OUTCOMES MEMORANDUM

TO: CAMT Salmon Subcommittee Members

FROM: Rafael Silberblatt

DATE: November 6, 2020

RE: October 29, 2020 CAMT Salmon Subcommittee Meeting

Attendees: Alison Collins, April Hennessy, Brad Cavallo, Bruce DiGennaro Bryan Matthias, Brycen Swart, Carl Wilcox, Cathy Marcinkevage, Deanna Sereno, Erik Loboshefsky, Frances Brewster, Jason Hassrick, Jereme Gaeta, John Ferguson, John Plumb, Kate Spear, Lenny Grimaldo, Lewis Bair, Michael MacWilliams, Michelle Havey, Mike Beakes, Mike Dodrill, Mike Tillotson, Natascia Tamburello, Pascale Goertler, Rene Henery, Russ Perry, Stephanie Fong, Sydney Gonsalves, Thad Bettner, Trinh Nguyen

Action Items:

- Subcommittee members - Provide feedback on Anchor QEA hypotheses spreadsheet (see instructions provided in "Read Me" tab)
- Subcommittee members - Let Pascale know if there are any conflicts, she should be aware of from 2/16-2/19
- Bruce - Coordinate entrainment presentation to CAMT & Policy Group (share draft at 11/12 Subcommittee meeting)
- Rafi, Bruce, Cathy, Brycen, Brad, Rene - Develop a list of CSSP key takeaways to share with CAMT & Policy Group (solicit feedback at 11/12 Subcommittee meeting) and start working on memo.
- Bruce - Work with Subcommittee members on salmon recovery scope of work proposal.

Discussion Highlights:

1. **Agenda Review and Updates**

- A steelhead workshop is tentatively scheduled for February 17-19, 2021.
    - **[Action]** Subcommittee members will let Pascale know if there are any conflicts, she should be aware of from 2/16-2/19.

2. **Evaluating Juvenile Salmonid Behavioral Responses to Hydrodynamic Conditions in the Sacramento-San Joaquin Delta (Anchor QEA)**

- Anchor QEA provided an overview of their project and solicited input regarding their approach.
    - The project evaluates juvenile salmonid behavioral responses to hydrodynamic conditions, using a 6-year steelhead telemetry data set and 3D models. The goal of the project is to inform management decisions.
    - The team is currently in the initial phases of data analysis, and intends to host a workshop in

September 2021 to discuss the methods and preliminary findings of the study and solicit final input and suggestions on interpreting project findings, additional analyses and deliverables.

- The Anchor QEA team requested feedback on the following:
  - The chosen approach ahead of running the model and generating draft results,
  - The prioritization of questions and hypotheses to inform the study, and
  - The prioritization of locations.
- The initial approach included:
  - Coordinating with the University of Washington to understand the spatial extent and identify focus areas and a representative year to develop an analytical process.
  - Conducting data exploration considering patterns, correlation and representation in different areas, including fish detection (relative to flow, barriers), fish movement (upstream, downstream, main stem, off the main stem), as well as the correlation between fish data and hydrodynamic outputs from the model and hydrodynamic explanatory variables.
  - Reviewing previously published analyses of data and identifying the multi-state model. Strengths of the multi-state model include evaluating fish movement at any time, the potential for easy comparison with Chinook data (USGS is using a similar approach), and the ability to use covariates.
  - The model is being built based on the hypothesis that local water flow rate and velocity are the primary cues for fish behavior. Other variables will also be explored. Data analysis should help determine which variables are the greatest drivers and where they should be used.
- Next steps include prioritizing areas for analysis and building the model in those areas using the six years of steel head data. To this end, the team shared a spreadsheet of hypotheses for the Subcommittee to review and reprioritize where necessary.
  - Developed a list of 40 hypotheses related to fish behavior.
  - Each hypothesis was summarized in terms of an explanatory variable or a particular area.
  - Prioritization was based on common themes across multiple groups, the amount of available data and whether the question could be addressed in this study. The highest ranking was given to hypotheses that were important overall, important for management decisions or easily available from the data.
  - On the map, all hydro locations (green dots) were grouped at decision points or by the rate at which fish migrate through areas without decision points.

- Questions/Comments
  - The list of hypotheses is good. The new thing is using the runtime to characterize new conditions for which there is no data. What about starting by testing the conditions within the reach?
    - Good point. There were hypotheses related to larger scale network level questions, but those are considered lower priority. Larger scale questions might be better answered with a different approach in a different study.
  - Curious about detections further seaward, towards Suisun/Montezuma.
    - There are far fewer detections in that area. Perhaps, after combining all 6-years of data

there might be more representation. There is more detection further upstream.

- Why is Montezuma important?
  - The junction could be important because fish can get into Suisun Marsh where there is a lot of potential habitat for rearing before going to the ocean. It is a decision point for fish, either they continue to main channel or they stop in rearing habitat.

- Consider including the water project area region because it is very dynamic— could learn about the impacts of water project operations on fish movement.
  - Currently not looking at entertainment because there are a lot of complications. Starting in the channels and junctions but can add that area when looking at more variables.
    - Kramer will be doing a study that involves releasing acoustically tagged fish in that area. If the team can find areas of uncertainty that could help. The study design has already been created but can be changed. The study will either be October 2021 or 2022, and detection sites can be moved based on findings from this study.
- Appreciate the focus on the Head of Old River. Recently got requests from the State Board regarding activity in that area now that there is no effort to put a barrier in. It would be nice to have information on what is going on.
  - That would be with or without barrier?
    - There are four years of data for when the barrier was available. There is curiosity around if it should or should not have a barrier. This is a critical area for management.

- **[Action]** Subcommittee members: Provide feedback on Anchor QEA hypotheses spreadsheet (see instructions provided in "Read Me" tab).

3. CDFW Presentation on IEP Salvage Prediction Tool

- CDFW presented on a winter-run Chinook salmon salvage prediction tool.
  - The proposal is still under review for the 2021 Work Plan and is not an official work element.
  - Aim to have the preliminary model to share with agencies by March 2021.
  - Overall objective is to develop a suite of models and an interactive web tool that predicts Chinook salmon salvage based on San Francisco Estuary and Watershed-wide physical, limnological, and biological variables while accounting for spatiotemporal lags.
  - Proposed research approach is a non-linear, non-parametric, ensemble machine learning regression tree that uses a multiple model framework focusing on three primary models: real time, recent time and full.
  - Potential research products include:
    - A real-time risk assessment tool to achieve the conservation necessity of minimizing endangered species incidental take while continuing to provide water to the State of California
    - Deepening our understanding of winter-run Chinook salmon ecology, conservation, and management

        - Assessing relative importance of known drivers of loss, such as the Delta Cross Channel position and Old and Middle River flow
        - Identifying whether/which processing non-real-time limnological and biological study- and station-specific samples should be prioritized to improve risk-assessment.
- Questions/Comments
    - If this modelling framework does not have to adhere to normal assumptions of data distribution, how do these types of models deal with detection probability or false zeros (i.e. distinguishing between catch, no catch, the fish are there but not caught)?
        - There is currently no gear efficiency correction factor or observation efficiency factor.
    - What are the key differences between the two (CDFW and ICF) machine learning tools for predicting salvage?
        - The biggest difference from a variable standpoint is that ICF's predictions are based on activity at the pumps (where the top predictor is what happened at salvage the week prior), while CDFW's is based on activities in the estuary before the Chinook arrive.
        - The models are similar at the real-time level. From ICF's findings and their consideration of other available fish sampling, the pumps are continuous samplers, so including the salvage from the week before increases its predictability. Neither one is a better approach, they are both viable and should complement one another.
        - They are not mutually exclusive and could provide managers with a lot more confidence. If both models raise red flags, that is a strong body of evidence. This is a powerful approach for decision makers to have at their disposal.
        - Differences in algorithms - on a pure performance level, gradient boosting does a better job. Quantile regression forests do not take an average over the tree predictions. An intuitive way of thinking about risks is a percentile case to compare current and past conditions. The interpretation of the prediction intervals will be slightly different, but the intuitive nature of the quantile approach is what was interesting about it. It would not be terribly hard to include a BRT into the dataset.
        - The STV dart methods used by CDFW will have a much better model fit and median prediction. The weakness is the uncertainty interval because there is not an intuitive way of getting that out of the model. Another component that makes the dropout method powerful, but what can happen with the quantile regression model, is that it could become super focused on one part of the data set. The dropout method makes sure this does not happen.
    - There is an abundance of data on juvenile winter run that could be included.
        - That data is already in the model.
    - This approach is of most value if it can locate winter run and the areas that can lead to entrainment risk in the Delta.
        - The data are very limited, specifically the genetics in the juvenile monitoring programs, e.g. Knights Landing is the only one with available genetics. Instead, the length of date approach and the catches and caught period can be considered to determine the better predictor.

This will address the routing question or help identify areas of the data to look at to ensure that they are not pulled toward the pump.

- Regarding differences, CDFW is using a genetic database and that may provide some differences in the model's conclusion. Since CDFW is compiling the data set, it is in a unique position to develop a new length of date model.
- As a manager there are two levels of risk assessment that are of interest:
    - when fish will be vulnerable to entrainment
    - the ability to assess the difference in risk between different OMR actions
        - The model CDFW is developing is going to be a better model leading up to when they are detected. When they are detected, it is possible to switch gears and focus on the ICF model. Used together, they both provide a combination of tools from which to leverage.
- The key difference, then, is that the CDFW model is about estimating the probability of entrainment and the ICF model provides the number of fish entrained. From a management perspective, the desire is to have the entrainment level at zero, but it often is not. Is it possible to know significant entrainment events instead of number of fish entrained?
    - Yes, for the CDFW model, the examples presented today were based on the probability of detection. For salmon, it is neither zero nor one, but a continuous variable. The model output could be the number predicted to be entrained based on the environmental conditions. If managers have thresholds for entrainment, it would be easy to take the probability approach and have two models, one with raw numbers and the other with the probability above a threshold.

- Next steps for Presentation on IEP Salvage Prediction Tool:
    - CAMT members have expressed an interest in learning more about the ICF tool, its goals, and applications for the upcoming entrainment season.
    - Subcommittee members agreed to create a high-level presentation for CAMT and the Policy Group, including both the ICF and CDFW models, their relationship with one another, applications, limitations, and management relevance.
    - **[Action]** Bruce will coordinate entrainment presentation to CAMT & Policy Group (share draft at 11/12 Subcommittee meeting)

4. CSSP Subcommittee Memo Outline (DRAFT)

- Natascia Tamburello presented feedback received on the draft Coordinated Salmonid Science Plan and changes made in the final version.
- The Subcommittee agreed to prepare a presentation for CAMT and the Policy Group regarding CSSP results, methods piloted, potential next steps, etc.
- The Subcommittee discussed the timeline for preparing the presentation for the Policy Group meeting in December:
    - Prepare a draft for the upcoming Subcommittee meeting on November 12th to discuss and finalize the message.
    - Share the presentation with CAMT on November 17th
    - Share the presentation with the Policy Group in December.

- **[Action]** The refiner working group will prepare 4-5 takeaways in a PowerPoint presentation for November's Subcommittee meeting.

5. CSAMP and Salmon Recovery

- A Policy Group subcommittee has developed some parameters for future salmon recovery efforts. The Subcommittee can help flesh out objectives and the Scope of Work.
    - **[Action]** Bruce will work with Subcommittee members on salmon recovery scope of work proposal.

6. November Subcommittee Prep

- Discuss feedback to Anchor QEA on their list of hypotheses.
- Review and provide feedback on the Salvage Prediction Tool presentation.
- Finalize CSSP takeaways for the Policy Group meeting.
- Review and provide feedback on a presentation created by the Lifecycle Model Stakeholders Group for the CAMT meeting on November 17.