

Priest Rapids Coordinating Committee Conference Call

Microsoft Teams
Monday, January 13, 2025
10:00 a.m. to 12:15 p.m.

Conference Call Minutes

PRCC Representatives, Alternates, and Facilitation

Tom Dresser, Rod O'Connor (Alt),	Keely Murdoch, Brandon Rogers (Alt), YN
Tim Taylor (Alt) GPUD	Tom Lorz, CTUIR
Scott Carlon, Justin Yeager (Alt), NMFS	Clayton Buck, Wanapum
Bill Gale, Jason Romine (Alt), USFWS	Larissa Rohrbach, Anchor QEA, Facilitator
Chad Jackson, Andrew Murdoch (Alt), WDFW	Kristi Geris, Anchor QEA, Technical Support
Kirk Truscott, Casey Baldwin (Alt), CTCR	

Meeting Attendees

Tom Dresser, GPUD	Keely Murdoch, YN
Rod O'Connor, GPUD	Tom Lorz, CTUIR
Tim Taylor, GPUD	Pete McHugh, CRITFC (CTUIR)
Scott Carlon, NMFS	Larissa Rohrbach, Anchor QEA, Facilitator
Bill Gale, USFWS	Kristi Geris, Anchor QEA, Technical Support
Jason Romine, USFWS	Allen Evans, RTR
Chad Jackson, WDFW	Quinn Payton, RTR
Andrew Murdoch, WDFW	Katie Adase, RTR
Jessica Stocking, WDFW	Nate Banet, RTR

A special meeting of the PRCC was held to hear a presentation from Real Time Research (RTR) on avian predation monitoring in the Columbia Plateau Region (CPR), supported in part by Grant PUD's No Net Impact (NNI) fund.

I. Avian Predation in the Columbia Plateau Region

L. Rohrbach welcomed the PRCC, and the presentation team including A. Evans (RTR Fisheries Scientist), Q. Payton (RTR Statistician), K. Adase (RTR Data Analyst), and N. Banet (RTR Wildlife Biologist). In preparation for today's meeting, questions received from the Washington Department of Fish and Wildlife (WDFW) and Columbia River

Inter-Tribal Fish Commission (CRITFC) were shared with RTR, as distributed to the PRCC on December 26. RTR's proposal for 2025 work (Attachment A) was distributed on January 2. Today's presentation focuses on 2024 work but also sets up approval of the proposal for 2025 work, which will be discussed during this month's PRCC meeting on January 28.

A. Evans shared the presentation *Avian Predation in The Columbia Plateau Region, 2024* (Attachment B), which was distributed to the PRCC by K. Geris today, after the meeting. Discussions were as follows. (*Note: RTR later provided written responses to questions submitted prior to the meeting, distributed to the PRCC on January 22, 2025 [Attachment C]*).

Slides 1 to 30

- T. Dresser noted the focused effort to address the double-crested cormorant (DCCO) issue at the Astoria-Megler Bridge, and he asked about DCCO fidelity to an area. How far upriver might DCCO migrate if dissuasion activities are implemented in the Lower Columbia River? A. Evans said California gulls (LAXX¹) are tolerant to human disturbance, whereas DCCO will abandon a site due to human disturbance. However, the data indicate not much connectivity between estuary and inland DCCO. There is some, but these are fairly distinct populations.
- A. Murdoch asked whether this avian predation management plan is specific to the Upper Columbia River (UCR) or whether it is part of an overall management plan for the entire Columbia River Basin. A. Evans clarified there are three separate management plans by species and region. This Inland Avian Predation Management Plan addresses Caspian terns (CATE) in the CPR. There is also a CATE management plan for the Columbia River Estuary (CRE) and a DCCO management plan for the CRE.
- P. McHugh noted, in Slide 28, the inability to get back down to 200 CATE breeding pairs despite a regional effort. What is needed, or is this feasible? A. Evans caveated that there are differences of opinion on this question. From 2014 to 2020, there was steady progress made each year. In 2020, the goals of the management plan were met. This can be attained again, but it is a long process. These are a long-lived species that know the colony sites in the area and can live over 25 years. It takes coordination and a desire to stick with adaptive management. Crescent Island is a good example. The colony was eliminated but is now re-established due to ineffective adaptive management.

¹ Includes ring-billed gulls.

Slides 31 to 53

- T. Lorz asked whether RTR has evaluated differences in survival by fish size. A. Evans said RTR just published a paper on this last year. There is strong evidence that predation rates are lower in salmon, because salmon are smaller than steelhead, especially among plunge divers (CATE and LAXX). This is a universal pattern across Columbia and Snake River salmon and steelhead populations.
- T. Lorz said that based on acoustic telemetry data, there is up to 30% loss from McNary (MCN) to John Day (JDA). Might the majority of this be due to avian predation? A. Evans said based on Slide 47, there is no dramatic difference in survival from MCN to JDA or JDA to Bonneville (BON). There was a new DCCO colony in the BON Reservoir near Murdoch, Washington, but mortality rates in that area were low. There was dramatic mortality on salmon downstream of BON, but not downstream of MCN. For salmon, maybe look at something other than avian predation. For steelhead, avian predation may be the cause of high mortality. T. Lorz said the mortality rates on this slide for MCN to JDA are the lowest he has seen since 1995. He will look further into this.
- K. Murdoch appreciates that this presentation included predation rates by hatchery and wild origin. Understanding who is preyed upon and at what rates is important for prioritizing recovery and management actions and decisions. One issue with this dataset is until recently there was no scanning for coded wire tags (CWTs). About 30% of hatchery releases in the UCR have intact fins, including an intact adipose (ad) fin. These fish in theory should have CWTs. Although, there is some tag shed. Some hatcheries do not have any marks. The data in Appendix B² indicate that the proportion of wild fish at Rock Island (RIS) has been in the upper 20%. For wild fish at RIS, if these data represent the run at large, she would not expect this percentage to be so high. These numbers do align with unmarked hatchery fish. Considering this dataset has only recently included scanning for CWTs, she assumes some of the wild fish in this dataset are hatchery fish. Hopefully CWT scanning improves. She is surprised how few CWTs were detected. Regarding collection at RIS, is this really representative of the run at large? It is in the best interest to better understand these things. A. Evans said, regarding assignment of hatchery versus wild, RTR does the best it can given the available information. The data indicate that wild fish are more likely to survive than hatchery fish, and the graph on Slide 42 shows this. The ratio changes throughout the system, but hatchery fish fall out at a higher rate. This may be part of the story mathematically. K. Murdoch does not expect predation rates on wild fish to be the same as hatchery fish. There are many

² Table B.1. Rear-type (hatchery, wild) of PIT-tagged Upper Columbia River steelhead smolts at Rock Island Dam during 2008–2023 (from the final report summarizing 2023 work).

reasons why wild fish have different predation rates. Hydro system mortality might be different for hatchery and wild fish, but this discrepancy may be difficult to understand by sampling at RIS. Q. Payton understands the concerns about RIS and appreciates recommendations of ways to look at the data. He reviewed the comments from WDFW and CRITFC. He wants to address these questions, so he looked at study fish detected at all downstream juvenile bypass systems (MCN, JDA, and BON) for hatchery versus wild, including recapture rates, and there is no statistically significant difference in the data. He is not saying there is no difference. RIS is not perfect, but it provides a way to get a pseudo random sample of the river. He agreed it could be productive to tease out the biases.

- A. Murdoch said in the Habitat Conservation Plan (HCP) forum, WDFW is looking at passage timing of smolts based on bypass operations at RIS and Rocky Reach (RRH). RIS is much different than every other bypass system in the Columbia River Basin. One issue with RIS is it has low capture probability. Then there is this assumption that RIS captures the run at large, but this is limited to when RIS is operating and not to when fish are migrating. RRH has high capture probability. About 30% to 45% of fish migrating past RRH enter the bypass. WDFW is investigating what is driving capture probability at RIS, and the initial finding is nothing. WDFW cannot identify an operational metric that would account for any capture probability observed at RIS. This capture probability ranges from low and not uniform to increasing throughout the run. It is not constant, which gives him pause. The fact that this cannot be attributed to operations or river conditions means it is more likely a function of water temperature or “date of year” (or smoltification).
- A. Murdoch asked whether RTR has thought more about sorting out bird predation rates from indirect or direct hydro system mortality rates. It would be helpful to bin total mortality into hydro, avian, and piscine to better understand mortality during the smolt migration period. He understands the advantage of avian predation is the ability to scan passive integrated transponder (PIT) tags and develop models to estimate the total number of PIT tagged fish consumed by birds, but the question is why did the fish die? Are there thoughts about fine-tuning avian predation versus other sources of mortality? Some researchers are starting to sort this out by using dead fish releases. What proportion of dead fish versus live fish are birds consuming? A concern is there is this long time series of this unique group of fish captured and tagged at RIS, but fish managers are using other groups of fish in the models. Same with survival studies; these unique groups of fish are used, but fish managers are using other groups of fish, which is not consistent. If everyone used the same fish for all analyses

throughout the life cycle, there would be no need to weight the data.³ A. Evans said as long as there is an adequate sample size in space and time, a retroactive analysis can be performed. For example, Slide 49 shows estimates of total mortality on each of these groups of fish. The cause is birds. There are definitely other sources of predation. A. Murdoch asked, for every PIT tag found on a bird colony, is this attributed to fish mortality due to avian predation of a live, healthy fish? A. Evans said this is not what he said. If a PIT tag is found on a bird colony, the tag was in a fish that was eaten. Some birds steal fish from other birds. Sometimes LAXX consume dead fish. However, there would have to be millions of dead fish floating down the river to say all these PIT tags found on bird colonies were already dead. Some birds do not eat dead fish and some do, but it is a small fraction. A. Murdoch asked whether a consumed dead fish would only be found in a LAXX colony. A. Evans said it could possibly be found in an American white pelican colony. Higher predation rates are observed in CATE because LAXX steal fish from CATE. Q. Payton said CATE almost exclusively consume live fish. He understands that the question is whether CATE are eating live fish that would have otherwise died due to other causes (latent mortality), but were eaten because these fish were now easy targets. He looked into this by modeling weekly data across 17 years and found as CATE predation increases, survival decreases by a significant proportion. This includes not only eating fish but also killing and not eating the fish. This finding is consistent across UCR steelhead, Snake River steelhead, steelhead at BON, and in juvenile stocks. These data are on Slide 38; RTR just published a paper on this.⁴

- P. McHugh said that on Slide 34, the percentage of hatchery fish possessing a CWT is lower than what is reported in the Regional Mark Processing Center's Regional Mark Information System (RMIS). Why is this? A. Evans cannot say what proportion should have a CWT. There is something different happening in fish presumed to be hatchery versus wild (double asterisk on Slide 34), but this would not grossly change the balance. K. Murdoch agreed these data seem low. Ad-present hatchery steelhead should all have CWTs, minus tag shed, which should be less than 5%. A. Evans said he can break out "presumed hatchery" more next year. K. Murdoch said this would be helpful. Also, when scanning for CWTs, a V-Block (or V-Detector) is more efficient than a wand, and some fish

³ A. Murdoch added in the Teams chat: "Fish managers do not use fish tagged at Rock Island Dam. So, any other groups of fish would be better for analysis because fish managers develop models at the population level."

⁴ A. Murdoch added in the Teams chat: "He was trying to address the compensatory versus additive mortality issue. He has seen very different results. More work is needed to help understand this issue. When piscine predators are added, this becomes even more complicated."

have CWTs in the body and not the snout. A. Evans confirmed RTR uses a V-Block and that staff know there can be CWTs in the body or the snout.⁵

- B. Gale said that in reviewing the *U.S. v. Oregon Management Agreement* Production Tables, he is noticing different terminology is used for what percentage of fish are CWT, ad-clipped, and/or both, so RMIS is the best resource for tag rates rather than management documents. Regarding the Predation by Hatchery Release Cohort data that RTR and K. Murdoch are working on (Slide 45), will this be distributed for review by the PRCC Hatchery Subcommittee (HSC) or PRCC? A. Evans said the plan was a PRCC review, but the data can first be reviewed by the U.S. Fish and Wildlife Service (USFWS) if preferred. K. Murdoch recalled that this was a request she made last year. Tagging at RIS produces one number and one predation rate, which is great if the goal is to look at an index of changes in predation rate over time. However, this does not provide information on who is being preyed upon. Part of last year's request was also to include information about predation rates on hatchery versus wild fish, which is now included as Appendix B to the annual report. However, this still does not show, among hatchery fish, who is being preyed upon. There is a huge diversity of hatcheries in the UCR, as shown on Slide 45. Understanding who is being preyed upon the most can inform recovery and management actions. If one hatchery type is preyed upon more or less, this is a tool to work with to make sure fish released are less vulnerable to predation. Slide 45 is just a start, but eventually maybe there can be further discussion within the PRCC and/or PRCC HSC. B. Gale said this all sounds great, and he is supportive of a PRCC or PRCC HSC review. However, he would like to have a courtesy review to fact check the hatchery tagging data against what USFWS knows about its own programs, see if there are additional data USFWS can provide to improve the analysis, and make sure nothing is misunderstood. K. Murdoch agreed this is a good idea, including having the PUDs review their programs. She also noted that the release files for each hatchery program are uploaded to the PIT Tag Information System (PTAGIS).

Next Steps

L. Rohrbach said RTR's proposal for 2025 work is summarized in the objectives on Slide 53. The PRCC needs to decide whether these objectives are fundable by NNI funds. There was mention of a possible additional feasibility study on Slide 33. To be clear, this would be separate from the funding request listed as objectives on Slide 53. A. Evans said this is correct. Parts of the funding request on Slide 53 are time sensitive and need approval sooner than later. The additional analysis can be done

⁵ P. McHugh added in the Teams chat: "One last word on CWT scanning, not a huge item to chase down, but worth confirming methods and expected tag rates for data QAQC going forward."

retrospectively, at any time, upon PRCC approval. T. Dresser said the proposal as laid out on Slide 53 is similar to past years that have been previously reviewed and approved by the PRCC as falling within NNI funding requirements. Regarding additional analyses, Grant PUD is open to considering this. He suggested the PRCC review the updated NNI funding guidance sent last fall. Contractually, if this is a scope change, it may need to be addressed under a separate contract.

L. Rohrbach noted that A. Murdoch asked in the Teams chat whether there will be written responses to the questions submitted by WDFW and CRITFC or whether RTR can point to the presentation slides where these questions were addressed. A. Evans said he can do this. L. Rohrbach thanked the RTR team and said this discussion will continue during this month's PRCC meeting.

II. Next Meetings

The next regularly scheduled PRCC meeting will be on Tuesday, January 28, 2025, from 9:00 a.m. to 11:00 a.m., to be held virtually. A joint session with the HCP Coordination Committee for a Subyearling Chinook Salmon Workshop Recap (Joint Session 2) will be held after the PRCC meeting, from 11:00 a.m. to 12:30 p.m.

III. Attachments

Attachment A – PROPOSAL: Avian Predation on ESA-listed Juvenile Salmonids on the Middle Columbia River, 2025

Attachment B – *Avian Predation in The Columbia Plateau Region, 2024*

Attachment C – PRCC questions to RTR and written responses, January 22, 2025



PROPOSAL: Avian Predation on ESA-listed Juvenile Salmonids on the Middle Columbia River, 2025

Submitted To:	Priest Rapids Coordinating Committee/Grant County PUD
Submitted By:	Real Time Research, Inc. (RTR)
Submitted On:	January 2, 2025
Project Duration:	Date of award – March 31, 2026

TECHNICAL PROPOSAL

PROJECT BACKGROUND

Grant County Public Utility District (GPUD) and the Priest Rapids Coordinating Committee (PRCC), with cost sharing from federal partners (U.S. Army Corps of Engineers {USACE}, Bonneville Power Administration {BPA}, and the Bureau of Reclamation {BOR}), conducted a system-wide assessment of avian predation in the Columbia River basin. Work funded by GPUD/PRCC focused on (1) evaluating the efficacy of the Inland Avian Predation Management Plan (IAPMP), (2) provided in-season data for adaptive management decisions, and (3) helped to identify emerging predation concerns in the middle Columbia River. The goal of the IAPMP is to reduce predation on ESA-listed juvenile salmonids by Caspian terns nesting at colonies in the Columbia River Plateau (CRP) region (USACE 2014). The Plan targeted the two largest historical tern colony breeding sites in the region, Crescent Island on the lower Columbia River and Goose Island in Potholes Reservoir adjacent to the middle Columbia River. The objectives of the Plan were to use passive nest dissuasion techniques (e.g., fencing, flagging, woody debris, and vegetation plantings) to eliminate tern nesting habitat and to use active nest dissuasion techniques (human hazing and egg collection) as an adaptive management tool to ensure terns were not able to establish colonies and raise young at either site. Concomitant with management implemented as part of the IAPMP, the Plan called for monitoring and evaluating the efficacy of those management components and actions at both the colony- and system-level (with cost sharing from the BOR, BPA, and USACE), including measuring changes in colony size and predation impacts of terns and other piscivorous waterbirds (e.g., double-crested cormorants, American white pelicans, California gulls) on ESA-listed juvenile salmonids.

To-date, results from studies funded by GPUD/PRCC have helped evaluate the outcome of on-going management, provide near real-time data to inform adaptive managements decisions and actions, and have identified several new concerns involving avian predation in and around the middle Columbia River. Work has included close coordination with the BOR to help ensure management actions at Goose Island and elsewhere in Pothole Reservoir were effective during the breeding season. For instance, in 2024, we discovered an incipient tern colony of 126 breeding pairs on an unnamed island in North Potholes Reservoir during a fixed-wing aerial survey. The BOR was immediately notified of the colony and within 48 hours active and passive nest dissuasion techniques were deployed to successfully prevent continued tern nesting at the site. We also worked closely with the Columbia River Inter-Tribal Fish Commission, the U.S. Fish and Wildlife Service, and the USACE to guide efforts in dissuading terns from nesting on Crescent Island and Badger Island in the Columbia River. This research has also helped to identify several emerging predation concerns, like predation by America white pelicans on Badger Island on adult Sockeye Salmon, predation by double-crested cormorants on juvenile Chinook Salmon on Hanford Island, Goose Island (new colony in 2024), Island 20 (a new colony in 2024), and predation on juvenile steelhead by Caspian terns on Lenore Lake; all colonies that forage in the middle Columbia River. Although both colony size and smolt predation rates by Caspian terns nesting at the managed colony sites (Goose Island, Crescent Island) have been significantly reduced since implementation of the IAPMP, displaced terns have also recruited to extant or incipient colony sites in the CRP region (Roby et al. 2021, Evans et al. 2023). For example, Caspian terns have re-established the colony site on Crescent Island and birds have recently (as of 2024) nested on an unnamed island in northern Potholes Reservoir and on an unnamed island in Burbank Slough in McNary Reservoir.

Preliminary results from 2024 indicate that the IAPMP Caspian tern colony size target of less than 40 breeding pairs was achieved at Goose Island colony but was exceeded at the Lenore Lake colony (69 breeding pairs), an unnamed island in North Potholes Reservoir (126 pairs), and the Crescent Island colony (186 pairs). The over-all target goal of less than 200 Caspian tern pairs at all CRP colonies combined was exceeded. The predation rate target goal of less than 2.0% per salmonid ESU/DPS, per colony, however, was achieved at all tern colonies in 2024. The highest predation rates were 1.7% (95% credible interval = 1.0–3.2), 1.5% (0.9–2.6), and 1.3% (0.7–2.6) on Upper Columbia River steelhead by terns breeding on the unnamed island in northern Potholes Reservoir, Goose Island in Potholes Reservoir, and North Shoal Island in Lenore Lake, respectively. Predation rates on all other ESA-listed ESUs/DPSs evaluated were less than 1.0% per colony, per ESU/DPS, in 2024. Over-all, relatively low levels of tern predation were observed at tern colonies in 2024 compared with levels observed prior to implementation of the IAPMP (e.g., predation by Goose Island terns only averaged 15.7% prior to implementation of the Plan).

The cumulative predation rate on Upper Columbia River steelhead by Caspian terns from all colonies in the CRP region has also been substantially lower, on average, during the post-management period (e.g., 7.6% post-management versus 20.0% pre-management; Roby et al. 2021). In 2024, preliminary data indicates that the cumulative predation rate on Upper Columbia River steelhead by all tern colonies during smolt passage from Rock Island Dam to McNary Dam was 5.9% (4.1–7.4), slightly higher than in 2023 (ca. 3.2%), but amongst the lowest observed since 2008. Despite measurable success in reducing predation rates by tern colonies since 2014, predation by other colonial waterbird species (double-crested cormorants, American white pelican, California and ring-billed gulls) and colonies have been similar to, and some cases higher than, those of tern colonies in CRP region. For example, preliminary results indicate that the cumulative effects of consumption by gulls, cormorants, and pelicans on Upper Columbia River steelhead during passage from Rock Island Dam to McNary Dam was estimated at 11.3% (9.5–15.0) in 2024. These results indicate the need for ongoing adaptive management to maximize and sustain the benefits to smolt survival associated with managing piscivorous waterbirds in the middle Columbia River.

PROJECT OVERVIEW

Work proposed here would be part of a system-wide effort to monitor, evaluate, and adaptively manage avian predation in the Columbia River basin with a focus on predation in the middle Columbia River. In 2024, BPA and USACE are funding research, monitoring, and evaluation studies focused on avian predation downstream of the confluence of the Snake and Columbia rivers (i.e., lower Columbia River). Work proposed here will include aerial and ground-based surveys needed to assess colony size and smolt predation rates (using smolt PIT tags detected/recovered on bird colonies) of both managed and unmanaged piscivorous waterbirds that forage on smolts in and around middle Columbia River. Aerial surveys generally provide information on colony location and size at the time of the survey, while ground-based monitoring provides information on nesting chronology, nesting success, and factors that influence nesting success. As was the case in previous years, the USACE and BOR will be funding ongoing management actions in the Columbia River estuary (USACE) and in Potholes Reservoir (BOR) in 2025. The CRITFC, USFWS, and USACE will also be placing woody debris on select islands to prevent or limit tern nesting at Crescent and Badger Island, and the USACE is planning to maintain

elevated water levels in the John Day Reservoir to flood upland nesting habitat on the Blalock Islands to prevent tern nesting at this historical nesting site. The Confederated Tribes and Bands of the Yakama Nation are also proposed to continue to dissuade gulls from nesting on Miller Rocks Island in The Dalles Reservoir.

Funding approval from the PRCC in 2025 would continue to support avian predation studies in the CRP region for those colonies that are within foraging distance of the middle Columbia River, to include Potholes Reservoir, Lenore Lake, Banks Lake, Island 20, Hanford Island, and any incipient colonies that form in the region above the Snake River confluence. Funding from the PRCC would also supplement funding received from BPA to conduct a system-wide assessment of avian predation on ESA-listed salmonid stocks from the Columbia Basin and will produce information needed to adaptively manage ongoing avian predation management plans to maximize their benefits in increasing smolt survival (see [Table 1](#) for cost sharing). Specifically, this funding would continue to allow us to (1) evaluate the response of Caspian terns and other piscivorous waterbirds to nest dissuasion activities on Goose Island and elsewhere at Potholes Reservoir, (2) determine changes in distribution and colony size of Caspian terns and other piscivorous colonial waterbirds nesting on or near the mid-Columbia River, (3) determine relative changes in predation rates on salmonid smolts by Caspian terns and other piscivorous colonial waterbirds nesting on or near the mid-Columbia River, and (4) provide technical assistance to the PRCC and regional partners in the development and adaptive management of short- and long-term plans to reduce bird predation on salmonids during passage through the mid-Columbia River. Finally, we propose to (5) estimate spatially- and temporally explicit avian predation rates on steelhead that are tagged as part of survival studies in the Priest Rapids Project (Wanapum and Priest Rapids dams and reservoirs) in 2025. Because survival study steelhead will be double-tagged (PIT, acoustic), precise and accurate estimates of colony-specific and cumulative predation can be generated within the Priest Rapids Project based on the acoustic array configuration used to estimate fish survival and the number of PIT tags from double-tagged fish that are recovered on bird colonies as part of this project (see [below](#) for additional details).

Table 1. Proposed cost sharing for avian predation RM&E in the Columbia River basin in 2025. RM&E at colonies marked in (1) green would be completed with funding from BPA (approved), (2) yellow would be completed by USACE (if approved), and (3) blue would be completed with cost sharing from the PRCC (if approved). A system-wide assessment of avian predation would depend on receiving funding for all the work elements listed below. Avian predator species are Caspian terns (CATE), double-crested cormorants (DCCO), American white pelicans (AWPE), and California and ring-billed gulls (GULL).

System-wide Assessment of Avian Predation on the Survival of Juvenile Salmonids in the Columbia River basin, 2025

	Colony Census					
	Flight 1	Flight 2	Flight 3	Ground	PIT Recovery	Predation Rates
Estuary						
East Sand CATE	X	X	X	X	X	X
East Sand DCCO	X	X	X	X	X	X
PIERs CATE	X	X	X	X	X	
Astoria/Megler Bridge DCCO	X	X	X	X	X	X
Channel Markers DCCO	X	X	X	X	X	
Rice Island CATE	X	X	X	X	X	X
Miller Sands Spit AWPE	X	X	X	X	X	X
Troutdale Towers DCCO	X	X	X	X	X	X
Incipient CATE/DCCO/AWPE	X	X	X	X	X	X
Loafing Sites (~1-2)	X	X	X	X	X	
Lower Columbia						
Miller Rocks GULL	X	X	X	X	X	X
Blalocks CATE/GULL	X	X	X	X	X	X
Crescent CATE/GULL/DCCO	X	X	X	X	X	X
Badger CATE/GULL/AWPE	X	X	X	X	X	X
Foundation DCCO	X	X	X	X	X	X
Incipient CATE/DCCO/AWPE	X	X	X	X	X	X
Mid-Columbia						
Island 20 GULL/DCCO	X	X	X ¹	X	X	X
Hanford Reach DCCO	X	X	X ¹	X	X	X
Potholes CATE	X	X	X ¹	X	X	X
Sprague CATE/DCCO	X	X	X ¹	X	X	X
Lenore CATE	X	X	X ¹	X	X	X
Banks CATE	X	X	X ¹	X	X	X
Incipient CATE/DCCO/AWPE	X	X	X ¹	X	X	X

¹ An additional early-season reconnaissance flight would be conducted to identify incipient CATE colonies in CPR

PROJECT OBJECTIVES & TASKS

This work is part of a comprehensive program to implement avian predation management plans (including adaptive management), evaluate action effectiveness of those plans, and identify emerging predation concerns. Cost sharing provided by other agencies in 2025 (i.e., BPA, USACE, and BOR) greatly reduces the cost of the work proposed herein (i.e., an economy of scale).

Objective 1. Evaluate response of Caspian terns and other piscivorous colonial waterbirds to nest dissuasion activities on Goose Island and elsewhere in Potholes Reservoir.

As was the case in 2024, we anticipate that some Caspian terns will attempt to nest on Goose Island and elsewhere in Potholes Reservoir in 2025. As part of this objective, we would monitor the activities of terns on Goose Island and at potential breeding sites in northern Potholes Reservoir from April through July. A combination of boat-based and aerial surveys would be used to assess tern colony attendance (i.e., number of adults) and colony size (i.e., number of breeding pairs) at sites within Potholes Reservoir. Based on the discovery of a large tern colony (126 breeding pairs) on an unnamed island in northern Potholes Reservoir on 18 May 2024, a location that was outside of the BOR's survey route, we propose to conduct one additional, early season (late April) aerial survey of Potholes Reservoir and other potential tern nesting sites with foraging range of mid-Columbia River in 2025 (Table 1). With this proposed additional flight, a total of four aerial surveys would be conducted in 2025. As part of this study, we would share in-season results with BOR and other action agencies in near real-time, information that will be used to adaptively manage tern dissuasion activities in 2025.

Data collection methodologies used as part of this objective would follow established protocols (Antolos et al. 2004; Roby et al. 2014; Adkins et al. 2014; Collis et al. 2015, 2016, 2017; Evans et al. 2022, 2023) such that the data collected in 2025 could be compared with data collected in previous years, with the main goal of evaluating the efficacy of management activities implemented on Goose Island and elsewhere in Potholes Reservoir in 2025.

Objective 2. Determine changes in nesting distribution and colony size of Caspian terns and other piscivorous colonial waterbirds on or near the mid-Columbia River

Periodic monitoring (bi-weekly or monthly, depending on the colony) would be conducted at prospective colony sites in the CRP region above the Snake River confluence to help evaluate the consequences of management actions implemented as part of the IAPMP. We would assess whether reductions in colony size associated with nest dissuasion actions at Goose Island, elsewhere in the Potholes Reservoir area, Crescent Island, and the Blalock Islands were offset by increases in tern colonies upstream of the Snake and Columbia rivers' confluence. Specifically, we would examine whether occupancy or size of tern colonies increased at unmanaged sites such as Lenore Lake, Banks Lake, and potentially others that may continue to consume significant numbers of juvenile salmonids (see [Objective 3](#)). Finally, data on colony location and size collected as part of this objective would also be used to determine which colony sites to scan for smolt PIT tags after the breeding season to estimate predation rates (see [Objective 3](#)).

Objective 3. Determine changes in survival and predation rates on salmonid smolts by Caspian terns and other piscivorous colonial waterbirds nesting on or near the mid-Columbia River.

Previous established methods would be used to estimate predation rates (percentage of available PIT-tagged fish consumed by birds) on salmonid smolts by Caspian terns and other piscivorous colonial waterbird species in the CRP region that nest and forage upstream of the Snake River confluence on the middle Columbia River. Predation rates would be based on releases of PIT-tagged steelhead at Rock Island Dam (RIS; see details *below*), as well as releases of PIT-tagged fish from other ESA-listed populations (as part of other tagging studies in the region; see Evans et al. 2012), to the extent adequate data exists. Data would be used to evaluate the relative susceptibility of each salmonid population to colonial waterbird predation by predator species (tern, cormorant, pelican, gull) on both a weekly and annual basis during the smolt out-migration period (April – July, depending on the population). In 2024, smolt PIT tags were recovered from two newly formed Great Blue Heron and Great Egret colonies in the middle Columbia River. As a potential emerging predation concern, these sites would be scanned in 2025 if colonies form there again. Predation rates would also be estimated separately for wild- and hatchery-origin steelhead to the extent adequate data exists (see also *below*). Finally, predation rates from 2025 would be compared and contrasted to results from previous years and management periods (pre- versus post-management) to evaluate the efficacy of management actions in the region to reduce predation.

With cost sharing from BPA, estimates of predation rates would also include estimates of the cumulative effects of avian predation (i.e., consumption by all avian predator species {terns, cormorants, pelicans, and gulls} during smolt passage from RIS to McNary Dam (McN), McN to Bonneville Dam (BON), and BON to the Pacific Ocean (see also Evans et al. 2019). Collectively, these analyses would address several system-wide, management-relevant questions and would update and maintain a standardized, multi-year avian predation dataset (2008–2025). In addition to estimates of predation, estimates of survival or total mortality ($1 - \text{survival}$) within these same temporal- and spatial-scales would be generated as part of this Objective, providing data to evaluate relative changes in survival and how those changes are associated with changes in predation by colonial waterbirds (see also Payton et al. 2020 for details). This work would follow established protocols and methods so that the results obtained in 2025 are directly comparable to those generated in previous years. A brief description of the methods used to tag, recover, and analyze smolt PIT tags from bird colonies to estimate predation and survival rates are provided below:

Task 3.1. RIS Steelhead PIT-tagging: In collaboration with Chelan County PUD, we propose to continue to PIT tag ~7,000 Upper Columbia River steelhead at Rock Island Dam (RIS) in 2025. Based on the run-timing of steelhead smolts at RIS in years past, we anticipate daily tagging would commence in mid-April and end in mid-June. Steelhead would be randomly selected for tagging (i.e., tagged regardless of their condition, origin, and size) and tagged in concert with, and in proportion to, the run at-large (tagged and untagged; see Evans et al. 2014). The sampling approach used at RIS ensures that steelhead from all natural spawning stocks (Entiat, Methow, Okanogan, and Wenatchee rivers) that enter the Priest Rapids Project are included in the sample and that smolts of all sizes, conditions, and rear-types are included in the sample in proportion to their relative abundance; criteria that allows us to make credible inference about the entire ESA-listed UCR steelhead population within the Priest Rapids Project. To assess rear-type more accurately, all presumed wild steelhead (fish with completely intact fins) would also be scanned for the presence of a coded wire tag. The protocol used to sample and tag steelhead at RIS also generates a long-term, standardized dataset in which to evaluate relative

changes in predation and survival across multiple river reaches, years, and management periods.

Note: In 2024, record low numbers of steelhead were collected at the RIS fish trap ($n = 3,884$; annual average = 13,050 during 1997–2023). As a result, only 3,800 fish were PIT-tagged as part of this study, also a record low number and well short of the target goal of 7,000 tagged fish. In 2025, ~ 2,000 steelhead will be sourced from RIS (and possibly other sites) for use in steelhead survival studies in the Priest Rapids Project. Assuming more normal or typical numbers of steelhead are collected in the RIS trap in 2025, there should be adequate numbers of steelhead for both studies (avian predation, survival).

Task 3.2. PIT tag recovery: Using previously established methods (see Evans et al. 2012), we would scan piscivorous waterbird colonies for smolt PIT tags and calculate colony-specific and ESU/DPS-specific predation rates. Portable pole-mounted antennas would be used to detect PIT tags *in situ* as soon as birds disperse from their breeding colonies, generally beginning in late-July or early-August. PIT tags would be detected at each colony site by systematically scanning the entire area occupied by birds during the breeding season (referred to as a “pass”) with multiple passes conducted at each colony. The area scanned by researchers would be determined based on aerial photography of the colony site and visits to the colony by researchers during the breeding season as part of *Objective 2* (see *above*).

Task 3.3. Survival and predation rate analyses: Following previously established methods (Hostetter et al. 2015; Payton et al. 2019), we would estimate predation rates and survival rates based on recoveries of smolt PIT tags on bird colonies and detections of live tagged fish during outmigration to the Pacific Ocean. Predation rates will be derived using the proportion of PIT tags found on each colony from the available population of PIT-tagged fish (i.e., smolt availability based on releases/detections of tagged fish upstream of the colony of interest), and then adjusting by the probability that a consumed PIT tag was subsequently deposited on-colony (i.e., deposition probability) and detected by researchers following the breeding season (i.e., detection probability). The mark-recapture-recovery model also incorporates live detections of tagged fish (e.g., at downstream in-river PIT tag arrays) in space and time, providing a way to jointly estimate predation and survival probabilities (see Payton et al. 2019). Results will be used to compare smolt losses amongst colonies and across years, data critical to determining the over-all efficacy of the IAPMP and management of avian predation elsewhere in the CRB. Use of these well-established methods will ensure that estimates of predation rates generated as part of this study are directly comparable to estimates from years past.

Finally, we propose to estimate predation and survival rates based on a fish’s rear-type (hatchery, wild) for steelhead smolts, to the extent adequate sample sizes exist. To evaluate if one group of fish (hatchery, wild) is more susceptible to bird predation than the other group, comparisons of rates will be made on a weekly and annual basis and then analyzed across the study period (year). This approach uses the standardized model with a common estimate of deposition and detection across categories, which facilitates increased precision (i.e., smaller bounds around the estimate; see also Evans et al. 2016). To supplement analyses based on steelhead smolts tagged at RIS, we will also estimate predation and survival of hatchery and wild steelhead smolts passively detected at the Rock Reach Bypass facility and from select release or detection sites (e.g., barge antennas) in tributary systems, with guidance from the PRCC and to the extent adequate sample sizes exist. In addition to predation and survival estimates, estimates of recapture probabilities at downstream detection sites (e.g., dams, net trawl, barges, pile dikes) and differential survival amongst and between groups or cohorts will be investigated, to extent adequate data exists.

Note: Funding from BPA will be used to evaluate the system-wide, cumulative effects of avian predation, thereby reducing the analytical cost of this objective. Funding from BPA would also be used to quantify to what degree reductions in avian predation rates on steelhead and other ESA-listed species and populations result in higher rates of fish survival (i.e., to what degree predation is an additive source of fish mortality); a question that is paramount to understanding the potential efficacy of management aimed at reducing avian predation in the CRB.

Objective 4. Provide technical assistance to GPUD/PRCC in developing and adaptively managing short- and long-term plans to reduce avian predation on juvenile salmonids.

As part of this objective, we would continue to serve as technical advisors to GPUD/PRCC and other regional managers on issues concerning avian predation. This assistance would include, but is not limited to, (1) attending meetings with regional stakeholders, (2) providing requested in-season information/data, (3) giving presentations of research results, and (4) providing recommendations regarding emerging issues and adaptive management strategies.

Objective 5. Conduct an analysis of avian predation on double-tagged steelhead in the Priest Rapids Project in 2025.

Recoveries of PIT tags from fish that are double tagged (acoustic, PIT), coupled with the last known detections of live fish passing telemetry arrays, can be used to estimate predation and survival at precise spatial and temporal scales (Evans et al. 2016). Data can also be used to quantify the foraging range of birds from specific colonies, to identify foraging hotspots, and determine what proportion of all smolt losses were due to avian predation in space and time. In 2025, survival studies that utilize double-tagged steelhead in the Priest Rapids Project are scheduled to commence, providing a unique opportunity to estimate avian predation at much finer spatial and temporal scales than what is possible with PIT-tagged only fish. Detections of live PIT-tagged only fish are generally limited to dams with bypass facilities or in-river PIT tag arrays, sites where detection probabilities are often low, like at the McNary Dam juvenile bypass facility. Conversely, extremely high detection probabilities (close to 1.0 or 100%) of acoustic tags at in-river arrays result in the ability to generate precise estimates of predation and survival (Evans et al. 2016).

We propose to use the previously published methods of Evans et al. (2016) to estimate colony-specific and cumulative predation of double-tagged steelhead, including an analysis of predation hotspots and high-resolution estimates of where, spatially, and when, temporally, steelhead were consumed by specific avian predator species and colonies that foraged in the Priest Rapids Project in 2025. Analyses will extend to river reaches outside of the Project, to the extent telemetry arrays and tag life allow. [Appendix A, Table A.1 and A2 \(below\)](#) provide examples of results from Evans et al. (2016). Analyses on double-tagged smolts in the Priest Rapids Project were also conducted in 2016 (Roby et al. 2017). Several new colonies in middle Columbia River, however, have formed since 2016, including the Lenore Lake tern colony and the Hanford Island cormorant colony. Finally, results of this project will quantify to what degree avian predation limited the survival of steelhead within the Priest Rapids Project relative to other, non-avian sources of mortality in the Project.

Note: Completion of Objective 5 is contingent on scanning bird colonies for fish tags as part of Objective 3. Completion also assumes telemetry data collected in 2025 by other researchers is made available for use in this analysis.

SCHEDULE

Feb – Mar 2025	Hire field crew & submit research permit applications (WDFW, USFWS, BOR)
Apr – Jul 2025	Colony monitoring
Apr – Jun 2025	PIT-tagging of steelhead at Rock Island Dam
Jul – Oct 2025	PIT tag recovery on bird colonies
Jan 2026	Submit draft annual report
Mar 2026	Submit final annual report

DELIVERABLES

Research results would be presented in (1) an Annual Report, (2) periodic in season reports, (3) peer-reviewed journal articles, and (4) presentations at regional planning meetings and other professional meetings.

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COST BY OBJECTIVE

Estimated cost of the work proposed to the GPUD/PRCC in 2025 are provided by objective (see [below](#)). As was the case in previous years, most of the funding for avian predation RM&E in the Columbia River Basin in 2025 will come from other sources (e.g., BPA). Costs in 2025 are like those in 2024, but include an additional fixed-wing aerial survey as part of Objective 1 and the costs to analyze double-tagged smolts as part of Objective 5 (a newly proposed objective).

Objective	Description	Estimated Cost
1	Evaluate response of Caspian terns and other piscivorous colonial waterbirds to nest dissuasion activities on Goose Island and elsewhere in Potholes Reservoir	\$59,855
2	Determine changes in the nesting distribution and colony size of Caspian terns and other piscivorous colonial waterbirds on or near the mid-Columbia River	\$75,469
3	Determine changes in survival and predation rates on salmonid smolts by Caspian terns and other piscivorous colonial waterbirds nesting on or near the mid-Columbia River	\$173,249
4	Provide technical assistance to GPUD/PRCC in developing and adaptively managing short- and long-term plans to reduce avian predation on juvenile salmonids	\$13,379
5	Conduct an analysis of avian predation on double-tagged steelhead in the Priest Rapids Project in 2025.	\$36,549
	Total Cost	\$358,501

APPENDIX A: Examples of avian predation results from double-tagged smolts in 2014

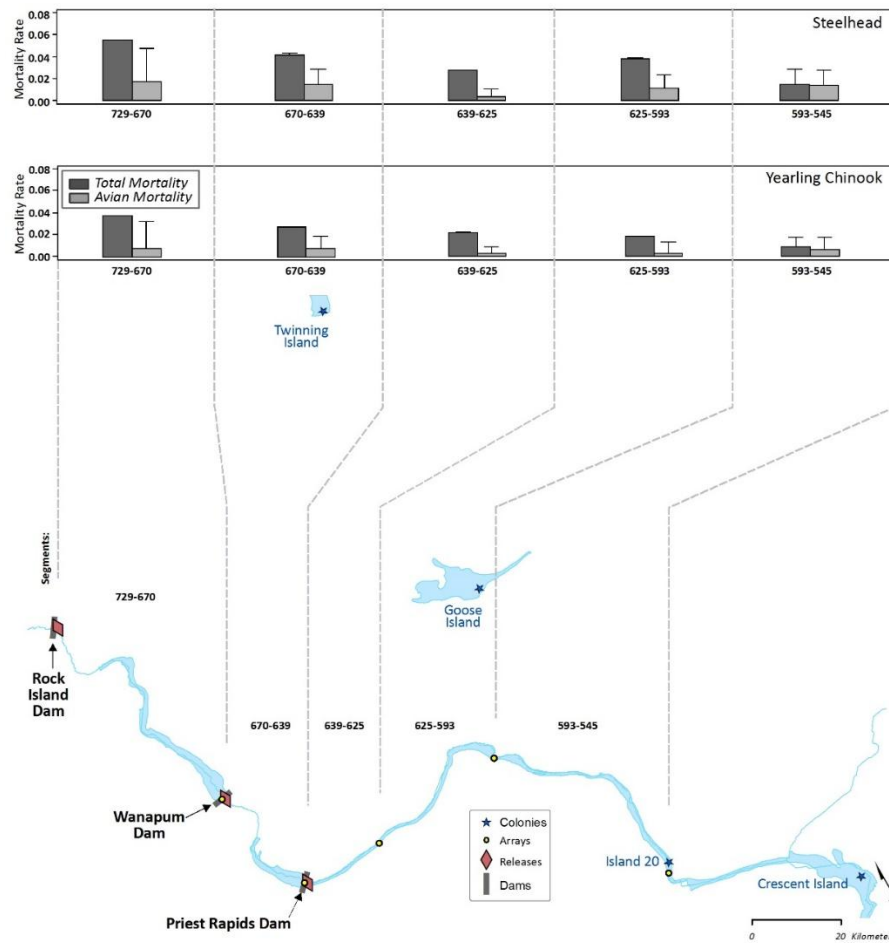


Figure A.1 Estimated total mortality and mortality due to predation by birds from four breeding colonies on tagged smolts in a section of the middle Columbia River in 2014. Locations of smolt release sites (red diamonds), acoustic arrays (yellow dots), bird colony sites (blue stars), and hydroelectric dams (grey bars) are shown. Figure from Evans et al. (2016).

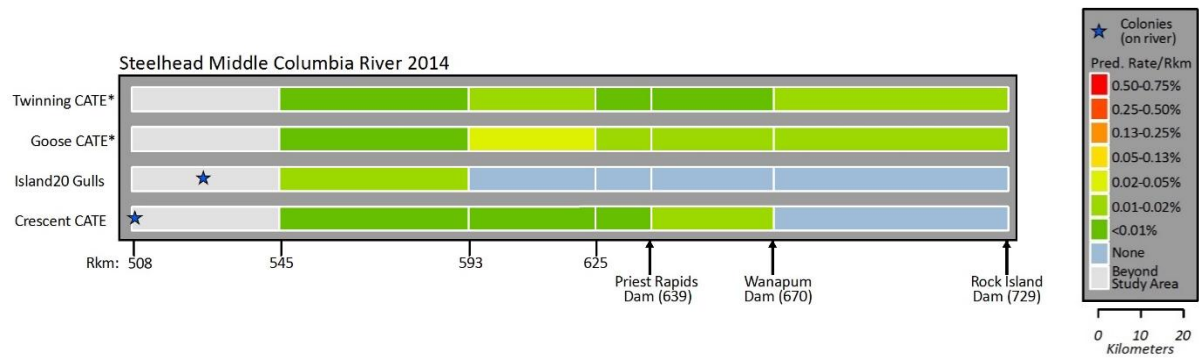


Figure A.2. Bird colony-specific locations of predation on tagged juvenile steelhead in the middle Columbia River in 2014. Results are depicted as predation rates per river kilometer (Rkm). Species of fish-eating colonial waterbirds evaluated include Caspian terns (CATE), double-crested cormorants (DCCO), California and ring-billed gulls (Gulls), and American white pelicans (AWPE). An asterisk next to a colony site denotes that the colony is located off-river. Figure from Evans et al. (2016).

AVIAN PREDATION IN THE COLUMBIA PLATEAU REGION, 2024

**PRESENTATION TO THE PRIEST RAPIDS
COORDINATING COMMITTEE**



January 13, 2024

PRESENTATION OUTLINE



BACKGROUND

Inland Avian Predation Management Plan (IAPMP)
Predation by other avian predator species



STUDY GOALS

Efficacy of IAPMP
Colony locations and sizes
Predation rates



PRELIMINARY RESULTS

Colony monitoring
Rock Island Dam steelhead tagging
Colony-specific and cumulative predation rates
Hatchery program predation rates

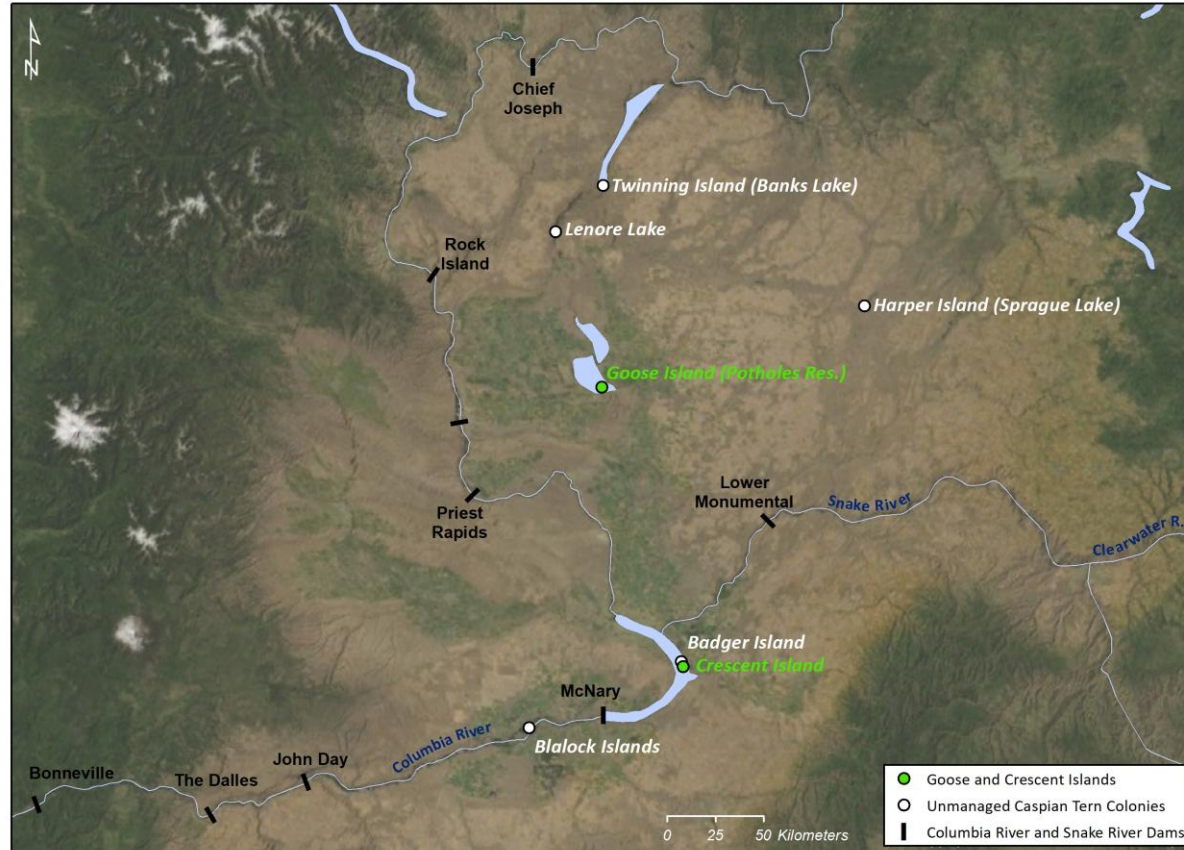


BACKGROUND

Inland Avian Predation Management Plan



HISTORICAL TERN COLONY LOCATIONS (CPR)



INLAND AVIAN PREDATION MANAGEMENT PLAN



NEST DISSUASION

Passive & active dissuasion to prevent tern nesting on Goose and Crescent islands



COLONY MONITORING

Changes in tern nesting distribution and colony size in the CPR



PREDATION MONITORING

Changes in tern predation rates on salmonid smolts in the CPR



ADAPTIVE MANAGEMENT

At both managed and unmanaged tern colonies in the CPR



ADAPTIVE MANAGEMENT TRIGGERS (CPR)

Tern Colony Size

- < 40 breeding pairs - per colony
- < 200 breeding pairs - regionwide

Tern Predation Rates

- < 2% predation rate - per colony
- < 5% predation rate - regionwide



OTHER PISCIVOROUS WATERBIRD SPECIES (CPR)

- **Double-crested Cormorants**
 - High per capita predation effects
- **American White Pelicans**
 - Historically one colony CPR (Badger Island)
 - Consumes both juvenile and adult salmonids
- **California and Ring-bill gulls**
 - Most numeric but not strictly piscivorous
- **Great Blue Herons and Great Egrets**
 - Limited data
- **Other species**
 - Limited data
 - Less numeric



2024 PRCC FUNDED PROJECT GOALS

OBJECTIVE 1

Assess efficacy of
IAPMP

OBJECTIVE 2

Assess changes in
colony size
(terns and other
predator species)

OBJECTIVE 3

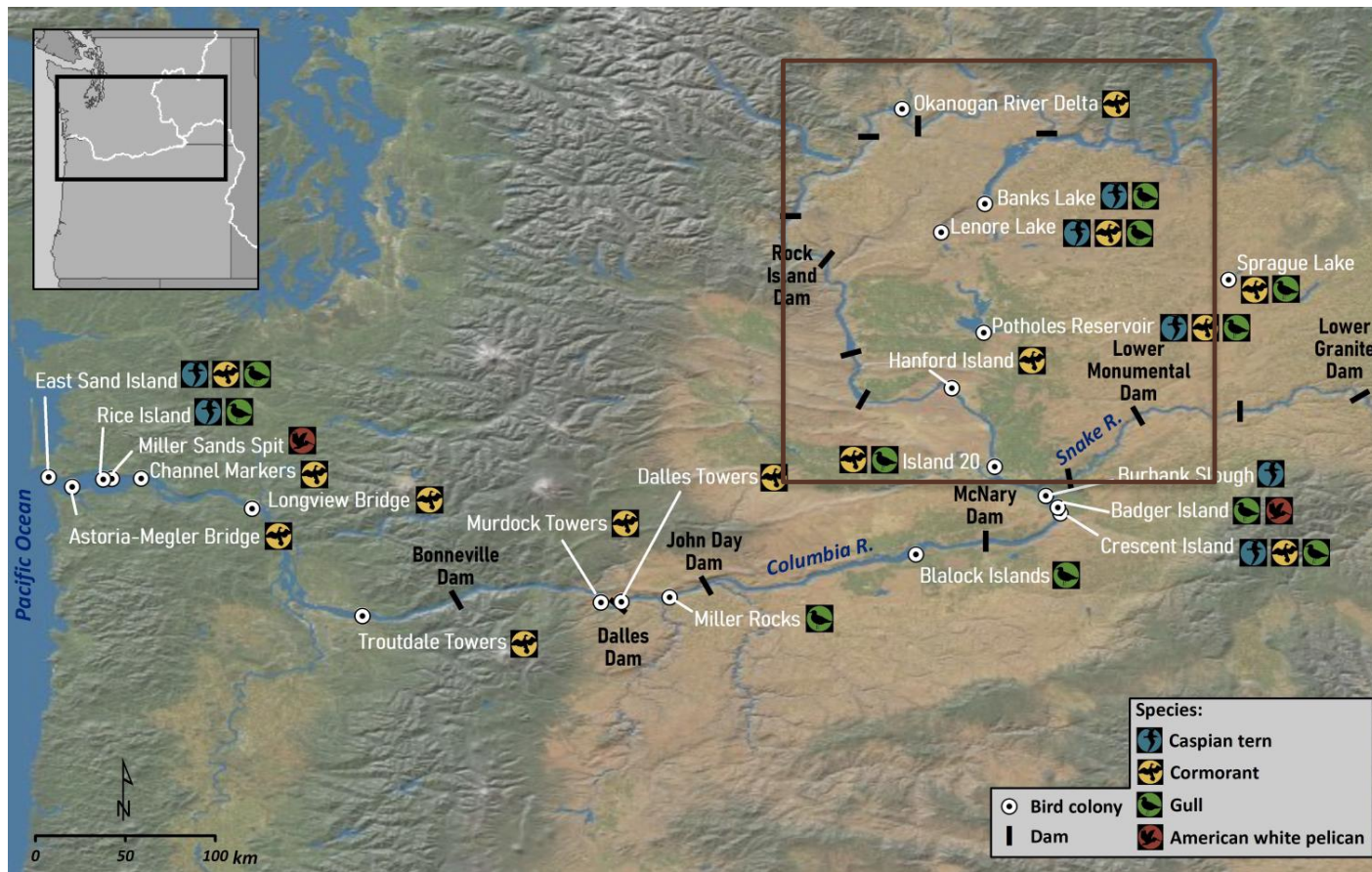
Assess changes in
predation rates
(terns and other
predator species)

OBJECTIVE 4

Provide technical
assistance
(terns and other
predator species)

- PRCC funding was for colonies within foraging distance of the Priest Rapids Project in the Mid-C
- BPA funding was for colonies within foraging distance of the mainstem Columbia and Lower Snake Rivers

STUDY AREA (Columbia River Basin)



2024 PRELIMINARY RESULTS

Colony Sizes



BOR – APHIS

- Limited tern nesting to < 40 pairs, with a peak count of 23 pairs
- Continued high fidelity to Goose Island, with prospecting terns observed throughout the breeding season
- Report from BOR in-prep



ADAPTIVE MANAGEMENT (North Potholes)

PRCC FUNDED RM&E DISCOVERS NEW COLONY

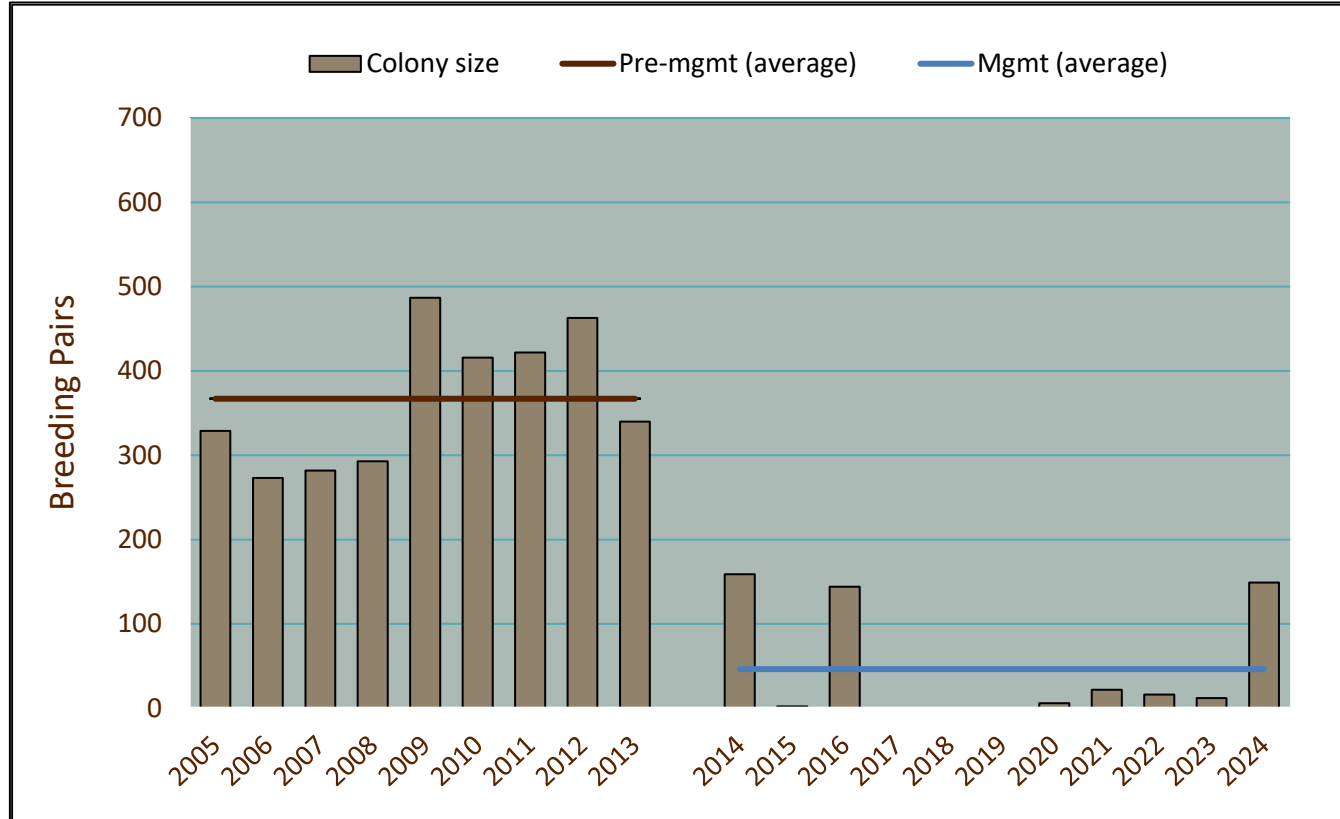
Aerial survey located an incipient tern colony in North Potholes Reservoir on 18 May 2024

ADAPTIVE MANAGEMENT IMPLEMENTED

U.S. Bureau of Reclamation via APHIS passively dissuaded terns from the island within 72 hours



TERN COLONY SIZE (Goose & surrounding islands)

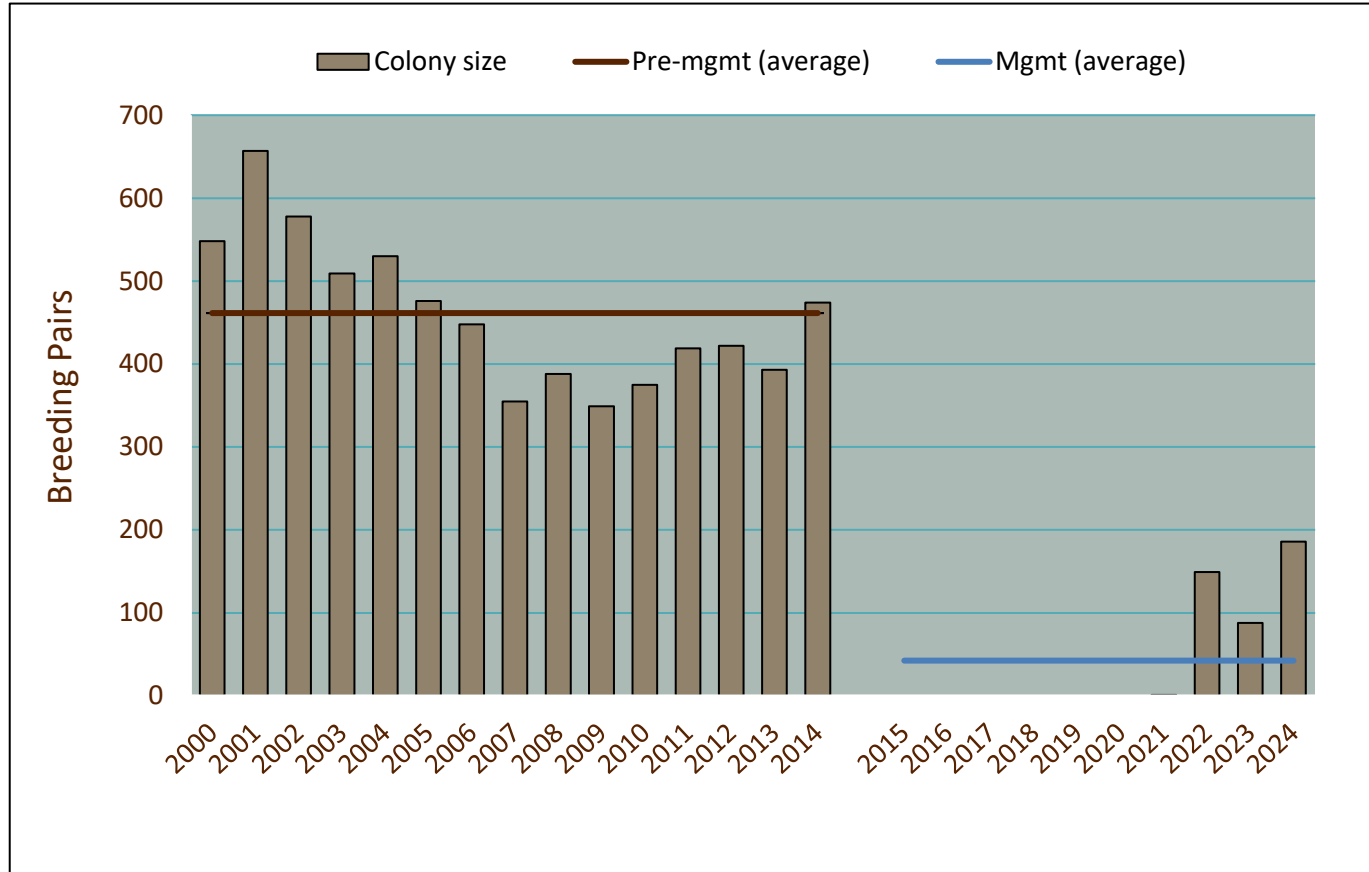


Preliminary

MANAGEMENT & ADAPTIVE MANAGEMENT (Crescent Island)



TERN COLONY SIZE (Crescent Island)

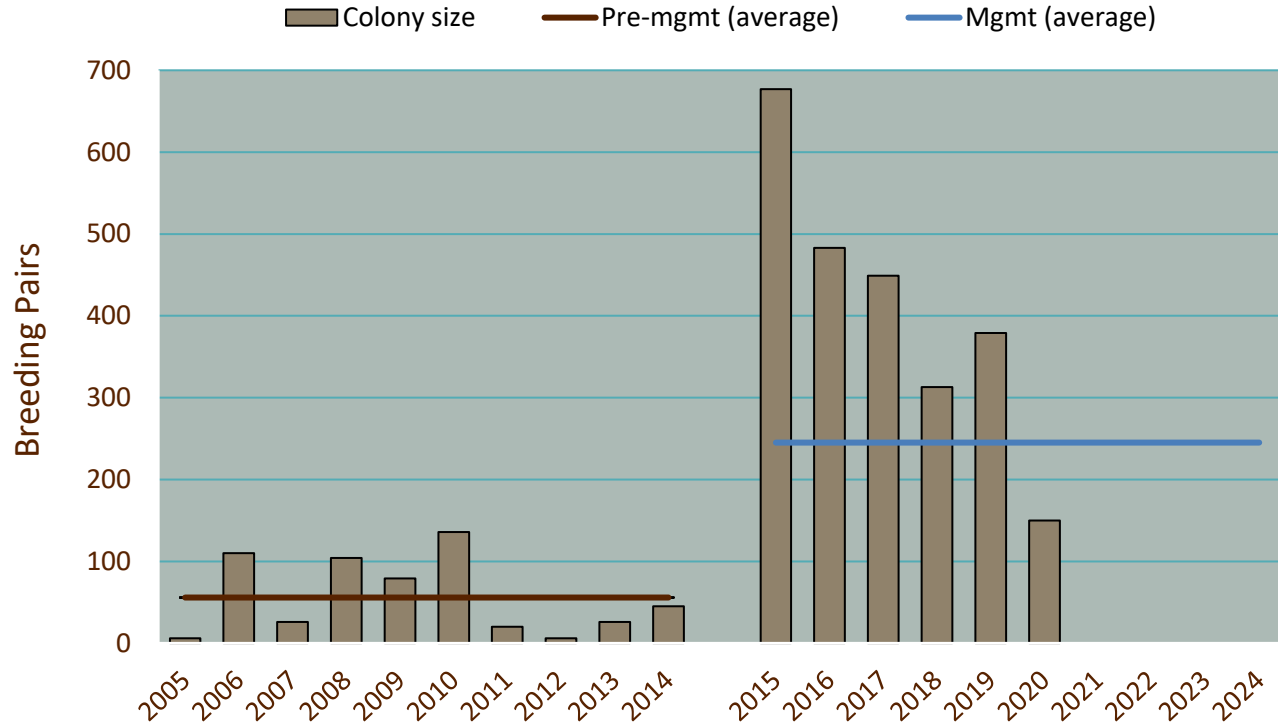


Preliminary

ADAPTIVE MANAGEMENT (Blalock Islands)



TERN COLONY SIZE (Blalock Islands)

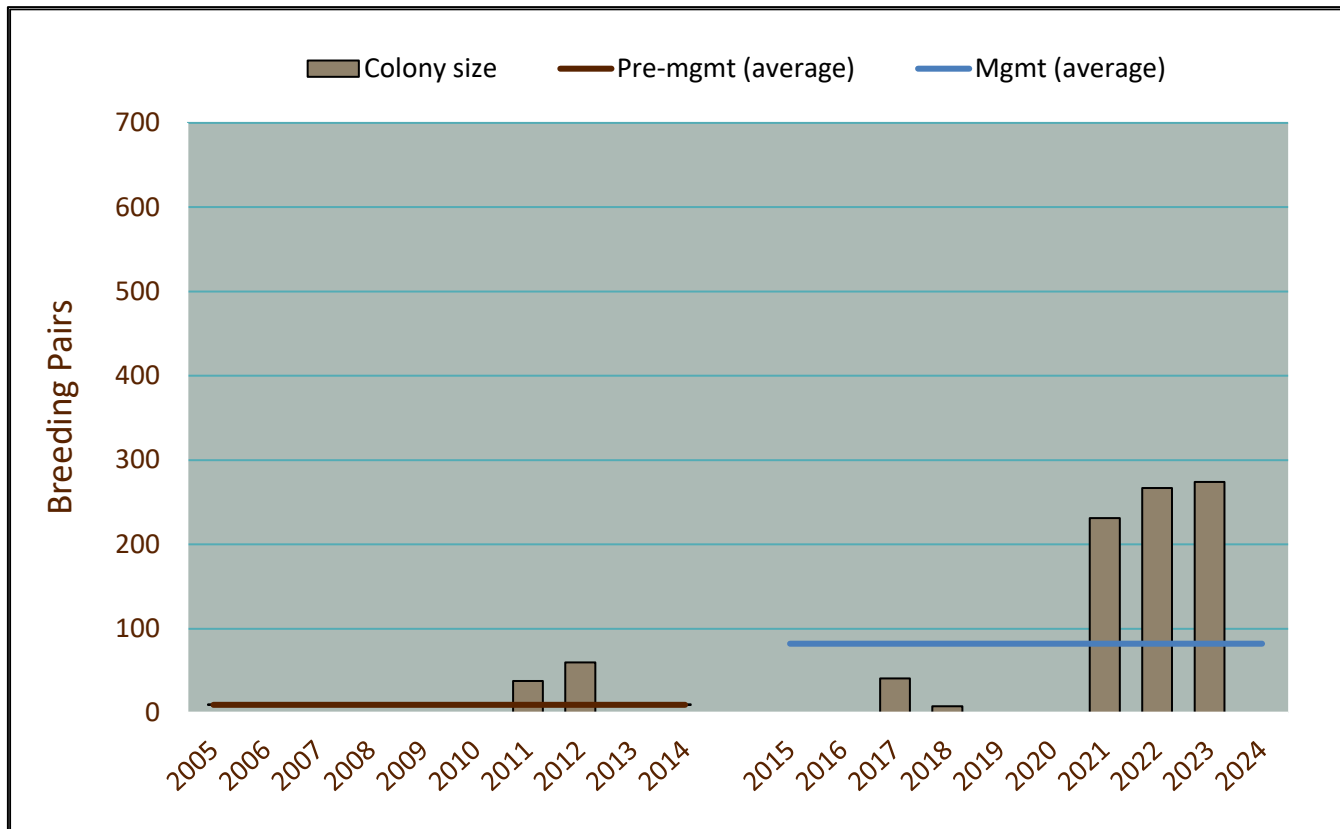


Preliminary

ADAPTIVE MANAGEMENT (Badger Island)



TERN COLONY SIZE (Badger Island)

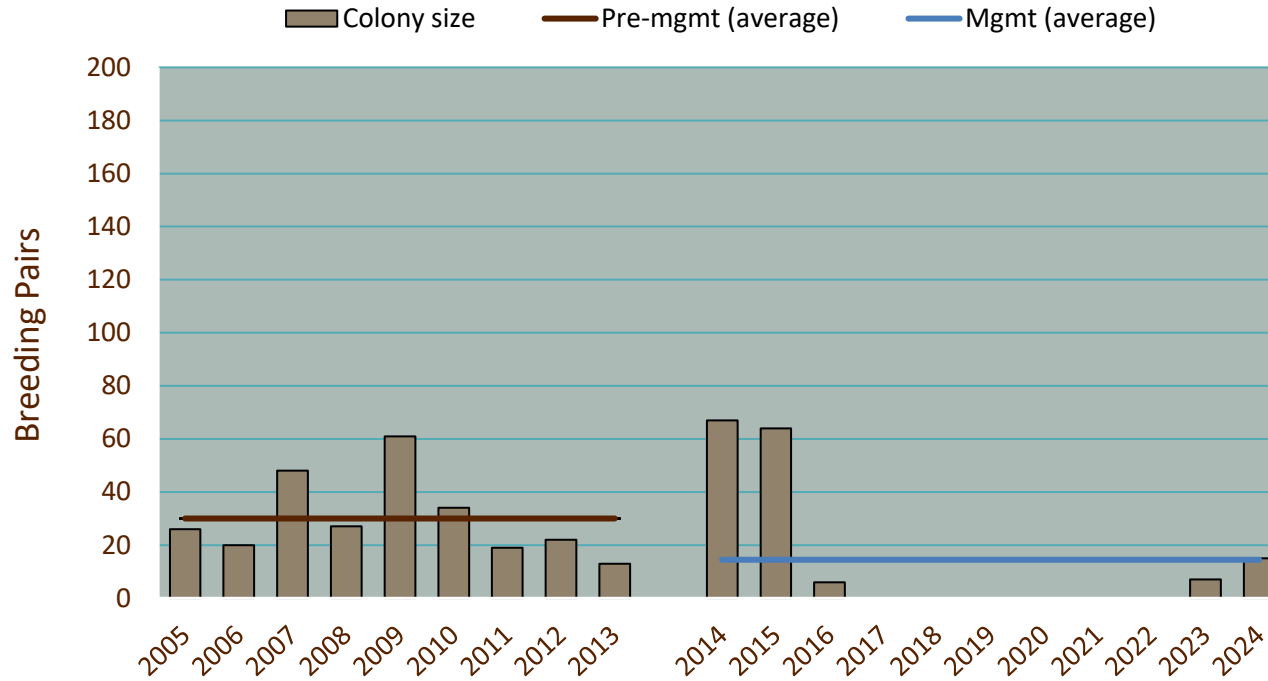


Preliminary

NO ADAPTIVE MANAGEMENT (Banks Lake)



TERN COLONY SIZE (Banks Lake)

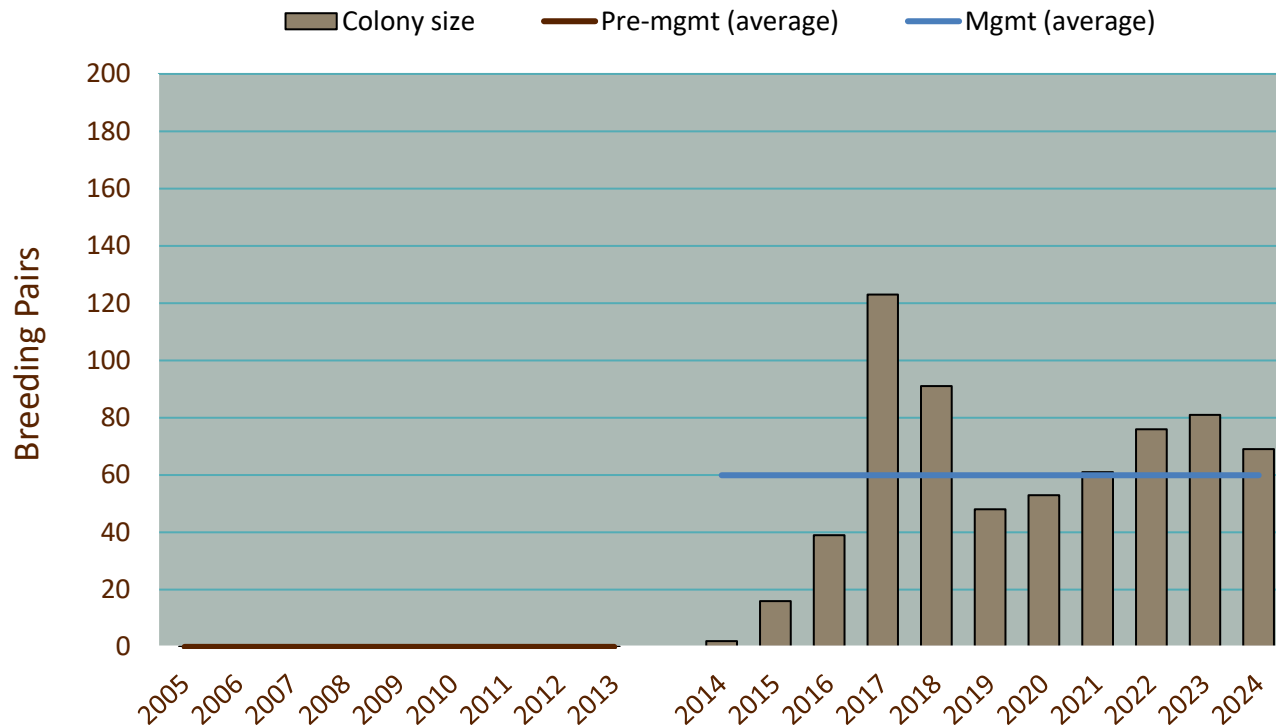


Preliminary

NO ADAPTIVE MANAGEMENT (Lenore Lake Islands)



TERN COLONY SIZE (Lenore Lake Islands)



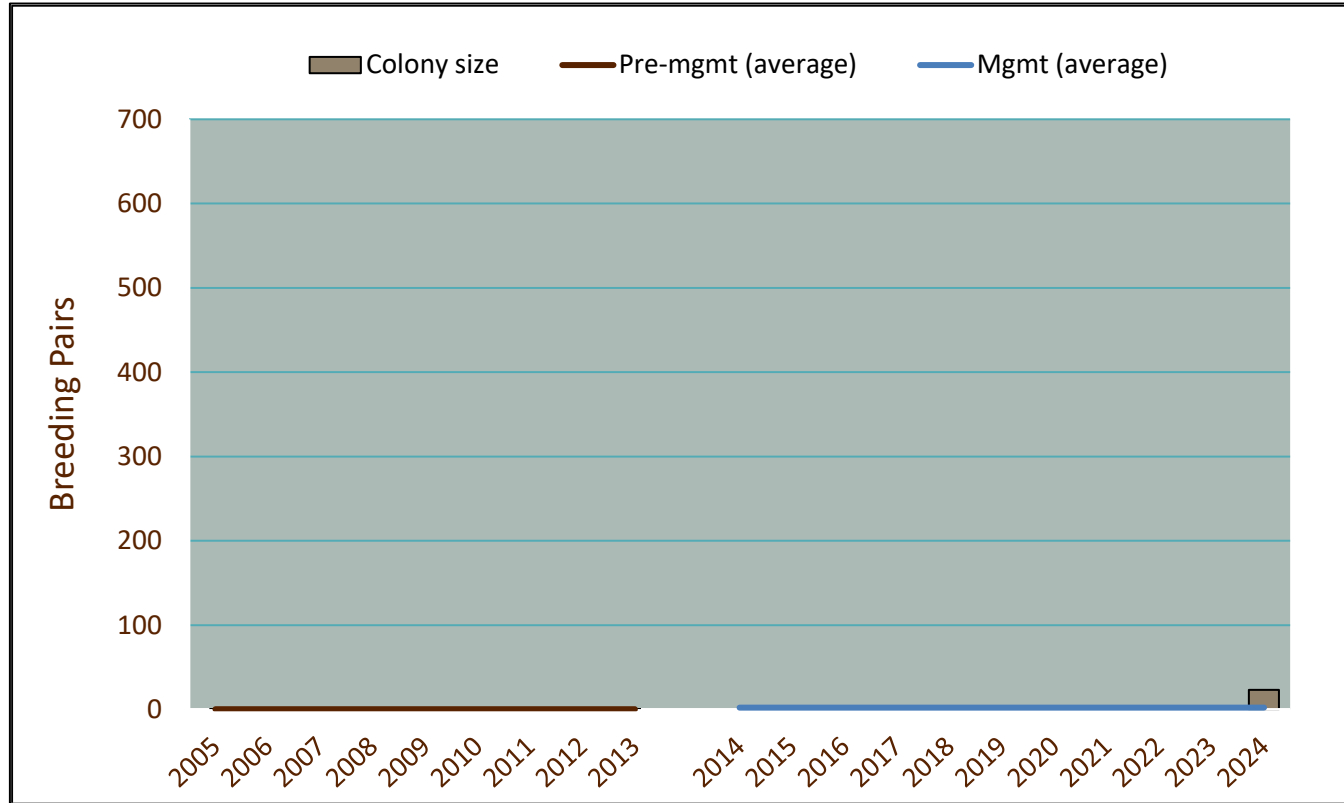
Preliminary

TERN COLONY SIZE (Burbank Slough)



Preliminary

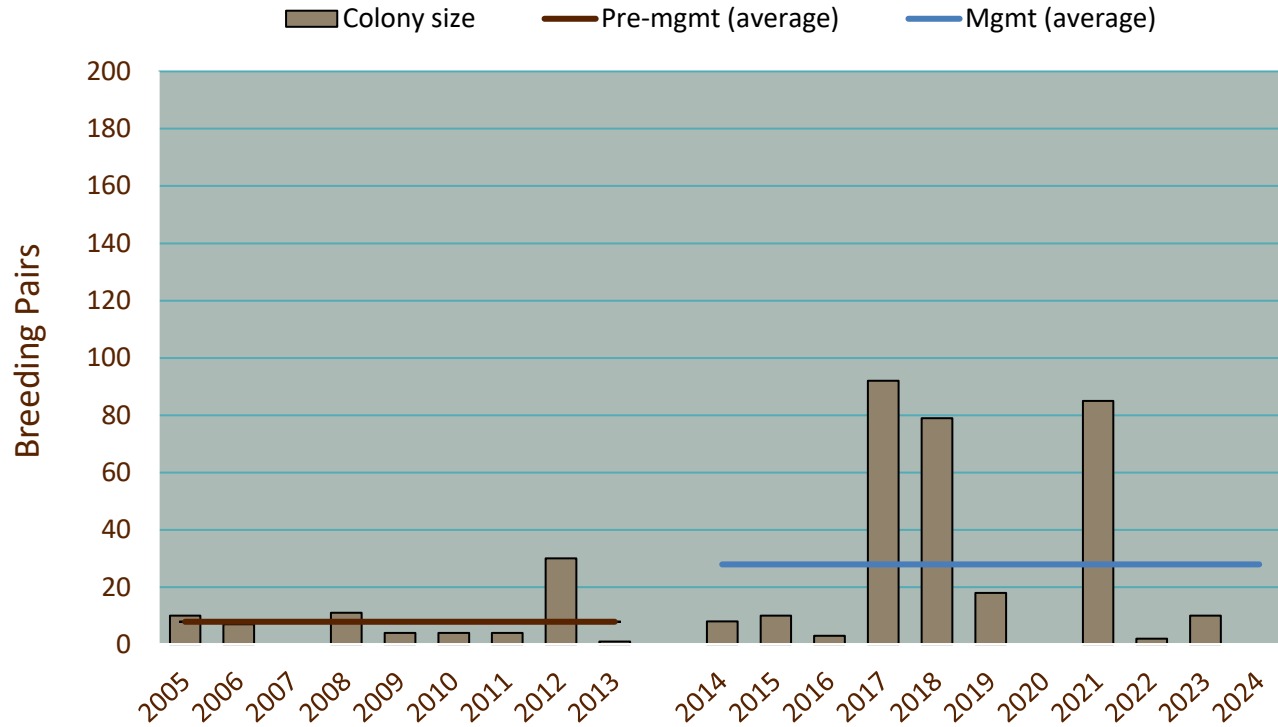
NO ADAPTIVE MANAGEMENT (Burbank Slough)



NO ADAPTIVE MANAGEMENT (Sprague Lake, Harper Island)

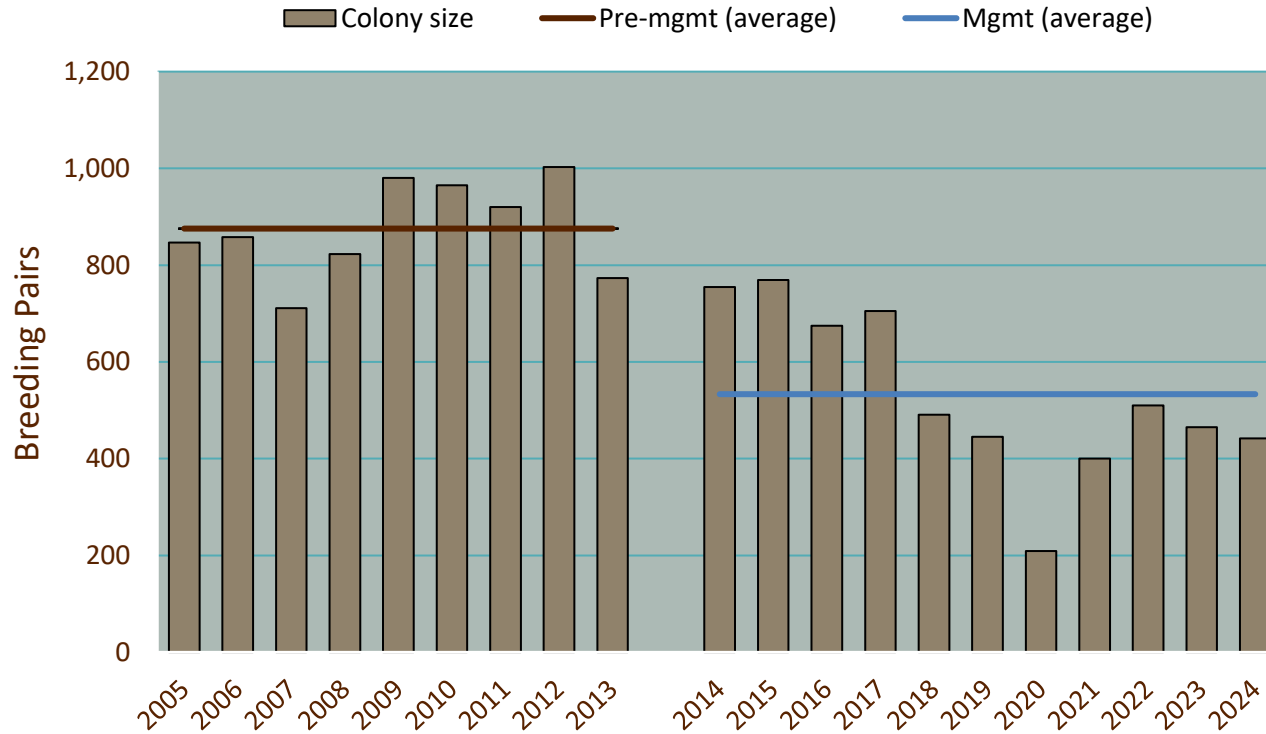


TERN COLONY SIZE (Harper Island)



Preliminary

TERN COLONY SIZE (All CRP)



Preliminary

2024 COLONY SIZE (Other Avian Species, CPR)

Colony *	Gulls	Cormorants	Pelicans
Miller Rocks (CR)	3,707		
Blalock Islands (CR)	1,161 ↓		
Crescent Island (CR)	3,617 ↑	629 ↑	36 ↑
Badger Island (CR)	1,026 ↓		3,205 ↑
Foundation Island (CR)		0 ↓	
Island 20 (MC)	7,559 ↑		
Hanford Island (MC)		89	
Okanogan (MC)		54	
Sprague Lake (Off-river)		302 ↓	

Arrow indicates > 10% increase or decrease relative to 2023

* List limited to colonies where PIT tags were recovered in 2024; complete list of all monitored colonies with counts will be provided in the 2024 Annual Report to BPA/PRCC



Preliminary

SUMMARY OF RESULTS (CPR Colony Monitoring)



STRONG FIDELITY OF TERNS TO REGION

Terns still attempting to nest on Goose Is. and the Crescent Island colony is now re-established



ADAPTIVE MANAGEMENT UNDERWAY

Occurring at colonies in Potholes R. and Blalocks, and to a lesser degree Crescent and Badger islands. No adaptive management at other sites.



39% DECLINE IN REGIONAL TERN POP (2024)

Breeding population declined as much as 76% in 2020. Total number of terns remains above threshold target of 200 pairs (442 pairs in 2024)



OTHER AVIAN PREDATORS MORE NUMEROUS

Gulls most numerous, followed by pelicans. Cormorant colony at Crescent now largest in CPR (emerging issue)



2024 PRELIMINARY RESULTS

Rock Island Tagging Effort



Why Rock Island Dam?

- Upper-most foraging range for terns and most other colonies of concern
 - Can determine when fish were consumed – important for detection probabilities
 - Full impact – mortality prior to exposure to birds masks the full impact of bird predation
- Start of the Priest Rapids Project
 - **We know** how many fish are alive
 - **We know** when they are entering the project
- Representative sample
 - Contains **all** elements of UCR steelhead population at-large
 - Approximate “random” sampling (all rear-types, conditions, sizes, migrant-times)
 - Can sample in proportion to run (tagged and untagged)
- Long-term database and time series (2008–2024)
 - Constant reference frame (spatial scale and sampling scheme)
 - Allows for evaluation of changes in predation and survival over time; a primary goal of the PRCC funded study

Inclusion of other tagging programs

- Rocky Reach Juvenile Bypass Facility

Pros: Large samples sizes, “Free” data

Cons: Opportunistic Sample

- Fish tagged upstream, not at RRJ (i.e., not a random sample of fish)
- Mostly hatchery fish, $\approx 1/2$ from just three release sites
- Need to weight estimates for run at-large (tagging and untagged); adds uncertainty to estimates of predation and survival
- Availability in Priest Rapids Project uncertain (see 2023 RRJ vs RIS analysis in RTR’s 2023 Annual Report to the PRCC, Appendix C)

- Wenatchee Barge

Pros: Potentially underrepresented populations

Cons: Availability Uncertainties

- Feasibility study for 2025?

2024 Rock Island Steelhead Tagging Effort

Adipose Clipped (%)	Eroded Fins (%)	Fully Intact Fins (%)	All *
2,467 (65%)	573 (15%)	766 (20%)	3,800



Presumed Hatchery



Presumed Wild

Classification (#)	CWT (%)
Presumed wild (766)	4 (0.5%)
Presumed Hatchery (340**)	60 (17.6%)

* Record low collection numbers of steelhead and other smolt species in 2024.

** A subsample of ~ 50 hatchery fish per week were scanned for CWT, while all (100%) presumed wild fish were scanned for a CWT.

2024 PRELIMINARY RESULTS

Predation Rates



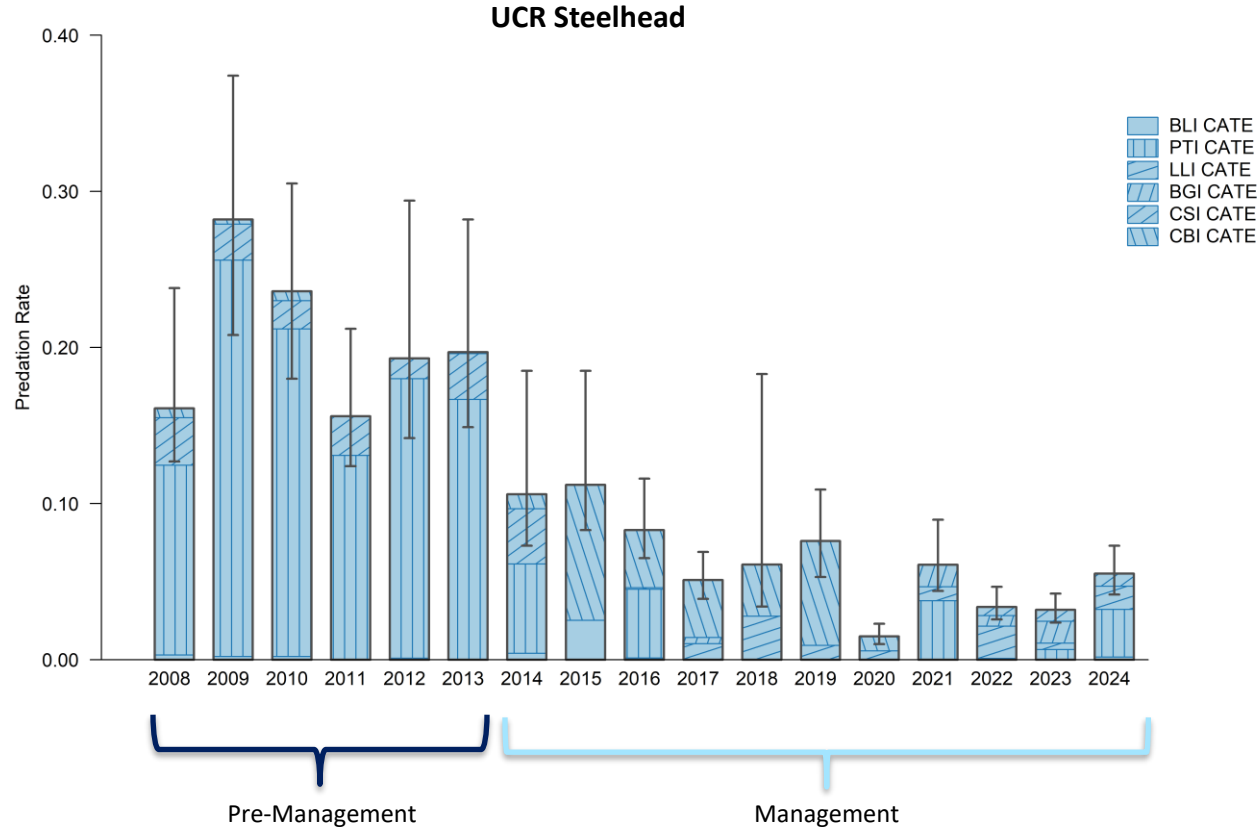
2024 TERN PREDATION RATES (CPR)

ESU/DPS	Goose Island	North Potholes	Lenore Lk	Crescent Island	Burbank SI
UCR Steelhead	1.3% (0.7–2.6)	1.7% (1.0–3.2)	1.5% (0.9–2.6)	0.9% (0.4–1.7)	0.1% (0.1–0.4)
SR Steelhead	< 0.1%	< 0.1%	< 0.1%	0.6% (0.2–1.3)	< 0.1%
SR Sockeye	NA	NA	NA	NA	NA
SR Sp/Su Chinook	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
UCR Sp Chinook	NA	NA	NA	NA	NA
SR Fall Chinook	< 0.1%	< 0.1%	< 0.1%	0.2% (0.1–0.7)	< 0.1%

- All estimates were < 2.0% per ESU/DPS, per colony, achieving target goal
- Cumulative estimates (all colonies combined) were > 5.0%, exceeding threshold

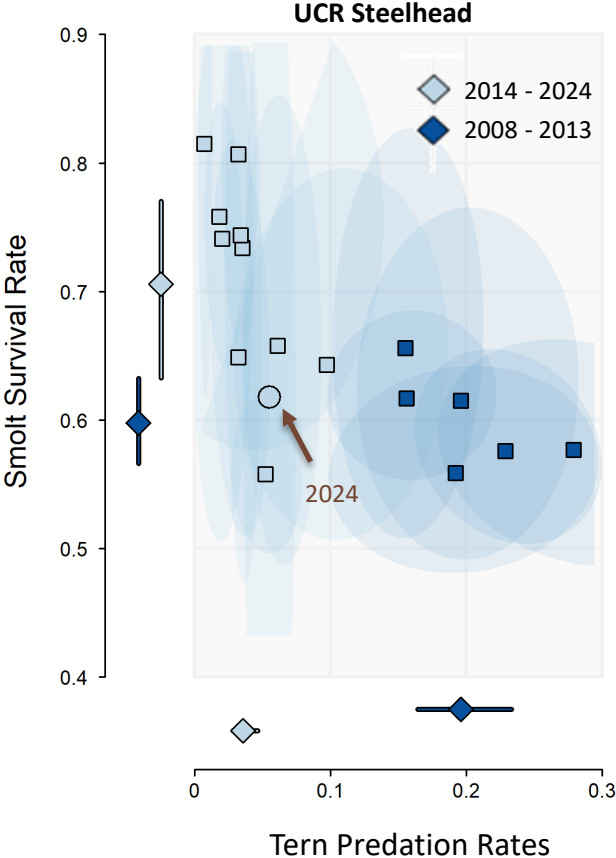
Preliminary

TERN PREDATION RATES (CPR)



Preliminary

TERN PREDATION RATES AND SURVIVAL (CPR)



Preliminary

2024 GULL CONSUMPTION (CPR)

ESU/DPS	Island 20	Badger Is.	Crescent Is.	Blalock Is.	Miller Rocks Is.
UCR Steelhead	8.5% (1.8–4.6)	0.7% (0.3–1.3)	2.5% (1.2–4.8)	NA	NA
SR Steelhead	1.0% (0.3–2.8)	1.1% (0.4–3.6)	2.3% (0.9–5.1)	1.7% (0.4–4.7%)	5.2% (2.2–10.8)
SR Sockeye	NA	NA	NA	NA	NA
SR Sp/Su Chinook	1.0% (0.2–3.6)	0.4% (0.1–1.7)	1.3% (0.2–4.4)	0.5% (0.2–1.1)	0.5% (0.2–1.2)
UCR Sp Chinook	NA	NA	NA	1.5% (0.4–4.1)	1.4% (0.2–4.7)
SR Fall Chinook	0.6% (0.1–1.9)	0.1% (0.1–0.6)	0.7% (0.1–2.5)	0.7% (0.1–2.7)	1.5% (0.3–4.4)

Preliminary

2024 CORMORANT PREDATION (CPR)

ESU/DPS	Handford Is.	Island 20	Crescent Is.	Murdock Towers
UCR Steelhead	0.2% (0.1–0.9)	0.1% (<0.1-0.4)	0.7% (0.2–1.9)	NA
SR Steelhead	< 0.1%	< 0.1%	2.6% (1.1–6.4%)	0.7% (0.1–3.3%)
SR Sockeye	NA	NA	NA	NA
SR Sp/Su Chinook	< 0.1%	< 0.1%	2.5% (1.4–4.8%)	0.3% (0.1–1.2%)
UCR Sp Chinook	NA	NA	NA	1.9% (0.5–6.0%)
SR Fall Chinook	< 0.1%	< 0.1%	0.4% (0.1–1.8%)	0.9% (0.3–2.3%)

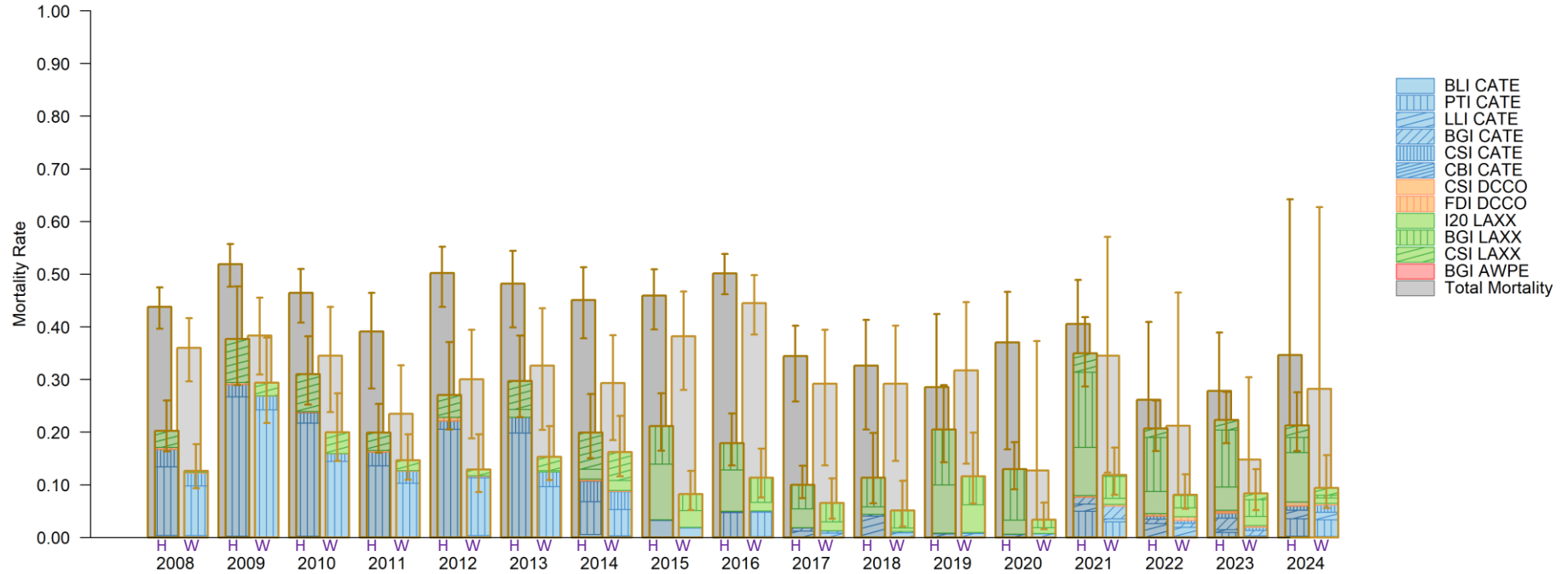
2024 PELICAN PREDATION (CPR)

ESU/DPS	Badger Island
UCR Steelhead	0.2% (0.1–0.7)
SR Steelhead	1.0% (0.2–3.2)
SR Sockeye	NA
SR Sp/Su Chinook	0.2% (0.1–1.2)
UCR Sp Chinook	NA
SR Fall Chinook	0.2% (0.1–1.1)

- Impacts on select stocks (e.g., Yakima, Umatilla, and URB Chinook) from tributary systems are consistently higher than on UCR & SR smolts (Evans et al. 2024)
- Consume adult-sized salmonids, especially sockeye, and impacts were substantial in some years (upwards of 8% of upstream migrants, 47,000 adults annually {Payton et al. in-press})

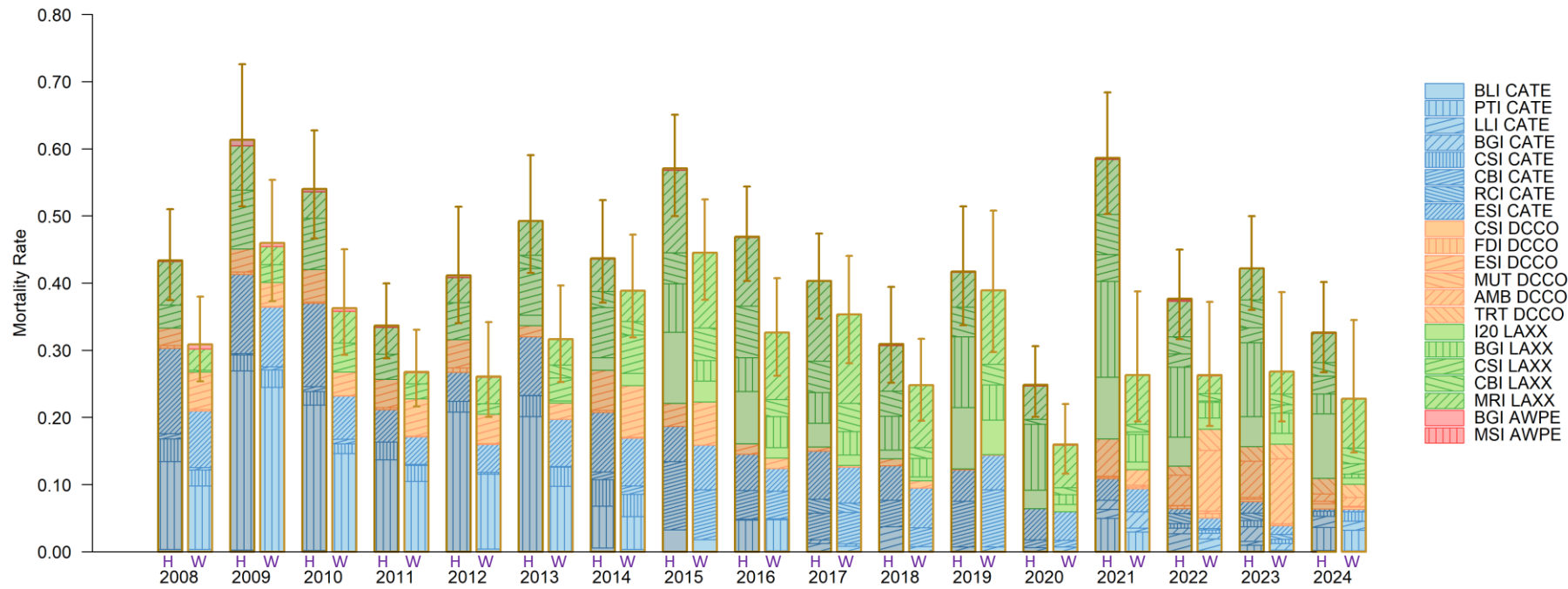
Preliminary

UCR STEELHEAD PREDATION BY REAR-TYPE (RIS_MCN)



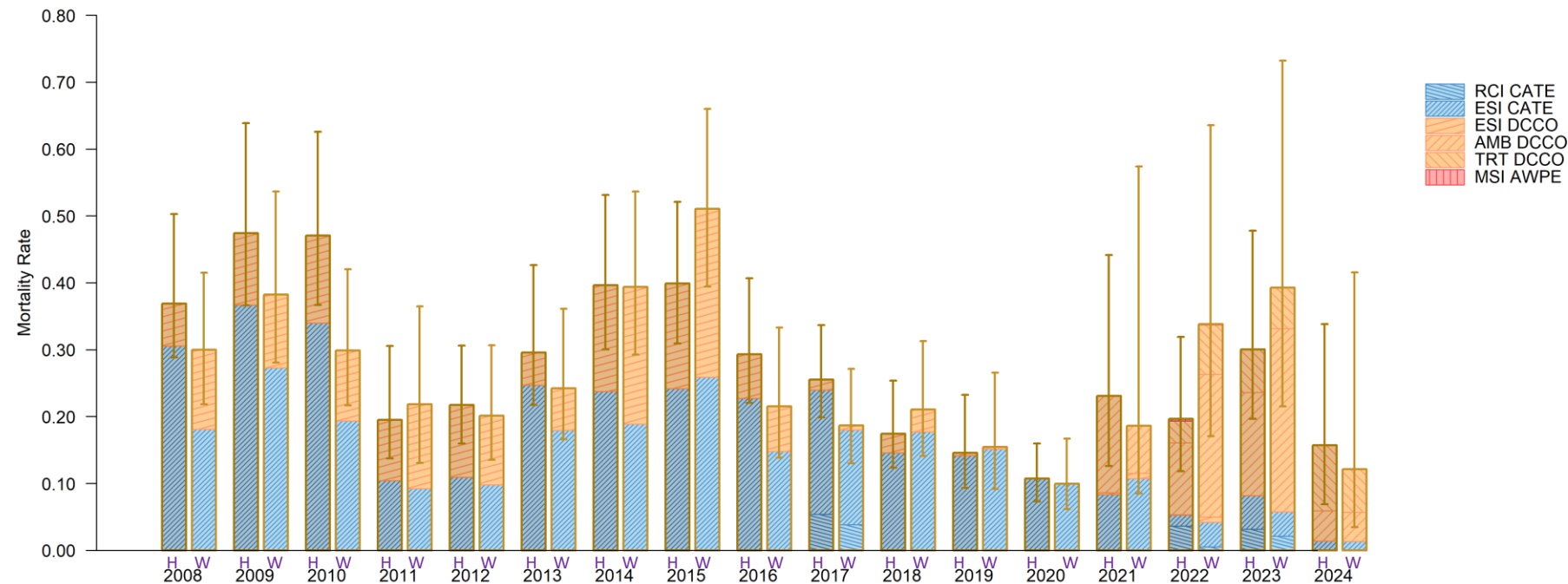
Preliminary

UCR STEELHEAD PREDATION BY REAR-TYPE (RIS_PO)



Preliminary

UCR STEELHEAD PREDATION BY REAR-TYPE (BON_PO)

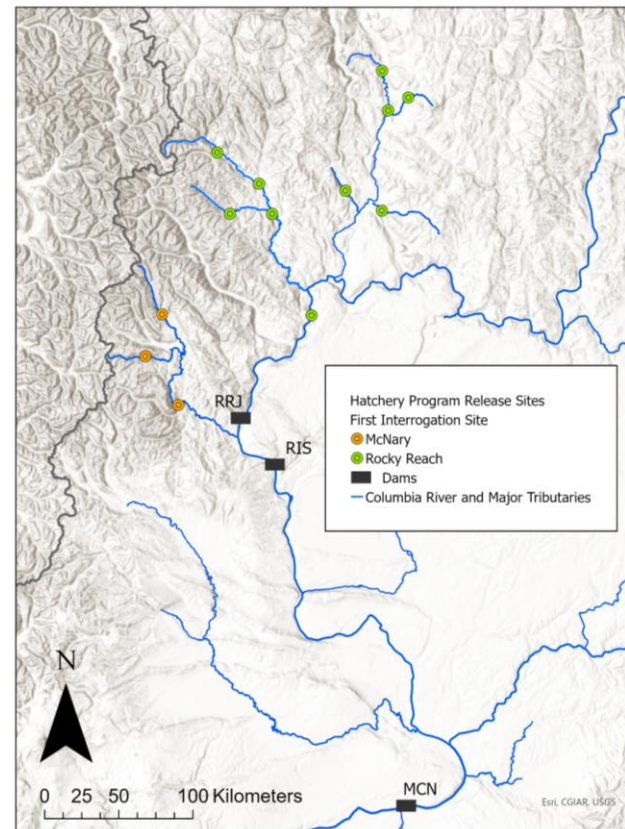


Preliminary

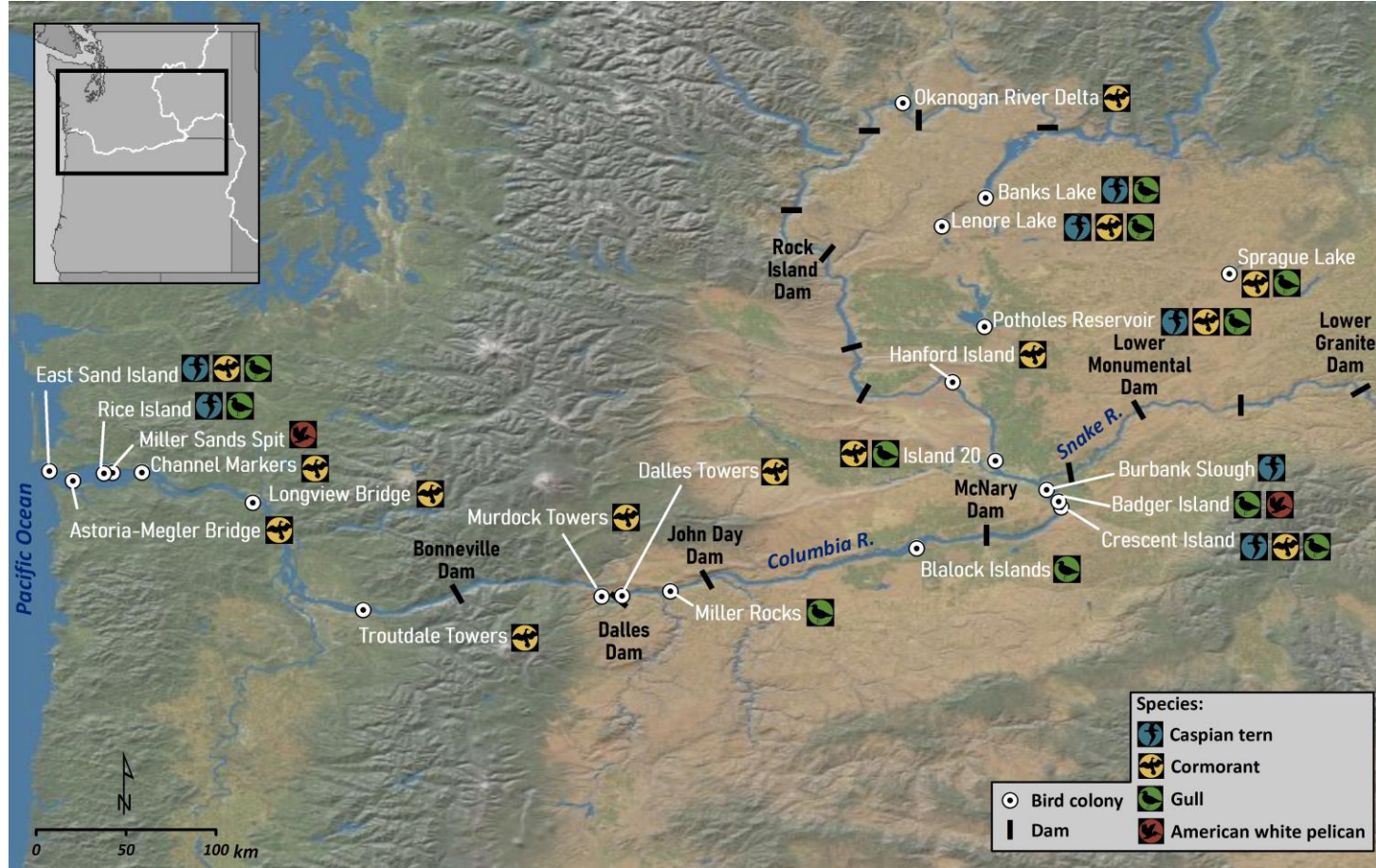
PREDATION BY HATCHERY RELEASE COHORT

Program/Production Group	Brood Type	Age at Release
Methow Basin Conservation 1-Year Smolt	Mix of WxW and HxW	1 year
Methow Basin Conservation 2-Year Smolt	Mix of WxW and HxW	2 year
Columbia River Safety Net Program	Exclusively HxH	1 year
Methow River Safety Net Program	Exclusively HxH	1 year
Okanogan Conservation 1- year smolts	Mix of WxW and HxW	1 year
Okanogan Safety Net 1-year smolts	Exclusively HxH	1 year
Wenatchee River Steelhead Conservation	Mix of WxW and HxH	1 year
Early Winters	Mix of WxW and HxW	2 year

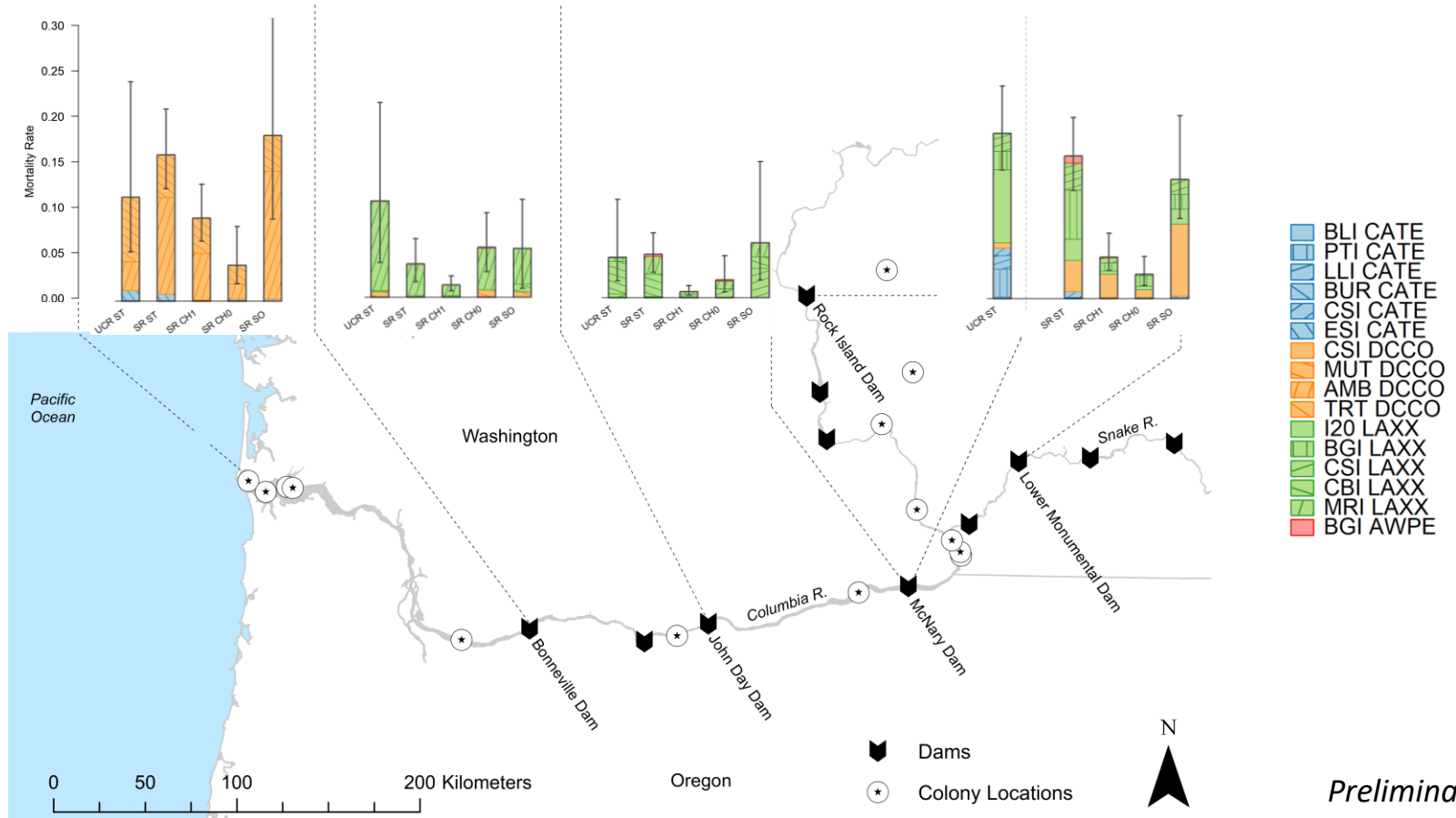
Results In-prep (included in 2024 Draft Report to PRCC)



SYSTEM-WIDE PREDATION RATES (CRB)



2024 REACH-SPECIFIC PREDATION RATES (System-wide)

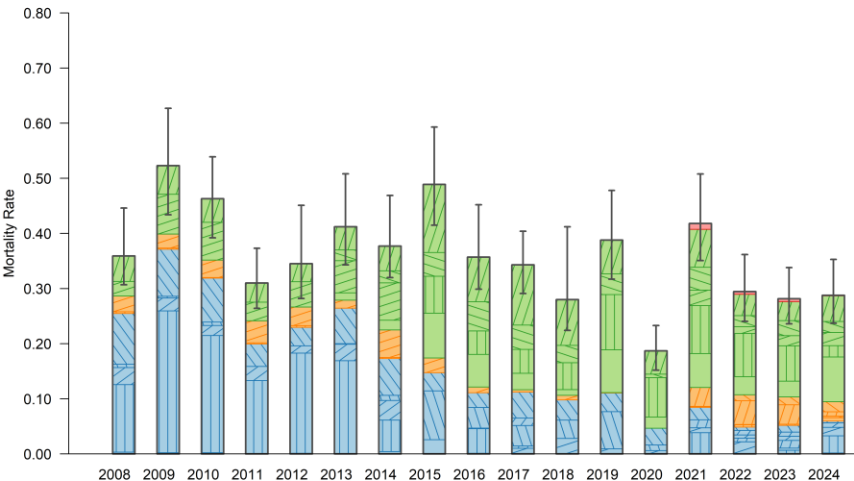


CUMULATIVE PREDATION (System-wide)

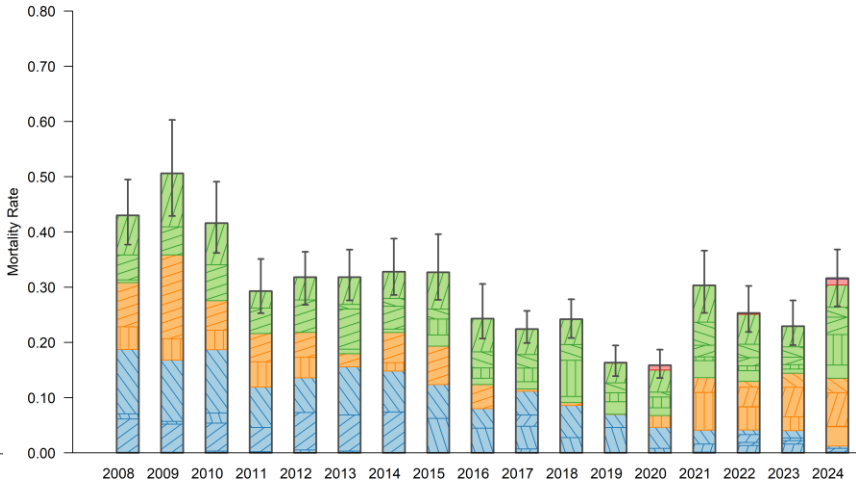
Avian Colonies

- BLI CATE
- PTI CATE
- LLI CATE
- BGI CATE
- CSI CATE
- CBI CATE
- RCI CATE
- ESI CATE
- CSI DCCO
- FDI DCCO
- ESI DCCO
- MUT DCCO
- AMB DCCO
- TRT DCCO
- I20 LAXX
- BGI LAXX
- CSI LAXX
- CBI LAXX
- MRI LAXX
- BGI AWPE
- MSI AWPE

Upper Columbia River Steelhead

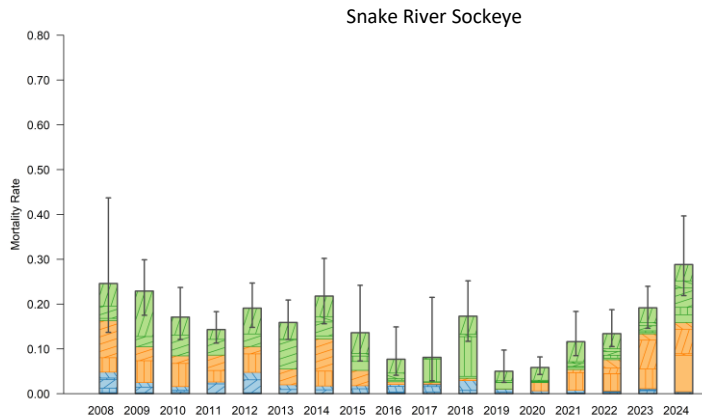
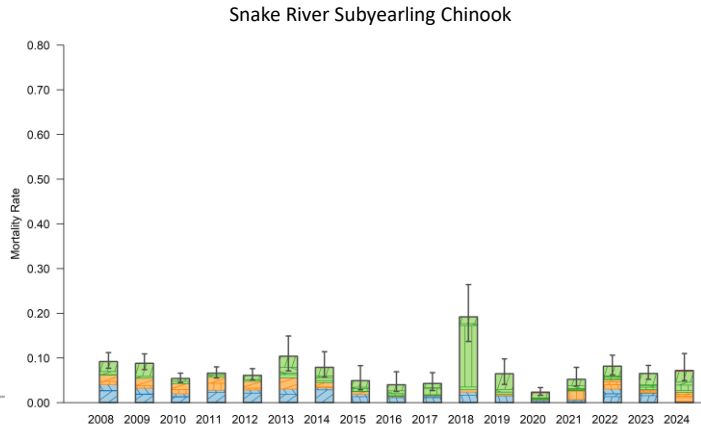
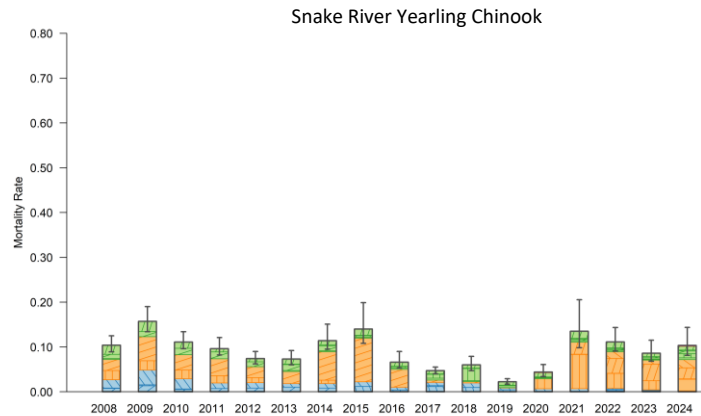


Snake River Steelhead



Preliminary

CUMULATIVE PREDATION (System-wide)



Avian Colonies



Preliminary

SUMMARY OF RESULTS (Tern Predation Rates; CPR)



LOWER LEVELS OF TERN PREDATION SINCE 2020

Predation lower, on average, following tern management
Strong relationship between tern predation and smolt survival.
Per colony IAPMP goals ($< 2\%$) achieved, cumulative goals ($< 5\%$) were not.

Tern predation increased in 2024 compared with 2023; new colonies and growing colonies {Crescent}.



PREDATION ON HATCHERY STEELHEAD VARIES BY PREDATOR SPECIES

Predation generally higher on hatchery fish upstream of Bonneville due to tern and gull predation.

No difference in predation by rear-type in CRE due to predation by cormorants (indiscriminately consume smolts).



Hatchery release cohorts

In-prep



SUMMARY OF RESULTS (Other Predation Rates)



PREDATION BY OTHER AVIAN SPECIES SUBSTANTIAL

Rates often comparable to or greater than those of terns, especially on steelhead by gulls.



SYSTEM-WIDE PREDATION LEVELS SUBSTANTIAL

Rates consistently highest on steelhead, upwards 40% of all smolts in some years; greatest mortality source during outmigration



REACH-SPECIFIC PREDATION LEVELS VARY

Highest estimates in 2024 were from gull colonies upstream of BON and cormorants in the CRE.



PREDATION ON SALMON LOWER THAN STEELHEAD

Cumulative effects of predation consistently lower on salmon smolts compared to steelhead. Predation on SR sockeye, however, has increased since 2019 due cormorant predation in CRE .



THANK YOU

QUESTIONS?



2025 PRCC PROPOSAL

With Cost Share from BPA

OBJECTIVE 1

Assess efficacy of
tern management

OBJECTIVE 2

Assess changes in
colony size (terns and
other predator
species)

OBJECTIVE 3

Assess changes in
predation rates
(terns and other
predator species)

OBJECTIVE 4

Provide technical
assistance (terns and
other predator
species)

OBJECTIVE 5

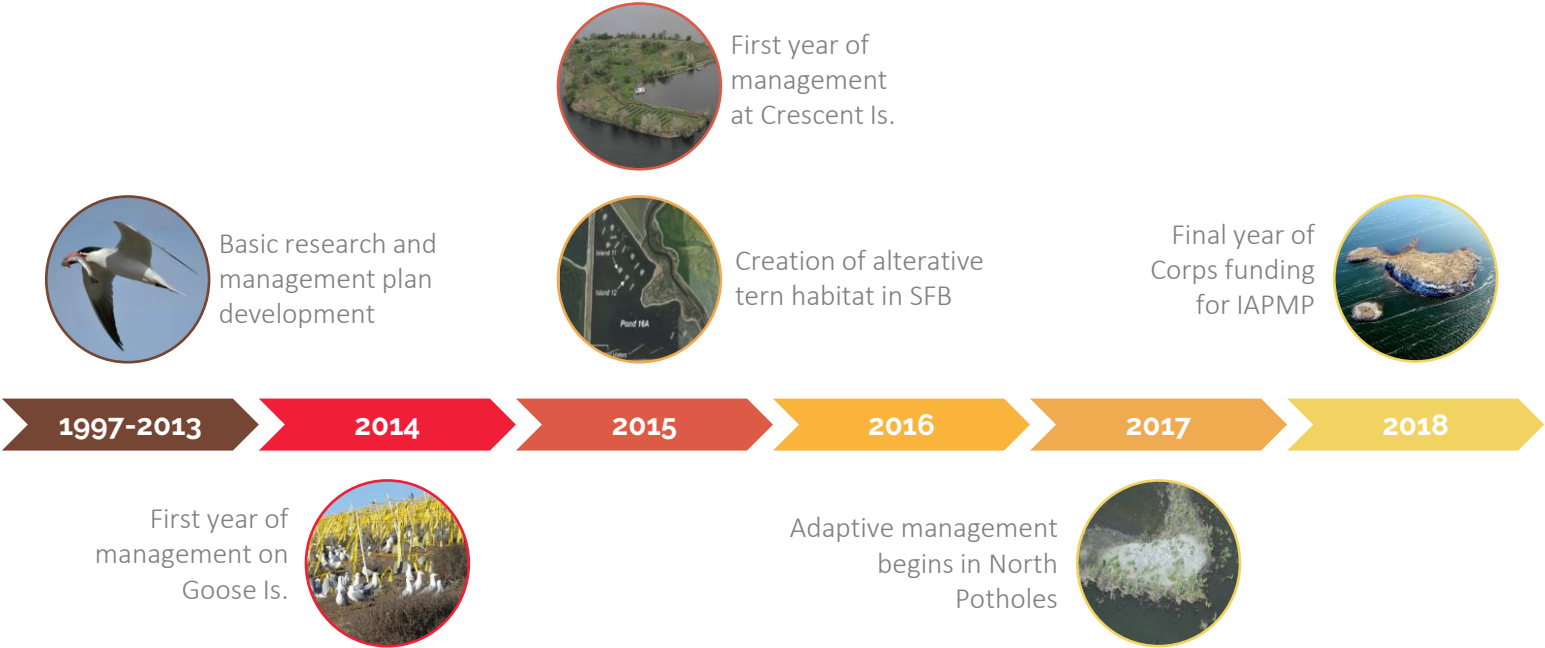
Estimate predation
on double-tagged
steelhead (spatially-
explicate predation in
the Priest Rapids
Project)

➤ *Cost sharing with BPA has been secured for 2025*

BACK-UP SLIDES



INLAND AVIAN PREDATION MANAGEMENT PLAN - TIMELINE



CASPIAN TERN MANAGEMENT TIMELINE (cont.)



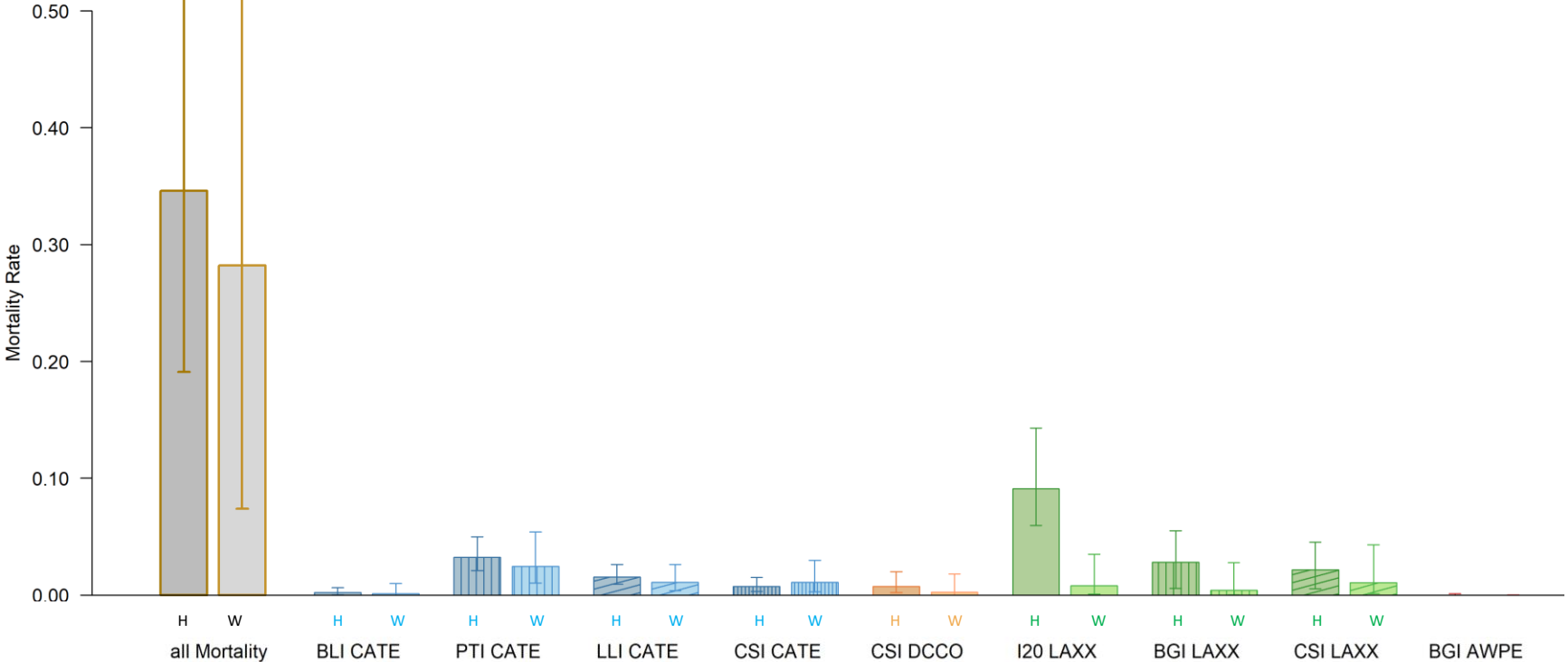
Rock Island Dam – Steelhead Smolt PIT-tagging Effort



<u>Presumed Rear-type</u>		
Year	Hatchery (%)	Wild (%)
2008	5,373 (73.9%)	1,898 (26.1%)
2009	5,150 (72.4%)	1,964 (27.6%)
2010	5,387 (73.1%)	1,978 (26.9%)
2011	5,961 (76.9%)	1,795 (23.1%)
2012	5,107 (76.1%)	1,605 (23.9%)
2013	4,284 (72.7%)	1,609 (27.3%)
2014	5,686 (74.2%)	1,977 (25.8%)
2015	5,105 (72.2%)	1,964 (27.8%)
2016	4,965 (73.4%)	1,799 (26.6%)
2017	5,776 (77.7%)	1,660 (22.3%)
2018	5,261 (72.7%)	1,980 (27.3%)
2019	3,201 (72.8%)	1,196 (27.2%)
2020	4,895 (71.6%)	1,946 (28.3%)
2021	6,366 (78.7%)	1,724 (21.3%)
2022	4,579 (73.7%)	1,634 (26.3%)
2023	6,172 (73.7%)	2,205 (26.3%)
2024	3,038 (79.9%)	762 (20.1%)

CWT Years (6 years)	None-CWT Years (11 years)
25.4% classified wild	26.1% classified wild

2024 UCR STEELHEAD PREDATION BY REAR-TYPE (RIS_MCN)



Preliminary

PREDATION BY HATCHERY RELEASE COHORT

Sample Size	Year	1 year Smolts*	2 year Smolts**	Columbia River Safety Net	Metho River Safety Net	Okanogan Conservation 1-Year smolts	Okanogan Safety Net 1-Year smolts	Wenatchee River Steelhead Conservation	Early Winters
N Released	2021	10,674	24,589	4,990	4,976	4,998	14,983	30,226	-
N at RRJ		3,578	8,686	2,574	2,714	1,846	4,822	-	-
N Released	2022	16,244	24,430	4,996	4,999	4,993	14,991	30,100	-
N at RRJ		3,907	8,326	2,448	2,559	1,911	4,251	-	-
N Released	2023	10,483	25,390	4,992	4,986	4,989	14,976	30,279	-
N at RRJ		2,912	7,467	2,763	1,773	1,592	3,942	-	-
N Released	2024	4,983	18,325	5,021	4,964	4,994	14,995	35,320	8,869
N at RRJ		859	4,445	2,629	2,048	1,524	3,791	-	2,394

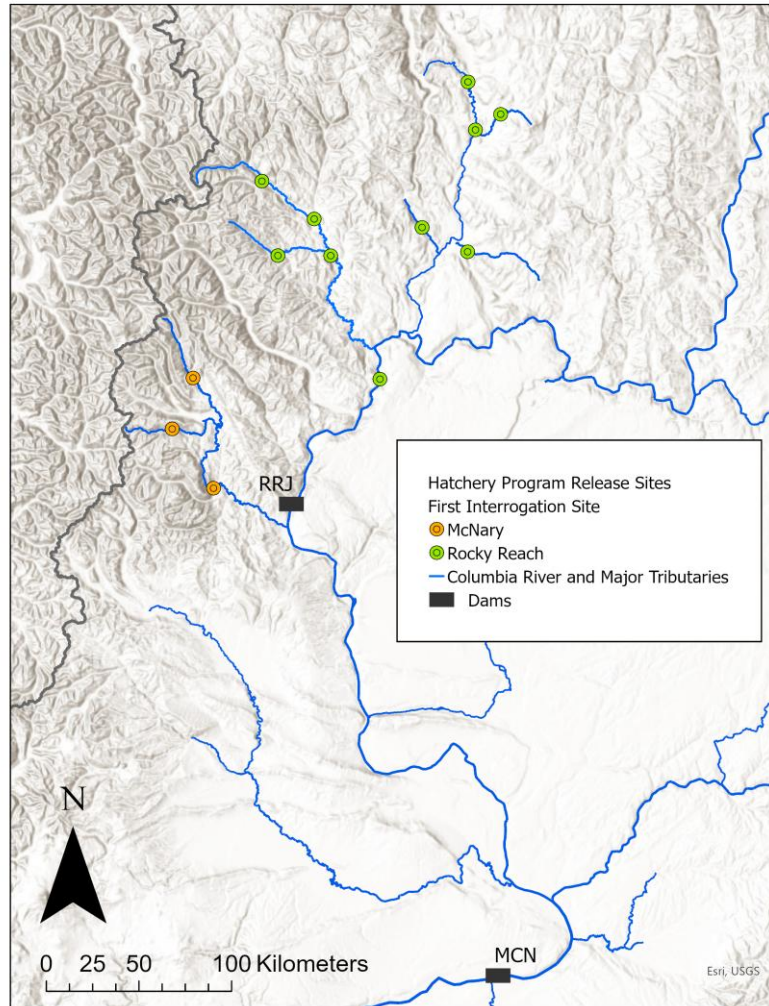
* 1-year smolts are Methow Conservation Programs (WINT/WELH) 1-year programs (released from Twisp and WINT)

** 2-year smolts are Methow Conservation Programs (WINT/WELH) 2-year programs (released from Twisp and WINT)

Preliminary

PREDATION BY HATCHERY RELEASE COHORT

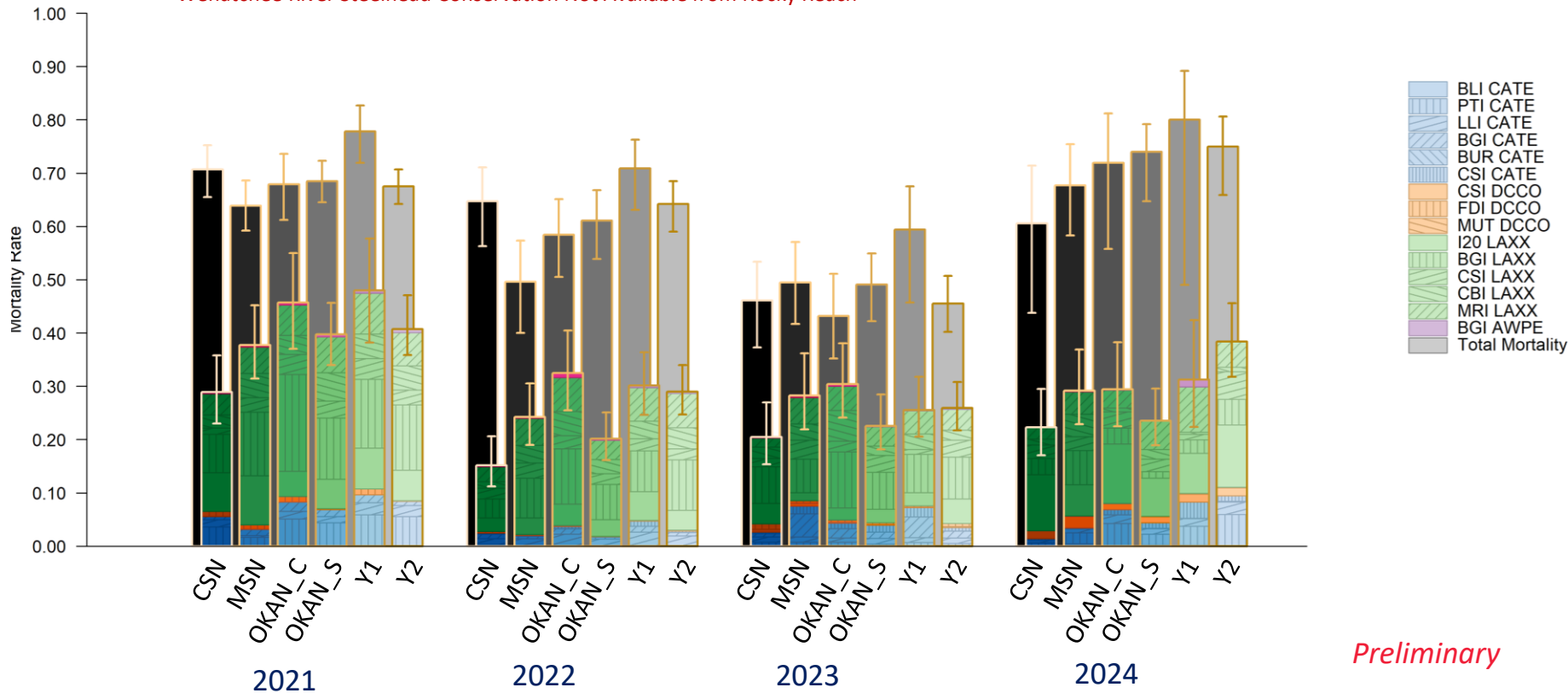
Fish from the Wenatchee Steelhead Conservation program (orange) are not seen until McNary. All other programs of interest are released above Rocky Reach (green).



PREDATION BY HATCHERY RELEASE COHORT

Rocky Reach Dam to Bonneville Dam

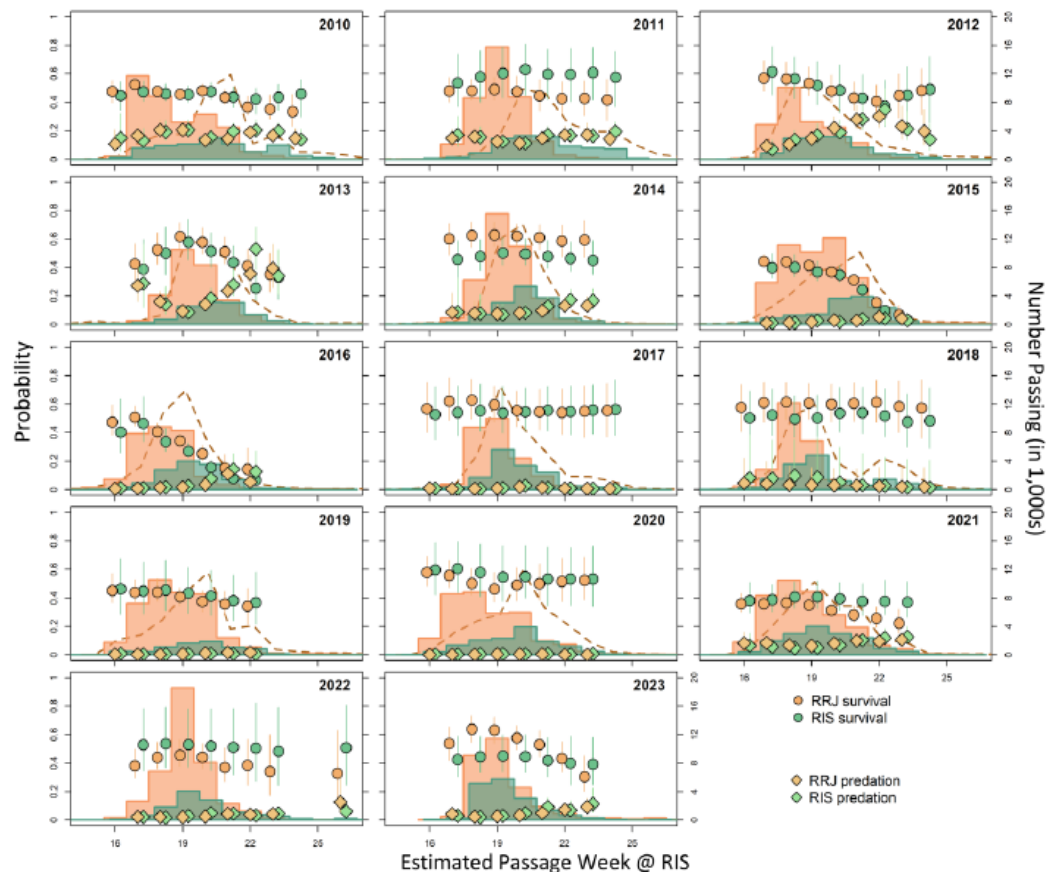
* Wenatchee River Steelhead Conservation Not Available from Rocky Reach



2024 Rock Island Steelhead Tagging

RRJ Steelhead vs RIS Steelhead Comparison (from 2023's report)

- From RIS (modelled travel time from RRJ to RIS)
- Compared within week by rear type
- No prevailing differences that would suggest any systematic bias of the Rock Island sample



Response to PRCC Question/Comments - RTR Avian Predation Study

Questions received: December 20, 2024

RTR's response: January 21, 2025

We thank the PRCC for providing written questions and comments regarding the NNI funded Avian Predation Study. As requested during our January 13th presentation, below please find responses to your questions. We greatly appreciate your interest in this project, and we welcome any additional questions/comments.

CRITFC Questions/Comments

1. What do you think were the main factors that led to such a low number of fish being available to tag in 2024?

RTR Response: The current theory is that low flow conditions during the peak outmigration period, coupled with powerhouse operations, resulted in low entrainment rates in the RIS fish trap in 2024. This is supported by the finding that collection numbers in the trap were low for all salmonid smolt species in 2024, not just steelhead. Chelan County PUD is planning to conduct a formal analysis of the factor(s) that resulted in record low collection efficiencies at the trap in 2024, information that will be shared with the PRCC when available.

2. In light of 2024's smaller-than-ideal sample, combined with the increasing availability of passively detected PIT-tagged migrants (Wenatchee barge + expanded tagging above Rocky Reach), is it possible to reimagine the analysis to tap into these other/larger data sources? This could potentially include continued tagging at Rock Island to supplement the pool of tagged fish available for predation studies and to keep the series of a Rock Island-anchored estimates going. Are there analytical or data hurdles that make this infeasible?

RTR Response: Yes, assuming adequate sample sizes and recapture histories, you could analyze predation and survival on other groups of tagged fish from the Mid-C (e.g., those detected at Rocky Reach, specific hatchery releases, barge detections, etc.). The challenge is that many of these fish are tagged and released/detected at locations that are outside of Priest Rapids Project and beyond the foraging range of the colonies included in the predation study. Sample sizes of released/detected fish are also often too small (e.g., Wenatchee Barge) for use in predation and survival models and fish are not recaptured (resighted) until they reach McNary Dam.

3. Bringing passive detections from upstream sites opens up some other possibilities that could increase the utility of estimates to management - e.g., moving beyond wild vs. hatchery and generating release-group-specific estimates of predation rates. If you've explored the passive detection and release data in your prior analyses, do you have any thoughts on what can be done here, stock resolution-wise?

RTR response: See response above. Yes, we agree, there are several other management-relevant questions that can be addressed by incorporating other groups of tagged fish in predation and survival analyses. In general, depending on recapture and recovery probabilities, models often require > 5,000 PIT-tagged fish to generate reliable estimates and the spatial scale of results will depend on the nearest downstream recapture site with adequate recapture capabilities. For fish released in, say, the Okanogan, the spatial scale would be from released to McNary Dam, which is > 400 Rkm downstream. This is useful information on the fate of Okanogan fish, but well beyond the spatial scale of the PRCC funded avian predation project to-date.

4. Were all fish scanned for coded wire tags? Based on RMPC release data for steelhead migrating in 2024, about 2/3 of adipose-clipped hatchery fish had CWTs, did you see similar ratios in your data for these same fish? What device(s) are Chelan PUD taggers using to check for CWTs?

RTR Response: All (100%) of fish that met the visual criteria of a wild fish (completely intact fins, with no tags or other markings {e.g., eroded dorsal fins} indicative of a hatchery environment) were scanned for a CWT. A subsample of 50 hatchery fish per week were also scanned for a CWT to ensure the CWT detector was functioning (due to the paucity of presumed wild fish found with a CWT {0.5%} in 2024). Chelan used a traditional "V" CWT detector (stationary detector) that was surrounded by a rubber wall to minimum interference). We are not sure about the expected ratio or proportion of hatchery fish released upstream that were CWT in 2024.

WDFW - RTR Avian Predation Questions/Comments **(Most questions are versions of past questions)**

1. Differential avian predation on hatchery and wild steelhead would influence the suite of management actions (i.e., reduce predation risk or predator abundance) that would be considered to reduce avian predation. All predation rates should be estimated and reported separately by origin whenever possible. What was the predation rate of UCR wild and hatchery steelhead in 2024?

RTR response: Predation rates for UCR steelhead based on presumed rear-types (wild, hatchery) have been reported as part of this project in years past, with data dating back to 2008 (see Appendix B of the 2023 Annual Report). An updated version of this appendix will be included in the 2024 Annual Report. Based on WDFW's comments here, we will also include an estimate of predation for presumed hatchery and wild fish last detected at Rocky Reach Dam in 2024, with the caveat that small sample sizes result in imprecise estimates of predation and, especially, survival.

Although there is considerable evidence that hatchery fish are more susceptible to predation by plunge diving predators, like gulls and terns, there is no evidence of differential predation by cormorants (pursuit divers; see also Hostetter et al. 2023). Since different river reaches have different predators (terns, cormorants, gulls, pelicans), impacts to hatchery and wild fish vary by reach. Although there is evidence of differential predation by rear-type for some avian species and colonies, difference in cumulative (predation by all predator species and years) predation by rear-type tend to be relatively small (a few percentage points), with a larger proportion of both hatchery and wild fish consumed during outmigration (30–50% for both hatchery and wild fish, depending on the year).

[Hostetter, N.J., A.F. Evans, Q. Payton, D.D. Roby, D.E. Lyons, and K. Collis. 2023. A review of factors affecting the susceptibility of juvenile salmonids to avian predation. North American Journal of Fisheries Management DOI:10.1002/nafm.10862.](#)

[birdresearchnw.org/2023 Avian Predation Final Annual Report.pdf](https://birdresearchnw.org/2023%20Avian%20Predation%20Final%20Annual%20Report.pdf)

- a. Certain hatchery fish may not be adipose fin clipped or CWT. Almost twice the proportion of wild fish tagged than observed upstream of Rock Island Dam (Table 1). How do you know that adipose fin present steelhead are wild? Was scale pattern analysis performed or it assumed steelhead with no clips or tags are wild?

RTR response: As discussed during the presentation on January 13th, rear-type classification was based on visual criteria, including, but not limited to, the presence/absence of an adipose fin. Below is a summary of classification methods and preliminary results from 2024:

“In an attempt to more accurately classify the rear-type (hatchery, wild) of steelhead sampled at RIS, non-adipose clipped smolts with no signs of fin erosion or other

marks/tags indicative of a hatchery environment – fish that met the visual classification criteria of a wild smolt (Evans et al. 2014) – were scanned for the presence of a coded wire tag (CWT), an indication that the fish was actually hatchery. In total, 4 (or 0.5%) of the 766 presumed wild steelhead sampled at RIS had a CWT, fish that were reclassified as hatchery. In 2023, three 3 (or 0.1%) of the 2,155 presumed wild steelhead sampled at RIS had a CWT. To ensure the CWT detector/antenna was properly functioning, a subsample of adipose clipped steelhead (i.e. known hatchery fish) were checked each week for the presence of a CWT. In 2024, 60 (or 17.6%) of the 340 hatchery steelhead scanned for a CWT had a detectible CWT, indicating the antenna was working.

Of the 3,038 fish classified as hatchery in 2024, 2,465 had their adipose fin clipped and 573 had fin erosion or other signs indicative of a hatchery environment.”

We agree that the classification system used at RIS is likely not perfect and that some presumed wild fish were erroneously classified as hatchery. We think this number is small, but we will continue to do everything we can to correctly classify fish by rear-type and we welcome WDFW advice regarding the use of other rapid and non-invasive classification techniques.

2. Fish collected at Rock Island Bypass are reported to represent the run at large. Given that the bypass collects fish via unscreened gatewells from Powerhouse 2 with an unknown, albeit extremely low and likely variable capture probability (~1-4%) and that factors effecting capture probability at Rock Island Dam are unknown, what analysis has been conducted that demonstrates RI bypass fish are representative of the run at large for the UCR?

RTR response: Uncertainties regarding capture probabilities does not mean a sample is non-representative. A representative sample is one that includes all elements of the population at-large (tagged and untagged, fish of all origins, rear-types, conditions, sizes, and run-timing). Because RIS is downstream of all major steelhead spawning tributaries in UCR and because fish can be randomly sampled (regardless of rear-type, condition, or size) in proportion to run passing RIS, you can, theoretically, obtain a representative sample at RIS. Sites further upriver, such as Rocky Reach Dam, however, exclude fish from the Wenatchee River and excluded untagged fish that volitionally arrive at RRJ. Appendix C of 2023 Avian Predation provides a detailed analysis of this topic:

[birdresearchnw.org/2023 Avian Predation Final Annual Report.pdf](https://birdresearchnw.org/2023%20Avian%20Predation%20Final%20Annual%20Report.pdf)

- a. General factors influencing powerhouse passage (i.e., discharge, water temperature, fish size, time of day, migration path) have been identified (Harnish et al. 2023), but whether these same factors influencing gateway passage is unknown. WDFW has requested data from CCPUD to conduct a similar powerhouse passage analysis and is also investigating factors influencing Bypass counts (e.g., Total river flow, PH2 flow, temp).

RTR response: See response above to similar question from CRITFC. Yes, we agree, several factors likely influence collection probabilities at the RIS fish trap and hopefully we'll gain a better understanding of those factors in the future.

3. Was Rock Island Dam bypass chosen as a tagging site because of low sample sizes from upstream populations? (See comments below).

RTR Response: Samples from upstream populations lack the requisite information needed for predation (and survival) probabilities through the project; namely, we need to know which tagged fish entered the project (i.e. migrated past Rock Island Dam) and when they did so in order to assess the likelihood such a tag can be recovered (as recovery probabilities, which change throughout the migration season). To this end, Rock Island Dam (RIS) serves as the most appropriate 'starting point' for the avian predation project and JMS model (see also Payton et al. 2019) and it further allows us to make relative comparisons of predation and survival within and across years dating back to 2008 (prior to avian predation management). Below is text from our 2023 Annual Report about why fish have been tagged at RIS in years past.

"To help ensure adequate numbers of ESA-listed UCR steelhead were available for predation rate analyses, smolts were intentionally captured, PIT-tagged, and released into the tailrace of Rock Island Dam (RIS) on the middle Columbia River as part of this study. Previously research has demonstrated that the UCR steelhead population is highly susceptible to predation by terns, cormorants, and gulls (Evans et al. 2012, Evans et al. 2019, Payton et al. 2020) and is therefore a suitable group to evaluate the efficacy of management actions aimed at reducing avian predation. Efforts to tag steelhead smolts at RIS as part of avian predation studies have also been ongoing since 2008, providing a long-term dataset in which to evaluate relative changes in predation rates associated with both managed and unmanaged piscivorous waterbird colonies (Evans et al. 2012, Evans et al. 2019). The tagging of steelhead smolts at RIS also provide a means to investigate factors that influence smolt susceptibility to avian predation (e.g., fish length, condition, rear-type; Hostetter et al. 2023) and to determine to what degree avian predation is an additive versus compensatory source of mortality (Payton et al. 2020).

A detailed description of the sampling methods used to PIT tag steelhead at RIS are provided in Evans et al. (2014). In brief, steelhead were captured at the RIS juvenile fish trap, PIT-tagged (Biomark model APT12), measured (mm; fork-length), condition-scored (based the presence/absence of injuries, descaling, and disease), and released into the tailrace of RIS during the peak smolt out-migration period of April to June. Steelhead were randomly selected for tagging (i.e. tagged regardless of condition, rear-type, or size) and were tagged in-concert with, and in proportion to, the run-at-large to ensure that the tagged sample was representative of the steelhead population at-large (tagged and untagged). The sampling approach used at RIS as part of this study ensures that (1) steelhead from all naturally spawning stocks of the ESA-listed DPS are included in the sample (Entiat, Methow, Okanogan, and Wenatchee rivers), (2) that smolts of all sizes, conditions, and rear-types are included in the sample in proportion to their relative abundance in-river, and (3) that smolts are tagged in-concert with the run at-large; criteria that allows us to make credible inference about the entire ESA-listed UCR steelhead population (see also Payton et al. 2020 and Evans et al. 2024).”

Evans, A.F., N.J. Hostetter, K. Collis, D.D. Roby, and F.J. Loge. 2014. Relationship between juvenile fish condition and survival to adulthood in steelhead. Transactions of the American Fisheries Society 143:899-909.

Payton, Q., N.J. Hostetter, and A.F. Evans. 2019. Jointly estimating survival and mortality: Integrating recapture and recovery data from complex multiple predator systems. Environmental and Ecological Statistics 26:107-125.

Payton, Q., A.F. Evans, N.J. Hostetter, D.D. Roby, B. Cramer, and K. Collis. 2020. Measuring the additive effects of predation on prey survival across spatial scales. Ecological Applications 30:e02193.10.1002/eap.2193.

Of course, the sample from RIS is not perfect and there are potential drawbacks to the RIS site, such as potential for bias introduced by non-random entrainment probabilities and/or handling effects due to tagging. To address this, our report from 2023 included a relative comparison between predation and survival of steelhead smolts passively detected at RRJ or tagged at RIS, with a dataset spanning back to 2010 (Appendix C). In this report we accounted for uncertainty due to travel time between RRJ and RIS, as well as the known differences in survival and predation probabilities among hatchery- and wild steelhead. We found no evidence of a systematic difference in probabilities of survival and tern predation within the same week and among similar rear-types. That is, we found no difference in the relative fitness of fish tagged at RIS versus those passively detected at RRJ due handling effects or any other factor. Absence of evidence is not evidence of absence, however, and this is not to say that handling effects at RIS (or at any other tagging site) are not real, but survival and tern predation probabilities of

handled (RIS) and unhandled (RRJ) smolts were similar, with very similar trends within and across years. For these reasons, we believe that for the purpose of making relative comparisons of predation and total mortality between groups of steelhead traveling through the middle Columbia River, RIS is currently the best suited 'starting point' to answer this question.

4. What proportion of avian predation is related to the direct interactions of fish with a dam(s)? Direct, indirect, or delayed mortality associated with dam passage and subsequent consumption by avian predators is another critical question related to possible management actions. Conflicting analyses demonstrating compensatory or additive mortality is another source of uncertainty for fish managers. Have steps been identified to further investigate this issue? If so, what are they and are they supported by fish managers?

RTR response: This is a very important question; to what degree does avian predation limit fish survival and what would survival be in the absence of avian predation. If there is no relationship between avian predation and survival, then predation is completely compensatory. If there is a relationship, then some proportion of fish consumed by birds would have survived in the absence of predation. According to the Independent Scientific Review Panel, which recently reviewed this topic, the best available science was presented and published by Payton et al. (2020).

Payton et al. (2020) demonstrated a readily apparent linear relationship, wherein weeks with higher tern predation were associated with lower probabilities of steelhead survival. This was observed in UCR steelhead from RIS to BON. This was also observed in SR steelhead from LMJ to BON (Payton et al. 2021) and all steelhead seen leaving the CRB until their adult return at BON (Payton et al. 2020). We have modelled this relationship and found it to be statistically significant in all cases and years.

While predation by cormorants and gulls is of a notably different character and pattern, we have also found evidence of an additive relationship with these predators and other salmonid species across other spatial scales as well (Payton et al. 2021, Evans et al. 2022).

[Payton, Q., A.F. Evans, N.J. Hostetter, D.D. Roby, B. Cramer, and K. Collis. 2020. Measuring the additive effects of predation on prey survival across spatial scales. *Ecological Applications* 30:e02193.10.1002/eap.2193.](#)

[2022 Avian Predation Final Annual Report.pdf](#)

- a. Analyze detection histories of PIT tags recovered on the breeding colonies and compare them to fish that survived (i.e., detected at one or more downstream locations).
5. Is variability in CATE abundance (209-1003) or total abundance in the Columbia Plateau related to hatchery steelhead survival to Bonneville?

RTR Response: There is a relationship between CATE colony abundance and steelhead predation rates, if that answers your question? We recommend the following manuscript:

[Hostetter, N.J., Q. Payton, D.D. Roby, K. Collis, and A.F. Evans. 2022. Predation probabilities and functional responses: How piscivorous waterbirds respond to pulses in fish abundance. Ecosphere 13:e4220.](#)

Comments/information for Future Discussions

Fish managers no longer use fish tagged at dams for survival analysis or to inform hydro operations. Those same issues (i.e., passage route, holding, tagging and release effects) undoubtedly influence predation rates or at least the fish managers interpretation of the results. Good news is that viable options are available. Rocky Reach and the Wenatchee barge do provide study fish without the inherent issues associated with Rock Island Bypass and allow for more scientifically credible comparisons to be made (Table 1). Alternatively, because detection probability is not 1.0, RTR can request a list of files containing wild steelhead smolts tagged at smolt traps during the spring outmigration period (Table 2). Due to residualism and post-release survival issues related to hatchery steelhead, observations of actively migrating hatchery fish (Table 1), not PIT tag release files should be used in hatchery steelhead predation analysis. If larger samples sizes are needed, RTR can request the PUDs and fish managers to tag more wild steelhead (e.g., use NNI funds to tag more Wenatchee steelhead).

Site	Det. Prob.	Hatchery	Wild	Total
RI Bypass	0.01-0.04	2,757 81%	658 19%	3,415
RR Bypass	0.38-0.46	18,026	2,141	20,167
Wen. Barge	0.06-0.11	550	25	575

Total	18,576	2,166	20,742
	90%	10%	

Table 1. 2024 Steelhead Smolt PIT tag Observations

Table 2. 2024 Wild steelhead PIT tagged at smolt trap prior to July 1, 2024

Trap Site	Tagged before July 1
Lower Wen	288
Chiwawa	522
Nason	65
Entiat rkm 2	1,183
Entiat rkm 11	1,140
Methow	332
Twisp	570
Omak	484
Total	4,584

Uncertainties associated with tagging at the Rock Island Bypass (i.e., representativeness, handling/tagging effects and identification by origin) confound the results, but also comparisons of among origin and the UCR to other DPS's in the Columbia Basin. Efforts are already under way to tag more wild steelhead especially in areas that are currently underrepresented (e.g., second Entiat trap). WDFW recommends the Rock Island Bypass be dropped as a mark site permanently. This will eliminate potential handling and tagging effects and the issues concerning the correct identification of wild and hatchery steelhead. More importantly, consistency in tag groups among when conducting any analysis will also provide better opportunities to integrate avian predation results with other type of analysis (e.g., fish and pinnipeds related predation, life cycle models, integrated population models). Avian predation and the impact on viability/recovery could be prioritized among other sources of mortality.

RTR Response: We acknowledge the WDFW's concerns regarding RIS as mark site and we will gladly work with WDFW and the PRCC to investigate predation and survival in other groups of tagging fish from the Mid-C, to the extent adequate sample sizes exist and as approved by the PRCC.