**Genetics Ad Hoc Work Group Meeting**

**Meeting Summary**

**June 25, 2020, 9:00 AM – 11:00 AM**

**Location: Zoom Meeting**

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| **Who** | **What** | **By When** |
| Eric Gonzalez and the Program Support Team (PST) | Send the SNP panel update to the PST for distribution | 6/25/2020 |
| PST | Distribute the Conceptual Ecological Model (CEM) presentation | 6/25/2020 |
| Genetics Work Group members | Consider how to incorporate genetics monitoring and the SNP panel into the Rio Grande silvery minnow (RGSM) CEM | Before next meeting |
| Alison Hutson | Send the PST U.S. Fish and Wildlife’s (USFWS) genetic plan | 6/29/2020 |
| Dana Price and PST | Send the spreadsheet with previous project ideas based on Fraser recommendations to the PST for distribution | 6/25/2020 |
| Wade Wilson and PST | Send papers on comparing microsatellites to next generation sequencing to the PST for distribution | 6/26/2020 |
| PST | Send the one-page descriptions on previously discussed projects for scope of work (SOW) development | 6/26/2020 |
| PST | Schedule a meeting in mid-July for a focused discussion on SOW development | ASAP |

**Next Meeting:** Mid-July

**Meeting Summary**

**Welcome, Introductions, Agenda Review**

* Catherine Murphy, PST, opened the meeting, discussed the agenda, and led introductions.
* Decision: Approval of the agenda for the June 25, 2020 meeting.

**Update on SNP Panel contract**

*Timing of Results*

* Eric Gonzalez, U.S. Bureau of Reclamation (Reclamation), presented an update on the development of high-throughput markers for the RGSM, submitted by Megan Osborne, University of New Mexico (UNM) [see Development of high-throughput markers for RGSM report]. These are the main points of this update:
  + A full draft report is due in September and there has been no indication that it will not be ready.
  + The single nucleotide polymorphisms (SNP) panel is nearly completed. The team is currently running data analysis.
  + In the second experiment of developing sex-specific markers for RGSM, the team is currently running bioinformatics analysis – data filtering.
  + Action Item: Eric G. will send the update to the PST for distribution to the Genetics Ad Hoc Work Group.

**RGSM CEMs**

* Catherine M. presented the graphical RGSM conceptual ecological model (CEM) and led a discussion on how to incorporate the Program’s RGSM genetic work into it (see RGSM CEM graphical models presentation) These are the main points of the presentation:
  + The CEM is never finished; it will continue to be improved with new information.
  + If a Program participant recognizes something that needs to be improved, the Program can design a study to inform and adjust the CEM.
  + The CEM is a representation of the Program’s understanding of how the RGSM is interacting in its system.
  + The Program will be designing studies to link research hypotheses to management alternatives.
  + The Program and adaptive management (AM):
    - Within the AM cycle, the Program does not implement and monitor, but it can inform managers and activities using science.
    - The Program contributes to the assessment, design, evaluation, and adjustment pieces of AM.
    - To integrate the Program into AM, it needs to compile all the information generated thus far into a database tool and link the different elements together to apply what has been learned to what will be implemented. Ex. Link species outcomes to management alternatives, changes in habitat, and river conditions.
    - An important missing piece in the AM relational database tool is genetic considerations.
* Genetics Ad Hoc Work Group members asked the following questions related to the presentations:
  + Will the database have a tie-back to specific agencies and their BOs?
    - Many of the management activities in the database come from the BOs, which is a direct link.
    - There may need to be another piece relating the BOs.
  + Are population indices a part of species outcomes?
    - Yes – but quality (genetic quality) needs to be incorporated into the conceptual ecological models (CEMs) in addition to quantity and probability of survival.
* Catherine M. then asked the group for ideas on how to better incorporate RGSM genetic diversity into the CEM. During the discussion, the following points were made:
  + The level of genetic diversity is already depicted in the CEM, but it can be better linked to other pieces. With genetics, the concern is the quality of the RGSM, not just the number.
  + Genetics Ad Hoc Work Group members have questions related to fish behavior and survival.
  + A more complex genetics module will help communicate to the Executive Committee and resource managers why the various genetic investigations are necessary.
  + The database is an attempt at drawing a pathway between field and laboratory studies, influences on species status, lessons learned, and management of the system.
  + Action Item: The Genetics Ad Hoc Group members will consider how to incorporate genetics monitoring and the SNP panel into the RGSM CEM.

**Review of Fraser Panel Recommendations**

* Catherine M. opened discussion on the Fraser Panel Recommendations (see Fraser panel recommendations spreadsheet). These are the main points of the discussion:
  + The SNP project and genetics monitoring are currently being done.
  + The hatchery program is run based on USFWS’s genetics plan.
  + There have also been some small studies on group versus paired spawning.
  + There isn’t a lot of RGSM genetics information available outside of monitoring efforts.
  + Due to the speed of the current microsatellites method, hatcheries don’t get genetics information on fish until they are already in the river. SNP should offer a more precise and timely look at RGSM genetics, and could be used to better inform the RGSM augmentation program.
  + Once the recovery criteria are incorporated, one of the elements in the Program database will be the genetics plan.
  + The SNP project and monitoring effort have different priorities and compete for time and financial resources.
  + May need to slow down on integration of genetics into the model until results of the SNP project are finalized.
  + There are still many questions about the life history of the RGSM, such as batch spawning.
  + There is a complete genetic monitoring dataset but the data exhibit a lot of variability.
  + There will be little to no change to the long-term genetic monitoring program. But SNPs could provide the means for comparing fish raised at different hatcheries in different ways. This could inform hatcheries management of best practices.
  + Incorporating the genetics into the big picture can help communicate the importance of this genetics research and its influence on species recovery.
    - The goal should be to develop a clear message, relating genetic findings to species outcomes.
    - This will help to justify and prioritize funding for studies.
  + There are three major categories the Fraser recommendations fall under:

1. Timeliness: The SNP panels should deliver genetics information for the RGSM more quickly than analysis of microsatellites. Hatcheries want to optimize what they are putting into the river and they need results quickly.
2. Adaptiveness: New markers should offer a better idea of the adaptive variation of RGSM, whereas microsatellites are considered to be selectively neutral. Hatcheries want to be able to tie genetics to fitness, such as behavioral advantage or tolerance for poor environmental conditions. For example, which RGSM are able to resist diseases or escape predators. Hatcheries want markers for tracking adaptive variation.
3. Diversity: Hatcheries want to use new genetic markers in the propagation program to maximize variation in group spawning by selecting the best broodstock.
   * Currently, hatcheries are not making management decisions based on genetics until the year following augmentation because results are slow.
   * Maximizing genetic diversity supports an RGSM population that will survive and thrive long-term.
   * Project ideas and scopes of work (SOW) have been developed for studies that either needed the SNP panel to succeed, or would be greatly enhanced by having the SNP panel.
   * Currently, hatcheries take fin clips for genetic monitoring of RGSM that were produced the year prior to release into the river. The SNP panels would be used to genotype the existing broodstock, so hatcheries will know RGSM genetics before spawning.
   * Hatcheries restrict genetic variation. For example, group spawning only occurs for a short period of time, limiting variation. Hatcheries don’t want to fall further behind the curve.
   * The Program can connect USFWS’s genetic plan to the process followed in hatcheries and to various species outcomes that are influenced by genetics using the AM database.
     + Nothing needs to be facilitated. The genetics plan is hard to modify.
     + The goal is not to modify the plan, it’s to get the message out on what is done and why. Showing how genetics informs the bigger picture will help justify funding for projects.
   * Action Item: Alison Hutson, New Mexico Interstate Stream Commission, will send the PST USFWS’s genetics plan.
   * The Fraser recommendations were grouped previously. For example, examine reach difference using new markers.
     + Action Item: Dana Price will send the PST her spreadsheet with these categories.
   * Following Megan Osborne’s completion of the SNP project and her presentation (estimated in fall 2020), the Genetics Ad Hoc Work Group should discuss how to calibrate the microsatellites and SNP methods to determine if the use of microsatellites should be phased out or continued with the addition of SNPs.
     + Megan O. says the industry is trending away from microsatellites as next generation sequencing gives a more in-depth look into genetics.
     + Action Item: Wade Wilson will send examples of papers that compare microsatellites to next generation sequencing.
     + The presentation on the genetics project will cover the advantage of SNPs over microsatellites.
     + Was a comparison of SNPs and microsatellites part of the project?
       - It was decided that the comparison would not be part of the study.
     + The Genetics Ad Hoc Work Group wants to move forward to develop a SOW for comparing SNPs and microsatellites.
   * Other projects previously discussed are paired versus group spawning, PIT-tagging and genetic comparison of broodstock, and the temperature degree day study.
     + There are one-page project descriptions for these that can be starters to develop SOWs.
     + Action Item: Debbie Lee, PST, will send the project descriptions to the Genetics Ad Hoc Work Group.
     + The Genetics Ad Hoc Work Group will meet in mid-July for a more focused meeting on the projects moving forward.
     + Action Item: The PST will schedule a Genetics Ad Hoc Work Group meeting for mid-July.
     + The projects should tie back to Program goals and management actions in order to make stronger case for funding.

**Meeting Participants**

**Participant Organization**

Michelle Tuineau Program Support Team

Eric Gonzales U.S. Bureau of Reclamation

Catherine Murphy Program Support Team

Kathy Lang City of Albuquerque

Dana Price U.S. Army Corps of Engineers

Mick Porter U.S. Army Corps of Engineers

Debbie Lee Program Support Team

Wade Wilson U.S Fish and Wildlife Service

Alison Hutson New Mexico Interstate Stream Commission