Columbia Basin Collaborative
Science Integration Work Group
Meeting Summary

Tuesday, September 19, 2023, from 2:00 – 4:00pm PT/ 3:00 – 5:00pm MT

Attendees

Working Group Members in Attendance: Bob Lessard (Columbia River Inter-Tribal Fish Commission), Calla Hagle (Burns Paiute Tribe Natural Resources), Dennis Daw (Fort McDermitt Paiute and Shoshone/Upper Snake River Tribes Foundation), Aaron Lieberman (Idaho Outfitters and Guides Association), Jay Hesse (Nez Perce Tribe), Patty Dornbusch (National Oceanic and Atmospheric Administration), Michelle Rub (National Oceanic and Atmospheric Administration), David Bain (Orca Conservancy), Art Martin (Oregon Department of Fish and Wildlife), David Doeringsfeld (Port of Lewiston), Gary Marston (Trout Unlimited), Haley Ohms (Trout Unlimited), Crystal Callahan (University of Idaho McClure Center), Crystal Callahan (University of Idaho McClure Center), Sean Tackley (US Army Corps of Engineers), Claire McGrath (US Bureau of Reclamation), Susan Camp (US Bureau of Reclamation), Charlene Hurst (Washington Department of Fish and Wildlife)**,** Michael Garrity (Washington Department of Fish and Wildlife)**,** Tom Iverson (Yakama Nation Fisheries)

Observers in Attendance: Stephen Pfeiffer (Idaho Rivers United), Kyle Maki (Idaho Wildlife Federation), Grant Waltz (Oregon Department of Fish and Wildlife), Tucker Jones (Oregon Department of Fish and Wildlife), Adam Storch (Oregon Department of Fish and Wildlife), Kevin Scribner (Salmon-Safe), Michaela Lowe (Washington Department of Fish and Wildlife), Bill Bosch (Yakama Nation), Stuart Crane (Yakama Nation), Alex Conley (Yakima Basin Fish & Wildlife Recovery Board), Heather Nicholson

Presenters: Arianna Goodman (National Oceanic and Atmospheric Administration), George Pess (National Oceanic and Atmospheric Administration), Jeff Jorgensen (National Oceanic and Atmospheric Administration), Morgan Bond (National Oceanic and Atmospheric Administration), Tim Beechie (National Oceanic and Atmospheric Administration)

Facilitation Team: Liz Mack (Kearns & West), Angela Hessenius (Kearns & West)

Welcome, Agenda Review, and Updates

Liz Mack, Kearns & West (K&W), provided an overview of the agenda and meeting guidelines. The topics included: 1) Presentation on Ongoing Efforts to Study Carrying Capacity in the Columbia River Basin, 2) Discussion on Next Steps for SIWG Carrying Capacity Recommendation Concept, and 3) Confirm Next Steps and Action Items.

Presentation on Ongoing Efforts to Study Carrying Capacity in the Columbia River Basin

Background

Morgan Bond, Arianna Goodman, Jeff Jorgensen, Tim Beechie, and George Pess with the Northwest Fisheries Science Center (NWFSC) gave a presentation on their ongoing efforts to study habitat carrying

capacity in the Columbia River Basin. Morgan began by defining capacity using the stock-recruitment relationship. With spawners on the X-axis and adult life stage on the Y-axis, the initial steepness of the curve represents productivity, and the asymptote represents average maximum capacity. Morgan noted that productivity can vary in systems with the same carrying capacity and that productivity is increasingly important at small population sizes. Habitat capacity is defined as the maximum number of fish that can be expected from the available habitat. This is an instantaneous value that is varying all the time and specific to a species, life stage, and location.

Habitat Expansion Approach

One approach that the researchers at the NWFSC have taken to estimate carrying capacity is a habitat expansion approach, based on the geomorphic factors and shape of the landscape in each region. Using the US National Hydrography Dataset and the US National Elevation Dataset (10-meter resolution), they derived information on habitat characteristics including slope, bankfull width, valley width, confinement, catchment area, temperature, land cover, and flow. From those factors, they have developed models of the habitat. From these components, they classified habitats into four types: banks, bars, mid-channel, and side channel. Taking estimates of densities expected in each habitat and summing across the area of interest provided the basis for capacity. This approach requires matching fish densities and habitat. These density estimates were derived from serial sampling conducted over a long period of time in a fully seeded environment. The 90th percentile of maximum density observed was used. Habitats were modeled at the 200-meter reach scale. For this approach to be useful, habitat estimates need to match the fish densities available and the restoration options evaluated.

As an example, Morgan shared the modeling results for the Similkameen River. No salmon currently occupy the river, and the question that the modeling sought to answer was what is the potential capacity if salmon were given access? This technique works well for sites where there are not currently any fish. The total Chinook parr capacity was estimated to be 3.9 million and the total steelhead parr capacity was estimated to be 9.8 million parr.

Fitting Approach

Another approach that the NWFSC has taken to estimate carrying capacity is a fitting approach. This approach requires site-specific fish density and habitat information and models the relationship between the 90th percentile maximum density and habitat covariates. This approach requires attaining detailed habitat information, including measuring 100 or more aspects of a specific habitat site and returning to the site to measure fish. This process helps to identify which attributes are driving capacity in the system. The challenge with this approach is that it relies on global attributes, coarse pieces of information that are available everywhere.

The fitting approach requires expansion because the site-specific covariates are not available outside of the sampled sites. One of the pros of the fitting approach is that it incorporates local fish data into estimates. Other considerations include that it requires a massive amount of fish density data, that the 90th percentile of density may not represent capacity since many places have a fraction of their historical abundance, they are limited to global attributes when expanding to a basin-wide scale, and that fish data are only available from wadable streams.

Other Models and Considerations

Other models have also been developed to estimate habitat carrying capacity. The intrinsic potential model for interior Chinook developed by Cooney & Holzer (2006) incorporates elements including gradient, confinement, width, and temperature (exceedance of 22°C). Spawning gravel estimates have also been developed based on an expansion of historical notes and gravel surveys from the 1940s throughout the Columbia River Basin.

The presenters emphasized that the concept of capacity needs specific questions to be valuable. There is greater value with specific context with respect to management levers. Capacity is most useful when comparing among regions or actions or when capacity is known to be limiting. For example, when considering how capacity might change with a floodplain reconnection action, understanding capacity can help answer what the potential for fish population increase is with this action.

The NWFSC also shared the Habitat and Restoration Planning (HARP) model, which uses an expansion approach and is based on habitats and resolution that are chosen to match specific restoration levers. The presenters walked through an example of how the HARP model can evaluate the effect of a potential restoration actions on habitat conditions to yield life-cycle model outputs.

In conclusion, the presenters shared a few reflections in response to questions from the SIWG. They estimated that it might cost about $100,000 per 6-digit HUC to estimate capacity for spawners and parr, but that the cost is highly dependent on the availability of local data. They noted that standalone information on capacity is less beneficial, but that information can easily be incorporated into life cycle models to support management decisions. In response to a question about benefits of conducting a study now versus later, they shared the conducting a study sooner would save time since the findings could be incorporated into life cycle modeling work. Capacity estimation in areas with known capacity limitations would also be particularly beneficial. LiDAR coverage is especially important since the biggest limitation currently is the availability of LiDAR data. They noted that the Upper Columbia has good data but is still underserved in that regard.

Questions and Discussion:

- How is what we know about carrying capacity in the estuary incorporated into the HARP model?
    - Estuary capacity is an important piece, but it varies on level of importance for overall carrying capacity. Estuary capacity in the Columbia River is also dependent on the life history of the species included. It is assumed that yearling Chinook smolts use the estuary less than lower river fry/parr migrants that may have substantial growth in that habitat. The approach is similar, though, and known capacity densities of fish are applied to the total amount of each habitat type. In other systems, capacity has been scaled by distance from the main channel (assuming that access and use becomes more limited as fish have to travel further to access that habitat and the tidal cycle will limit the use of the furthest distributary channels.)
- Work group members noted that if you improve productivity and are far from capacity, that can have a significant effect; if the system is already close to capacity, then those actions are not as effective.
- One of the primary benefits is that tools such as the HARP model can provide is identifying actions that should be taken that are not currently being pursued. These models not only

consider current conditions, but also climate change and the magnitude of actions needed to see a signal over time. It is helpful and informative to shed more light on what should reasonably be expected from restoration actions rather than making assumptions.

- What is the right scale to study densities relative to capacity?
    - There is not a single right spatial scale; it depends on the specific considerations and questions being asked. If the group is interested in bottlenecks, then they should also think about the temporal scale with what is already known about these populations.
- How much would a basin-wide study cost?
    - There would be efficiencies involved in conducting the study over a larger area. It might cost approximately $1 million for the whole Columbia River Basing depending on the availability of LiDAR coverage.
- Would you recommend using this approach to do a basin-wide scale?
    - It depends on the goal and whether that information would be used to ask more fine scale questions.
    - Is it possible to collect data in a way that would support ongoing efforts to study carrying capacity and support the production of a baseline that be further developed?
    - The NWFSC presenters commented that it is not clear what specific questions the SIWG is trying to answer and what the goals for this study would be.
    - Understanding carrying capacity is a good initial step. Research has been ongoing for decades to provide this fundamental information.
    - It is important to consider what life stage a capacity study would estimate. Different data might be required for a parr versus spawning capacity study.
    - Work group members shared that their goals include being able to evaluate bottlenecks in the system that are preventing the restoration of fish populations, and being able to evaluate management actions to understand whether those actions will make a difference or not.
    - This is the type of inquiry that the NWFSC researchers are currently working on, to understand how these elements all connect.
    - A work group member suggested that the group consider that if this effort is already happening, there may be actions that the CBC can recommend that would support those ongoing efforts. For example, standardizing data collection or creating a shared database.
- Work group members noted that carrying capacity is real-time information and is not actionable without being incorporated into life cycle modeling.
    - There is a concern that carrying capacity information could be used as a tool to argue against hatchery production.
    - Some work group members felt that the CBC should not pursue basin-wide carrying capacity study. What is needed is a tool that can provide direction and improve prioritization of actions based on what has the greatest return on investment. They noted that the focus on carrying capacity does not help them conduct better management decisions.
    - The presenters shared that the HARP model can help compare actions and determine which habitat restoration action will improve population performance. The climate

change component of the model also helps answer the question of whether the same factors that are important now will be important in the future.
    - Upcoming work includes trying to link different models more closely and create one unified framework. This would combine tributary and mainstem models with models for the estuary/ocean.
    - If the question that the group is trying to answer is which specific actions should be pursued, then it will be necessary to investigate on a more specific level and evaluate one major population group (MPG) or evolutionarily significant unit (ESU) at a time.
- Other work group members felt that it is important to have a sense of what is happening and where to be able to make decisions about actions, and that understanding capacity is important to know where improvements can be made.
    - For each of the habitat components, the first step is to estimate conditions today, and then the NWFSC also uses a variety of approaches to estimate the natural potential for each attribute.
    - For actions such as floodplain reconnection, it is important to know where improvements can happen and by how much.
    - The presenters added that the life cycle model runs at each subbasin level, and the detail depends on the scale at which people are asking questions.
- Would it be possible to scale up the results and estimate carrying capacity for the entire basin using remote sensing data?
    - The NWFSC team has not attempted to do this yet. They need to have the stream classifications, and there are likely land use influences and constraints. It is theoretically possible to extrapolate across the basin, but they would want to test to make sure that this approach works first. There is not a good way to automate the remote sensing and habitat classification process, so it is difficult to say whether that approach would be successful, but it would be feasible to try. At the sub-basin level much of the habitat delineation is still done manually using satellite or aerial imagery and LiDAR elevations. Even if both were available basin-wide, it would not be automated. The HARP model also attempts to incorporate local features that may be unique to a system (e.g., reaches that go dry) at the advice of a local advisory panel, which could not be done basin-wide all at once.
- The NWFSC shared some additional examples where the HARP model was used to evaluate restoration potential and compare restoration scenarios, including in the Chehalis and Stillaguamish basins.
    - They noted that the kinds of actions that are important vary by species.
    - Using the model, they can look at which restoration actions will provide the most benefit at different subbasin scales and under different climate scenarios.
- Would this tool apply as an alternative for looking at the mainstem and reservoirs?
    - There are separate models that would be linked together (the HARP model for tributaries, the Compass model for the mainstem, and other models for the estuary/ocean).

Discussion on Next Steps for SIWG Carrying Capacity Recommendation Concept

CBC Process Update

Liz shared updates with the group on the overall CBC work plan, which has evolved since the previous SIWG meeting. The Integration/Recommendations Group (I/RG) was originally scheduled to meet in early November; this meeting is now being pushed to later in November. The SIWG will meet again prior to the I/RG meeting to review recommendations from the topic-specific work groups.

Next Steps for Carrying Capacity Recommendation Concept

Liz facilitated a discussion among work group members to decide on a pathway forward for the carrying capacity recommendation concept.

Questions and Discussion:

- Is this effort funded by the NOAA West Coast Regional Office?
    - The West Coast Region has funded modeling efforts, and they are also funding work in the Upper Columbia to develop the HARP model. This is part of a plan that was developed by Bonneville Power Administration and the US Bureau of Reclamation under the Federal Columbia River Power System Biological Opinion Tributary/Habitat Program. They want to explore using the HARP model as part of the 5-year reviews and as a tool for adaptive management.
    - It would be great to have a model that could be applied consistently for all the populations in the basin. It could be some time before the HARP model is developed for all populations in the basin.
- Work group members reflected that it is important for this group to clarify and develop a collective understanding of which questions they are trying to answer.
    - It seems like some people are thinking about this effort on different scales. If the goal is to identify which populations should be prioritized for habitat restoration, that seems like a different question to try to answer. Another tool this group could consider is looking at focal populations. This framework was applied for Snake River spring/summer Chinook, and they developed several indices looking at current populations. This tool can examine the potential to restore habitat in the context of climate vulnerability. They identified a subset of populations within the ESU that would see significant near-term benefits. The group needs to clarify the question they are asking, such as, for each population, what are the habitat restoration actions that that will provide the greatest benefit?
    - Other work groups members shared that they have used this kind of model to qualitatively evaluate how different actions would change habitat conditions and affect life cycle survival. The examples that the presenters shared were potential drivers in tributary habitat. When the full suite of actions over the entire life cycle are included, the modeling effort becomes highly complex.
    - Since one of the charges of the SIWG is to review and look for potential pitfalls across the suite of actions recommended by the topic-specific work groups, this topic was originally brought up because there was an understanding that any populations already close to capacity would struggle. There might be circumstances where either expectations must be adjusted or capacity must be improved.
    - Some work group members cautioned against pursuing an academic study.

    - Other work group members shared that the original intention behind this recommendation concept was to add perspective to specific recommendations and help justify whether recommended actions are worth pursuing given limited funding resources, and if not, indicating whether there are bottlenecks that should be addressed.
    - Work group members noted that this is a cross-cutting issue that relates to multiple other topics. For example, this information would help evaluate whether putting more hatchery fish in the system will increase returns or decrease them by exceeding carrying capacity and reducing the viability of fish reaching the ocean. Carrying capacity information would also help estimate how much returns are likely to increase if certain blocked areas are opened and answer questions about where harvest should be increased or decreased.
    - Others added that another component of the draft recommendation concept was a better understanding of the timing of hatchery releases to answer the question of if impacts to wild fish could be buffered by broadening the range of time when hatchery fish are released in the basin. There were also components around escapement goals and juvenile densities. The overarching question that they wanted to address was what is the capacity of the system and how does that change seasonally and annually?
- Liz posed the question of what the group was leaning towards in terms of next steps for the draft recommendation concept to study carrying capacity.
    - Work group members shared that they would like to see more of a rationale for how this study would support management decisions and a stronger case for the practical application of the information that would be provided. Some work group members shared concerns that additional information about carrying capacity would not enable more efficient actions.
    - Given the context of limited capacity, this does not seem like a priority for the group to pursue at this time and should not be put ahead of other priorities of developing bigger and bolder actions for salmon recovery.

Confirm Next Steps and Action Items

Action items from this meeting included the following:

- **K&W:** Hold time in October to review additional topic-specific work group recommendations as needed.
- **SIWG:** Following the November I/RG meeting, determine pathway forward for carrying capacity recommendation concept.

Liz thanked everyone for participating and adjourned the meeting.