LEWIS RIVER AQUATIC COORDINATION COMMITTEE

Facilitator: ERIK LESKO
503-412-8401

Location: TEAMS MEETING ONLY

Date: January 14, 2021

Time: 9:30 AM – 12:15 PM

Agenda Items

9:30 a.m.	Welcome ➢ Review Agenda, ACC 12/10/20 Meeting Notes ➢ Comment & Accept Agenda, 12/10/20 Meeting Notes
10:00 a.m.	Public Comment Opportunity
10:15 a.m.	Swift FSC Collection Efficiency Results for 2020 – Presentation by Four Peaks Environmental
11:00 a.m.	ACC Meeting Protocol; public attendance
11:30 a.m.	Study/Work Product Updates ○ 2020 ACC Funds Year-end Accounting ○ Flows/Reservoir Conditions Update ○ ATS Update ○ Fish Passage Update
12:00 p.m.	➢ Next Meeting's Agenda ➢ Public Comment Opportunity Note: all meeting notes and the meeting schedule can be located at: https://www.pacificorp.com/energy/hydro/lewis-river/acc-tcc.html
12:15 p.m.	**Meeting adjourn**

Microsoft Teams meeting
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Or call in (audio only)
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Phone Conference ID: 867 438 35#

FINAL Meeting Notes
Lewis River License Implementation
Aquatic Coordination Committee (ACC) Meeting
January 14, 2021
TEAMS Meeting Only

ACC Representatives Present (16)
Eli Asher, Cowlitz Indian Tribe
Amanda Froberg, Cowlitz PUD
Steve West, LCFRB
Scott Anderson, NMFS
Kim McCune, PacifiCorp
Chris Karchesky, PacifiCorp
Erik Lesko, PacifiCorp
Jeremiah Doyle, PacifiCorp
Jim Byrne, Trout Unlimited
Joshua Jones (JD), USDA FS
Kate Day, USDA FS
Peggy Miller, WDFW
Josua Holowatz, WDFW
Bryce Glaser, WDFW
Aaron Roberts, WDFW
Bill Sharp, Yakama Nation

Guests (3)
Logan Negherbon, NMFS
Mark Weiland, Four Peaks Environmental
Samuel Haffey, Four Peaks Environmental

Calendar:

February 11, 2021	ACC Meeting	TEAMS Meeting

Assignments from January 14, 2021	**Status**
Scott Anderson (NMFS): Update ACC on Biological Opinions.	

Assignments from December 10, 2020	**Status**
Lesko/Kimmick/McCune: Follow up on Hyde's requests regarding extension of Swift boat ramp and fish cleaning stations.	**Complete – 1/14/21**
Lesko: Follow up first of the year with Harding to discuss fish stranding survey schedule.	**Ongoing**

Assignments from August 13, 2020	**Status**
Romanski: Jim Byrne (Trout Unlimited) requested Tim Romanski (USFWS) investigate why it was decided in 2005 and find out how and why the Merwin trap design was settled on and specified.	**Ongoing**

Opening, Review of Agenda and Meeting Notes
Erik Lesko (PacifiCorp) called the meeting to order at 9:33am and reviewed the agenda. No additions to the agenda were requested.

Lesko also reviewed the December 10, 2020 meeting notes. The ACC approved the December 10, 2020 meeting notes at 9:45am to include one clarifying edit.

2020/2021 Aquatic Fund Schedule Update
Lesko reminded the ACC of the aquatic fund schedule at this time. The authors are finalizing their proposals to be submitted to the Utilities & ACC by January 29, 2021 (see Timeline below).

Lewis River Aquatic Fund Process Timeline

Activity	Target Milestone Date
Request for proposals distributed along with landowner acknowledgement form	September 4
Draft Full Proposals due to ACC	November 20
Conduct Proposed Project Information Meeting *(applicant presentations)*	December ACC meeting
ACC members submit written request for clarification of project information if questions not answered in previous meeting/presentation.	January 4
Final Full Proposals due (ACC requests for clarification need to be included as an Appendix)	January 29
Final Full Proposals submitted to ACC for 30-day review and evaluation	February 1
ACC scoring template due to Utilities	March 1
Distribute combined master scoring template to ACC	March 5
*Conduct Project Selection Meeting	March 11 ACC meeting
Provide add'l 7-day review period for absentee ACC participants, if needed	Third Thursday in March
Submit Project Selection Report to FERC	By April 15th

*Project applicants not permitted to attend this meeting.

Swift FSC Collection Efficiency Results for 2020 – Presentation by Four Peaks Environmental (Attachment A)

Samuel Haffey with Four Peaks Environmental presented results of the 2020 Swift Reservoir Smolt Collection Efficiency to the ACC. Slides presented by Haffey can be found below as Attachment A. As part of the presentation, Haffey provided an overview of the intent of the study, which was to assess behavior and passage success of juvenile salmon as they approach and enter the Swift Reservoir Floating Surface Collector. He also added that this was an ongoing assessment and that PacifiCorp has made a lot of improvements/changes to the facility from information collected previously to improve fish passage including: adding a fish guidance net, reducing acoustic noise in and around the facility, increasing entrance flow and attraction velocity, and balancing hydraulics in the fish passage channel.

Haffey went on to discuss how previous modifications have been successful in encouraging fish to enter the collector. The 2019 study indicated that most fish that find the zone of influence (ZOI) which is an area in a 150' radius emanating out from the front of the collector. Most of the fish that find that ZOI will enter the net transition structure (NTS), a trapezoidal attachment on the front of the collector yet too many of them reject and turn around after entering that structure and leaving. The 2019 study also found that 40% of the fish that enter the collector turn back before collection. Results of the 2019 study indicated that passage through the fish passage channel, the section between the entrance of the FSC and the sorting building, was the bottleneck and leading cause for fish rejecting the FSC.

The 2020 study focused the study on trying to identify where fish are turning around in the fish collection channel. So, 40% are turning around somewhere between the NTS and the fish collection channel. The 2020 study focused on this section of the facility, with the intent to better investigate small scale movements and see if there were any patterns or explanations of what is causing this behavior.

Fish behavior in and around the FSC is assessed by a series of passage metrics outlined in Objective 4 of the Lewis River Monitoring and Evaluation Plan. The schematic below explains what those passage metrics are. The diagram is a schematic of the ZOI, NTS, and the fish collection channel. The metrics are the percentage of fish that get to each zone that migrate to the next zone, and are as follows:

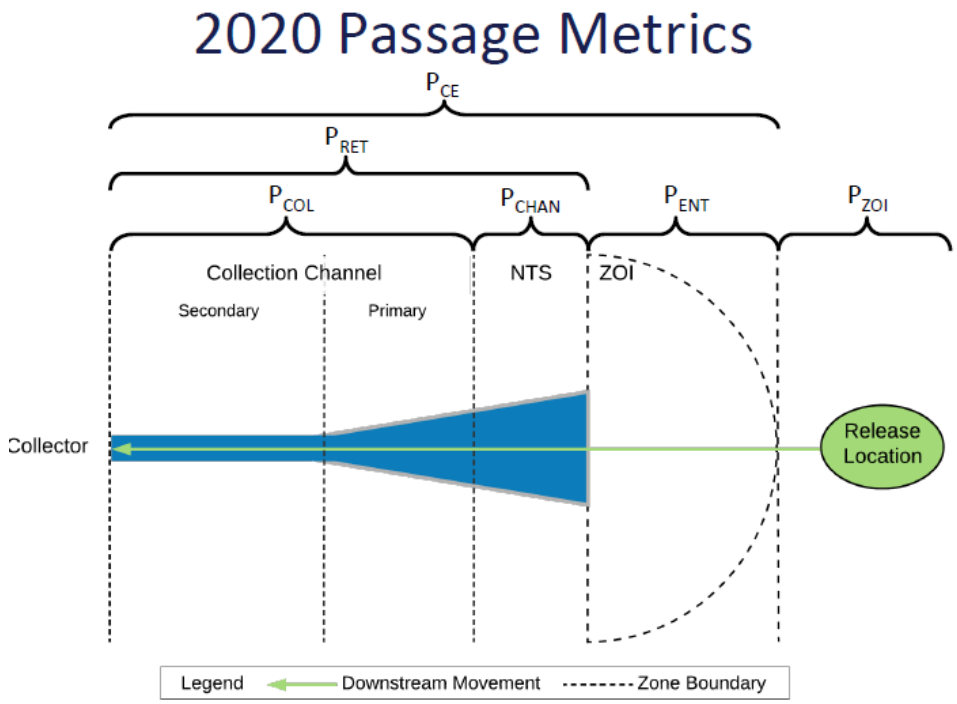
P_{ENT} = percentage of fish in the ZOI that move down into the NTS;

P_{CHAN} = percentage fish in the NTS that make it into the fish passage channel;

P_{COL}= those fish in the channel that end up going over the weir and are collected;

P_{RET} = number of fish that enter the NTS and are eventually collected; and

P_{CE} = percentage of fish that arrive in the ZOI that are eventually collected – this has a performance requirement of 95%.



The way the fish are monitored and the method of gathering data is with the use of acoustic telemetry and PIT tags. A small tag is implanted into the study fish. The tag emits an acoustic signal and there are several acoustic receivers set up throughout the study area to detect that signal. The detectors on these receivers are used to estimate which zone along the path of the migration the fish is in when it emits the signal.

Haffey explained that the resulting zone presence data was analyzed for each fish to estimate passage metrics and investigate fish behavior in the NTS and fish collection channel. This information was used to evaluate what might be influencing fish to turn around or influencing them to be successfully collected.

The overview of the study by the numbers include:

- 524 dual-tagged* fish released

*dual tags consist of passive integrated transponder (PIT) and acoustic telemetry

  - 183 Chinook Salmon
  - 187 Coho Salmon
  - 154 steelhead

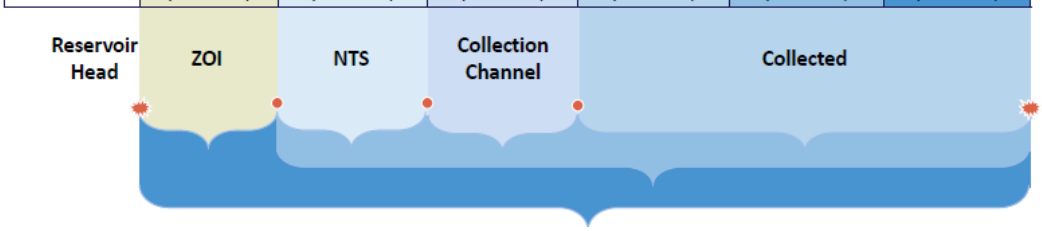
- Fish were collected and tagged at the FSC, and then transported 9 miles upstream and released near the head of the reservoir.

- Fish were tagged and release over several dates between March 19 - May 28.

- Monitoring for fish behavior continued until July 17 when the FSC was turned off for the summer.

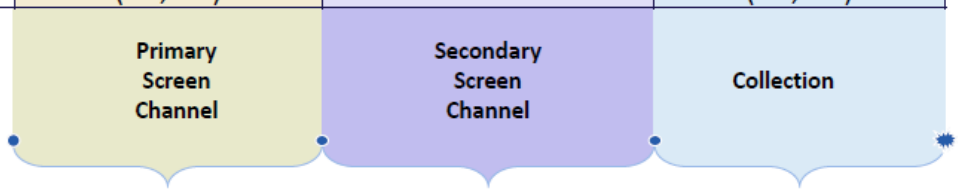
Haffey reviewed in detail the passage metrics as outlined below. He noted that if all the fish that enter the collector (PENT = 96%) can be encouraged to get collected, collection efficiency would be over 95% for all species. The results of the 2020 evaluation support the previous findings that the fish channel is the bottleneck for meeting the performance standard as currently only about 43% are being retained. What this tells us is there are about 2 points along that path between the NTS and final collection where fish are turning back.

Species	P_{ZOI} (%)	P_{ENT} (%)	P_{CHAN} (%)	P_{COL} (%)	P_{RET} (%)	P_{CE} (%)
Chinook Salmon	58	95	71	66	47	44
	(52, 64)	(90, 99)	(59, 83)	(53, 78)	(39, 55)	(36, 52)
Coho Salmon	62	95	82	51	42	39
	(56, 68)	(90, 99)	(73, 91)	(41, 60)	(34, 50)	(32, 47)
Steelhead	73	99	67	63	42	42
	(67, 79)	(97, 100)	(59, 75)	(53, 73)	(35, 50)	(34, 50)
All	64	96	74	58	43	42
	(60, 67)	(94, 99)	(69, 80)	(52, 65)	(39, 48)	(37, 46)



Haffey explained that the fish channel is split into two (2) separate screen chambers referred to as the primary and secondary screen sections. The primary reach is the funnel-shaped triangular section, and the secondary is the straighter more confined section. Is there a point inside the collection channel where fish are turning around? The answer is no, if the fish get to the collection channel, they move all the way down to the secondary screen area before turning back (see transition metrics below). The middle column indicates they are making it from the primary to the secondary. The bottle neck appears to be from the secondary reach over the weir.

Species	NTS to Primary (%)	Primary to Secondary (%)	Secondary to Collection (%)
Chinook Salmon	71	88	75
	(54, 83)	(41, 99)	(52, 89)
Coho Salmon	78	100	54
	(68, 85)	-	(43, 64)
Steelhead	66	91	70
	(56, 75)	(68, 98)	(56, 82)
All	70	99	63
	(64, 75)	-	(54, 71)



Haffey continued by comparing past study with the 2020 results. Compared to past years where similar methodologies were used, one can clearly see the increase in percentage of fish entering the FSC once the attractions flow were increased at the beginning of the 2019 montioring year (P_{ENT}). However, in 2019 there appeared a slightly higher success rate of fish moving through the fish passage channel and successfully being collected particularly for juvenile Chinook and Coho (P_{RET}), but retention efficiency continues to be the bottleneck across the three studies.

Year	Species	P_{ZOI}(%)	P_{ENT} (%)	P_{RET} (%)	P_{CE} (%)
2017	Chinook Salmon	57	47	24	11
	Coho Salmon	74	65	41	27
	Steelhead	59	49	40	20
2019	Chinook Salmon	54	78	65	51
	Coho Salmon	82	98	64	64
	Steelhead	58	97	28	27
2020	Chinook Salmon	58	95	47	44
	Coho Salmon	62	95	42	39
	Steelhead	73	99	42	42

Haffey described evaluating what might be causing the fish to turn around in the fish passage channel. Their analysis included visualizations, descriptive statistics, and a multifactor logistic regression that considered the following (see **Attachment A** for greater detail relative to fork length and time of day illustrating distinct patterns):

- Number of attempts
- Species
- Fork length
- Date of passage attempt
- Time of passage attempt

- Days at large

So, what changed? The debris loading was much higher in 2020 than in 2019 as more debris was correlated with more activity in, on and around the FSC during work hours. Jet boat crews in the ZOI, and maintenance crews on the FSC. The increased human activity in, on and around the FSC may be a significate factor in what we are seeing with the fish, and why we saw a drop from 2019 retention rates. In addition, other environmental factors may also be important. Future studies will focus on gathering information as to when people are on the collector, weather, water temperature and more precise information about debris so we can correlate that information with what we are seeing inside the collector and see if more patterns can be found and identifying what is preventing fish from entering the FSC.

In summary, the 2020 study showed the highest collection efficiency (P_{CE}) to date for steelhead using acoustic tags. Collection efficiency for Coho and Chinook were the second highest observed but it decreased relative to 2019 estimates. Nearly all fish that reach the ZOI enter the FSC (P_{ENT}). Gains in this metric indicate that FSC modifications continue to be effective at encouraging fish to enter, but retention within the FSC continues to be the limiting factor to achieving collection efficiency targets.

Karchesky ask the ACC if there were any questions. Josh Holowatz (WDFW) asked if turbidity would be monitored in future studies? Karchesky answered that the 2021 study was not planning to monitor turbidity per se, but there are plans to install a weather station on the collector so it may be possible to include some additional probes to that. It appears the largest factor inside the fish passage channel was noise rather than visual cues, but we can certainly look at turbidity as well. Bryce Glaser (WDFW) asked if fish could be collected and tagged upstream to minimize any learned behavior responses by using fish previously collected at the FSC, as is prescribed in the current AMEP. Karchesky said yes, attempts have been made but have been largely unsuccessful. We can't get enough of the right size and life-stage of fish. He said there has been previous effort to get fish from the screw trap at Eagle Cliff, but they are generally to small and are not out-migrants (parr/fry). There has also been attempts to angle and net fish in the reservoir, but those efforts have been largely unsuccessful and interject other biases. Because most recent studies that have been used for comparison have used FSC fish, it is likely that any potential learned behavior bias is consistent across years.

Karchesky also reminded the ACC that improvements for debris management at the FSC are still ongoing and that he expects that PacifiCorp will be in a better position to manage high debris loads in the future. Still debris loading is a real problem on Swift Reservoir.

<Break 10:33am>
<Reconvene 10:37am>

ACC Meeting Protocol; public attendance
While the ACC meetings are open to the public the ACC Representatives wanted to revisit the protocol when public is in attendance.

Below are two excerpts from the ACC/TCC Structure & Ground Rules to help guide the ACC when public is in attendance. Lesko confirmed that the following is in place and the ACC did not request any changes to the Ground Rules document. Peggy Miller (WDFW) noted that the TCC will follow the same public attendance protocol as the ACC.

ACC & TCC meeting schedule

The ACC and TCC meetings are open to the public, however, some agenda items are confidential and not open to the public. Meeting dates, locations, and times are subject to change, so please notify the Lewis River Project Coordinator that you will be attending at least eight (8) business days prior to attending. All agenda items and handouts to be distributed to the ACC and/or TCC members must be submitted to PacifiCorp ten (10) days prior to the meeting.

Time will be provided at each meeting for public comment as needed and determined by respective Coordination Committees (e.g., 15 minutes before lunch break and 15 minutes at conclusion of meeting).

V. Roles of the Parties

Interested Parties

Interested parties are those people or entities that are interested in Committee activities, but were not Parties to the Agreement (e.g., general public) or are Agreement Parties that have not designated Committee representatives for membership. To the extent desired by an individual or party, they may receive respective Committee information and attend meetings; however they will not be included in the Consensus process or during confidential sessions. Time will be provided at each meeting for public comment as needed and determined by respective Committees (e.g., 15 minutes before lunch break and 15 minutes at conclusion of meeting).

The only time that the public can interject with questions and comments is during the public comment periods provided in the agenda. McCune noted that this information is all available to the public on the Lewis River website at the following link: https://www.pacificorp.com/energy/hydro/lewis-river/acc-tcc.html > Meetings

Study/Work Product Updates

2020 ACC Fund Year-end Accounting

Lewis River License Implementation
Lewis River Aquatics Fund - Resource Projects
Sections 7.5, 7.5.1, 7.5.3.1, & 7.7

Funding Start Date: 4/30/05

Totals:	$ 4,606,062.37	$ (2,404,281.00)	$ 850,574.34	$ 3,052,355.71	
Release Date	**Funds Received**	**Expense**	**Interest**	**Balance**	**Notes**
12/01/20	$ -	$ (175,000.00)	$ -	$ 2,983,481.23	2020 WDFW Eagle Island Chum Spawn
12/31/20	$ -	$ -	$ 68,874.48	$ 3,052,355.71	
		$ -	$ -		
	$ -	$ -	$ -		
	$ -	$ -	$ -		
	$ -	$ -	$ -		
	$ -	$ -	$ -		
	$ -	$ -	$ -		
	$ -	$ -	$ -		
		Total Spent to Date:	$ (2,404,281.00)		
		Balance Remaining:	$ 3,052,355.71		* Project close out complete

Note: In August 2009, the Bureau of Economic Analysis (BEA) restate the index numbers in Table 1.1.9 (Implicit Price Deflators for Gross Domestic Product). The index numbers are now based on 2005 = 100. This changes the beginning adjustment number for youar 2000, quarter 3.

Lewis River License Implementation
Lewis River Aquatics Fund - Bull Trout
Sections 7.5, 7.5.1, 7.5.3, 7.5.3.1, & 7.7

Funding Start Date: 4/30/05

Totals:	$ 710,489.80	$ (234,547.92)	$ 358,963.95	$ 834,905.83	
Release Date	**Funds Received**	**Expense**	**Interest**	**Balance**	**Notes**
4/30/20	$ -	$ -	$ 10,697.80	$ 816,962.35	
12/31/20	$ -	$ -	$ 17,943.48	$ 834,905.83	
	$ -	$ -	$ -		
	$ -	$ -	$ -		
	$ -	$ -	$ -		
	$ -	$ -	$ -		
	$ -	$ -	$ -		
	$ -	$ -	$ -		
	$ -	$ -	$ -		
	$ -	$ -	$ -		
	$ -	$ -	$ -		
	$ -	$ -	$ -		
		Total Spent to Date:		$ (234,547.92)	
		Balance Remaining:		$ 834,905.83	

Lewis River License Implementation
Lewis River LWD Fund - Haul
Section 7.1.1

Funding Start Date: 12/26/08
Unspent balance in any year shall be carried forward

Totals:	$ 28,000.00	$ (27,656.58)	$ 343.42	
Release Date	**Funds Received**	**Funds Dispersed**	**Balance**	**Notes**
4/30/20	$ 2,000.00		$ 6,013.42	7.1.1 Large Woody Debris Program, ILR-LWD
8/19/20		$ (5,670.00)	$ 343.42	Habitat Logs; Fish First and LKE Corp
		Total Spent to Date:	$ (27,656.58)	
		Balance Remaining:	$ 343.42	

The next contribution to the 7.5 Aquatics Resource Fund is 2021 Q2 - $225,000 escalated. No additional contributions will be made to the Bull Trout Fund according to the Settlement Agreement.

Flows/Reservoir Conditions Update
Natural inflow (at Merwin) = 21,338 cfs
Total outflow (at Merwin) = 21,957 cfs
Merwin Reservoir elevation = -7.3 feet
Yale Reservoir elevation = -12.6 feet
Swift Reservoir elevation = -10.7 feet
Total hole = -30.63 feet

ATS Update
The final draft Hatchery & Supplementation Plan was submitted to the FERC on December 29, 2020. The next step is development of the 2021 Annual Operating Plan which the ATS is working on currently to include transition planning for integrating hatchery programs, developing handling

and sampling protocols for returning adults and continuing to develop and improve screw trapping methods to better document juvenile abundance and outmigration rates in the lower Lewis River.

The Utilities are currently working with their contractors to begin the rewrite of the aquatic monitoring and evaluation plan (AMEP) as required by the Agreement. The Utilities will provide a revised AMEP to the ATS in June or July 2021. We anticipate working with the ATS to complete and submit a draft AMEP to the ACC by October 2021 to begin the required 90-day ACC review and comment period. The goal is to submit the final AMEP to the FERC in the spring of 2022.

Fish Passage Update
Chris Karchesky (PacifiCorp) informed the ACC that there has been a lot of water coming into Swift Reservoir recently. If you recall, there are two potential release sites for adult fish upstream of Swift Forest Dam. The first, the boat launch at Swift Forest Campground; and the second, at the temporary release pipe stationed up on PacifiCorp property at Eagle Cliff bridge. We use both those facilities, but we use the pipe primarily as it's easier to get in and out of and we are also putting fish just slightly above the reservoir to give them a kick start for moving forward upstream. With high flows as we have seen in the last 48 hours that release pipe has been washed out, so it requires repairs. We are now releasing fish exclusively at the boat launch. Currently we have transitioned out of late coho and have mostly put winter steelhead upstream.

As for the Merwin Dam adult trap, Karchesky reminded that ACC that there was an unscheduled outage due to some issues with the crowding system in December, and that repairs were completed in early January. Karchesky also mentioned that with the current high flows in the lower river (~30,000 cfs) the trap was currently off to prevent any damage due to high water. The lift and conveyance system will be returned to service once spill at Merwin Dam stops. Karchesky also mentioned that up to three sealions have been spotted in the tailrace of Merwin Dam and has been in communication with WDFW regarding monitoring and information gathering. Josh Holowatz (WDFW) stated that WDFW will soon have some new folks hired who will be working on Columbia River pinniped issues under the state's new permit. Tributary issues will be part of their duties.

With regards to the FSC, Karchesky indicated that with high inflows above Swift Dam, debris has been an issue. For the most part, removal efforts near the upper reservoir have prevented the FSC from being turned-off. Karchesky will update the ACC if that changes. He also indicated that there was a slight bump in daily fish numbers collected at the FSC, which is typical when high inflow occurs.

Merwin Fish Collection Facility and General Operations (Attachment B)
A total of 522 fish were captured at the Merwin Dam Adult Fish Collection Facility (MFCF) during the month of December. The majority of the fish collected were coho (70.4%) and hatchery winter steelhead (28.0%). Approximately one-third (34.2%) of the coho collected in December were of natural origin (NOR).

The MFCF fish lift and conveyance system was taken out of service on December 16th, after it was discovered that the cable assisted crowding structure derailed and pushed a piece of steel support plating into the hopper sump, which prevented the hopper from lifting. Various components of the crowding structure needed to be refabricated and replaced as a result. The lift and conveyance system were placed back in operation on January 1, 2021.

Total river flow below Merwin Dam was relatively consistent for the month of December, except for the scheduled drawdown days to accommodate ongoing carcass surveys. Total river flow ranged between approximately 1,200 and 12,000 cubic feet per second (cfs; Figure 1).

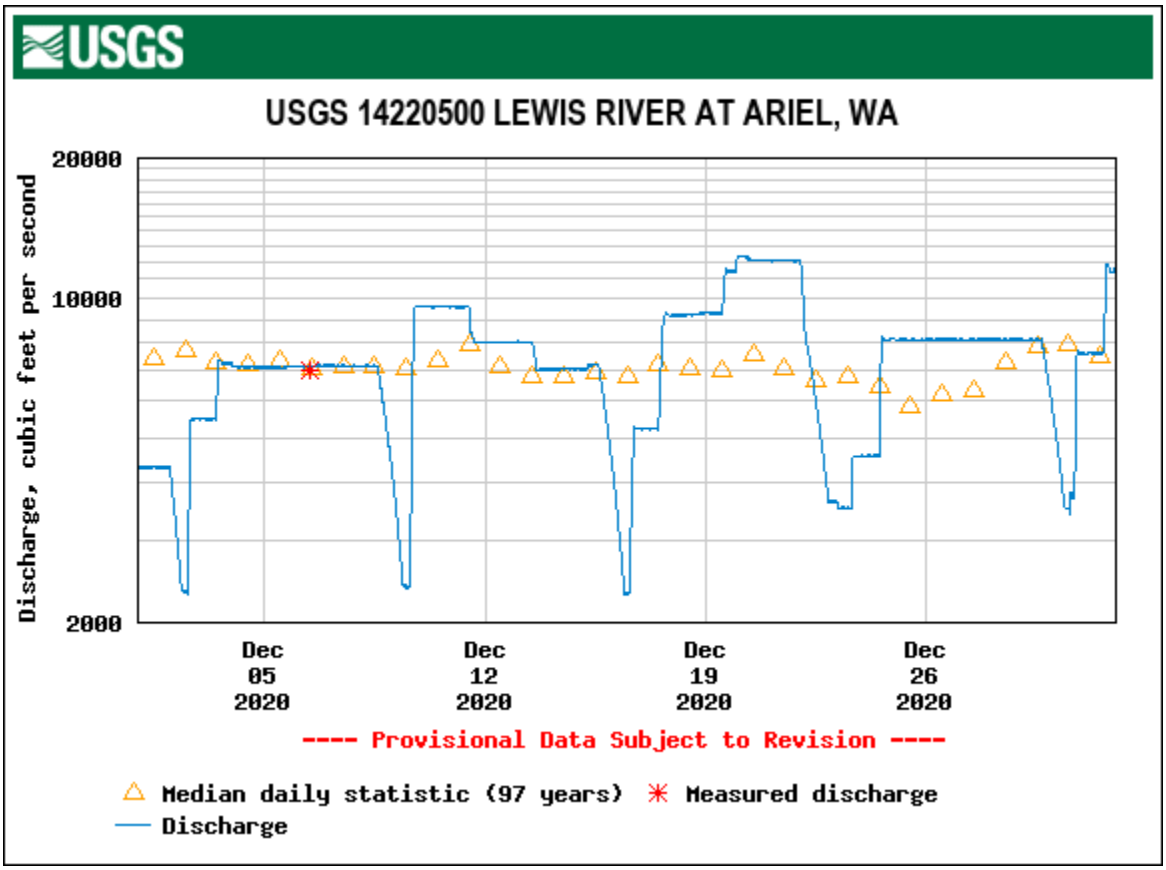


Figure 1. Discharge in cubic feet per second recorded at the USGS Ariel, WA gauge (14220500) located immediately downstream of Merwin Dam.

Upstream Transport (Attachment B)

A total of 836 fish were transported throughout the month of December, of which 609 were supplied by Lewis River Hatchery. Nearly all of the fish transported upstream were late run coho (99.4%). Similar to November, the majority of the coho transported upstream were of natural origin (NOR) (88.6%). The total number of NOR coho that have been collected at the MFCF in 2020 is now 4,352 fish, which is approximately 338% of the 2014-2019 average return (Figure 2). For calendar year 2020, a total of 9,476 coho, 725 Blank Wire Tag winter steelhead, 634 spring Chinook, 327 true wild winter steelhead, and 84 cutthroat have been transported upstream of Swift Dam.

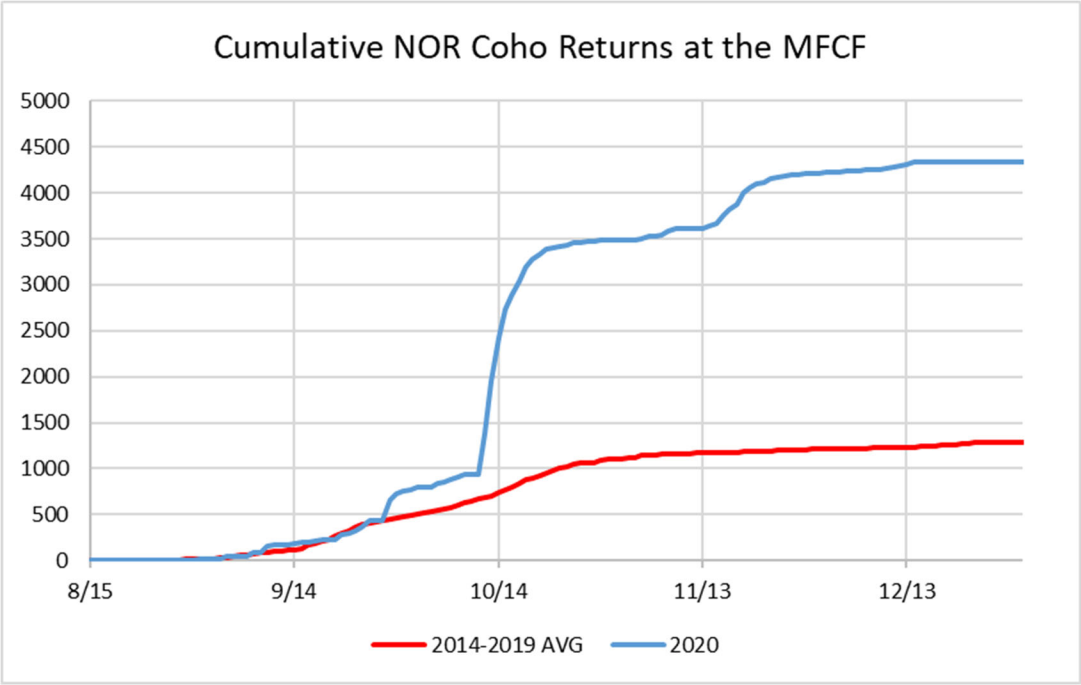


Figure 2. Cumulative number of natural origin (NOR) coho collected at Merwin Adult Fish Collection Facility in 2020, relative to the 2014-2019 average.

Swift Floating Surface Collector (Attachment B)

The Swift Floating Surface Collector (FSC) was taken out of operation on December 24th due to heavy debris loading. It was placed back into service on January 1st, after the debris was removed. A total of 474 fish were collected at the FSC in the month of December. As has been the trend in recent months, the majority of these fish were juvenile coho (80.2%).

Agenda items for February 11, 2021

- Review January 14, 2021 Meeting Notes **(ACC COMMENTS DUE February 2, 2021)**
- NMFS Biological Opinion Update
- Study/Work Product Updates

Adjourn 11:15am

Next Scheduled Meeting:

February 11, 2021
TEAMS Call Only
9:30 a.m. – 11:00 a.m.

Meeting Handouts & Attachments:

- Meeting Notes from 12/10/2020
- Agenda from 1/14/2021
- **Attachment A** – Swift FSC Collection Facility; Four Peaks Environmental PowerPoint
- **Attachment B** – Lewis River Fish Passage Report (December 2020)

FOUR PEAKS ENVIRONMENTAL
Science & Data Solutions

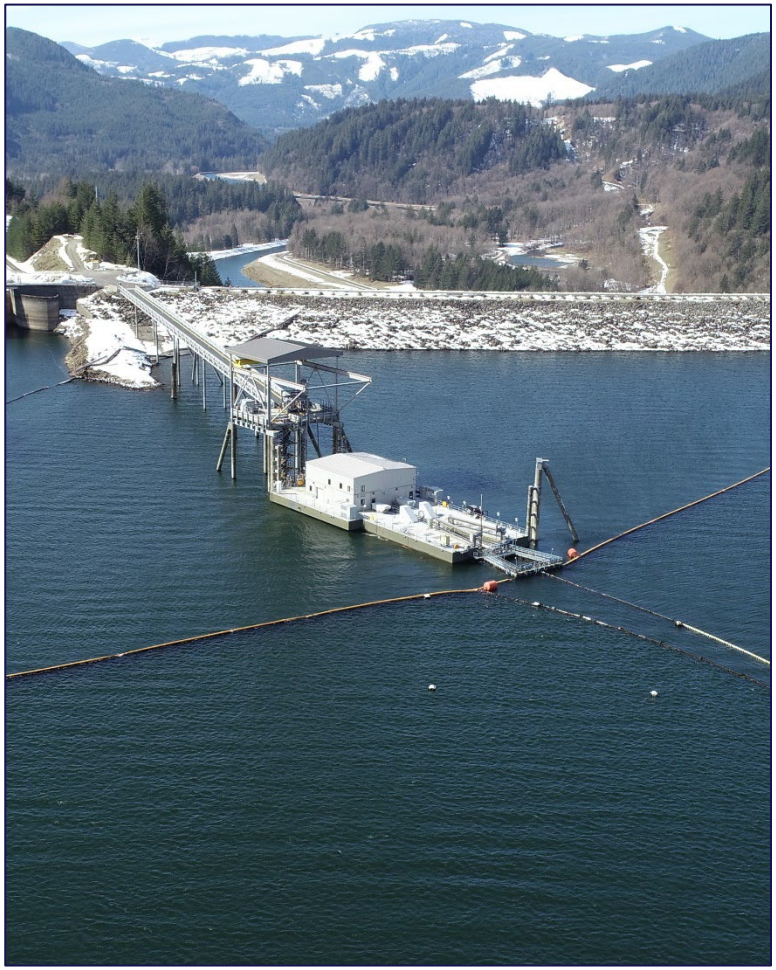
Swift Reservoir 2020 Floating Surface Collector Efficiency Evaluation

Lewis River Aquatic Coordination Committee Meeting

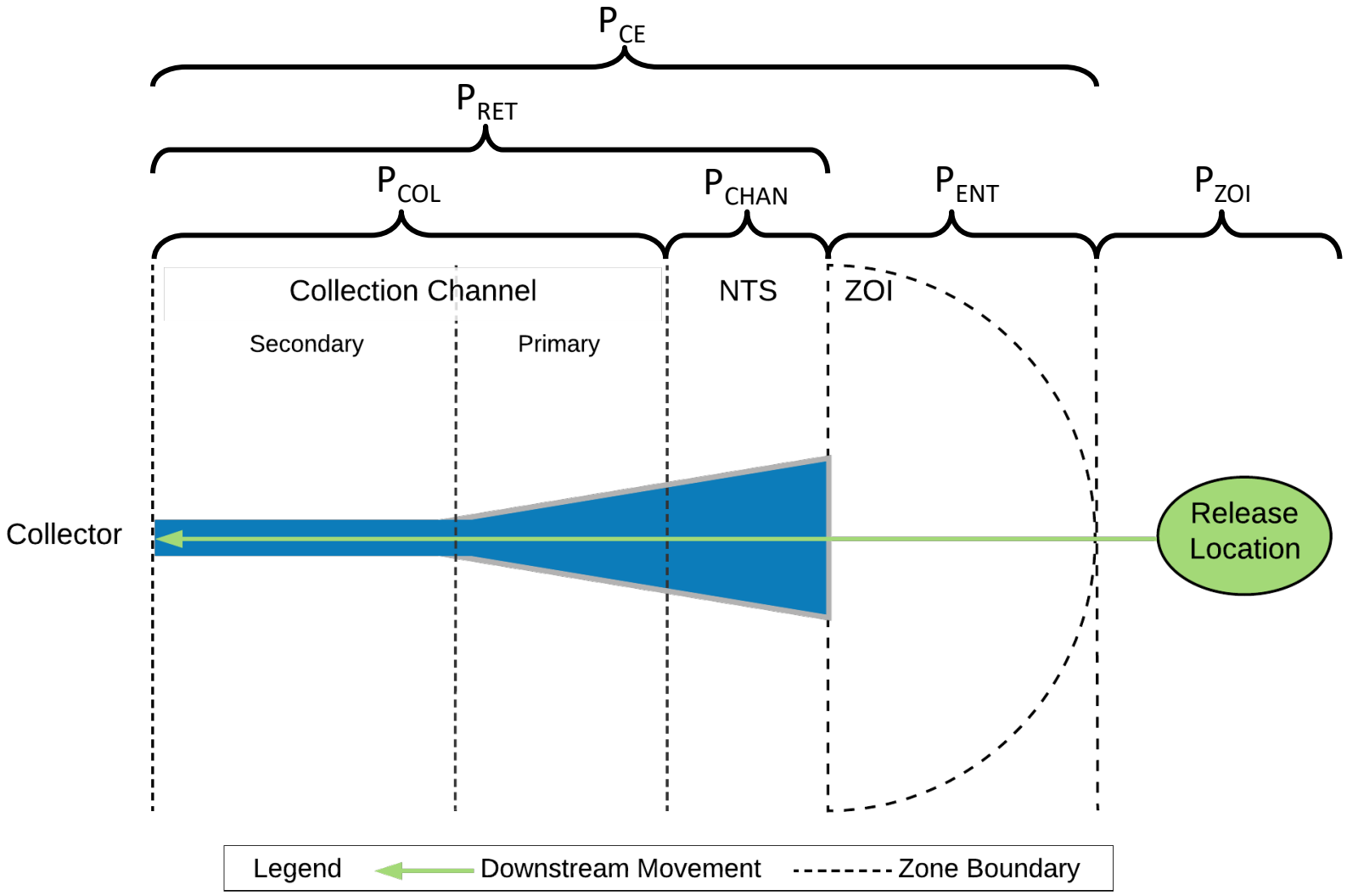
January 14, 2021

2020 Study Objectives

- Collector modifications have been successful in encouraging fish to enter the collector
  - 2019 study: Most fish that find the ZOI, enter the NTS
- Too many fish reject collection after entering to achieve performance standards
  - 2019 study: 40% of the fish that enter the collector turn back before collection
- 2020 study focused on behavior within the collector
  - Calculate passage metrics and investigate behavior in the NTS and Collection Channel



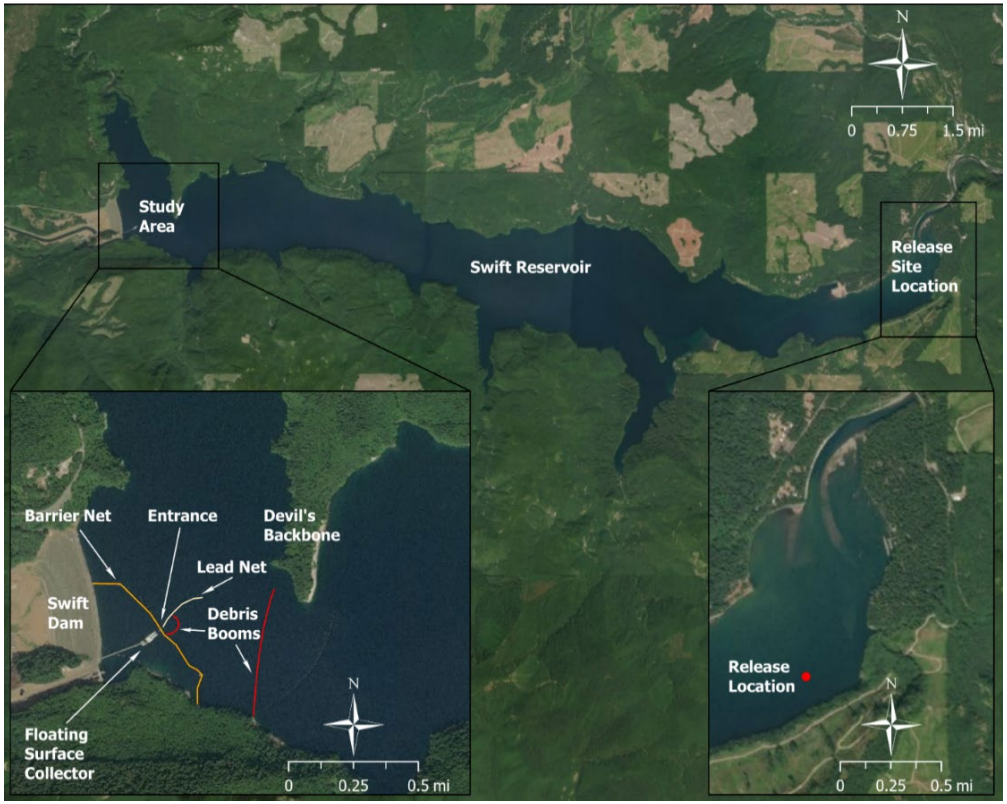
2020 Passage Metrics



Methods Overview

- Use acoustic telemetry to position fish in discrete zones along the migration path to collection
  - Zone of influence (ZOI)
  - NTS
  - Collection Channel with sub zones for primary and secondary screen sections
- Analyze the resulting zone presence data to estimate passage metrics and investigate fish behavior in the NTS and collector
  - Use zone presence data to determine how far fish progress within the Collection Channel
  - Evaluate factors that influence fish behavior in the Collection Channel

Field Study Overview

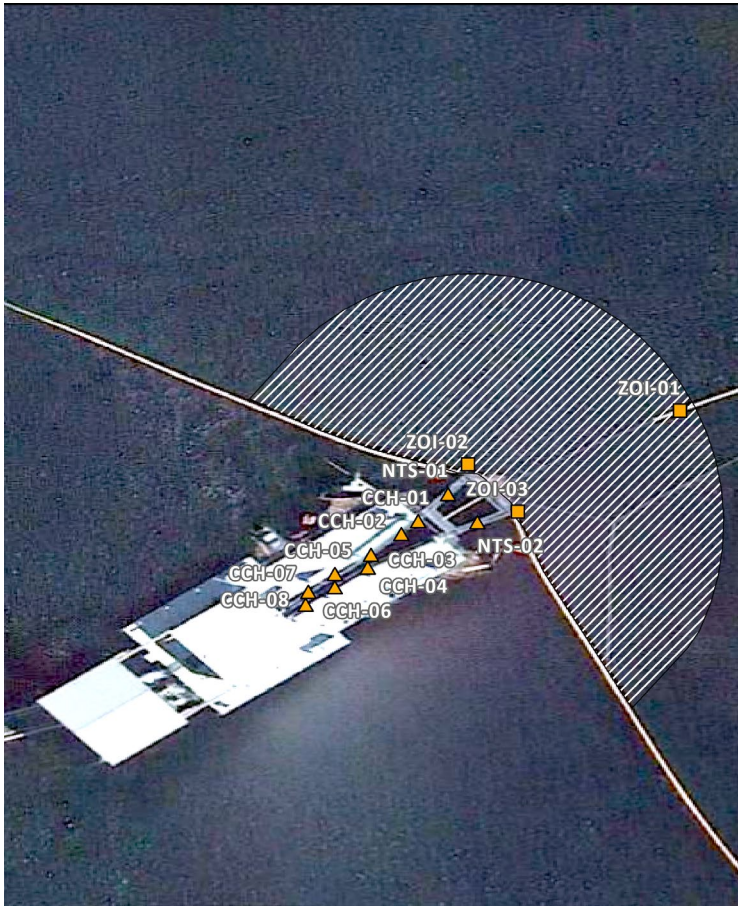


- 524 dual-tagged* fish released
  - 183 Chinook Salmon
  - 187 Coho Salmon
  - 154 steelhead
- Site: 9 miles upstream of the Swift floating surface collector (FSC)
- Dates: March 19 - May 28

* dual-tags consist of passive integrated transponder (PIT) and acoustic telemetry

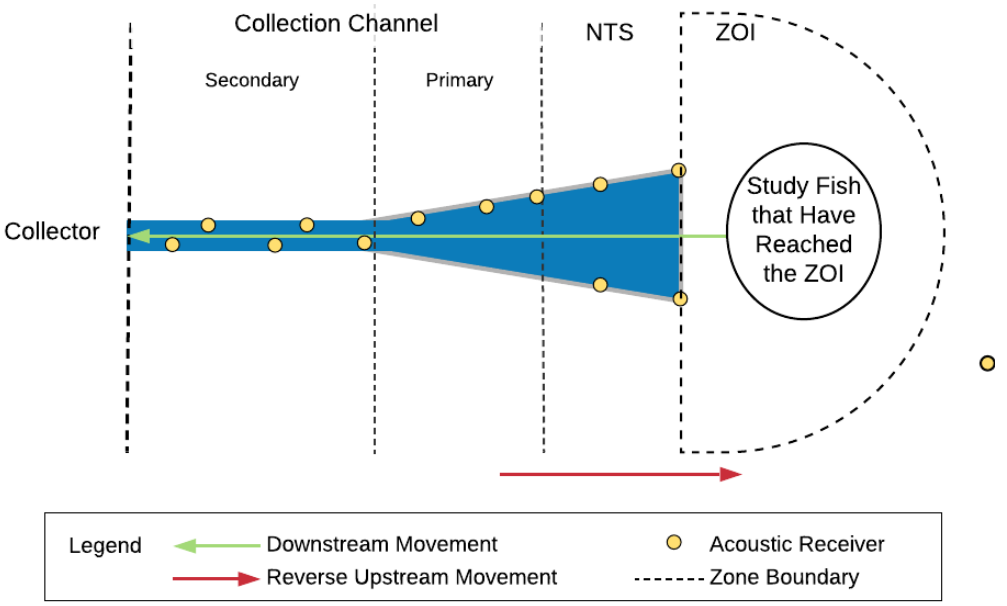
Field Study Overview (cont.)

- Fish tracked via acoustic telemetry from ZOI through the Collection Channel
- Fish tracking continued until July 17
  - Each tag has an estimated 45-day battery life from time of release
- Collection confirmed with PIT tags



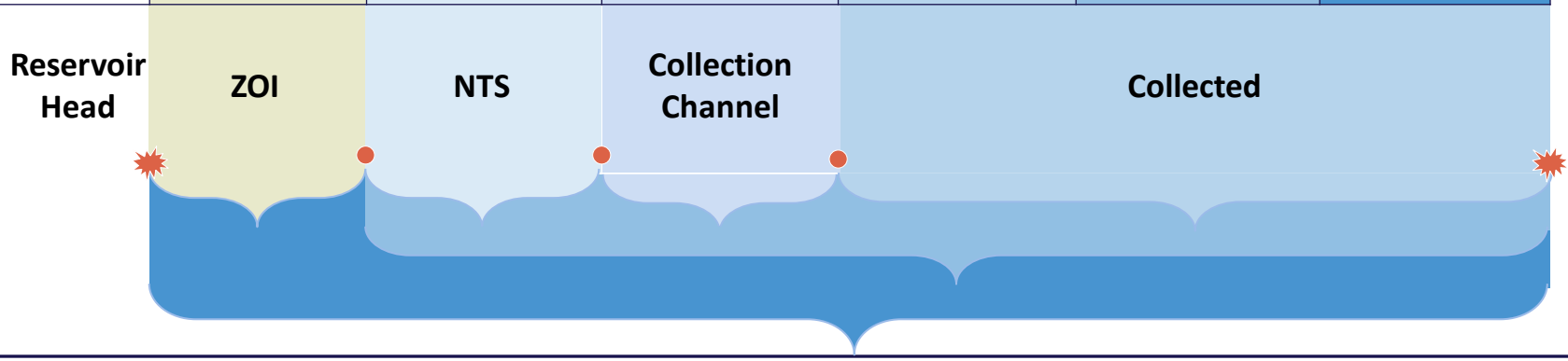
Acoustic Telemetry Arrays

- Total Receivers: 13
  - ZOI: 3
  - NTS: 2
  - Total Collection Channel: 8
    - Primary Screen: 3
    - Secondary Screen: 5
- 20 week deployment: February 28 – July 17
- 12 field visits to maintain arrays and download detection data



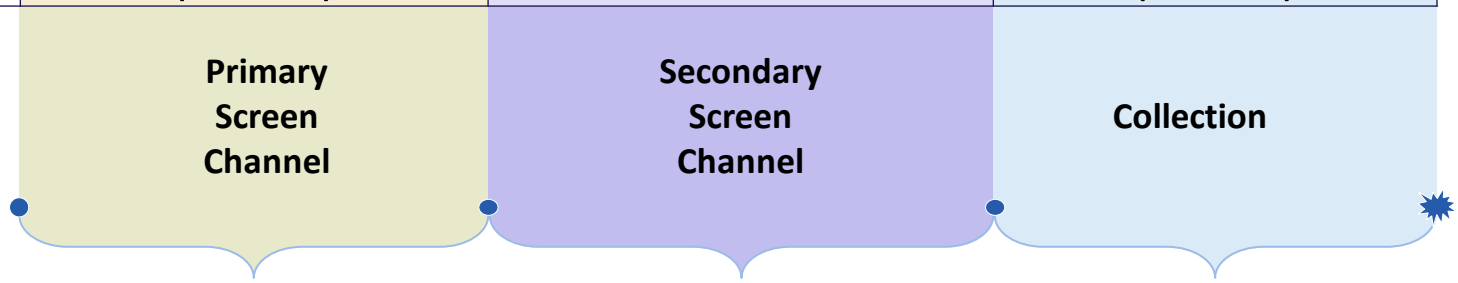
Passage Metrics

Species	P_{ZOI} (%)	P_{ENT} (%)	P_{CHAN} (%)	P_{COL} (%)	P_{RET} (%)	P_{CE} (%)
Chinook Salmon	58	95	71	66	47	44
	(52, 64)	(90, 99)	(59, 83)	(53, 78)	(39, 55)	(36, 52)
Coho Salmon	62	95	82	51	42	39
	(56, 68)	(90, 99)	(73, 91)	(41, 60)	(34, 50)	(32, 47)
Steelhead	73	99	67	63	42	42
	(67, 79)	(97, 100)	(59, 75)	(53, 73)	(35, 50)	(34, 50)
All	64	96	74	58	43	42
	(60, 67)	(94, 99)	(69, 80)	(52, 65)	(39, 48)	(37, 46)

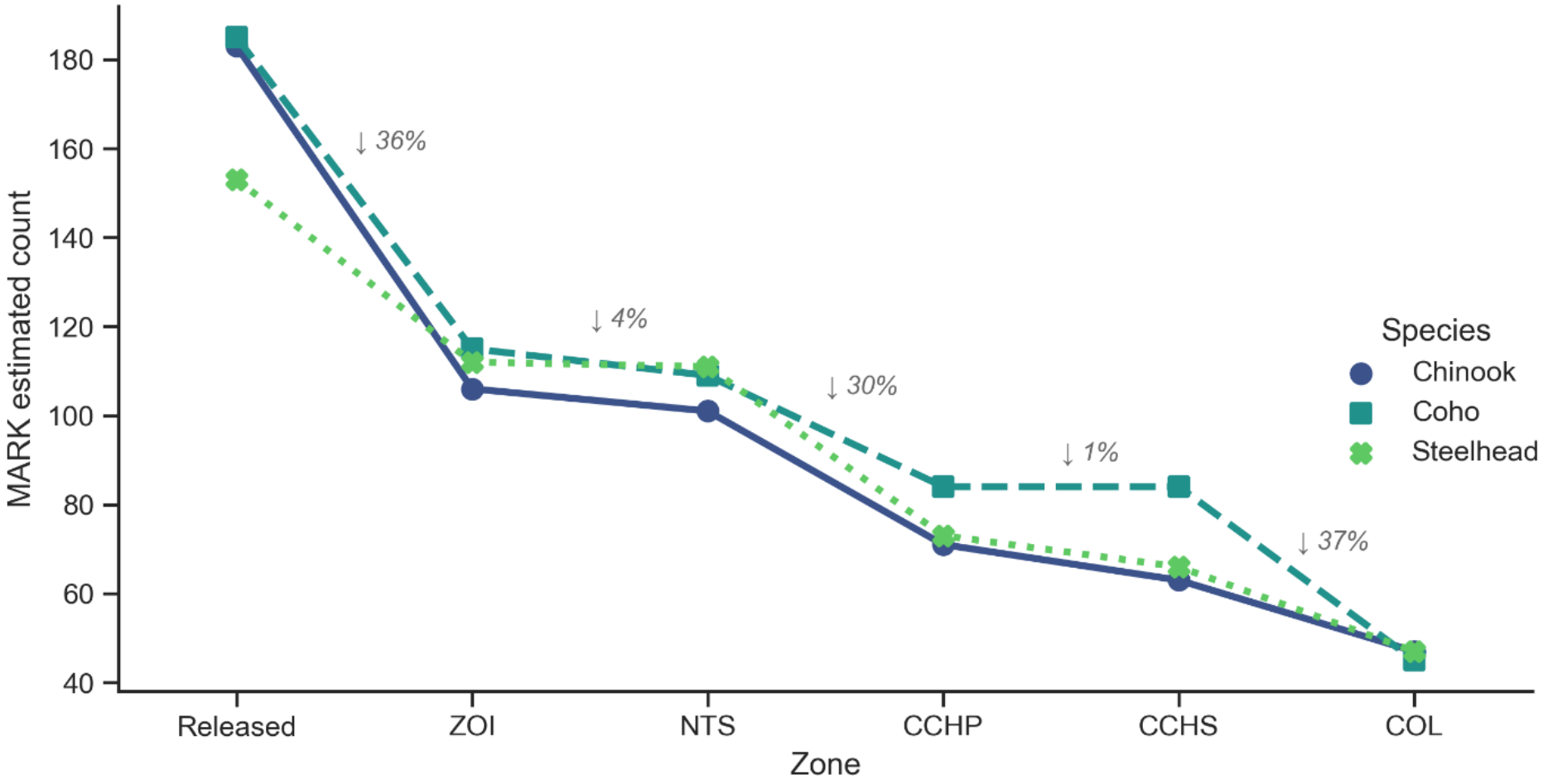


Channel Transitions

Species	NTS to Primary (%)	Primary to Secondary (%)	Secondary to Collection (%)
Chinook Salmon	71	88	75
	(54, 83)	(41, 99)	(52, 89)
Coho Salmon	78	100	54
	(68, 85)	-	(43, 64)
Steelhead	66	91	70
	(56, 75)	(68, 98)	(56, 82)
All	70	99	63
	(64, 75)	-	(54, 71)



Passage Bottlenecks



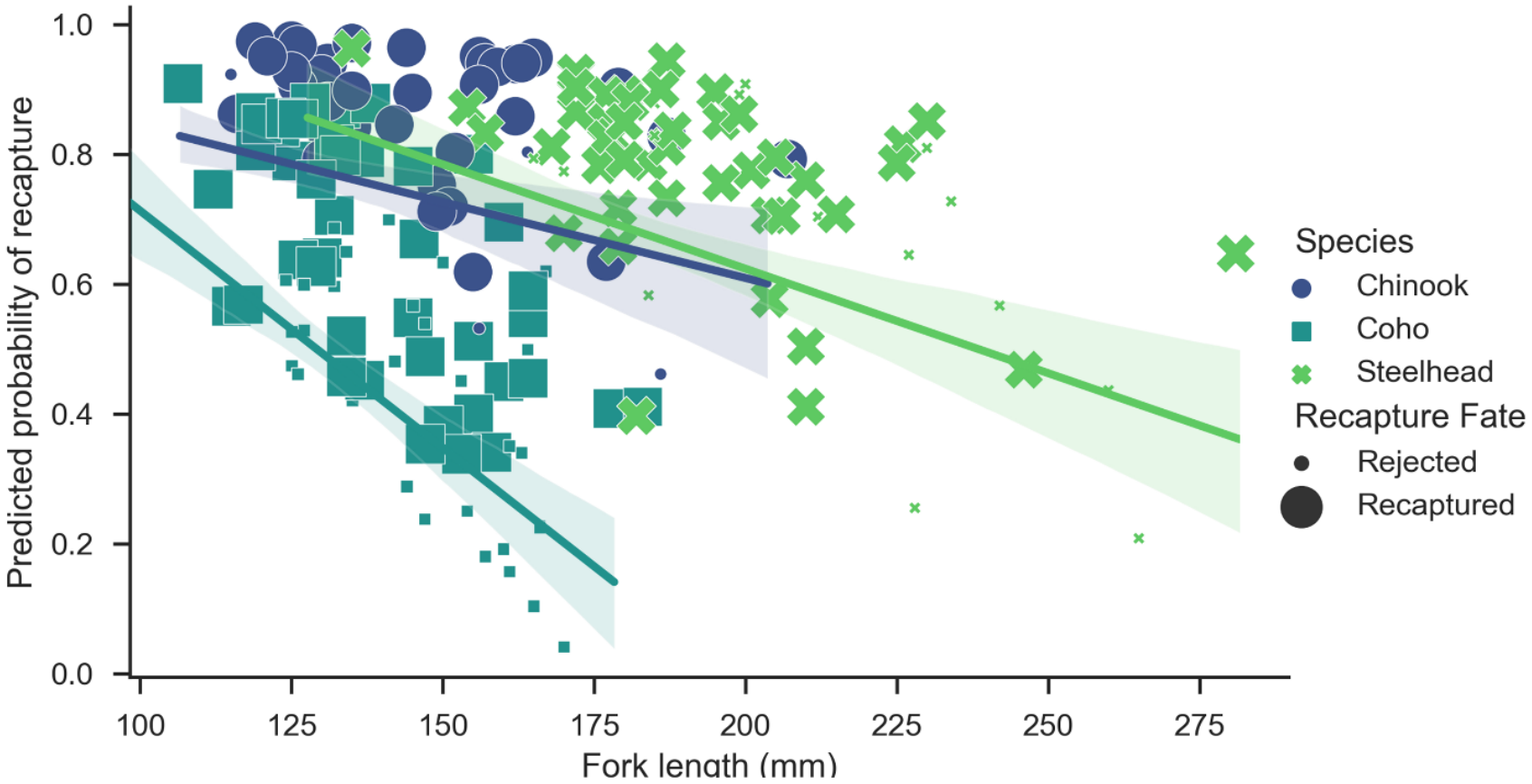
Comparison to Past Studies

Year	Species	P_{ZOI}(%)	P_{ENT} (%)	P_{RET} (%)	P_{CE} (%)
2017	Chinook Salmon	57	47	24	11
	Coho Salmon	74	65	41	27
	Steelhead	59	49	40	20
2019	Chinook Salmon	54	78	65	51
	Coho Salmon	82	98	64	64
	Steelhead	58	97	28	27
2020	Chinook Salmon	58	95	47	44
	Coho Salmon	62	95	42	39
	Steelhead	73	99	42	42

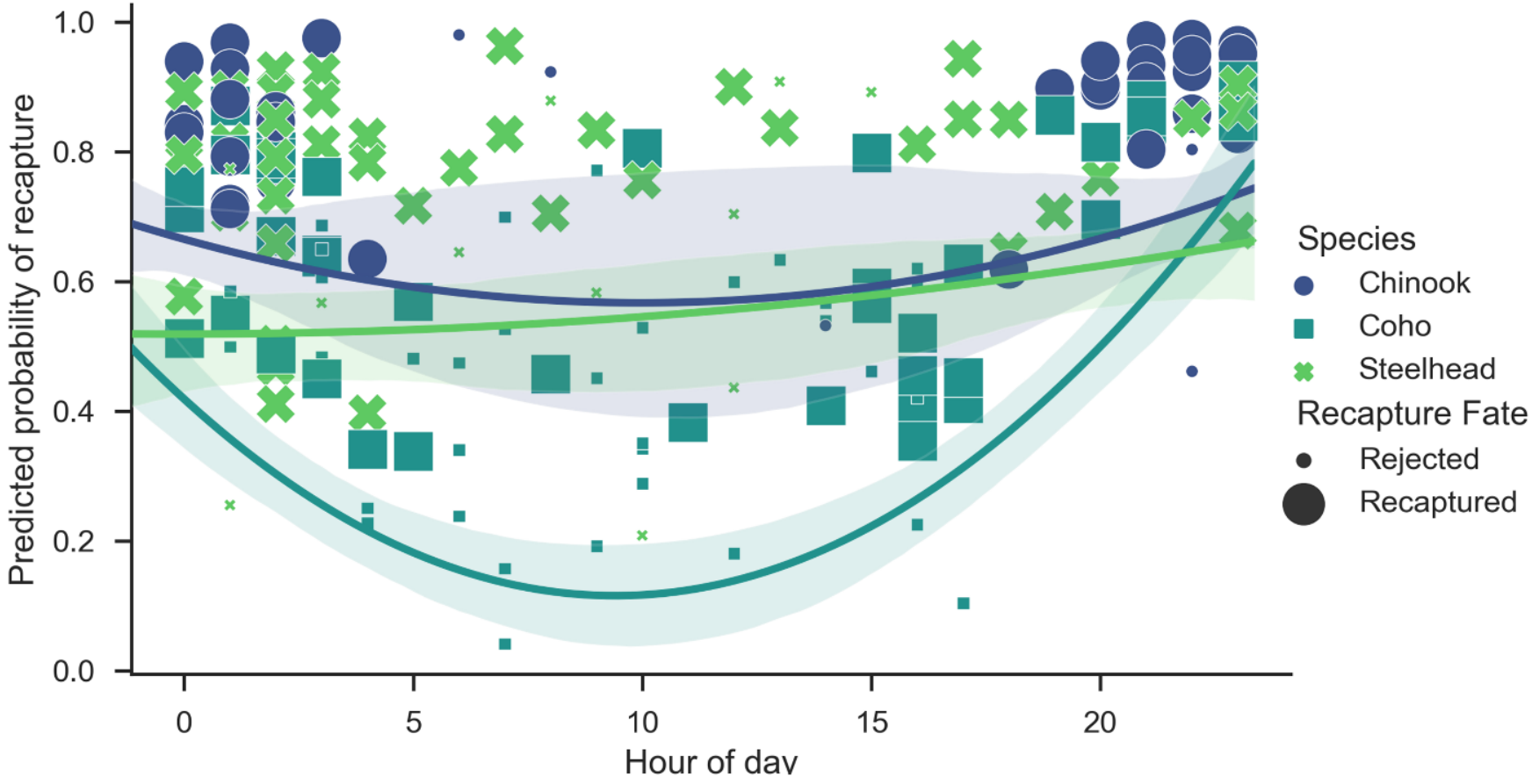
Passage Attempt Analysis

- Identify individual passage attempt events in the zone presence data
- Look for patterns that explain passage success
- Analysis included visualizations, descriptive statistics, and a multifactor logistic regression that considered
  - Number of attempts
  - **Species**
  - **Fork length**
  - Date of passage attempt
  - **Time of passage attempt**
  - Days at large

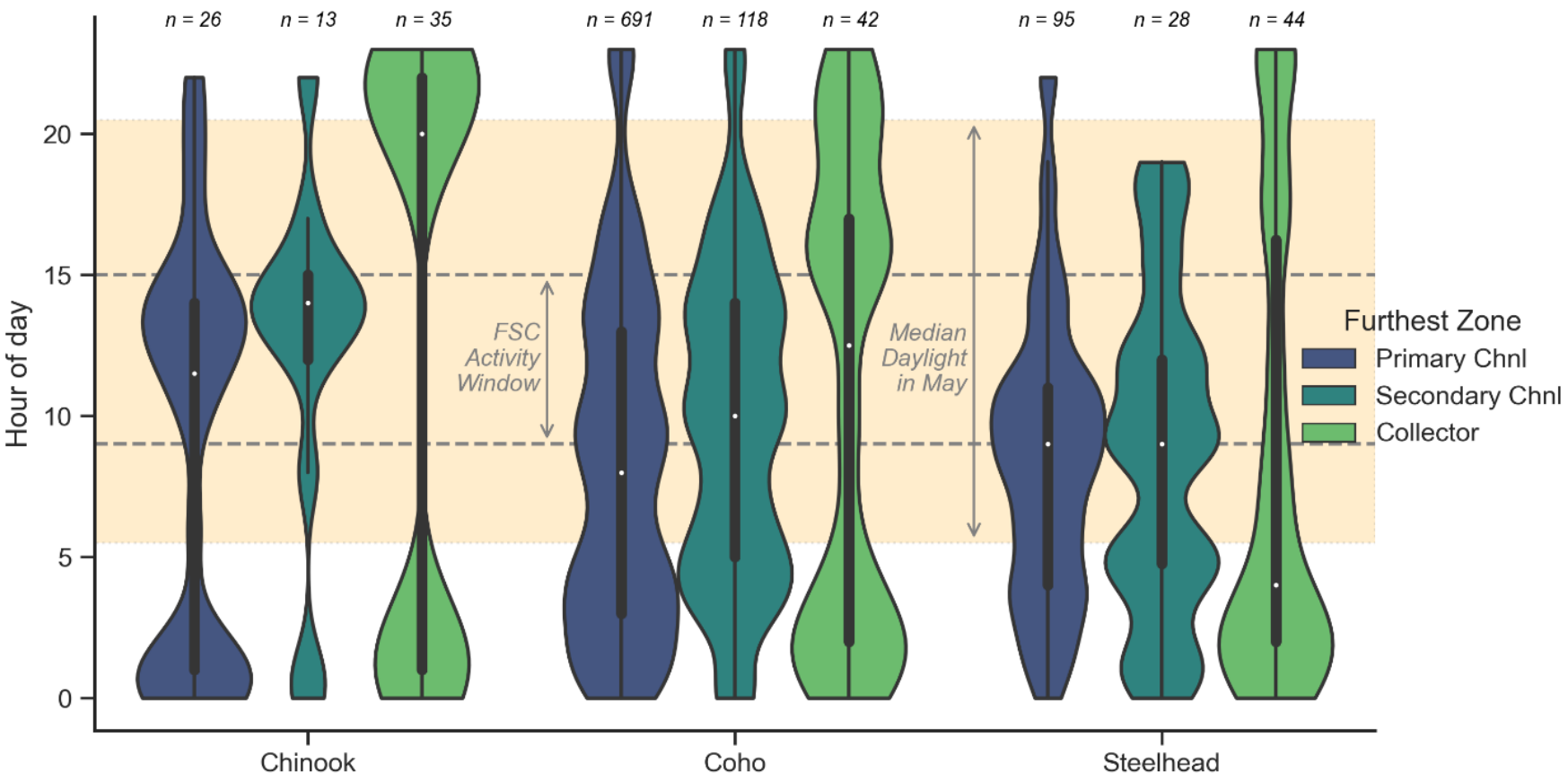
Fork Length


Predicted probability of recapture
1.0
0.8
0.6
0.4
0.2
0.0
100
125
150
175
200
225
250
275
Fork length (mm)
Species
Chinook
Coho
Steelhead
Recapture Fate
Rejected
Recaptured

Time of Day


Predicted probability of recapture
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
Hour of day
Species
Chinook
Coho
Steelhead
Recapture Fate
Rejected
Recaptured

Time of Day


n = 26
n = 13
n = 35
n = 691
n = 118
n = 42
n = 95
n = 28
n = 44
Hour of day
20
15
10
5
0
FSC Activity Window
Median Daylight in May
Furthest Zone
Primary Chnl
Secondary Chnl
Collector
Chinook
Coho
Steelhead

What Changed?

- Debris loading was higher in 2020 than in 2019
- More debris means more activity on and around the collector during work hours
  - Jet boat crews in ZOI
  - Maintenance crews on the collector
- Other environmental factors may also be important
- 2021 study will focus on investigating these factors further

Summary

- Highest collection efficiency (P_{CE}) to date for steelhead in any acoustic study
  - Collection efficiency for Coho and Chinook were the second highest observed, decreasing relative to 2019
- Nearly all fish that reach the ZOI enter the FSC (P_{ENT})
  - Gains in this metric indicate that FSC modifications continue to be effective at encouraging fish to enter
- Retention within the FSC (P_{RET}) continues to be the limiting factor to achieving collection efficiency targets

Summary (cont.)

- Larger fish have a lower probability of collection after entering the Collection Channel
  - Stronger swimmers may be more capable of escape when presented with stimuli that initiates avoidance
- Fish are predominantly collected during late afternoon and night
  - Work activity patterns on and around the collector may explain this behavior
- Increased debris loading relative to 2019 may explain changes in P_{CE}
  - More activity related to debris clearing on and around the collector in 2020 vs. 2019

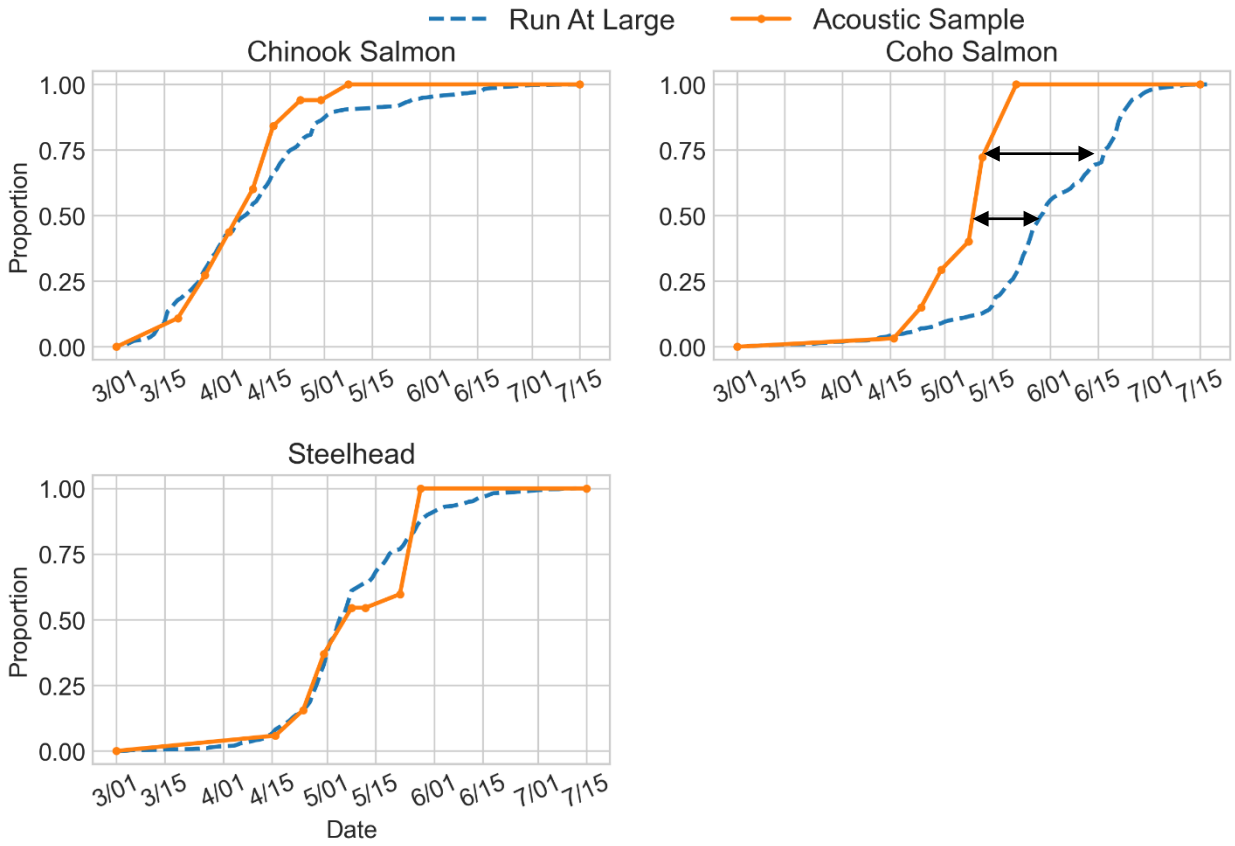
Questions?

FOUR PEAKS ENVIRONMENTAL
Science & Data Solutions

Backup Slides

Fish Releases

- 524 study fish released between March 19 and May 28: 187 Coho Salmon, 183 Chinook Salmon, 154 steelhead



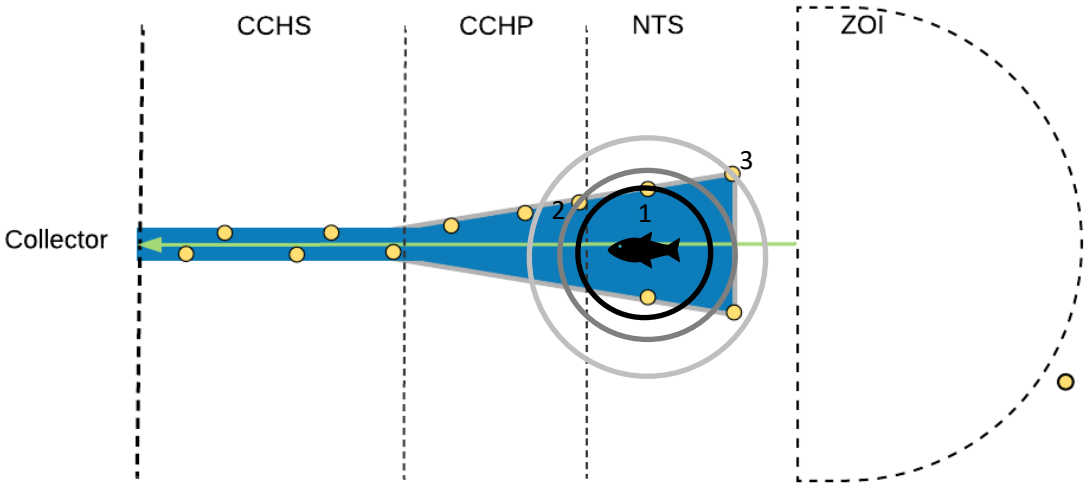
Field Events

- Fry Bar PIT Antenna Downtime (to 03/26, 04/06 – 05/04)
  - Collection data included individuals detected via hand-wanding by Meridian and detections in Woodland Release Ponds
  - Some fish are believed to have been collected without detection
- Collector Shut-Off (05/08 – 05/11)
  - Fish were able to hold in the channel during this time
- Channel Shading (04/26 – Current)

Data Treatments

- Collector downtime (05/08 – 05/11)
  - Real-world conditions
  - Included for Performance Metrics
  - “A/B”d for Behavioral Analysis
    - Can treat as “predictor” for recapture
- Omitted three tags with no known species or PIT from Performance Metrics
- Omitted two fish likely collected while PIT antenna was down from Behavioral Analysis

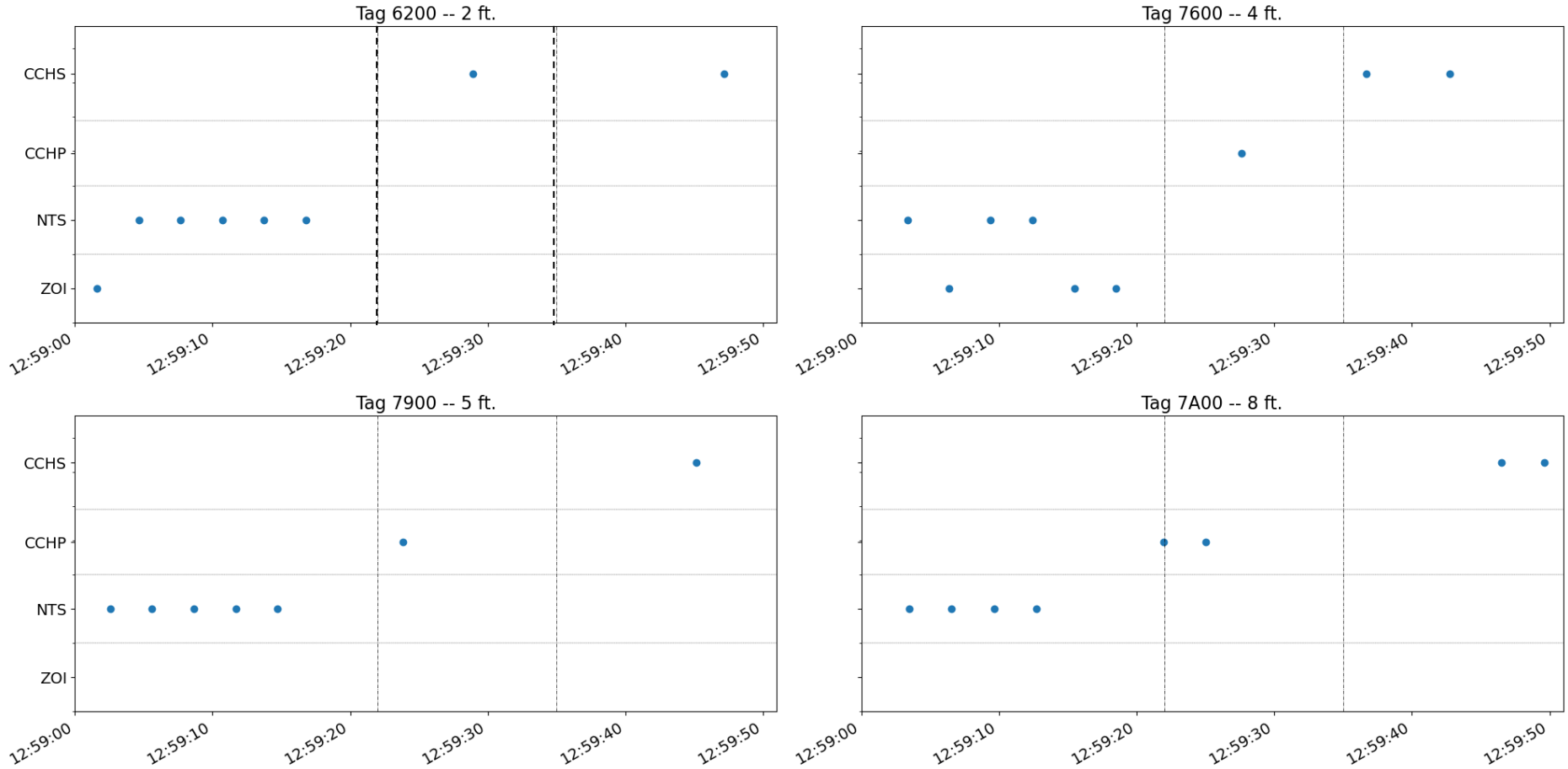
Methods



- Four zones: ZOI, NTS, CCHP, and CCHS
- Zone criteria require at least 1 ping within a zone meeting certain zone specific criteria
- Criteria for each zone include considerations of time of arrival and amplitude

Zone Presence Accuracy

April 2nd -- Channel Testing Results



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Detection/Tracking Efficiency

Species	ZOI (%)	NTS (%)	Channel (%)		
			CCHP	CCHS	Total
Chinook Salmon	98 (92, 99)	97 (88, 99)	42 (31, 54)	32 (21, 43)	53 (39, 67)
Coho Salmon	98 (93, 100)	93 (85, 97)	84 (77, 91)	74 (66, 82)	84 (71, 92)
Steelhead	98 (93, 100)	97 (89, 99)	82 (73, 90)	66 (55, 77)	87 (74, 94)
All	98 (96, 99)	95 (91, 97)	72 (66, 77)	57 (50, 64)	75 (67, 81)

* 95% confidence intervals are provided here
CCHP: Collection Channel Primary Screen; CCHS: Collection Channel Secondary Screen

Metric Calculations

Metric	Calculation (uncorrected)
ZOI Encounter Rate (P_{ZOI})	$P_{\mathrm{ZOI}} = \frac{DET_{ZOI}}{R}$
Entrance Efficiency (P_{ENT})	$P_{ENT} = \frac{DET_{ZOI} \cap DET_{NTS}}{DET_{ZOI}}$
Channel Entrance Efficiency (P_{CHAN})	$P_{CHAN} = \frac{DET_{NTS} \cap DET_{CHAN}}{DET_{NTS}}$
Channel Collection Efficiency (P_{COL})	$P_{COL} = \frac{DET_{CHAN} \cap C}{DET_{CHAN}}$
Retention Efficiency (P_{RET})	$P_{RET} = \frac{DET_{NTS} \cap C}{DET_{NTS}}$
Collection Efficiency (P_{CE})	$P_{CE} = \frac{DET_{ZOI} \cap C}{DET_{ZOI}}$

R = unique tagged fish released

DET_{ZOI} = unique tagged fish identified in the vicinity of the floating surface collector (i.e., in the ZOI)

DET_{NTS} = unique tagged fish detected inside the entrance of the net transition structure

DET_{CHAN} = unique tagged fish detected inside the collection channel

C = unique tagged fish identified in the fish collection ponds inside the floating surface collector (i.e., collected)

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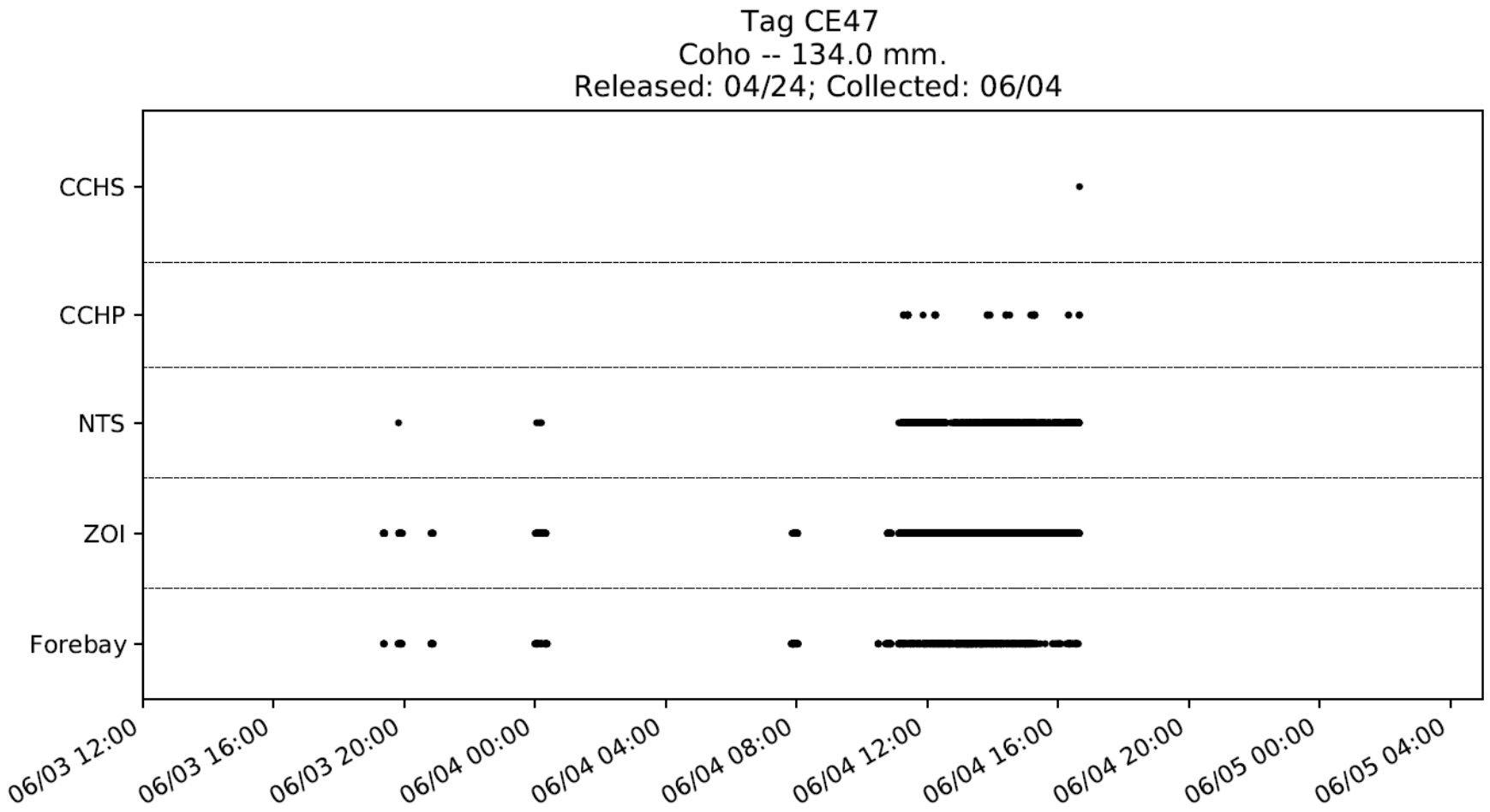
Example Zone Presence Time Series



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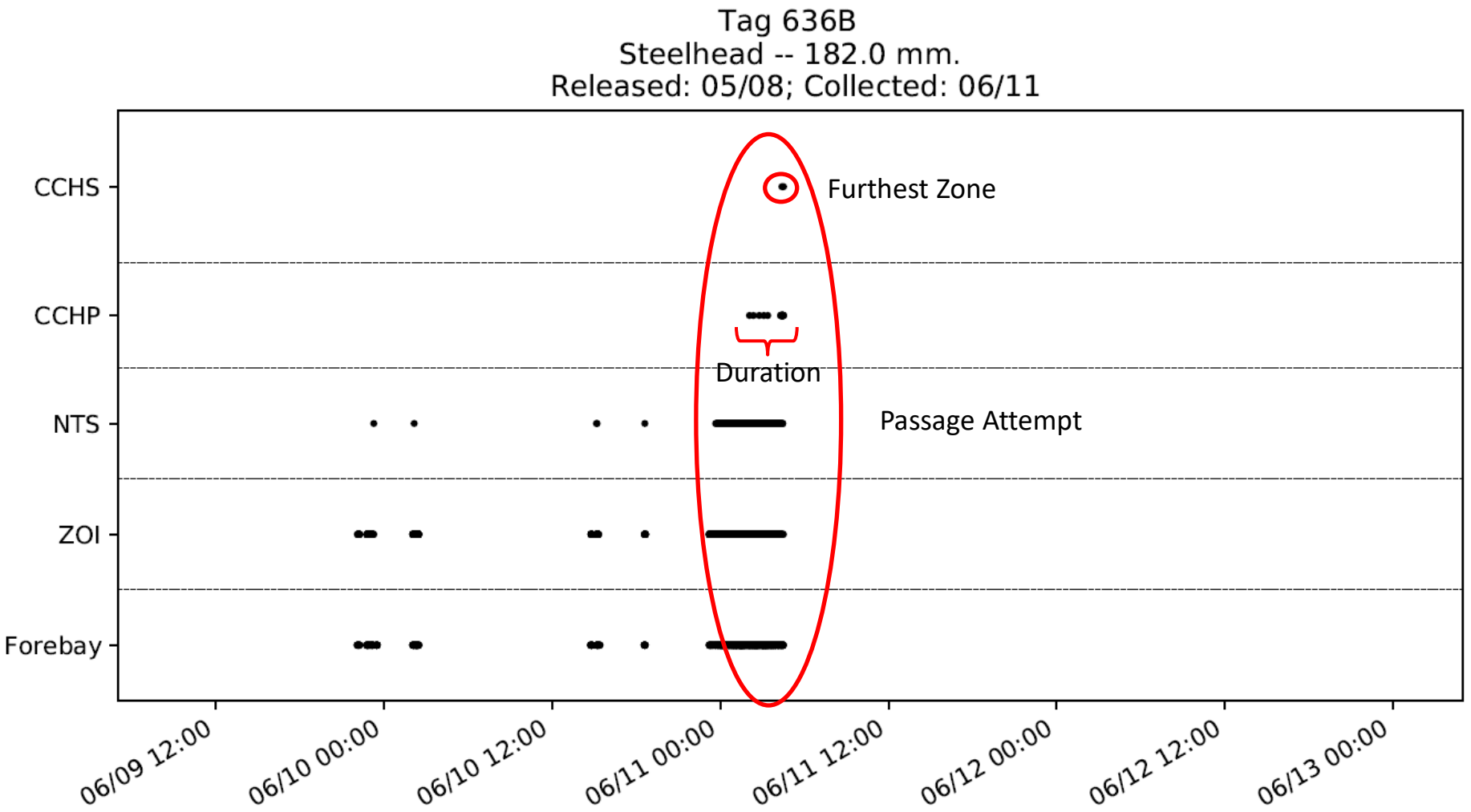
Passage Attempt Dataset



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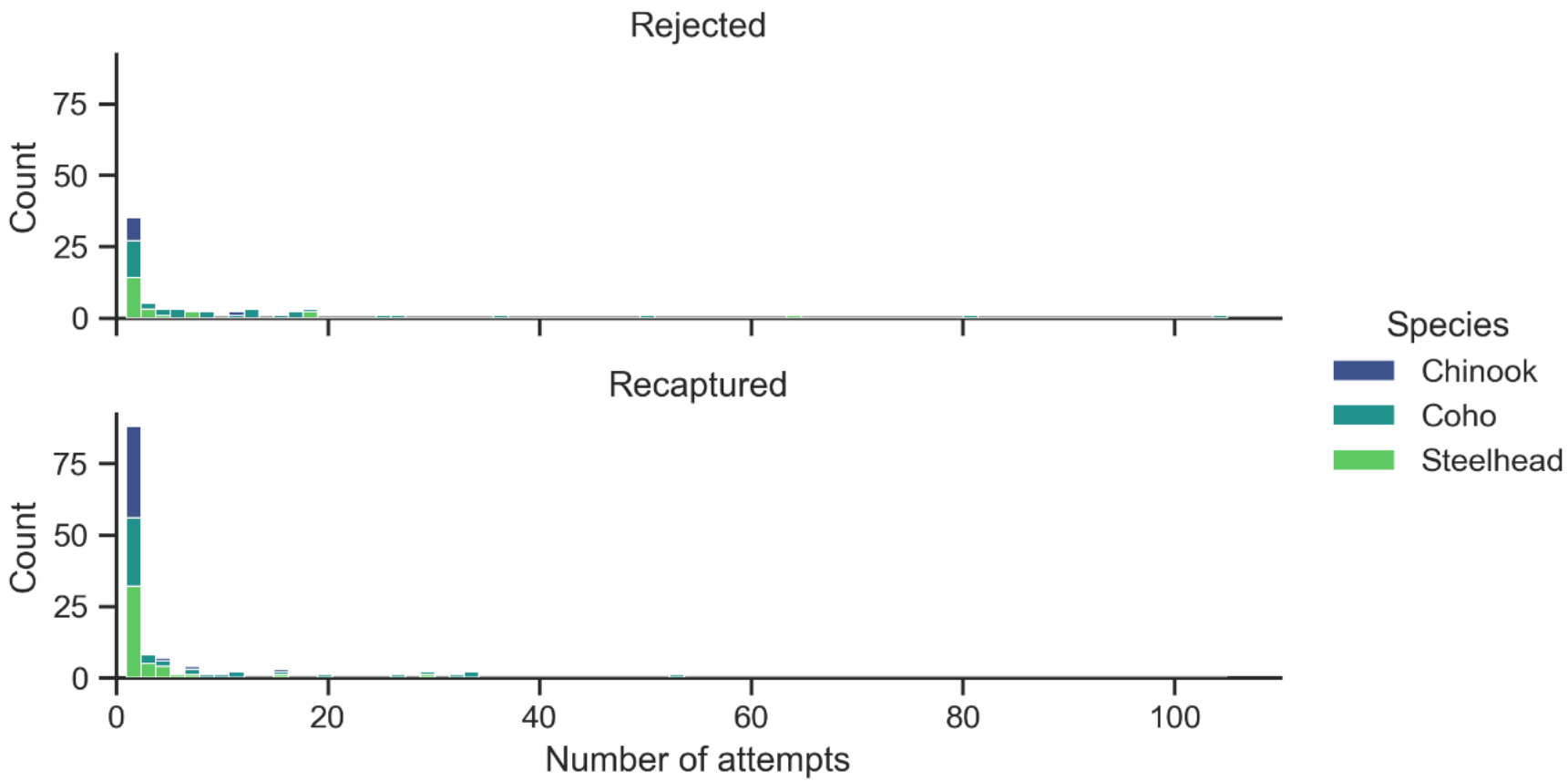
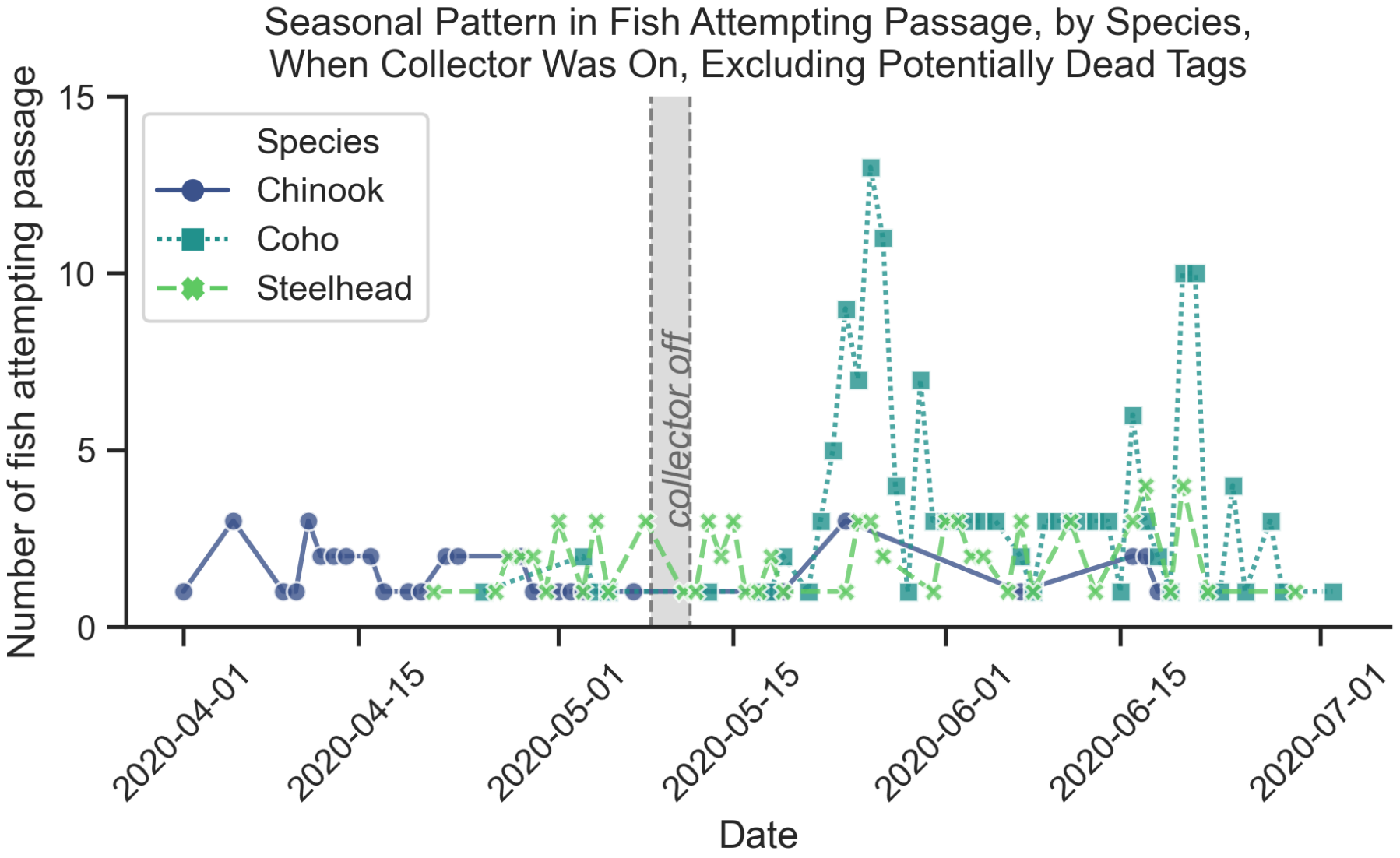
Number of Attempts



Data Summary: When (seasonally) do fish attempt passage?



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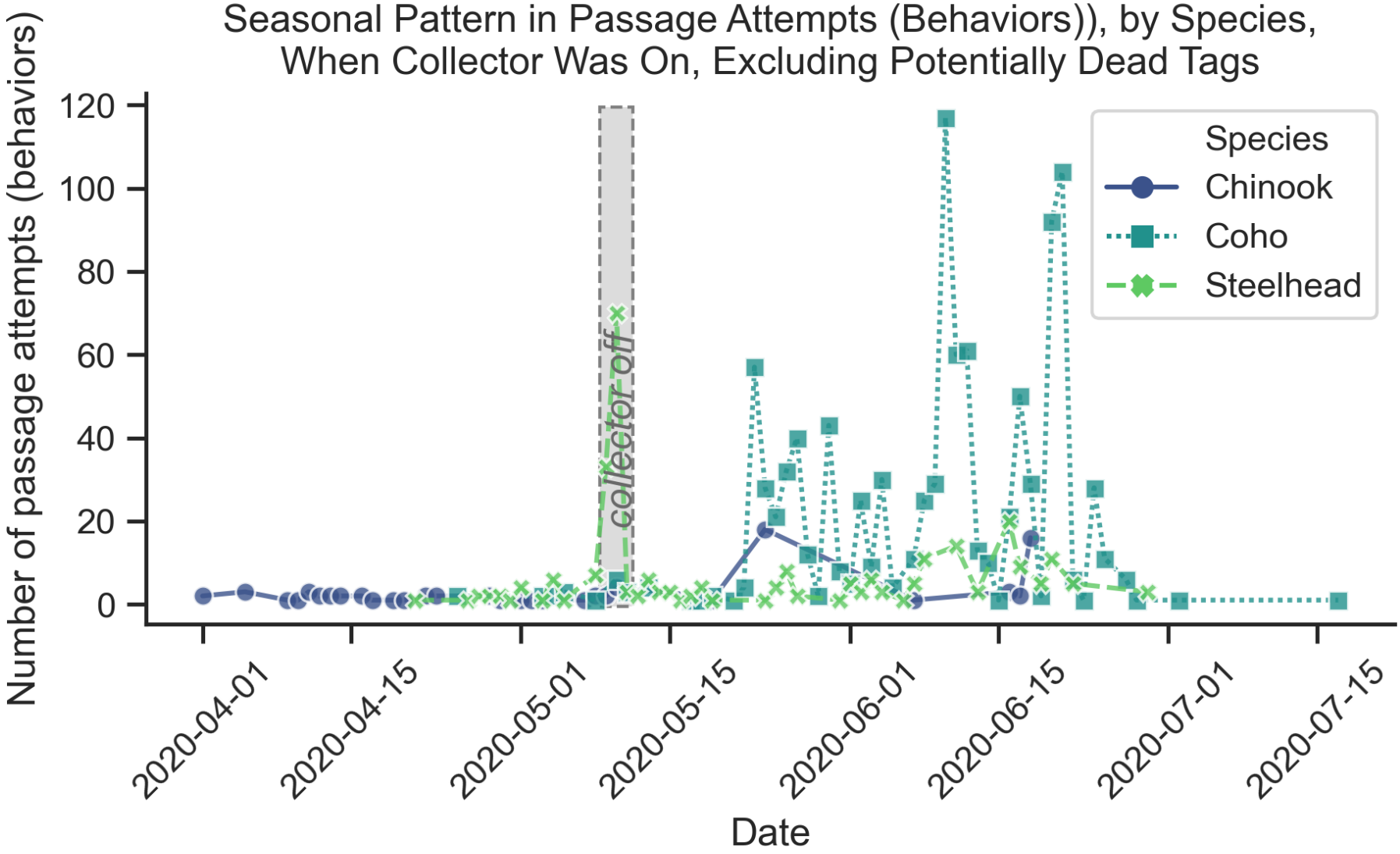

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ENVIRONMENTAL
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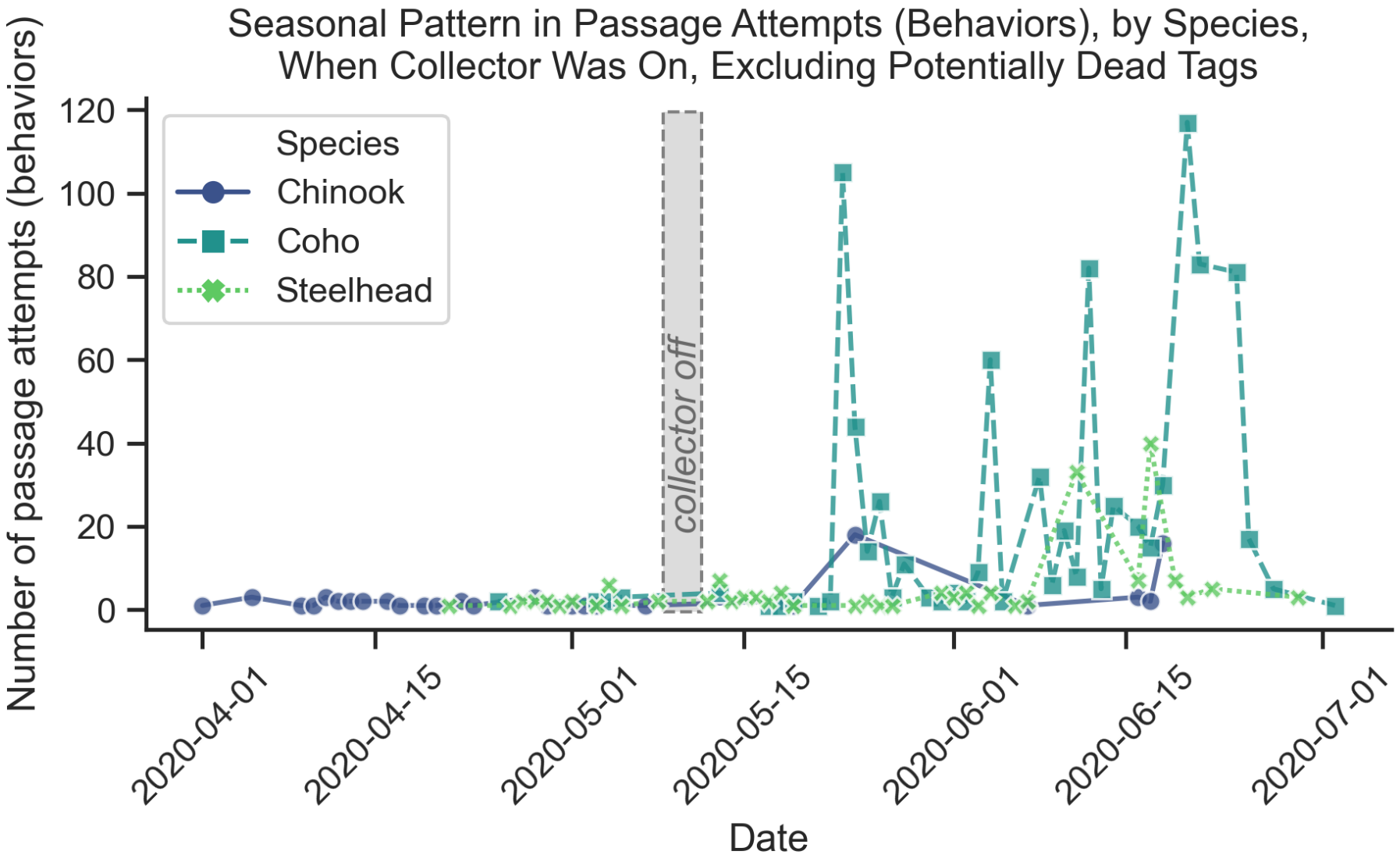

FOUR PEAKS
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Lewis River Fish Passage Report

December

Merwin Fish Collection Facility and General Operations

A total of 522 fish were captured at the Merwin Dam Adult Fish Collection Facility (MFCF) during the month of December. The majority of the fish collected were coho (70.4%) and hatchery winter steelhead (28.0%). Approximately one-third (34.2%) of the coho collected in December were of natural origin (NOR).

The MFCF fish lift and conveyance system was taken out of service on December 16th, after it was discovered that the cable assisted crowding structure derailed and pushed a piece of steel support plating into the hopper sump, which prevented the hopper from lifting. Various components of the crowding structure needed to be refabricated and replaced as a result. The lift and conveyance system was placed back in operation on January 1, 2021.

Total river flow below Merwin Dam was relatively consistent for the month of December, except for the scheduled drawdown days to accommodate ongoing carcass surveys. Total river flow ranged between approximately 1,200 and 12,000 cubic feet per second (cfs; Figure 1).

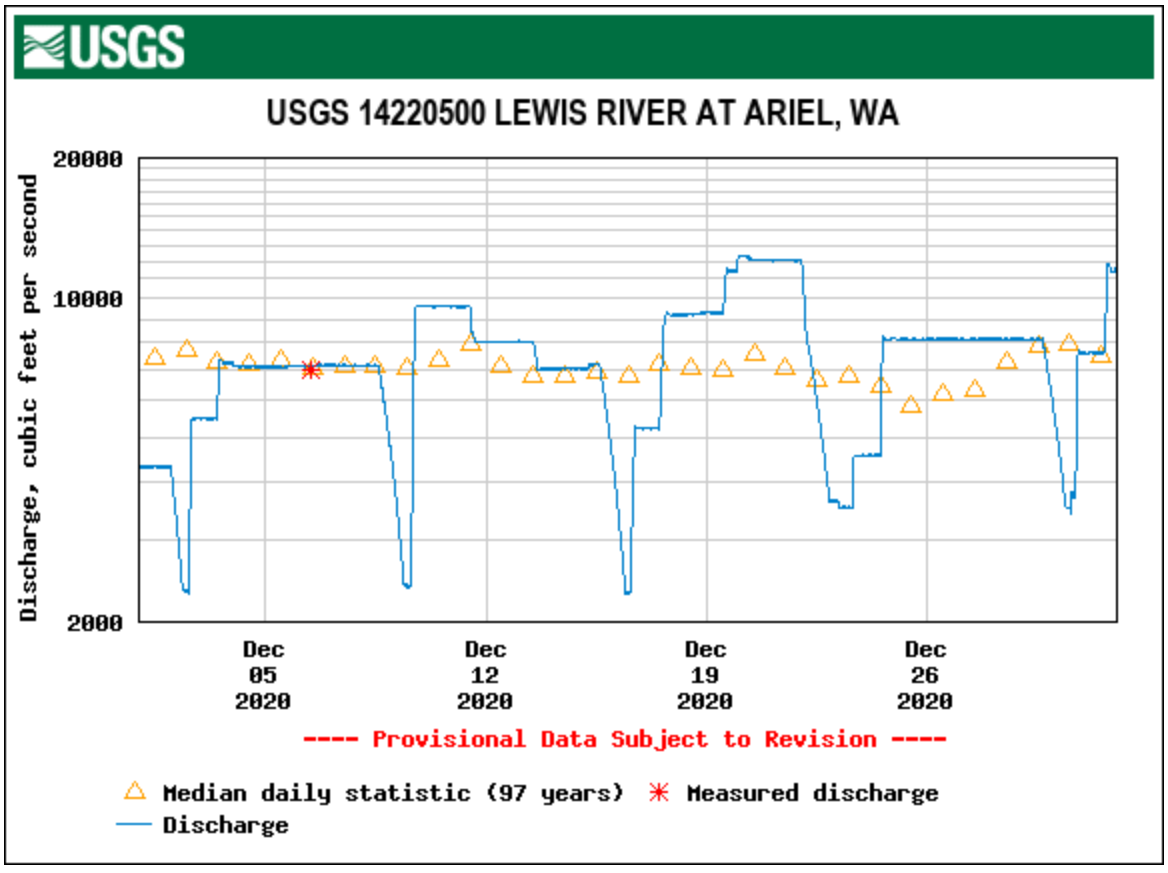

Figure 1. Discharge in cubic feet per second recorded at the USGS Ariel, WA gauge (14220500) located immediately downstream of Merwin Dam.

Upstream Transport

A total of 836 fish were transported throughout the month of December, of which 609 were supplied by Lewis River Hatchery. Nearly all of the fish transported upstream were late run coho (99.4%). Similar to November, the majority of the coho transported upstream were of natural origin (NOR) (88.6%). The total number of NOR coho that have been collected at the MFCF in 2020 is now 4,352 fish, which is approximately 338% of the 2014-2019 average return (Figure 2).

For calendar year 2020, a total of 9,476 coho, 725 Blank Wire Tag winter steelhead, 634 spring Chinook, 327 true wild winter steelhead, and 84 cutthroat have been transported upstream of Swift Dam.

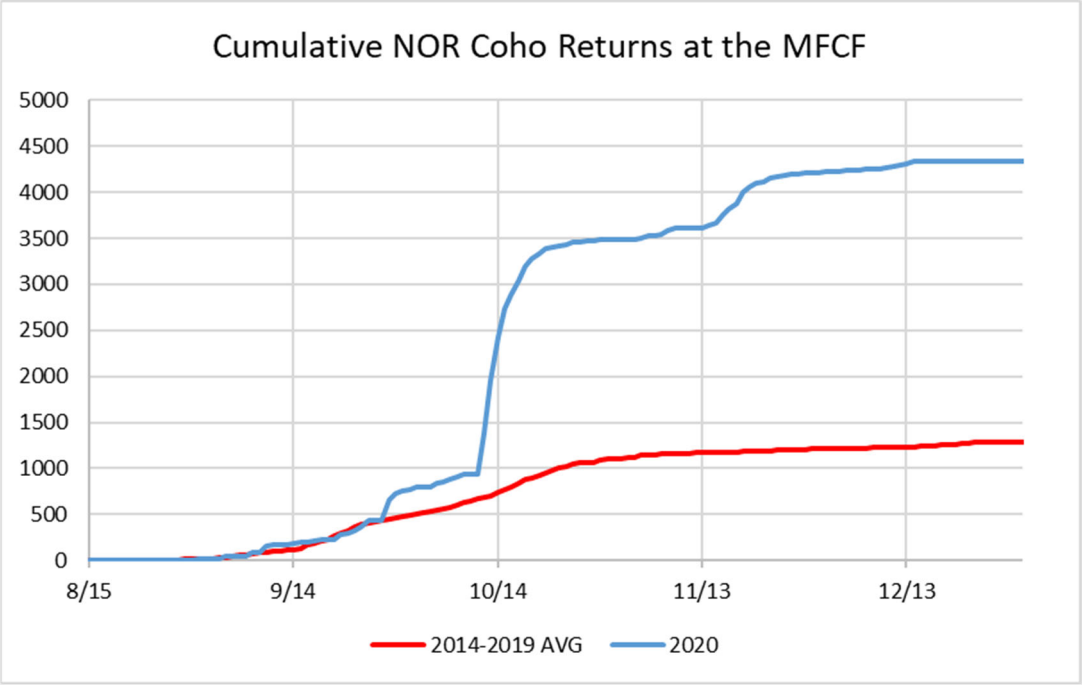

Figure 2. Cumulative number of natural origin (NOR) coho collected at Merwin Adult Fish Collection Facility in 2020, relative to the 2014-2019 average.

Floating Surface Collector

The Swift Floating Surface Collector (FSC) was taken out of operation on December 24th due to heavy debris loading. It was placed back into service on January 1st, after the debris was removed. A total of 474 fish were collected at the FSC in the month of December. As has been the trend in recent months, the majority of these fish were juvenile coho (80.2%).

Fish Facility Report
Merwin Adult Trap
December 2020

Reporting Date	Spring Chinook (1)									Early Coho											
	AD-Clip			Wild			Recap			AD-Clip			CWT			Wild			Recap		
	M	F	JK	M	F	JK	M	F	JK	M	F	JK	M	F	JK	M	F	JK	M	F	JK
1-Dec																					
2-Dec																					
3-Dec																					
4-Dec																					
5-Dec																					
6-Dec											1										
7-Dec														1							
8-Dec												1									
9-Dec																					
10-Dec										4	6	7	1	5	1						
11-Dec										2	2										
12-Dec											2										
13-Dec																					
14-Dec																					
15-Dec																					
16-Dec																					
17-Dec																					
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25-Dec																					
26-Dec																					
27-Dec																					
28-Dec																					
29-Dec																					
30-Dec																					
31-Dec																					
Monthly	0	0	0	0	0	0	0	0	0	6	11	8	1	6	1	0	0	0	0	0	0
Annual	709	567	821	76	53	41	0	0	0	1473	1869	2076	218	296	406	1469	1986	186	0	0	0

Reporting Date	Late Coho												S. Steelhead					
	AD-Clip			CWT			Wild			Recap			Fresh		Recap		Wild	
	M	F	JK	M	F	JK	M	F	JK	M	F	JK	M	F	M	F	M	F
1-Dec	3	5	1		1			3										
2-Dec	1	2	1			1												
3-Dec	10	4	1	1		3		4	1									
4-Dec	7	8	6		3	2	3	6	2									
5-Dec	1	5	1				1	1										
6-Dec	1	4	2			1	3	1	1									
7-Dec	3	4					5	3										
8-Dec							1											
9-Dec																		
10-Dec	9	27					8	4										
11-Dec	8	13	3	2	2	2	7	6										
12-Dec	8	14	3				13	10										
13-Dec	1	7	1		2	1	10	6										
14-Dec	2	8	3				10	8	1									
15-Dec		6					2	2										
16-Dec		5					3	1										
17-Dec																		
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28-Dec																		
29-Dec																		
30-Dec																		
31-Dec																		
Monthly	54	112	22	3	8	10	66	55	5	0	0	0	0	0	0	0	0	0
Annual	321	349	132	52	58	66	340	346	25	0	0	0	649	1031	159	446	3	1

Reporting Date	W. Steelhead								Fall Chinook									Sockeye		Chum		Pink		Cutthroat	Rainbow (< 20 inches)	Bull Trout	Daily Total
	AD-Clip		BWT		Recap		Wild		AD-Clip			Wild			Recap												
	M	F	M	F	M	F	M	F	M	F	JK	M	F	JK	M	F	JK	M	F	M	F	M	F				
1-Dec	2	2																									17
2-Dec	2	3																									10
3-Dec	1											1															26
4-Dec	2	2										2												1			44
5-Dec	2	4																									15
6-Dec	1	4																									19
7-Dec	4	6																									26
8-Dec	1	2																						1			6
9-Dec																											
10-Dec	8	12																									92
11-Dec	8	12																									67
12-Dec	5	8																									63
13-Dec	9	5						1																1			44
14-Dec	6	8																									46
15-Dec	3	10																						1			24
16-Dec	1	13																									23
17-Dec																											
18-Dec																											
19-Dec																											
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26-Dec																											
27-Dec																											
28-Dec																											
29-Dec																											
30-Dec																											
31-Dec																											
Monthly	55	91	0	0	0	0	0	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	4	0	0	522
Annual	352	272	339	383	0	1	246	210	147	100	131	152	187	33	0	0	0	6	6	1	0	0	0	86	0	0	18876

1 Only hatchery verses wild distinctions are currently being made. All hatchery fish are labeled as "AD-Clip".
2 Total counts do not include recaptured salmon.

Fish Facility Report

Swift Floating Surface Collector

December 2020

	Coho			Chinook			Steelhead				Cutthroat			Bull	Planted	
Day	**fry**	**parr**	**smolt**	**fry**	**parr**	**smolt**	**fry**	**parr**	**smolt**	**kelt**	**fry**	**<13 in**	**> 13 in**	**Trout**	**Rainbow**	**Total**
1			0			0			0					0	0	**0**
2		2	5			0			1					0	0	**8**
3		3	2			2			2					0	0	**9**
4		3	2			1			0					0	0	**6**
5	1	1	5			0			0			2		0	0	**9**
6		1	0			1			0			1		0	0	**3**
7	1	1	0		1	1			0					0	0	**4**
8		5	1			1			0					0	0	**7**
9		1	0			0			0					0	0	**1**
10		2	0			1			0			1		0	0	**4**
11			0			2			0					0	0	**2**
12		5	0			1			0					0	0	**6**
13	3	19	2			6			1					0	0	**31**
14		7	1			3			0			1		0	0	**12**
15		8	1			4			0			2		0	1	**16**
16		4	0			1			1			1		0	0	**7**
17		2	1			1			0					0	0	**4**
18		2	3			2			0			1		0	0	**8**
19		5	1			1		1	0					0	0	**8**
20		3	1			0		2	2			1		0	2	**11**
21	2	14	7			2			1			2		0	1	**29**
22		26	4			2			5			4		0	1	**42**
23		32	6			5			0			5		0	1	**49**
24		170	15			3			4			5		0	1	**198**
25																
26																
27																
28																
29																
30																
31																
Monthly	7	316	57	0	1	40	0	3	17	0	0	26	0	0	7	**474**
Total	88	5054	26231	3	3039	12690	67	54	4118	124	1	478	29	21	2081	**54078**