Meeting Minutes

Lewis River Aquatic Technical Subgroup

To: Lewis River Aquatic Technical Subgroup Date: September 21, 2023

From: Larissa Rohrbach, ATS Coordinator, Anchor QEA, LLC

Re: Final Minutes of the August 31, 2023, Lewis River Aquatic Technical Subgroup Meeting

The Lewis River Aquatic Technical Subgroup (ATS) meeting was held virtually on August 31, 2023, from 10:00 a.m. to 1:00 p.m. Attendees are listed in Section IV of these meeting minutes.

Action Item Summary

- See Work Plan.
- Erik Lesko will provide a revised Yale Habitat Preparation Plan with a comment and response matrix to the ACC for their approval of revisions.
- Bryce Glaser will further discussions in the short term on adapting hatchery infrastructure and operations for changes in coho salmon broodstock collection, incubation and ponding to fully or partially implement the coho salmon transition plan this year.
- Erik Lesko will provide a summary of methods and constraints for tagging adult steelhead in the lower Lewis River for pHOS monitoring by September 8.
- Erik Lesko will organize a meeting between CFS and WDFW geneticists to resolve final Genetic Monitoring Strategy details and implementation plans.
- Larissa Rohrbach will review the PacifiCorp's Annual Report comment-response matrix and identify issues from the Hatchery and Supplementation Program Annual Operations Report that require ATS discussion.

Agreements or Recommendations

- None.

Review Items

- None.

Finalized Documents

- None.

I. Welcome (Rohrbach/Lesko)

A. Announcements

- None.

B. Review Agenda

- Rohrbach reviewed the agenda and no changes were requested.

II. ATS Meeting Topics

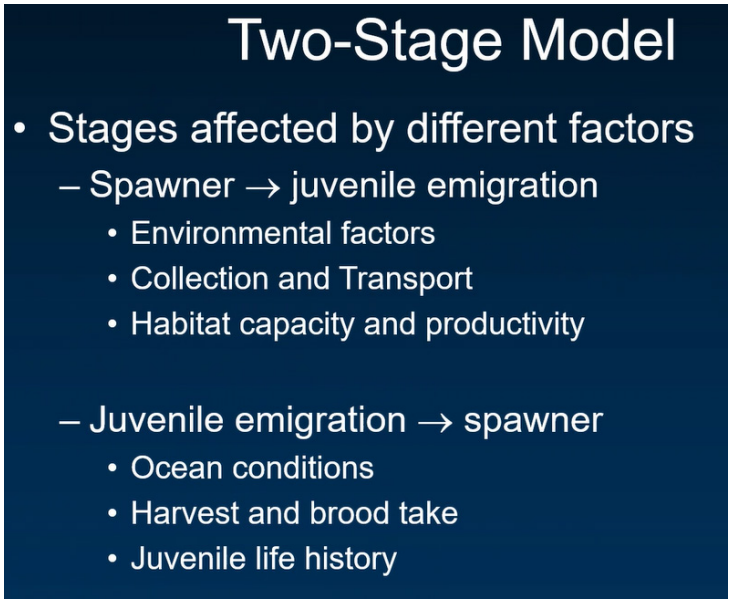
A. Integrated Population Model Framework (USGS)

The developers of the Integrated Population Model (IPM) for the Lewis River populations were invited to share the framework for the model to the ATS, and gave a presentation entitled, *"Estimating Life Cycle Demographic Parameters of Coho Salmon in the Lewis River"* (Attachment A). Snapshots of that presentation are included in the notes below. Russ Perry (USGS) is a lead scientist on IPM efforts in other basins such as the Snake and Cowlitz. John Plumb (USGS) is a research scientist supporting these projects.

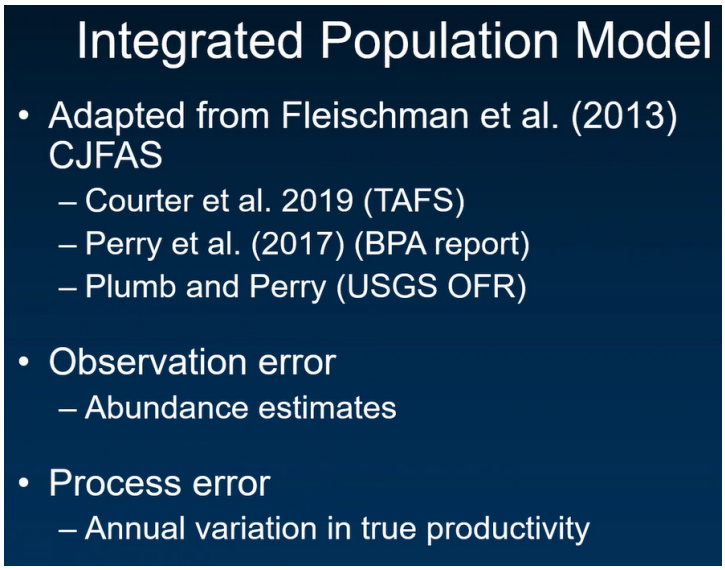
Chris Karchesky said he has worked with the USGS staff to compile data into an accessible and understandable format. This effort involved collecting information on historic cohorts and analyzing age structures. There are a few outstanding pieces to complete, then USGS will move forward with incorporating covariates like flow. The work was initiated with coho salmon, which provided the easiest and most consistent dataset for analysis. The Monitoring and Evaluation (M&E) plan outlines a 5-year development period for the model. The presentation included background on what an IPM is, status of the analysis, next steps, and time for open discussion.

Perry stated the objective of the IPM is to relate covariates (e.g. environmental conditions, collection efficiencies) to the different life stages of the fish.

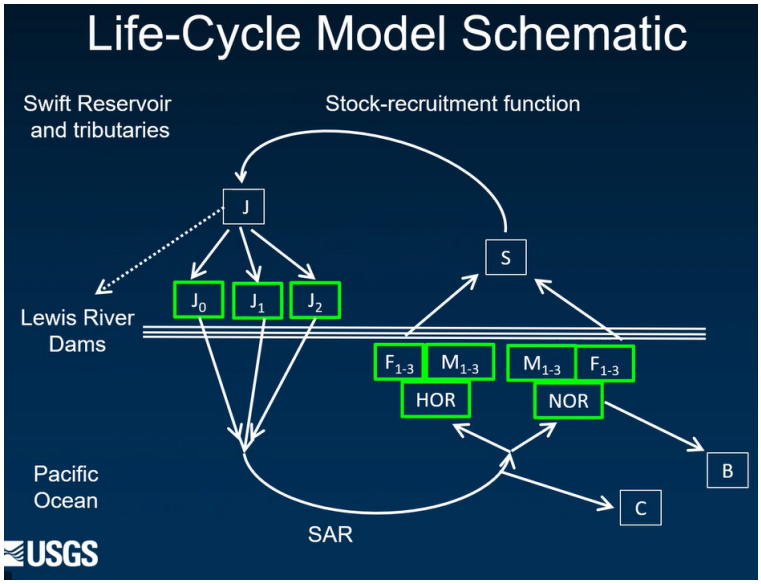
Plumb described the components of the two-stage model, from parent spawners to juvenile emigration of their offspring, and then from that juvenile emigration back to their spawner stage.

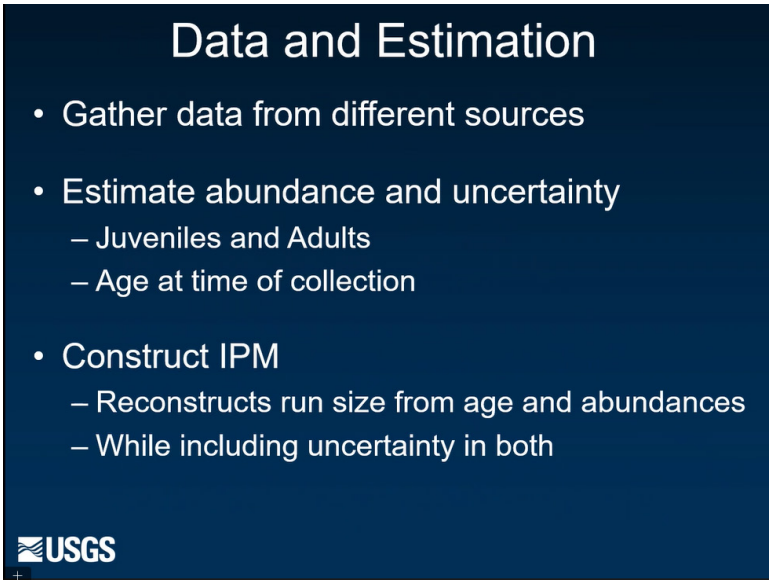


The approach was adapted from Fleishman et al. (2003) who took a spawner-to-spawner approach. Other similar model efforts include on authored by Ian Courter et al., on the Clackamas and Perry on the Snake River.

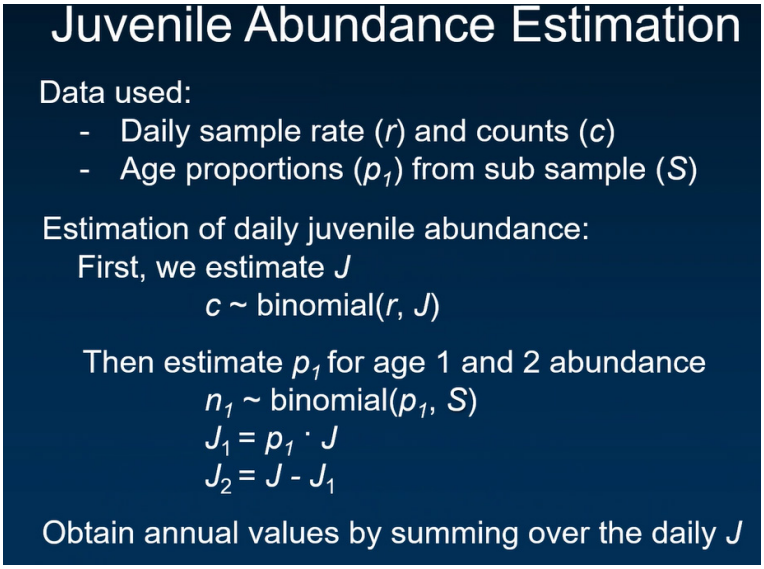


Plumb described the functions used to estimate conversion from one life stage to the other, and the steps for incorporating data sources. He noted there are a lot of data to work with for the Lewis River. Males are tracked in the model, but they will only be modeling females because their primary contribution to productivity.





Plumb showed how juvenile abundance is being estimated. Kale Bentley asked how this is similar to what is being done for a separate analysis by WDFW. Plumb said Chris Karchesky provided the abundance estimates for use in this model, which are identical to those generated by WDFW's analysis, and this effort will further estimate the measures of uncertainty.

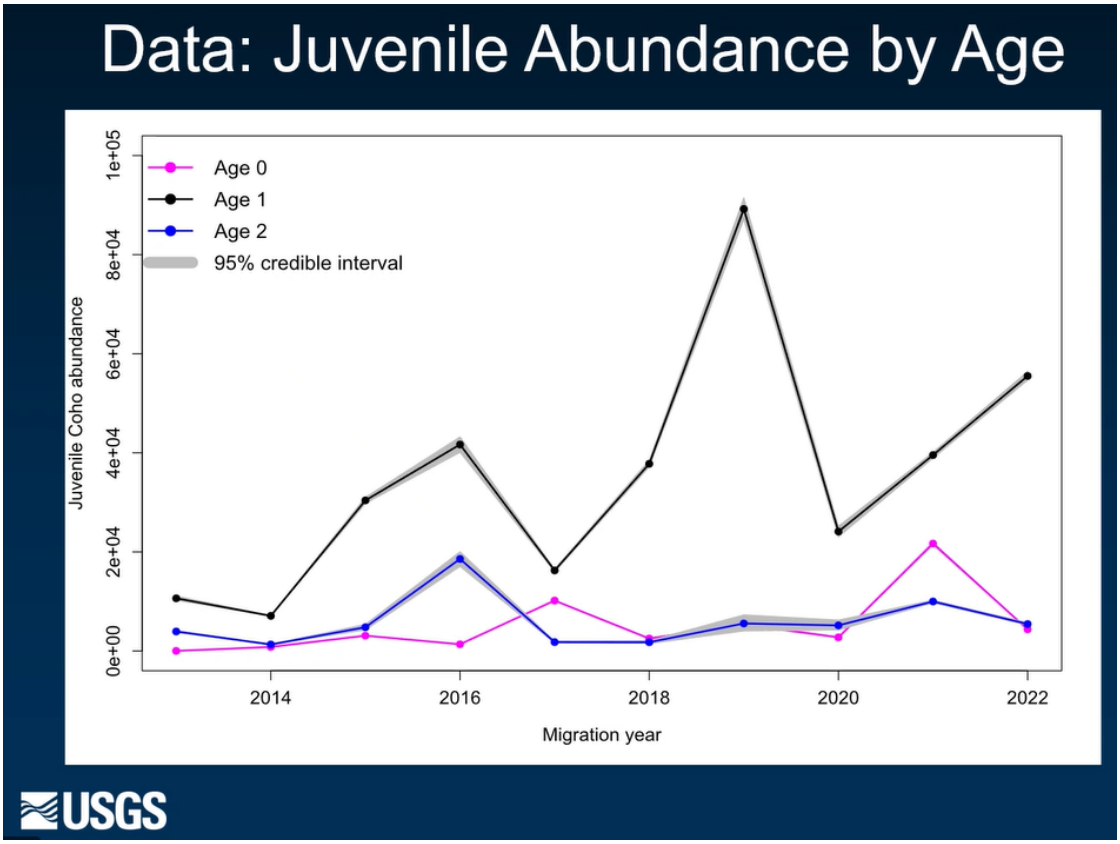


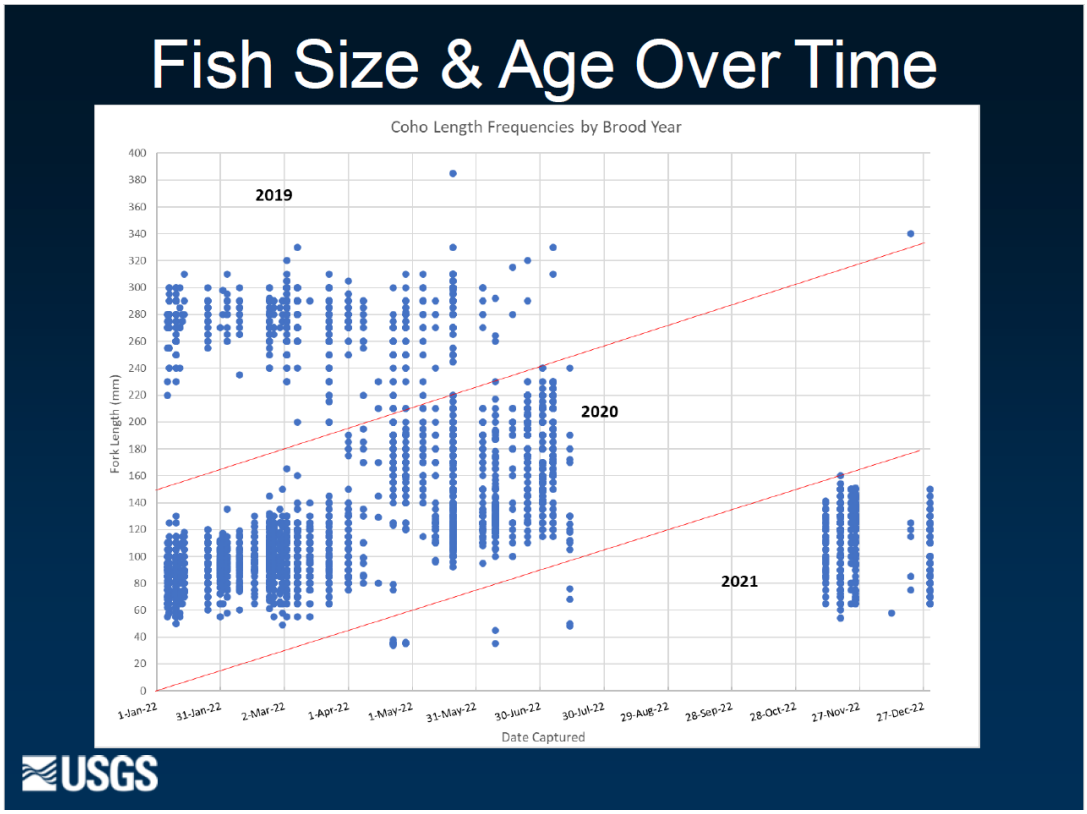
Plumb described the process being used to determine age by size, in order to estimate juvenile abundance by age. For coho salmon, outmigrants are relatively easy to identify based on size.

Bentley asked if coho salmon age determinations were made based on size, or also with scale analysis. Karchesky said the age structure of the juvenile outmigrants at the FSC was determined by length, based on a length-by-day distribution from data compiled over several years of sampling. Some fish were directly enumerated and assigned to an age group (e.g. fry/age-0 are small, large fish are assumed to be age-2). Perry said Pacificorp developed the size cutoffs and then provided the subsample of juvenile outmigrants for determining assignments to 1-year-old or 2-year-old groups, which is then applied to the total abundance. Bentley said there is little overlap in sizes between age classes for coho salmon, but there is some; he asked if that overlap or uncertainty is being ignored for now and Karchesky answered yes. Karchesky noted that this is also a reason the method for assigning ages for Coho salmon was changed to assigning fish to a brood year rather than just smolt or fry.

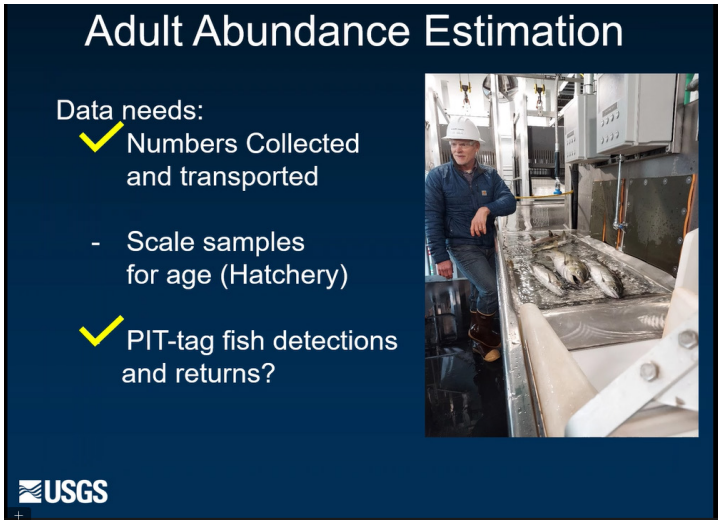
Bentley noted that steelhead age determination will be more difficult, and asked if scales are being collected on steelhead. Perry agreed that steelhead are more complicated, and that is one of the reasons they started with coho salmon. Karchesky said scales are being collected to age the steelhead. Bentley said, based on smolt trap data, sometimes the age-2 and age-3 steelhead are the exact same size, and Karchesky agreed that is observed due to fish rearing in different habitats. Kale said it's also complicated by different collection efficiencies of different ages. Perry asked what ages of outmigrant steelhead are observed. Karchesky said few age-0 are observed, and age-1 and age-2 fish are 18 to 16 inches. Usually there are two different size distributions but scale analysis will be important to better interpret the size distributions.

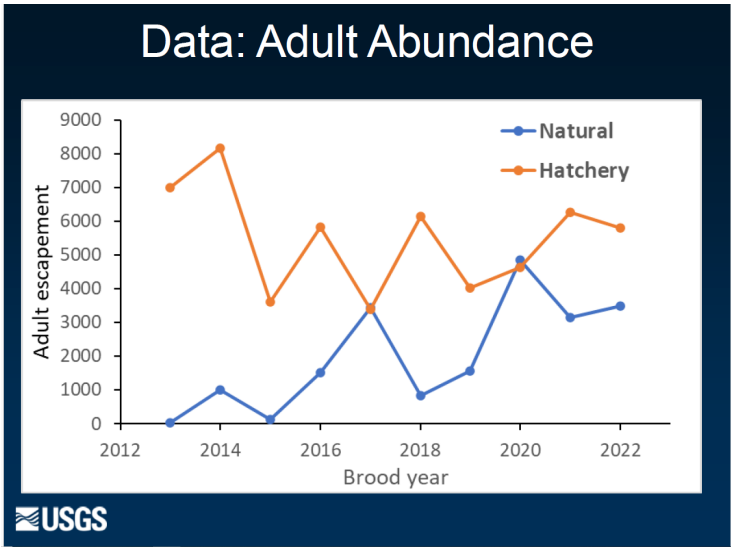
Perry said one reason the uncertainties were so low for coho salmon is because the sample rates at the FSC are generally 20% or higher each day, so the expansion error is low, and the differentiation in size is larger. All juvenile sizes are included; size sampling occurs from October through July, excluding a 3-month period when the FSC is not operating.



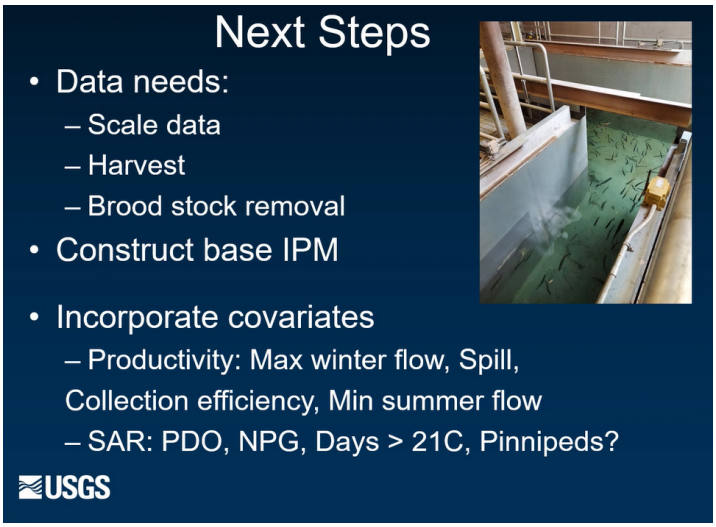


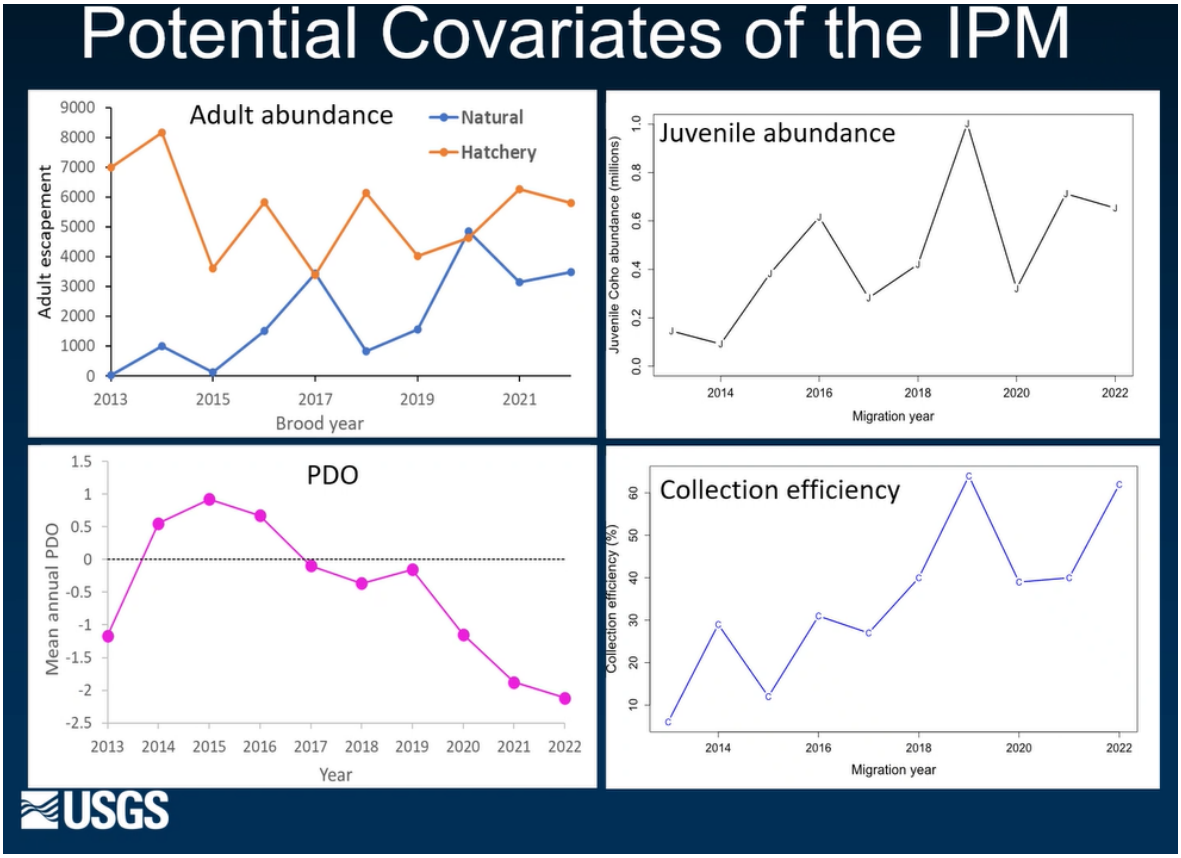
Plumb said the coho salmon adult age and size sampling is a full census of fish being transported, so there is no uncertainty due to expansion error. Final age determination based on scales is in progress. Adult abundance factors can be included in the model, for instance, pHOS can be included as a covariate in the model.



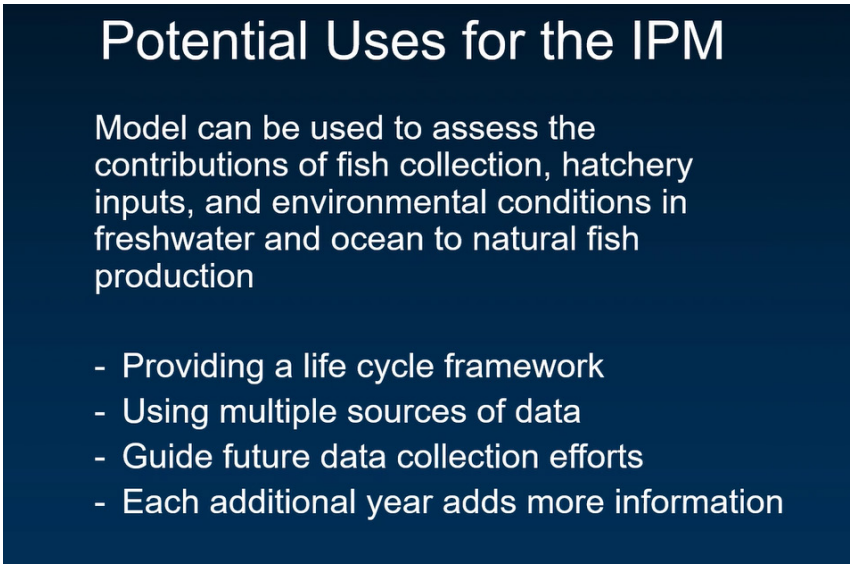


Plumb described the next steps for the work, which is to finish obtaining a few data inputs for the constructing the base IPM. Then covariates will be brought into the model. Example covariates include temperature, or a temperature threshold such as that used for Snake, which may be useful for the Lewis River during upstream migration.

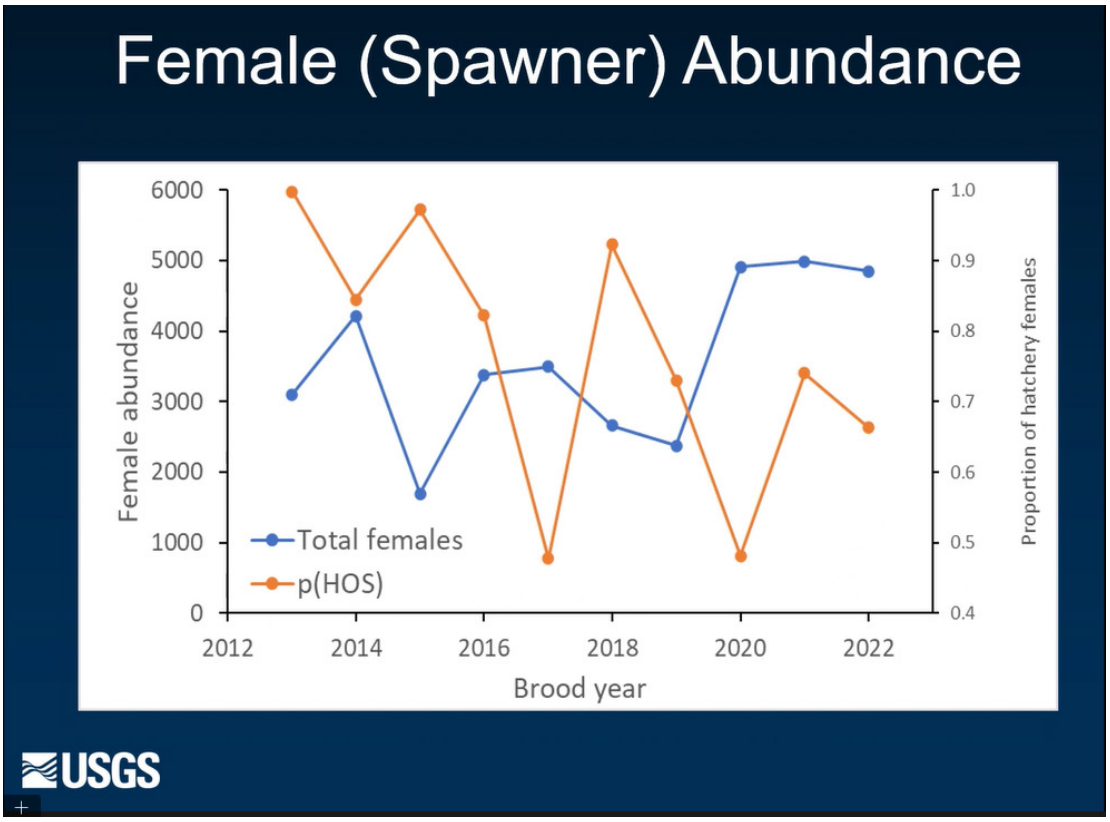




Plumb concluded by summarizing the potential uses for the IPM, and suggested it would be useful to hear feedback from the ATS on uses. He thanked Karchesky and Jeanie Heltzel for their work.



Perry said the benefit of determining how to organize the data for inputting into an IPM is helpful for thinking about how the data are collected. Bentley said it would be helpful to have that written up as part of the outcomes of the project; this group has discussed over many years how to document data streams from the monitoring activities and input workflow. Karchesky said it has been helpful to go through the historic data and more contemporary data to identify biases (e.g. natural-origin returns based on PIT tags) and data gaps. For instance, a constant number of 9,000 coho salmon have been transported to the upper basin each year, but there is a lot of variation the number of females transported. The composition of the fish that are passed upstream depends on fish availability which means transport timing has varied, such that in some years approximately 80% of the fish were from the late coho salmon stock.

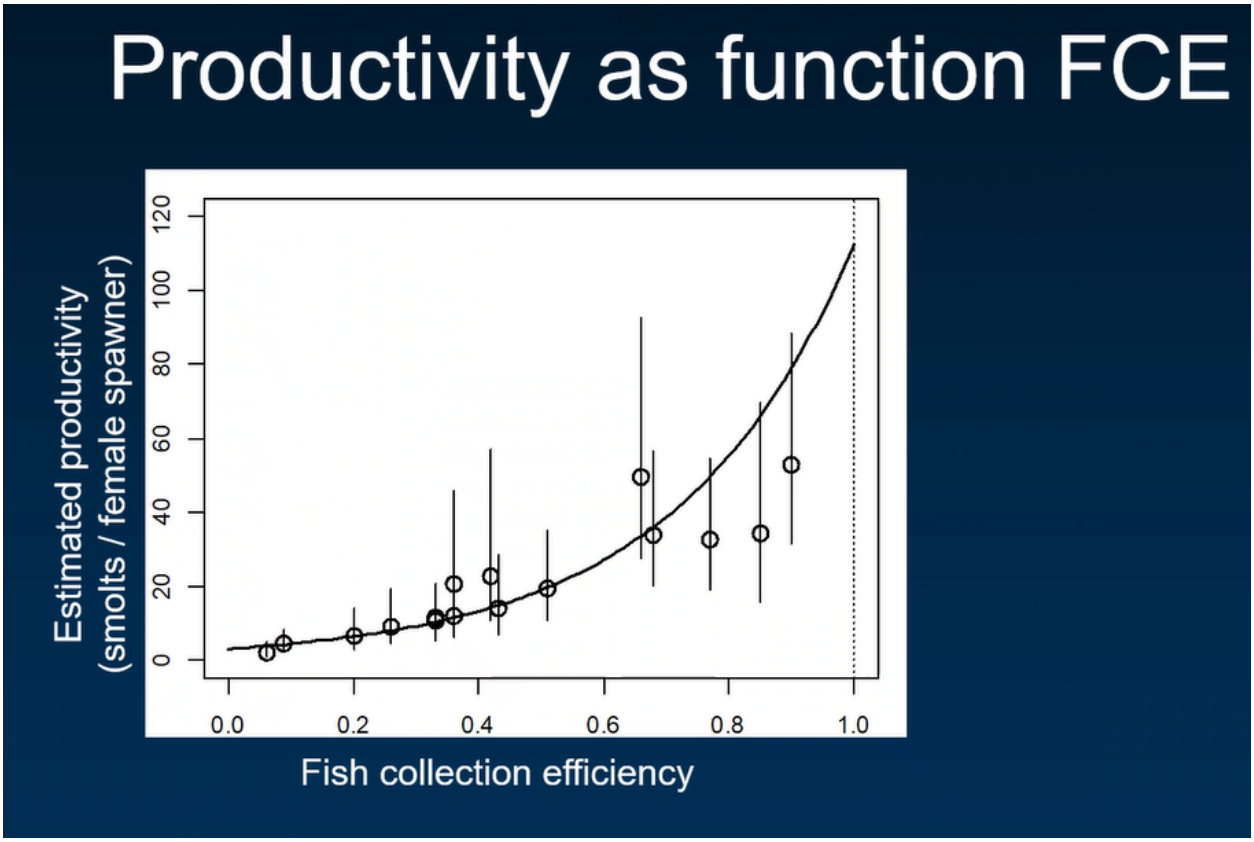


Bryce Glaser said now that the program is working toward a new integrated stock with the transition plans, this IPM can help us to understand performance of that transition plan, for instance whether an appropriate number of fish being transported. If 9,000 fish are always being moved upstream there may not be enough contrast in the data to test performance. Perry said in a Beverton-Holt curve, the number of fish will increase and stabilize at a given carrying capacity, and how quickly the number of fish increases is called the productivity when there's no density dependence. He agreed that if a constant number of 9,000 is always transported the estimates of productivity and capacity by not be very good, and if there is an opportunity to allow different numbers of spawners to be

transported upstream that may fill some of those gaps. Glaser said that over the next couple of years with strong coho salmon returns anticipated during these years of high productivity in the ocean, they could consider trying to transport more than 9,000 to reach a higher productivity. Because of the transition to the integrated program, early returns will no longer be moved up unless there is an emergency, so fewer fish may be available while transitioning. Bentley agreed there are a lot of extra hatchery fish now; last year the return was 70,000 coho salmon. After the transition plan is initiated, we may have to wait until collection efficiency is much better than it is now, matched with good ocean conditions, to achieve those numbers again. Perry said there is contrast in the number of females transported upstream from 1,500 to 500 females; that productivity curve hasn't been developed yet, but it is a unique system where there is some ability to control the number of spawners to better estimate population parameters.

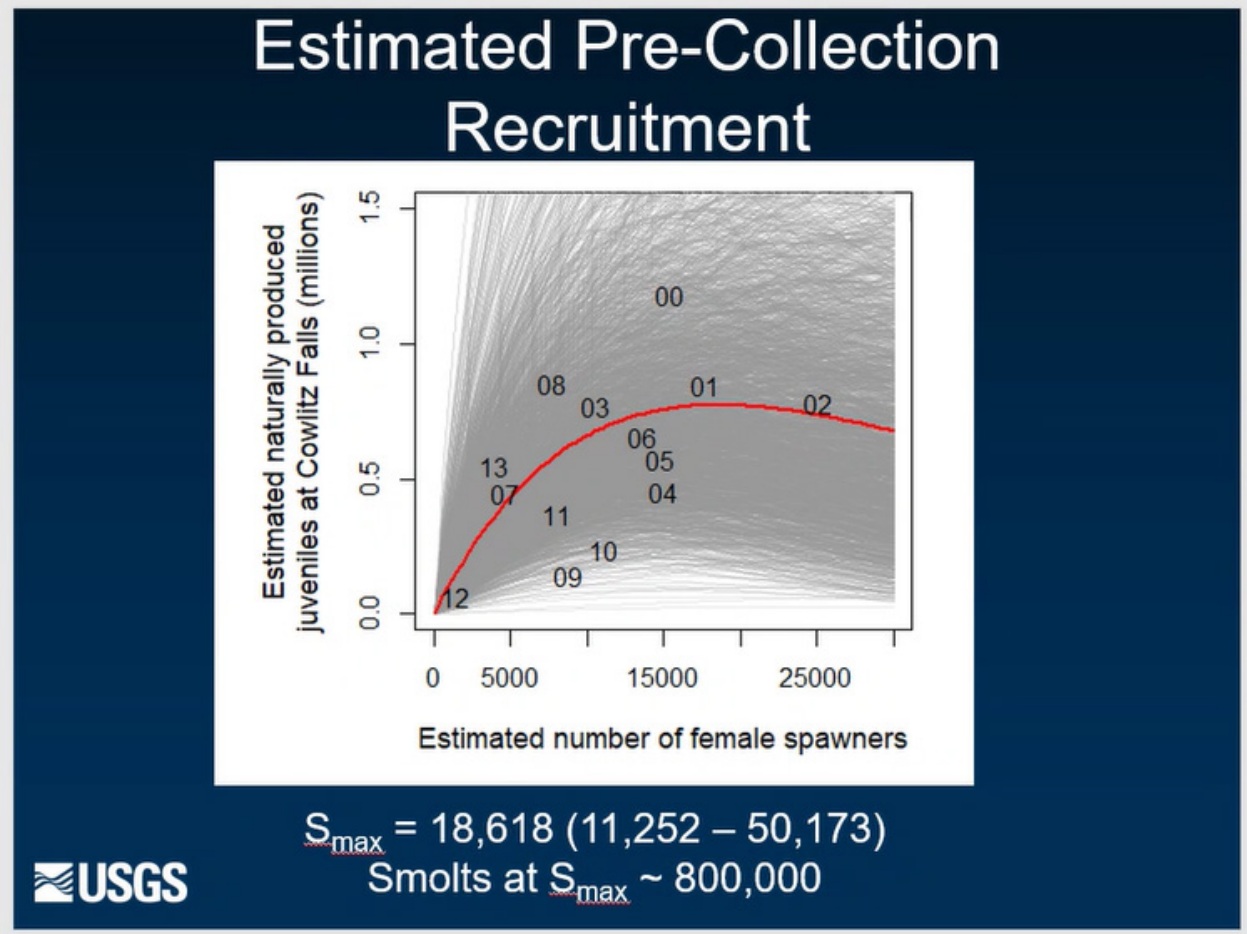
Karchesky said fish placed in the reservoir late, after thanksgiving, tend to drop down and spawn in the transition zone; however, if fish are transported too early there is no water in the tributaries. The program would benefit from being more informed about how the flow and timing conditions are influencing productivity. For instance, 2019 had good spawning conditions with a lot of water; a lot of those conditions have been matched in other years, but productivity still hasn't been matched. Glaser said transitioning to the integrated program with broader return timing will allow those selection pressures to drive that population size. Plumb said they have not so far included early and late coho salmon to assess the interactions between run timing and covariates like flow.

Plumb and Perry shared observations on the upper Cowlitz basin based on collected/transported fish, expanded for fish collection efficiency (FCE). Productivity as a function of FCE was estimated, up to 95% FCE. There are fish passage survival mandates and metrics, but the model can also be used to estimate probabilities, with uncertainties, that inform the management of the trap and haul system.



Glaser said in the future, the program will reduce the number of HOR spawning in the upper basin; knowing the capacity with inform this decision if relative reproductive success of HOR vs NOR fish could be factored in. Karchesky agreed; the Snake River has approximately 30 years of data to draw from, Cowlitz has approximately 20 years, the Lewis now has approximately 10 years. The framework gets better with modifications to the program and additional data points, and then it becomes a better tool for inference. The intent is to build the tool now before Yale Dam downstream passage comes online. The ultimate goals is to inform the outcomes, such as Ocean Recruits, and identify what factors are in our control, or out of our control. Discussions can be had now to understand effects of the transition plans.

Josua Holowatz agreed there is a need to think about demographic replacement, for instance, transporting additional HOR fish to maximize productivity rather than being tied to a firm 9,000 fish which may not be as useful.



Bentley said the ATS will be revising the monitoring plan regarding data management, leveraging data we are already collecting, indicating where the data are being used, data gaps, and what objectives can't be addressed right now. We can prioritize work based on how the model can inform those things. Perry agreed the idea was to develop the base model and then identify how it can inform the monitoring plans.

Glaser said there were some issues in the coho salmon transition plan that were never fully resolved, including that the 9,000-fish target for transporting upstream unclear whether they should be HOR or NOR. Perhaps the guidance should be changed to be easier to manage. The ATS should consider what recommendations to make to the ACC and how soon to make them if they are to be implemented this year. Bentley observed that collection curves for transport could be developed, similar to those used for broodstock collection. Karchesky said there is a transport curve. Karchesky asked if there is a magnitude of increase in transport numbers to target. Bentley suggested looking at other estimates of productivity related to watershed area.

Perry said within next couple of months they will have a base IPM that will generate annual productivity and smolt-to-adult return ratios. The modeled data will better inform a target number of fish for transport.

Karchesky said regarding timing, coho salmon are arriving now. Glaser said currently the plan is to use all early-run coho salmon for implementing the Habitat Preparation Plan actions; the plan for this year could be to transport up to 9,000 hatchery fish according to transport curve.

Steve Manlow asked to what degree habitat restoration could confound estimates, for instance 11 miles of work on Clear Creak will be done be USFS. Perry said there will be contributions from particular covariates to estimating the effects of that; but then there will an additional covariate of unexplained change. Before and after habitat restoration could be evaluated, but it would take some time to observe results of restoration. Collecting information over time will help to understand whether those capacity estimates are shifting. Big shifts in productivity, like adding a whole new reservoir when a new collector comes online, can be reported out separately.

Holowatz said in the low abundance year of 2017, there were 42,000 fish, 29,000 were early-run.

B. Yale Habitat Preparation Plan Comment Review (Lesko)

The Yale Habitat Preparation plan was distributed for ATS review on July 16, then to the ACC for 30-day review on August 3, for approval in the September 14 ACC meeting. Language about the HPP is found in the Settlement Agreement (SA) section 7.4 Habitat Preparation Plan.

Erik Lesko said Comments were provided by the LCSRB in early August, and WDFW's comments were received but have not been incorporated yet. Questions have been raised about the biological and ecological benefit, but recognizing this is a SA requirement, this year's approval is for updates to the HPP. Parties that have questions about supporting it can abstain from a decision.

Glaser said that last year no decision document was prepared, and asked if this approval should be more formalized this year, noting that once fish passage comes online, a thorough review will be necessary each year. Lesko said the revisions to the HPP are not in conflict with the Settlement Agreement, and so a formal decision document may not be necessary. Another perspective is that if it requires Consultation with the ACC, a decision document should be created. The ACC approval was documented in the notes last year and Lesko suggested going forward with the same approach this year.

Josua Holowatz said the only substantive change to field work would be not operating the Cougar Creek Weir; there will be a different monitoring strategy based on PIT tag detections and habitat

walks. Manlow said he focused his review on technical concerns that may need resolution in future years.

Glaser said when the SA was written there was a strong push to include this HPP, but there is no evidence this is beneficial. Generally, the conclusion by the ATS last year was that if major changes were proposed to the HPP, it would require a separate ACC process to modify the SA. The ATS decided last year that the HPP can go forward if there are adequate numbers of fish and if the HPP is not putting other program objectives at jeopardy or creating a negative biological impact. Manlow agreed that is the LCSRB's position, to look for opportunities to move NOR fish into the upper basin and ensure there is not a negative impact of this program on recovery. LCSRB supports adjusting the monitoring to better understand where these fish go in tributaries. Glaser said monitoring has been discussed a lot; there are no monitoring obligations associated with the HPP, however it's agreed that opportunistic monitoring should be capitalized on.

Glaser said NOR transport could occur in 2023-2024, in accordance with agreements to start 5-years before operation of downstream passage with the Yale FSC. It has not been determined how soon the recently-approved transition plans could be implemented. There is a need to discuss how to prioritize NORs for use in broodstock, upstream transport, or for the HPP. For all intents and purposes, this could be the last year of the HPP. Bentley asked where the fish passage implementation dates are documented. Glaser said the implementation timing is defined as part of the Elements of Fish Passage document (currently in review for ACC approval). Details from the Elements of Fish Passage document will be carried over to update the Fish Transport Plan by the Fish Passage Subgroup. The Fish Transport Plan is still in draft form, and has not been formally approved. The H&S Plan and updates to the Annual Operating Plan (AOP) have worked as surrogates for updating the original transport plans that were drafted around 2007. The next steps for the Fish Transport Plan will be to develop concepts to the 50% design level, then in 2024 make those updates. WDFW will then have to approve the updated Fish Transport Plan. The ATS would then identify a schedule for updating the H&S Plan and AOP. Amelia Johnson asked how these timelines relate to the earlier conversation about potentially moving more than 9,000 coho salmon upstream this year or next year to test capacity and productivity assumptions? Glaser said the AOP describes the upstream transport targets; these could be modified in updates to the 2024 AOP, but then would be formalized and approved in the Fish Transport Plan.

Holowatz said, as an example, the Cowlitz plan has detailed directions on how to modify transport based on temperature, but in this document there is less detail on sites and protocols. Karchesky said there will eventually be more detail describing what to do with adults at upstream sites in the system. Holowatz asked whether radiotelemetry could be used in Yale Reservoir to tag some adults at release to monitor where they go and observe adult behavior. Lesko said he has concerns about tying

monitoring to the HPP; that type of work would better inform fish passage and would be more appropriate to tie to the fish passage section of the SA. Karchesky said more context is also needed around what could be done with that information. Holowatz said additional radiotelemetry could inform entrainment into Swift 2 once those units cycle on, or whether fish use the bypass reach as their primary homing route, or whether they move into Siouxon Creek. Karchesky said regarding a behavioral study, for some time, primarily HORs will be transported that will stray (because they originate from hatcheries below the dams); it would be better to design as study around NORs that are from Swift Reservoir and release them in Yale Reservoir so they are likely to move upstream.

Lesko said he will document comments and responses as an attachment to the revised HPP. The comments and responses can be sent to the ACC to inform their approval, which will be documented in the meeting notes. Next year, the ATS will start to discuss the composition and numbers of fish to move upstream earlier in the year.

Holowatz noted that, similar to last year, there will be a 16-inch maximum size restriction for retaining fish in the reservoir through a fishing rule change to prevent retention of fish transported for the HPP.

C. Transition Plan Implementation Timelines (Glaser)

Glaser said the coho salmon and steelhead transition plans have been approved by the ACC, with the transition beginning from 2023 to 2025, and NMFS has supported starting sooner than later ahead of Consultation on hatchery programs. The coho salmon transition plan directs a change to the broodstock collection strategy for the late integrated program to collect from the full return. Coho broodstock collection is starting now. Collection for the early coho salmon program will stay the same. The numbers for upstream transport (as documented in the AOP transport curve) will depend on use of integrated adult returns as jacks and adults in future years. In past years, there have been NORs that arrive between the early and late program collection dates; previously they were all transported upstream and not used for broodstock. There is a period during the first 2 weeks of October that HORs were not used.

Glaser asked, if implementing a transition for the late coho salmon program this year, what steps are needed through this fall? Should the collection curve be adjusted to integrate some of the NORs or HORs that arrive earlier? Is it feasible? New broodstock collection curves would be needed before October to provide guidance to hatchery staff. There were proposed infrastructure changes needed to facilitate this.

Kevin Young said in the past, broodstock collection was carried out with fewer, large takes that can all be spawned at the same time, so incubation can be timed together on the same temperatures

and feed rates for the different takes can be adjusted to achieve the same size and release dates. Now there will be several egg-takes at different times across the run; they would need to be fed on different trajectories so the size of all the groups can be brought together for grow out and ponding on the hatchery production timeline. There are minor infrastructure needs to help isolate smaller broodstock takes over a longer period of time. The major infrastructure need is a chiller to slow down development of the earliest takes. Without the chillers, the young from the early takes would emerge earlier and grow out larger than target sizes, precocity rates could increase, and the early groups may trend toward earlier smolting.

Bentley asked whether by agreeing to the transition plans there was agreement to adding chillers? Glaser answered that it was generally agreed that there is a need to adjust the infrastructure for more smaller takes.

Glaser asked if in 2023 the program could start with some changes to collect from the later end of the return. Young said yes, fish can be collected later which would probably benefit the program. Glaser asked if it is worth working on the later end of the run now or to wait until the infrastructure needs are determined for the earlier part of the run.

Karchesky asked if the early NOR returns could be retained. Young said it's possible, but he would need to determine the logistics. That group would have to be ponded separately from the early coho salmon program. Young said he started tracking the logistics during the 2022 broodstock collection to understand how this type of program can work with the infrastructure and operations.

Glaser said the goal is to collect across all the NORs, then determine how many early HORs or just late HORs should also be collected. Bentley said the intent is not to create 3 programs by taking NOR fish early, then rearing them on an early maturation schedule.

Holowatz showed the example collection timing that was included in the transition plan. The largest number of NOR returns occur in October when the Lewis River water temperatures are warmest.

Integration Target: 50% or less if necessary; NOR brood stock mining rate: 30% max; Demographic Replacement: ≥1 wild spawner equivalent

Collection timing curves and weekly collection goal table: Example only, actual collection goals will be set via Annual Operating Plan

Lesko asked if the incubation management could be modified at Speelyai Hatchery using its cold-water supply. Young said the rearing infrastructure is all at Lewis River hatchery; once the transition plan is fully implemented, spawning and egg take will occur at Speelyai Hatchery because of the cold water, then fry will be transferred to Lewis Hatchery. But Speelyai Hatchery doesn't have the rearing infrastructure to hold fry through May. Lesko asked if Speelyai Hatchery has enough water supply. Young said August and September is borderline, but in October it recovers; they do not need more water for egg incubation but do need to expand the rearing out to the fry stage.

Lesko said PacifiCorp are developing a temperature model with the Department of Ecology for downstream of Merwin Dam because temperature does exceed standards. The outcome may be installation of temperature towers at Merwin Dam to moderate the peak river temperatures in October, which may provide cooler water for Lewis hatchery operations.

Young said a new chiller would cost approximately $200,000. Glaser said in the big picture, it might fit into other funding sources because it could benefit spring Chinook salmon rearing. There could be opportunities for cost-sharing.

Glaser said there are several complicating factors and asked if there is alignment within the ATS to plan on implementing fully next year rather than starting partial components this year. Young supported that approach.

Glaser offered to lead further conversation around infrastructure needs and implementation plans. There is a need to discuss and to evaluate alternatives to the infrastructure changes proposed, and work toward a preferred alternative. Bentley suggested starting a conversation within the week to identify if there could be some opportunity to collect from the early part of the run this year. Glaser suggested furthering those conversations and bringing alternatives back to the group if anything is

identified in the near term and no members disagreed. Young supported working on this now rather than later.

Glaser said there is a need to propose a similar approach for steelhead to be ready to make changes by spring. Holowatz asked if enough brood has been collected to expand the summer steelhead production now? Young answered no, and Glaser said that will be planned for next year.

D. Update said Adult Steelhead Abundance and Composition Monitoring Strategies (Lesko/Peterson)

Erik Lesko provided an update on the responses to the review of steelhead abundance and composition monitoring. A the end of May, Erin Peterson provided a review of the current methods used for steelhead abundance and pHOS monitoring. Lesko had responded to Peterson in comments, and WDFW has provided Lesko additional responses. Lesko has also discussed the sampling method using tanglenetting with Dalton Hance (USGS) who designed the original Baysian model to estimate pHOS.

Lesko said he would like to discuss with the ATS how the pHOS will be used at this point in the program and why it is important. Bentley said there is a difference between having thresholds that limit what you can do with a hatchery program and monitoring pHOS to understand what impact these programs are having on the overall population. The lower river is a subcomponent is of the overall population. Lesko said that regardless of what the pHOS is, there would be not changes made to the program. Bentley said that even though we know that not all programs are set up to achieve HSRG guidelines, we want to know which populations are performing better than others on this metric because there is wiggle room in how those programs are being managed. With implementation of the transition plan, the winter steelhead program will increase temporal overlap between HOR and NOR spawners and pHOS is a metric to measure the effect of the steeping stone program on the NOR. Bentley said pHOS is a subcomponent of monitoring abundance and composition and there is strong evidence that the current abundance estimates are biased. Reinitiating the tangle-netting would allow us to correct some of those biases.

Lesko noted the pHOS model wasn't set up to monitor the impacts of the early winter steelhead program, and genetic screening for broodstock selection will no longer be done.

Lesko said he discussed sampling steelhead by tanglenetting versus angling with Jeremiah Doyle, and discussed a mix of methods such as tanglenetting early and angling later in the season. Bentley suggested implementing both methods simultaneously to evaluate methods and determine which to go forward with in the future. Bentley said tanglenetting is a preferred approach because it has worked before; angling is not a tested approach. Lesko said concerns have been raised about

violating assumptions by using one method versus another; in the past the tanglenetting intentionally targeted spawners, now the implementation is being redesigned and tanglenetting may miss fish that are rapidly migrating upstream. Aside from concerns about the direct effects of netting on the fish, tanglenetting may not be the most effective sampling method for upstream migrants. Bentley again suggested testing both methods to understand which sampling is more representative. Sampling by tanglenetting is not representative of the whole run.

Bentley said in the description of the study design and analysis, the only concern mentioned was detection efficiency. Bentley said the model can account for changes in transition probability over time. Peterson said capture probability is allowed to vary in the model.

Lesko asked how to adjust for times of the year when tanglenetting can not occur due to high flows. He suggested angling because it can be implemented throughout the season with perhaps more consistent results. Bentley said there will be variation in catch rate with either method. There is a need to compare methods or pair them to complement each other.

Bentley said how biased the estimates are depends on how far the sampling and deviates from the assumptions. The next steps would be to evaluate specifics of the sampling approaches, paired with discussing how biases can be accounted for in the model. Lesko supported this as a priority for discussion.

Bentley said he is comfortable with the level of detail in the study plan on tanglenetting done in the past, but there may be extra detail needed on number and location at sites, frequency, duration, response to river conditions, and any responses to spring Chinook salmon migration.

Holowatz said mesh size can alleviate capture of Chinook salmon. He noted that above Colvin Creek closes to the recreational fishery, so any anglers hired to tag steelhead would signage as research vessels.

Bentley said WDFW evaluated the methods, analysis, and assumptions in the memo and outlined any concerns. If there are new concerns about the methodology, these need to documented in a simple list of bullets for discussion, then a meeting can be set up with Hance to discuss the effects on the model. Peterson said what is needed is some documentation to compare what is needed for the model versus what can be provided. Lesko agreed to describe the ideal protocols on paper; then include the constraints around what can be achieved. Lesko agreed to summarize methods and concerns by end of next week.

E. Update said Genetic Monitoring Strategy (Lesko)

Lesko sent the updated Genetics Monitoring Strategy to Kale Bentley in early July; there has been no interaction since then. Cramer Fish Sciences (CFS) added some contents. There is still some sampling that and an implementation plan that needs to be figured out. Sampling and more PIT tagging has started in the upper basin. There isn't a lot of water there.

Lesko will organize a meeting between CFS and WDFW geneticists to resolve final issues documented in earlier emails.

F. Update said Hatchery Practices and Pathology (Hatchery and Fish Health Staff)

Broodstock Collection In-season Updates (Hatchery Staff)

Kevin Young updated the group that broodstock collection for coho salmon starts next week. Spring Chinook salmon broodstock collection targets were met, and spawning starts next week. Summer steelhead broodstock collection is ending. There are a lot of coho salmon this year.

Fish condition at Speelyai Hatchery is good. There is some columnaris at Merwin Hatchery. Bacterial kidney disease levels in Lewis spring Chinook salmon is low. Everything is trending in a good way.

III. ATS Administration (Rohrbach)

A. Review ATS Work Plan Priorities

Glaser said WDFW is submitting Habitat and Genetic Monitoring Plans (HGMPs) for Consultation today.

B. Review Next Meeting Topics (Rohrbach)

The next meeting will be September 28, in-person, in the same location with a virtual option.

The ATS identified the following potential items to discuss at the next meeting:

- Steelhead pHOS – continued discussion
- Transition planning – continued discussion
- Anticipated updates for the AOP for 2024

IV. List of Attendees

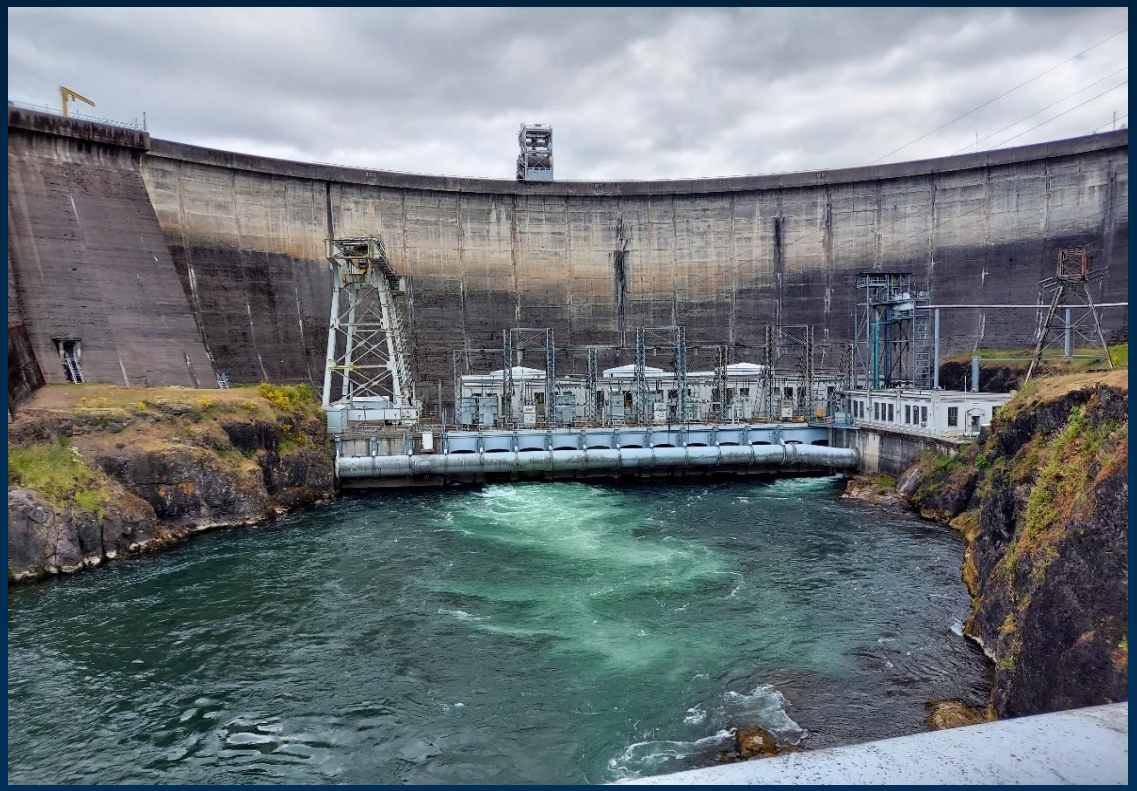
Name	Affiliation
Larissa Rohrbach	Anchor QEA
Chris Karchesky	PacifiCorp
Erik Lesko	PacifiCorp
Amanda Farrar	Cowlitz PUD
Christina Donehower	Cowlitz Tribe
Steve Manlow	LCFRB
Amelia Johnson	LCFRB
Kathryn Blair	NMFS
Emi Melton	NMFS
Russel Perry	USGS
John Plumb	USGS
Bryce Glaser	WDFW
Kale Bentley	WDFW
Josua Holowatz	WDFW
Anja Huff	WDFW
Erin Peterson	WDFW
Kevin Young	WDFW

USGS
science for a changing world

Estimating Life Cycle Demographic Parameters of Coho Salmon in the Lewis River

John M. Plumb
Russell W. Perry

Update for PacifiCorp
31 August 2023



U.S. Department of the Interior
U.S. Geological Survey

Lewis River Coho Life Cycle Model

- Overview of model structure
- Status of analysis
- Next steps
- Discuss possible model uses

USGS

Two-Stage Model

- Stages affected by different factors
  - Spawner $\rightarrow$ juvenile emigration
    - Environmental factors
    - Collection and Transport
    - Habitat capacity and productivity
  - Juvenile emigration $\rightarrow$ spawner
    - Ocean conditions
    - Harvest and brood take
    - Juvenile life history

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Integrated Population Model

- Adapted from Fleischman et al. (2013) CJFAS
  - Courter et al. 2019 (TAFS)
  - Perry et al. (2017) (BPA report)
  - Plumb and Perry (USGS OFR)
- Observation error
  - Abundance estimates
- Process error
  - Annual variation in true productivity

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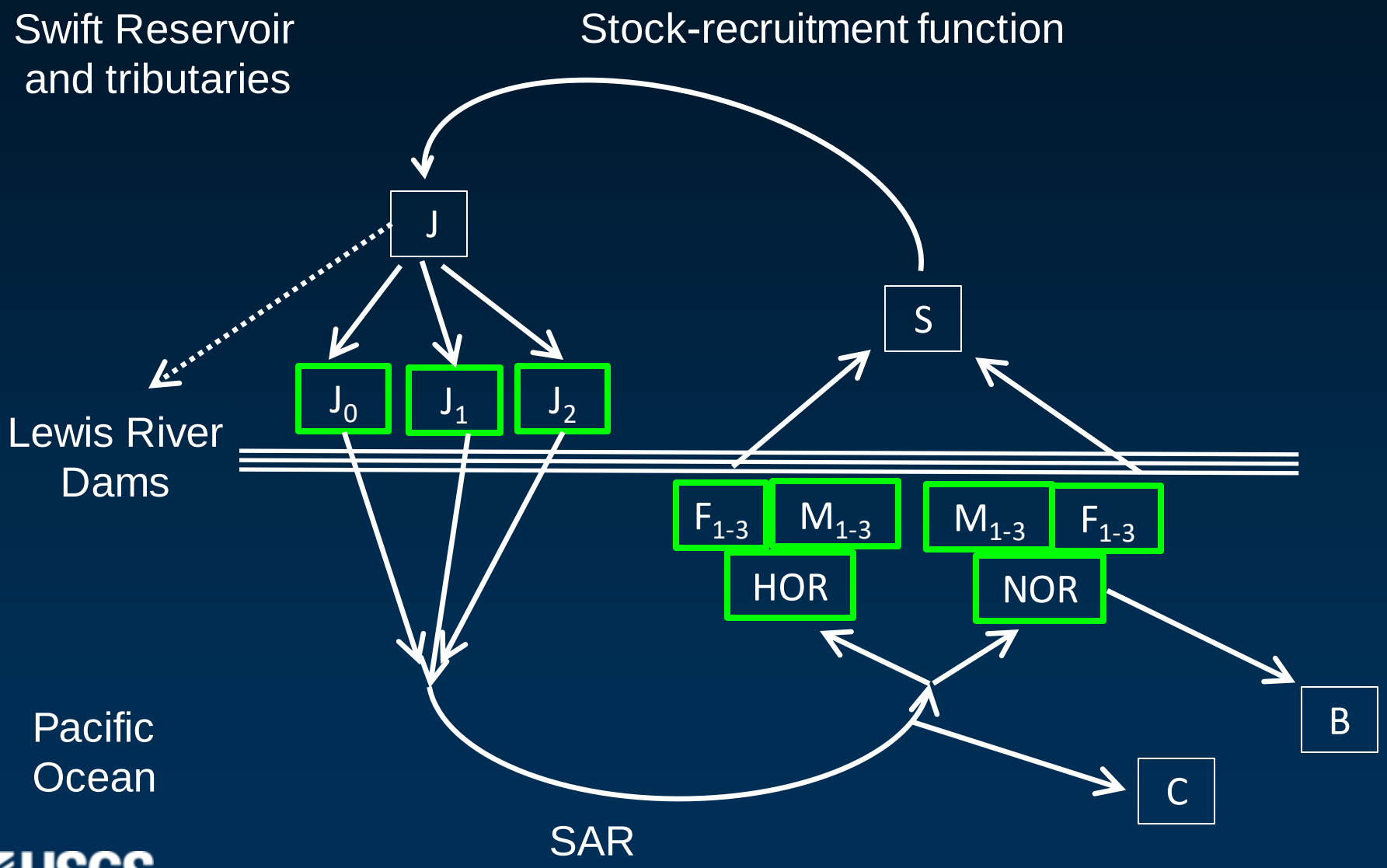
Life-Cycle Model Schematic



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Data and Estimation

- Gather data from different sources
- Estimate abundance and uncertainty
  - Juveniles and Adults
  - Age at time of collection
- Construct IPM
  - Reconstructs run size from age and abundances
  - While including uncertainty in both

USGS

Juvenile Abundance Estimation

Data used:

- Daily sample rate (r) and counts (c)
- Age proportions (p_1) from sub sample (S)

Estimation of daily juvenile abundance:

First, we estimate J

$$c \sim \text{binomial}(r, J)$$

Then estimate p_1 for age 1 and 2 abundance

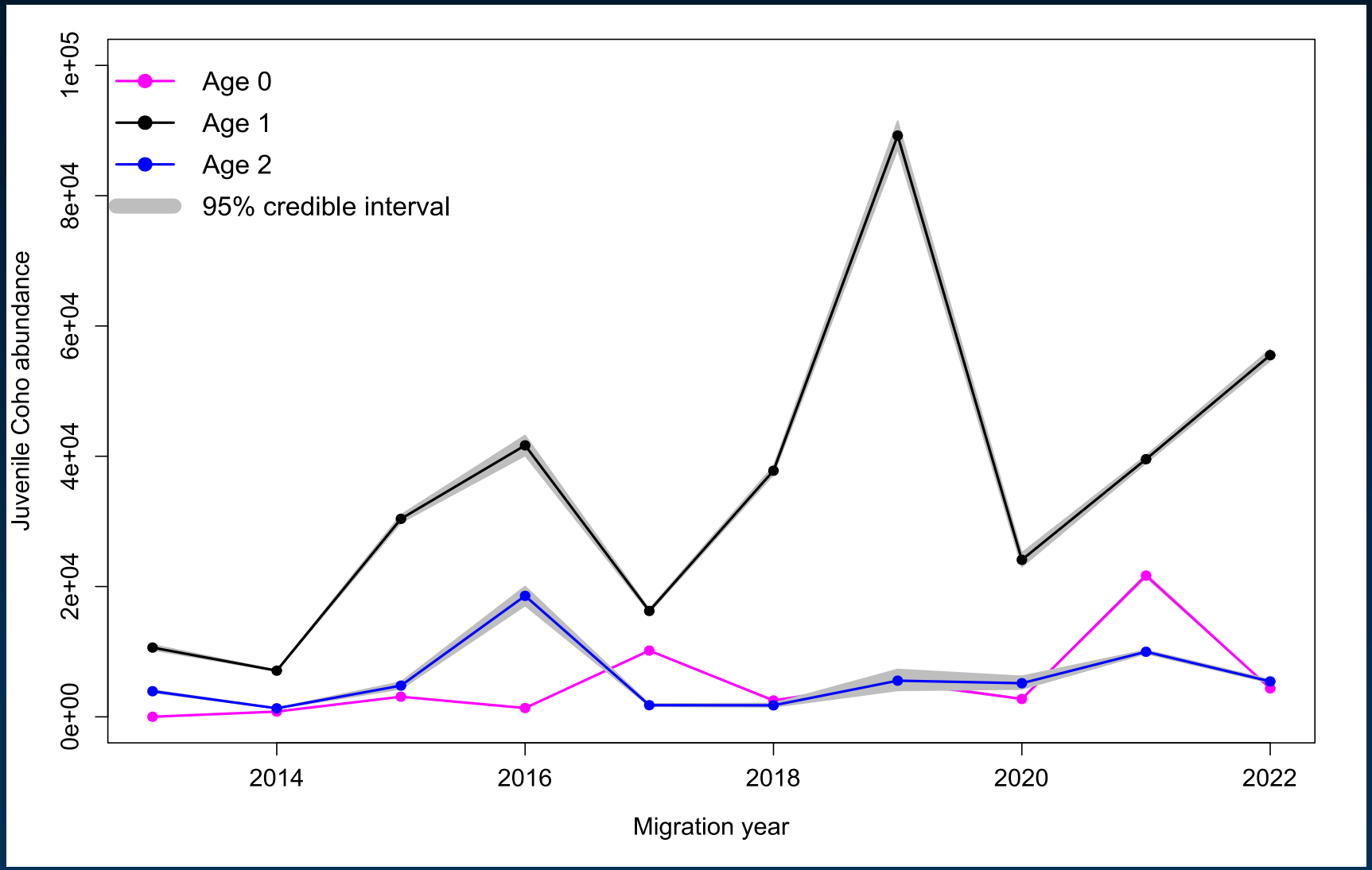
$$n_1 \sim \text{binomial}(p_1, S)$$

$$J_1 = p_1 \cdot J$$

$$J_2 = J - J_1$$

Obtain annual values by summing over the daily J

Data: Juvenile Abundance by Age



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Adult Abundance Estimation

Data needs:

- ✓ Numbers Collected and transported
- Scale samples for age (Hatchery)
- ✓ PIT-tag fish detections and returns?

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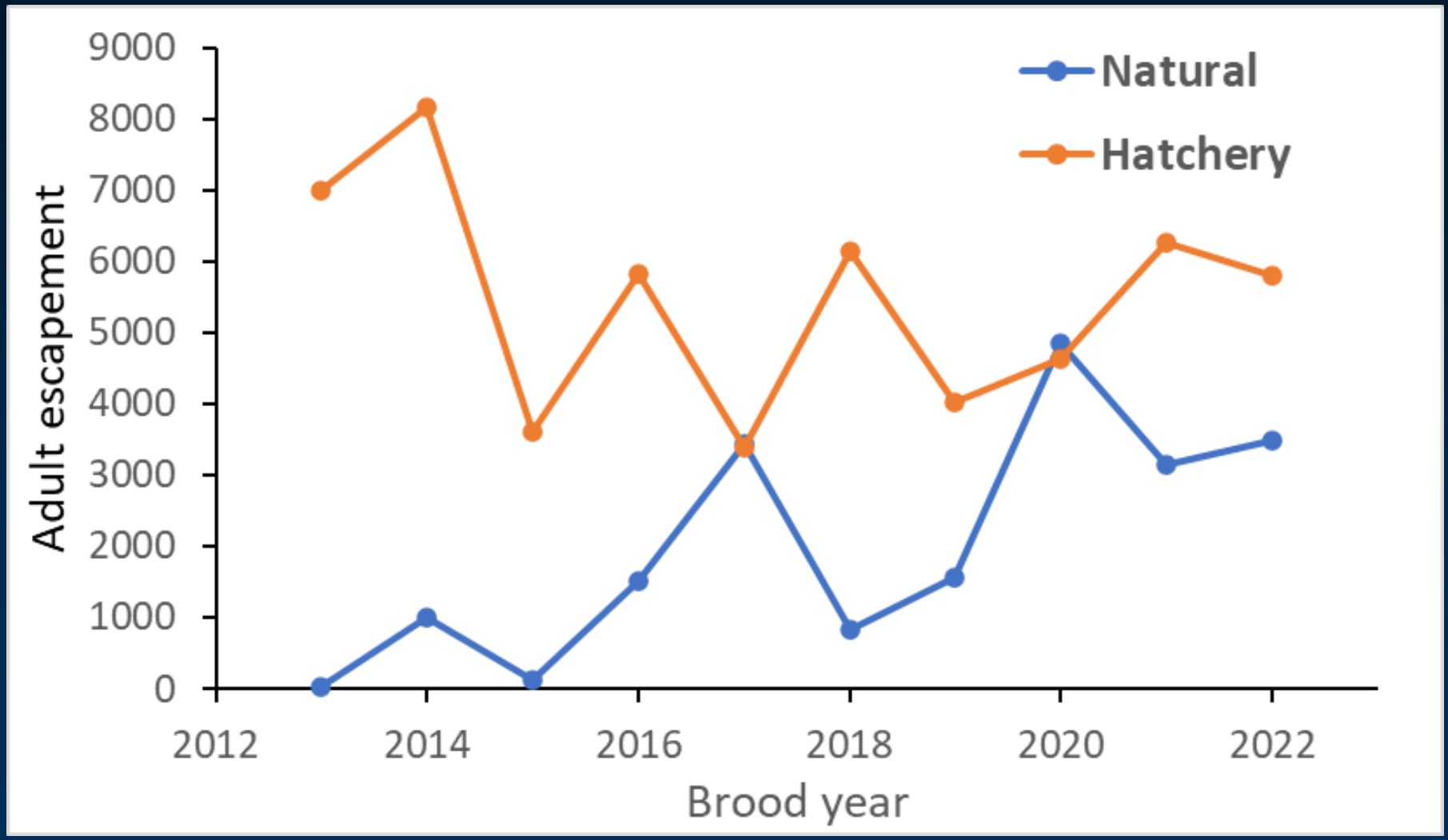
Data: Adult Abundance



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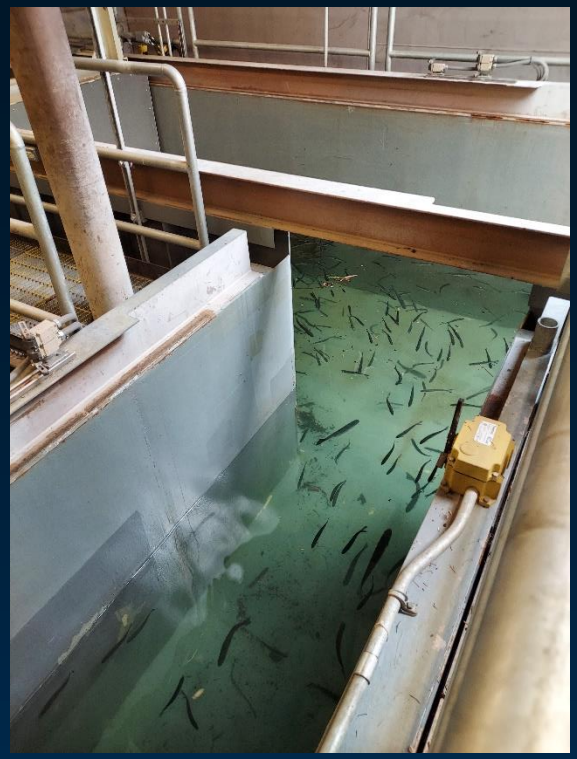
Next Steps



- Data needs:
  - Scale data
  - Harvest
  - Brood stock removal
- Construct base IPM
- Incorporate covariates
  - Productivity: Max winter flow, Spill, Collection efficiency, Min summer flow
  - SAR: PDO, NPG, Days > 21C, Pinnipeds?

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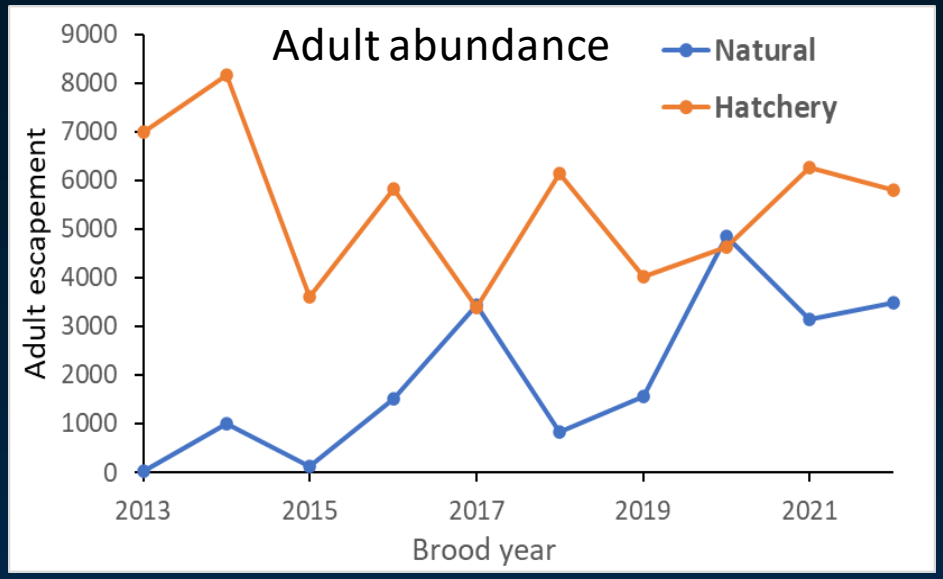
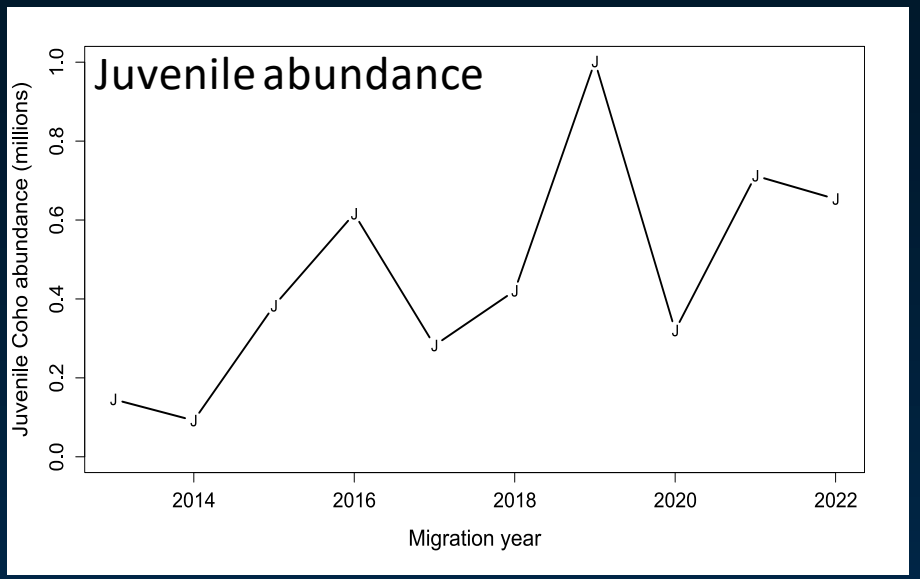
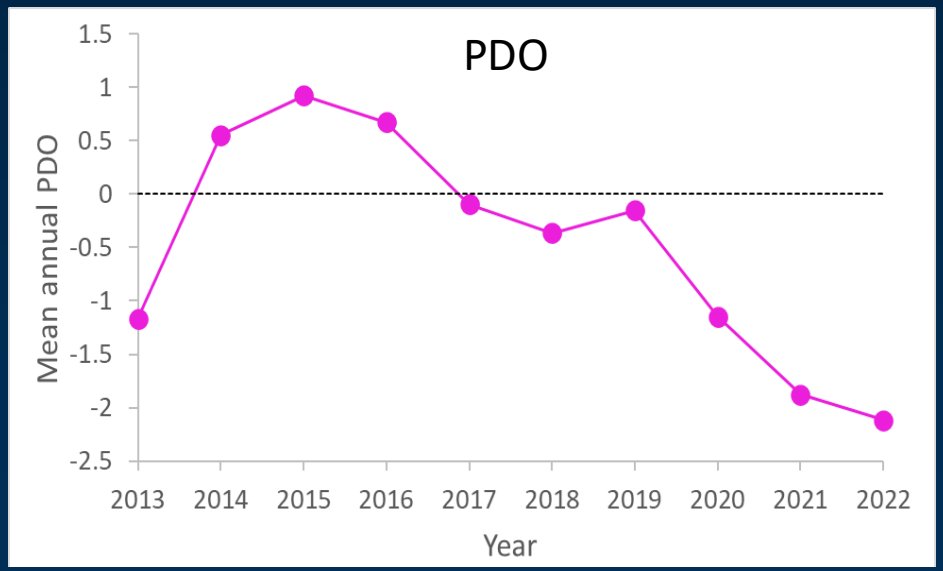
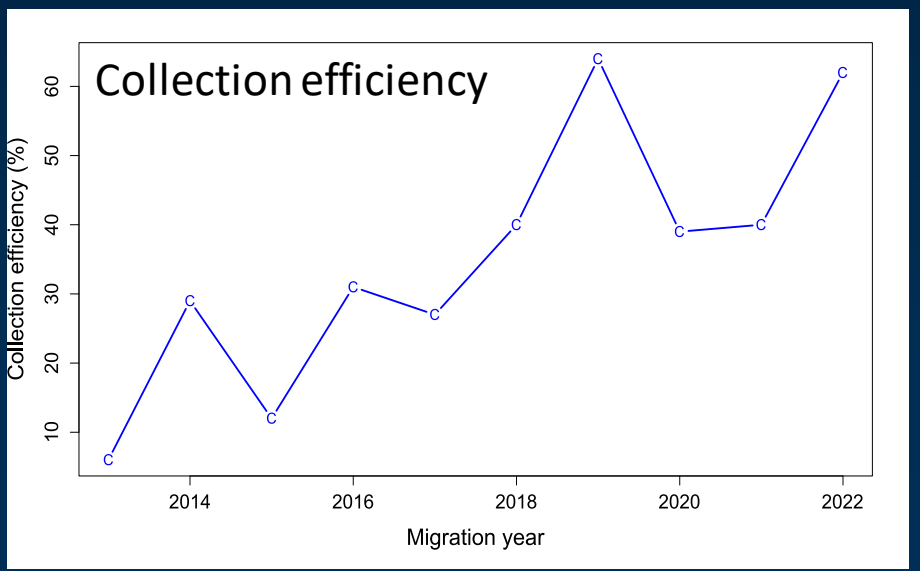
Potential Covariates of the IPM









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Potential Uses for the IPM

Model can be used to assess the contributions of fish collection, hatchery inputs, and environmental conditions in freshwater and ocean to natural fish production

- Providing a life cycle framework
- Using multiple sources of data
- Guide future data collection efforts
- Each additional year adds more information

Questions?

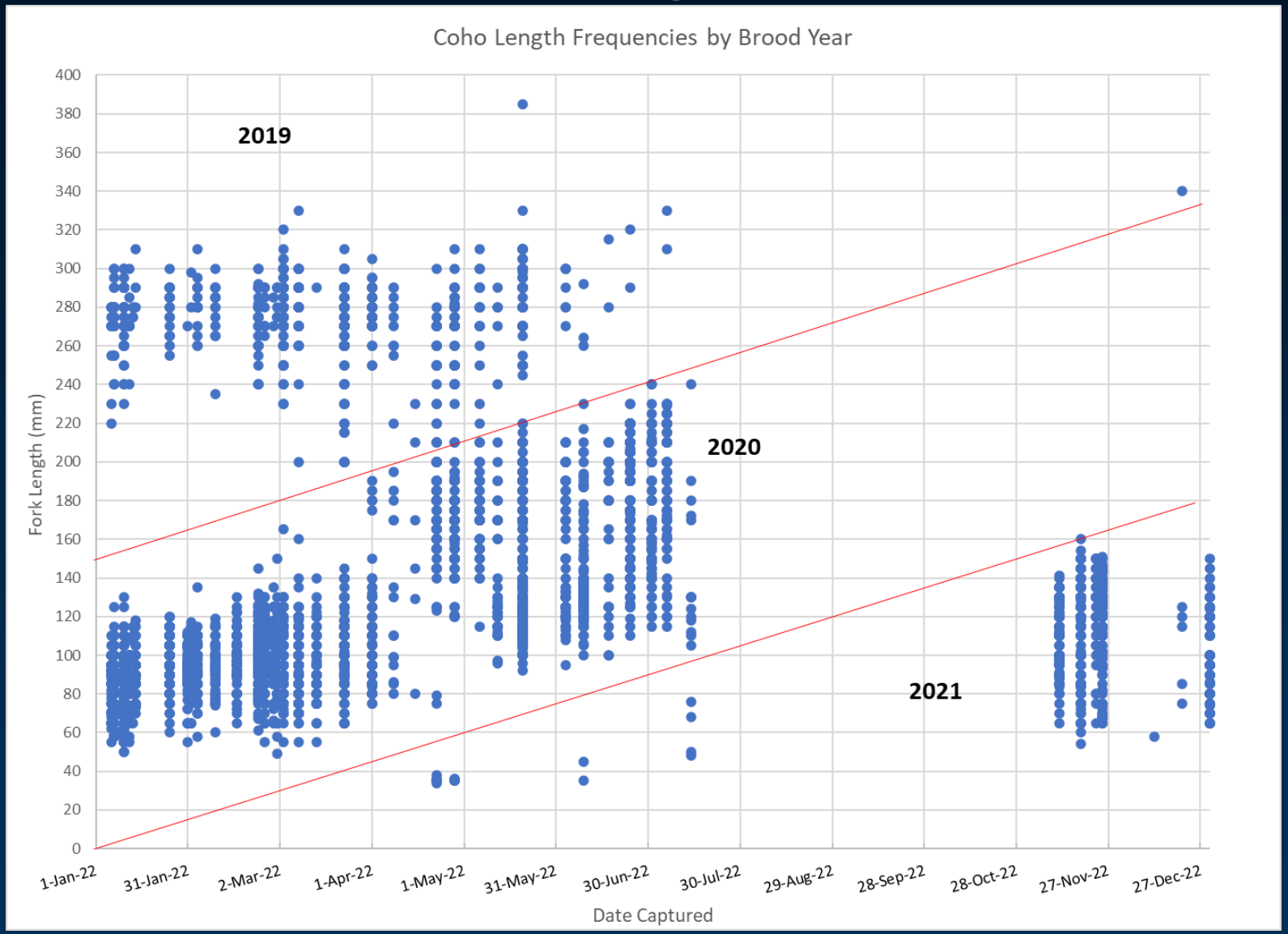
Much thanks to…

Chris Karchesky

Jeanie Heltzel

USGS

Fish Size & Age Over Time



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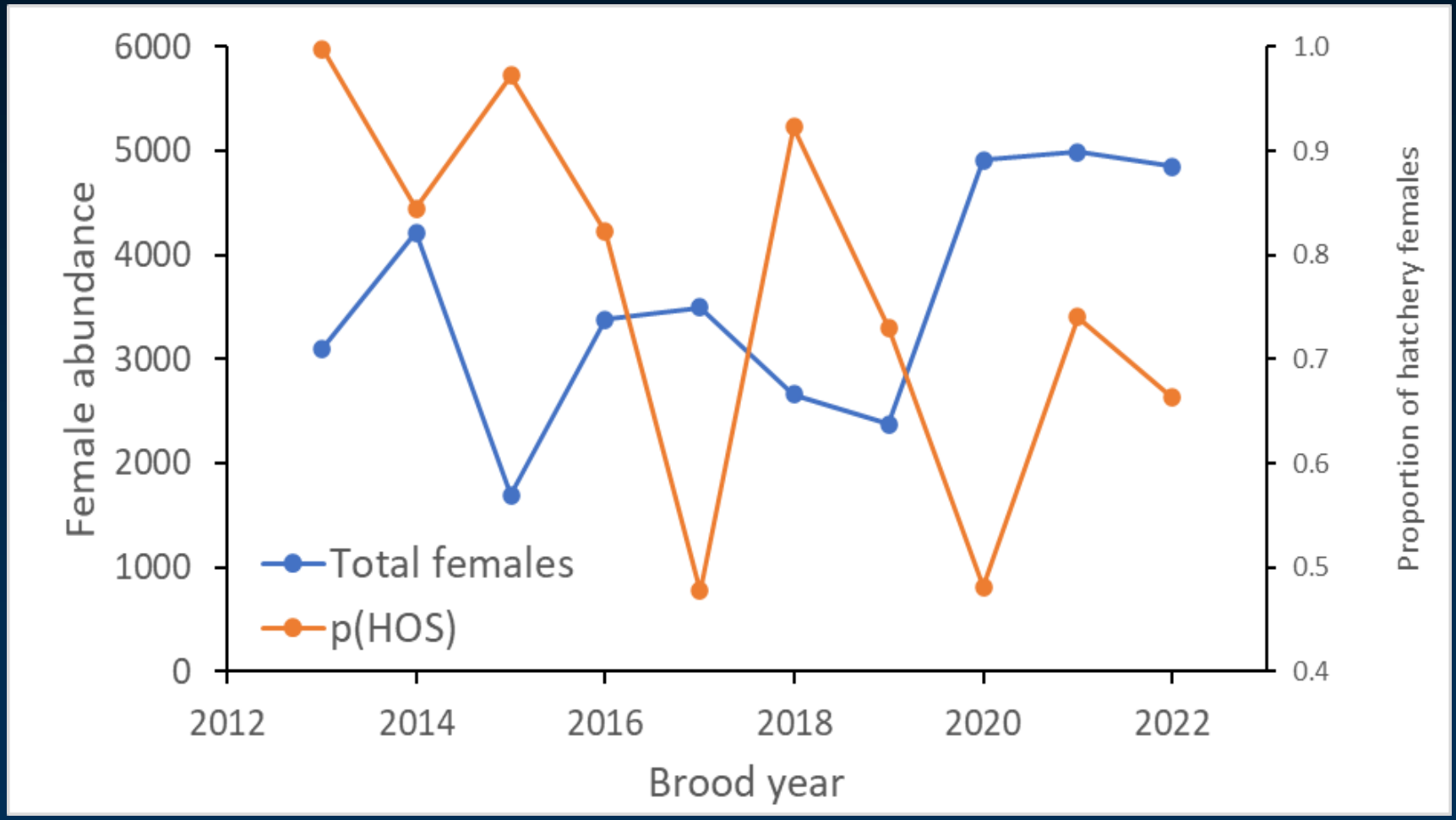
Female (Spawner) Abundance



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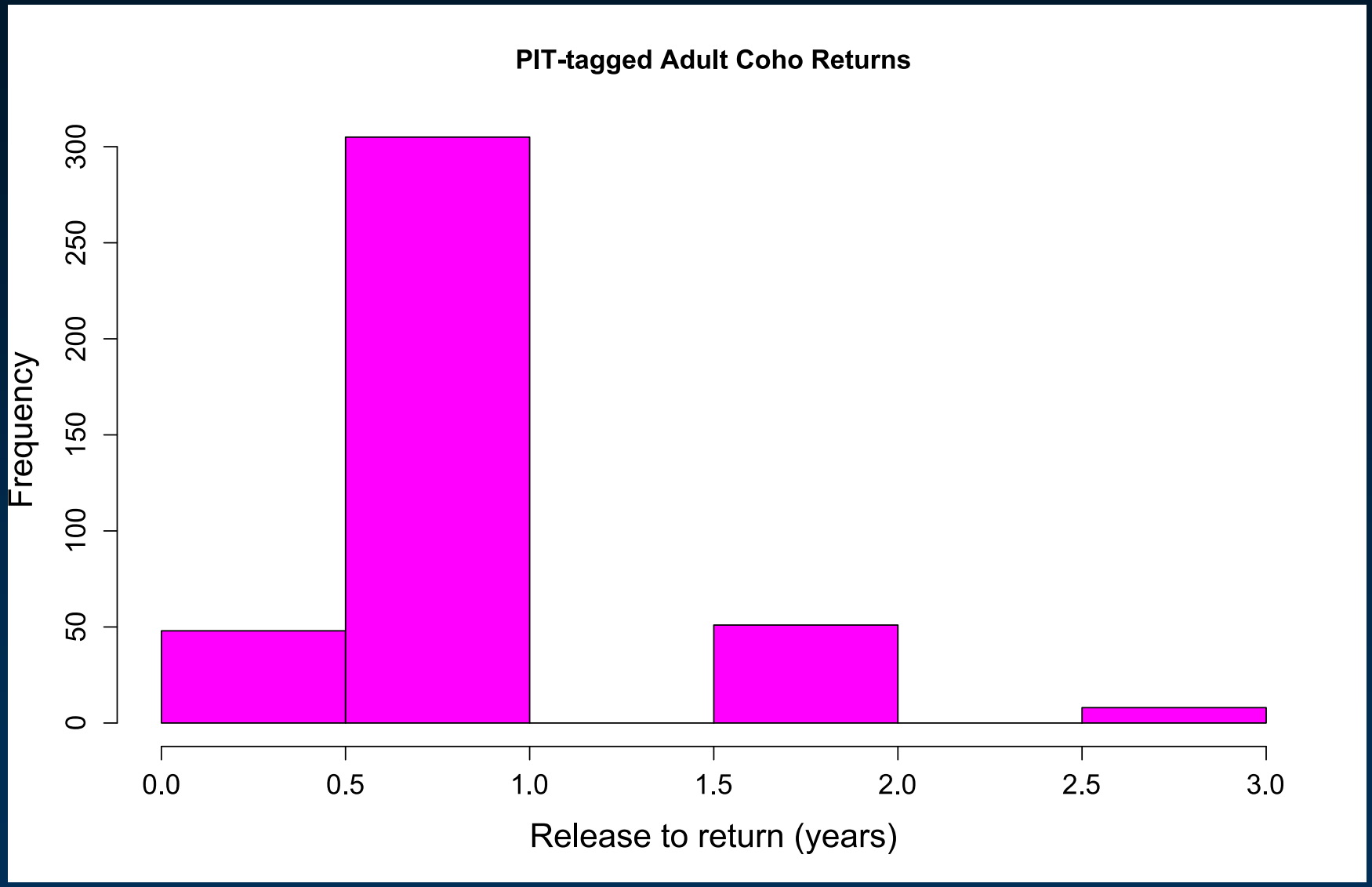
Data: PIT-tagged Adults



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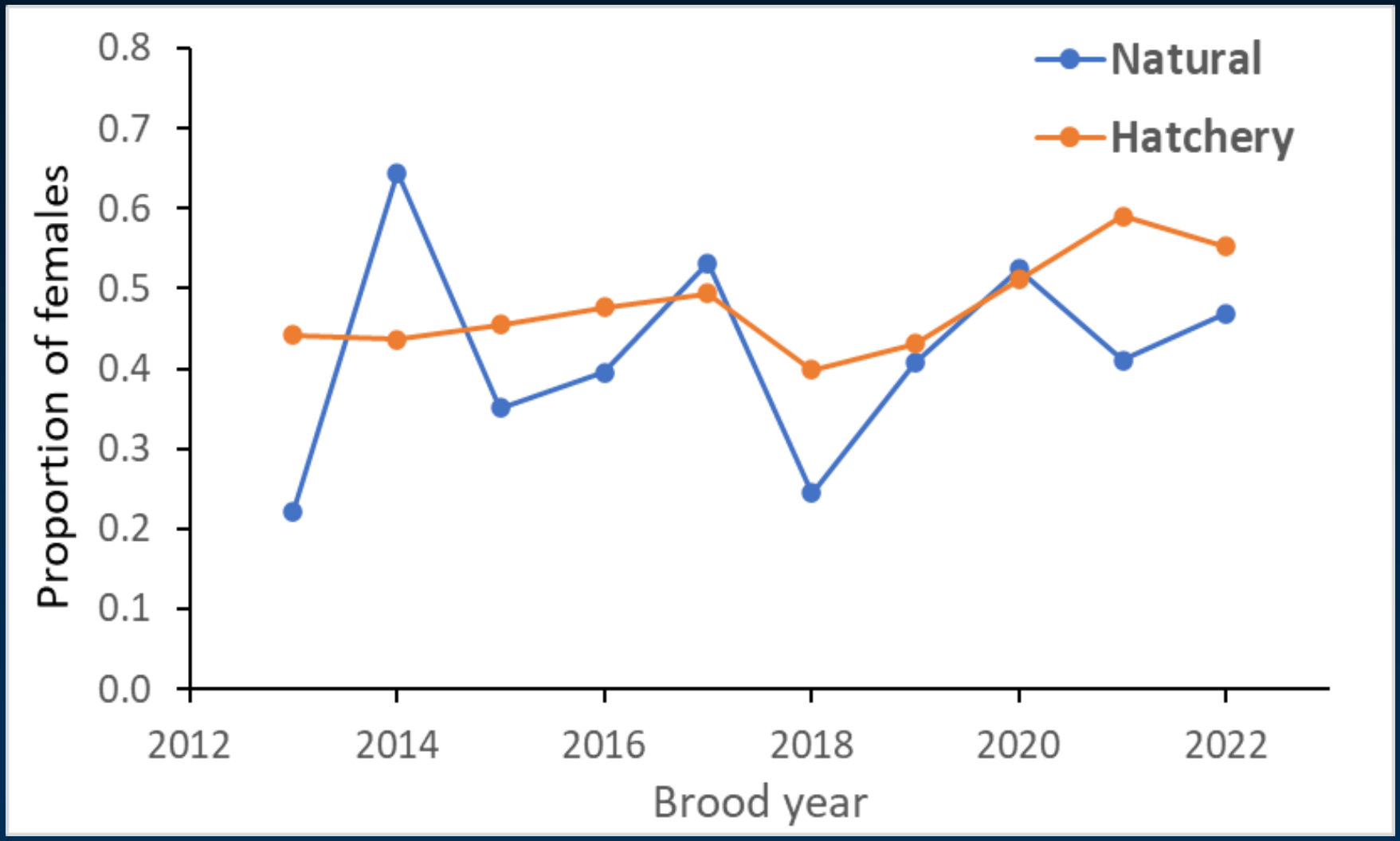
Data: Proportion of Females



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