issues with net configurations and logistics associated with the deployment and operation of the trap nets. Sampling began in earnest the following week. Sampling with nearshore nets in Green Peter Reservoir was conducted between mid-June and early July of 2023 (see Appendix Figure A5 for a map of trapping locations). Nearshore sampling in Lookout Point reservoir occurred between late June and mid-July of 2023 (Appendix Figure A4). Offshore sampling using suspended gill nets was conducted in Green Peter Reservoir between late July and the end of September. No offshore sampling was conducted in Green Peter after September because the CFS boat moored on that reservoir sunk on 10/2/2023. Due to the reservoir drawdown, CFS was not able to identify safe routine access to the reservoir for the purposes of this study, thus sampling was suspended for the 2023 season. However CFS is further investigating reservoir access options for the 2024 season. Offshore gill net sampling in Lookout Point reservoir was conducted between mid-August and early December in 2023. Effort (# of sets and sampling weekly instead of biweekly) increased in the late fall because effort was reallocated to Lookout Point reservoir after sampling on Green Peter was suspended.

Sampling for 2024 began in early February with nearshore trapping. Nearshore trapping continued through mid-June before being suspended due to rising surface temperatures and increased non-target incidental mortality. In mid-June we transitioned to suspended offshore gill nets, which will be used through November if conditions allow. Effort by year, reservoir, sampling week and gear type are summarized in Table 7.

Table 7. Sampling seasons, number of sets and juvenile adipose-clipped hatchery Chinook salmon (CHS-AD), natural origin Chinook salmon (CHS-Natural) and natural origin *O. mykiss* (RBT-Natural) catch by year, reservoir and net type. Total number of sets is how many nets were set over the course of the season. Number of sets for CPUE removes a small subset of sets that were not fishing properly and should not be considered for CPUE analyses. These nets were removed for various reasons (e.g. tampered with, lead disconnected from shore, log damage, etc.). RBT-Natural were not counted during 2023.

Reservoir	Habitat	Season Start	Season End	Net type	Total # of sets	# of sets for CPUE	Catch		
							CHS-AD	CHS-Natural	RBT-Natural
2023									
Green Peter	Nearshore	6/20/2023	7/5/2023	box minnow	60	59	0	0	-
	Nearshore	6/15/2023	7/5/2023	oneida	26	26	0	0	-
	Offshore	7/31/2023	9/30/2023	gill net 30'	111	108	0	1	-
	Offshore	7/31/2023	8/1/2023	gill net 80'	3	2	0	0	-
Lookout Point	Nearshore	6/26/2023	7/12/2023	box minnow	54	51	0	1	-
	Nearshore	6/26/2023	7/12/2023	oneida	18	18	1	15	-
	Offshore	8/22/2023	12/6/2023	gill net 30'	311	309	9	4	-
2024									
Green Peter	Nearshore	2/12/2024	6/5/2024	box minnow	260	257	0	1	0
	Nearshore	2/12/2024	6/5/2024	oneida	104	104	8	49	11
	Offshore	6/17/2024	6/19/2024	gill net 80'	26	22	1	18	3
Lookout Point	Nearshore	2/5/2024	6/12/2024	box minnow	255	247	0	4	1
	Nearshore	2/5/2024	6/12/2024	oneida	85	85	3	11	36
	Offshore	6/24/2024	6/26/2024	gill net 80'	24	23	1	7	0

Nearshore Chinook salmon and *O. mykiss* longitudinal distribution

Lookout Point

During the 2023 nearshore sampling period (mid-June through mid-July), only 17 subyearling Chinook salmon were captured in box minnow and Oneida lake traps in Lookout Point Reservoir, of which 16 where natural origin and 1 was a hatchery origin Chinook salmon (one recapture from the bulk marking project) (Table 9). All but one Chinook salmon were captured in Oneida lake traps. Based on fork length (see Figure 48, Table 10), all fish captured were assigned as subyearlings. The majority of trap sets had zero Chinook salmon catch, however, those that did were in the Upper and Middle reservoir zones, with 13 caught in the Upper zone nearest the head of the reservoir, 4 in the Middle zone, and zero captured in the Lower zone (Figure 38, Figure 39). Because only two weeks were sampled in the nearshore environment in 2023, changes in nearshore longitudinal distribution were not evaluated over time. Weekly mean surface water temperatures of nearshore trap sets ranged from 21.0 - 23.6ºC depending on the zone and sampling week, with the coolest temperatures generally seen in the Upper zone (Table 10).

Nearshore sampling during 2024 spanned from February through mid-June, during which 3 hatchery yearling Chinook salmon (all bulk marking project recaptures), 5 natural origin Chinook salmon subyearlings, 10 natural origin Chinook salmon yearlings, 37 natural origin *O. mykiss* (adipose intact) juveniles (<200mm), and 2 natural origin *O. mykiss* adults (>200mm) were captured (Table 8). Hatchery Chinook salmon were captured in the middle and lower reservoir zones, and natural origin Chinook salmon were captured in the upper and middle zones (none in lower). Natural origin *O. mykiss* were caught in all reservoir zones (Figure 38).

Details on effort by sampling week, and detailed catch and catch per unit effort (CPUE) information for nearshore trapping in both reservoirs are presented in Appendix Tables A1 and A2.

Table 8. Catch of target species (Chinook salmon and natural origin O. mykiss) caught in Lookout Point and Green Peter Reservoirs during 2023-2024 sampling, and the number implanted with a tag in the field (VIE or PIT), the number of recaptures and mortalities. All recaptures were PIT tagged fish. There were no VIE recaptures.

Reservoir	Species	Life stage	Trap Type	Total Catch	# VIE tagged	# PIT tagged	# Recap	Mortalities
			2023					
Green Peter	CHS-Natural	Sub-Yearling	Gill net	1	0	0	0	1
Lookout Point	CHS-AD	Sub-Yearling	Nearshore trap	1	0	0	1	0
	CHS-Natural	Sub-Yearling	Nearshore trap	16	0	1	0	0
	CHS-AD	Sub-Yearling	Gill net	9	0	3	6	3
	CHS-Natural	Sub-Yearling	Gill net	4	0	0	0	2
			2024					
Green Peter	CHS-AD	Sub-Yearling	Nearshore trap	6	0	0	5	0
	CHS-AD	Yearling	Nearshore trap	2	0	1	2	0
	CHS-Natural	Sub-Yearling	Nearshore trap	47	28	11	0	2
	CHS-Natural	Yearling	Nearshore trap	3	0	2	0	0
	RBT-Natural	Adult	Nearshore trap	1	0	1	0	0
	RBT-Natural	Juvenile	Nearshore trap	11	4	4	0	0
	CHS-AD	Sub-Yearling	Gill net	1	0	0	1	1
	CHS-Natural	Sub-Yearling	Gill net	16	0	0	0	14
	CHS-Natural	Yearling	Gill net	2	0	0	0	2
	RBT-Natural	Adult	Gill net	1	0	0	0	0

Reservoir	Species	Life stage	Trap Type	Total Catch	# VIE tagged	# PIT tagged	# Recap	Mortalities
	RBT-Natural	Juvenile	Gill net	3	0	0	0	3
Lookout Point	CHS-AD	Yearling	Nearshore trap	3	0	0	3	0
	CHS-Natural	Sub-Yearling	Nearshore trap	5	3	2	0	1
	CHS-Natural	Yearling	Nearshore trap	10	0	9	0	1
	RBT-Natural	Adult	Nearshore trap	2	0	2	0	0
	RBT-Natural	Juvenile	Nearshore trap	37	1	20	0	2
	CHS-AD	Sub-Yearling	Gill net	1	0	0	0	0
	CHS-Natural	Sub-Yearling	Gill net	7	0	0	0	7
	RBT-Natural	Adult	Gill net	1	0	0	0	1

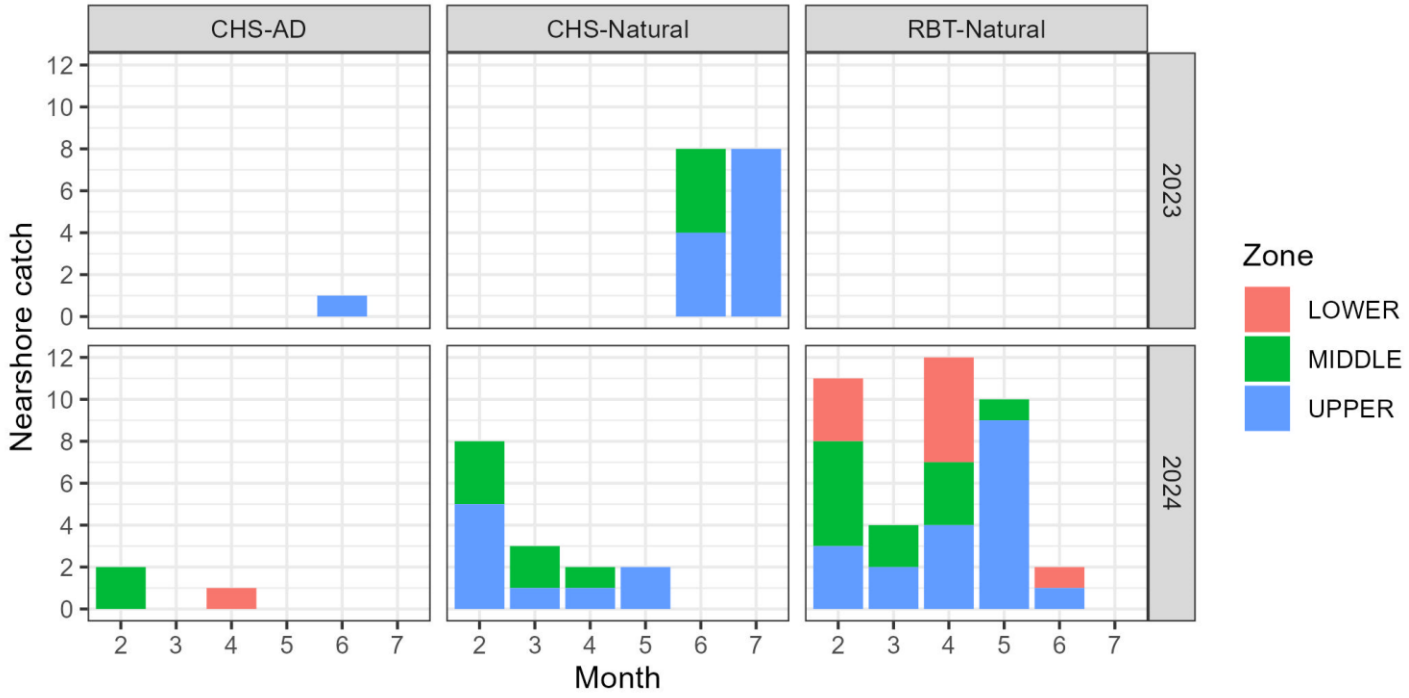

Figure 38. Lookout Point Reservoir nearshore catch of target species by sampling month and zone for 2023 and 2024. Note that *O. mykiss*/RBT were not treated as target species and evaluated for mark status in 2023 so data is only shown for 2024 for that species.

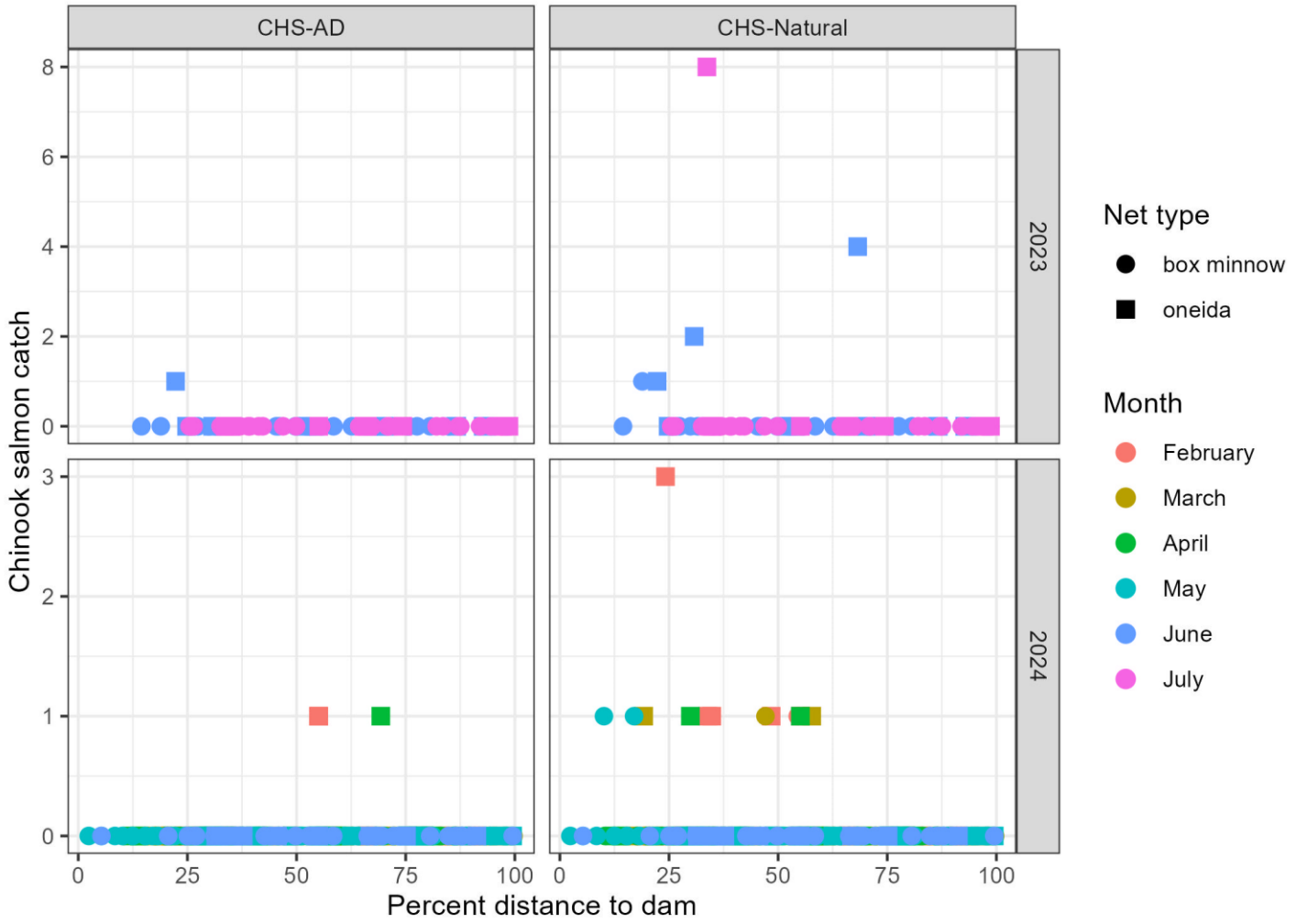

Figure 39. Chinook salmon catch in nearshore traps in Lookout Point reservoir by sampling month and gear type (box minnow or Oneida lake trap) relative to the percent distance to the dam along the reservoir centerline.

Table 9. Fork lengths (mm) of Chinook salmon (CHS) caught in nearshore traps by month and reservoir zone. Values are the mean followed by the range in parentheses.

					Reservoir Zone			
Reservoir	**Month**	**Species**	**Age class**	**Net type**	**LOWER**	**MIDDLE**	**UPPER**	**QUARTZVILLE**
2023								
Lookout Point	June	CHS-AD	Sub-Yearling	oneida			95 (95-95)	
	June	CHS-Natural	Sub-Yearling	box minnow			80 (80-80)	
	June	CHS-Natural	Sub-Yearling	oneida		87.2 (80-92)	81 (73-90)	
	July	CHS-Natural	Sub-Yearling	oneida			84.8 (77-100)	
2024								
Green Peter	Feb	CHS-AD	Yearling	oneida	83 (83-83)			95 (95-95)
	Feb	CHS-Natural	Sub-Yearling	oneida	46 (46-46)	40.6 (37-42)	39.3 (36-44)	51 (51-51)
	Feb	CHS-Natural	Yearling	oneida		120 (120-120)	117 (117-117)	
	Mar	CHS-AD	Sub-Yearling	oneida			56 (56-56)	58 (58-58)
	Mar	CHS-Natural	Sub-Yearling	box minnow				38 (38-38)

Reservoir	Month	Species	Age class	Net type	Reservoir Zone			
					LOWER	MIDDLE	UPPER	QUARTZVILLE
	Mar	CHS-Natural	Sub-Yearling	oneida	53 (53-53)	54.7 (49-58)	38.2 (34-44)	37.5 (37-38)
	Apr	CHS-Natural	Sub-Yearling	oneida		74 (74-74)	57 (51-63)	37.7 (32-42)
	May	CHS-AD	Sub-Yearling	oneida			140 (140-140)	
	May	CHS-Natural	Sub-Yearling	oneida		103 (103-103)		57.5 (50-65)
	June	CHS-AD	Sub-Yearling	oneida			104 (96-113)	
	June	CHS-Natural	Sub-Yearling	oneida	88 (88-88)		85 (85-85)	
	June	CHS-Natural	Yearling	oneida	169 (169-169)			
Lookout Point	Feb	CHS-AD	Yearling	oneida		145.5 (117-174)		
	Feb	CHS-Natural	Yearling	box minnow		84 (84-84)		
	Feb	CHS-Natural	Yearling	oneida		90.5 (80-101)	85 (73-96)	
	Mar	CHS-Natural	Sub-Yearling	box minnow		38 (38-38)		
	Mar	CHS-Natural	Sub-Yearling	oneida			47 (47-47)	
	Mar	CHS-Natural	Yearling	oneida		97 (97-97)		
	Apr	CHS-AD	Yearling	oneida	119 (119-119)			
	Apr	CHS-Natural	Sub-Yearling	oneida		73 (73-73)		
	Apr	CHS-Natural	Yearling	oneida			93 (93-93)	
	May	CHS-Natural	Sub-Yearling	box minnow			43.5 (43-44)	

Green Peter

No subyearling Chinook salmon were captured in nearshore traps set in Green Peter reservoir during 2023, however the sampling period was shorter and later than originally planned (late June through mid-July) (Table 8). Weekly mean surface water temperatures of trap locations ranged from 20.0 – 24.2ºC, depending on zone and sampling week, with temperatures approximately 1ºC cooler at trapping locations in the Quartzville arm than the rest of the reservoir (Table 10).

In 2024, nearshore sampling was conducted from February through mid-June, during which 6 subyearling hatchery Chinook salmon (5 bulk marking project recaptures), 2 hatchery Chinook salmon yearlings (2 bulk marking project recaptures), 47 natural origin Chinook subyearlings, 3 natural origin Chinook salmon yearlings, 1 natural origin *O. mykiss* adult, and 11 natural origin *O. mykiss* juveniles were captured (Table 8). Catch of hatchery Chinook salmon occurred in the lower, upper and Quartzville zones during February and March, but catches were only seen in the upper zone during May and June (Figure 22). Natural origin Chinook salmon were found in all zones of the reservoir, but the largest catches occurred during February and March in the upper and middle zones. Fork lengths of natural origin Chinook salmon caught in the upper zone tended to be smaller than those seen in other zones (Table 9). Natural origin *O. mykiss* were caught in the greatest number during February, spread between the upper, lower and Quartzville zones. Nearshore trapping in Green Peter Reservoir was suspended for the year in mid-June when surface waters at trapping locations were approaching 20C (Table 10).

See Appendix Table A2 for detailed nearshore effort and CPUE data.

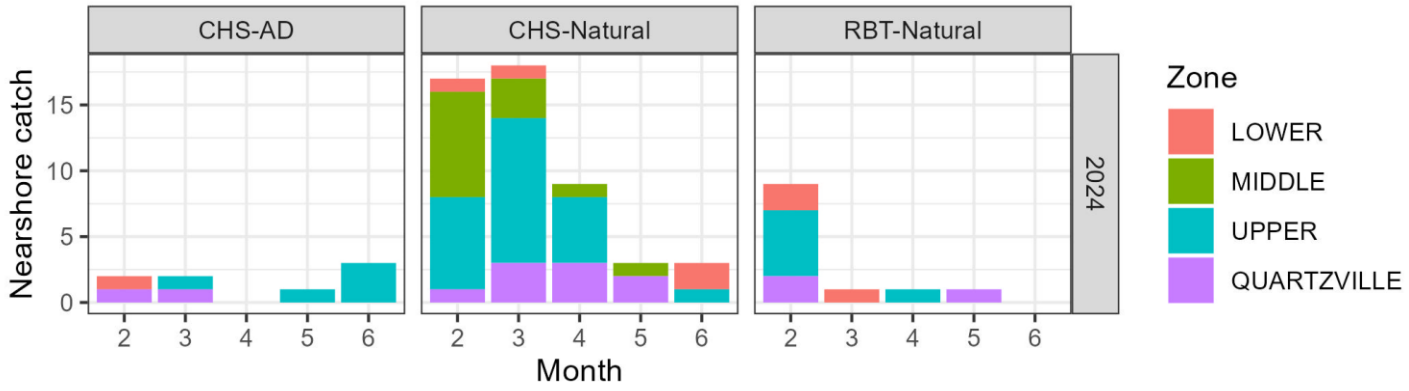

Figure 40. Nearshore catch of target species by month and reservoir zone for Green Peter Reservoir in 2024. No target species were captured during nearshore sampling in 2023 in Green Peter.

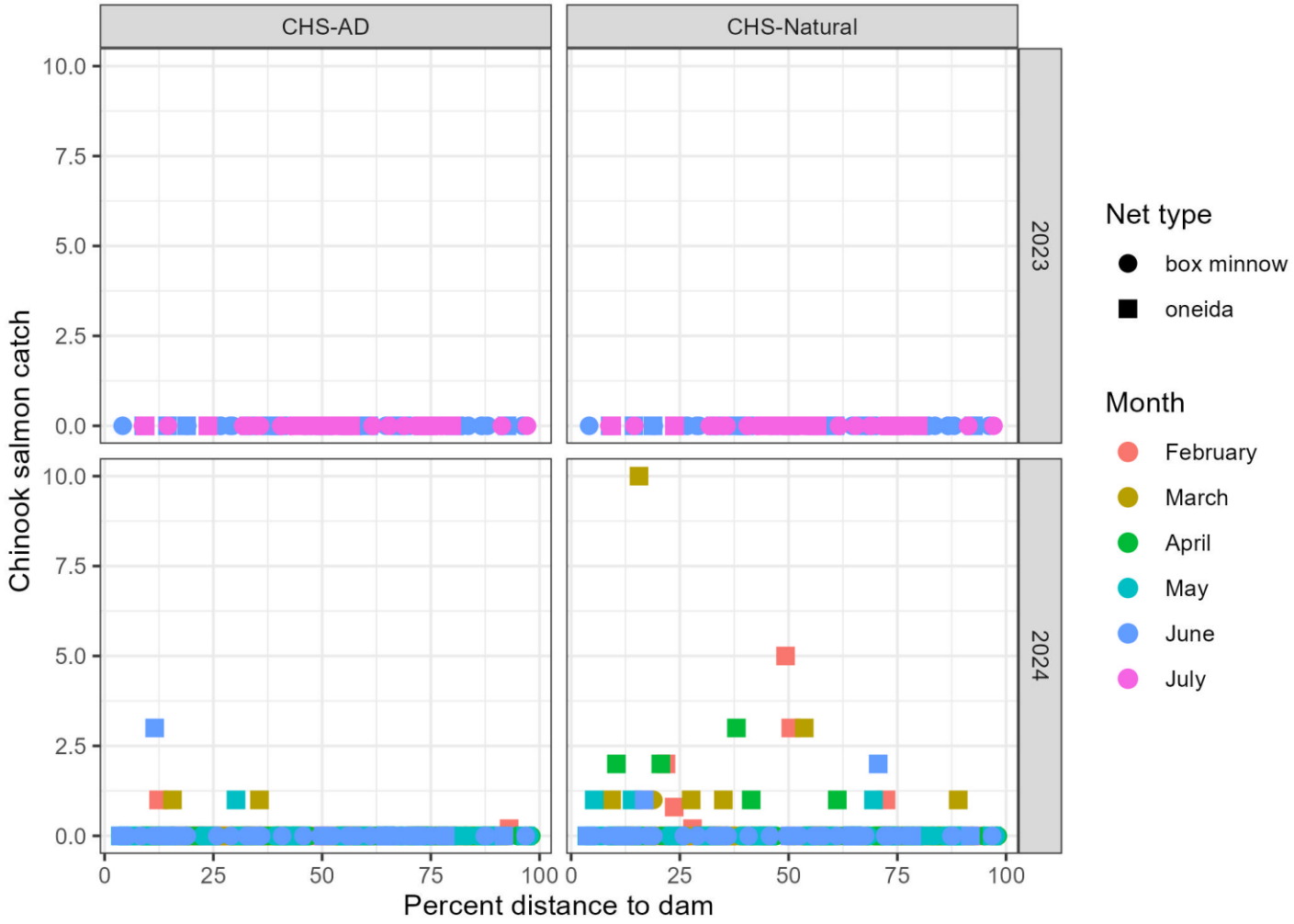

Figure 41. Chinook salmon catch in nearshore traps in Green Peter Reservoir by sampling month and gear type (box minnow or Oneida lake trap) relative to the percent distance to the dam along the reservoir centerline.

Table 10. Water surface temperatures at nearshore trapping locations. Values shown are the mean, with the range in parentheses.

Reservoir	Month	Week	LOWER	MIDDLE	UPPER	QUARTZVILLE
2023						
Green Peter	June	24	20 (20 - 20)	21 (21 - 21)	-	-
	June	25	21.2 (20.6 - 22)	21.4 (20.7 - 22.1)	21.2 (20.7 - 22)	20.3 (19.9 - 21)
	July	27	23.9 (23.2 - 24.6)	24.2 (23.4 - 24.8)	24.4 (23.7 - 24.9)	23.5 (22.1 - 24.3)
Lookout Point	June	26	21.9 (21.5 - 22.4)	22 (21.1 - 22.6)	21 (17.4 - 22.6)	-
	July	28	23.3 (22.7 - 24.1)	23.6 (23.2 - 24)	23.1 (21.7 - 23.9)	-
2024						
Green Peter	Feb	7	8.2 (7.9 - 8.7)	8.4 (7.8 - 9)	8.1 (7.4 - 8.5)	8.2 (7.6 - 8.4)
	Feb	9	8.3 (8 - 8.8)	8.6 (8.2 - 8.9)	8.4 (7.7 - 8.9)	8 (6.9 - 8.9)
	Mar	11	8.8 (8.3 - 10.2)	8.9 (8 - 10.7)	8.3 (7.4 - 9)	8 (7.3 - 8.5)
	Mar	13	9.4 (9 - 9.8)	9.8 (9.5 - 10)	9.8 (8.7 - 10.2)	9.8 (9.6 - 10.1)
	Apr	15	11.8 (10.9 - 12.4)	12.4 (11.8 - 12.8)	12.2 (11.3 - 13)	12.3 (12.1 - 12.7)
	Apr	17	13.3 (12.9 - 13.6)	13.9 (13.5 - 14.5)	14 (12.7 - 14.6)	14.2 (14 - 14.5)
	May	19	15.4 (14 - 16.9)	16.2 (14.3 - 19.9)	13.8 (12.6 - 14.9)	14.7 (13.5 - 16.6)
	May	21	16.5 (14.3 - 17.3)	16.8 (15.6 - 18.1)	17.3 (16.1 - 17.6)	16.9 (16.2 - 17.4)
	June	23	17.9 (16.7 - 18.4)	18.2 (17.5 - 19.1)	18 (16.5 - 19.3)	18.2 (17.5 - 19)
Lookout Point	Feb	6	8 (7.6 - 8.2)	8.3 (8.2 - 8.4)	7.8 (7.4 - 8.3)	-
	Feb	8	9.3 (9.1 - 9.6)	8.9 (8.6 - 9.2)	8.6 (8.4 - 8.7)	-
	Mar	10	9.1 (9 - 9.3)	8.5 (7.5 - 9.5)	7.2 (6.8 - 7.6)	-
	Mar	12	10 (9.5 - 11)	9.9 (9.2 - 12.6)	9.2 (8.7 - 9.5)	-
	Apr	14	10.8 (10 - 11.9)	10.8 (10.4 - 11.2)	10.3 (9.7 - 10.7)	-
	Apr	16	12.3 (11.8 - 13.1)	12.2 (11.6 - 12.5)	10.6 (8.5 - 12.1)	-
	Apr	18	13.8 (13.2 - 14.5)	13.8 (13.2 - 14.6)	13.4 (13 - 13.9)	-
	May	18	13.4 (13.3 - 13.7)	13.9 (13.6 - 14.1)	13.4 (13.2 - 13.5)	-
	May	20	15.9 (14 - 17.5)	16.4 (15.8 - 17.3)	16.1 (15 - 16.9)	-
	May	22	17.1 (15.9 - 18)	17.6 (17.2 - 18.2)	17.4 (16.6 - 18.3)	-
	June	24	20.2 (19.3 - 20.9)	20.4 (20.2 - 20.6)	20.4 (19.9 - 20.9)	-

Offshore juvenile Chinook salmon and *O. mykiss* longitudinal distribution

Lookout Point

Offshore suspended gill net sampling in Lookout Point reservoir was conducted from late August through early December during 2023. A total of 13 Chinook salmon were caught over the course of the 2023 sampling season in Lookout Point Reservoir, of which 9 were hatchery origin (six recaptures from the bulk marking project and 3 ad-clipped hatchery Chinook), and 4 were natural origin (Table 11). Based on evaluation of fork lengths and PIT tag release information, all were subyearlings (Table 11, Figure 48). Due to dropping reservoir elevations and shallow depths in the upper zone of the reservoir, offshore gill netting was restricted to stations downstream of station A4 for the duration of the offshore sampling period (only the middle and lower zones sampled). As the drawdown progressed, nets that were intended for use at stations A4-6 were relocated downstream to increase the number of nets set at permanent sites (A1-A3) and temporary sampling stations were additionally established between permanent sites to increase spatial coverage (A1.5, A2.5, and A3.5). Because of low catch rates, the ability to draw inferences on the offshore longitudinal distribution of Chinook salmon is limited, however general distribution patterns of offshore catch seen in 2023 are described here. No Chinook salmon were captured during August gill netting (Figure 42, Table 12). In September, two hatchery origin Chinook salmon were captured, one of which was sampled at station A3 (middle of reservoir near Signal Point boat launch) and the other at A1 nearest

the dam in the forebay. During October, four subyearling Chinook salmon were captured spread across A1-A3. Chinook salmon caught in November (n=7) were sampled in A1-A2. No Chinook salmon were captured in the first week of December (last week of sampling). Overall, the distribution of offshore catches during 2023 reflected the shrinking footprint of the reservoir during the drawdown period.

Offshore gillnetting in Lookout Point during 2024 will run from mid-June through October. Catches for the first two weeks of the gill netting season are presented in this report, however the remaining data, assessment and discussion of longitudinal patterns will be presented in the January 2025 biannual report. Offshore catches during late June consisted of 7 natural origin Chinook salmon and 1 hatchery origin Chinook salmon, all of which were captured in the lowermost station (A1) near the dam (Figure 42, Table 11). One adult (>200 mm) natural origin *O. mykiss* was also captured in the uppermost zone (A6).

Detailed catch and CPUE data for each sampling week and zone is provided in Appendix Table A3.

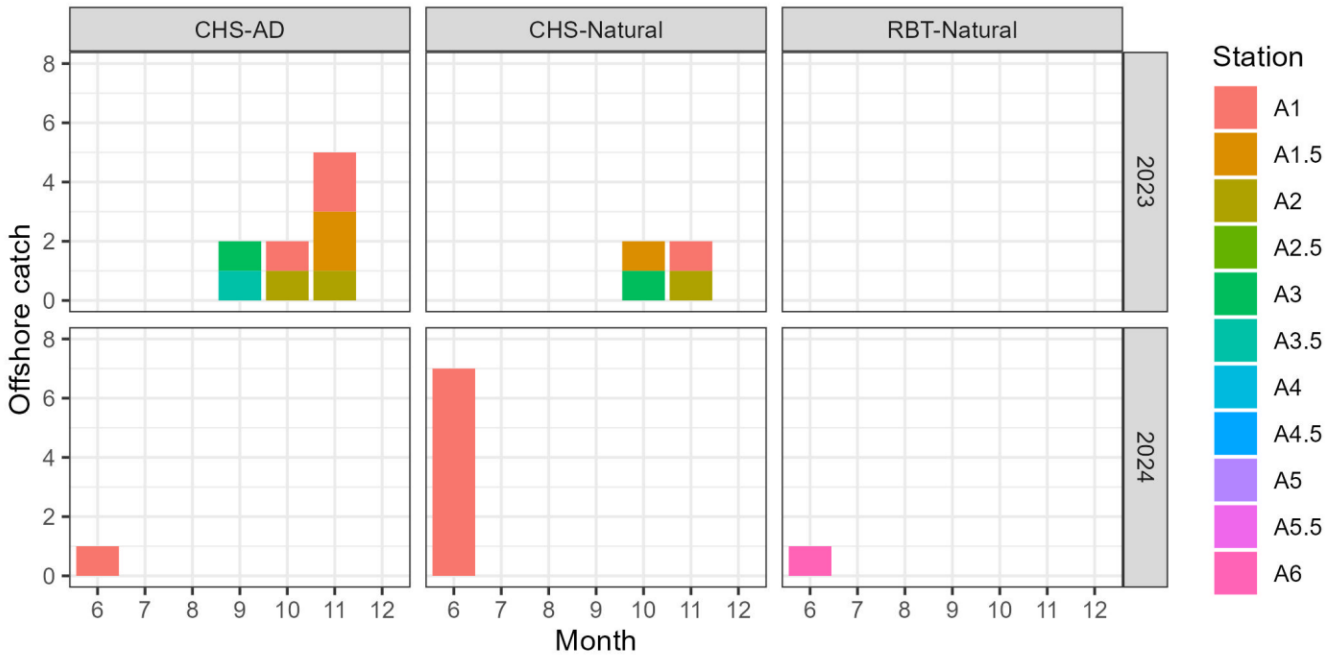

Figure 42. Total catch of Chinook salmon and natural origin *O. mykiss* (RBT-Natural) in gill nets set offshore in Lookout Point reservoir by station. Station A1 is at the dam, and station A6 is most upstream at the head of the reservoir (HoR). Note that *O. mykiss*/RBT were not treated as target species and evaluated for mark status in 2023 so data is only shown for 2024 for that species.

Table 11. Fork lengths of juvenile Chinook salmon (CHS) caught in offshore suspended gill nets. Lengths are fork length measured in millimeters. Weeks not listed had no CHS catch.

							Fork Length (mm)		
Reservoir	**Month**	**Week**	**Zone**	**Net Type**	**Species**	**Catch**	**Mean**	**Min**	**Max**
2023									
Green Peter	Sep	39	A5	gill net 30'	CHS-Natural	1	119	119	119
Lookout Point	Sep	38	A3	gill net 30'	CHS-AD	1	132	132	132
	Sep	38	A3.5	gill net 30'	CHS-AD	1	136	136	136
	Oct	40	A3	gill net 30'	CHS-Natural	1	140	140	140
	Oct	42	A1	gill net 30'	CHS-AD	1	159	159	159
	Oct	43	A2	gill net 30'	CHS-AD	1	139	139	139

	Oct	43	A1.5	gill net 30'	CHS-Natural	1	130	130	130
	Nov	46	A1	gill net 30'	CHS-AD	1	130	130	130
	Nov	46	A1.5	gill net 30'	CHS-AD	2	145.5	144	147
	Nov	46	A2	gill net 30'	CHS-AD	1	138	138	138
	Nov	46	A1	gill net 30'	CHS-Natural	1	150	150	150
	Nov	46	A2	gill net 30'	CHS-Natural	1	202	202	202
	Nov	48	A1	gill net 30'	CHS-AD	1	144	144	144
2024									
Green Peter	June	25	A1	gill net 80'	CHS-AD	1	134	134	134
	June	25	A1	gill net 80'	CHS-Natural	4	111	94	125
	June	25	A3	gill net 80'	CHS-Natural	3	109.7	93	127
	June	25	A4	gill net 80'	CHS-Natural	1	127	127	127
	June	25	A5	gill net 80'	CHS-Natural	2	146	135	157
	June	25	A6	gill net 80'	CHS-Natural	7	109.4	84	188
	June	25	Q1	gill net 80'	CHS-Natural	1	87	87	87
Lookout Point	June	26	A1	gill net 80'	CHS-AD	1	103	103	103
	June	26	A1	gill net 80'	CHS-Natural	7	112.4	81	134

Green Peter

Offshore sampling in Green Peter during 2023 was conducted from late July through the end of September using suspended gill nets. Only one subyearling Chinook salmon was caught during offshore sampling in Green Peter Reservoir (Table 11, Figure 42). The lone specimen was a 119 mm fork length natural origin subyearling, caught at station A5 in the upper zone of the reservoir at the end of September. Because only one specimen was captured, no inferences can be drawn regarding the longitudinal distribution of Chinook salmon in Green Peter reservoir during 2023.

Offshore sampling in Green Peter for 2024 began in mid-June and will continue through October. During the last half of June, 1 hatchery origin Chinook salmon subyearling (recapture from the bulk marking project), 16 natural origin subyearling Chinook salmon, 2 natural origin yearling Chinook salmon, 1 natural origin adult O. mykiss (>200 mm) and three juvenile natural origin O. mykiss (<200 mm) were captured (Table 8, Table 11). The hatchery Chinook salmon was captured at the lowermost station (A1) near the dam, while the natural origin Chinook were captured throughout the reservoir but in greatest numbers at the uppermost zone (A6) (Figure 43). Natural origin O. mykiss were captured in June (3 juveniles and 1 adult) in the upper (A5 and A6) and lower (A1) reservoir zones. An assessment of longitudinal patterns will be covered in the next biannual report (January 2025) once the data has been collected.

Detailed effort and CPUE data for offshore sampling is provided in Appendix Table A3.

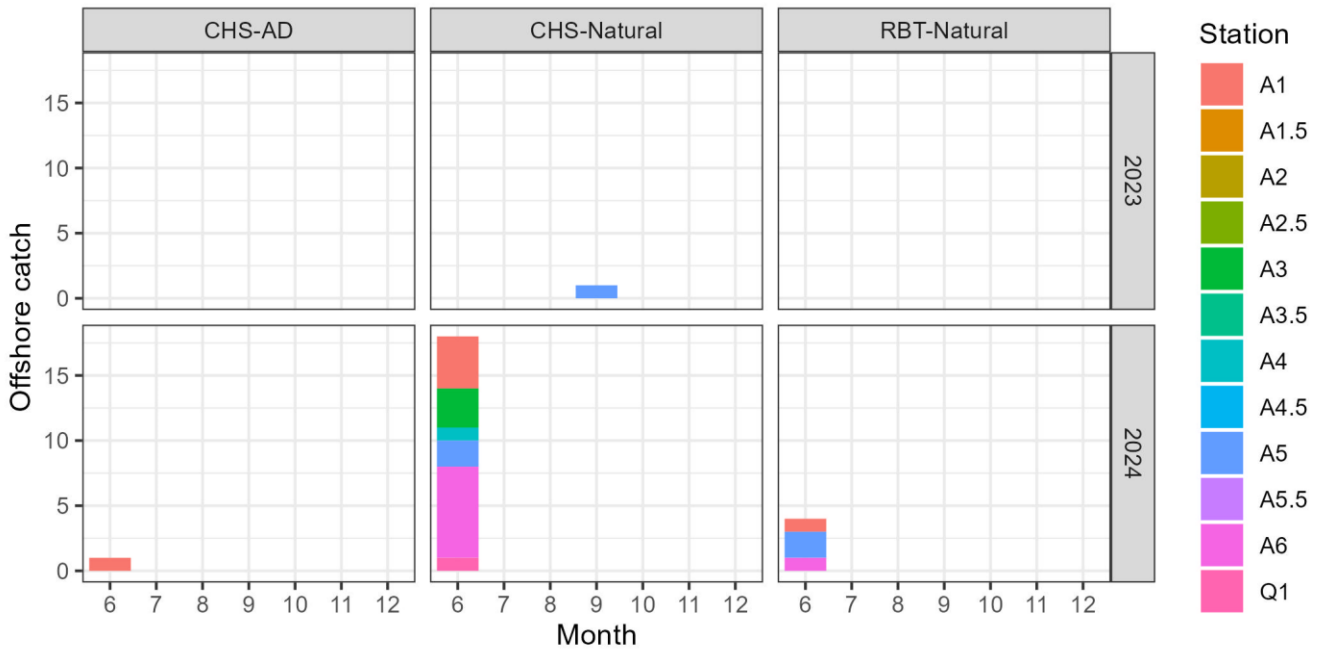

Figure 43. Total catch of Chinook salmon and natural origin *O. mykiss* (RBT-Natural) in gill nets set offshore in Green Peter reservoir by station. Station A1 is at the dam, and station A6 is most upstream at the head of the reservoir (HoR).

Abundance index of Chinook salmon within longitudinal reservoir zones

Catch per unit effort (CPUE) was used as an abundance index to compare hatchery and natural origin subyearling Chinook salmon catches between reservoir longitudinal zones. CPUE was calculated for each set and species as the number of fish captured per 24 hr set. Mean CPUE was evaluated for each reservoir, sampling week, gear type and reservoir longitudinal zone. CPUE was used to display spatial and temporal patterns of catch in relation to reservoir elevation and dam operations. Catch rates in 2023 were very low, consequently these results must be interpreted cautiously and should not be used to evaluate the effects of the injunction measures on juvenile salmon. Catch data for 2024 is still being collected and results included here are preliminary and will be expanded upon in the next biannual report.

Lookout Point

Statistical comparisons of 2023 CPUE were not made between reservoir zones or dam operational periods due to very low catch rates, but during nearshore sampling in June and July, mean CPUE of both natural and hatchery origin Chinook salmon tended to be higher in the Upper and Middle reservoir zones in comparison to the Lower zone (Figure 44, Table 12). The nearshore sampling period in 2023 occurred after the initiation of reservoir drawdown associated with the interim injunction measures (Figure 44). Offshore gill net mean CPUE for hatchery Chinook salmon suggests offshore abundance was highest in late September in the middle zone, then was highest in the lower zone in mid-November during peak drawdown when only the lower zone remained (Figure 44). Similarly, catches suggest natural origin Chinook salmon offshore CPUE peaked in the middle zone during early October and in the lower zone in mid-November (Figure 44).

During 2024, nearshore CPUE was highest in February, coinciding with a period of increased flow out of the reservoir (cfs). Offshore CPUE patterns in relation to operations for 2024 will be covered in the next biannual report.

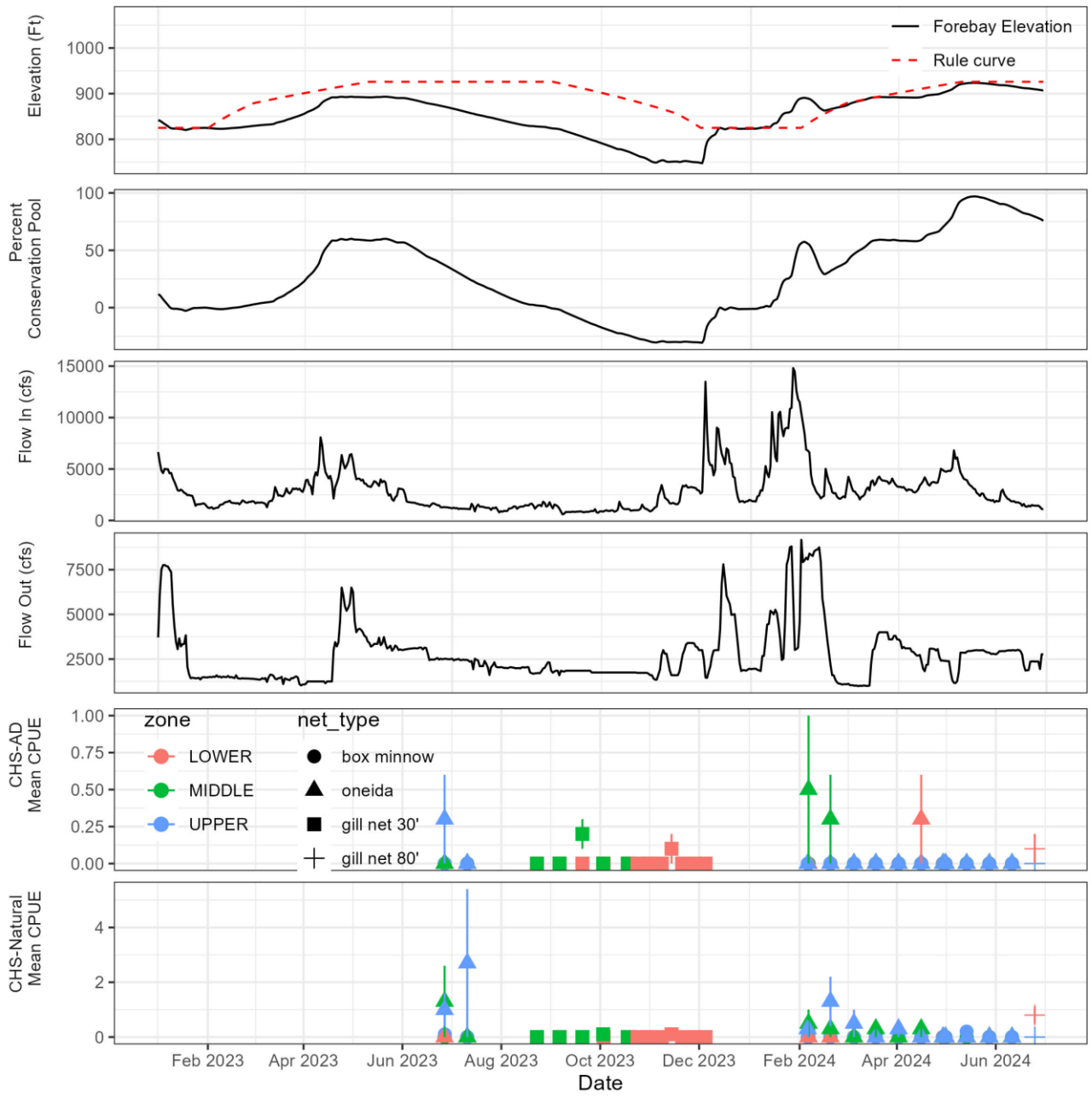

Figure 44. Lookout Point Reservoir elevation (percent of full conservation pool elevation and forebay elevation relative to rule curve) and flow in and out of the reservoir (cfs) in comparison to hatchery (CHS-AD) and natural origin (CHS-Natural) juvenile Chinook salmon mean CPUE. Mean CPUE is for all nets set in each sampling week and is plotted on the x-axis by the mean sampling date for the week. Mean CPUE is presented for each reservoir longitudinal zone and net type. CPUE for gill net sets is shown for only nets with mean temperature of less than 20 ºC with all net depths combined.

Green Peter

During 2023, only one Chinook salmon was captured in Green Peter reservoir. That specimen was captured offshore in the upper zone during late September during the drawdown and coinciding with an increase in flow out (cfs) of the reservoir (Figure 45, Table 12). No comparisons are being made of CPUE for 2023 due to insufficient catches and suspension of offshore sampling, which occurred in early October.

Catches in 2024 to date were highest in the nearshore during February and March for natural origin Chinook salmon, and in June for hatchery Chinook salmon. The catch peak seen in February corresponds to a peak in flow out of the reservoir (Figure 45). A more thorough evaluation of the 2024 CPUE data will be covered in the next biannual report.

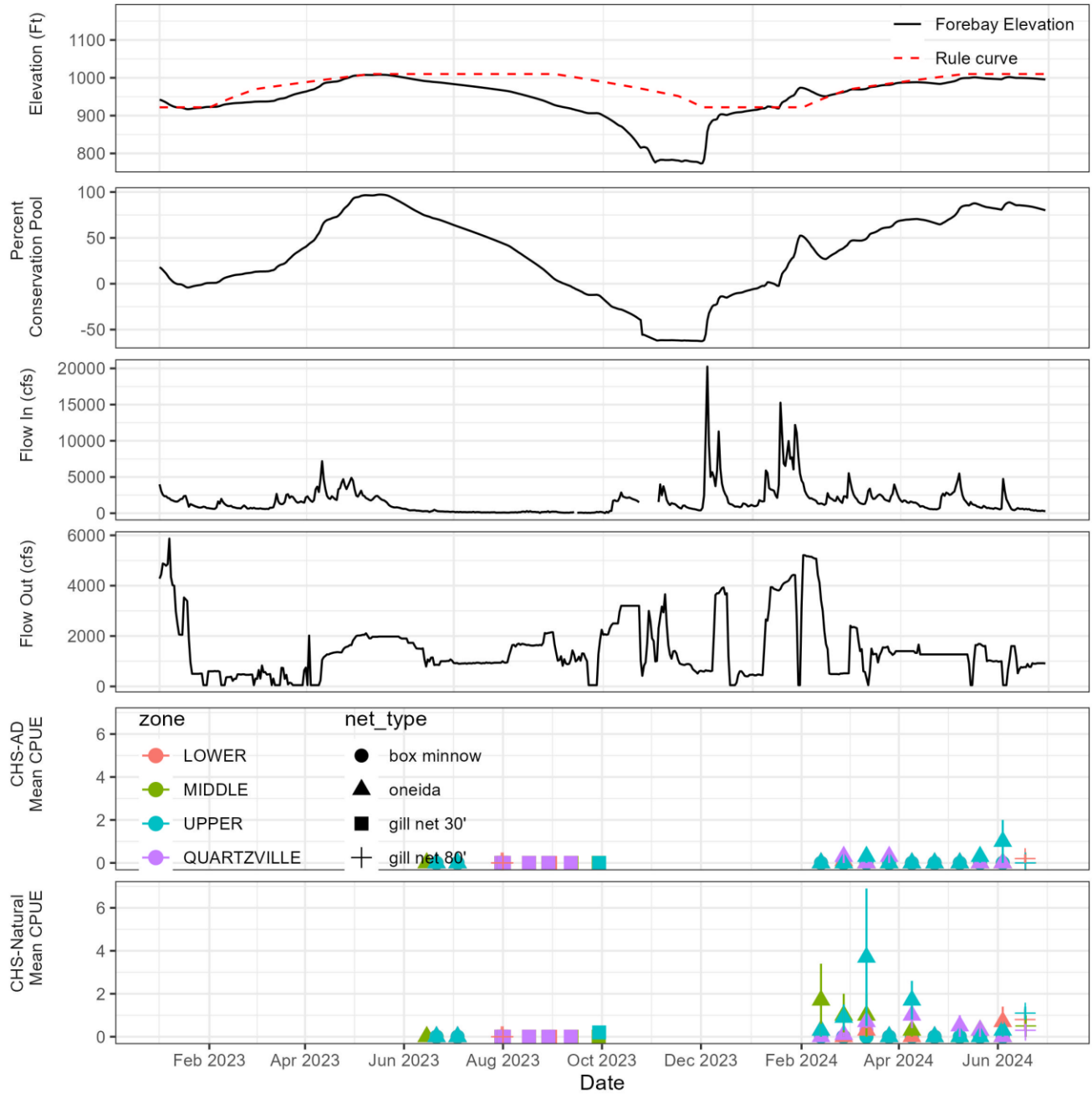

Figure 45. Green Peter Reservoir elevation (percent of full conservation pool elevation and forebay elevation relative to rule curve) and flow in and out of the reservoir (cfs) in comparison to natural origin (CHS-Natural) juvenile Chinook salmon mean CPUE. Mean CPUE is presented for each reservoir longitudinal zone and net type. Mean CPUE is for all nets set in each sampling week and is plotted on the x-axis by the mean sampling date for the week. CPUE for gill net sets is shown for only nets with mean temperature of less than 20 ºC with all net depths combined. No hatchery (CHS-AD) Chinook salmon were captured in this reservoir.

Table 12. Total CHS catch and percentage of catch caught in each reservoir zone in relation to how full the reservoir was during fish sampling. Total catch is summed across all gear types and includes both hatchery and natural origin Chinook salmon. Reservoir fullness was assessed by the minimum and maximum percent of full conservation pool elevation observed during fish sampling days.

		% Cons. Pool		Total	Percent of CHS catch by zone			
Reservoir	Month	Min	Max	catch	LOWER	MIDDLE	UPPER	QUARTZVILLE
2023								
Green Peter	6	69.46	73.89	0.0	-	-	-	-
	7	43.69	62.97	0.0	-	-	-	-
	8	7.12	43.69	0.0	-	-	-	-
	9	-15.89	-2.51	1.0	0.0	0.0	100.0	0.0
Lookout Point	6	35.24	37.86	9.0	0.0	44.4	55.6	-
	7	23.94	26.58	8.0	0.0	0.0	100.0	-
	8	1.51	2	0.0	-	-	-	-
	9	-11.99	-1.58	2.0	0.0	100.0	-	-
	10	-29.78	-17.57	4.0	75.0	25.0	-	-
	11	-30.26	-29.27	7.0	100.0	-	-	-
	12	-24.49	-12.57	0.0	-	-	-	-
2024								
Green Peter	2	26.713	42.752	19.0	10.5	42.1	36.8	10.5
	3	48.561	64.367	20.0	5.0	15.0	60.0	20.0
	4	64.869	70.793	9.0	0.0	11.1	55.6	33.3
	5	82.616	86.075	4.0	0.0	25.0	25.0	50.0
	6	80.963	88.157	25.0	28.0	16.0	52.0	4.0
Lookout Point	2	31.336	56.665	10.0	0.0	50.0	50.0	-
	3	46.817	59.245	3.0	0.0	66.7	33.3	-
	4	58.252	73.53	3.0	33.3	33.3	33.3	-
	5	73.542	96.772	2.0	0.0	0.0	100.0	-
	6	77.688	87.783	8.0	100.0	0.0	0.0	-

Chinook salmon catch by net temperature and depth

Temperatures in both reservoirs, but particularly in Lookout Point were high during much of the 2023 sampling season. Juvenile Chinook salmon catch was examined by net temperature to examine trends in Chinook salmon habitat use. Water surface temperature was used for nearshore traps while the mean temperature of the vertical temperature profile over the range of depths spanned by each net was used for gill nets. This evaluation is observational and opportunistic as the sampling design was not intended to evaluate catch by temperature or depth.

General patterns observed are that Chinook salmon were captured in nearshore traps up to 23.6ºC (Figure 46). In the offshore environment, Chinook salmon were captured from 7.8 to 20.0ºC. The lone Chinook salmon captured in Green Peter reservoir during 2023 was captured in a 5 m deep gill net set in September (Figure 47). Chinook salmon in Lookout Point Reservoir were captured from 0 to 12 m depth. Numerous deeper nets were set primarily during late summer and early fall to try to target 15ºC but zero Chinook salmon were captured in the deeper nets. Data from 2024 will be added to this analysis for the next biannual report in January 2025.

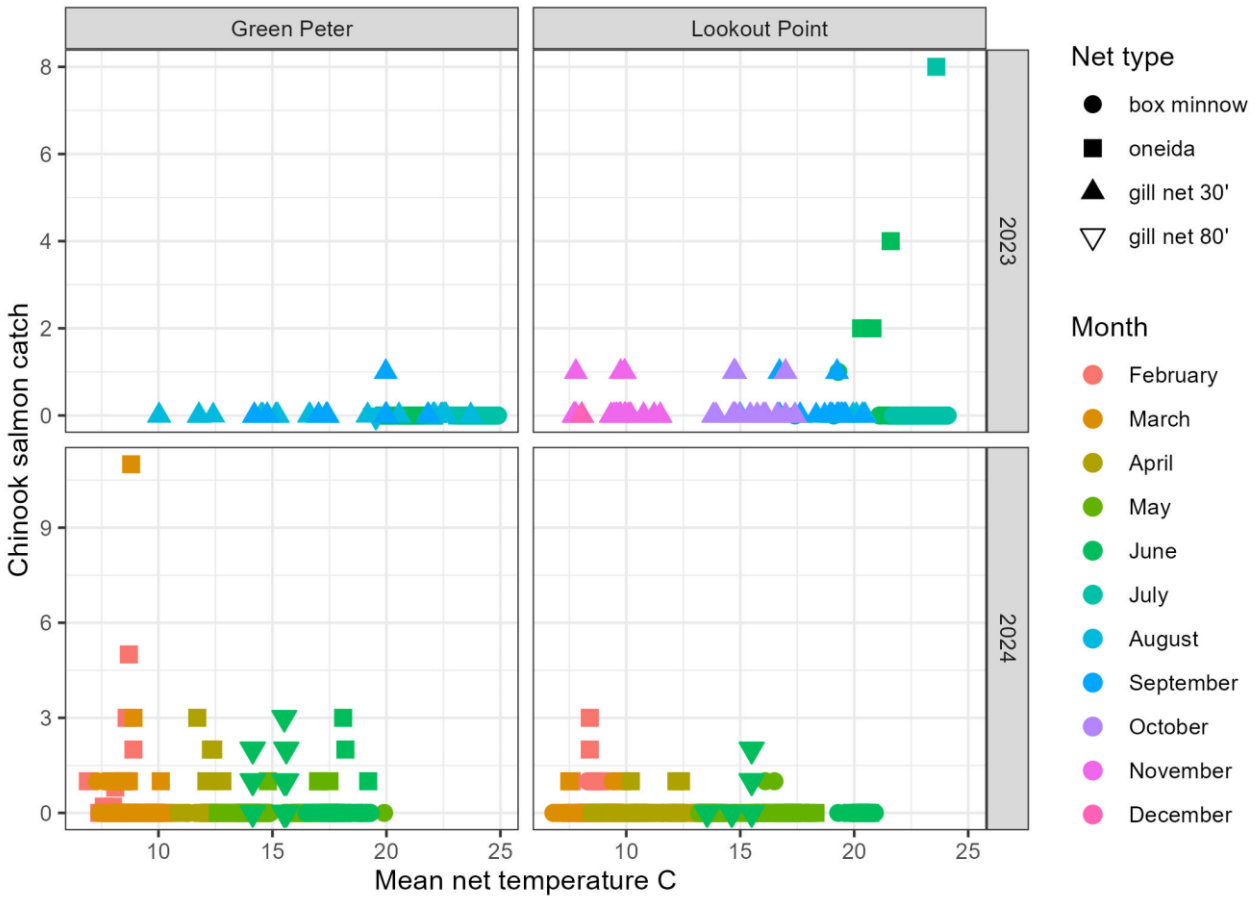

Figure 46. Catch of juvenile Chinook salmon (marked and natural origin combined) by mean net/trap temperature (°C). Mean net water temperature is surface temperature for nearshore traps (box minnow and Oneida), and the mean temperature of the limnology profile over the range of depths covered by gill nets.

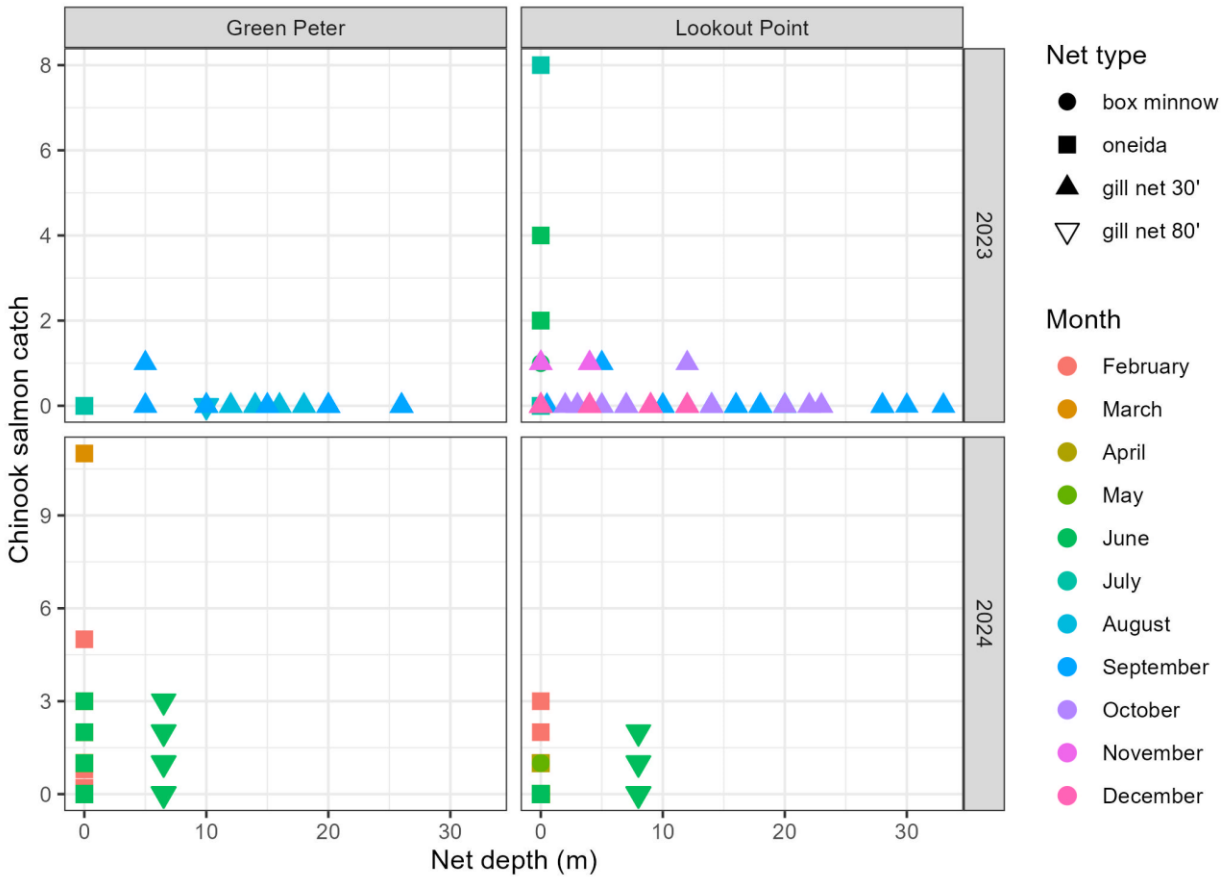

Figure 47. Catch of juvenile Chinook salmon (marked and natural origin combined) in nets by mean net/trap depth (m). Net depth is the top of the net.

Reservoir Recaptures

Over the course of 2023 reservoir sampling, we recaptured seven PIT tagged subyearling Chinook salmon marked and release by the bulk marking project, all within Lookout Point Reservoir (Table 13). One Chinook salmon was released in spring (5/30/2023) at the head of the reservoir (Black Canyon) release site and recaptured approximately a month later in the Upper zone of the reservoir. Of the fall bulk releases, one Chinook salmon released from Signal Point boat launch (Middle reservoir zone – A3) was released on 9/18/2023 and recaptured in the forebay (A1) a month later. Three fish released on 9/18/2023 at the Head of Reservoir Black Canyon site were recaptured, two of which were recaptured a day later in the middle zone of the reservoir. The final recapture from that group was recaptured over a month after release in the Lower zone (A2). Lastly, two fish released on 11/9/2023 in the Hills Creek Dam tailrace were recaptured five days later in the Lower zone at gill net stations in or near the forebay (A1 and A1.5). The two fish released during the maximum drawdown period (November) rapidly transited downstream to the forebay (Table 13).

Through 6/30/2024, we have recaptured 11 juvenile Chinook salmon as part of our 2024 reservoir sampling efforts (Table 13). All specimens were PIT tagged as part of the bulk marking project. Of these fish, 5 were released as yearlings, and 6 as fry. Two yearlings released into the Hill Creek Dam Tailrace were recaptured in Lookout Point Reservoir 6 and 21 days later. Another yearling released at Signal Point boat launch was recaptured 6 days later in the lower zone of Lookout Point Reservoir. Two yearlings released into Green Peter reservoir were recaptured 5 and 6 days later in Green Peter Reservoir. Six fry released into Green Peter Reservoir at head-of-reservoir sites in March and April were recaptured between 7 and 75 days later.

All Chinook salmon captured on the reservoirs are examined for existing VIE tags, but no recaptures have been observed.

Table 13. Capture information for PIT tagged subyearling hatchery Chinook salmon recaptured during reservoir sampling. Release information (release site and date), capture information (reservoir zone, net type, capture date and capture fork length), and travel time are provided.

Tag code	Release Site	Lifestage	Release date	Capture reservoir	Capture zone	Net type	Recapture date	Travel time (days)	Fork length (mm)
				2023					
3D6.15348010F9	LOP Head of Reservoir - Black Canyon	Subyear	5/30/2023	Lookout Point	UPPER	oneida	6/26/2023	27	95
3DD.003E56DA4A	LOP Forebay - Signal Point	Subyear	9/18/2023	Lookout Point	LOWER	gill net 30'	10/19/2023	31	159
3D6.1534843D2A	LOP Head of Reservoir - Black Canyon	Subyear	9/18/2023	Lookout Point	MIDDLE	gill net 30'	9/19/2023	1	132
3DD.003E4C26BB	LOP Head of Reservoir - Black Canyon	Subyear	9/18/2023	Lookout Point	MIDDLE	gill net 30'	9/19/2023	1	136
3DD.003E571ABF	LOP Head of Reservoir - Black Canyon	Subyear	9/18/2023	Lookout Point	LOWER	gill net 30'	10/23/2023	35	139
3DD.003E55F157	Hills Creek Dam Tailrace	Subyear	11/9/2023	Lookout Point	LOWER	gill net 30'	11/14/2023	5	130
3DD.003E56771E	Hills Creek Dam Tailrace	Subyear	11/9/2023	Lookout Point	LOWER	gill net 30'	11/14/2023	5	147
				2024					
3DD.0078DD87C5	Hills Creek Dam Tailrace	Yearling	1/31/2024	Lookout Point	MIDDLE	oneida	2/6/2024	6	117
3DD.0078DD98BD	Hills Creek Dam Tailrace	Yearling	1/31/2024	Lookout Point	MIDDLE	oneida	2/21/2024	21	174
3DD.0078DC842B	Green Peter Head of Reservoir - Quartzville Creek Arm	Yearling	2/22/2024	Green Peter	QUARTZVILLE	oneida	2/27/2024	5	95
3DD.0078DCD4C5	Green Peter Mid Reservoir - Thistle Boat Ramp	Yearling	2/22/2024	Green Peter	LOWER	oneida	2/28/2024	6	83
3D6.1534983074	Green Peter Head of Reservoir - Middle Santiam Arm	Fry	3/6/2024	Green Peter	UPPER	oneida	3/13/2024	7	56
3D6.153498322E	Green Peter Head of Reservoir - Middle Santiam Arm	Fry	3/6/2024	Green Peter	UPPER	oneida	5/20/2024	75	140
3D6.1534982770	Green Peter Head of Reservoir - Quartzville Creek Arm	Fry	3/6/2024	Green Peter	QUARTZVILLE	oneida	3/26/2024	20	58
3DD.003E55D989	LOP Forebay - Signal Point	Yearling	4/10/2024	Lookout Point	LOWER	oneida	4/16/2024	6	119
3D6.1534845AC1	Green Peter Head of Reservoir - Middle Santiam Arm	Fry	4/12/2024	Green Peter	UPPER	oneida	6/3/2024	52	113
3D6.1534981A3E	Green Peter Head of Reservoir - Middle Santiam Arm	Fry	4/12/2024	Green Peter	UPPER	oneida	6/3/2024	52	103
3D6.1534842363	Green Peter Head of Reservoir - Quartzville Creek Arm	Fry	4/12/2024	Green Peter	LOWER	gill net 80'	6/19/2024	68	134

Growth of juvenile salmon

Using our 2023 data, we looked at changes in fork length of juvenile Chinook salmon over time in Lookout Point to evaluate size and growth (Figure 48, Table 14). Only one hatchery Chinook salmon was captured in early summer (late June-mid July), but in fall hatchery Chinook salmon were of similar size to natural origin Chinook salmon (Table 14). Natural origin Chinook salmon captured in early summer had a mean fork length of 84 mm, which increased to a mean of 156 mm for natural origin Chinook salmon captured during fall sampling (Table 14). This represents an average growth rate of 0.61 mm fork length/day between mean capture dates. Growth between early summer and fall will be evaluated for hatchery and wild juvenile Chinook salmon for 2024 after the fall data has been collected and will be reported in the next biannual report.

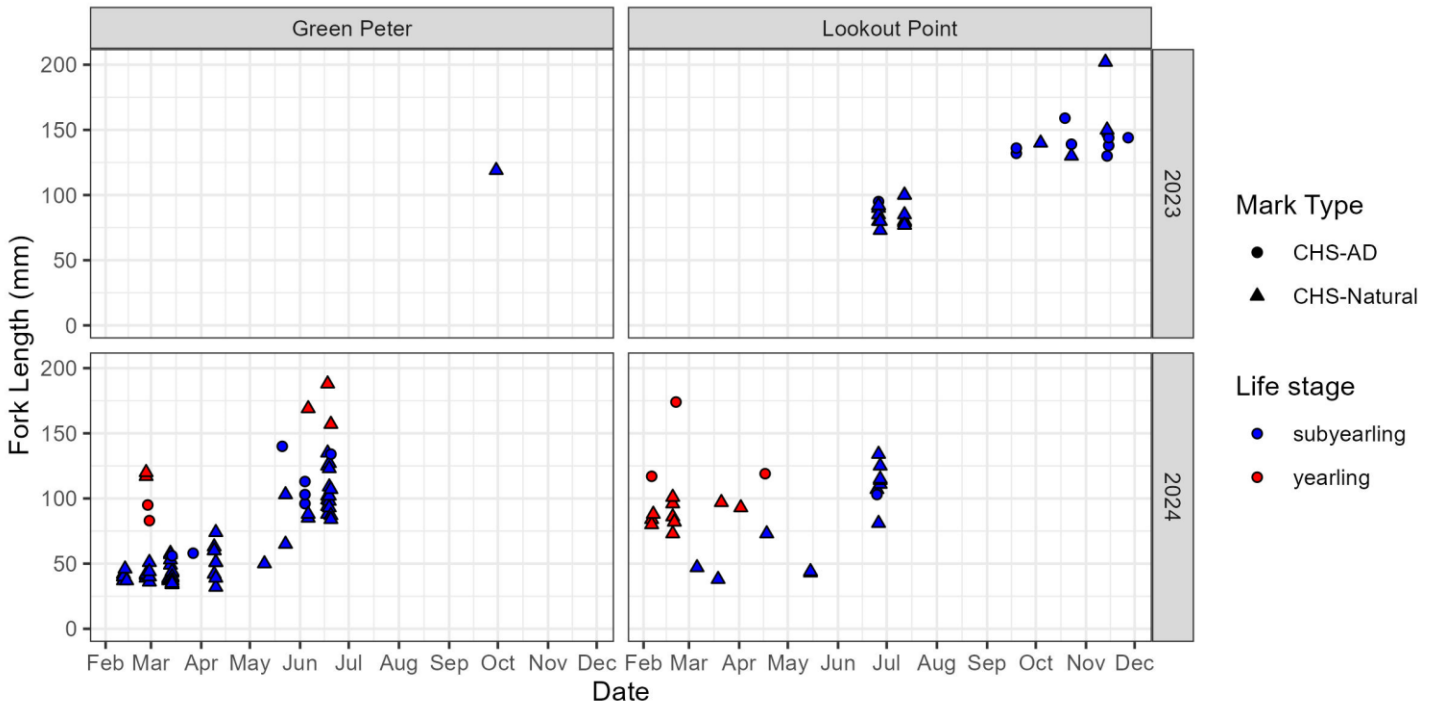

Figure 48. Fork length (mm) of juvenile Chinook salmon caught in Lookout Point and Green Peter reservoirs.

Table 14. Mean fork length and weight of natural origin Chinook salmon caught in Lookout Point Reservoir by season.

Season	Mean Capture Date	Species	N	Mean fork length (mm)	SE fork length	Mean weight (g)	SE weight
summer	7/4/2023	CHS-Natural	16	84.4	0.5	8.3	0.2
fall	10/29/2023	CHS-Natural	4	155.5	8.0	58.1	11.1

Copepod infection prevalence

All fish handled were examined for parasitic copepod presence on the gills and fins. The number and sizes of salmonids examined for parasitic copepod presence are presented in Table 15 for each species and reservoir. No fish captured to date in either our 2023 or 2024 sampling periods have had copepods (prevalence rate of 0% for all species and sampling weeks) (Table 15).

Table 15. Parasitic copepod infection prevalence for salmonids captured in Green Peter and Lookout Point reservoirs. Number of fish examined for copepod presence (N), mean and range of fork length and copepod prevalence rate (# fish with copepods/N) are presented.

Reservoir	Species	N	Mean Capture Week	Mean Fork Length (mm)	Min Fork Length (mm)	Max Fork Length (mm)	Copepod prevalence
			2023				
Green Peter	CHS-Natural	1	39	119	119	119	0.00%
	CUT	4	29.5	184.2	165	217	0.00%

Reservoir	Species	N	Mean Capture Week	Mean Fork Length (mm)	Min Fork Length (mm)	Max Fork Length (mm)	Copepod prevalence
	KOK	16	35.5	157.7	75	307	0.00%
	RBT	11	31	261.9	225	290	0.00%
Lookout Point	CHS-AD	10	41.9	136.4	95	159	0.00%
	CHS-Natural	20	30.4	98.6	73	202	0.00%
	RBT	1	38	432	432	432	0.00%
			2024				
Green Peter	CHS-AD	9	17.4	97.6	56	140	0.00%
	CHS-Natural	68	15.5	68.8	32	188	0.00%
	CUT	9	14.3	98.8	80	113	0.00%
	RBT-AD	53	24.7	268.8	213	320	0.00%
Lookout Point	CHS-AD	4	14	128.2	103	174	0.00%
	CHS-Natural	22	15.6	86.9	38	134	0.00%
	CUT	5	10.4	92	72	111	0.00%
	RBT-AD	2	23	244.5	169	320	0.00%

Catch composition

Catch composition by reservoir, month and species is provided below in Table 16, and detailed total catch and CPUE by sampling week and gear type is provided in Appendix Tables A2 and A3.

In Lookout Point Reservoir during 2023 sampling, the most abundant fish encountered was white crappie (Table 16). Numerous nearshore trap sets had very large catches in June and July of young of the year crappie *spp.* (classified as white crappie for reporting based on the recommendation of ODFW district biologists). These sets also had high catches of young of the year largemouth bass. Later in the season, the most abundant fish species caught in gill nets was walleye. Fork lengths for all fish species captured are provided in Appendix Figures A6-A8, however as our sampling methods were targeted for small fish, the sizes of fish captured may not be reflective of the true size distribution of fish species present in the reservoir. In 2024 sampling through 6/30/2024, our most abundant species in Lookout Point Reservoir has been juvenile sculpin, followed by young of year unidentified centrarchids (Table 16). Nearshore netting was suspended earlier in 2024 than in 2023 to reduce incidental catch and mortality of juvenile warmwater fishes and based upon water exceeding 20 ºC.

Catches in Green Peter Reservoir during 2023 were numerically dominated by bluegill of multiple size/age classes in June and July nearshore sampling. Bass were also encountered in moderate numbers in nearshore traps. Kokanee and *O. mykiss* had the highest catch rates in offshore gill net sampling. Fork lengths for all species captured are in Appendix Figures A6-A8. Sampling during 2024 in Green Peter Reservoir has resulted in moderate catches of bluegill, adult hatchery rainbow trout, and natural origin Chinook salmon (Table 16).

Table 16. Total fish catch by reservoir by month for each species encountered. CHS-Natural – Natural origin Chinook salmon, CHS-AD – hatchery Chinook salmon, UnID Salmonid – unidentified salmonid, KOK – kokanee, CUT - Cutthroat trout, RBT- *O. mykiss*, SMB - Smallmouth Bass, LMB - Largemouth bass, WAL – Walleye, BLC - Black Crappie, BLG - Bluegill, NPM - Northern Pikeminnow, BBH- brown bullhead, LSS - Large-scale sucker, LWB – western brook lamprey.

Month	reservoir	CHS-Natural	CHS-AD	RBT	RBT-AD	RBT-Natural	KOK	CUT	UnID Salmonid	SMB	LMB	WAL	WHC	BLC	BLG	Unid centr.	NPM	BBH	SCU	LSS	LWB	Total catch
2023																						
June	Green Peter	0	0	0	0	0	0	1	0	8	52	0	0	2	348	0	1	0	0	0	0	412
July	Green Peter	0	0	3	0	0	1	2	0	26	2	0	0	1	253	0	2	0	0	0	0	290
Aug	Green Peter	0	0	8	0	0	7	0	0	1	0	0	0	0	0	0	0	0	0	0	0	16
Sep	Green Peter	1	0	0	0	0	8	1	0	0	0	0	0	0	1	0	0	0	0	0	0	11
June	Lookout Point	8	1	0	0	0	0	0	0	1	283	4	6474	0	0	0	0	0	16	1	0	6788
July	Lookout Point	8	0	0	0	0	0	0	0	1	109	1	6000	0	0	0	3	1	1	0	0	6124
Aug	Lookout Point	0	0	0	0	0	0	0	0	0	0	29	2	0	0	0	0	0	0	0	0	31
Sep	Lookout Point	0	2	1	0	0	0	0	0	0	1	59	4	0	0	0	0	0	0	0	0	67
Oct	Lookout Point	2	2	0	0	0	0	0	0	0	0	85	3	2	0	0	0	0	0	0	0	94
Nov	Lookout Point	2	5	0	0	0	0	0	1	0	0	7	2	1	0	0	0	0	0	0	0	18
Dec	Lookout Point	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2024																						
Feb	Green Peter	17	2	0	0	9	0	2	0	0	0	0	0	0	19	0	1	0	0	0	1	51
Mar	Green Peter	18	2	0	0	1	0	0	0	0	0	0	0	0	17	0	0	0	0	0	0	38
April	Green Peter	9	0	0	2	1	0	6	0	2	0	0	0	0	11	0	3	0	0	0	0	34
May	Green Peter	3	1	0	0	1	0	1	0	0	0	0	0	0	13	0	20	0	0	0	0	39
June	Green Peter	21	4	0	51	4	0	0	0	1	0	0	0	0	52	0	5	0	0	0	0	138
Feb	Lookout Point	8	2	0	0	11	0	3	0	0	0	0	0	0	1	0	2	0	1	0	0	28
Mar	Lookout Point	3	0	0	0	4	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	10
Apr	Lookout Point	2	1	0	0	12	0	2	0	0	0	0	0	0	0	0	3	9	0	5	0	34
May	Lookout Point	2	0	0	1	10	0	0	0	0	0	0	0	0	2	0	9	0	0	0	0	24
June	Lookout Point	7	1	0	1	3	0	0	0	3	0	0	0	4	3	116	0	0	264	1	0	403

Predator bycatch

Capture methods were targeted to sample juvenile Chinook salmon and other small fish, thus we only evaluated predator (>200 mm fork length piscivorous fish species) captured as bycatch and we did not systematically sample the entire size range of the predator community. Large (>200 mm) bycatch excluded from this analysis were Chinook salmon subyearlings, largescale suckers, kokanee and brown bullhead as these species do not typically consume fish prey as a significant portion of their diet. Total catch and catch per unit effort (CPUE, fish/24h set) were used to assess relative abundance of predator bycatch (Table 17). Catch per unit effort (CPUE) was used as a measure of relative abundance for predators for each reservoir, gear type and to assess general distribution patterns among reservoir longitudinal zones.

We encountered a total of 14 potential predatory fishes in Green Peter Reservoir and 10 potential predators in Lookout Point Reservoir during the 2023 sampling period. Green Peter predator sized fish were all captured in the Lower zone and were comprised of *O. mykiss* (200-290 mm), smallmouth bass (200-220 mm) and cutthroat trout (217 mm) (Table 17, Figure 49). Lookout Point predators were captured in all zones of the reservoir in low numbers and were comprised of walleye (213-560 mm), smallmouth bass (200-220 mm), northern pikeminnow (210 mm), *O. mykiss* (432 mm), white crappie (305 mm)), black crappie (305-310 mm) and unidentified adult salmonid (this live fish was loosely hooked by the gill net and fell out of the net before being processed, estimated at 550 mm) (Table 17, Figure 49). Smaller (<200 mm) walleye were abundant in Lookout Point Reservoir, suggesting that the predator sized population is likely considerably larger than our results from small mesh gill nets indicate. In both reservoirs, potential predators were scanned for PIT tags in the case that they had consumed one of our marked fish. No stomach contents were removed from any fish in this study.

Our 2024 sampling to date has been predominately nearshore trapping which has a low likelihood of capturing larger piscivores. However, we transitioned to using 80' gill nets exclusively effective 6/15/2024. These nets are larger surface area and mesh sizes than were used in 2023 offshore sampling, thus we anticipate larger catches of predators in 2024. To date, we have captured 9 predator sized fishes in Lookout Point Reservoir, comprised of *O. mykiss*, smallmouth bass, and black crappie. Green Peter predator catch to date stands at 56 predators, comprised predominantly of adult hatchery *O. mykiss*. Large northern pikeminnow, smallmouth bass and natural origin O. mykiss have been captured in much lower numbers (Table 17).

Table 17. Total catch, mean CPUE and lengths of predator species over 200mm caught as bycatch during the sampling period by month and reservoir zone (includes all net depths). RBT – *O. mykiss*, SMB – Smallmouth bass, CUT – cutthroat, NMP – northern pikeminnow, WAL – walleye, BLC – black crappie, WHC – white crappie, UnID Salmonid – unidentified adult salmonid. *Estimated length

Reservoir	Month	Net Type	Zone	Species	Total catch	Effort (# sets)	Mean CPUE	Mean Fork Length (mm)	Min Fork Length (mm)	Max Fork Length (mm)
				2023						
Green Peter	Jul	gill net 80'	LOWER	RBT	3	1	3	256.7	225	280
	Jul	gill net 80'	LOWER	SMB	1	1	1	200	200	200
	Aug	gill net 30'	LOWER	RBT	2	15	0.13	269.5	255	284
	Aug	gill net 30'	LOWER	SMB	1	15	0.07	220	220	220
	Aug	gill net 80'	LOWER	RBT	6	1	6	262	225	290
	Sep	gill net 30'	LOWER	CUT	1	21	0.05	217	217	217
Lookout Point	June	oneida	MIDDLE	SMB	1	3	0.33	220	220	220
	July	oneida	UPPER	NPM	1	3	0.33	210	210	210
	July	oneida	UPPER	SMB	1	3	0.33	200	200	200

Reservoir	Month	Net Type	Zone	Species	Total catch	Effort (# sets)	Mean CPUE	Mean Fork Length (mm)	Min Fork Length (mm)	Max Fork Length (mm)
	Sep	gill net 30'	MIDDLE	RBT	1	23	0.04	432	432	432
	Oct	gill net 30'	LOWER	WAL	2	73	0.03	386.5	213	560
	Oct	gill net 30'	MIDDLE	BLC	1	13	0.08	310	310	310
	Oct	gill net 30'	MIDDLE	WHC	1	13	0.08	305	305	305
	Nov	gill net 30'	LOWER	BLC	1	116	0.01	305	305	305
	Nov	gill net 30'	LOWER	UnID Salmonid	1	116	0.01	550*	550*	550*
				2024						
Green Peter	Feb	oneida	LOWER	RBT-Natural	1	6	0.17	305	305	305
	Apr	oneida	LOWER	RBT-AD	1	6	0.17	290	290	290
	Apr	oneida	LOWER	SMB	2	6	0.33	250.5	225	276
	Apr	oneida	MIDDLE	RBT-AD	1	6	0.17	229	229	229
	June	gill net 80'	LOWER	RBT-AD	6	5	1.2	277.4	258	305
	June	gill net 80'	MIDDLE	NPM	1	6	0.17	230	230	230
	June	gill net 80'	MIDDLE	RBT-AD	9	6	1.5	271.9	217	320
	June	gill net 80'	UPPER	NPM	1	8	0.12	250	250	250
	June	gill net 80'	UPPER	RBT-AD	33	8	4.12	266.5	213	305
	6	gill net 80'	UPPER	RBT-Natural	1	8	0.12	205	205	205
Lookout Point	2	oneida	UPPER	RBT-Natural	1	6	0.17	206	206	206
	3	oneida	UPPER	RBT-Natural	1	5	0.2	296	296	296
	6	oneida	LOWER	SMB	1	3	0.33	220	220	220
	6	gill net 80'	LOWER	RBT-AD	1	9	0.11	320	320	320
	6	gill net 80'	MIDDLE	BLC	1	9	0.11	310	310	310
	6	gill net 80'	MIDDLE	SMB	1	9	0.11	287	287	287
	6	gill net 80'	UPPER	BLC	1	5	0.2	301.7	280	320
	6	gill net 80'	UPPER	RBT-Natural	1	5	0.2	255	255	255
	6	gill net 80'	UPPER	SMB	1	5	0.2	310	310	310

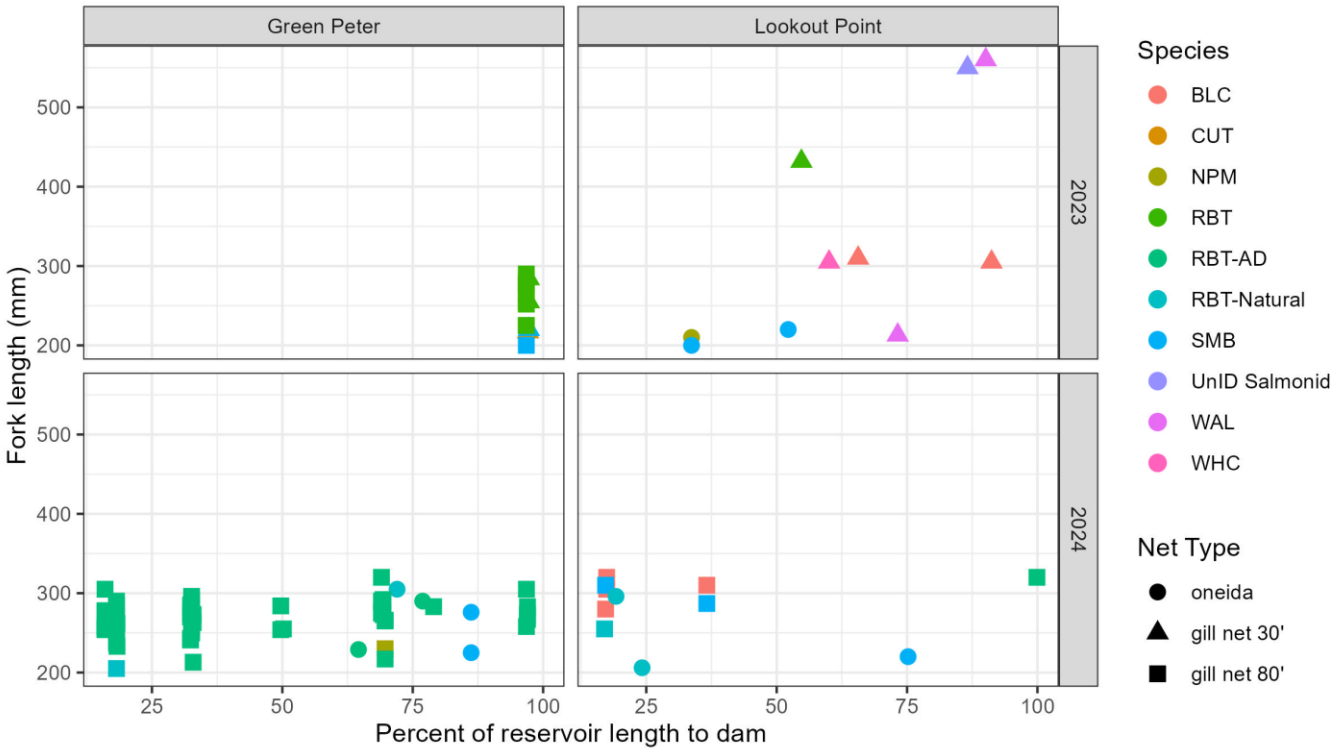

Figure 49. Fork lengths of predators >200mm captured in Green Peter and Lookout Point reservoirs in relation to percent of reservoir length to the dam (0=HoR, 100=dam).

DISCUSSION

This biannual report summarizes the efforts and results of bulk marking and reservoir distribution studies completed during the reporting period of January through June 2024 and to date, including final reporting for all 2023 activities completed from contract award through December 2023. Rotary Screw Trap results are presented in a separate report.

The bulk marking project was a significant undertaking aimed at understanding the movement patterns of juvenile Chinook salmon across various basins, with a particular focus on how Willamette Valley Project dam operations can influence those movement patterns. Across the Upper Willamette River Basin, the project aimed to tag juvenile Chinook salmon across the Middle Fork Willamette, South Santiam, North Santiam, and South Fork McKenzie River basins. The objectives sought to tag tens of thousands of fish in each basin to provide a comprehensive dataset for subsequent tracking and analysis. As of June 30, 2024, we have tagged and released a total of 340,688 juvenile Chinook salmon in the project area.

While the project has provided valuable insights into fish movement, it is important to note that the total redetection rate across the project area was low (~1.5 percent). This limitation impacts the ability to draw strong conclusions, as the low number of redetections may not fully represent the movement of the population at large. Thus, the results presented here should be viewed with caution.

The subsequent recapture of PIT-tagged juvenile Chinook salmon in the Upper Willamette River Basin has provided some insight into the post-release movement patterns of those fish. A total of 5,011 PIT-tagged juvenile Chinook salmon have been redetected across various observation locations in the basin, resulting in an overall redetection rate of 1.5 percent. Across all basins, we observed that fish released further downstream tended to

travel through the project area more quickly. For example, travel times from release to the Cougar Dam Tailrace were shorter for fish released into the forebay compared to those released at the head of the reservoir. Fish released in the Cougar forebay on November 14, 2023, had a median travel time of 1.9 days to the Cougar Tailrace, whereas those released at the head of the reservoir on November 13, 2023, had a median travel time of 30.0 days. Similarly, yearling Chinook salmon released at the head of Cougar Reservoir on March 8, 2024, had a median travel time of 26.0 days compared to 3.0 days for yearlings released in the forebay.

There was also evidence that dam operations impacted travel times and rates. For example, mean travel time from the head of Fall Creek Reservoir to the Fall Creek tailrace decreased from 138.1 days for fish released on June 12, 2023 (full pool), to 24.4 days for fish released on September 28, 2023 (end of drawdown from 750 feet to 738 feet), and to 2.2 days for subyearlings and 1.8 days for yearlings released on November 6 and February 22, 2024, respectively, when the reservoir was at full drawdown (700 feet). Similarly, in the Cougar project area, the results illustrated that travel times were influenced by dam operations and reservoir elevation levels. Initial releases at Cougar in late summer, under conditions of slow reservoir drafting and exclusive powerhouse flow, resulted in longer travel times for the juveniles to reach the tailrace. This contrasted with releases during the fall drawdown period, where substantially shorter travel times were recorded, suggesting enhanced migratory passage efficiency as a result of lower forebay elevation and regulating outlet operations. The Hills Creek releases further emphasized the role of dam operations on migration efficiency. Early releases at the head of the reservoir experienced prolonged travel times, aligning with periods of higher forebay elevations and consistent powerhouse flows. However, releases made in anticipation of or during fall drawdown operations saw faster travel times, highlighting the influence of operational strategies in facilitating fish passage.

Unfortunately, we did not have enough recoveries to make meaningful insights about the impact of the deep drawdowns at Lookout Point and Green Peter reservoirs. The total redetection rate of 1.5 percent across the project area limits our ability to draw robust conclusions from the data alone. With such low redetection rates, the summary data presented here may not be fully representative of the population at large, and these observations should be interpreted cautiously. Pooling data across years and seasons on subsequent reports may improve the precision. Additionally, the data summaries presented herein do not account for survival versus delayed migration. It is possible that some fish experienced delayed migration due to reservoir conditions rather than being lost from the population, and this needs to be considered in future analyses.

The addition of the Lebanon Dam PIT antennas on the South Santiam River will help future iterations of this project evaluate the deep drawdown at Green Peter Reservoir. Currently, there are no operational PIT detection arrays downstream of Lookout Point Reservoir in the Middle Fork Willamette River. Adding detection arrays downstream of Lookout Point Reservoir may benefit the evaluation of the efficacy of the Lookout Point Reservoir deep drawdown on fish passage at Lookout Point Dam. However, it is important to note that PIT detection in the Willamette Basin faces many challenges, including limited numbers of PIT-tagged salmonids, difficulties associated with installing and maintaining PIT detection systems, and unknown detection efficiencies. Even with additional PIT detection infrastructure, low redetection rates may limit the ability to gather enough data to draw meaningful conclusions, particularly within the short timeframes with the injunction period.

The incorporation of additional detections in future analyses would enhance our understanding of juvenile Chinook salmon migration and survival through the study area. A more comprehensive dataset, including higher detection rates, a broader spatial distribution of detection locations, and a better understanding of PIT tag detection efficiency, would allow for more detailed analyses such as survival estimates from release to recapture. These estimates could provide insights into mortality during migration, factors influencing survival, and the effectiveness of different migration pathways. In future reports, we aim to integrate these types of analyses to provide a more detailed understanding of the dynamics affecting juvenile Chinook salmon within the project area.

We are also currently working on developing a model to estimate survival for migration pathways where we have sufficiently high numbers of redetections and reliable detection efficiencies (e.g., Cougar tailrace rotary screw traps). We plan to present results from that work in the subsequent bi-annual report.

On Lookout Point Reservoir, nearshore sampling in 2023 occurred between June 26 and July 12 and was delayed from our target start of early May due to supply chain and permitting delays. During that period, we only captured 1 subyearling Chinook salmon in box minnow sets (n=51 sets) and 16 in oneida sets (n=18 sets). No juvenile *O. mykiss* were captured in 2023 nearshore traps. We presumed our low catch rates were most likely due to missing the key period of the outmigration season and that we sampled after nearshore surface temperatures had risen to unsuitable levels for salmonids. Surface water temperatures at trap locations were over 20ºC for the duration of 2023 nearshore sampling, except for a few isolated traps in the upper zone of the reservoir. Biweekly nearshore sampling during the 2024 field season began February 05 and continued through June 12, at which point we suspended nearshore surface trapping due to rising surface temperatures and transitioned to offshore suspended gill nets. During the 2024 nearshore sampling period on Lookout Point Reservoir, we captured a total of 4 juvenile Chinook salmon in box minnow sets (n=247 sets) and 14 in oneida sets (n=85 sets). Despite sampling across the entire spring period, catch rates of juvenile Chinook salmon did not increase in 2024. In comparison, past nearshore sampling in Lookout Point Reservoir using identical gear specifications (Oneida and box traps) and sampling design that sampled from March 05 through June 20, 2014 captured a total of 650 subyearling Chinook salmon in box minnow traps (n= 390 sets) and 1,047 in Oneida net sets (n=54 sets) (Monzyk et al. 2015). Similar scale catches were seen in 2013 as well (1,893 subyearlings captured in 393 box traps and 12 oneida sets) (Monzyk et al. 2014). It is unclear why our 2024 nearshore catch rates are much lower than these previous studies, although anecdotal information from anglers suggests that both reservoirs have changed over the past 10 years and Chinook returns to the basin were very low in 2023. It is possible nearshore abundance has declined or that we failed to capture fish that were present. Our traps appeared to be fishing properly and did result in some large >1,000 specimen non-target catches. Chinook salmon fry exhibit schooling behavior and it is possible that a patchy distribution, paired with small sample size relative to the size of the reservoir, may have contributed to our low encounter and catch rates. Catch per set in previous studies (Monzyk et al 2014; Monzyk et al. 2015) did show high variance, particularly for sets in March and April when a large proportion of the season's total catch came from approximately 10 high catch sets in the upper zone (Monzyk et al. 2015, see Figure 1-3).

Nearshore trapping was conducted in Green Peter Reservoir in 2023 from June 15 through July 05, but zero juvenile Chinook salmon or *O. mykiss* were captured during this period. In 2024, nearshore collections in Green Peter Reservoir occurred between February 12 and June 05, resulting in 1 juvenile Chinook salmon captured in box minnow traps (n=257 sets) and 57 captured in Oneida traps (n=104 sets). No past nearshore sampling studies exist for comparison of capture rates for Green Peter.

Offshore catch rates during 2023 sampling were also extremely low. In Lookout Point Reservoir, offshore suspended small mesh gill netting was conducted between August 22 and December 6 at biweekly or weekly interval using 30'x6' gill nets. Over that period, only 13 subyearling Chinook salmon were captured in 296 sets (0.04 Chinook salmon/net) in waters less than 20ºC (n=309 total sets across all temperatures). Comparatively, ODFW captured a total of 1,090 subyearling Chinook from 282 gill net sets (3.9 Chinook salmon/net) conducted over July-August and October-November in 2014 in Lookout Point Reservoir (Monzyk et al. 2014). This drastic difference in catch per net likely stems from multiple causes. First, the gill nets we used in 2023 were of much smaller surface area and contained smaller mesh sizes than those used previously by ODFW. While efforts were taken to duplicate ODFW's custom net specifications, supply chain issues and the timeline of the project necessitated using available nets of different specifications. Compared by net area, nets used in 2023 were 16.5 m^2 (9.1 x 1.8m) compared with 112 m^2 (24.4 x 4.6m) in 2014. Expanding by the number of net sets in each respective study, our gill net effort by net area in 2023 was effectively 15% of that of ODFW's efforts in 2014.

Net area accounts for some of the difference in catch rates, but not all as our catch was approximately 1% of ODFW's. It is also possible that our catches were lower due to using smaller mesh sizes (2023: 9.5, 12.7 and 15.9 mm square mesh; 2014: 9.5, 12.7, 19.1 and 25.4 mm). Most of our Chinook salmon catch was in 15.9 mm mesh, followed by 12.7 with no catch in 9.5 mm. At the time of this report, catch by mesh size for ODFW's work was not available to us, however in future we may further examine catch by mesh size to better understand the impacts of mesh size on our catch rates. Other factors that may have come into play to reduce Chinook salmon catch rates include the drawdown, high turbidity, high temperatures throughout the water column during August and September, or potentially lower numbers of Chinook salmon upstream of Lookout Point Reservoir. We secured new nets matching the ODFW specifications for use in 2024 offshore sampling. Offshore sampling began on Lookout Point starting 6/24/2024. During that week, the final week of this biannual reporting period, 8 juvenile Chinook salmon were captured in 23 sets (0.35 Chinook salmon/net). Offshore sampling is anticipated to continue through November if conditions allow and results will be included in the next biannual report.

Offshore sampling in Green Peter Reservoir occurred from 7/31/2023 through 9/30/2023 and recommenced for 2024 on 6/17/2024. During 2023, only 1 juvenile Chinook salmon was captured out of 108 sets (0.01 Chinook salmon/net). No previous studies of offshore catch rates exist for Green Peter to compare these results to. During the first week of offshore sampling of 2024 using the larger 80' long nets, 19 juvenile Chinook were captured from 22 sets (0.86 Chinook salmon/net). Offshore catches of Chinook salmon for both reservoirs appear to have increased in response to our change to larger gill nets. We will also be conducting weekly sampling when possible during summer 2024 (as opposed to biweekly) to try to increase Chinook salmon catches.

The low catch rates for juvenile Chinook salmon in nearshore and offshore 2023 reservoir sampling and nearshore 2024 sampling severely hinder our ability to draw inference regarding distributional patterns, abundance and effects of injunction measures on outmigrants. We can report and compare general patterns of reservoir catch and CPUE, however, results should be interpreted with caution and should not be used alone to evaluate success of injunction measures. With that caveat, our results suggest that in Lookout Point Reservoir, natural origin Chinook salmon using nearshore habitat are primarily located in the upper and middle zones of the reservoir. These results contrast with past studies where all Chinook salmon captured in June were found in the Lower zone in 2014, with peak catches in the Upper zone occurring earlier in the season (Monzyk et al. 2015). In the offshore environment during 2023, we saw a general pattern of catches shifting to the downstream stations during fall as the drawdown progressed. At peak drawdown, only the lower zone (stations A1-A2) remained sampleable, while all upstream stations had become dewatered. In comparison, past evaluations observed a bimodal distribution in summer (higher catch rates in A1 and A5) in summer with a shift to greater catches in the lower zone (A1 and A2) later in fall (Monzyk et al. 2015). By compacting the accessible reservoir habitat in late fall, the drawdown may have concentrated Chinook salmon in the lower zone or Chinook salmon may not have entered the reservoir until after the sampling period. RST captures at the Lookout Point tailrace trap in 2023 show peak natural origin Chinook salmon catch in January, mid-spring (Late April through mid-May), and December coinciding with spill events, with few captures between June and the end of October (EAS 2024b). At the Lookout Point Head of Reservoir trap location, catch peaked in 2023 during April/May with a much smaller second peak in December (EAS 2024b). Together, the RST results suggest that fish may have been primarily moving in spring before 2023 reservoir sampling began and again in December at or after the conclusion of reservoir sampling. 2024 sampling in both reservoirs occured in early February and will continue through November, so the same concern is moot for 2024 reservoir sampling. A concurrent ongoing USGS acoustic telemetry study evaluating juvenile Chinook salmon movement also had lower than anticipated observations of Chinook salmon using the reservoir environment in 2023 (Toby Kock, USGS, personal communication). High water temperatures in Lookout Point throughout the reservoir water column in August and September could explain a delay in reservoir entrance.

Results from sampling during the first half of 2024 in Green Peter suggest that nearshore habitat use by natural origin Chinook salmon was greatest during February and March, before tapering off through the remainder of spring. As expected early season catches were predominately in the upper, middle and Quartzville zones, with a higher percentage of catch in the lower zone seen in June, consistent with outplanting of 100 adult female Chinook in Quartzville Creek during 2023. Offshore longitudinal patterns for Green Peter will be evaluated in the next biannual report once more data becomes available.

We observed zero incidence of *S. californiensis* copepod infection (0% prevalence rate) in any target or non-target species over the duration of 2023 sampling and first half of 2024 sampling in either reservoir. This is greatly reduced from prevalence rates observed in previous years and in contrast with results seen in catches above and below the reservoir in RSTs in 2023. Past work observed a 75% prevalence rate of copepod infection in reservoir rearing subyearling Chinook salmon October-November in Lookout Point Reservoir during 2014 (Monzyk et al. 2015). Similar magnitude prevalence rates were seen in 2012 and 2013, with a trend of increasing prevalence over the July through December period) (Monzyk et al. 2015). At the Lookout Point Reservoir tailrace RST location, copepod infection prevalences in 2023 were 32% and 34% for natural origin and hatchery Chinook salmon respectively, compared with 0.7% for natural origin Chinook salmon above the reservoir at the Lookout Point Head of Reservoir trap location (EAS 2024b). Given that RST results indicate elevated copepod infection downstream of the reservoir, in contrast to our results, we interpret our 0% prevalence rate as potentially an artifact of our small salmonid sample size.

Our limnology results indicate temperature concerns for salmonids in Lookout Point Reservoir during August and September of 2023. From mid-August through late September, the water column down to 30 m was 19-21ºC. At that time, the maximum depth in the forebay was approximately 35 m, and depths greater than 30 m had low dissolved oxygen that would have presented stressful conditions for salmonids (less than 5 mg/L) (Bjornn and Reiser 1991). Thus, during peak temperatures all habitat available for all salmonids was suboptimal in Lookout Point reservoir for salmonids. In 2017 and 2018, temperatures above 18ºC occurred during late summer down to approximately 20 m, however the maximum depth of the reservoir was greater, and a layer of suitable temperature remained throughout the season (Kock et al. 2019b). The drawdown, which reduced reservoir elevations relative to past years, may have contributed to the change in conditions. Other potential causes include Hills Creek operations, and differences in flows or inflow temperatures between years. A visual comparison of river temperatures at the MF Willamette River Below North Fork Oakridge USGS gage (14148000) upstream of Lookout Point Reservoir for June-September of 2017, 2018 and 2023 shows no drastic differences in water temperatures between years, however 2023 did have slightly warmer temperatures in June by approximately 1 to 2 ºC (no apparent differences for other months).

Our limnology vertical profiles in Lookout Point reservoir and USGS Green Peter tailrace monitoring also identified concerns with high turbidity levels in both reservoirs during the 2023 drawdown, with turbidity exceeding 200 NTU in November and December during the peak of the drawdown. Suspended sediments have been associated with negative effects on the spawning, growth, and reproduction of salmonids (Bash et al. 2001). Past studies have found high levels to be fatal to salmonids while lower levels may cause reduced foraging capability, reduced growth, resistance to disease and impaired migration (Lloyd 1987). Adverse effects have been associated with turbidity levels as low as 18-70 NTU (Gregory 1992). Laboratory studies have found that juvenile steelhead and coho avoid areas with mean turbidity of 167 NTUs or higher but no avoidance was seen at the 57-77 NTU range (Sigler et al. 1984). Based on these past studies, the elevated turbidity levels seen in Lookout Point and Green Peter reservoirs during fall 2023 may have caused avoidance behavior or had other adverse impacts on juvenile salmonids. This may be reflected in the relatively modest estimated growth rate seen in 2023 in Lookout Point for natural origin Chinook salmon caught between early summer and fall. The mean growth rate (0.61 mm of fork length/day) observed in 2023 for natural origin Chinook salmon was comparable to rates seen

in 2011 (0.61 mm/d fork length) but less than rates observed during 2012-2014 (0.84-0.86 mm/d fork length) (Monzyk et al. 2015). Turbidity during spring 2024 was low in both reservoirs and it remains to be seen whether high turbidity will return in the fall with the next drawdown event.

It is possible that higher turbidity during fall 2023 may have reduced predation pressure on juvenile salmonids from resident piscivores that rely on visual foraging, as has been documented in other systems (Gregory and Levings 1998). In Lookout Point Reservoir, most predator size (>200 mm) bycatch were walleye, crappie spp., smallmouth bass, *O. mykiss* and northern pikeminnow, however, our sampling methods were not designed to capture predator sized fish. Past work that assessed the predator community in Lookout Point Reservoir during 2013-2015 identified northern pikeminnow, crappie spp., largemouth bass, and walleye as the most abundant predators (Brandt et al. 2016). In floating gill nets, northern pikeminnow were the most abundant species in 2013-2015 (Brandt et al. 2016), however in our suspended gill nets, walleye (not exclusively >200mm) comprised the greatest proportion of the catch, suggesting their relative abundance may have increased since the previous assessment. Offshore non-target catch rates and predator bycatch will be reevaluated after the conclusion of 2024 offshore sampling.

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APPENDIX

Figure A1. Box minnow trap deployment.

Figure A2. Oneida trap deployment.

Figure A3. Gill net deployment.

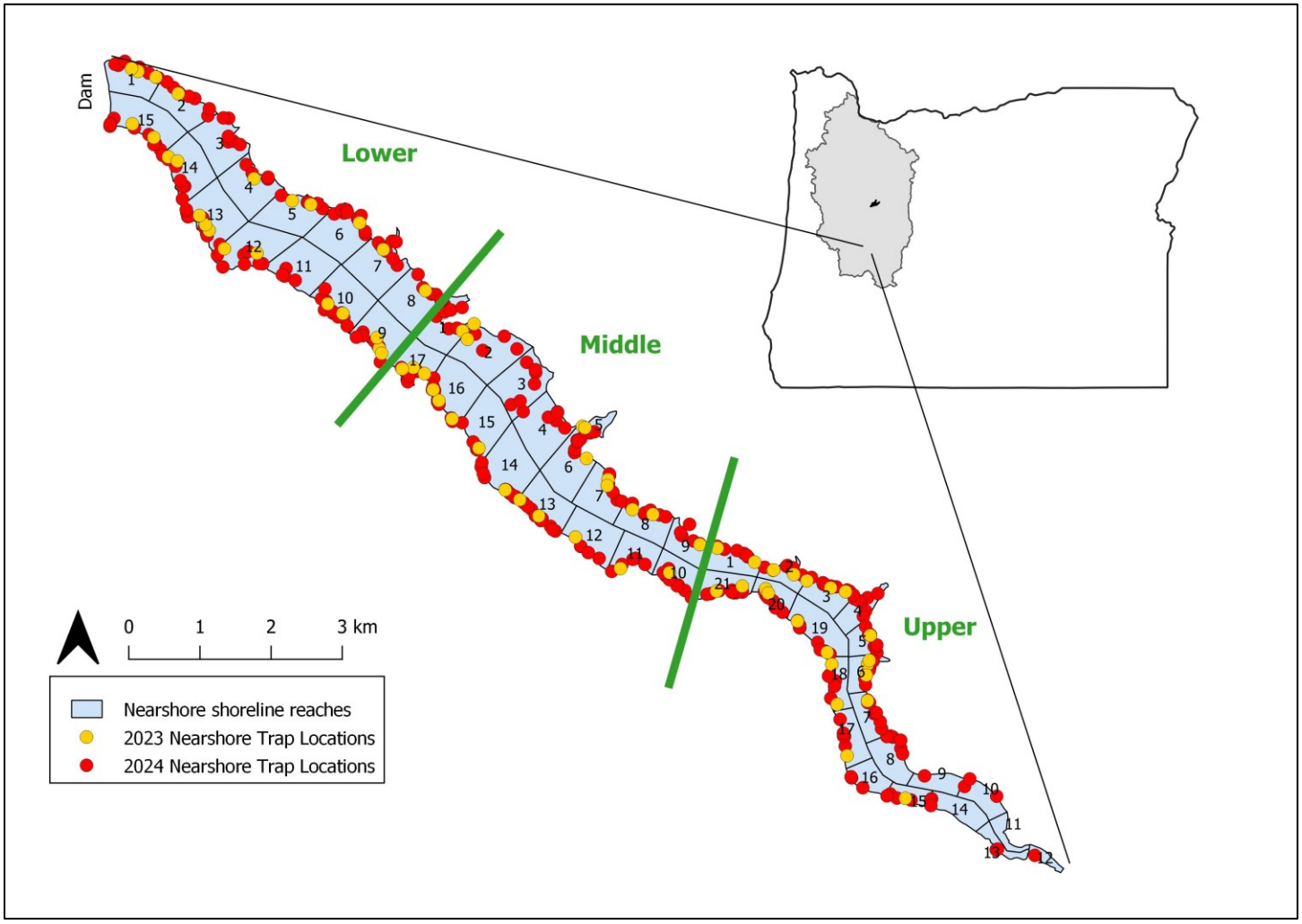

Figure A4. Nearshore trap locations for Lookout Point Reservoir.

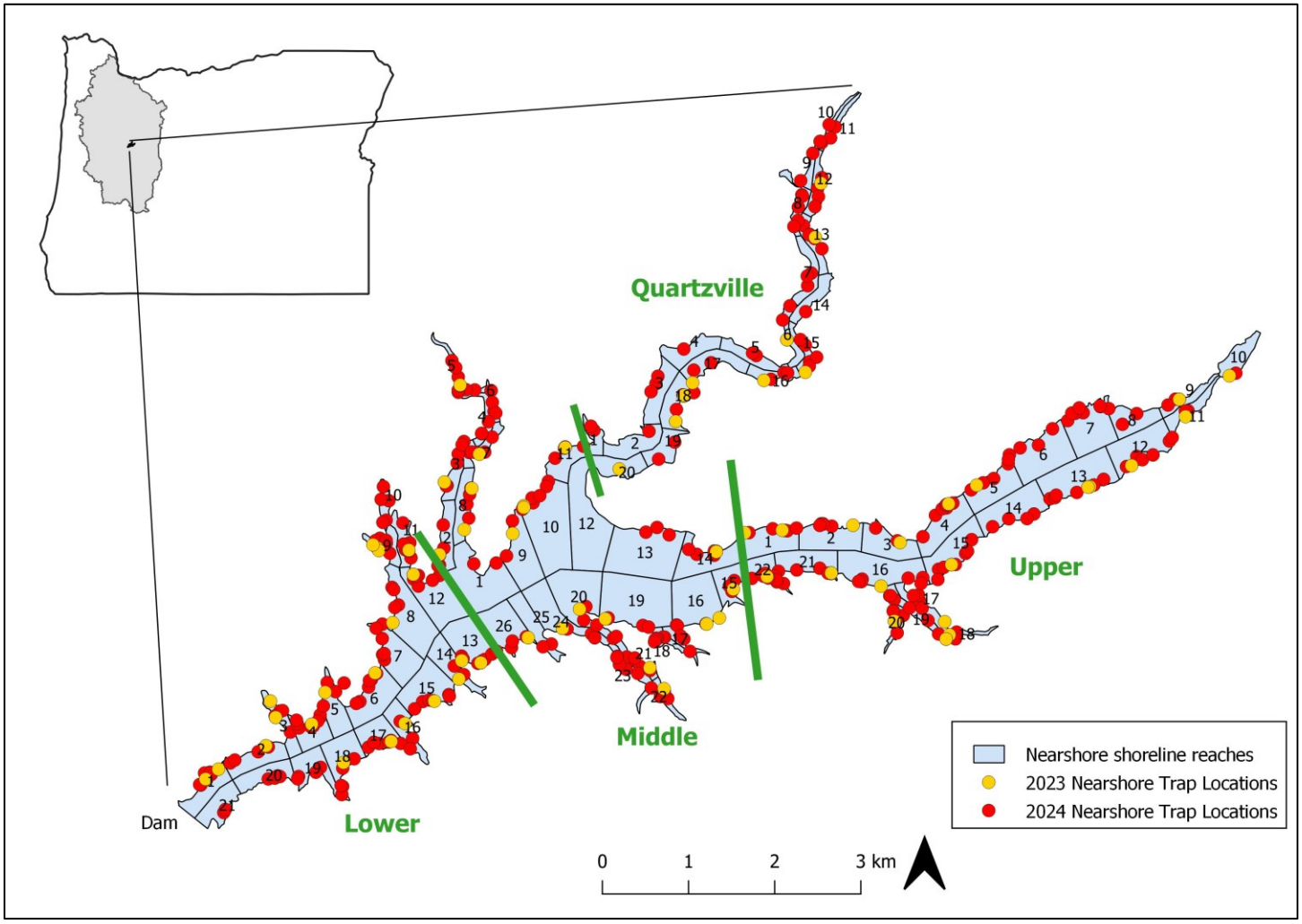

Figure A5. Nearshore trap locations for Green Peter Reservoir.

Table A1. Sampling effort by statistical week. Effort (number of 24 hr sets) is shown for each gear type and reservoir. Values are the total number of sets (net depths aggregated) with the number of sets with mean temperature below 20°C in parentheses.

Reservoir	Week	Start	End	Oneida	Box minnow	Gill net 30'	Gill net 80'
			2023				
Green Peter	24	6/15/2023	6/15/2023	2 (0)	0 (0)	0 (0)	0 (0)
	25	6/20/2023	6/22/2023	12 (1)	29 (0)	0 (0)	0 (0)
	27	7/3/2023	7/5/2023	12 (0)	30 (0)	0 (0)	0 (0)
	31	7/31/2023	8/2/2023	0 (0)	0 (0)	21 (14)	2 (2)
	33	8/17/2023	8/17/2023	0 (0)	0 (0)	9 (6)	0 (0)
	35	8/28/2023	8/30/2023	0 (0)	0 (0)	26 (12)	0 (0)
	37	9/11/2023	9/13/2023	0 (0)	0 (0)	26 (23)	0 (0)
	39	9/28/2023	9/30/2023	0 (0)	0 (0)	26 (21)	0 (0)
Lookout Point	26	6/26/2023	6/28/2023	9 (0)	25 (3)	0 (0)	0 (0)
	28	7/10/2023	7/12/2023	9 (0)	26 (0)	0 (0)	0 (0)
	34	8/22/2023	8/24/2023	0 (0)	0 (0)	24 (12)	0 (0)

Reservoir	Week	Start	End	Oneida	Box minnow	Gill net 30'	Gill net 80'
	36	9/5/2023	9/7/2023	0 (0)	0 (0)	23 (22)	0 (0)
	38	9/19/2023	9/21/2023	0 (0)	0 (0)	24 (24)	0 (0)
	40	10/2/2023	10/4/2023	0 (0)	0 (0)	24 (24)	0 (0)
	42	10/17/2023	10/19/2023	0 (0)	0 (0)	24 (24)	0 (0)
	43	10/23/2023	10/25/2023	0 (0)	0 (0)	24 (24)	0 (0)
	44	10/30/2023	11/1/2023	0 (0)	0 (0)	22 (22)	0 (0)
	45	11/7/2023	11/9/2023	0 (0)	0 (0)	24 (24)	0 (0)
	46	11/13/2023	11/15/2023	0 (0)	0 (0)	36 (36)	0 (0)
	47	11/20/2023	11/21/2023	0 (0)	0 (0)	24 (24)	0 (0)
	48	11/27/2023	11/29/2023	0 (0)	0 (0)	24 (24)	0 (0)
	49	12/4/2023	12/6/2023	0 (0)	0 (0)	36 (36)	0 (0)
			2024				
Green Peter	7	2/12/2024	2/14/2024	12 (12)	30 (30)	0 (0)	0 (0)
	9	2/26/2024	2/28/2024	12 (12)	28 (28)	0 (0)	0 (0)
	11	3/11/2024	3/13/2024	12 (12)	29 (29)	0 (0)	0 (0)
	13	3/25/2024	3/27/2024	12 (12)	30 (30)	0 (0)	0 (0)
	15	4/8/2024	4/10/2024	12 (12)	30 (30)	0 (0)	0 (0)
	17	4/22/2024	4/24/2024	12 (12)	30 (30)	0 (0)	0 (0)
	19	5/8/2024	5/9/2024	8 (8)	20 (20)	0 (0)	0 (0)
	21	5/20/2024	5/22/2024	12 (12)	30 (30)	0 (0)	0 (0)
	23	6/3/2024	6/5/2024	12 (12)	30 (30)	0 (0)	0 (0)
	25	6/17/2024	6/19/2024	0 (0)	0 (0)	0 (0)	22 (22)
Lookout Point	6	2/5/2024	2/7/2024	7 (7)	20 (20)	0 (0)	0 (0)
	8	2/19/2024	2/21/2024	9 (9)	27 (27)	0 (0)	0 (0)
	10	3/5/2024	3/6/2024	6 (6)	17 (17)	0 (0)	0 (0)
	12	3/18/2024	3/20/2024	9 (9)	27 (27)	0 (0)	0 (0)
	14	4/1/2024	4/3/2024	9 (9)	25 (25)	0 (0)	0 (0)
	16	4/15/2024	4/17/2024	9 (9)	26 (26)	0 (0)	0 (0)
	18	4/29/2024	5/1/2024	9 (9)	25 (25)	0 (0)	0 (0)
	20	5/13/2024	5/15/2024	9 (9)	26 (26)	0 (0)	0 (0)
	22	5/27/2024	5/29/2024	9 (9)	27 (27)	0 (0)	0 (0)
	24	6/10/2024	6/12/2024	9 (1)	27 (4)	0 (0)	0 (0)
	26	6/24/2024	6/26/2024	0 (0)	0 (0)	0 (0)	23 (23)

Table A2. Total catch and mean CPUE for nearshore trap sets. Total catch is presented for each species, followed by mean CPUE in parentheses. "Water temp. C" represents mean water surface temperature at trap sites.

Reservoir	Month	Zone	Net type	Effort (# sets)	Total catch	Water temp. C	CHS-Natural	CHS-AD	CUT	RBT-AD	RBT-Natural	BBH	LSS	BLC	WHC	BLG	SMB	LMB	Unid centr.	WAL	NPM	SCU	LWB
2023																							
Green Peter	6	LOWER	box minnow	9	0	21.2	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	6	MIDDLE	box minnow	8	5	21.3	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (0.2)	1 (0.1)	1 (0.1)	0 (0)	0 (0)	1 (0.1)	0 (0)	0 (0)
Green Peter	6	QUARTZ	box minnow	3	1	20.7	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	6	UPPER	box minnow	9	16	21.2	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	6 (0.7)	0 (0)	10 (1.1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	6	LOWER	oneida	4	60	21	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.2)	0 (0)	57 (14.2)	1 (0.2)	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	6	MIDDLE	oneida	4	161	21.3	0 (0)	0 (0)	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.2)	0 (0)	150 (37.5)	3 (0.8)	6 (1.5)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	6	QUARTZ	oneida	3	51	20	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	49 (16.3)	0 (0)	2 (0.7)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	6	UPPER	oneida	3	118	20.9	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	83 (27.7)	3 (1)	32 (10.7)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	7	LOWER	box minnow	9	1	23.9	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	7	MIDDLE	box minnow	9	6	24.2	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	5 (0.6)	0 (0)	1 (0.1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	7	QUARTZ	box minnow	3	16	23.8	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (0.7)	14 (4.7)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	7	UPPER	box minnow	9	9	24.5	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.1)	8 (0.9)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	7	LOWER	oneida	3	20	23.9	0 (0)	0 (0)	1 (0.3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	18 (6)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.3)	0 (0)	0 (0)
Green Peter	7	MIDDLE	oneida	3	71	24.2	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	70 (23.3)	1 (0.3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	7	QUARTZ	oneida	3	85	23.1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	84 (28)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.3)	0 (0)	0 (0)
Green Peter	7	UPPER	oneida	3	77	24.1	0 (0)	0 (0)	1 (0.3)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.3)	0 (0)	72 (24)	2 (0.7)	1 (0.3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	6	LOWER	box minnow	8	124	22	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	122 (15.2)	0 (0)	0 (0)	2 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	6	MIDDLE	box minnow	9	207	22	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	181 (20.1)	0 (0)	0 (0)	26 (2.9)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	6	UPPER	box minnow	8	71	20.9	1 (0.1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.1)	0 (0)	0 (0)	51 (6.4)	0 (0)	3 (0.4)	0 (0)	15 (1.9)	0 (0)
Lookout Point	6	LOWER	oneida	3	3003	21.8	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3003 (1001)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	6	MIDDLE	oneida	3	1906	21.9	4 (1.3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1700 (566.7)	0 (0)	1 (0.3)	200 (66.7)	0 (0)	1 (0.3)	0 (0)	0 (0)	0 (0)
Lookout Point	6	UPPER	oneida	3	1466	21.2	3 (1)	1 (0.3)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.3)	0 (0)	1461 (487)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	7	LOWER	box minnow	9	74	23.3	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	72 (8)	0 (0)	0 (0)	1 (0.1)	0 (0)	0 (0)	0 (0)	1 (0.1)	0 (0)
Lookout Point	7	MIDDLE	box minnow	8	35	23.6	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	23 (2.9)	0 (0)	0 (0)	12 (1.5)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	7	UPPER	box minnow	9	76	23.2	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	40 (4.4)	0 (0)	0 (0)	36 (4)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	7	LOWER	oneida	3	2151	23.1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.3)	0 (0)	0 (0)	2150 (716.7)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	7	MIDDLE	oneida	3	1846	23.5	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1844 (614.7)	0 (0)	0 (0)	1 (0.3)	0 (0)	1 (0.3)	0 (0)	0 (0)	0 (0)
Lookout Point	7	UPPER	oneida	3	1942	22.9	8 (2.7)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1871 (623.7)	0 (0)	1 (0.3)	59 (19.7)	0 (0)	0 (0)	3 (1)	0 (0)	0 (0)
2024																							
Green Peter	2	LOWER	box minnow	18	0	8.2	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	2	MIDDLE	box minnow	18	0	8.5	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	2	QUARTZ	box minnow	5	0	8.3	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	2	UPPER	box minnow	17	1	8.3	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.1)	0 (0)	0 (0)
Green Peter	2	LOWER	oneida	6	5.4	8.3	1 (0.2)	0.2 (0)	1 (0.2)	0 (0)	2 (0.3)	0 (0)	0 (0)	0 (0)	0 (0)	1.2 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	2	MIDDLE	oneida	6	10.2	8.4	8 (1.3)	0 (0)	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1.2 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	2	QUARTZ	oneida	6	11.6	8	0.2 (0)	1 (0.2)	0 (0)	0 (0)	2 (0.3)	0 (0)	0 (0)	0 (0)	0 (0)	8.4 (1.4)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	2	UPPER	oneida	6	10.8	8.1	3.8 (0.6)	0 (0)	0 (0)	0 (0)	4.2 (0.7)	0 (0)	0 (0)	0 (0)	0 (0)	1.8 (0.3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.2)
Green Peter	3	LOWER	box minnow	18	1	9.1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	3	MIDDLE	box minnow	18	0	9.3	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	3	QUARTZ	box minnow	6	1	8.9	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

Reservoir	Month	Zone	Net type	Effort (# sets)	Total catch	Water temp. C	CHS-Natural	CHS-AD	CUT	RBT-AD	RBT-Natural	BBH	LSS	BLC	WHC	BLG	SMB	LMB	Unid centr.	WAL	NPM	SCU	LWB
Green Peter	3	UPPER	box minnow	17	0	9.1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	3	LOWER	oneida	6	7	9.2	1 (0.2)	0 (0)	0 (0)	0 (0)	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	5 (0.8)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	3	MIDDLE	oneida	6	11	9.4	3 (0.5)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	8 (1.3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	3	QUARTZ	oneida	6	3	9	2 (0.3)	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	3	UPPER	oneida	6	15	9	11 (1.8)	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3 (0.5)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	4	LOWER	box minnow	18	0	12.6	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	4	MIDDLE	box minnow	18	0	13.2	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	4	QUARTZ	box minnow	6	0	13.3	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	4	UPPER	box minnow	18	1	13.1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	4	LOWER	oneida	6	14	12.6	0 (0)	0 (0)	5 (0.8)	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	5 (0.8)	2 (0.3)	0 (0)	0 (0)	0 (0)	1 (0.2)	0 (0)	0 (0)
Green Peter	4	MIDDLE	oneida	6	3	13.1	1 (0.2)	0 (0)	1 (0.2)	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	4	QUARTZ	oneida	6	9	13.3	3 (0.5)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	4 (0.7)	0 (0)	0 (0)	0 (0)	0 (0)	2 (0.3)	0 (0)	0 (0)
Green Peter	4	UPPER	oneida	6	7	13	5 (0.8)	0 (0)	0 (0)	0 (0)	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	5	LOWER	box minnow	15	0	16.1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	5	MIDDLE	box minnow	15	0	16.6	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	5	QUARTZ	box minnow	5	1	16.1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.2)	0 (0)	0 (0)
Green Peter	5	UPPER	box minnow	15	0	15.9	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	5	LOWER	oneida	5	19	16	0 (0)	0 (0)	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	17 (3.4)	0 (0)	0 (0)
Green Peter	5	MIDDLE	oneida	5	7	16.4	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	6 (1.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	5	QUARTZ	oneida	5	8	15.9	2 (0.4)	0 (0)	0 (0)	0 (0)	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	4 (0.8)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.2)	0 (0)	0 (0)
Green Peter	5	UPPER	oneida	5	4	15.9	0 (0)	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (0.4)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.2)	0 (0)	0 (0)
Green Peter	6	LOWER	box minnow	9	0	17.9	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	6	MIDDLE	box minnow	9	0	18.2	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	6	QUARTZ	box minnow	3	0	18.3	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	6	UPPER	box minnow	9	0	18	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	6	LOWER	oneida	3	3	17.8	2 (0.7)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	6	MIDDLE	oneida	3	2	18.2	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (0.7)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	6	QUARTZ	oneida	3	47	18.2	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	47 (15.7)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	6	UPPER	oneida	3	10	18.3	1 (0.3)	3 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3 (1)	0 (0)	0 (0)	0 (0)	0 (0)	3 (1)	0 (0)	0 (0)
Lookout Point	2	LOWER	box minnow	14	1	8.8	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	2	MIDDLE	box minnow	15	1	8.7	1 (0.1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	2	UPPER	box minnow	18	1	8.2	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.1)	0 (0)	0 (0)
Lookout Point	2	LOWER	oneida	5	2	8.7	0 (0)	0 (0)	0 (0)	0 (0)	2 (0.4)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	2	MIDDLE	oneida	5	9	8.6	2 (0.4)	2 (0.4)	0 (0)	0 (0)	5 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	2	UPPER	oneida	6	14	8.2	5 (0.8)	0 (0)	3 (0.5)	0 (0)	3 (0.5)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.2)	1 (0.2)	0 (0)
Lookout Point	3	LOWER	box minnow	15	0	9.6	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	3	MIDDLE	box minnow	15	1	9.5	1 (0.1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	3	UPPER	box minnow	14	0	8.4	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	3	LOWER	oneida	5	0	9.6	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	3	MIDDLE	oneida	5	4	9	1 (0.2)	0 (0)	0 (0)	0 (0)	2 (0.4)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.2)	0 (0)	0 (0)
Lookout Point	3	UPPER	oneida	5	5	8.4	1 (0.2)	0 (0)	0 (0)	0 (0)	2 (0.4)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (0.4)	0 (0)	0 (0)
Lookout Point	4	LOWER	box minnow	21	0	11.9	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	4	MIDDLE	box minnow	23	0	12.1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	4	UPPER	box minnow	23	0	11.3	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	4	LOWER	oneida	8	6	12.2	0 (0)	1 (0.1)	0 (0)	0 (0)	5 (0.6)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

Reservoir	Month	Zone	Net type	Effort (# sets)	Total catch	Water temp. C	CHS-Natural	CHS-AD	CUT	RBT-AD	RBT-Natural	BBH	LSS	BLC	WHC	BLG	SMB	LMB	Unid centr.	WAL	NPM	SCU	LWB
Lookout Point	4	MIDDLE	oneida	8	17	12.1	1 (0.1)	0 (0)	0 (0)	0 (0)	3 (0.4)	9 (1.1)	4 (0.5)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	4	UPPER	oneida	8	11	10.9	1 (0.1)	0 (0)	2 (0.2)	0 (0)	4 (0.5)	0 (0)	1 (0.1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3 (0.4)	0 (0)	0 (0)
Lookout Point	5	LOWER	box minnow	20	0	16.1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	5	MIDDLE	box minnow	21	0	16.5	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	5	UPPER	box minnow	21	4	16.3	2 (0.1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (0.1)	0 (0)	0 (0)
Lookout Point	5	LOWER	oneida	7	1	15.8	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.1)	0 (0)	0 (0)
Lookout Point	5	MIDDLE	oneida	7	3	16.6	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.1)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.1)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.1)	0 (0)	0 (0)
Lookout Point	5	UPPER	oneida	7	16	16.2	0 (0)	0 (0)	0 (0)	1 (0.1)	9 (1.3)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.1)	0 (0)	0 (0)	0 (0)	0 (0)	5 (0.7)	0 (0)	0 (0)
Lookout Point	6	LOWER	box minnow	9	81	20.2	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	46 (5.1)	0 (0)	0 (0)	35 (3.9)	0 (0)
Lookout Point	6	MIDDLE	box minnow	9	89	20.4	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	25 (2.8)	0 (0)	0 (0)	64 (7.1)	0 (0)
Lookout Point	6	UPPER	box minnow	9	73	20.4	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	15 (1.7)	0 (0)	0 (0)	58 (6.4)	0 (0)
Lookout Point	6	LOWER	oneida	3	79	20.3	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.3)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.3)	1 (0.3)	0 (0)	30 (10)	0 (0)	0 (0)	46 (15.3)	0 (0)
Lookout Point	6	MIDDLE	oneida	3	58	20.4	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (0.7)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	56 (18.7)	0 (0)
Lookout Point	6	UPPER	oneida	3	6	20.4	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	5 (1.7)	0 (0)

Table A3. Total catch and mean CPUE for offshore net sets. Total catch is presented for each species, followed by mean CPUE in parentheses. "Water temp. C" represents mean water temperature of the vertical temperature profile over the range of depths covered by the net. *RBT not identified to natural origin or adipose-clipped (2023 only).

Reservoir	Month	Zone	Net Type	Net depth (m)	Effort (# sets)	Total catch	Water temp. C	CHS-Natural	CHS-AD	UnID Salmonid	CUT	KOK	RBT*	RBT-AD	RBT-Natural	BLC	WHC	BLG	SMB	LMB	WAL	NPM
2023																						
Green Peter	7	A2	gill net 30'	14	1	0	15.2	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	7	A3	gill net 30'	16	1	0	11.8	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	7	A5	gill net 30'	12	1	0	20.6	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	7	A6	gill net 30'	10	1	0	22.4	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	7	Q1	gill net 30'	16	1	0	11.8	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	7	Q1	gill net 30'	18	1	0	10	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	7	A1	gill net 80'	10	1	4	19.5	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3 (3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)	0 (0)	0 (0)	0 (0)
Green Peter	8	A1	gill net 30'	10	4	3	22.4	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (0.5)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.2)	0 (0)	0 (0)	0 (0)
Green Peter	8	A1	gill net 30'	12	2	0	22.5	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	8	A1	gill net 30'	18	1	0	14.5	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	8	A1	gill net 30'	20	1	0	12.4	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	8	A2	gill net 30'	14	5	0	19.3	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	8	A2	gill net 30'	16	1	0	16.6	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	8	A2	gill net 30'	18	1	0	17	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

Reservoir	Month	Zone	Net Type	Net depth (m)	Effort (# sets)	Total catch	Water temp. C	CHS-Natural	CHS-AD	UnID Salmonid	CUT	KOK	RBT*	RBT-AD	RBT-Natural	BLC	WHC	BLG	SMB	LMB	WAL	NPM
Green Peter	8	A3	gill net 30'	16	6	1	16.7	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	8	A3	gill net 30'	20	3	2	15.2	0 (0)	0 (0)	0 (0)	0 (0)	2 (0.7)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	8	A4	gill net 30'	12	1	0	21.8	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	8	A4	gill net 30'	14	3	1	16.1	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	8	A4	gill net 30'	16	3	0	20	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	8	A4	gill net 30'	18	1	0	17.4	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	8	A5	gill net 30'	10	4	0	22.9	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	8	A5	gill net 30'	12	2	0	20.6	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	8	A5.5	gill net 30'	10	1	0	23.7	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	8	A6	gill net 30'	10	2	0	22.4	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	8	Q1	gill net 30'	14	4	0	21.3	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	8	Q1	gill net 30'	16	2	0	11.8	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	8	Q1	gill net 30'	18	3	0	12.5	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	8	A1	gill net 80'	10	1	9	19.5	0 (0)	0 (0)	0 (0)	0 (0)	3 (3)	6 (6)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	9	A1	gill net 30'	20	5	0	17	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	9	A1	gill net 30'	26	6	4	14.2	0 (0)	0 (0)	0 (0)	1 (0.2)	3 (0.5)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	9	A2	gill net 30'	15	2	0	20	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	9	A2	gill net 30'	20	6	0	17	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	9	A2	gill net 30'	26	2	1	14.2	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.5)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	9	A3	gill net 30'	15	1	0	20	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	9	A3	gill net 30'	20	4	0	17.4	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	9	A3	gill net 30'	26	3	1	14.8	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	9	A4	gill net 30'	20	4	0	17.4	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	9	A4	gill net 30'	26	4	2	14.8	0 (0)	0 (0)	0 (0)	0 (0)	2 (0.5)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	9	A5	gill net 30'	5	4	3	20	1 (0.2)	0 (0)	0 (0)	0 (0)	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	9	A5	gill net 30'	10	3	0	21.8	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	9	Q1	gill net 30'	15	4	0	20	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	9	Q1	gill net 30'	20	4	0	17.4	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	8	A1	gill net 30'	16	3	1	20	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.3)	0 (0)
Lookout Point	8	A1	gill net 30'	20	3	1	19.4	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.3)	0 (0)
Lookout Point	8	A2	gill net 30'	14	3	0	20.1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	8	A2	gill net 30'	18	3	8	19.6	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	8 (2.7)	0 (0)

Reservoir	Month	Zone	Net Type	Net depth (m)	Effort (# sets)	Total catch	Water temp. C	CHS-Natural	CHS-AD	UnID Salmonid	CUT	KOK	RBT*	RBT-AD	RBT-Natural	BLC	WHC	BLG	SMB	LMB	WAL	NPM
Lookout Point	8	A3	gill net 30'	12	3	8	20.4	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	8 (2.7)	0 (0)
Lookout Point	8	A3	gill net 30'	16	3	8	20	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (0.7)	0 (0)	0 (0)	0 (0)	6 (2)	0 (0)
Lookout Point	8	A3.5	gill net 30'	10	3	2	20.5	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (0.7)	0 (0)
Lookout Point	8	A3.5	gill net 30'	14	3	3	20.1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3 (1)	0 (0)
Lookout Point	9	A1	gill net 30'	0	1	0	16.7	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	9	A1	gill net 30'	18	1	0	19	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	9	A1	gill net 30'	20	1	1	18.9	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)	0 (0)
Lookout Point	9	A1	gill net 30'	28	7	0	17.7	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	9	A1	gill net 30'	30	1	0	18.7	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	9	A1	gill net 30'	33	2	0	15	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	9	A2	gill net 30'	14	3	0	19.5	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	9	A2	gill net 30'	16	3	1	19.3	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.3)	0 (0)
Lookout Point	9	A2	gill net 30'	18	6	1	19	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.2)	0 (0)
Lookout Point	9	A3	gill net 30'	5	3	44	19.2	0 (0)	1 (0.3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	43 (14.3)	0 (0)
Lookout Point	9	A3	gill net 30'	7	3	10	19.3	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (0.7)	0 (0)	0 (0)	0 (0)	8 (2.7)	0 (0)
Lookout Point	9	A3	gill net 30'	14	3	2	19.5	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (0.7)	0 (0)
Lookout Point	9	A3	gill net 30'	16	3	0	19.3	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	9	A3.5	gill net 30'	0	5	6	16.7	0 (0)	1 (0.2)	0 (0)	0 (0)	0 (0)	1 (0.2)	0 (0)	0 (0)	0 (0)	2 (0.4)	0 (0)	0 (0)	1 (0.2)	1 (0.2)	0 (0)
Lookout Point	9	A3.5	gill net 30'	0.5	1	0	20.4	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	9	A3.5	gill net 30'	10	2	2	19.6	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (1)	0 (0)
Lookout Point	9	A3.5	gill net 30'	12	2	0	19.6	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	10	A1	gill net 30'	0	2	0	11.5	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	10	A1	gill net 30'	4	2	2	11.2	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (1)	0 (0)
Lookout Point	10	A1	gill net 30'	7	6	5	14.8	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	5 (0.8)	0 (0)
Lookout Point	10	A1	gill net 30'	12	6	1	14.8	0 (0)	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	10	A1	gill net 30'	22	3	0	16	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	10	A1	gill net 30'	23	3	0	16.1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	10	A1.5	gill net 30'	0	5	23	13.4	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	22 (4.4)	0 (0)
Lookout Point	10	A1.5	gill net 30'	4	2	1	11.2	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.5)	0 (0)
Lookout Point	10	A1.5	gill net 30'	9	3	2	14.7	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.3)	0 (0)	0 (0)	0 (0)	1 (0.3)	0 (0)
Lookout Point	10	A1.5	gill net 30'	20	1	0	16	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	10	A2	gill net 30'	0	5	7	13.4	0 (0)	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	6 (1.2)	0 (0)

Reservoir	Month	Zone	Net Type	Net depth (m)	Effort (# sets)	Total catch	Water temp. C	CHS-Natural	CHS-AD	UnID Salmonid	CUT	KOK	RBT*	RBT-AD	RBT-Natural	BLC	WHC	BLG	SMB	LMB	WAL	NPM
Lookout Point	10	A2	gill net 30'	4	2	4	11.2	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	4 (2)	0 (0)
Lookout Point	10	A2	gill net 30'	5	3	0	15	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	10	A2	gill net 30'	7	6	3	15.4	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3 (0.5)	0 (0)
Lookout Point	10	A2	gill net 30'	9	2	0	10.8	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	10	A2	gill net 30'	14	6	0	16.6	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	10	A2	gill net 30'	20	1	0	16	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	10	A2.5	gill net 30'	0	9	3	15.2	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.1)	1 (0.1)	0 (0)	0 (0)	0 (0)	1 (0.1)	0 (0)
Lookout Point	10	A2.5	gill net 30'	3	6	15	15.7	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	15 (2.5)	0 (0)
Lookout Point	10	A3	gill net 30'	0	3	0	13.9	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	10	A3	gill net 30'	2	3	16	17.4	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.3)	0 (0)	0 (0)	0 (0)	0 (0)	15 (5)	0 (0)
Lookout Point	10	A3	gill net 30'	4	3	10	17	1 (0.3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	9 (3)	0 (0)
Lookout Point	10	A3.5	gill net 30'	0	4	2	13.8	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.2)	0 (0)	0 (0)	0 (0)	1 (0.2)	0 (0)
Lookout Point	11	A1	gill net 30'	0	11	2	9.7	0 (0)	2 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	11	A1	gill net 30'	4	11	1	9.6	1 (0.1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	11	A1	gill net 30'	9	11	0	9.5	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	11	A1	gill net 30'	12	7	0	8.9	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	11	A1.5	gill net 30'	0	18	2	9.5	0 (0)	2 (0.1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	11	A1.5	gill net 30'	4	11	2	9.6	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.1)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.1)	0 (0)
Lookout Point	11	A1.5	gill net 30'	9	7	1	9	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	11	A2	gill net 30'	0	18	3	9.5	1 (0.1)	1 (0.1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.1)	0 (0)
Lookout Point	11	A2	gill net 30'	4	11	6	9.6	0 (0)	0 (0)	1 (0.1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	5 (0.5)	0 (0)
Lookout Point	11	A2	gill net 30'	9	11	1	9.5	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	12	A1	gill net 30'	0	3	0	8	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	12	A1	gill net 30'	4	3	0	8	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	12	A1	gill net 30'	9	3	0	8.1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	12	A1	gill net 30'	12	3	0	8	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	12	A1.5	gill net 30'	0	6	0	8	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	12	A1.5	gill net 30'	4	3	0	8	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	12	A1.5	gill net 30'	9	3	0	8.1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	12	A2	gill net 30'	0	6	0	8	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	12	A2	gill net 30'	4	3	0	8	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	12	A2	gill net 30'	9	3	0	8.1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

Reservoir	Month	Zone	Net Type	Net depth (m)	Effort (# sets)	Total catch	Water temp. C	CHS-Natural	CHS-AD	UnID Salmonid	CUT	KOK	RBT*	RBT-AD	RBT-Natural	BLC	WHC	BLG	SMB	LMB	WAL	NPM
2024																						
Green Peter	6	A1	gill net 80'	6.5	4	12	15.6	4 (1)	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	6 (1.5)	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	6	A2	gill net 80'	6.5	1	0	15.6	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	6	A3	gill net 80'	6.5	3	12	15.5	3 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	8 (2.7)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.3)
Green Peter	6	A4	gill net 80'	6.5	3	1	15.5	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	6	A5	gill net 80'	6.5	4	22	14.1	2 (0.5)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	18 (4.5)	2 (0.5)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Green Peter	6	A6	gill net 80'	6.5	4	24	14.1	7 (1.8)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	15 (3.8)	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.2)
Green Peter	6	Q1	gill net 80'	6.5	3	1	15.5	1 (0.3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	6	A1	gill net 80'	8	6	9	15.5	7 (1.2)	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	6	A2	gill net 80'	8	3	0	15.5	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	6	A3	gill net 80'	8	3	0	14.6	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	6	A4	gill net 80'	8	4	0	14.6	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lookout Point	6	A5	gill net 80'	8	4	2	14.1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.2)	0 (0)	0 (0)	1 (0.2)	0 (0)	0 (0)	0 (0)
Lookout Point	6	A6	gill net 80'	8	3	3	13.5	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.3)	1 (0.3)	0 (0)	0 (0)	1 (0.3)	0 (0)	0 (0)	0 (0)

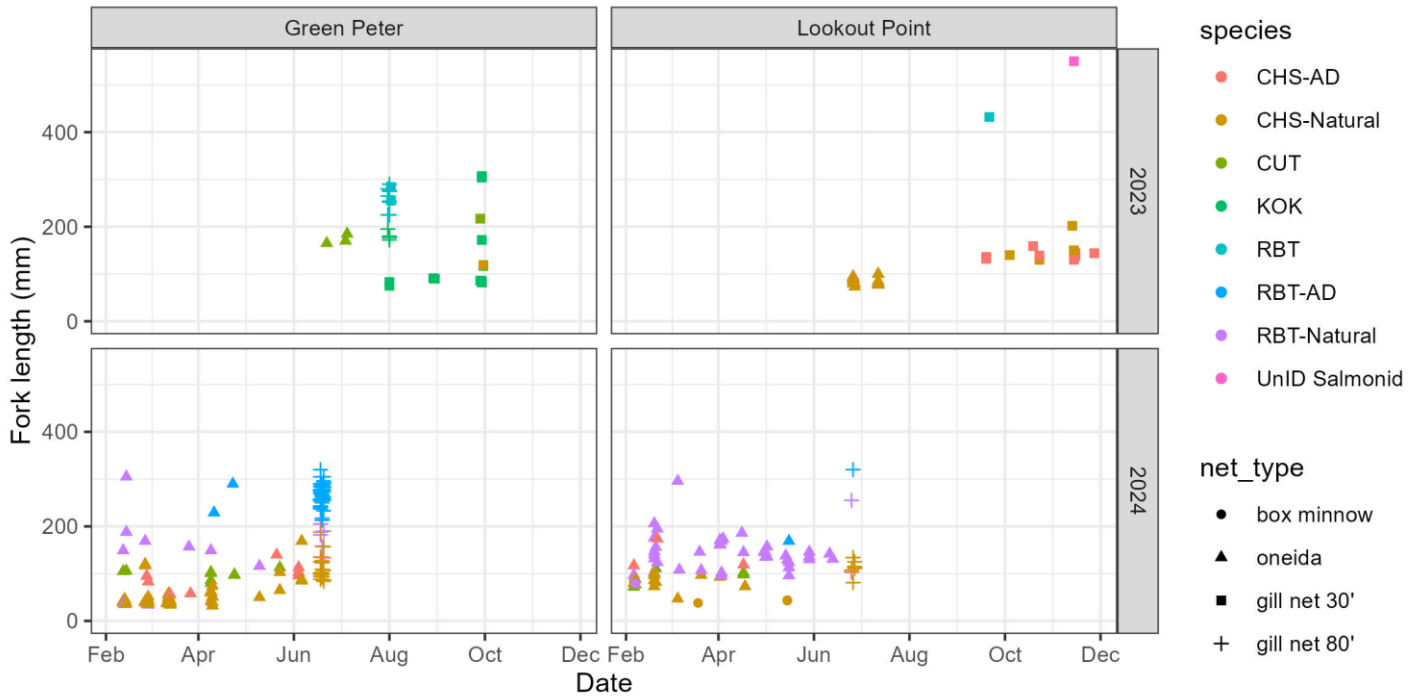

Figure A6. Fork lengths of all salmonid species captured in reservoir sampling by sampling date.

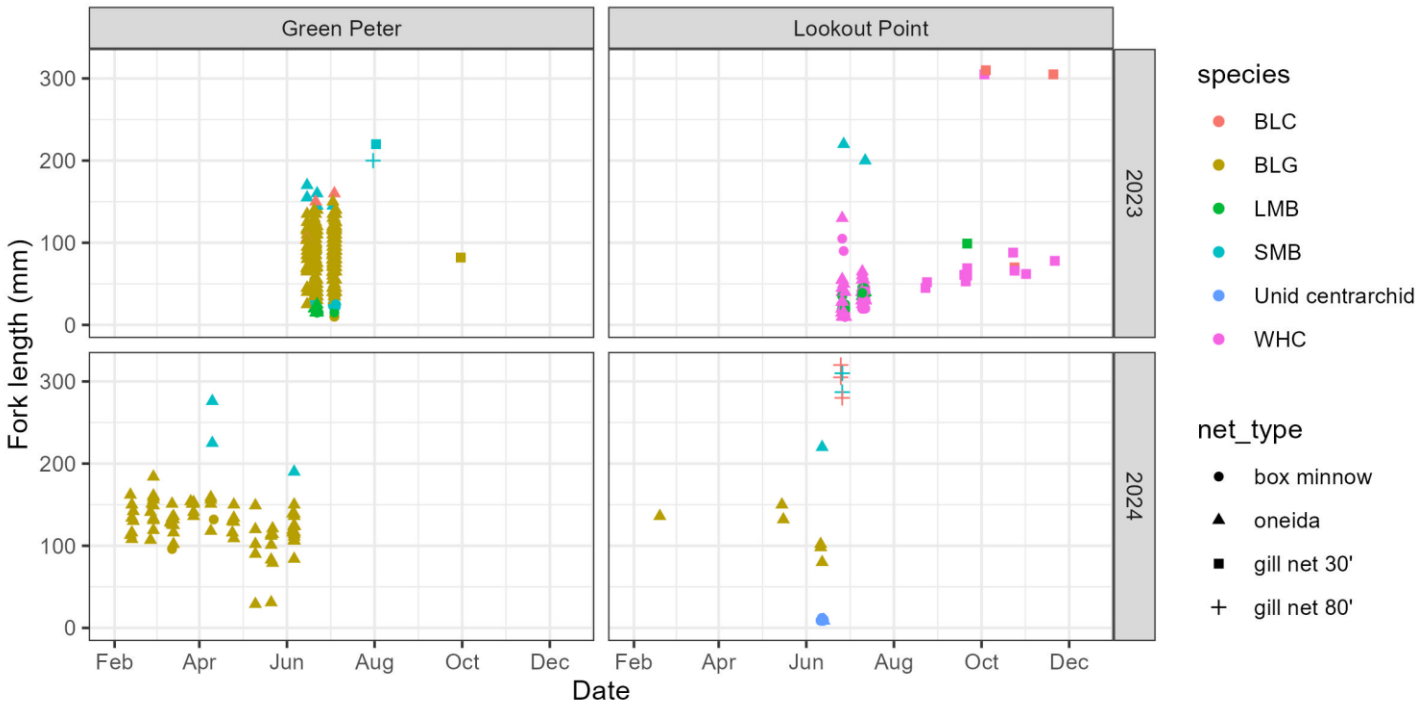

Figure A7. Fork lengths of centrarchid species captured in reservoir sampling by sampling date.

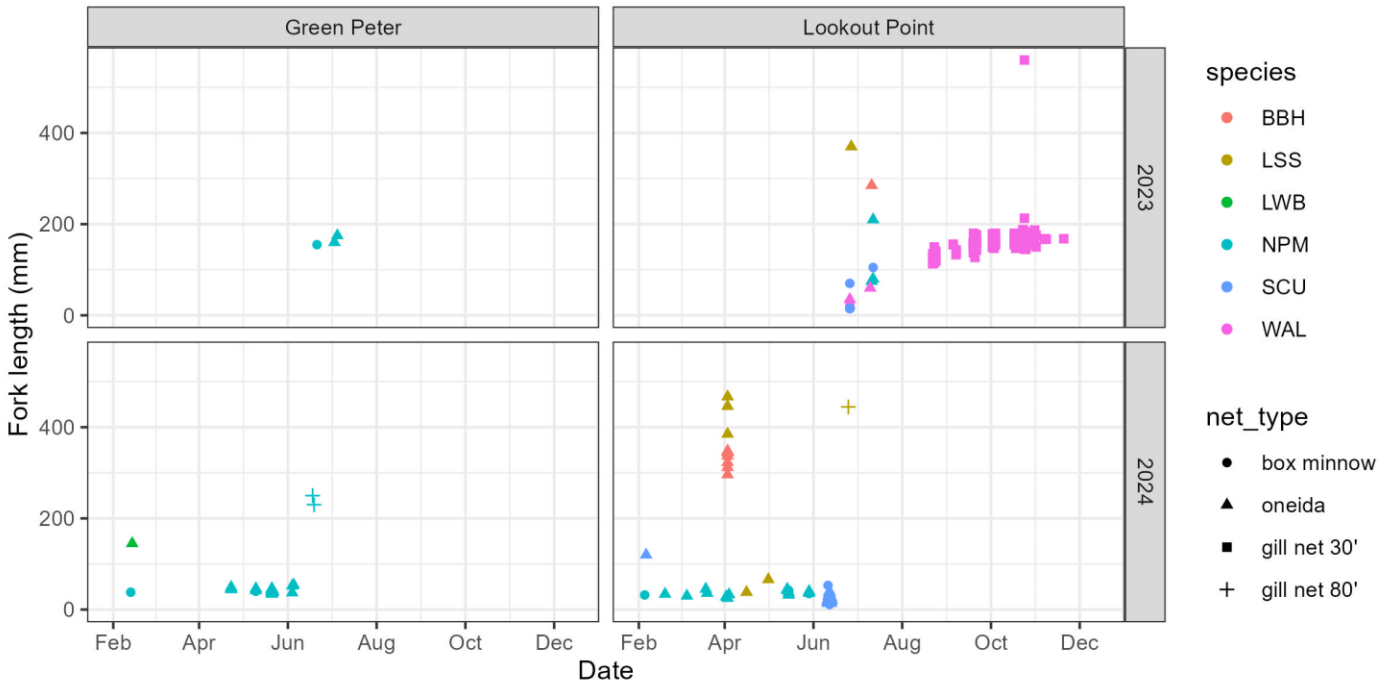

Figure A8. Fork lengths of other species captured in reservoir sampling by sampling date.