PVA Biology Work Group Meeting
May 24, 2011
US Bureau of Reclamation
555 Broadway Blvd. NE, Albuquerque, NM 87102
San Juan Conference Room

Actions

- Dave Campbell will keep Dr. Miller updated via email and verify that he is in agreement with conclusions from today's meeting.
- Dave Gensler will modify the PVA letter to the PHVA to incorporate requests for the paleo data, hydrology data from 1945 forward, and assistance from the PHVA work group in sequence development and review.
- Stacey Kopitsch will inform the PMT of the PVA workgroup's recommendation that the process for gaining consensus on data sets be applied to all Program data.
- Dave Campbell will check with Scott Durst to see what flycatcher data is available.
- Dave Campbell will ask Jason Remshardt if there is a master list of all the pit tags in the Middle Rio Grande system.
- Dave Campbell will see if Brian Milsap can attend the July meeting as he has experience with adaptive management and PVA models.
- Rick Billings will have HRW begin development of a draft agenda for a joint HRW/PVA Habitat workshop. The draft agenda will be provided to PVA once available

Decisions

- The March 29, 2011 meeting minutes were approved with no changes.

Meeting Summary

- The meeting was brought to order and introductions were made. The agenda was approved with the addition of a discussion on the relationship of the Population Viability Analysis (PVA) and the adaptive management (AM) process.
- Bureau of Reclamation (Reclamation) is in the process of putting together a Statement of Objectives for a contract to continue development of the RAMAS model. As of this time it's not known when Reclamation will complete the RFP process but it's expected to be within the next 2 to 3 months.
- Attendees discussed the need for the RAMAS modeler to be present for discussions regarding the incorporation of hydrology scenarios into the PVA models in order for there to be a fair modeling process. To avoid stalling progress on hydrology integration and data consensus the PVA work group agreed to work under the assumption that Dr. Miller will still be developing the RAMAS model. Since Dr. Miller doesn't have any substantial differences with Dr. Goodman in respect to data consensus or hydrology incorporation issues the workgroup will move forward with discussions on data consensus and hydrology incorporation. Dave Campbell will keep Dr. Miller updated via email and verify that he is in agreement with conclusions from today's meeting.
- Attendees discussed the hydrologic data needs of the PVA. Given the PVA's need for 50-year hydrologic sequences, a random process for creation of flow sequences, and a flexible approach for modeling flow sequences that can be easily updated as new information becomes available, attendees agreed that the PVA would be better served if the PVA modelers used the hydrology data to develop flow sequences that best suit their individual models. This would mean that the

PVA modelers will need the paleo data, hydrology data from 1945 forward, and assistance from the PHVA work group in creating and reviewing hydrology sequences. The modelers can provide documentation to the Program on how the hydrology sequences were developed and how they will be incorporated into the models. Dave Gensler will modify the PVA letter to the PHVA to incorporate requests for the paleo data, hydrology data from 1945 forward, and assistance from the PHVA work group in sequence development and review. The letter will then be distributed to the PVA work group via email for finalization.

- Dr. Goodman presented a process used in other institutions for dealing with data consensus. There was general agreement for the process to be used for gaining consensus on data sets for the PVA. There was also the recommendation that the process also be applied to all Program data. Stacey Kopitsch will inform the PMT of the PVA workgroup's recommendation that the process for gaining consensus on data sets be applied to all Program data. The PVA Co-Chairs will communicate the consensus data process to the Executive Committee (EC) and also provide them with a list of data sets and the status of where each data set is in the consensus process.
- Additional data needs for the PVA include egg drift data; the complete genetics raw data; and Southwestern Willow Flycatcher (flycatcher) habitat, nesting, and fledging success data. Dave Campbell will check with Scott Durst to see what flycatcher data is available. In order to better understand how management of the flycatcher will interact with management of the minnow the PVA will invite people who are knowledgeable on the flycatcher to attend a future PVA meeting. Dave Campbell will ask Jason Remshardt if there is a master list of all the PIT tags in the Middle Rio Grande system.
- Attendees discussed combining monitoring data from ASIR and Jason Remshardt; since these monitoring efforts use similar protocol it may be possible to combine their data in order to get better spatial coverage. Dr. Goodman presented an initial attempt to merge the data and indicated that he is comfortable with merging the data.
- The March 29, 2011 meeting minutes were approved with no changes.
- Attendees were shown a presentation on the status of habitat and flood plain modeling efforts in the Middle Rio Grande by Rick Billings. There was discussion on the need to improve efforts to monitor and document the effectiveness of habitat restoration projects and how the PVA work group and Habitat Restoration Work group can interact. Attendees also discussed the possibility for a habitat workshop to explore options for improving monitoring of habitat restoration projects.
- Dr. Goodman gave a presentation on procedures used by other institutions to test consensus on statistical analyses and consensus on PVA models. Attendees generally agreed that the procedures could be used for the Program PVA but that the procedures will need to be cleaned up before they are shared with the EC. Attendees discussed that it is premature in the PVA modeling process for comparison of the models. It will be communicated to the EC that coming to consensus on the modeling process is not a simple process and when the time is right the PVA work group intends to utilize this consensus process.

Upcoming PVA Meetings:

- June 28th - full day meeting. Tentative agenda items include: presentation on the river drying data, and discussion with flycatcher staff.
- July 26th - full day meeting. Tentative agenda items include: Discussion of the draft AM Plan, and discussion on the relationship between the PVA and AM. Dave Campbell will see if Brian Milsap can attend the July meeting as he has experience with AM and PVA models.

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Meeting Notes

Introductions, Review Agenda

- The meeting was brought to order and introductions were made. The agenda was approved with the addition of a discussion on the relationship of the Population Viability Analysis (PVA) and the adaptive management (AM) process.
- The work group discussed the relationship of the PVA and the AM process.
    - It was suggested that the PVA work group figure out language regarding the PVA work group and AM that might be used to update the charter. It was one opinion that most of the people at the Executive Committee (EC) meeting are becoming cognizant of the linkage of the PVA and AM. At the last EC meeting concerns had been voice for how AM will be done. It was stated that that the PVA should be the foundation for an AM process.
    - It was asked if Brian Milsap from U.S. Fish and Wildlife Service (the Service) is still available to the Program as he has experience with both AM and PVA models.
        - It was explained that Brian Milsap is still in the Albuquerque office but he is now the National Bald Eagle Coordinator.
- Attendees discussed how to proceed with data consensus as Dr. Miller (RAMAS model developer) is no longer under contract thus was unable to attend today's meeting.
    - Bureau of Reclamation (Reclamation) is currently working on a Statement of Objectives (SOO) for a contract to get someone in place to continue development of the RAMAS model. Comments from state and non-federal agencies (excluding any contractors) on the SOO are due to Yvette McKenna by COB today.
    - It was asked if Reclamation has compiled a list of what has already been accomplished on the RAMAS model in order to avoid repeating steps that Dr. Miller has already completed in model development. The current RAMAS model should be a government supplied material and the contract should be to continue development of that model.
        - This will need to be discussed with Reclamation as they will now be handling the contract.

PVA letter to the PHVA

- Attendees discussed the directive from the EC for the PVA and Population Habitat Viability Assessment (PHVA) work groups to reach timely resolution regarding the incorporation of the hydrology scenarios into the PVA models. The EC requested a written statement explaining the resolution and expected schedule of completion.
    - The first step in progress towards completing the directive is the PVA letter to the PHVA work group.
    - As Dr. Miller is not currently under contract he will not be able to participate in discussions regarding incorporation of hydrology scenarios in the PVA. At this time there is not a concrete date of when Reclamation will complete the Request For Proposal (RFP) process. The RFP has to be out for 30 days and a TPEC will be formed. It's expected to be 2-3 months before a contractor is in place.
    - Attendees discussed whether they should proceed with discussions on the hydrology sequences without both models represented as it would not be fair to the model process.

- It was said that Dr. Miller is still participating but to a very little extent (since he will not be paid or reimbursed for these efforts) and that the PVA work group may be able to have the discussions while keeping him updated via email. To avoid stalling progress on hydrology integration and data consensus the PVA work group agreed to work under the assumption that Dr. Miller will still be developing the RAMAS model.
- It was suggested that the PVA work group notify the EC that they will be working with Dr. Miller but that the PVA work group will not "storm ahead" without a contract for a RAMAS modeler in place.
- It was said that since Dr. Miller doesn't seem to have any substantial differences with Dr. Goodman in respect to data consensus or hydrology incorporation the PVA work group can move forward with discussions on hydrology integration and data consensus without Dr. Miller being physically present. The PVA work group can later verify that Dr. Miller is in agreement with the discussions.
- Dr. Miller has seen a previous draft of the PVA letter to the PHVA but not the latest draft; he has said that he may comment on the final.

Action: Dave Campbell will keep Dr. Miller updated via email and verify that he is in agreement with conclusions from today's meeting.

- Attendees discussed the requests the PVA work group is making to the PHVA work group.
  - It was said that the PVA models will not be successful unless they can be run for an extended period of time especially given the dynamics of the Rio Grande Silvery Minnow (silvery minnow) and it has been found that 10-year hydrology sequences are not long enough. Early in the PHVA process there was considerable discussion on the time frame that would be modeled. Ten-year and 50-year hydrology sequences were both considered but the decision for 10-year sequences was made because it was felt that this was a time frame the URGWOM model was capable of running and the Biological Opinion (BiOp) is for 10-years. It's now clear, however that 50-year sequences are needed in order to see the effects on the silvery minnow.
  - It was explained that the 10-year sequences were developed from 1000 100-year synthetic sequences. It was suggested, since there are the existing 1000 synthetic sequences to draw from, that 50-year sequences be sampled using the same methodology that was used in sampling the 10-year sequences.
  - There is also the issue of turning the synthetic sequences, which are Ottowi sequence patterns, into day-to-day flow. The day-to-day flows are developed by looking at years for which there is a complete historic record of flow in the system, which is from 1975 forward. These years are post construction of Cochiti reservoir. When a particular Ottowi index supply appears to closely correspond with a historic year then 365 days of flow are developed. It was suggested that this be process done with 50-year sequences instead of 10.
  - One issue with developing 50-year sequences is that it will take considerably longer to select the correct flow sequence or representative year that will be used.
  - Dr. Goodman recommended that the process for creating hydrology sequences be an automated random process as opposed to selecting years.
  - It was briefly discussed that though Cochiti is a pass through reservoir it still affects high discharges and this is why PHVA has only been using the post-1974 data sets.
    - The Ottowi output for the year is turned into daily flows. When Cochiti reservoir is in operation the water ends up as flood storage and comes out in the fall. The gages downstream from Ottowi are used.

- It was stated that this may not be as significant as it's being made out to be. One of the reasons that the PHVA has said that they cannot develop 50-year sequences is because they only have 40 years to choose from. But you may be able to take the years where the Ottowi index supply is greater or smaller than in historic record and make adjustments to fix some of the historic data sets. An example was given that if a there is a 1.5 million acre-feet distribution for a year but the paleo data indicates that there is occasionally a 2 million acre-feet distribution then a 2 million acre-feet a year distribution will need to be included every once in a while – to do this a 1.5 million acre-feet distribution can be increased to create a synthetic data set.
- It was suggested that the raw post-1974 data sets be used as representative years to generate extremes. Then this data could be used to create random sequences. This would be a more straightforward approach and would require less additional processing.

- It was explained that the 10-year sequences were created by taking a window of 10 years to create a sequence with the window being moved over by one year to create additional sequences (ex. Years 1-10, years 2-11, years 3-12). This created multiple 100-year sequences which were then ranked from driest to wettest years and the 5 years (the 10, 30, 50, 70, and 90% dryness years) were pulled out to use in the model runs. This could also be done with a window of 50 years and instead of ranking the years they can be used to randomly generate sequences.
    - It was said that for the 50-year sequences there should be a more random way of generating the sequences.
    - Another opinion was that the 50-year sequences would encompass enough variability year to year that they would not need to be randomly selected.
    - It was commented that most of the work that many of the PVA participants do is in snow melt systems where there is a clear spring runoff and years can be characterized as wet, dry, and average years. In this system, however, it's hard to drive with snow melt and years don't fall neatly into those categories. Either it needs to be determined how to find scenarios that characterize what the river does or sequences need to be randomly created from the 1000 100-year sequences.
- Dr. Goodman shared that a paper that has just been published in *Nature Climate Change* indicates that "…ENSO amplitude exhibits a quasi-regular cycle of 50-90 years that is closely coupled to the tropical Pacific mean state". Dr Goodman cautioned that if the PVA is to be defended under close scrutiny then a more flexible hydrology approach that is more readily updated as the science changes should be adopted.
    - The published reference is: Interdecadal modulation of El Nino amplitude during the past millennium. Jinbao Li, Shang-Ping Xie, Edward R. cook, gang Huang, Rosanne D'arrigo, Fei Liu, Jian Ma, and Xiao-tong Zheng. May 2011 – Vol1 Issue 2.
- Dr. Goodman said that he would prefer to use the paleo reconstructions and the existing gage data to develop hydrology sequences for use in the FORTRAN model. The process Dr. Goodman will use will be automated and can be easily changed as the information that indicates cycle length changes. Processes that

are used during brainstorming for the RPA process will also need to be much faster and more transparent.

- Dr. Goodman explained that the FORTRAN model will not have a fixed hydrology sequence. The FORTRAN model will be running multiple sequences and they will not be done with the same hydrology. The 10-year sequences from the PHVA can be used to ground proof the hydrology sequences that Dr. Goodman develops.
    - Ideally the water management rule sets should literally be "if there is this amount of water and this projection of snow pack, then this is what we will do." The management rule sets should be built into the PVA in terms of the water years and the minnow years.
    - The PVA could be done with the rule sets or just the consequences but if only the consequences are built in then the flexibility for discussion is lost. If the rule sets are included then rule sets can be changed on varying levels to see if there is something that will be good for the silvery minnow and that the water users can also agree on.
- It was commented that the models will also be useful to community planners and for other utilities.
- Dr. Miller will be looking at monthly or quarterly time steps and not daily. Given today's discussion it's not known how he would approach the hydrology integration. The RAMAS and FORTRAN models are two different models and what is used to populate them can be different.
- It was explained that the sequence of years is important. The water that is available to work with in 2035 is dependent on a water management decision in the reservoir that was made in 2011. A sequence has to be created from beginning to end based on the known operating procedures of the reservoir.
- It was asked how much of the pre Cochiti data could be used and still has fairly good gage data?
    - Data starting from the 1940s could probably be used.
    - Those data already contain the effects of water management decisions. It was asked how to back out of those datasets to create mapping between Ottowi Index and real hydrology. If the real hydrology is already a product of management then we will just be replaying past management decisions.
        - The Ottowi index supply can be set out from the management decisions by using the water from just above Cochiti Reservoir. It will already have Chama in it.
    - It was asked what else would be needed for the other dimensions of the river hydrology if all the driver is, in terms of nature's supply, is the inflow above Cochiti.
        - It was explained that the Ottowi index supply attempts with some caveats to represent the amount of water that would have been produced naturally by the Rio Grande system at Ottowi at any given year. To some extent the reservoir gives some influence.
    - It was asked if it is possible to determine what the influence of the reservoir is and then adjust the post Cochiti data.
        - It was said that this would be difficult to do further downstream because the further downstream the less of a record there is; some of the gages are also not very good. By looking at project

deliveries and outflow from reservoirs from 1939 to present and comparing that to the Ottowi index supply it may be possible to figure out the tributary inflows.
        - The irrigation should be predictable enough that it could be encompassed by a single number from year to year.
        - It might also be possible to analyze the Ottowi index supply and compare it to the compact deliveries to figure out the time lag involved.
    - Dr. Goodman shared that what he would need to create hydrology sequences would be the paleo reconstruction data, the actual data going back to 1945, and the availability of the PHVA work group to assist in developing the sequences and review of the sequences for QA/QC.
    - Both the PVA modelers will be provided with the paleo reconstruction data and the record data to develop flow sequences that best suit their individual models.
    - It was discussed that a huge amount of effort has gone into URGWOM and reason for this must be partly because there is an institutional comfort with the process. It was said that any alternatives created by the PVA modelers need to at least match the URGWOM outputs under the appropriate circumstances. This ground proofing step should be added so that the hydrology sequences made by the modelers are at the same level as the URGWOM hydrology sequences.
- It was briefly discussed that there seem to be two different mindsets in the Rio Grande and other systems. The biologists are asking the hydrologists how much water there is in order to make a determination of whether that is enough or not and the hydrologists want the biologists to tell them how much water is needed.
    - One problem is that it's not known what the fish needs. This is one area where AM is helpful. An example was given that in Flaming Gorge "flow recommendations" are given and they may change depending on what is known.
    - It was commented that the Rio Grande system has extreme variability and Colorado has huge effects on the flow.
    - It was said that the approach from a management perspective may not be to analyze the effect of every flow on the species for a thousand year horizon but to determine the flows that are in needed within a certain window of time. For example, within a 10-year window, x number of a certain type of flows may be needed. The decision for how those flows are provided will then be left up to the management of the system.
- The modelers will need to provide the PVA work group with a description of how they will incorporate the flows into each of the models; this can be provided to the EC.

Current Data Sets

- Attendees discussed the current data sets and data sets that are still needed.
    - Dr. Goodman indicated that he is not comfortable with the current data sets and that there will need to be discussions on the version of the data sets that will be used.
    - It was said that inconsistencies of the collection sites and nomenclature are found within some of the datasets. There may also be some issues in regard to translation among datasets – this issue can be taken care of with processing.
    - Dr. Goodman so far has looked in depth at the two monitoring data sets from ASIR and Jason Remshardt. He found inconsistencies and has gone back to ASIR and Jason and has asked if the specific data inconsistencies were due to transcription errors. ASIR and Jason then look back through their records and fix any errors.

- Dr. Goodman has also found that there is inadequate documentation in the genetics data set making it unusable in its current form. This is troubling because he has no one to communicate with on these issues.
    - It was also said that some of the fields in the genetic data sets are not well defined; it's difficult to determine what some of the fields are.
- Dr. Goodman said that while participating in the AM meetings he has realized that since the Southwestern Willow Flycatcher (flycatcher) will be a part of the BiOp it will need to be determined how management of the flycatcher will interact with management of the silvery minnow. Flycatcher habitat, nesting, and fledging success data will be needed. In brief conversations with Hector Garcia (Reclamation) it was found there is not a unified database for this information but that is was all included in reports and it would be a laborious process to compile the data.
    - It was shared that that there are two data sets that pull the data from the reports given that the reports are submitted. One of them is managed out of the Service Albuquerque office by Scott Durst with USGS. Dave Campbell volunteered to check with Scott Durst to see what data is available.

Action: Dave Campbell will check with Scott Durst to see what flycatcher data is available.

- A request was made to schedule presentations from flycatcher experts. Presentations from Hira Walker, Scott Durst, Darryl Ahlers, and Hector Garcia were suggested.

Presentation on Process for Consensus Data Set – Dr. Goodman

- Meeting attendees discussed the EC directive for the PVA work group to achieve a consensus data set.
    - It was said that there seems to be the mindset from some people in the Program that the PVA models will be a finished product that will never change and that the data that goes into them will never change. There may need to educate the Program that the process for both PVA models is ongoing and will continue to be ongoing. For now the EC can be given a status for the draft models and the data of where they are in the process and where they plan to go.
    - It was said that the data consensus should be easy to get agreement on but the model differences will be more difficult. It was recommended by Dr. Goodman that both modelers be present for discussions on model differences and that the discussions not be attempted at this point in the process.
- Dr. Goodman shared that he will be presenting on a process for data consensus, a possible merging of the Jason Remshardt and ASIR monitoring datasets, and institutional approaches to modeling.
- Dr. Goodman presented a document he created that describes a process used in other institutions for dealing with data consensus that he proposes that the PVA adopt. Dr. Goodman will circulate the document for the PVA work group to review and Dave Campbell will send the document to Dr. Miller to see if he would like to comment on it.
    - There are 2 main objectives for data consensus.
        - The first objective of consensus is to disclose the data that the parties intend to use or wish to use for BiOp and RPA analysis.
        - The second objective is to promote a clear diagnosis of possible differences that may arise, either between models are statistical analyses. In the absence of common data sets it is unclear if the different models or analyses are using different data sets.
    - Data consensus should be a living process that is updated in an orderly way.
        - The process for arriving at a consensus data set usually consists of these basic steps:

- a) All parties present a list of datasets that they intend to use or wish to see used.
    - This will be a Program-wide question and will require buy in from all agencies and will be similar to a legal discovery proceeding. This will be the data that should be used in building up to the BiOp and RPAs.
- b) The data owners will then have to provide the best available version of the data set. Best available means that it should be complete and have been quality checked; this can be time consuming especially for a data set that has never been analyzed before.
- c) The group will then poll for concurrence that these are the best available data sets – this concurrence will need to be recorded.
- d) The group verifies usability of the data and documents its conclusions.
- e) The set of accepted data then needs to be archived in a way that everyone has access to them.

- A final part of the process would be agreement for how the data is updated and how data sets are added. This means that the above process will need to be repeated in a timely manner so there is not disruption of the technical analysis.
- This process is for the original data set and would not preclude post processing of the data. Every post processing decision that is made should be well documented. The data owners should also be free to make corrections to the original database but it needs to be well documented.

- Meeting attendees further discussed the process for data consensus and the related EC directive.
    - If the ASIR and Jason Remshardt monitoring data were merged it would require synthesis of the 2 data sets. This would not oblige either Jason or ASIR to do the merging or to cease keeping their original record. It will need to be recorded that the data is being merged, how it is being merged, and how regularly it will be updated.
    - Every dataset should also be accompanied by a meta data file.
    - At some point in this process the consensus data should be transferred to the Database Management System (DBMS) to be sure that is accessible to the most amount of people.
        - It was explained that currently an ad hoc work group is managing construction of the Program database. A beta version of the DBMS is scheduled to be released in fall 2011.
    - With a consensus dataset everyone should understand that there is a common place where both of the modelers started. For example, if the models come to different conclusions when the same data was used it can then be determined if these are due to the use of different methodology or the use of different data subsets.
    - It was explained that one of the challenges of the DBMS is that datasets come in with different fields. It was contracted out to Daniel B. Stephens & Associates, Inc. with help from SWCA to put all the data into a standard framework.
    - Dr. Goodman asked if there is a master dataset for PIT tags.
        - It's not known if there is ongoing, continued monitoring for PIT tags in areas other than the bypass facility but it is thought that Jason's group and ASIR take PIT tag readers out with them.
        - It was said that it would be valuable to have a master list of all the PIT tags in the Middle Rio Grande (MRG) system. It was asked if there was some utility to bring all the PIT tag information together.

Action: Dave Campbell will ask Jason Remshardt if there is a master list of all the pit tags in the Middle Rio Grande system.

        - It was asked if there are other groups using PIT tags.
            - All of the Service PIT tag information is available for download on their website but it is not known if there are other groups using PIT tags in the MRG.
            - It was shared that Interstate Stream Commission (ISC) is using PIT tags but none of the implanted silvery minnow have been released into the river. The silvery minnow are all 2-3 years old and it's not known what the future plans are for the fish. The PIT tags that ISC is using are 9mm as opposed to the 12 mm PIT tags that Jason's group is using. Some PIT tag readers are capable of reading both.
            - It was agreed by several attendees that tagged fish should be documented.
                - When passage facilities become a reality there will be strong motivation to put stationary readers or coils into those facilities.
        - It was suggested that standard PIT tag requirements be included in the standard protocol for the silvery minnow permit process.
    - Attendees briefly discussed the Age and Growth Study. The draft report has gone out to the Science Work group for review. The actual annual measurements should be available soon.
    - The PVA work group will need to clearly articulate to the EC what a consensus data set is and how the work group will proceed in obtaining a consensus data set. It was suggested that the PVA work group also make the recommendation that this process for data consensus be implemented Program-wide.
        - It was briefly discussed that though the DBMS contractor is putting the Program data into a common format they are not performing QA/QC on the data. Because of this there is the potential for there to be two data sets as Dr. Goodman has data sets that have been QA/QC'd and it's likely that these corrections were not made to the datasets that will be included in the Program database.
        - It was suggested that a representative from the DBMS work group or Daniel B. Stephens attend a PVA meeting to explain what is being done when data is included in the database.
    - It was recommended that the PVA work group also provide the EC with a list of data sets to be used in the PVA and where each dataset is in regard to consensus.

Egg Drift Monitoring – Dr. Goodman

- There are a lot of remaining questions regarding egg drift. There have been numerous efforts for monitoring but they have yet to be pulled together. For ASIR, we have almost 10 years of them applying a fairly consistent protocol and the resulting annual reports. Unfortunately, we do no have access to their data files. Dr. Goodman expressed that he really wants to have the data.
- Dr. Goodman explained that he went through the ASIR reports, digitized graphs and tried to reconcile with the tables to develop his "version" of the ASIR egg monitoring data. He cautioned attendees to expected variation from the actual data and his version, but it is the best available at this time.
    - Rich Valdez shared that he had been attempting to use the length of fish (at time of capture) to back calculate the birth of the fish. He is also trying to reconcile the egg drift data with the birth date/spawning date of the fish in order to get some idea of how they match up. Unfortunately, they are not matching up at this time; this could be due to error in his growth function which is not temperature corrected. There is

also inherent variability of when fish are spawned according to the environmental conditions.
        - It may be that the growth is way off or the egg drift data don't necessarily predict which fish seceded.
- Almost all of the ASIR egg monitoring has been downstream in the San Acacia Reach which may or may not be giving us a good window of spawning elsewhere. Literature indicates that eggs don't travel very far. So egg monitoring in one area is taking a pulse in that restricted area and not the whole river. A thread of emails with David Gensler shows that there is a lot of people in numerous places looking for eggs. This means there is the potential to answer these questions as long as the various parties are using comparable protocols and the results are being compiled some where.
    - It was pointed out that the monitoring is secondary to the collection process. The point of so many people on the river is to collect eggs. Although it is possible that the egg collection could be done in such a way that it could be considered monitoring. It is unknown if there is a formalized "egg collection" process and unfortunately, there is no central communication structure between the entities (for collection purposes).
        - There are at least 4 entities involved in the egg collection: the BioPark, the Service's Fisheries office, SWCA, and ASIR but the BioPark is leading the initiative. If there is any coordination, it is through the BioPark. The goal is to collect every egg possible.
        - It is unknown if any data is being recorded at the same time. In the past, temperature, time, and some flow/velocity data was captured; but it is unknown if all parties are collecting this information.
        - Dr. Goodman shared his opinion that this would probably be important to AM. ESSA (AM plan development contractor) has already garnered insight that the Cochiti deviation is one of the central stories here. It might be critical for AM decisions in the future to understand the effectiveness of egg monitoring, how to make it better, and how to interpret results.
        - ***Question:*** Is there such a thing as egg monitoring without egg collection?
            - ***Response:*** There is monitoring in the canals to see if the eggs end up there. This is done every year and is pretty standardized (i.e., done at the same locations for the same amount of time during the same time every year).
            - They monitor one hour in a day. A significant amount of eggs might be missed. We don't know how accurate it is.
        - The Service has found up to 10,000 eggs in one spot before. It is like we sometimes stumble into a treasure trove of eggs in one spot while we can't find a single egg in other spots. Maybe 24-hour monitoring could help address this.
            - But it depends on the purpose – right now the intent is to just collect as many eggs as possible.
            - One of the first steps might be to try to assemble a database out of the information from this year and previous years. Maybe the ScW could be better equipped to handle this task. It was cautioned that the egg monitoring data is one of the hardest data sets to deal with – just coming up with a metric to assess it all will be challenging.
            - We could make a set of egg monitoring recommendations that if followed (especially by the BioPark) could turn the information into more of a database.

- Additionally, we could ask Service to make standardization (protocols or reporting criteria) part of the permitting requirement.

Preview for Merging the Two Data Sets

- Dr. Goodman presented his merger of the data sets. Jason Remshardt's monitoring data starts in 1999; the ASIR data starts in 1993 but was "chopped" due to lack of corresponding Service monitoring data.
- Dr. Goodman showed a graph with time on the Y axis (going from past to present as you go down). Within each year, the data determines where location on the Y axis as it is a data axis and a year axis. The X axis is river mile. The 3 reaches are outlined by vertical black lines. The left most part of the X axis represents Angostura, the middle is Isleta, and the right hand is the San Acacia Reach. Each dot on the graph represents a sampling event - meaning in that location and on that date one group or the other went out with seines. Jason's data is represented by blue dots and ASIR data is green dots; the squares indicate where one group or the other has encountered isolated pools. There are certain favored locations where Jason has focused; they seem to correspond to where a lot of hatchery fish were released.
    - We need to confirm with Jason that he was attempting to recapture fish and this is indeed why he there were location preferences. In 2001, he abandoned a lot of sites that he had been exploring and refocused his work.
    - ASIR has been more consistent with their station locations, but has also drop some
    - Even so there is the possibility of combining both data sets to get better spatial coverage – as long it is legitimate to put them together.
    - We can also compare the isolate pool data to determine if both groups were encountering them at the same time.

- One technical issue with merging the data is determining if both groups used the same protocol. Jason has said that their methods are pretty much the same.
    - Jason provided the data by seine haul. When Jason monitors a site, he makes 10 to 50 seine hauls and records the general location (river mile), what habitat was sampled with the seine haul, and other factors such as velocity, depth, etc.
    - ASIR doesn't provide the data to that level of detail by seine haul. Instead, the ASIR data is by sampling event. They construct a sampling event at a site and they make a number of hauls, usually around 15 to 20. They attempt to pick a representative sample of habitats. They record the number of fish and area sampled; the number of fish caught at each site is summed as it the area sampled – this is used to make a ratio which is the CPUE. All we see are the sums.
        - Jason does not sum numbers to get a CPUE, but since he's provided the individual seine haul data, Dr. Goodman explained that by post processing he could construct comparable sampling events.
            - It is clear where Jason stopped and took samples. He has same flavored stations but at each station he takes 20+ hauls and he deliberately tries to distribute over habitats. Each haul is of a particular habitat type, particular depth and velocity. We've been informed that Dudley does the same thing.
        - ASIR did record individual seine data but it is not in their electronic database. Rob Dudley said it would be a large undertaking to transcribe the information and they aren't compensated for doing so.
            - Transcribing data (from several thousand seine hauls) has been done in the Green River and it only took a few weeks; it should not be that big of a task. Some of the data is assumed to be in Excel format.

Given these, it is suggested that there be further conversations with ASIR. There is more power in looking at individual seine hauls (rather than the sums) and it could provide clues as to how to improve the sampling.

- In order to justify merging data sets, there needs to be discussion about the comparability of the data.
    - In another graph (Figure 4), the horizontal axis now represents time (going from the beginning on the left to present on the right) and the vertical axis is CPUE (number of fish per 100 m^2). The values were taken directly from ASIR and were constructing from Jason's data by combining the seine hauls that constitute a sampling event. Please note that the vertical axis is log scale.
    - Regarding the habitat data, it's hard to determine if they are taking habitats for the frequency that they occur at a site or whether they are deliberately taking them from dry. There is also no habitat mapping for the sites which is flow dependent and will change at each location from year to year depending on conditions.
        - There is no inventory of habitat conducted at the same time (ex. 23 riffles at this reach). This is one reason the design should be changed a bit.
    - In a graph of sampling from Angostura, every dot now represents all samples in the year. The space is now gone from this plot and it is stratified by reach. Dr. Goodman explained that he averaged the two sources, so now ASIR is red, Jason is green, and the horizontal bars are the average over the entire year of the sampling events. They are tracking one another; they are at the same number and very close. The differences in 2009 can be explained because Jason sampled all year, but Dudley's sampling was delayed until the fall due to contracting issues. 2010 was a bad year and they both agree. Remember, this is just Angostura for the young-of-year.
        - Dr. Goodman's conclusion is that they are sensing recruitment in the same way - which is encouraging and justifies considering merging the data. It is a fair question to ask about the comparability in the other reaches. Jason is not sampling as intensely in the other reaches.
        - In Figure 5, the Age 1+ fish are also tracking. While the distribution of the Age 1+ fish is more "patchy" at the end of the year, Dr. Goodman expressed comfort with merging the data.
    - Figure 6 shows whether or not the 2 sampling protocols are "seeing" similar distribution of fish in space. The horizontal axis is river mile. Angostura is on the left; Isleta is center; and San Acacia is on the right. A dot at a river mile location is the annual mean at that location for that data source. The lines connect the locations within a year. A red line would be where Dudley found fish - station by station - averaged over the year for young-of-year. The purpose of this graph is to look for patterns in space.
        - The answer is no; both protocols "see" fish along the length of the river. The only unusual location is the station right below the San Acacia Reach Diversion which has an abnormal frequency of high values.
        - Dr. Goodman explained that nothing "jumped out" regarding Jason and Dudley seeing different distributions in space.
    - Figure 7 is a graph to compare the sampling protocols for fish distribution for the Age 1+ fish. The story is similar except for a hot spot right below Isleta. The diversion dams seem to be creating hot spot pools. Dr. Goodman shared that he has discussed this with Dudley and his impression is that the hot spot samples occurred in situations when the river was dry and there was leakage through the dam. The

assumption is that the hot spots were essentially isolated pools fed by leakage through the dam. We will have to see if Jason concurs.
    - Since Angostura never goes dry, it would then be the control.

    - In conclusion, Dr. Goodman shared that he is very encouraged with the prospect of merging the data sets.
        - Jason's data, because the information is by haul, will allow us to explore questions that haven't been pursued yet (mainly pertaining to what is observed at the haul level). More than 90% of hauls come up with Age 0s. It is as if the sampling protocol is sampling for schools and is very "hit or miss."
        - Because Jason's data provides information broken down by habitat, substrate, and features we can ask if there are preferred habitats and circumstances. And to limited degree, yes. The habitat most likely to have non-Age 0 fish is back waters. There is a frequency of 15% for the non-Age 0 in the back waters. There are still a lot of zeros.
        - The means and the variances track. However, Dr. Goodman's opinion is that we are sampling schools and not fish. If you want to find silvery minnows - other than Age 0 – the place to concentrate on is the back waters. The other thing that Dr. Goodman has learned from this data is that a seine haul that has debris as a feature is an optimum place to look for adults. Adults seem to be concentrating in and around debris. The silvery minnow, in general, are more evenly distributed in back waters than other habitats but not by a wide margin. Dr. Goodman's analysis is that as the fish grow older they become patchier in distribution; this begs the question where are they "hanging out?" makes me wonder where they are hanging out.

- ***Question:*** Would it be useful to run the red shiner through this same analysis to see if it lines up?
    - ***Response:*** It would be interesting to see. Is there thought that they are competitors?
    - The numbers seem to alternate between the two; it seems that there is either good habitat for one or the other.
    - Also, the literature points to red shiners preying on larval fish.
    - Competition plus predation is a hypothesis that Tom Wesche proposed in this system.

- ***Question:*** Based on the characteristic strong binomial distribution of these data (because they are non-independents), did you test log transformations to see if they approached normality?
    - ***Response:*** Yes, but we still don't get normality. We need to see if there should just be scoring presence or absence by seine haul, which came up as non-zero.
    - Is this for an occupancy model in terms of presence or absence of fish?
        - No, and I don't recommend going there. I don't think that is what the fish are doing; it's not like there are set places that the fish either occupy or don't. It is that there are set schools that move around and we just happen to encounter them.
        - An occupancy model would have to take how often a school of fish goes to a patch of habitat into account; and patches of habitat change all the time in the river.

- ***Question:*** Back to Figure 3 and maybe all the figures, does the timing of the sampling between Jason's and ASIR samples match well? By month?

- ***Response:*** Most of the time they both try to get a sample per month for every month of the year. But there are times when they don't. ASIR has been undergoing some drift in over time as to when in the month they sample. They do it a little later each year but I haven't looked for that pattern in Jason's data.
- If Jason samples in one month and ASIR samples in another month, the time space is not so great. Those can't be pooled and compared.
  - I wouldn't do that. If you remember the cohort graphs, I would pool all day letting the dots fall where they may and then do a log through them to reconstruct the cohort data. Even though I am making the two data as part of the same set, I am not "shoeing" them into the same month; a sampling occurs when it occurs. The big difference is we will have more dots and data for that regression.

- ***Question:*** They haven't been taking many lengths since 2000?
  - ***Response:*** That's ASIR; Jason is still collecting length data.
  - Your length data set reports about 38k lengths from 1993 and on, but isn't most of that from about to 2003 or 2004? But Jason does have lengths?
    - Yes, Jason has more length data. It would be good to talk to him to see what he was looking for in lengths.

- ***Question:*** Do Jason and Dudley make the same age determinations?
  - ***Response:*** I don't know. I'm not sure how Dudley does it. There's the "seat of the pants" method that they just classify but that is not very mechanical. We will have to ask them. Right now, I'm comfortable that they can tell young-of -year from older fish. I've gotten the impression that Dudley is skilled at distinguishing Age 1 and Age 2 because the frequency of Age 1 and 2s look right based on estimations from mortalities.

Regular Work Group Business

- The work group approved the March 29th, 2011 meeting minutes with no changes.
- Rick Billings requested confirmation that he is on the PVA mailing list as he is participating regularly.

Status of Habitat and Floodplain Modeling Efforts in the MRG – R. Billings

- Rick Billings presented an update on efforts pertaining to habitat and floodplain modeling efforts – what is being done and what the rationale is. Most of this work was derived from a series of questions and was spearheaded by Jason Remshardt, Mick Porter, and Rich Valdez.
- *What is the Habitat Restoration (HR) work group up to?*
  - Currently, the HRW is working on scopes of work (SOWs), getting SOW evaluations, and putting out grants.
  - There is not much water so most of the HR sites are dry this year.
  - The group is also developing a "new" physical conceptual model of the system and "synthesizing" results from restoration techniques, locations, methods, peer review and existing data.
    - The Program paid for reach analysis and recommendation reports and the HR work group have learned those are good for a "shot gun" approach but we want to look at habitat and restoration more extensively by reach.
    - In developing the new, physical conceptual model, the group is learning that hydrology and geomorphology are the keys for habitat intervention. The group has also learned that it's a water problem not a fish (biology) problem.

- HRW members are very active in the Monitoring Plan Team (MPT) and with the Effectiveness Monitoring Program.

- *How can HRW help?*
  - HRW is considering restoration needs and results on a reach wide scale; we are also trying to develop larger projects for more of easier-to-see results and ease in measuring/monitoring.
  - However, there is the opinion that the work groups are still "miles apart." It would be beneficial to get HR into the modeling effort to inform restoration work; and to use modeling outputs to design restoration work. This will help us determine to what level habitat really makes a difference to the minnow.
  - The HRW is also attempting to understand and apply the restoration techniques necessary for more in-channel habitat complexity for below average flow conditions - we don't know much about low flow habitat because restoration work focusing in the channel hasn't been done.
    - Dr. Goodman's recent analyses (from the last year) showing the drastic summer drop off for the young of year has forced us to really consider in-channel habitat. For example, since channel incision is one of the issues, how do we restore sediment and cause the thalweg to be shallower? Using things like debris piles?
    - The HRW is looking for guidance on how to approach this.
  - HRW also intends to work closely with PVA and Science to develop hypotheses within and for AM to benefit all the groups. All the concurrent work (Reclamation & Corps' BAs, PVA models, AM plan, LTP, etc.) is coming to a head so HRW is looking for ways to keep forward momentum in a manner that is big enough to make a difference and be easily measured.
  - What are habitat "needs" for the PVA, and when are they needed?

- *What can the PVA do for HRW?*
  - 1. Can we develop/implement a restoration goal (ex. 250 acres of inundated shoreline, Isleta reach, mile marker x to y) and then estimate the effects upon the population in that reach? Can the PVA provide HRW with guidance for that? Does the population respond well?
  - 2. Should we look at reach by reach habitat contributions, or consider activity in the MRG as a whole? HRW is trying to go from site location focus to reach focus and have an overall plan/idea for where we think the river should be. While the Program has done a lot, there is the opinion that we are not learning from it.
  - 3. Will modeling help indicate which reach or techniques are most appropriate (dare we say effective?). We are hopeful to take things to the next level. If HRW can "stick close" to the PVA then there can be an informative feedback loop that is beneficial to all.
    - HRW would like the PVA to provide guidance on which things and where restoration would be most useful.
    - It was commented that the intent is to get the scale of a restoration project to a level that it is detectable by monitoring techniques (this is how to test the effectiveness). We haven't done a good job of looking at groups of habitat or how much one particular area has helped; instead we have focused on just each site.
- This presentation was in part to initiate communication between the PVA and HRW groups. The PVA forces the Program to look at the data as a whole and is an important focusing

mechanism because we can do better habitat restoration work if we understand the fish population.

- It was commented that the HRW is doing the right thing but there is no process to validate or to tie the work into the science. There needs to be some objective process to say whether the work is really beneficial.
    - Part of the problem is the issues with sampling the minnow in the channel. There are shorter time frames and larger areas to sample which makes it a huge challenge. There just isn't a good technique yet.
    - One opinion is that HR can be viewed in essence as a treatment. It is something that is done to assist species. In this system it is hard to duplicate a treatment and compare spatially but a temporal before/after comparison can be done. It is also a very dynamic system which is one of the biggest challenges. What we observe may be different than what the fish wants. There needs to be sound evaluation processes because it could be a series of factors (not just the treatment itself) that influenced fish use or fish population.
    - HRW is now taking a more systematic approach to determine if what is being done is really making a difference. For too long, the restoration has been too much of a shotgun approach.
    - There is some promising anecdotal information but transition from the observations to a more structured, affordable data collection effort (that we can do statistical analysis on) is challenging. PVA may be helpful for figuring out strategies.
        - It is hoped that PVA will have the ability to shed some light on the relationship between the fish and some environmental metric (i.e., how the fish react).
    - Attendees discussed inviting HRW members, geomorphologists, hydrologists, instream habitat experts, and mesohabitat experts to a brainstorming session on monitoring (or a workshop) for HR. Jason Remshardt, Mark Stone, and Mike Harvey were mentioned by named.
        - It was suggested that other systems where folks have monitored fish use of habitat be explored and compared.
        - There was general agreement among participants that the big question is how to monitor and document the effectiveness of HR projects. This is a different question from how to monitor the population as a whole. It is probably not wise to think that a project could affect an entire reach affect and will show a change on the entire population.
            - What existing projects (with reports) can be reviewed to provide more insight? No synthesis has been done yet. But how do we get that started?
            - Both the Los Lunas project and ISC work were recommended as places to start. Another suggestion was the SWCA and ISC reports.
                - It was cautioned that often sampling occurs in restoration sites where the elevation of the bank has been lowered or vegetation removed (in order to allow more lateral expansion of the channel at lower flows) but there is rarely sampling of natural features that inundate as specific levels for comparison purposes. We could benefit from evaluation techniques like that.

- It is hard to tie habitat and flow and even harder to tie flow to fish response. A really structured hypothesis testing approach should be set up.

- It was commented that with a sand bed river system and a shortage of water, there is not really a lot of flexibility with water therefore managers have to make a conscious decision to work the land.
  - There has been a progression of thought from the ideas of just doing restoration to the understanding that the fish needs inundation.
  - The reproductive portions of the minnow's life stages have been the focus of much of our work; the remaining life stages have not had much applied to them.
  - To effect the population, restoration projects will probably have to be on a much larger scale. Although one concern is that if we don't have the tools for evaluating the small projects, how can we quantify larger ones?
  - Right now, we do not have a good handle on the amount and type of habitat that exists in the system. HRW is looking at the acres that are inundated.
  - Is there interest (and value) in trying use the pre-1972 HECRAS data to have a "pre-Cochiti" picture? This would provide information on the background trends which from a habitat standpoint is well worth knowing. It might also inform whether the river is becoming better or worse from the minnow's perspective.
  - Another question might be "how much manipulation is needed to benefit the species?" What percentage of habitat has been touched?
    - Probably less than 5%. Part of the issue is that much of this is compliance driven. If we can develop a more streamlined approach/process, we might be able to avoid a lot of costs. HRW is looking at different contractors now including how to use in-house operators to save costs.
  - There is good data supporting the adult silvery minnow's use of inundated habitat; but it is not systematic. The Program needs to get to the point of being consistently systematic.

- *Minnow Counting Project (predicted minnow migration at low flows) or Localized Monitoring System*
  - Attendees discussed the idea of trying to use river drying to predict a large minnow migration out of a reach and using strategically placed weirs (at either end) to count fish as they move.
    - One opinion is that 200 cfs or less might be a "trigger" flow volume to cause the minnow to leave.
    - Another project suggestion was to release a known number of tagged fish in an area of unknown population and compare the ratio of tagged to untagged fish as they move out of a given area.
    - Instead of the weir suggestion, a screw trap can be placed in an area where it is believed the minnow will be passing. The key to this project is knowing when/where the fish were passing by.
    - There is some level of control over the drying rate so this experiment could feasibly be set up. Obviously this would include structures in the river and require a big permitting process but physically it could be done.
  - This type of project might fit under the "minnow salvage" category which could a make it more effective by tapping into the salvage personnel and permitting.

        - Isleta Dam down to Peralta would be an excellent place for such a project.
        - There will need to be a more detailed project outline before pursuing. The "weirs" could be fyke nets which might be easier depending on the types of flow.
        - It was shared that the salmon experts use rotating screens that are sort of self cleaning.
        - This type of project could also be contemplated for a stretch of floodplain if we know the route the water will take as it recedes.
        - The purpose of this type of project is to learn how many fish and how many young-of-year there are in a specified reach river. This is one way to determine if HR is working without having to modify hundreds of acres. It is similar to a localized monitoring system - which is the puzzle the Program has been wrestling with.
        - It will also help inform what effect drying has on a population.
            - The speed at which drying occurs probably influences how many of the fish get isolated/trapped in pools. The slower the drying, the more time they have to move. This theory is supported by the fact that at the southern end - where things are managed slowly - they don't find as many trapped fish.
            - It could also be related to the geometry – with the initial recession being more conducive to allowing fish to retreat. If this is the case, then HR can determine how many backhoes it would take to prevent those traps occurring.

- *Habitat Workshop*
    - A workshop would probably have to be approved by the CC (not necessarily the EC) especially if there were to be any cost or budgeting requirements (venue, provided materials, travel for any outside speakers, facilitator, etc.). This would require developing a joint proposal between HRW and PVA for the workshop.
        - HRW is very interested in getting feedback and guidance.
        - PVA and HRW would have to work together to develop a focused agenda with discussion topics.
        - One suggested structure to follow consists of 3 parts: (1) present current work for a "picture of the Program" and what is being done; (2) peer reviewers can present on aspects of what does and doesn't work; and then (3) moving forward based on what you know and what has been learned. The first portion is the education piece (ex. what the Program has been, what has been achieved, what are the results, what is the background of the system, etc.).
    - We have an idea of what constitutes good habitat, but we can be certain; we can't prove it. Even if we are creating good habitat there might be some subtle components missing.
    - Attendees agreed that it would be worthwhile and appropriate to put together a proposal for a habitat workshop and to flesh out some of the ideas in that context as well as continuing the habitat discussions during the work group meetings.
        - From a PVA perspective, the focus might be what habitat hypotheses need to be answered. Questions need to be formulated into hypotheses so that the answers will help us move forward.

Action: Rick Billings will have HRW begin development of a draft agenda for a workshop. The draft agenda will be provided to PVA once available.

- It was pointed out that the Program is considering a technical workshop for this fall (or late summer). Is there a way to consolidate the efforts? The Program's workshop is looking at a 2-day event with both flycatcher and minnow presentations. One benefit to combining the workshops is that the funding is already in place for the Program's technical workshop.
    - It was suggested that maybe there could be a habitat module.
    - Concern was expressed that the habitat concepts and issues might get "lost" in a larger, varied setting. Also, there is likely to be more focused, expert participation (and interest) if there were an event dedicated to just the habitat topics.
    - There is value in bringing in outside experts from across the county to participant in workshop discussions. It is an additional "check and balance" besides the peer reviews.
    - A Program-wide "status reassessment" would be good, but one opinion is that there needs to be more focused for the Program.
    - It was suggested that a HRW/PVA develop a list of questions or areas of importance to be distributed to the Program for feedback.
- It was suggested that a short paragraph describing the need and desire for a habitat workshop be developed before the June 1st CC meeting.

Presentation on the Testing for Consensus on Statistical Analyses – D. Goodman

- Dr. Goodman shared his perspective that the data consensus should be relatively easy; however, the model consensus which also needs to be addressed won't be so easy. Dr. Goodman used the "statistical analyses" as the bridge to the model analysis - as a template that will ease the PVA into the model consensus. Disagreements over statistical analyses can be problematic but are usually easy to resolve once the differences are understood.
    - The first step toward resolution (of results of statistical analyses) is to have good documentation of the methodology. The purpose is to allow a third party to independently reproduce the results. Included in the documentation is the theory of the analysis and software identification (ex. packages that were used). Implicit in the documentation of methods is the documentation of assumptions and their justification. Any other assumptions should be made explicit. Every estimate has a confidence interval. That interval becomes a reference as to whether the difference in estimates really is a true difference or is just part of the uncertainty. (It also means that from the stand point of resolving estimates, a bare estimate without a confidence interval is meaningless – the uncertainty needs to be quantified.) Some apparent differences between estimates actually don't mean a thing if those differences are within the confidence interval of the estimates; this needs to be communicated to the EC.
- If all those conditions are met, how does a group come to a consensus on the conclusions if there are differences? The group needs to work through an evaluation to determine if the methods were legitimate and consistent with assumptions.
    - Were the assumptions reasonable? What evidence is there to support differences in the assumptions? Decision makers still need to know which conclusion is the better conclusion.
        - (1) The group doing the evaluation can decide which one makes more sense given what is known about the system; or (2) if none of the assumptions are "exact", there can be different assumptions that are more or less plausible that each lead to different conclusions. When they are both technically plausible, you can combine the analyses. And the results of the combined analysis are then the correct technical appraisal. You will have broadened

your confidence intervals by combining the assumptions. If it is not possible to decide which the more accurate assumption is, the fair thing to do is to use them both.
        - There are statistical techniques for doing this Bayesian averaging. Dr. Goodman shared his perspective that this is also a good paradigm for model consensus, but there is something about modeling that makes it psychologically more difficult.
- This "line of thought" can be applied to the testing for consistency on PVA models.
    - The first step is to understand the structure of a PVA and its relationship with statistical analyses. A PVA model is a 2 stage analysis.
        - The first stage is a retrospective analysis; this means looking at and analyzing all the data you already have to get estimates of the various rates that will be used in the PVA (ex. birth rates, death rates, correlations with environmental variables, etc.). But this phase of PVA modeling often gets ignored because the next stage is more "fun."
        - The second stage is feeding all the parameter estimates into the computer to make the predictions and get results. What is seductive about this is that it superficially looks good. The retrospective analysis is where the credibility comes from.
- One of the big questions is "where did the parameters come from?" That's been our big question for the last three years. This is where the real work PVA work is - providing a basis for the inputs to the predictive part of the model.
- If there are multiple, differing PVAs with conflict over differing predictions, the group might structure a diagnoses of the differences. One possibility would be the statistical analyses that made up the retrospective analysis (i.e., if they were in fact using different parameter estimates based on different data). Was it differences in data or methods? The other possibility is if there were parameters that not thought of (i.e., not estimated) and thus not included in the predictive model. These could be considered "wild cards" and it needs to be determined if the different models used these wild cards differently; this would explain the different results. But the issue doesn't end there - if the technical people cannot defend the inputs and results, how can decision makers be expected to make decisions?
    - There is a "truthing" process in that the results of well constructed models (even if the predictions are different) can be tested in the future against reality to determine which is more accurate.
- Disciplined institutions will try to find retrospective analyses for as many parameters as possible. If there are still some "wild cards", there is a formalization using some language from climate modelers as a next step; when there are untested and un-validated differing assumptions then another validation is in order. Running the predictive model "backward" to model the last 20 years is "hindcasting." Hindcasting is valuable because it tests the models predictions to a known reality. This should also be imposed on the process of resolving differences - asking whether the system is working plausibly or not.
    - There is the danger that an individual would try to construct a model that would in fact match up with the hindcast - this then runs the risk that the model won't perform well in the prospective. Having sufficient and comprehensive documentation on what was done and why will help prevent such a situation. It promotes transparency.
    - If both conflicting models both pass the hindcast by matching observations then the differences can be attributed to the assumptions. If there are differing assumptions in the model's predictions but the group cannot decide amongst and there are no real reasons to "vote one off" then the technically correct thing to do is to merge the models. The climate experts did just this - using model averaging or ensemble

predictions. Dr. Goodman expressed his opinion that this would be a good process for dealing with any future differences that may arise.
    - Merging models can mean either (1) an analytical sense or (2) a physical sense. The "correct" prediction could be a sum of both model distributions (merging the outputs). Or one of the models could be run with all the assumptions included. An assumption is a parameter.
    - What was been outlined in this discussion is more or less what climate modelers and other venues use.
- Attendees discussed what exactly the EC requested and how the information would need to be "cleaned" up for presentation to the EC. One opinion is that the EC wanted almost an "itemized list" of the differences between the models; how do they compare?
    - Some members expressed the opinion that such a "list" is premature as the models may be very close in their predictions. The PVA group can explain to the EC what the RAMAS model does and that the FORTRAN model is a Bayesian PVA. However, one reason to pursue this is to avoid the situation where the executive mistakenly think the modelers will provide a "buffet" and they can pick what they want from it.
    - The EC was not expecting a response by June – the purpose was to make sure the discussions take place at some point in the future.
    - These discussions are ongoing and need to occur in the development of the models as the go forward (what are the assumptions and how is each being incorporated into each model).

    - ***Question for Dr. Goodman:*** A few years ago, you wrote a chapter in a book called "population viability analysis" that describes the differences between a "frequentists" approach and a Bayesian approach. How do you envision reconciling these differences with regard to evaluating these 2 models?
        - ***Response:*** That will be a tactical question. Theoretically, it would be Bayesian = right and frequency probability = wrong; but in practice, it may not make a big case. I would suggest holding off in order to determine if it is needed. There isn't a consensus among PVA experts or statisticians.
            - If, for example, it turns out that Dr. Miller and I use different density dependency models that will be where "the action is" regardless of Bayesian or frequentist probability. In my experience, density dependency will be the key. If in the end Dr. Miller's vision of density dependence looks like mine and we use similar parameters then there won't be huge differences in predictions.
            - However, it is not clear what flexibilities Dr. Miller has with modifying the density dependency.
- Once the PVA group is comfortable with this, the next step is determining how to share some version of these discussions and rationale with the EC. In general, it should be explained that the model consensus isn't that simple but there is a process and the work group and modelers intend to embrace that process.

Consensus Data Set – D. Goodman

- Dr. Goodman shared that the group has laid out the general process and expected length of time to develop a consensus data set.
- It was pointed out that there are 3 categories of data: (1) data that we are confident in; (2) data that needs more clarification; and (3) data that we still need to get. It was also shared that during the discussion with the EC, that they be made aware that receipt of the missing data

doesn't need to happen before the first PVA runs but can be provided and included over time to improve the models.

- Attendees discussed the best way to present the process and data issues to the EC. One way would be to inform the EC of the PVA recommended process and explain the data issues (resolution with the current data, how to get the needed resolution, explanation that ASIR won't provide the data, etc.) and then get the EC's permission to proceed. The other option was to decide all these details at the PVA work group level, as the technical experts, and then just inform the EC what the group is doing and why.
- While the PVA models may have some utility in the development of the BiOp, the real strength comes as part of the RPA and AM processes.
- Concern was expressed that at some point in the future, after all the modeling and analysis has been invested, ASIR comes forward and argues against the conclusions with "here is the analysis of the real data."
    - Considering this concern, it was suggested that the Program have the same process for consensus data se(s) to be applied to the Program as a whole, especially in regards to how the database is populated.
    - The best way to forward this approach would be to make the recommendation to the PMT first. This would allow the PVA to continue to deal with PVA issues.

Action: Stacey Kopitsch will inform the PMT of the PVA workgroup's recommendation that the process for gaining consensus on data sets be applied to all Program data.

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- *Hydrology and PHVA data needs*
    - It was discussed earlier today that the PVA may be better served by just requesting the data and letting the PVA modelers incorporate the hydrology data in a way that best suites the PVA model(s) itself. That may be quicker and more effective as opposed to pressuring PHVA for URGWOM runs. PHVA engagement is 2-fold: (1) helping with development and (2) providing review.
    - Regarding the hydrology request letter, it could be a request that PHVA provide 1,000 100-year series for an evaluation by the PVA (or the PVA modelers) to determine the utility and initial analyses that could be requested of PHVA. Leave the door open for that continued collaboration with that group.
    - It was pointed out that URGWOM was not created to integrate into the PVA - it has its own purposes. The hydrology modeling necessary to integrate into the PVA seems to be different than what URGWOM is capable of providing. The PVA needs to focus on getting to the point of having useable hydrology to integrate. This would be better than trying to use data/hydrology that is not a good fit for the process and then having to provide the justifications and explanations.

Action: Dave Gensler will modify the PVA letter to the PHVA to incorporate requests for the paleo data, hydrology data from 1945 forward, and assistance from the PHVA work group in sequence development and review.

Outstanding Issues and Next meeting

- There are no more AM meetings planned at this time. The draft AM plan is scheduled to be released at the end of June. It was suggested that it would be productive for PVA to have a meeting after the draft plan has been received in order to discuss and consider any responses/feedback/comments.
    - Dave Campbell and David Gensler will need to "flesh things out" for the 16th then get feedback from the PVA group; this information will be passed on to Phil Miller allowing him the opportunity to comment.

Action: Dave Campbell will check with the PMT to determine the status of the RFP including expected release and TPEC formation.

- It is assumed that some PVA members will be able to participate in the TPEC and that there should be both federal and non-federal representation.
- Dr. Goodman suggested the PVA work group be open to meeting anytime a new data set is received (in order to discuss the new data to be included). Dr. Goodman offered to be available and come in for such meetings. However, the only thing currently on the horizon is what Rick Billings proposed.
- It was suggested that the PVA consider meeting monthly to help provide regularity, keep participants engaged, and be available to contribute to the AM processes if/as necessary. For now, the PVA scheduled meetings for both June and July.
    - It was suggested that flycatcher experts be included in the June discussions. To include the experts who do the flycatcher surveys, those topics will need to be scheduled in the afternoon.
    - Interest was also expressed in the having updates from the database manager on the Program's DBMS.
    - Other potential topics and follow up included updates/data from the ISC Floodplain Restoration work and a presentation on the River Drying data.
    - The July meeting could be focused on discussing AM and how it hinges on the PVA work.

Action: Dave Campbell will see if Brian Milsap can attend the July meeting as he has experience with AM and PVA models.

Next Meetings

- June 28th from 8:30am to 4:00pm
    - Tentative Agenda items include: (1) 1 hour River Drying Presentation & Data – R. Valdez; (2) Update on ISC Floodplain Restoration work and associated data – R. Valdez; (3) Update on the Program Database; (4)
- July 26th from 8:30am to 4:00pm
    - Tentative Agenda items include: (1) Feedback, comments, and responses to the Draft AM plan; (2) Integration of PVA with AM discussions;

PVA Meeting Attendees
May 24, 2011

NAME	AFFILIATION	PHONE NUMBER	EMAIL ADDRESS
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