From: J. Stuart - NOAA Federal <j.stuart@noaa.gov>
Sent: Tuesday, March 12, 2019 6:32 AM
To: Harrison, Katrina
Cc: Garwin Yip - NOAA Federal; Barbara Byrne - NOAA Federal; Cathy Marcinkevage - NOAA Federal; Jana Affonso; Katherine Sun; Kaylee Allen; Jacobs, Brooke@Wildlife; Wilkinson, Chris@DWR; REYES, RENE; Buckman, Carolyn; Flahive, Kaitlin; David Mooney; Ellis, Gregg; Callejo, Russell; Pinero, Janice
Subject: Re: ROC BA - Tracy Fish Facility Details

Thank you Katrina.

Jeff

On Mon, Mar 11, 2019 at 4:24 PM Harrison, Katrina <kharrison@usbr.gov> wrote:

Hello all -

See below for answers to the Tracy Fish Facility questions. Thank you Rene for putting this together!

What is the current louver efficiency?

Louver efficiency at the Tracy Fish Collection Facility (TFCF) is dependent on the flow and velocities, fish species, and the fish size (life stage). The number of pumps (units) running at the Jones Pumping Plant (JPP) dictates the flow and velocity at the TFCF. There are 6 units at JPP but a maximum of 5 can used; each unit increases the velocity through the TFCF primary channel about 0.5 ft/sec.

For juvenile Chinook Salmon, the most recent whole facility efficiency evaluations completed using acoustic tag telemetry suggests that primary louver efficiency ranges from 50-100% with an average of approximately 88.7% (Karp *et al.* 2017, Wu *et al.* in progress). At higher pumping regimes of 4-5 JPP units, for juvenile Chinook Salmon, louver efficiency was high at 71.4-100 % (Karp *et al.* 2017).

For adult Delta Smelt, louver efficiency is 13% at high pumping regime of 5 units (3 ft/sec; Bowen *et al.* 2004). At lower pumping regime of 1 unit (~1 ft/sec), the louver efficiency improves to 34.2-82.5% (Bowen *et al.* 2004; Bridges *et al*., 2019 in press).

For juvenile Delta Smelt (32–40 mm FL), louver efficiency as low as 22% was observed in a bulk fish release study in 2010 (Bridges, unpublished data). Furthermore, in a comparison of wild non-smelt larval salvage at varying secondary channel velocities (1 vs 3 ft/sec) in 2012, more larvae were diverted by the louvers at the slower velocity (Reyes, unpublished data).

It is important to note that the equations used to calculate salmon louver efficiency at the TFCF were based on an unpublished findings done almost 5 decades ago at Skinner and were not based on any work done at the TFCF. Below is the salmon loss calculation containing a louver efficiency estimate for Chinook salmon less than 101 mm FL and greater than 101 mm FL (Aasen 2013):

If Length < 101 mm → ENCOUNT = SALVAGE/EFF1;
If Length > 100 mm → ENCOUNT = SALVAGE/EFF2;
EFF1 = 0.630 + [0.0494 * (Primary Channel Flow /[Primary Channel Depth*Width])]
EFF2 = 0.568 + [0.0579 * (Primary Channel Flow /[Primary Channel Depth*Width])]

What are our current estimates of prescreen loss?

Definition of "pre-screen loss" should be clarified first. "Pre-screen loss rate" is defined as "*the rate of loss to entrained salmon during movement from the trash racks to the primary louvers*" (Aasen 2013). In essence, the "pre-screen loss rate" is the predation rate within the primary channel. Although Chinook Salmon mortality have been observed in front of the TFCF trash rack (Vogel 2010), this mortality is not included in the pre-screen loss calculation since this is outside of the area between the trash rack and primary louvers. Currently, a 15 percent pre-screen loss rate due to predation is an agreed upon placeholder value (D. Odenweller, personal communication) but is yet to be fully verified. For this placeholder, the predation rate within the primary channel is currently being verified with the use of Predation Detection Acoustic Tags (PDAT).

Prescreen loss at the TFCF is dependent on fish species, fish size (life-stage), and predator load within the primary channel. In addition, it appears that prescreen loss may be correlated with pumping rates (water velocity) and/or turbidity, although more data needs to be collected to adequately determine these relationships. Data from Karp *et al.* (2017) and Wu *et al.* (In Progress) suggest that prescreen loss ranges from 0-40% for juvenile Chinook Salmon. Low estimates of pre-screen loss (assuming all unknown fates in the primary channel are non-participants) from these studies average approximately 14.0%, while high estimates of prescreen loss (assuming all unknown fates in the primary channel are losses to predation) average approximately 15.9%. Therefore, our preliminary results indicate that the predation rate (or prescreen loss) may be close to the 15 percent placeholder value mentioned above (Karp *et al.* 2017, Wu *et al.,* in progress).

What are the current louver cleaning procedures and operations, including whether exports will be shut down if louvers are damaged, cleaning takes too long, or other maintenance scenarios where the facilities are not capable of salvaging fish?

Loss due to cleaning is not quantified in the current loss calculation. However, we estimate that approximately 6.7% of juvenile Chinook Salmon that encounter the louvers are lost through the louvers when they are lifted for cleaning and approximately 33.3% of louver loss occurs during louver cleaning activity (Karp *et al.* 2017). This value, however, is preliminary and needs further verification. There is a TFFIP study plan being developed to study the amount of loss occurring during louver cleaning.

The current primary louver cleaning procedures and operations involve lifting each individual louver panel, 36 total, out of the water in order to spray wash the debris. Generally, each primary louver panel is lifted and lowered back into place three times per day (generally 0600-0800, 1400-1600, and 2300-0100), although frequency of cleaning may be increased or decreased according to pumping rate and debris loads (details in the next paragraph). It takes approximately 3-7 minutes to lift, spray clean, and lower each louver panel back into place. While export pumping may be reduced to address damaged louver panels, issues during cleaning, or other maintenance scenarios where facilities are not capable of effectively salvaging fish, complete shutdown of pumping usually does not occur due to issues related to the primary louvers.

Although we don't have an official SOP for when louver cleaning should be done, TFCF operators follow certain "guidelines":

- At 5 JPP units, louvers are cleaned before the incoming tide as much as possible. The morning day shift usually begin cleaning as soon as they start their work, around 0600. During high debris periods, operators monitor differentials and clean before any problems arise. At a

minimum, all 36 louver panels are cleaned 2-3 times a day but during heavy debris loads, operators clean 3-6 times a day.

- At 2-4 JPP units, operators determine when to clean and making sure the louvers do not reach 1 ft differential.
- At 1 JPP unit, operators will normally clean periodically during the incoming tide.

How often does cleaning of primary louvers and secondary bypasses occurs and timeframes?

Generally, each primary louver panel is lifted, sprayed clean, and lowered back into place three times per day (generally 0600-0800, 1400-1600, and 2300-0100), although frequency of cleaning may be increased or decreased according to pumping rate and debris loads. As mentioned above, cleaning frequency can be as high as 3-6 times per day during 5 unit JPP operation and during high debris periods. The 2018 louver cleaning data (see below) suggests less frequent cleaning is required in early summer (low averages of 60 minutes per day) and much higher during the winter months (high averages of 440 minutes per day). This means that there is a louver panel lifted 1-7.5 hours per day depending on season, pumping rates, and debris loads.

Cleaning Primary Louvers (2018)

Month	Average daily (minutes)
January	240
February	131
March	112
April	64
May	76
June	138
July	274
August	310
September	200
October	440
November	270
December	370

Secondary bypasses are not cleaned, although they are shut during cleaning of the primary louvers to prevent excessive debris from entering the holding tanks. When operators clean primary louver panels 1-9 (upstream-downstream) they close secondary bypass #1. When operators clean primary louver panels 10-18, operators close secondary bypass #2, while secondary bypass #3 is closed when they clean louver panels 19-27, and secondary bypass #4 is closed when they clean panels 28-36.

What are the current collection handling, trucking, and release operations, and post release survival and mortality?

Salvage of fish occurs at the TFCF 24 hours per day, 365 days per year. Fish are salvaged in flow-through holding tanks (6.1-m diameter, 4.7-m deep) that provide continuous flows of water (Sutphin and Wu 2008). Fish are maintained in these holding tanks for 8-24 hours depending on the species of fish that are being salvaged, the number of fish salvaged, and debris load. The number of fish that are salvaged in TFCF holding tanks is generally estimated by performing a 30 minute fish-count subsample every 120 minutes (2 hours). The number of each species of fish collected in the subsample is determined and then multiplied by 4 (120 pumping minutes/30 minute fish-count subsample = expansion factor of 4) to estimate the total number of each species of fish, as well as the total number of fish, that were salvaged in TFCF holding tanks during the

120 minute period. Pumping minutes and fish-count minutes could potentially deviate from 120 minutes and 30 minutes, respectively, which would change the expansion factor used to estimate total fish salvage.

If no Chinook Salmon, Steelhead, or Delta Smelt are salvaged, fish can be maintained in TFCF holding tank for up to 24 hours. If a Chinook Salmon or Steelhead is collected during fish-counts, fish can only be maintained in TFCF holding tanks for up to 12 hours. If a Delta Smelt is collected during fish-count, salvaged fish may only be held in TFCF holding tanks for up to 8 hours. When fish can be maintained in TFCF holding tanks for 24 hours, fish transport (fish-haul) generally occurs at approximately 0700 each day. When 2 fish-hauls per day are necessary, fish hauls generally occur at 0700 and 2130 each day. When 3 fish-hauls are necessary, they are usually completed at 0700, 1500, and 2130 each day. Fish-haul is also dictated by the Bates Tables which uses size classes, species, and water temperature as indicators for when to conduct a fish-haul.

During normal operations, salvaged fish are transported approximately 49.9 km and released at one of two Reclamation release sites near the confluence of the Sacramento and San Joaquin Rivers (Antioch Fish Release Site and Emmaton Fish Release Site). In general, the Emmaton Fish Release Site is used for fish-hauls performed during daytime hours and the Antioch Fish Release Site is used for fish-hauls performed during nighttime hours. This is done for safety and security reasons as the Antioch Fish release Site has a gate that can be locked behind the operator after he/she enters the release site area. Upon arrival at release sites, operators measure certain important water quality parameters (dissolved oxygen, salinity, and temperature) prior to releasing fish. This is done to verify that water quality parameters remain acceptable during fish transport.

Salmon loss due to handling and trucking are generally low and are based on CDFW trucking and handling studies. Salmon loss is < 2 percent for salmon < 100 mm and zero percent for salmon > 100 mm (Aasen 2013). The survival of Delta Smelt following salvage and return are relatively high based and are also based on handling and trucking studies by CDFW (Churchwell *et al.* 2005, Morinaka 2013).

Estimates of post-release survival and mortality are currently not available, although release site survival and mortality is being investigated by Reclamation (Fullard *et al.* In Progress) and results are anticipated within the next couple of years. It is anticipated that loss to predation is the main source of post release mortality.

References

Aasen, G. 2013. *Chinook Salmon loss estimation for Skinner Delta Fish Protective Facility and Tracy Fish Collection Facility.* Protocol. ftp://ftp.dfg.ca.gov/salvage/

Bowen, M.D., B.B. Baskerville-Bridges, K.W. Frizell, L. Hess, C.A. Karp, S.M. Siegfried, and S.L. Wynn. 2004. *Empirical and experimental analyses of secondary louver efficiency at the Tracy Fish Collection Facility, March 1996 to November 1997.* Tracy Fish Facility Studies, Volume 11. U. S. Bureau of Reclamation, Mid-Pacific Region, Denver Technical Service Center.

Fullard, C., Z.A. Sutphin, T. Agosta, M. Johnson, B. Wu, and C. Hart. In progress. *Assessing the Efficacy of a Modified Fish Salvage Release Scheme to Reduce Predation Loss of Juvenile Salmonids at the Sacramento-San Joaquin River Delta Release Sites.*

Karp, C., B.J. Wu, and K. Kumagai. 2017. *Juvenile Chinook Salmon, Steelhead, and adult Striped Bass movements and facility efficiency.* Tracy Fish Facility Studies, Volume 54. U.S. Bureau of Reclamation, Mid-Pacific Region and Denver Technical Service Center.

Wu, B.J., R.C. Reyes, C.L. Hart, K.K. Kumagai, and J. Miranda. In progress. *Use of Predation Detection Acoustic Tags to Estimate Juvenile Chinook Salmon Facility Efficiency at the Tracy Fish Collection Facility.*

Bridges, B.B. 2010. *Bypass ratio study at the Tracy Fish Collection Facility.* Unpublished data.

Bridges, B.B., B.J. Wu, R.C. Reyes, R.C. Bark, and M.D. Bowen. 2019, In press. *Adult Striped Bass impact on adult Delta Smelt and juvenile Chinook Salmon entrained at the Tracy Fish Collection Facility.* Tracy Fish Facility Studies, Volume 45. U. S. Bureau of Reclamation, Mid-Pacific Region, Denver Technical Service Center.

Churchwell, P.E., R. Padilla, K. Enstrom, K. Clark, D. Dorratcague, C.H Hanson, T. Finnegan, and J. Taplin. 2005. *Summary of the collection, handling, transport, and release (CHTR) process and data available on State Water Project (SWP) and Central Valley Project (CVP) fish salvage.* State of California, The Resources Agency, Department of Water Resources.

Morinaka, J. 2013. *Acute Mortality and Injury of Delta Smelt Associated With Collection, Handling, Transport, and Release at the State Water Project Fish Salvage Facility.* Interagency Ecological Program for the Sacramento-San Joaquin Estuary. Technical Report 89.

Reyes, R.C. 2012. *Larval fish secondary louver efficiency at various water velocities.* Unpublished data.

Vogel, D.A. 2010. *Evaluation of acoustic-tagged juvenile Chinook Salmon movements in the Sacramento-San Joaquin Delta during the 2009 Vernalis Adaptive Management Program.* Natural Resources Scientists, Inc. March 2010.

Z.A. Sutphin, and B.J. Wu. 2008. *Changes in Water Quality During Fish-Hauling Operations at the Tracy Fish Collection Facility. Tracy Fish Collection Facility Studies.* Tracy Technical Bulletin 2008-2. U.S. Bureau of Reclamation, Mid-Pacific Region and Denver Technical Service Center.

--
Jeffrey S. Stuart, M.S.
Fishery Biologist

NOAA Fisheries West Coast Region
U.S. Department of Commerce
California Central Valley Office
650 Capitol Mall, Suite 5-100
Sacramento, CA 95814-4706

Office: 916-930-3607
J.Stuart@noaa.gov

Find us online
www.westcoast.fisheries.noaa.gov


YouTube