San Joaquin River Spring-run Chinook Technical Memorandum Group Meeting
Juvenile Production Estimates (JPEs) Discussion
Thursday, June 26, 2014
10:00 am – 12:00 pm

Meeting Summary

Participants:

Philip Columbano, NMFS
Kim Webb, USFWS
John Netto, USFWS
Carl Mesik, USFWS
John Rubin, Attorney for San Luis and Delta Water Authority
Liz Vasquez, Reclamation, SJRRP
Elif Fehm-Sullivan, NMFS
Jonathan Schram, NMFS
Monica Gutierrez, NMFS
Rhonda Reed, NMFS
Rob Nielsen, NMFS
Bruce Oppenheim, NMFS
Pat Ferguson, CDFW
Erin Strange, NMFS
Jason Ushijima, Santa Clara Water Irrigation

1. **Review of Meeting notes from May 22nd:**

There were no comments or additions to the May 22nd meeting notes

2. **Meeting Purpose:**

Mini-workshop and discussion concerning the methods used for calculating winter-run Chinook juvenile production on the Sacramento River, and the applicability for implementing similar methods for reintroduced spring-run Chinook salmon to the San Joaquin River.

3. **Bruce Oppenheim, NMFS Fishery Biologist – Presentation (15 minutes)**
"Juvenile Production Estimate Calculation for Winter-run Chinook Salmon"

Presentation Summary:

Bruce mentioned that there are several ways to calculate JPEs. NMFS has been using the particular method Bruce presented today for the past 19 years for estimating the number of winter-run juveniles entering the Delta each year. This particular JPE method was created as

a simple spreadsheet model in Excel, and was initially used to determine incidental take limits at the Federal and state pumping facilities in the Delta. It was first developed in 1995 for the NMFS Biological Opinion on CVP/SWP operations (CVP/SWP Biological Opinion). It is reviewed every year by the Interagency Ecological Program Winter-run Project Work Team (WRPWT), but the group only advises modifications to the model when a thorough technical review is completed about every 5 years. The JPE changes every year, depending on the fish population size for that year, sex ratio, fecundity, survival at various life stages, *etc*., and if there are new data or information available that are deemed appropriate for integration into the JPE calculation methodology.

The NMFS JPE considers the number spawners and juvenile survival through all lifestages. There are 7 components to the JPE in relation to the Chinook life cycle. First is escapement, then pre-spawn mortality, then fecundity, and then 3 stages of survival (egg, egg-to-fry, fry-to-smolt, smolt to the Delta). Confidence intervals are calculated for each component. Estimates for these parameters were developed from the Chinook salmon literature and studies conducted on winter-run Chinook salmon.

Adult Escapement Calculations –

Since 2000, escapement estimates are based on CDFW carcass survey results because these are more accurate than the Red Bluff Diversion Dam ladder counts previously used. Bruce showed an example of escapement numbers from 2012 (refer to presentation). NMFS uses the estimated number of in-river adult females of both hatchery and natural origin based on CDFW's Jolly – Seber Escapement Estimate. From the estimated number of in-river adult females of both hatchery and natural origin, various environmental factors and data collected over the past year can be used to estimate other values, such as average fecundity (hatchery derived), egg loss due to temperature, total number of viable eggs in the system, *etc*. These values are then used to populate the model and along with other in-river juvenile migration information then estimate the number of winter-run smolts entering the Delta.

The definition of prespawn mortality is the number of winter-run females that die prior to spawning. Prespawn mortality estimates also come from the CDFW carcass count data, and is typically very low (1% - 2%) because once reaching the upper Sacramento River, winter-run are usually successful in holding for several months in temperature controlled cold waters. Prespawn mortality numbers are subtracted from total females, along with temperature effect on eggs. 100% mortality is assumed for females that spawn below the temperature compliance location. The number that spawn below the temperature compliance point is typically a small fraction (<1%) based on redd surveys.

Fecundity is the number of eggs per individual female winter-run Chinook. This number is derived annually from the hatchery broodstock, is usually based on a very small number (less than 50 females), and varies typically on the size of the individual female.

Juvenile Survival calculations-

Survival from egg, to alevin, to fry is typically 25%, and covers the upper spawning grounds in the Redding area down to the Red Bluff Diversion Dam, where the fish estimates are provided through rotary screw trap monitoring as they leave the spawning area and move further down river. Survival from fry, to parr, to pre-smolt covering juvenile migration in the Sacramento River from the Red Bluff Diversion Dam to 100 river miles downstream at Colusa is difficult to measure. Winter-run juveniles are unusual in that they tend to hold and rear in this section of the Sacramento River (between Red Bluff and Colusa) for some time until they are ready to smolt, particularly during dry years. The average survival estimate of 59% used in the model is based on studies done on fall-run Chinook in the Tehama Colusa Spawning Channel back in the 1970s and 1980s based on approximately 10 years of studies. During this time adults were counted going into the spawning channels and the number of juveniles were counted as they came out.

A survival estimate of 53% for pre-smolts to smolts leaving the Sacramento River and entering the Delta is based on a combination of studies over a period of 8 years using paired coded wire tagged (CWT) late-fall run Chinook releases from the Coleman National Fish Hatchery. These fish were released into Battle Creek and the Delta simultaneously, and then indirectly calculates survival estimates from fish recaptured 3 years later in the ocean fishery. The estimated survival varied depending on how many fish were recovered via the ocean fishery, and a disadvantage is that one had to wait 3 years before the ocean data could be collected, and a survival estimate could be reached.

NMFS has been including 95% confidence intervals in its winter-run Chinook JPE since 2010. Although these confidence intervals have been relatively wide, the advantage here is that it lets you look at different scenarios such as water years or flows, and provides a useful tool to understand how JPEs would be affected by the controlled release of flows into the Sacramento River.

New data –

In 2013, NMFS incorporated new data from 6 years of Chinook salmon acoustic tag studies into the winter-run JPE, which included one year of tagged winter-run and 5 years of tagged late fall-run. The JPE calculation is moving towards relying on direct estimates with the species of interest. Thus, obtaining survival information using tagged winter-run, instead of using late fall-run juveniles as surrogates, as was discussed earlier, will lead to a more accurate calculation. This also allowed NMFS to look at different water year types over the past 6 years, so NMFS could better understand how the recent drought conditions affected the winter-run JPE.

Application to San Joaquin spring-run -

Similar to the rotary screw trapping effort at the Red Bluff Diversion Dam, juvenile spring-run could be trapped in rotary screw traps placed in the different reaches within the San Joaquin River Restoration Area to calculate a spring-run Juvenile Production Index (JPI) for that year. This estimate is different from the JPE in that it uses trap efficiency and daily passage estimates to develop the index. Spring-run juveniles could be marked and identified at the Delta facilities pumps. Specific length criteria for the different developmental stages of spring-run (young-of-year and yearling) in the San Joaquin River could be developed, since we think juveniles in the San Joaquin River grow faster than in the Sacramento River. In addition to identifying San Joaquin spring-run at the Delta facilities, JPEs could be used to determine project success. One drawback for using JPEs on SJR spring-run would be that it would likely take 3 years to implement an effective JPE, as it would take time to gear up escapement and survival studies. Also, it's possible that spring-run survival in the San Joaquin would be so low, that using JPEs would not be feasible for the system.

JPE Topic Discussion:

The group discussed how a similar JPE could be developed for the SJRRP spring-run to account for these fish at the Delta facilities and meet the "de minimus" requirement. Once we estimate a San Joaquin spring-run JPE to the Delta and estimate how many juveniles are entering the delta, we could then subtract that number of fish from the applicable take estimate or operational trigger.

Why is the JPE used for winter-run Chinook, but not for spring-run Chinook on the Sacramento River? Although some work has been done in the past using spring-run Chinook to generate JPEs, spring-run are a bit more difficult because they have two different life histories (yearlings and young-of-the-year). For the SJRRP, one would have to do studies to see which life histories occur for the newly established spring-run populations in the San Joaquin River. Instead of there just being one location for spring-run to spawn in the San Joaquin River, spring-run could spawn either on the main stem or in the tributaries.

There were questions about some of the details of the parameters in the winter-JPE. Approximately 70,000/release fish were used in the paired releases of CWT late fall-run Chinook salmon into Battle Creek and the Delta. All juvenile fish migrating down the Sacramento River are counted at each rotary screw trap sampling location (RST). The salmon run is determined by the length of the juvenile salmon caught, when it was caught, and which RST that individual was caught at between Redding and the Highway 80 Bridge along the Sacramento River. If the captured fish at any of these facilities were CWT, the fish would be euthanized, the tags read, and positive run identification made.

So to clarify, the subject of greatest concern that could affect export rates at the Delta pumping facilities would be if SJRRP spring run reach these facilities at the same time (and size) as the slower growing winter-run from the Sacramento river, making it very difficult to determine salmon-run by size at these facilities. Although developing metrics for compiling

JPEs for spring-run in the San Joaquin could help us better estimate the proportion of spring-run relative to winter-run that would hit the Delta facilities, JPEs would not be able to accurately determine proportions of spring-run from the mainstem of the San Joaquin versus spring-run from the SJR tributaries.

It sounds like we wouldn't have any confidence in JPE data for SJRRP spring-run until at least 3 years go by following initial hatchery releases. In the meantime, before wild salmon start naturally producing on the San Joaquin River, these initially hatchery-released fish would be monitored as sentinels. We could continue to use CWT's fish as sentinels after natural production occurs. Other challenges include that we wouldn't have very many fish to start the initial population, and that because flows are currently intermittent within the Restoration Area, rotary screw traps would be ineffective lower in the system until we get better flows.

A concern was raised that studies suggest that survivability in the Sacramento River is more variable than presented here today. Survival is highly variable between years (such as in drought years), however survivability in the Sacramento has become more variable and lower overall in recent years as shown by a number of recent acoustic tag studies, which give us more accurate survivability estimates than ones derived from CWTs.

Thinking about estimating survival, the most problematic section in the San Joaquin River would likely be from the Restoration Area to Mossdale, due to the number of fish that could potentially be caught from the tributaries. Because it would be difficult to distinguish SJRRP spring-run from spring-run spawning in the tributaries, perhaps more monitoring efforts should be done further upstream on the mainstem of the San Joaquin, or more precise, consistent methods of monitoring be used at Mossdale? Perhaps side by side Kodiak trawls would be a more precise sampling method.

Some confusion was expressed about the estimates of actual take and JPEs since JPEs don't tell you how many fish are actually taken at the diversion facilities. JPEs aren't supposed to measure take levels at the diversion facilities, they're supposed to give you a starting survivability estimate of a spawning-run of fish. The limit (some pre-determined percentage) is then applied to that estimate to give the diversion facilities the number of salmon they are allowed to take from that particular population. We want to understand how the fish reintroduced to the program affect water operations, and then remove that affect to water operations so water supplies diverted ultimately aren't affected by the reintroduction.

A concern was raised that the current 2% incidental take cap for winter-run is too high. This discussion isn't necessarily relevant to the JPE discussion that we are having today and would be better discussed in another forum.

Next Steps:

- The October 2016 deadline for deciding the monitoring methods for SJRRP spring-run Chinook still stands.
- The next tech meeting will focus on Genetics, and will take place within the predetermined 2 hour time window on July 24th.